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Geology of the Northeast Temagami Area

District of Nipissing

By

G. Bennett

1978

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ABSTRACT

The report describes the geology and mineral occurrences of the townships of Briggs, Strathcona, Strathy, and Chambers in the District of Nipissing. The map-area is bounded by Longitudes 79°45′28″W,80°0′45″W, and Latitudes 46°55′20″N, 47°8′ 50″N. The area comprises approximately 373 km^2 (144 square miles).

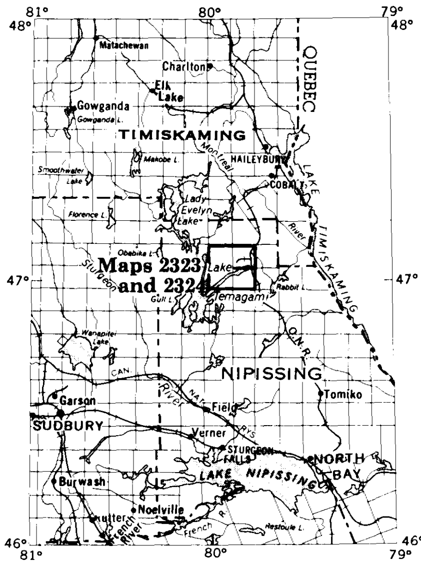

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Figure 1–Key map showing location of Northeast Temagami Area. Scale 1:3 168 000 (1 inch to 50 miles).

All the major lithologic units of the map-area are Precambrian in age. The oldest recognized rocks are metamorphosed basaltic flows, intermediate to felsic pyroclastic rocks and flows, detrital metasediments and iron formation that form a metavolcanic complex of early Precambrian age. The metavolcanic complex has been folded into a shallow plunging, northeast-trending syncline, and has undergone regional dynamothermal metamorphism to the lower greenschist facies. A variety of granitic plutons ranging in composition from quartz diorite to quartz monzonite intrude the metavolcanics. Several sills, dikes, and plugs of felsic porphyry, and ultramafic to intermediate rocks intrude the metavolcanics, but apparently predate the granite plutons.

Locally, the early Precambrian rocks are unconformably overlain by paraconglomerate, greywacke, and siltstone of the Gowganda Formation in the Huronian Supergroup. Thick sills and dikes of Nipissing-type diabase intrude the Gowganda Formation. Dikes of lamprophyre and altered gabbro intrude the granitic plutons and metavolcanics, but are also basement to the Huronian rocks.

Northwest-trending diabase dikes of the Sudbury swarm intrude the Huronian rocks, and are the youngest recognized rocks in the map-area.

The map-area has been the subject of periodic prospecting activity since the late 1800s, and a large number of occurrences of base and precious metals have been discovered. At least four gold deposits have had some underground development done on them and test shipments were made in the 1930s. In 1936 some production of copper, nickel, and precious metals was obtained from a sulphide deposit in ultramafic rocks. The only mine that operated in the map-area during 1969 and 1970 was the Sherman Mine, which is owned jointly by Dofasco and Cleveland-Cliffs Iron Company. The mine has a plant capacity of 1,000,000 tons of iron pellets per year with reserves, grading about 25 percent; iron sufficient for about 35 years production.

The Geology of the Northeast Temagami Area

District of Nipissing

by

Gerald Bennett[1]

INTRODUCTION

This report describes the geology of the townships of Briggs, Strathcona, Strathy, and Chambers, District of Nipissing. These townships comprise the Northeast Temagami map-area, and occur within the limits of Longitudes 79°45′28″ to 80°0′45″W and Latitudes 46°55′20″ to 47°8′50″N. The area covered by the report-area is approximately 373 km^2 (144 square miles).

Highway 11 trends northward through Strathcona and Strathy Townships and roads lead from Highway 11 in Strathcona Township through Briggs Township to the former Temagami Copper Mine in Phyllis Township. Strathy Township is also accessible from a gravel road leading west from Highway 11, just south of Net Lake.

Recently constructed logging roads of the Canadian Johns-Manville Company Limited extend into northeastern Chambers Township from roads in Banting and Best Townships. The main line of the Ontario Northland Railway trends northward through the eastern part of Strathy Township. Much of the remainder of the report-area can be easily reached by means of the larger lakes. None of the rivers are useful for transportation. Float-equipped aircraft are available at the village of Temagami.

The village of Temagami lies about 97 km (60 miles) north of North Bay and about 480 km (300 miles) north of Toronto by way of Highway 11. The "Tri-town area" of Haileybury, New Liskeard and Cobalt is located about 40.2 to 56.3 km (25 to 35 miles) north of Temagami along Highway 11.

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[1]Geologist, Geological Branch, Division of Mines, Sault Ste. Marie. Manuscript approved for publication by the Chief Geologist, July 23, 1974.

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Population

The main centre of population is the village of Temagami located at the northeastern end of the Northeast Arm of Lake Temagami. The population of Temagami during 1971 was 1,279 people. However, a new townsite referred to as "Temagami North" has been established about 6 km (4 miles) north of Temagami. Temagami North was originally intended as a townsite for the Sherman Mine, but lots are available to anyone wishing to settle in the area. A small townsite exists near the lumber mill of William Milne and Son Limited on the northern shore of Net Lake.

Natural Resources

The natural beauty of Lake Temagami, the abundance of fish and game, and the proximity to major transportation routes, made the Northeast Temagami area a centre for tourist activity since the turn of the century. Numerous cottages and tourist lodges have been built on the islands of Lake Temagami and on the shores of the other major lakes.

Lumbering has been an important industry in the past, but the large stands of red and white pine have been depleted. Some good specimens can still be seen along the shore of Lake Temagami and other major lakes. More recent lumbering operations have reduced the acreage of the stands of spruce, fir, birch, and poplar in the map-area. In 1970, The Canadian Johns-Manville Company Limited was carrying out lumbering operations between Kanichee Lake and Jackpine Lake. William Milne and Son operated a large lumber mill on Link Lake, and Northern Pinewoods Limited maintained a mill a few miles north of Strathy Township. A large mill operated by the Temagami Lumber Company at Goward closed in 1965 when stands of timber available to the company were depleted.

Lake trout, pickerel, pike and black bass can be caught in the major lakes. Moose and bear were seen during field mapping.

Topography

Most of the lakes and streams of the map-area drain into Lake Temagami which forms part of the drainage basin of Lake Nipissing. Kanichee Lake, Net Lake and most of the lakes east of Highway 11 drain eastward into Lake Timiskaming.

The relatively thin soil cover has resulted in a drainage pattern which is largely controlled by structural features in the bedrock. The tendency of the large lakes, including the Northeast Arm of Lake Temagami, to display linear and rectilinear forms indicates a similar bedrock control.

The maximum relief within the map-area is about 90 m (300 feet). Many hills have a maximum relief of 30 to 60 m (100 to 200 feet) and exhibit relatively gentle slopes. Steep scarps are locally developed on the areas underlain by Nipissing-type diabase and on the Gowganda Formation south of Snake Lake.

The drainage on the property of the Sherman Mine has been modified to allow settling and recirculation of plant effluent, and to allow minimum flooding of the open pits. As a result, most of Iron Lake [not marked on Map 2323, back pocket], approximately 2 km (1.25 miles) southwest of O'Connor Lake, has been drained, and its present shape does not coincide with that shown on the uncoloured preliminary Geological Maps P.666 and P.667 (Bennett and Innes 1971a and b). A dam across the southern part of Vermilion Lake, and deepening of the outlet into Tetapaga Lake has allowed the draining of the southwestern end of Vermilion Lake and the raising of the water level northeast of the dam. The level of Tetapaga Lake has also been raised.

Previous Work

A.E. Barlow was engaged in geological mapping in the area of Lake Nipissing and Lake Timiskaming between 1887 and 1895. The final report and map, published in 1907, included descriptions of part of the northeast Temagami area (Barlow 1899; 1907).

The iron deposits of the Temagami area were first described for publication by A.P. Coleman (1900) who visited the area in 1899. W.G. Miller (1901) examined the iron formation of the area a year later and provided a more complete description. In 1919, C.W. Knight examined and described many of the arsenic deposits including that of the Big Dan, and those at Arsenic Lake, as well as the copper-nickel deposit now held by Ajax Minerals Limited (6)[1]. He also commented on some general geological features of the area (Knight 1920).

Parts of Strathy and Chambers Townships were included in E.W. Todd's report and map (Todd 1925). In 1934, W.S. Savage mapped most of central Strathy Township and described many of the mineral occurrences known at that time. He also commented on mineral exploration then taking place (Savage 1935).

In the summer of 1941, W.W. Moorhouse mapped most of the area covered by this report as well as parts of the townships of Phyllis, Joan, Yates, and Cynthia. Moorhouse's report and geological map at a scale of 1:63,360 (1 inch to mile) were published in 1942, and have proved to be an invaluable aid at all stages of the present survey (see Moorhouse 1942).

Present Geological Survey

The geological mapping for this report was carried out during the summers of 1969 and 1970 with some additional work in late August and early September 1971 and 1972. Pace and compass traverses were run at approximately 0.4 km (¼ mile) intervals across the strike of most geological units. In addition, outcrops along the shore of the lakes and along the roads were located and described by

[1]Number in parentheses refers to property listed on Map 2323 in back pocket.

the field party. Topographical control was provided by vertical air photographs on a scale of 1:15,840 (1 inch to ¼ mile). The air photographs available pre-dated the main period of lumbering in central Chambers Township and the development of the Sherman Mine. As a result of this, considerable difficulty was experienced in tying the geology to recently constructed roads and pits on the Sherman Mine property, and in obtaining topographic control caused by the modified drainage in the mine area.

Geological data was plotted on base maps at a scale of 1:15,840 (1 inch to ¼ mile) supplied by the Cartography Section of the Ontario Division of Lands from maps of the Forest Resources Inventory of the Ontario Division of Forests.

About 220 thin sections of selected rock specimens were examined under the microscope. About 100 determinations of the composition of plagioclase were made using the five axis universal stage and the method described by A.C. Tobi (1963). Additional plagioclase determinations were made on the flat stage.

Acknowledgments

During the 1969 field season the author was assisted by N.K. McNally, C.P. Dupuis and B. Achtman. In the 1970 field season the author was assisted by D.G. Innes, A.D. Hunter, C.P. Dupuis, and P.J.S. Boyle. Messrs. McNally and Innes acted as senior assistants, and were responsible for much of the mapping. Messrs. Dupuis and Hunter did some independent mapping late in the 1970 field season and in 1971. Gordon Soucie and M. Andrews also assisted in the field in 1971.

Ray Harviksen of the Sherman Mine, R.J. Graham of Geophysical Engineering Limited and Joseph Deveaus of Copperfields Mining Corporation provided information and assistance at various times during the field mapping.

Dr. S.B. Lumbers, formerly of the Ontario Division of Mines, Ministry of Natural Resources, advised and assisted the author during the 1969 field season, and initiated many stimulating and useful discussions pertaining to the geology of the map-area.

GENERAL GEOLOGY

The main geological feature of the Northeast Temagami area is a northeast-trending metavolcanic-metasedimentary belt of Early Precambrian (Archean) age (Table 1). The belt averages about 13 km (8 miles) across and is about 29 km (18 miles) long. The dominant structure is that of a northeast-trending syncline modified by emplacement of granitic plutons.

Two generalized volcanic cycles beginning with mafic flows and ending with intermediate to felsic pyroclastic rocks and sedimentary rocks can be recognized in the area. A thick sequence of Algoma-type iron formation lies just above the main felsic to intermediate pyroclastic assemblage. A variety of metagabbros, metadiorites, and felsic porphyries intruded the metavolcanics. The metamorphic grade of the Early Precambrian rocks is mainly that of the lower greenschist facies.

The surrounding granitic batholiths are mainly trondhjemite, and quartz monzonite in composition and are intrusive into the metavolcanics. The southeastern and northwestern parts of the map-area are overlain by rocks of the Gowganda Formation of the Huronian Supergroup which consist mainly of relatively undisturbed paraconglomerate and siltstone units, forming a complex interlayered assemblage. The Gowganda Formation is intruded by dikes and sills of Nipissing Diabase. Northwest-trending diabase dikes appear to intrude the above rocks and are the youngest rocks in the map-area. Fine-grained chloritic dikes, lamprophyre, and coarse-grained altered gabbros cut the granitic rocks, but have not been found by the author to intrude the Huronian rocks.

Precambrian

EARLY PRECAMBRIAN (ARCHEAN)

Metavolcanics and Metasediments

MAFIC TO INTERMEDIATE METAVOLCANICS

Rocks classified in the field as mafic to intermediate metavolcanics consist mainly of pale grey to greenish grey weathering massive to faintly foliated rocks which are greyish green, and dark green to almost black on fresh surfaces. Carbonatized outcrops are brownish weathering, and tend to be more grey on fresh surfaces. Most of the metavolcanics included in this group are probably basaltic in composition. Andesites may be represented by the more leucocratic varieties intermixed among the darker rocks along the northern shore of the Northeast Arm of Lake Temagami.

In many outcrops, mafic intrusive rocks could not be distinguished from the coarser grained parts of thick basaltic flows. This is a common problem throughout the Early Precambrian (Archean) metavolcanic-metasedimentary belts of Ontario. Also in the map-area, the presence within the metavolcanic assemblage of chloritic mafic dikes and altered diabase, which are known to post-date the major granitic intrusions, is an additional complication. As a rule, the late chloritic mafic dikes are finer grained, narrower, have more sharply defined contacts and are more variable in strike than the early basaltic sills, but many instances exist where the distinction cannot easily be made, even in thin section.

Flows and Sills

By far the greater part of the mafic to intermediate metavolcanic assemblage appears to be flows and sills. Basaltic flows are most easily recognized by the presence of pillow structure and flow-breccia. The latter, however, can easily

TABLE 1 | TABLE OF LITHOLOGIC UNITS FOR THE NORTHEAST TEMAGAMI AREA.

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT
Swamp and stream deposits, till, sand and gravel

UNCONFORMITY

PALEOZOIC
CAMBRIAN
Carbonatite

INTRUSIVE CONTACT

PRECAMBRIAN
LATE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS
Olivine diabase (Sudbury type), granophyric diabase, porphyritic diabase, intrusive breccia

INTRUSIVE CONTACT

MIDDLE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS (NIPISSING TYPE)
Quartz diabase, gabbro, pegmatitic-gabbro, diorite

INTRUSIVE CONTACT

HURONIAN SUPERGROUP
COBALT GROUP
Gowganda Formation
Polymictic paraconglomerate, greywacke, arkose, feldspathic quartzite, siltstone, argillite

UNCONFORMITY

EARLY PRECAMBRIAN (ARCHEAN)
MAFIC INTRUSIVE ROCKS
Diabase and gabbro dikes (Matachewan type), mafic chloritic dikes, biotite and hornblende-rich lamprophyre

INTRUSIVE CONTACT

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS
GRANITIC PLUTONIC ROCKS
Quartz monzonite, porphyritic quartz monzonite, trondhjemite, hornblende trondhjemite, quartz diorite, hornblende quartz diorite, chlorite trondhjemite, granodiorite, leucogranite, aplite, pegmatite, agmatite, migmatite

INTRUSIVE CONTACT

Table 1 - continued

HYPABYSSAL FELSIC INTRUSIVE ROCKS
Quartz porphyry, quartz-feldspar porphyry, hornblende-feldspar porphyry, feldspar porphyry

INTRUSIVE CONTACT

INTERMEDIATE TO ULTRAMAFIC INTRUSIVE ROCKS
Diorite, quartz diorite, gabbro, quartz gabbro, serpentinite, pyroxenite

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS
DETRITAL METASEDIMENTS
Volcanic wacke, volcanic conglomerate, lithic greywacke, siltstone, slate, tuffaceous sandstone, conglomerate, carbonatized and sheared metasediments

IRON FORMATION
Banded silicate-oxide facies, sulphide facies

FELSIC TO INTERMEDIATE METAVOLCANICS
Dacite, rhyodacite, rhyolite; felsic volcanic breccia, tuff-breccia, tuff and lapilli tuff; intermediate volcanic breccia, tuff-breccia, lapilli-tuff and crystal tuff; carbonatized metavolcanics; minor andesite and agglomerate

MAFIC TO INTERMEDIATE METAVOLCANICS
Pillowed, porphyritic, amygdaloidal and massive basaltic and andesite flows; mafic lapilli-tuff and agglomerate; amphibolite and hornfels

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be confused with some tectonic breccias and probably some intrusive breccias. The small rock exposures in the Temagami area can rarely permit the width of individual flows to be ascertained with any degree of certainty. In the excellent exposures along Highway 11, however, there is evidence of flow thicknesses that range from 3 to 9 m (10 to 30 feet).

Pillow structures are recognizable in most of the mafic members, but are particularly well developed and abundant in the southern half of Strathy Township. The smallest pillow recognized is about 15 cm (6 inches) long and the largest seen (on the property of the Sherman Mine) has a length of about 2.4 m (8 feet) with a thickness of 0.9 m (3 feet). Pillows commonly range in size from 0.3 to 0.9 m (1 to 3 feet). The pillows are generally elongated in the direction of the regional strike, and many exposures provide an unambiguous indication of stratigraphic tops.

Many pillow structures show a zonal arrangement of amygdules parallel to the selvage of the pillows, and some amygdules are concentrated at the "top" of the pillow. These amygdules at the "top" are generally larger than those elsewhere within the pillow. A few cases were noted where amygdules were concentrated in the central parts of the pillow.

Near Arsenic Lake, in Strathy Township, a hyaloclastic breccia locally occurs between the plllows of mafic flows (not shown on Map 2323 because of scale). The breccia consists of pale green fragments ranging from less than 1 mm to 2 cm (0.8 inch) in length, most of which are highly contorted and deposited while still in a plastic state. The texture is similar to that of the eutaxitic texture of felsic welded tuffs (Smith 1960); the close association with pillowed metabasalt and the occurrence of basaltic fragments within the breccia indicates that it is a mafic "welded tuff" which probably resulted from local spatter cones or fractures on the surface of the flow.

Amygdules and varioles are particularly noticeable features of mafic flows in the southern half of Strathy Township and at a few other locations in the map-area. Few varioles and amygdules were noted in the metabasalts near the base of the exposed sequence.

The amygdules vary from less than 1 mm to about 8 cm (3 inches) long. They generally range in size from 5 mm to 2 cm (0.8 inch). The largest amygdules are notably flattened, and were found in mafic flows west of the plant of the Sherman Mine. The most common amygdule fillings are calcite, quartz, and fine-grained mafic material. These may occur separately or all within the one amygdule. Features similar to vesicles are considered by the author to be calcite-bearing amygdules, from which the calcite has been leached by groundwater. A zonal arrangement of minerals within the amygdules is apparent in some thin sections. Generally, amygdule fillings consist of granular quartz grains 0.1 to 0.5 mm in size, surrounded by a very narrow rim of actinolite which is, in turn surrounded by a narrow rim of epidote.

Variolitic metabasalt is mainly restricted to central Strathy Township in the vicinity of Arsenic Lake. The varioles are generally circular to elliptical, but irregular shapes are not unusual. Varioles range in size from a few mm to several cm and consist of pale green to pale brown, or yellowish cherty material that locally shows a faint radiating structure in hand specimen. In certain exposures the varioles may form up to 30 percent of the outcrop, and locally coalesce to form a phase which is much more felsic than the parent mafic metavolcanic rock.

In thin section, varioles appear to consist of very fine grained saussuritized feldspar, but identification is uncertain because of the small grain size. In the few specimens examined in thin section, the varioles showed no sign of any ordered structure, either radiating or orbicular. A number of them, however, apparently have forms that indicate an origin as a separate fluid phase within the mafic magma. A few varioles appear to be connected by a "tube" of similar material; others are twisted forms; several contain tiny amygdules which do not appear in the matrix of the rock. Those with hollow centres occur near Arsenic Lake. The occurrence of varioles and amygdules in the same general area suggests a possible genetic relationship. The origin of the variolitic structures in the Temagami area might be an interesting study for research.

Porphyritic metabasalt appears to be most abundant in the stratigraphically lower members of the volcanic pile. Dark green fine-grained massive metabasalt in southwestern Briggs Township contains up to 20 percent pale green to white phenocrysts of albitized plagioclase up to 2.5 cm (1 inch) long. Porphyritic metabasalt was also noted in central Strathcona Township and may be stratigraphi-

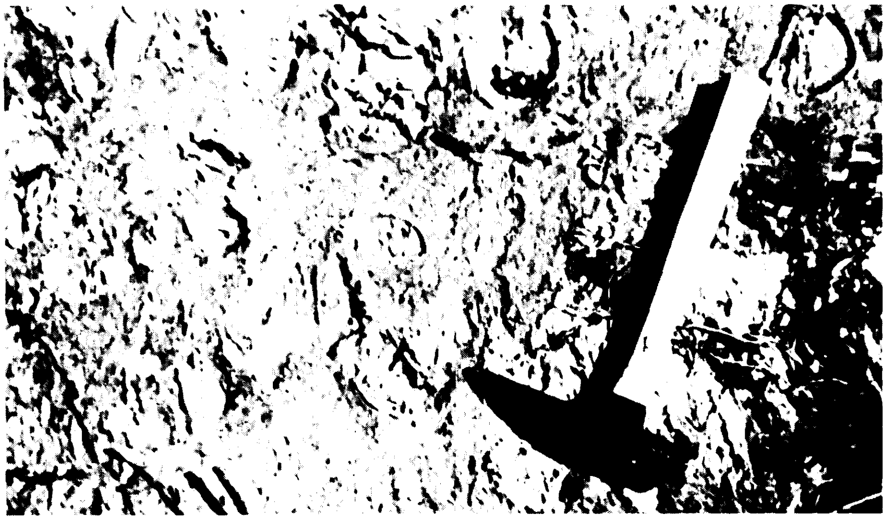

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Photo 1–Mafic agglomerate; east central Strathy Township. Note the chilled edge and globular shape of bombs and lapilli.

cally equivalent to that in Briggs Township. A remarkable development of porphryitic metabasalt is found in northwestern Strathy Township. In this area massive, and pillowed, medium- to coarse-grained basaltic metavolcanics contain up to 80 percent of subrounded to euhedral white weathering,pale green plagioclase phenocrysts up to several inches across.

The total area of porphyritic lavas exposed in Strathy Township is about 1.6 km^2 (1 square mile), but over most of this area the phenocryst content is only a few percent. The rocks easily could be mistaken for a younger intrusion, but the presence of well-developed pillow structures enclosing phenocrysts was noted in many localities.

Mafic Pyroclastic Rocks

Several occurrences of basaltic agglomerate were noted; most occur in southeastern Strathy Township, but a few occur near the boundary of Chambers and Strathy Townships and south of Chambers Lake.

The mafic agglomerate was shown on Preliminary Maps P.666 and P.667 (Bennett and Innes 1971a and b) as pillow breccia, which it closely resembles. The general lack of what might be interpreted as broken selvages of pillows makes it more likely that the rock is a mafic agglomerate.

In outcrop, agglomerate consists of rounded to irregularly shaped bombs, 30 to 50 cm (12 to 20 inches) long, which consist of brownish to greyish green weathering metabasalt. The bombs are set in a brownish weathering matrix of finely granular mafic material; the rock is apparently a mafic tuff (Photo 1). The bombs commonly show a well-defined chilled border which may consist of one or more concentric zones. A few were noted to have a centrally placed amygdule or inclusion of quartz. The bombs form 10 to 80 percent of individual outcrops. Little trace of bedding exists; the deposit being essentially chaotic in structure with a disrupted framework. The agglomerate (more correctly termed "agglomerate-tuff to tuff-agglomerate") was probably caused by a single explosive discharge of gas-charged mafic magma or a continuous eruption of gaseous mafic magma. A similar type of eruption probably produced the volcanic breccia characteristic of the Amphibolite Bay area [Southwestern Briggs Township]. This breccia is dominated by felsic debris, and is discussed in the subsection "Breccia and Tuffs". Reasons will be given, however, to show that the breccia, although felsic in overall composition, is caused by the eruption of mafic magma.

With the exception of specimens taken from contact aureoles of the granitic plutons, and those rocks which have undergone hydrothermal alteration, the intermediate to mafic metavolcanics display the following common mineral assemblage: albite ± epidote ± actinolite ± chlorite ± carbonate ± quartz, and ± sphene. Additional minor constituents include white mica, apatite, sulphide minerals, iron-titanium oxide minerals and leucoxene. The estimated range of percentages present is: 20 to 60 percent albite, 5 to 30 percent chlorite, 5 to 40 percent actinolite, and from 5 to 25 percent clinozoisite and epidote. As much as 15 percent iron-titanium oxide minerals were noted in mafic metavolcanics east of Spawning Lake in Briggs Township.

Textures of the mafic to intermediate metavolcanics are somewhat variable. In most cases, traces of the fabric of the original rock remain. The albite forms subhedral to euhedral laths up to 5 mm long; but generally less than 1 mm long. The pale green amphibole may form irregular patches and wisps, but locally the original outline of the pyroxene can be discerned. Chlorite appears to form knots and seams, and is less likely to form pseudomorphs. Although some specimens exhibit an apparently haphazard and chaotic recrystallized texture, some specimens are in a remarkable state of preservation. Some of the vesicular metabasalts retain the shapes of the original microliths and the primary felted texture. In the field, coarser grained varieties with a diabasic texture are sometimes difficult to distinguish from Nipissing Diabase.

FELSIC TO INTERMEDIATE METAVOLCANICS

In terms of structure and composition, these rocks are more varied than any other lithological assemblage in the map-area. During field mapping an attempt was made to include in this group only those rocks which range in composition from dacite to rhyodacite. Subsequent thin section examination and chemical analyses indicate that some of the rocks in this group shown on Preliminary Maps P.666 and P.667 (Bennett and Innes 1971 a and b) are probably andesitic in composition, but are close to the dacite boundary. These andesites are pale grey, flinty rocks with plagioclase phenocrysts from 2 to 4 mm in length. They are leucocratic and mesocratic rocks, and should not be confused with the dark green, mafic basaltic rocks described in the previous section.

Flows

Rocks in this group lack megascopic clastic textures. Most rocks in this group, however, may consist of "welded" and recrystallized tuffaceous rocks which have lost all visible evidence of their original pyroclastic origin.

The intermediate to felsic metavolcanic flows of the Northeast Temagami map-area range from grey to white on weathered surfaces, and almost black, through varying shades of grey and green to almost white on fresh surfaces. Ankeritized members are generally tinged with a red or orange hue, and tend to show pale green to pale brown colours on fresh surfaces. Most specimens are porphyritic, but the phenocrysts of plagioclase are generally from 1 mm or less to about 4 mm in length set in an aphanitic groundmass. Quartz phenocrysts are generally rounded, and range in diameter from 1 to 3 mm. Phenocrysts of plagioclase or quartz commonly form only a few percent of the rock; unless a careful examination of the weathered surface is made these phenocrysts may be overlooked when they are a mm in size or less.

Subrounded to irregular clots of chloritic material are common in the intermediate to felsic metavolcanics in some areas; particularly in central Chambers Township. The chloritic patches which range from less than 1 mm to about 4 mm in diameter, generally form only a few percent of the rock, and may be prominent in some exposures. Some of the chloritic patches appear to be amygdules and collapsed partly filled vesicles; others are apparently chloritic replacements of mafic minerals.

When examined in thin section, almost all the intermediate to felsic metavolcanics are prophyritic. Euhedral phenocrysts of albite rarely exceeding 3 mm are set in a very fine grained mosaic of granular quartz and feldspar, sericite, chlorite, clinozoisite, and actinolite. Quartz phenocrysts tend to be rounded, although euhedral forms are well represented.

Breccias and Tuffs

The term "volcanic breccias" (Fisher 1960) includes all breccias of volcanic origin including pyroclastic breccias, epiclastic rocks such as laharic-breccia (volcanic mudflows), waterlain volcanic-tuff, and volcanic talus-breccia.

Volcanic breccias are present throughout the volcanic assemblage of the Northeast Temagami area except in southeastern Strathcona Township, between Strathy Township, and the area immediately east of the Spawning Lake Stock in Briggs Township. Elsewhere, the felsic to intermediate metavolcanic breccias form layers from a few feet to several hundred feet thick intercalated with intermediate to felsic flows and mafic to intermediate metavolcanic flows. Good exposures of volcanic breccia and lapillistone are also found along the southern shore of the Northeast Arm of Lake Temagami in southwestern Briggs Township and along the northern shore of the Northeast Arm west of Axe Narrows. Highly ankeritized volcanic-breccias and tuffs are well exposed along Highway 11 in northern Strathcona Township.

The volcanic breccias display an extreme diversity of types. The most common type is similar to that exposed along Highway 11 south of Temagami. These breccias generally weather to a pale grey mottled colour, and are various shades of grey to dark green on fresh surfaces. Carbonatized areas are weathered to a conspicuous orange or brownish colour. The fragments, which are angular to well rounded, generally range in size from less than 1 cm to about 20 cm (8 inches). The average size of fragments from individual exposures generally ranges from 2.5 to 7.5 cm (1 inch to 3 inches). The lapilli and blocks are set in a matrix of lithic tuff consisting predominantly of sand-sized angular clasts. The degree of sorting is poor, and in most exposures the rock exhibits a disrupted fabric.

Bedding is rare, and is poorly defined (Photo 2). In some large exposures of volcanic breccia an irregular, but distinct size gradation can be seen. In almost all cases the size gradation is in agreement with stratigraphic direction as given by pillow structures in mafic lavas.

Several types of blocks and lapilli are commonly present, but most are dacitic metavolcanics with only subtle differences in appearance. Nevertheless, certain volcanic breccias which are exposed on Highway 11 south of Temagami at several locations contain lapilli of brownish ankeritic volcanic rocks set in a green matrix that clearly has not been ankeritized. No fragments of quartz or carbonate that might be considered to be derived from veins were noted in the breccia.

An unusual volcanic breccia and breccia-tuff occurs in the extreme part of southwestern Briggs Township, especially in Amphibolite Bay (Photo 3). The breccia consists largely of felsic volcanic debris, mainly lapilli, blocks, and tuffs of rhyolite and dacite. Scattered throughout the felsic debris are varying amounts of angular to rounded, fine-grained mafic lapilli and bombs (Photo 3). The shapes and the zoned structure displayed by the bombs indicate that they cooled in flight. This felsic to intermediate breccia is probably the result of the explosive eruption of gas-charged mafic magma. A similar breccia was found south of Chambers Lake in Chambers Township at approximately the same stratigraphic position as the breccia in Amphibolite Bay.

Rhyolite

Metavolcanics classified as rhyolite form a large part of the felsic volcanic unit which extends southwestward from central Strathy Township to the Cliffs of Canada property in southeastern Chambers Township. Rhyolite, rhyolite-breccias, and tuffs are intercalated with mafic metavolcanics north of Link Lake in Strathy Township. The felsic to intermediate metavolcanic assemblage in north-central Strathcona Township contains several units of rhyolitic rocks.

Rocks classified in the field as rhyolite are characterized by a very low content of mafic minerals (less than one percent) and a relatively high proportion of quartz phenocrysts. The rhyolitic rocks weather white, except where they are ankeritized. The fresh surface is pale yellow to pale green and is characterized by a translucent or "greasy" appearance. The matrix is generally aphanitic, but where sheared, sericitic micas are developed giving a silky sheen to the shear planes.

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Photo 2–Intermediate to felsic volcanic breccia; near Ontario Hydro transformer stations, about 2000 m (7,000 feet) north of Temagami, on west side of Highway 11.

ODM9617

Photo 3–Intermediate to felsic pyroclastic breccia with mafic bombs and lapilli; Amphibolite Bay, Northeast Arm of Lake Temagami.

ODM9618

Photo 4–Rhyolitic tuff-breccia with flattened pumice fragments; just south of railway line on property of William Milne and Son, Strathy Township.

Rhyolitic volcanic breccias tend to contain fragments of only one rhyolite. As a rule, the fragments of rhyolite-breccias tend to be smaller, generally less than 5 cm (2 inches) in size, than the dacitic breccias. Apparently, rhyolite tends to be more sheared and ankeritized than other volcanic rocks in the area. The genetic significance of this observation is uncertain; it might indicate an increase in fumarolic activity with rhyolitic vulcanism.

In thin section, the essential minerals in rhyolite are quartz, albite, and white mica. Quartz and albite form euhedral phenocrysts up to 5 mm long that are set in a very fine grained mosaic of granular quartz, albite, and white mica. Accessory minerals include clinozoisite, actinolite, and chlorite. A specimen of sheared rhyolite from the southern shore of Portage Bay of Lake Temagami contains minute euhedral crystals of chlorotoid (ottrelite) scattered throughout the groundmass. Carbonate concentrations in rhyolite form trace amounts to over 15 percent.

Several interesting occurrences of rhyolite breccia-tuff are found along the road to the Sherman Mine and near the townsite of William Milne and Son, just north of Link Lake. The breccia-tuff consists of about 10 percent lapilli and blocks of rhyolite in a matrix of sand-sized rhyolite-tuff. Numerous parallel wisps of darker material are evenly distributed throughout the rock (Photo 4). These wisps are almost certainly collapsed pumice fragments. Because of numerous pumice fragments, the lack of exotic blocks and the poor sorting, the rock is probably an ash flow deposit. Several such ash flows were recognized by the author; most appeared to be relatively thin units that were less than 30 m (100

TABLE 2 CHEMICAL ANALYSES OF METAVOLCANICS FROM THE NORTHEAST TEMAGAMI AREA, CHEMICAL ANALYSES BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES.

Chemical Analyses, Major Components in Percent

Sample Number	TZ8-2	E-2	C6-21	E7-91	C3-42
SiO_2	50.70	52.00	62.00	66.80	74.90
Al_2O_3	14.50	15.10	13.80	15.00	13.70
Fe_2O_3	3.30	4.39	1.45	1.93	0.39
FeO	7.65	6.13	5.69	2.81	1.07
MgO	3.72	4.53	3.52	1.43	0.85
CaO	7.56	8.83	2.69	2.28	1.80
Na_2O	1.99	3.02	5.55	3.62	0.86
K_2O	1.54	0.24	0.60	1.91	2.42
H_2O^+	3.70	2.46	2.11	1.42	1.54
H_2O	0.02	0.10	-	0.08	0.15
CO_2	4.77	0.28	0.79	0.82	2.38
TiO_2	1.39	1.21	0.59	0.48	0.08
P_2O_5	0.10	0.07	0.15	0.09	0.04
S	0.10	0.11	0.01	-	0.04
MnO	0.24	0.20	0.09	0.07	0.04
Total	101.28	98.67	99.04	98.74	100.26
Specific Gravity	2.79	2.98	2.72	2.74	2.73

Notes

TZ8-2	Mafic metavolcanic flow; east side of Highway 11, Strathy Township.
E-2	Porphyritic mafic metavolcanic flow; southern Briggs Township.
C6-21	Metadacite to andesite; southeast Chambers Township.
E7-91	Metadacite; south shore of Axe Narrows, Northeast Arm of Lake Temagami.
C3-42	Carbonatized, metamorphosed rhyolite, Tasse Lake, west-central Chambers Township.
-	Not detected.

feet) thick. Some ash flows were seen to be enclosed by pillow lavas, indicating that they were submarine deposits.

Peculiar spherulitic structures occur in an outcrop of white weathering rhyolite on the northern shore of Portage Bay at the northern end of the Northeast Arm of Lake Temagami. The structures consist of concentric circular or elliptical forms 2.5 to 10.2 cm (1 to 4 inches) across, around a centre filled with carbonate. Thin section examination suggests that the concentric forms have resulted from fracturing of the rhyolite around vesicles or amygdules. The concentric forms are probably a form of lithophysae.

PETROCHEMISTRY OF THE METAVOLCANICS

Chemical analyses of two metabasalts, and three intermediate to felsic metavolcanics are given in Table 2.

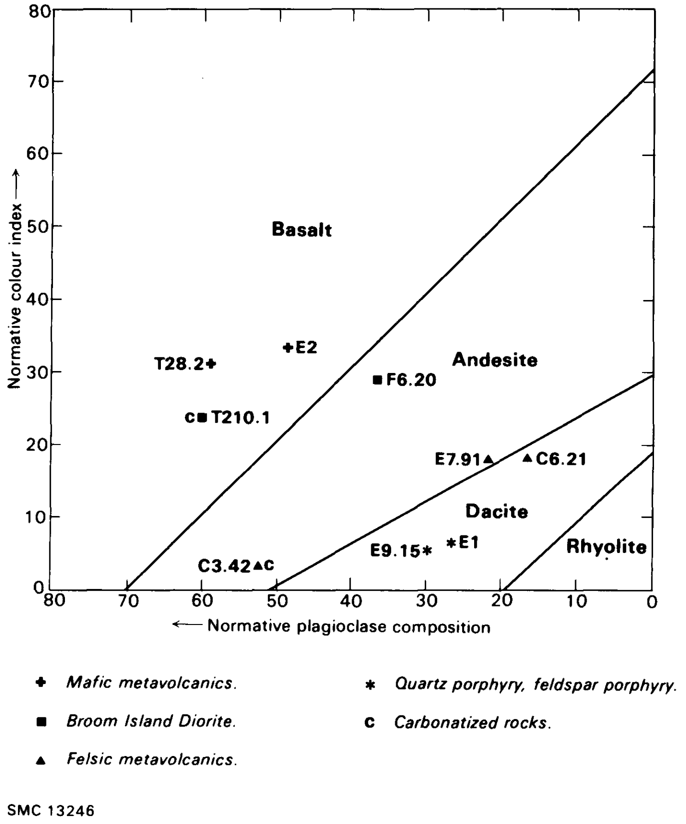

Figure 2–Normative plagioclase versus normative colour index for metavolcanics and rocks of possible metavolcanic association.

A plot of the normative plagioclase composition versus the normative colour index gives a chemically defined rock name equivalent to the generally accepted field name, provided the specimen is not significantly altered (Irvine and Baragar 1971). Figure 2 shows such a plot for the Temagami metavolcanics, and also two analyses of diorite and gabbroic rock and two analyses of quartz porphyry. These latter analyses are included for comparison, and because the rocks they represent may be part of the same period of igneous activity.

The two specimens classified in the field as metabasalt fall well within the basaltic area on the diagram (Figure 2). The three specimens of intermediate to felsic metavolcanics were classified in the field as dacite, rhyodacite, and rhyolite. Two of these specimens and the specimens of quartz porphyry plot on the line separating andesite from dacite (Figure 2). The plots confirm the identification of these rocks made from a thin section examination of many of the intermediate to felsic metavolcanics. The aberrant position of the carbonatized specimens is discussed in the section of this report dealing with carbonatization.

A more detailed classification of the metavolcanics was carried out by computer, using the method devised by Irvine and Baragar (1971). The results indicate that the metavolcanics of the northeast Temagami area are derived from a tholeiitic magma type, mainly the potassium-poor series.

IRON FORMATION

Two relatively persistent units of Algoma-type iron formation form the most reliable marker horizons of the map-area. The northern unit extends from south of Ferrim Lake at the western boundary of Chambers Township, eastwards through Iron Lake [not marked on Map 2323, back pocket, it is about 2.0 km (1.25 miles) southwest of O'Connor Lake] at the southeastern boundary of Chambers Township and northeastward through Vermilion Lake in Strathy Township. The southern unit extends from near the southwest corner of Briggs Township, along the north shore of the Northeast Arm of Lake Temagami, to the Tetapaga River and on through Turtle Lake on the boundary of Strathcona and Chambers Townships. The southern unit at its eastern end is unconformably overlain by the Gowganda Formation.

The northern unit is disrupted by the intrusion of the Spawning Lake Stock. The thickest sections occur at the Ko-Ko-Ko range (Jones and Laughlin Steel Corporation (5)) northwest of Business Lake in Chambers Township and at the lake 2.0 km (1.25 miles) southwest of O'Connor Lake in southeastern Chambers Township. At its northeastern end, the northern unit diminishes to narrow layers a few inches to a few feet thick intercalated with metavolcanics.

The thickest part of the southern unit lies between the northwestern corner of Strathcona Township and its eastern end near Snake Island Lake in Strathy Township. The part in Briggs Township may be discontinuous or very thin in the vicinity of the Tetapaga River. The presence of iron formation under the water of the Northeast Arm of Lake Temagami in central Briggs Township is indicated on magnetic maps of mining companies which are in the asessment files at Kirkland Lake (see Map 2324, back pocket, and Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

The iron formation consists mainly of oxide facies with subsidiary silicate facies, carbonate facies, and locally, sulphide facies. The oxide facies consists predominantly of interbedded chert-magnetite facies with minor hematite. Bright red to orange jaspilite is locally the predominant type of oxide facies. Silicate facies is the next most abundant facies noted by the author. Silicate facies is found intercalated with chert-magnetite and also occurs interbedded with clastic sedimentary rocks near the main iron formation units. Pale brown carbonate, probably siderite or ankerite, is locally disseminated with the oxide facies and may form narrow beds associated with oxide and silicate facies. Sulphide facies iron formation is best developed in the northern unit, especially in the vicinity of the north pit of the Sherman Mine. Many of the narrow, discontinuous beds of iron formation in central Strathy Township are pyrite- and pyrrhotite-rich iron formation. Interbedded chert and sulphide (probably pyrite) are present between the lakes 2.0 km (1.25 miles) southwest of O'Connor Lake and the Spawning Lake Stock. More detailed descriptions of the iron formation are given in the

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Photo 5–Metamorphosed volcanic conglomerate and greywacke; north shore of Northeast Arm of Lake Temagami near Axe Narrows.

sections "Cliffs of Canada (Sherman Mine) (1)" and "Jones and Laughlin Steel Corporation (5)", (see Property Descriptions for Chambers Township).

DETRITAL METASEDIMENTS

Metasediments such as volcanic greywacke, argillite, siltstone and cherty varieties are important components of only the upper members of the metavolcanic-metasedimentary pile (Photo 5). The thickest sequence of metasediments occurs along the axis of the narrow syncline in the vicinity of Tetapaga Lake in Briggs and Strathcona Townships. In this area, the metasediments have a maximum thickness of about 430 m (1,400 feet) just east of the Spawning Lake Stock. Thinner units of metasediments are found within the metavolcanic assemblage between Turtle Lake and the Tetapaga River in Briggs and Strathcona Townships and northwest of the southeastern corner of Chambers Township. The latter occurrence is poorly exposed and the extent of the metasediments in this area may be exaggerated. A thin unit of grey siltstone, too small to show at map scale, containing sparse rounded cobbles occurs south of Chambers Lake in Chambers Township.

Excellent exposures of metasediments and interbedded pyroclastic rocks and iron formation are found on the grounds of the public school at the northern edge of the village of Temagami and on the eastern side of Highway 11 about 0.8 km (½ mile) north of Temagami.

ODM9620

Photo 6–Interbedded greywacke and argillite (too small to show at map scale), southern Strathy Township.

Volcanic (Lithic) Greywacke, Siltstone, and Conglomerate

Metamorphosed volcanic (lithic) greywacke and siltstone are the most common Early Precambrian (Archean) metasediments, and probably form 70 to 90 percent of the total assemblage. The greywacke is generally pale grey to pale brownish grey on weathered surfaces, and medium grey to dark greenish grey on fresh surfaces. Bedding is usually well displayed in alternating greywacke, siltstone, argillite sequences. Bedding thickness varies from a few mm to several m but is usually in the range of 3 to 20 cm (1.2 to 7.9 inches). Graded bedding is common, and provides a useful indication of stratigraphic "tops". On the eastern side of Highway 11 about 0.8 km (½ mile) north of Temagami, the sedimentary rocks are brecciated and irregularly folded. At this location, the greywacke contains what appears to be a considerable proportion of pale grey chert or cherty argillite. The unconsolidated chert was probably a fluid silica gel that may have been the cause of pre-consolidation movement and brecciation; this was probably the case with much of the iron formation as well.

With decreasing grain size, the greywacke grades into siltstone and argillite (slate) (Photo 6). The decreasing grain size is generally accompanied by a darker colouration. As well as forming thin interbeds with the greywacke, the argillite (slate) and siltstone form units up to 30 m (100 feet) thick between Turtle Lake and the eastern boundary of Strathy Township. Parts of this argillaceous unit contain numerous nodules of granular pyrite that are about 2 cm (5 inches) across, but are occasionally up to 7 cm (3 inches) across. Some trenching near the eastern end of Turtle Lake indicates that the pyrite attracted some exploration attention.

There appears to be little coarse sedimentary detritus within the main sedimentary units. A conspicuous felsic to intermediate breccia, and tuff-breccia immediately underlies the metasediments in the vicinity of Turtle Lake in Strathy Township. The contact between the sedimentary rocks and the metavolcanics is locally gradational. The normally massive volcanic breccia shows crude bedding, and the volcanic blocks are more rounded near the contact with the metasediments. The boundary between the metavolcanics and the metasediments is therefore somewhat arbitrary at such locations.

A conglomerate or breccia is exposed at a few places from 0.8 km to 1.6 km (½ to 1 mile) northeast of Vermilion Lake. The rocks consist of subrounded to angular fragments of metavolcanics (both mafic and felsic), quartz and iron formation in a fine-grained granular matrix. Here, iron formation is abundant in some exposures. The conglomerate or breccia is probably an intraformational breccia or a fault-breccia.

Thin section examination reveals that the metamorphosed greywacke consists of approximately equal amounts of angular to subrounded grains of quartz, plagioclase and rock fragments, ranging in size from 0.3 mm to about 3 mm. A mosaic of silt to clay-sized quartz and feldspar with shreds of white mica, and minor epidote, chlorite, and sulphide minerals form a matrix which composes 10 to 30 percent of the rock. Carbonate and chlorite are locally present in amounts up to 10 percent. Stilpnomelane is present in a few specimens.

In some thin sections the original crystalline outline of the quartz and feldspar is still preserved.

DISCUSSION

The Early Precambrian (Archean) metasediments of the Temagami area are mainly volcaniclastics and could be classified as epiclastic volcanic rocks. The volcanic source area for these rocks is indicated by the following: the transition from volcanic breccias to relatively well-sorted metasediments, the similar mineralogy of the felsic metavolcanics and metasediments, and the presence of euhedral quartz and feldspar grains in a few specimens. Rapid deposition from a relatively unstable, partly unconsolidated felsic volcanic source is suggested by the immature nature of the material. The thickening of the metasediments near Pigot Lake indicates that the main areas of basining were towards the west.

METAMORPHISM

Thin section examination of the metavolcanics reveals a mineral assemblage consistent with the quartz-albite-muscovite-chlorite subfacies of the greenschist facies of regional metamorphism as defined in Winkler (1967). Because the few occurrences of biotite are so limited in extent, the author suggests that biotite is only caused by local effects such as baking of rocks adjacent to intrusions or to hydrothermal alteration. Therefore the quartz-albite-epidote-biotite subfacies of the greenschist facies of regional metamorphism was not attained in these rocks.

A more detailed sampling and thin sectioning programme would determine the width and nature of the contact aureoles around the various granitic bodies. The hornfels zones are characterized by abundant, shiny crystals of amphibole, and by brittle and tough rocks. Also the hornfels zones, although variable in width, are probably much less than 300 m (1,000 feet) wide around the intrusions. Where it is likely that relatively thin segments of metavolcanics are surrounded by granitic rocks, such as in southern Strathcona Township and in northeastern Strathy Township, the megascopic evidence of contact metamorphism indicates that the thickness of the metamorphic aureole is greater than 300 m (1,000 feet).

Intermediate to Ultramafic Intrusive Rocks

The rocks of this group include those intrusions which occur as thick sills within the metavolcanic pile, and can generally be distinguished from the mafic flows because of some megascopic characteristics. These rocks are known to intrude the flows, but do not appear to intrude the major granitic rocks of the area.

BROOM ISLAND DIORITE

At least two thick sills of pale green weathering, medium-grained, massive, equigranular to porphyritic dioritic to gabbroic rock are exposed on islands in the Northeast Arm of Lake Temagami in Briggs Township. The diorite can be distinguished from the metavolcanics by the presence of 10 to 30 percent dark green, stubby crystals of amphibole 1 to 2 mm long in a pale grey weathering groundmass. The contact facies of the Broom Island Diorite is porphyritic and finer grained than the "normal" diorite.

Thin section examination reveals 60 percent euhedral to subhedral crystals of albite from 1 to 3 mm long that are unzoned and display well-developed albite twinning. Alteration of the plagioclase has produced some very fine grained, micaceous material evenly disseminated throughout the crystals. Plagioclase in some of the diorite is pervaded by a very fine myrmekitic structure. The myremekitic structure appears to be controlled by the crystal structure of the host. The chief mafic mineral is a pale green, massive amphibole (tremolite-actinolite) which, with a pale green chlorite, and possibly a type of serpentine, form pseudomorphs after what appears to have been pyroxene. Biotite is present in amounts up to 7 percent; clinozoisite, quartz and leucoxene form 2 to 6 percent of the rock. In many places, the Broom Island Diorite contains abundant euhedral amphibole.

The finer grained contact facies shows a porphyritic texture and has a greater plagioclase content than the "normal" diorite. A strong preferred orientation of the plagioclase phenocrysts and matrix is probably a primary feature. The remaining minerals include chlorite, actinolite, quartz, and relatively large euhedral crystals of clinozoisite.

At least two sills of diorite and quartz diorite up to 180 m (600 feet) thick and megascopically similar to the Broom Island Diorite, are well exposed along the road to the Sherman Mine in southern Strathy Township. The diorite is pale grey to white on weathered surfaces and dark green on fresh surfaces. The rock is medium grained, equigranular and massive in hand specimen. The white weathered and pitted surface of some exposures in road-cuts suggest a felsic rock; but an examination of the fresh surface, and especially a smooth glacially polished surface, will reveal the dioritic to gabbroic composition and texture of the rock.

A thin section of a typical specimen indicates that the sill which extends along the road to the Sherman Mine consists of diorite to quartz diorite. The essential minerals are albite (60 percent), quartz (10 percent), penninite (10 percent), carbonate (10 percent), white mica (7 percent), and leucoxene (3 percent). The albite forms 1 to 2 mm subhedral grains which show albite twins and have only a moderate amount of micaceous alteration. Quartz, penninite, and scaly masses of white mica and carbonate are all interstitial to the plagioclase. This diorite has an appearance in thin section very similar to the contact facies of the Broom Island Diorite.

A chemical analysis of a representative sample of the Broom Island Diorite is given in Table 3, as well as that of a specimen from the dioritic rocks along the Sherman Mine road in Strathy Township. The marked differences in these analyses do not eliminate the possibility that these rocks are related. The chemical differences appear to be largely caused by alteration. Note the much higher content of carbon dioxide and water in the specimen from the Sherman Mine road. Recalculation of the analyses of the specimen from the Sherman Mine road shows that the silica and alumina content of both samples of diorite are similar when compared on a volatile free basis (see Table 7). Alumina and to a lesser extent silica, are probably less subject to weathering and hydrothermal alteration (Krauskopf 1967).

AJAX INTRUSION (CUNIPTAU GABBRO)

The body of mafic to ultramafic rocks referred to here as the Ajax Intrusion is located in central Strathy Township about 1.6 km (1 mile) south of Kanichee Lake. The intrusion is roughly oval in plan with a north-south length of about 1070 m (3,500 feet) and is about 760 m (2,500 feet) across. Several satellite intrusions nearby are presumed to be related to the main body.

The rocks of the Ajax Intrusion and related bodies range in composition from serpentinite to partly altered gabbro and diorite. The serpentinite appears to be largely restricted to a small protrusion into the metavolcanics from the western side of the main mass. The serpentinite contains significant deposits of copper, nickel, and precious metals. The petrography of the serpentinite is discussed in the section on Mineral Deposits dealing specifically with the property of Ajax Minerals Limited (6)[1].

[1]Number in parentheses refers to Property Number on Map 2323 in back pocket.

TABLE 3 CHEMICAL ANALYSES OF EARLY PRECAMBRIAN MAFIC INTRUSIVE ROCKS, (ANALYSES BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES).

Major Components in Percent

Sample Number	F6-20	TZ10-1
SiO_2	59.00	49.80
Al_2O_3	13.90	12.30
Fe_2O_3	1.61	3.43
FeO	4.84	6.90
MgO	6.40	1.20
CaO	4.78	4.72
Na_2O	3.38	1.60
K_2O	1.57	0.05
H_2O^+	2.50	5.73
H_2O	0.18	0.01
CO_2	0.20	2.84
TiO_2	0.54	0.49
P_2O_5	0.07	0.08
S	0.01	0.01
MnO	0.12	0.15
Total	99.10	101.10
Specific Gravity	2.82	2.74

Notes

F6-20 Broom Island Diorite; from an island in the Northeast Arm of Lake Temagami, central Briggs Township.

TZ10-1 Carbonatized diorite; on road to Sherman Mine in south-central Strathy Township.

The main body of the Ajax Intrusion consists of reddish brown to dark grey weathering gabbro and pyroxenite. Pyroxenite is dark green on fresh surfaces, while gabbro is mottled green and grey. All the exposed rocks are massive and equigranular. A limited amount of sampling and seven thin sections suggest that gabbroic rocks occupy the central part of the intrusion and pyroxenite the periphery.

Peridotite consists mainly of antigorite pseudomorphs of olivine within grains of clinopyroxene (Photo 7). Epidote, carbonate, iron-titanium oxide minerals, and chlorite are present in the groundmass.

The pyroxenite consists of 50 to 90 percent unaltered, zoned clinopyroxene. The optic axial angle (2V) of the core of a zoned clinopyroxene crystal was measured at 55 degrees, while that of the rim was 51 degrees. The remainder of the pyroxenite consists mainly of actinolite which replaces clinopyroxene. Epidote, carbonate, iron-titanium oxide minerals, and chlorite are present in minor amounts.

The gabbro is a highly altered or metamorphosed rock. The gabbroic texture of the original rock is preserved, but the plagioclase has been entirely replaced by granular clinozoisite, carbonate, and white mica. The pyroxene had been re-

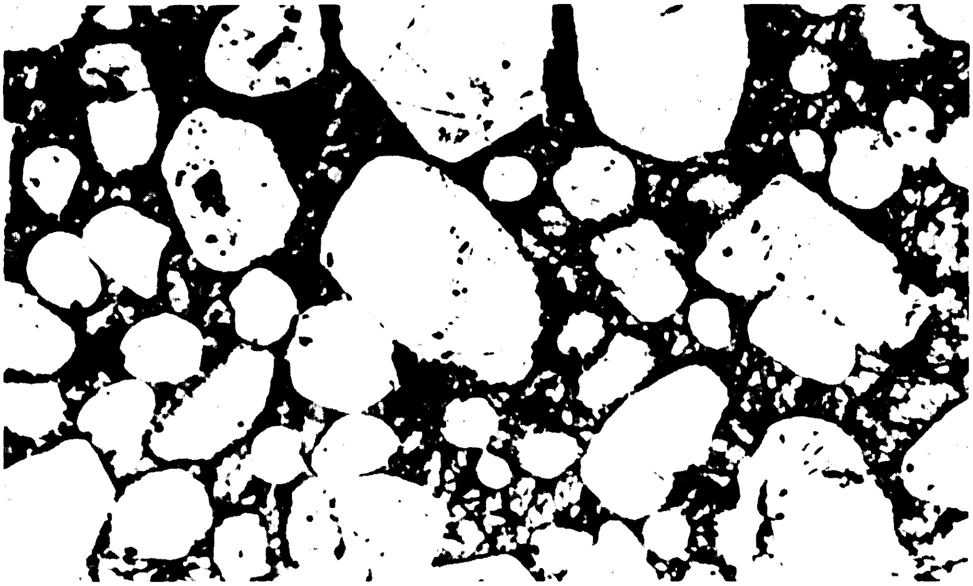

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Photo 7–Peridotite; Ajax Intrusion, Strathy Township. Antigorite pseudomorphs of olivine within clinopyroxene, plane polarized light X 25 Magnification.

placed by colourless to pale green tremolite-actinolite. Carbonate, oxide minerals, and leucoxene are accessory minerals (Photo 8).

TEMAGAMI ISLAND GABBRO

At least two intrusions of altered gabbroic and dioritic rocks form sill-like bodies from 150 to 300 m (500 to 1,000 feet) thick in southwestern Briggs Township and in north-central Strathcona Township. Diamond drilling has indicated that the sills dip steeply to the north. These intrusions are known locally as metadiorite sills and are considered by some geologists to have acted as a control for the high-grade copper ore bodies of the Temagami Copper Mine on Temagami Island, in Phyllis Township, about 2.4 km (1½ miles) southwest of the southwestern corner of Briggs Township (Simony 1964; Rose 1966; personal communication with mine geologist of Copperfields Mining Corporation, 1971).

The metadiorite is referred to here under the more specific title of the "Temagami Island Gabbro" to distinguish it from other intermediate to ultramafic intrusions.

In addition to the two main intrusions referred to above, the author observed two hitherto unrecorded, minor intrusions of Temagami Island Gabbro in the Northeast Arm of Lake Temagami. One occurrence is found as a roughly west-striking dike a few feet (1.0 m) wide, intruding felsic metavolcanics on a small island 760 m (2,500 feet) southwest from the southwestern tip of Ferguson

Photo 8–Altered gabbro; semi-opaque laths of altered plagioclase (dark) and uralitized pyroxene. Ajax Intrusion, central Strathy Township; plane polarized light X 25 Magnification.

Island in Strathcona Township. The second intrusion is found near the outlet of a small lake about 2400 m (8,000 feet) northeast of the southwestern corner of Briggs Township. This occurrence is a highly sheared dike only a few feet across which strikes northeast and dips steeply to the north. The exposure was covered by a few inches of water.

A. Colvine, Ontario Division of Mines Geologist (personal communication, 1975), reported the presence of outcrops of Temagami Island Gabbro on Ferguson Island.

The Temagami Island Gabbro is typically medium grained, medium to dark green to greyish green on fresh surfaces. Wave-washed surfaces are commonly bright green and pitted, making the rock easily distinguishable from mafic metavolcanics and most of the other mafic intrusive rocks of the area. The presence of scattered quartz "eyes", bronze coloured leucoxene, and pyrite is also characteristic. The fabric may range from massive to distinctly foliated and sheared. Local zones of carbonatization and silicification are common. In southwestern Briggs Township there are local areas of highly feldspathic and siliceous rock. Some of this rock resembles highly altered anorthosite similar to the anorthositic parts of the altered gabbro in central Strathy Township referred to in the subsection "Other Gabbroic and Ultramafic Bodies". The anorthositic and siliceous parts of the Temagami Island Gabbro occur on the northwestern side of the body. This position is probably the upper surface of the body.

Thin section examination reveals that the essential minerals are white mica (presumably paragonite), carbonate (calcite or dolomite), and chlorite. Quartz, albite, leucoxene, pyrite, and opaque oxides are accessory minerals. Locally, quartz (10 to 15 percent) is present forming equant grains about 0.5 mm across; but this appears to be a result of silicification rather than a differentiation process.

Locally, the original texture of the Temagami Island Gabbro is preserved in relict form. Pseudomorphs after euhedral plagioclase (?) from 0.5 to 3 mm long are enclosed in a mixture of fine-grained chlorite, carbonate, and white mica. This rock has a strong foliation, which may represent a relict cleavage in a former pyroxenite or amphibole. The plagioclase (?) pseudomorphs show a well defined alignment indicative of a strong primary foliation. The white mica and carbonate constitute the major part of the pseudomorphs and form a felted mass without any indication of foliation such as is shown by the surrounding material.

Pyrite Zone

The feature of the Temagami Island Gabbro which has received much attention, is a pyritic zone along the footwall, the southeast side of the sill. The pyrite zone appears to occur consistently with the base of the sill, although its thickness varies from a few inches to several tens of feet.

A description of the pyrite zone at the footwall of the Temagami Island diorite on Temagami Island was given by Rose (1966). Although the pyritic zone may be particularly well developed here, diamond-drill log descriptions from the Armex Limited property in Strathcona Township by Candela Development Company and Diadem Mines Limited (see "Property Descriptions for Strathcona Township"), as well as visual observation by the author, indicate that the relationships described by Rose (1966) apply to the pyrite zone at the base of the sill in Briggs and Strathcona Townships as well.

Rose (1966 p.32-33) stated:

> The pyritic deposits consist dominantly of heavy, irregular disseminations, less abundant impure veins, and nearly massive aggregates of very pale, fine-grained, nickel-bearing pyrite, emplaced mainly into grey rhyolite and altered mafic rocks that were once presumably andesite and diorite. A minor amount of millerite, linnaeite (siegenite?), pyrrhotite, and possibly also violarite and bravoite is intergrown with the pyrite and within gangue minerals that surround and penetrate the pyrite masses. Chalcopyrite is locally abundant in the pyritic ore, and is also associated with gersdorffite in places. Gersdorffite and millerite both appear to be more common in the chalcopyrite-rich occurrences.
>
> The host rocks are heavily fractured and brecciated. The dense rhyolite is much less altered than the mafic rocks, which are intensely saussuritized and chloritized, but both are commonly strongly dolomitized and silicified within the pyritic ore zone. In places the pyritic ore encloses linear and irregular remnants, wisps, and grains of unreplaced rock fragments, but as indicated above, it is also penetrated and replaced in part by quartz, carbonate, and silicate gangue minerals in irregular veins or masses that commonly also carry dispersed chalcopyrite....
>
> Several generations of intersecting glassy and milky quartz veins, essentially barren, but carrying a little pyrite or chalcopyrite, as well as quartz-carbonate veinlets suggest that there were overlapping periods of mineralization. This situation tends to obscure some of the more significant primary relationships between the minerals.
>
> Neither the full extent of the deposits nor the nature of the overall factors governing the formation of the pyritic ores are known. They appear to be magmatic replacement deposits formed in fracture zones in volcanic rocks along the footwall contact of the intrusive metadiorite sill.

Although the pyrite zone occurs in a position consistent with an origin by sulphide immiscibility and gravity settling, it displays much evidence of hydrothermal activity such as alteration and veining.

The main effect noted by the writer in Briggs and Strathcona Townships is the intense chloritization at the base of the sill where the sulphide minerals are concentrated. The sulphide minerals are not restricted to the mafic sill itself, but also are present as blebs and veins within the felsic metavolcanics adjacent to the base of the sill.

A detailed study of the sulphide zone in the area of the mine on Temagami Island was made by Franklin (1966). He concluded that the pyrite zone resulted from the hydrothermal alteration of a pyrrhotite-bearing zone at the base of the sill, the pyrrhotite being replaced by pyrite with the release of nickel to form millerite.

Rose (1966) concluded that the deposits at the Temagami Copper Mine resembled the Sudbury ores to some extent; texturally and geochemically, as well as the geologic setting.

OTHER GABBROIC TO DIORITIC INTRUSIONS

About 1200 m (4,000 feet) east of the Ajax Intrusion is a northeast-striking sill-like body of quartz diorite about 600 m (2,000 feet) long and 30 to 150 m (100 to 500 feet) wide. This intrusive body hosts the gold deposits on the Cominco Limited property (12), (see subsection "Cominco Limited (12)").

The quartz diorite is a relatively siliceous rock in comparison to the other mafic to intermediate intrusions of the Temagami area. Quartz forms graphic intergrowths between laths of saussuritized plagioclase (albite or oligoclase). Chlorite, carbonate, and clinozoisite are the remaining major constituents.

A sill-like northeast-trending body of highly altered gabbroic to anorthositic rocks is found about 0.8 km (½ mile) north of Arsenic Lake in central Strathy Township. The intrusion is about 1400 m (4,500 feet) long and averages about 180 m (600 feet) wide. The body is truncated by the granitic rocks of the Strathy-Chambers Batholith at its northeastern end.

The rocks of this intrusion vary a great deal in composition and texture. Along the northwestern border, the footwall side [1], the rocks are generally dark coloured, medium- to coarse-grained gabbroic types; but those on the southeastern or hanging wall side appear to be, at least in part, pale grey and anorthositic. Textures range from hypidiormorphic-granular to distinctly poikilitic types. Poikilitic crystals of black amphibole up to several inches long, enclose crystals of white to pale green saussuritized plagioclase. The texture is best described as being indistinct or irregular in most areas.

Three thin sections reveal similar mineral phases, although the relative proportions of the phases and textures varied considerably. The essential minerals are albite, penninite, pale green amphibole, carbonate and granular crystals of clinozoisite as much as 2 mm long. Leucoxene and quartz are present as minor

[1]see section "Ajax Minerals Limited (6)".

constituents. The albite occurs as fine, irregular grains with clinozoisite, but a few tabular crystals with more calcic cores are visible in one specimen. The clinozoisite displays deep anomalous blue interference colours and zoned crystals; some of them are euhedral.

The amphibole is apparently actinolite, judging from the pale green colour, and forms irregular, fibrous masses and well crystallized discrete grains. In general, the gabbro appears to be more highly altered than the enclosing metavolcanics.

Significant features of this particular body of gabbroic rocks are several areas of visibly appreciable mineralization. The mineralization generally consists of disseminated pyrite, pyrrhotite, chalcopyrite and galena. It may be coincidence, but several mineral occurrences are also found near the gabbro body within the metavolcanics.

Scattered throughout the metavolcanic assemblage of Chambers Township are several bodies of altered or metamorphosed gabbro to quartz diorite. The lack of continuous exposure makes the outline of the bodies on the map somewhat conjectural, but probably many of these bodies are small, irregular intrusions of plugs as well as sills. Most of the altered bodies are grey to greenish grey weathering dark green, massive, medium-grained rocks. Stubby crystals of amphibole or pyroxene can generally be recognized on the weathered surface.

In thin section, the essential minerals are albite, clinozoisite, and epidote, actinolite and chlorite. Some specimens contain granophyric quartz, brown hornblende and orthopyroxene (enstatite and hypersthene). The latter mafic minerals appear to be primary magmatic minerals but have been almost completely replaced by chlorite and amphibole. Carbonate is locally abundant. Accessory minerals include apatite, pyrite, iron-titanium oxide minerals, or leucoxene as an alteration of the oxide minerals.

The textures of the gabbroic and dioritic rocks are highly variable, ranging from distinct relict diabasic textures to completely secondary textures consisting of feathery crystals of actinolite, granular patches of deep blue clinozoisite, carbonate, and albite (see section on "Temagami Island Gabbro").

DISCUSSION

The dioritic to ultramafic rocks described in this section are important because of the occurrence of significant mineral deposits within and adjacent to them.

Two related problems exist when mapping these rocks. The first problem arises with the recognition and subdivision of the various intrusive bodies. Certainly, there are differences in composition and texture between the various intrusions that enable a geologist to separate the intrusions from the surrounding rocks and from other intrusions. The Broom Island Diorite, for example, can generally be distinguished in the field on the basis of texture and mineral composition from the Temagami Island Gabbro and from other gabbroic intrusions. The problem is whether these differences are significant in terms of age and origin.

The most important problem is the determination of the relative geological age of the intermediate to ultramafic intrusions. Most specimens of intermediate to ultramafic intrusive rocks examined are now composed of mineral assemblages probably formed under temperature and pressure conditions of the greenschist facies of regional metamorphism. These mineral assemblages indicate that the intermediate to ultramafic intrusive rocks have undergone metamorphism with the surrounding volcanic rocks. Such rocks could represent intrusive equivalents of the metavolcanic flows. Gabbro bodies of similar form have not been found to intrude the granitic batholiths. Ultramafic rocks such as those of the Ajax Intrusion and the small plug on Tasse Creek have not been found to intrude the granitic rocks. A pre-granite age for the dioritic to ultramafic rocks can, therefore, be assigned to these rocks with some degree of confidence.

Intermediate to Felsic Intrusive Rocks

HYPABYSSAL FELSIC INTRUSIVE ROCKS

Most of the intrusions in this group can be classed as felsic porphyries. Many porphyries, such as those in Briggs and Strathcona Townships, appear to be spatially associated with major granitic bodies. Other minor intrusions of porphyry within the interior of the metavolcanic belt may be related to the main period of vulcanism. Apparently no reliable petrographic criteria exist for classifying the various types of porphyry. Where intrusive contacts are lacking, the author may have had a bias to include the felsic porphyries as members of the felsic to intermediate metavolcanics.

Most of the porphyries appear, from indirect evidence, to predate the intrusion of the main granitic bodies. However, some fine-grained quartz porphyries and felsites intrude the Iceland Lake Pluton of Briggs and Strathcona Townships.

Porphyries of Granitic Association

A number of concordant and subconcordant intrusions of quartz-feldspar porphyry intrude metavolcanics bordering the Iceland Lake Pluton in Briggs and Strathcona Townships. Most of these intrusions occur as narrow sills and dikes along the eastern boundary of the Iceland Lake Pluton and as discrete bodies at the northeastern and southwestern ends of the pluton.

Detailed mapping along the contact between the Iceland Lake Pluton and the discrete quartz-feldspar porphyry bodies in southwestern Briggs Township, and near Jessie Lake in Strathcona Township failed to reveal any direct evidence of intrusive relationships. However, it was noted that the outcrop distribution indicated the porphyries were truncated by the plutonic masses, and are thus older than the granitic rocks. The same relationships hold for narrow dikes and sills of quartz porphyry and hornblende-bearing quartz-feldspar porphyry along the eastern side of the Iceland Lake Pluton.

These latter porphyries include a pale to medium grey variety which contains prominent, euhedral prisms of black amphibole up to 1.9 cm (¾ inch) long. Pale grey to chalky white plagioclase phenocrysts and quartz phenocrysts are generally present as well. The similarity of the size and habit of hornblende in the porphyry and in the hornblende trondhjemite of Strathcona Township suggests that these rocks are related.

The two specimens of hornblende-bearing porphyry examined in thin section are seen to be considerably more altered than specimens of the hornblende trondhjemite. Plagioclase phenocrysts are generally replaced by sericite and the hornblende is almost entirely replaced by chlorite and uralite. Patches of relatively clear plagioclase were determined to be An_3. Accessory minerals include epidote, opaque oxides, sphene, and white mica.

Most of the remaining quartz-feldspar porphyry bodies associated with the Iceland Lake Pluton are pale grey to white weathering, and dark grey to green, on fresh surfaces. Either or both quartz and feldspar phenocrysts may be distinct on the weathered surface, but in many exposures the only phenocrysts are small (2 mm) quartz "eyes" which are easily overlooked by the observer.

Many outcrops classified as rhyodacite in the vicinity of Jessie Lake and Pingue Lake in the northeastern part of Strathcona Township may be intrusive porphyry. Moorhouse (1942, p.7) experienced similar difficulty in classifying intrusive porphyry and metavolcanics in this area.

In thin section, the quartz-feldspar porphyry is seen to contain up to 20 percent moderately strained quartz phenocrysts from 1 to 5 mm across. Quartz forms euhedral phenocrysts and deeply embayed partly resorbed grains. Euhedral phenocrysts of albite (An_3 to An_8) generally show little evidence of zoning, or of relict zoning, and have a dispersed micaceous alteration. Microcline was not identified in these porphyries. With the exception of the amphibole-bearing porphyry previously described, mafic minerals are very scarce in most porphyries of Briggs and Strathcona Townships. Chlorite and uralite are the predominant mafic minerals. Epidote and clinozoisite are locally present as granular aggregates. Carbonate is generally present, and may be abundant in the more highly altered specimens. The groundmass consists of a fine mosaic of quartz, untwinned equant grains of feldspar, and abundant flakes and wisps of white mica. Zircon, apatite, opaque oxides, and sulphides may be present in trace amounts. Leucoxene replaces iron titanium oxides in altered specimens.

In addition to these older porphyries which are intruded by the Iceland Lake Pluton, there are several dikes and irregular masses of younger quartz porphyry that intrude all phases of the Iceland Lake Pluton. Outcrops of these younger porphyries form one or two north-trending zones extending from the southern boundary of Strathcona Township to the southern shore of the Northeast Arm of Lake Temagami.

Megascopically these rocks are pale grey to white weathering quartz porphyries. Fresh surfaces are pale grey with a porcelaneous appearance in some outcrops. In thin section, the rocks are seen to be highly altered. Feldspar, presumably plagioclase, is reduced to "ghost-like" outlines of fine, micaceous material in a very fine grained matrix of quartz, feldspar, sericite, chlorite, epidote, and carbonate. The adjacent plutonic rocks do not show this degree of alteration.

A distinctive sill of pale pink quartz-feldspar porphyry and white feldspar porphyry is exposed along the northern shore of the Northeast Arm of Lake Temagami and also on the northern shore of Tetapaga Lake. Moorhouse (1942, p.18) considered this rock to be related to the Spawning Lake Stock, which it somewhat resembles in hand specimen and is shown as such on Preliminary Map P.595 (Bennett and McNally 1970a). Thin section examination reveals that the rock is a feldspar porphyry consisting of about 60 percent phenocrysts of almost completely sericitized feldspar, (probably plagioclase) in a very fine grained matrix of quartz, albite (?), white mica, clinozoisite, and chlorite. The rock is a highly altered feldspar porphyry and the thin section examination shows that it does not resemble the quartz monzonite of the Spawning Lake Stock.

Other Porphyritic Intrusions

Perhaps the most interesting porphyries are those which occur near some of the more important metal deposits of the map-area and that could have some genetic relationship to them. Quartz porphyry, quartz-feldspar porphyry, and a fine-grained felsic rock (felsite) are found in close spatial association with the arsenide minerals at the Big Dan deposit, the Little Dan at Arsenic Lake and many minor sulphide occurrences which were prospected by Strathy Basin Mines about 1935 (Moorhouse 1942, p.26). Although all porphyries vary somewhat, they have essentially the same mineralogy, namely quartz and albite phenocrysts, with a groundmass of quartz and feldspar containing minor amounts of chlorite, white mica, epidote, carbonate, and rarely potassium feldspar and uralite. Most are relatively fine grained, but a north-south trending dike or sill south of Kanichee Lake is medium grained with a granitic texture. The clinozoisite of this dike displays compositional zoning similar to that noted in some altered gabbroic bodies.

A roughly rectangular body of quartz-feldspar porphyry about 1500 m (5,000 feet) long by 370 m (1,200 feet) wide is located in southwestern Chambers Township. The intrusive relationships of the porphyry to the Spawning Lake Stock and the gabbroic intrusives are unknown; the relationships shown on the geological map are assumed (Map 2323, back pocket). The outcrop distributions suggest that the porphyry intrudes the metavolcanics and is in turn intruded by the late diabase dikes.

The porphyry has a fine-grained to aphanitic quartzofeldspathic groundmass which contains about 10 percent rounded phenocrysts of quartz. Plagioclase phenocrysts about 5 mm long are also present, but are not conspicuous in hand specimen. The rock is massive, weathers pale grey to white, and is dark grey on fresh surfaces.

In thin section, the porphyry is seen to contain moderately altered, zoned plagioclase (An_2 to An_7) forming euhedral to subhedral phenocrysts about 5 mm long. Quartz forms rounded to euhedral grains about 4 mm across. White mica forms sheaf-like aggregates about 1 mm across. Accessory minerals include epidote, zircon, chlorite, pyrite, and microcline.

GRANITIC PLUTONIC ROCKS

Iceland Lake Pluton

The Iceland Lake Pluton includes most of the granitic rocks of Briggs and Strathcona Townships. The granitic rocks of this pluton may be divided into three groups which consist mainly of (1) chlorite trondhjemite, (2) hornblende-quartz diorite, (3) hornblende trondhjemite.

All three groups do not differ greatly in overall composition. The distinction was made mainly on the basis of texture as well as a megascopic estimation of the percentage of mafic minerals and quartz during field mapping. The rocks in question appear to straddle the boundary between quartz diorite and trondhjemite. The division used here agrees with that of Moorhouse (1942).

Chlorite Trondhjemite

The chlorite trondhjemite phase of the Iceland Lake Pluton includes that roughly oval-shaped body of granitic rocks extending from the southern boundary of the map-area near Driftwood Lake, northeastward into central Strathcona Township. The body is about 9.6 km (6 miles) long by 3.2 km (2 miles) wide with a total area in the map-area of about 20.7 km^2 (8 square miles). Good exposures of chlorite trondhjemite phase are found along the Temagami Mine road in Strathcona Township and on Iceland Lake in the western part of Strathcona Township.

The chlorite trondhjemite phase of the Iceland Lake Pluton is generally massive, equigranular, with an average grain size of about 3 mm. The chlorite trondhjemite is a mottled dull grey to pale brownish grey, or pale green on fresh surfaces, and grey to dull white on weathered surfaces. At many localities the joint surfaces are coated with a thin coating of dark green chlorite. This feature is particularly noticeable in outcrops along the Temagami Mine road (see Map 2324, back pocket), and a cursory examination would result in the false impression that the rock is quite variable in composition. Local areas of the trondhjemite are a pronounced green colour, but this appears to be caused by a green alteration of the plagioclase, rather than any marked difference in overall composition. Inclusions of metavolcanics are common in some parts of the chlorite trondhjemite, and are particularly well exhibited in outcrops along the road to the Temagami Mine. In most exposures the long direction of the inclusions were found to be aligned in an east to northeast direction. Pegmatite and aplite are rare in the chlorite trondhjemite phase.

Thin section examination reveals that the rock consists of subhedral tablets of albite (60 to 70 percent), irregular grains and masses of quartz (20 to 35 percent), and chlorite which has apparently replaced biotite (1 to 6 percent), epidote and clinozoisite (1 to 3 percent), forms small subhedral grains. Carbonate may be present in amounts up to 3 percent. Sphene, leucoxene, iron-titanium oxides, are commonly present. Zircon and apatite are present in very minor amounts. Potassium feldspar is present only as trace amounts in a few of the thin sections studied. Plagioclase is moderately altered, resulting in the development of sericite, carbonate and tiny grains of clinozoisite. The plagioclase was found to be albite (An_1 to An_8). The optic axis measurements are consistent with a low temperature structural state for plagioclase. In many thin sections albite apparently has a uniform composition with no evidence of zoning, or relict zoning as indicated by zones of varying degree of alteration.

Hornblende-Quartz Diorite

The hornblende-quartz diorite phase of the Iceland Lake Pluton forms the western part of the pluton, and its eastern limit roughly coincides with the eastern boundary of Briggs Township.

The quartz diorite is usually massive, medium grained, with a granitic texture. A few specimens from near the mouth of the South Tetapaga River displayed a somewhat granophyric texture. Quartz diorite generally has a higher percentage of mafic minerals than the chlorite trondhjemite, and can be easily distinguished from the hornblende trondhjemite by the coarser grain size and more euhedral and prismatic hornblende of the latter rock.

In thin section, most specimens of hornblende-quartz diorite contain subhedral, altered plagioclase grains (An_2 to An_8) about 3 to 4 mm long, but one was found to contain oligoclase (An_{14} to An_{20}). Green, partly chloritized and uralitized hornblende crystals and highly variable amounts of chlorite, biotite, epidote, and carbonate are present. Quartz may be present in amounts up to 15 percent, but locally may be so scarce that the rock could be classified as a diorite. Minor amounts of potassium feldspar, opaque oxides, and sulphide minerals are generally present.

One thin section contained two distinctly different types of plagioclase. The centres of some plagioclase grains from a sample near Driftwood Lake form the first type, and consist of relatively fresh plagioclase of composition An_{20} and an optic axial angle of -70° suggesting a high temperature structural state. Surrounding the rather ragged core is albite (An_3), the second type forms discrete grains typical of the remainder of the granitic mass. Narrow fractures extending across the specimen contain albite; plagioclase of the more calcic core is converted to albite in a narrow zone adjacent to the fractures.

Hornblende Trondhjemite

The hornblende trondhjemite phase of the Iceland Lake Pluton, which is restricted to the southern part of Strathcona Township, is mostly separated from the chlorite trondhjemite phase to the north by a screen of amphibolite of variable thickness.

The hornblende trondhjemite phase of the Iceland Lake Pluton is a medium- to coarse-grained rock, massive to faintly foliated, and locally displays a pronounced lineation. This rock generally weathers pale grey, and on fresh surfaces is mottled pale grey and black. At some localities the rock has a pale pink or yellowish tint. Shiny black prisms of hornblende from 3 mm to 2 cm long and from 1 mm to 5 mm wide are characteristic, and provide the main field criteria for the recognition of this granitic phase. In southeastern Strathcona Township a distinct southeast-plunging lineation is formed by the parallel alignment of these hornblende crystals.

The hornblende trondhjemite shows a wider range of compositions than other granitic phases of the Iceland Lake Pluton. On Highway 11 east of Herridge Lake the quartz content and the mafic content vary considerably. At localities where the volume of mafic minerals exceeds 15 percent, the rock may be considered a quartz diorite and at other localities less than 0.8 km (½ mile) away the quartz content may rise to over 40 percent. Inclusions and screens of mafic metavolcanics locally contaminate the rock. Pegmatite patches and narrow aplitic dikes are found at many localities. Locally narrow dikes of pink pegmatite contain bright red garnets up to 1 cm (0.4 inch) across.

Thin section examination reveals that the hornblende trondhjemite phase of the Iceland Lake Pluton is composed of less than 10 to 40 percent anhedral grains and granular patches of quartz which show slight undulatory extinction. Plagioclase forms subhedral grains 4 to 5 mm long, and is generally highly altered to a fine mixture of white mica, and probably clinozoisite and carbonate. A narrow less altered rim of albite (An_0 to An_9) surrounds most grains. No plagioclase more calcic than An_9 was found in any of the thin sections studied. Hornblende occurs as euhedral deep green to pale green prisms, some of which have undergone partial alteration to actinolite and chlorite. Biotite is commonly present in minor amounts, but is also partly altered to chlorite. The chlorite alteration of the biotite occurs as alternate lamellae of chlorite and biotite, suggestive of a twinning effect. Highly birefringent needles of rutile are locally abundant in patches of chlorite that may represent completely chloritized biotite.

Microcline is present in the hornblende trondhjemite in amounts ranging from 3 to 10 percent, and is generally interstitial with moderate replacement of plagioclase. Epidote is generally present as granular patches. Accessory minerals include sphene, zircon, apatite, clinozoisite, and rutile.

Contact Relationships

The contact zone between the chlorite trondhjemite phase of the Iceland Lake Pluton and the enveloping rocks is exposed on Highway 11 west of Lowell Lake. The zone appears to be relatively narrow, probably less than 30 m (100 feet) wide in some places, and there is no evidence of the development of gneissic migmatite. The contact consists of numerous angular inclusions of hard, black amphibolite in medium- to fine-grained trondhjemite and quartz-feldspar porphyry. Narrow dikes of pink aplite are also present.

At its northern boundary, south of Ferguson Island, the chlorite trondhjemite phase is noticeably finer grained and is difficult to distinguish from some of the metavolcanics of the area. Narrow felsic dikes in the metavolcanics may be phases of the Iceland Lake Pluton.

The contact between the chlorite trondhjemite phase and the hornblende diorite was observed in a gravel pit near the South Tetapaga River. At this locality the contact appeared to be gradational over about 6 m (20 feet). Moorhouse (1942, p.16) reported dikes of "granite", presumably the chlorite trondhjemite, cutting the diorite somewhere northeast of this occurrence.

The author observed rounded inclusions of the hornblende trondhjemite in a medium-grained massive granitic rock southeast of Driftwood Lake in Strathcona Township. It was first thought that the medium-grained rock represented a dike of the chlorite trondhjemite. However, the latter could be a younger aplite or even an intrusive breccia, since Dr. S.B. Lumbers (Curator of Geology, Royal Ontario Museum, personal communication, 1972), noted dikes of the hornblende trondhjemite intruding the chlorite trondhjemite on the southern shore of Driftwood Lake. This occurrence was observed later by the author.

Hornfels

It was not possible to determine conclusively whether the mafic metavolcanics at the eastern contact of the chlorite trondhjemite displays typical hornfels mineral assemblages or whether these rocks have been recrystallized to the greenschist facies of regional metamorphism. Megascopically, the contact amphibolites are distinctly harder and more brittle than the typical mafic metavolcanic rock, suggesting that the rocks had not undergone low grade regional metamorphism with the development of much chlorite. Thin section examination reveals that the amphibolites appear to contain less chlorite and more amphibolite than the normal metavolcanics, but the plagioclase is oligoclase or albite.

Level of Emplacement

The rocks of the Iceland Lake Pluton, particularly the chlorite trondhjemite phase and the hornblende-quartz diorite phase, exhibit some features considered by Buddington (1959) to be indicative of emplacement in the epizone which is less than 6.4 to 9.7 km (4 to 6 miles) below the surface (S.B. Lumbers, Curator of Geology, Royal Ontario Museum, personal communication, 1969).

Features indicative of a relatively high level of intrusion are:

A) The presence of numerous, apparently associated porphyry dikes.
B) The local presence of a fine-grained border facies.
C) Presence (although rare) of granophyric textures.
D) Local truncation of country rocks with no evidence of doming (e.g. southern Briggs Township).
E) Narrow or locally absent contact aureole.
F) Lack of aplite and pegmatite.
G) Relatively fine-grain size of main body of intrusion.

On the other hand, these criteria may be qualified by the lack of variolitic cavities, the rarity of granophyric textures, the local development of a contact aureole and the local doming and disturbance of the country rock. The author suggests that the level of intrusion of the Iceland Lake Pluton is transitional between the epizone and mesozone. The suggestion of Lumbers that the level of intrusion is equivalent to the lower epizone seems appropriate (S.B. Lumbers, Curator of Geology, Royal Ontario Museum, personal communication, 1972).

The hornblende trondhjemite phase exhibits some characteristics that suggest a lower level of intrusion than other phases. The coarser grain size, local development of pegmatite and aplite, and possibly a wider contact aureole are the main features in this regard. The writer suggests, however, that these features of the hornblende trondhjemite phase could also be interpreted to indicate that the rock was intruded into warmer country rocks than the earlier phases. This would be expected if the country rocks were heated by the intrusion of the chlorite trondhjemite phase a short time before the intrusion of the hornblende trondhjemite. The fact that dikes of hornblende trondhjemite intruding chlorite trondhjemite on Driftwood Lake are equigranular, with little evidence of chilling, could indicate that the chlorite trondhjemite had not entirely cooled when the hornblende trondhjemite was intruded. This is in contrast to the lack of such dikes of equigranular hornblende trondhjemite within the metavolcanics. The difference in texture, mineralogy, and structural relations between the hornblende trondhjemite and the earlier members of the Iceland Lake Pluton may not indicate different levels of intrusion: these differences could be due to the sequence of intrusion itself, and perhaps the larger size of the hornblende trondhjemite phase. This interpretation corresponds with the concepts of Buddington. Buddington (1959, p.676) stated that the zones of emplacement are actually "intensity zones", rather than strictly depth zones.

The Chambers-Strathy Batholith

The granitic rocks referred to as the Chambers-Strathy Batholith include the major area of granitic rocks in the northern half of Chambers Township and the northeastern part of Strathy Township. These two areas of granitic rocks are separated by an area of mafic metavolcanics and Nipissing Diabase, but the lithological similarity of the granitic rocks suggest that they are part of the same batholith.

The most common rock within the Chambers-Strathy Batholith is pale to bright pink, massive to faintly foliated, medium-grained quartz monzonite. The predominant minerals are plagioclase (An_6 to An_{15}), quartz, and microcline microperthite (10 to 25 percent). Biotite or small crystals of hornblende are the predominant mafic minerals, but these minerals generally compose less than five percent of the rock. Chlorite, sphene, zircon, allanite, clinozoisite and opaque oxides are accessory constituents.

Near their contacts with the mafic metavolcanics, the granitic rocks generally contain more quartz and are grey, rather than pink in colour. This is particularly noticeable along Highway 11 in Strathy Township.

Most of the variation in composition in the quartz monzonite may be caused by local contamination. Locally developed phases include grey, hornblende- and

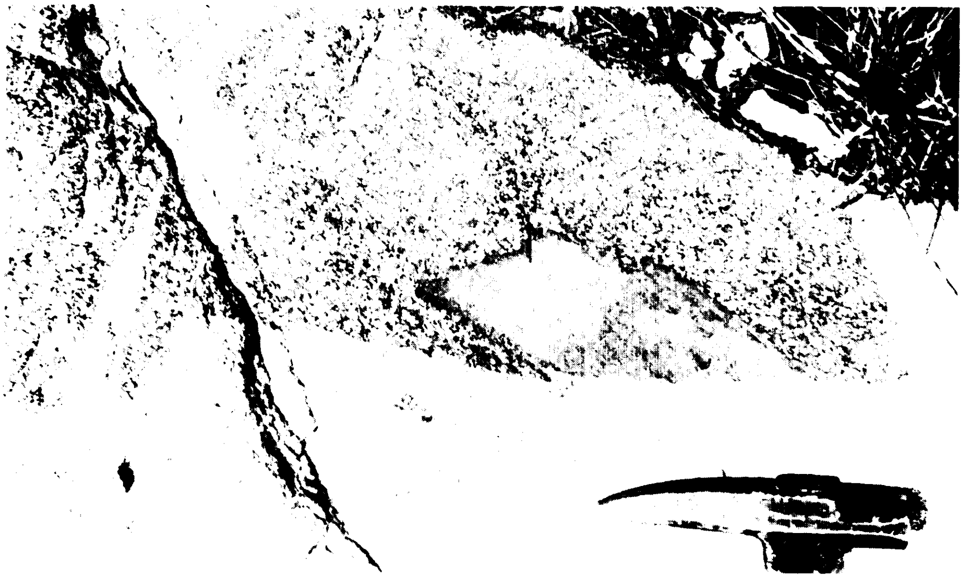

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Photo 9–Agmatitic Migmatite; northeast Chambers Township. An inclusion of fine-grained amphibolite can be seen within coarse-grained gabbro, that is itself an inclusion within quartz diorite.

biotite-bearing quartz diorite and granodiorite, all of which are prominent at the western end of Chambers Lake, around Guppy Lake and southeast of Jackpine Lake in Chambers Township. Most of these phases form bodies of relatively limited extent but unknown form.

Agmatitic Migmatite

Rocks included under the above heading form an irregular shaped area from 1.3 to 2.5 km^2 (½ to 1 square mile) in the extreme northeastern corner of Chambers Township and the northwestern corner of Strathy Township. The rocks in this group are highly variable, but the most abundant types appear to be an inclusion-rich quartz diorite to quartz monzonite. The most prominent inclusions vary from place to place, but inclusions are almost invariably more mafic than the matrix. Locally abundant are inclusions of mafic metavolcanics, diabase metavolcanics or metadiabase, and coarse-grained metagabbro. Inclusions of felsic metavolcanics are present, but relatively rare. Inclusions of diorite and quartz diorite may represent altered or partly assimilated metavolcanics, etc., or early phases of the granitic batholith. The inclusions vary from less than 2.5 cm (1 inch) to over 1.2 m (4 feet) across, and range in shape from angular to well rounded. One inclusion of coarse-grained gabbro contains an inclusion of mafic metavolcanics (Photo 9).

Intruding this hybrid zone area are a number of narrow dike rocks, many of which appear to be restricted to (and by inference may be related to) the agmatite zone. The earliest dikes appear to be aplitic quartz diorite, some of which have coarse hornblende crystals growing perpendicular to the walls. Cutting these are more mafic fine-grained dioritic dikes somewhat similar to the chloritic dikes found elsewhere in the map-area. A thick belt of coarse-grained, altered gabbro is found adjacent to the migmatite zone at the northern boundary of Chambers Township. This body could be a dike or a large inclusion. The gabbro is rather distinctive in appearance and inclusions of a similar type have been found in the agmatite. However, a dike of similar gabbro has been found cutting the quartz monzonite south of Hansen Lake in Chambers Township.

The Spawning Lake Stock

A large body of porphyritic quartz monzonite referred to as the Spawning Lake Stock is located in the western part of Briggs Township and the southern part of Chambers Township. The total area of the stock is about 64.7 km^2 (25 square miles), but about 12.9 km^2 (5 square miles) of this area is in the eastern part of Joan Township which lies immediately west of Briggs Township. The Spawning Lake Stock consists of two distinct phases, a central coarse porphyritic phase and a medium-grained grey border phase. Narrow dikes of aplite and pegmatite are locally abundant. The central phase makes up, by far, the largest part of the Spawning Lake Stock. It consists of a very uniform, pink, generally porphyritic, massive, quartz monzonite containing very little in the way of mafic minerals. The major minerals are large euhedral phenocrysts of microcline microperthite which average about 3 cm (1.2 inches) long. Small, euhedral crystals of plagioclase are locally included within the borders of the larger potassium feldspar grains. Subhedral to anhedral plagioclase (An_2 to An_{10}) range in size from 2 to 10 mm and is generally subordinate to microcline. Anhedral grains of highly strained quartz form 15 to 30 percent of the rock.

The mafic mineral usually present is green biotite. Locally, chlorite, epidote, and carbonate may be present in minor amounts. Traces of zircon, sphene, opaque oxides, and sulphide minerals are also present.

The border phase consists of pale grey to white porphyritic trondhjemite to quartz monzonite. The white colour and much finer grain size distinguishes the contact phase from the central phase. The width of the contact phase is variable; it may locally be as much as 0.4 km (¼ mile), but in most places is probably only a few hundred feet or less. The contact phase was not observed in the northern portion of the stock. Some very fine grained aplitic rocks located southeast of Sutton Lake could represent a chilled phase immediately adjacent to the contact with the metavolcanics. The plagioclase composition of one specimen of the contact phase was found to be oligoclase (An_{10} to An_{12}).

The criteria of Buddington (1959) indicate that the Spawning Lake Stock has the characteristics of a mesozonal or lower epizonal pluton. Intrusion of the southern half of the stock appears to have resulted in marked deflection of the structural trend of the metavolcanics, and indicates doming. The northern half of the body clearly truncates the enclosing rocks, and there is a notable space

TABLE 4 CHEMICAL ANALYSES OF FELSIC TO INTERMEDIATE INTRUSIVE ROCKS, NORTHEAST TEMAGAMI AREA; CHEMICAL ANALYSES BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES.

Major Components in Percent

Sample Number	E1	E9-15	E3	E4	E5	F3-1	TZ8-1
SiO_2	69.90	71.10	68.20	70.60	63.80	68.20	76.70
Al_2O_3	14.90	14.60	15.90	14.30	14.90	16.70	13.70
Fe_2O_3	0.85	1.15	1.51	1.13	2.41	0.89	0.54
FeO	2.16	2.09	1.70	1.77	2.20	0.49	0.42
MgO	1.36	1.27	1.10	1.15	2.57	0.72	0.23
CaO	2.81	3.01	3.37	2.77	3.80	1.23	0.32
Na_2O	4.17	3.74	4.91	4.06	4.65	5.06	4.09
K_2O	1.68	1.57	1.04	2.63	1.50	4.39	4.23
H_2O^+	1.47	1.55	1.07	0.87	1.66	0.72	0.52
H_2O	0.14	0.14	0.14	0.13	0.12	-	0.04
CO_2	1.73	1.10	0.28	0.16	0.75	0.10	0.10
TiO_2	0.43	0.41	0.37	0.34	0.57	0.18	0.03
P_2O_5	0.10	0.09	0.10	0.06	0.10	0.02	0.06
S	0.05	0.01	0.01	0.01	0.01	0.01	0.02
MnO	0.04	0.08	0.05	0.06	0.07	0.03	0.03
Total	101.80	101.90	99.80	100.00	99.10	98.70	101.00
Specific Gravity	2.84	2.75	2.70	2.71	2.75	2.63	2.61

Notes

E1 Quartz porphyry; southern Briggs Township.

E9-15 Quartz-feldspar porphyry; south shore of Northeast Arm of Lake Temagami, Strathcona Township.

E3 Chlorite trondhjemite phase of Iceland Lake Pluton; from road to former Temagami Copper Mines, north of Iceland Lake.

E4 Hornblende trondhjemite phase of Iceland Lake Pluton; from west side of Highway 11, near south boundary of Strathcona Township.

E5 Hornblende diorite phase, Iceland Lake Pluton; from north side of road between Snowshoe Lake and Broom Lake in southeastern Briggs Township.

F3-1 Porphyritic quartz monzonite, Spawning Lake Stock; southwest Briggs Township.

TZ8-1 Quartz monzonite; Chamber-Strathy Batholith; from west side of Highway 11, northeast Strathy Township.

problem. The intrusive relationship and petrography strongly suggest that the intrusion of the pluton occurred later than the main period of metamorphism, folding, shearing, and ankeritization.

Petrochemistry

Chemical analyses of five specimens from the plutonic granitic rocks and two analyses of specimens of porphyries associated with, and probably intruded by, the Iceland Lake Pluton are given in Table 4.

Examination of the analyses shows a high content of potassium in the Spawning Lake Stock and the Chambers-Strathy Batholith. Also, the porphyries are generally richer in volatile constituents (total water plus carbon dioxide) than the plutonic rocks. This is a reflection of the greater degree of alteration found in most specimens of the porphyries in comparison to the equigranular plutonic granites (Figures 3 and 4).

Mafic Intrusive Rocks

Altered Diorite and Gabbro Dikes (Matachewan-Type)

Dikes of altered gabbro or diabase were found to intrude the metavolcanic and granitic rocks of the area, including the post tectonic, Spawning Lake Stock. They have not been found to intrude the Huronian rocks of the map-area. The altered gabbro dikes range in width from about 9 m (30 feet) to as much as 60 m (200 feet). Some are persistent along strike for at least 3.2 km (2 miles).

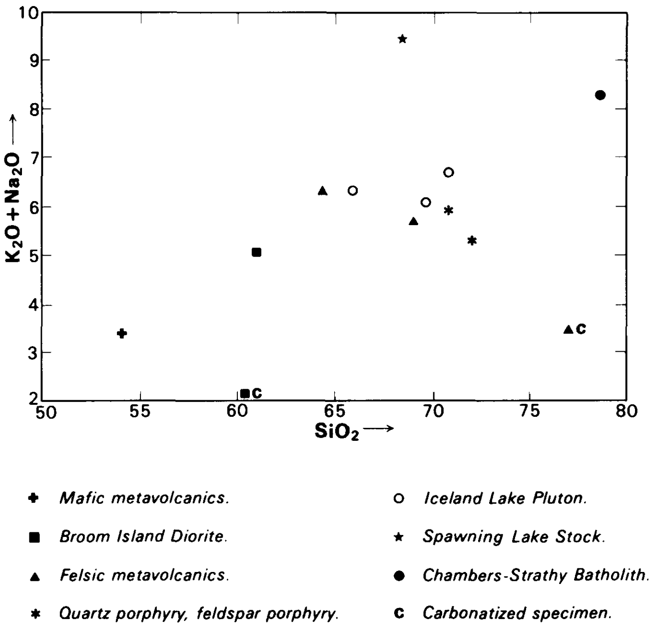
Outcrops of altered gabbro generally weather a mottled pale grey and black or dark green. Stubby crystals of amphibole are generally visible, and in a few samples may be so abundant that composition approaches that of a hornblendite. Such an amphibole-rich dike is exposed in rock cuts on the sides of Highway 11 in central Strathcona Township.

In thin section, the altered gabbro dikes are seen to consist of albite (An_5, $2V+80°$), forming subhedral tablets 2 to 4 mm long, or as indistinct granular patches. The dominant mafic minerals are actinolite, chlorite, and serpentine replacing pyroxene, and perhaps replacing olivine as well. Epidote, white mica, quartz, leucoxene, and iron-titanium oxides are accessory minerals. The texture where it is not completely destroyed by recrystallization, is hypidiomorphic granular rather than diabasic.

Lamprophyre

Twenty-six occurrences of lamprophyre were noted in the Northeast Temagami area during the field season of 1969 and 1970. These generally form dikes from a few inches to 6 m (20 feet) wide that rarely can be traced for more than a few hundred feet along strike. Lamprophyre may form irregular masses or pods rather than dikes.

The rocks classified an lamprophyre in the field are fine- to medium-grained, dark green to black, massive to strongly foliated rocks that commonly contain large amounts of biotite or amphibole or both. A fine-grained margin is absent or poorly developed in comparison to that of the diabase dikes. Some of the biotite-rich dikes are very chloritic and contain much limonite as well. A peculiar feature of many, if not most of the lamporphyres at Temagami, and one which sets them aside from other dike rocks in the area, is the presence of numerous xe-



SMC 13249

Figure 3–Variation of alkalies with silica. Analyses recalculated to a volatile free base.

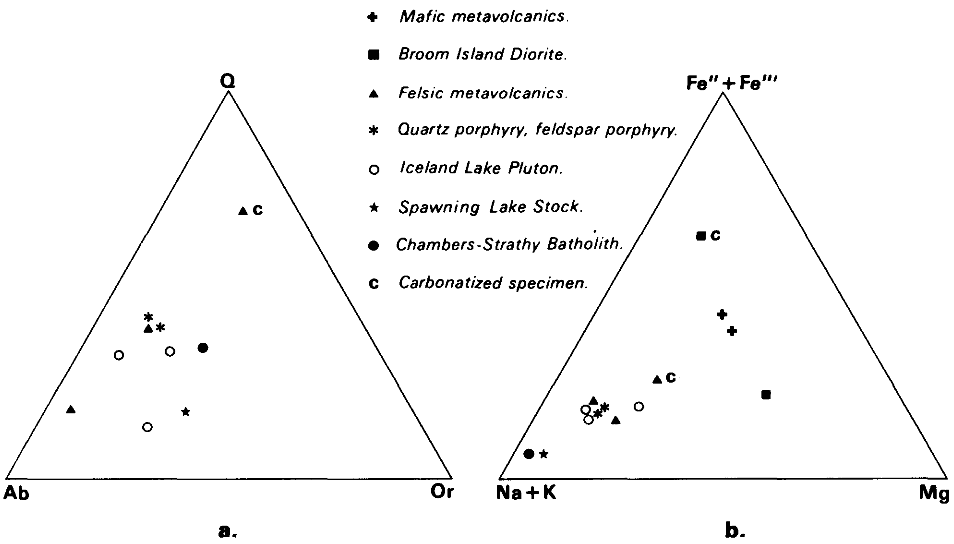


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Figure 4–Variation diagrams for some rocks of the Northeast Temagami Area.

noliths. The xenoliths range in size from less than one inch to about 0.9 m (3 feet) and may be angular to almost perfectly spherical.

Within the greenstone belt the most common xenoliths in the lamprophyres are Early Precambrian volcanic rocks; but generally more than one type is present, indicating some transportation of the fragments. Less commonly, granitic xenoliths and fragments of quartz veins occur more than 1.6 km (a mile) from any exposed granitic rocks. Lamprophyres that intrude granitic rocks commonly carry xenoliths of granite but rarely Early Precambrian volcanic rocks. The xenoliths of some lamprophyre dikes appear to have undergone varying degrees of alteration. Other lamprophyre dikes contain well rounded xenoliths of granitic rocks with no evidence of alteration.

In thin section, the lamprophyres were classified as spessartite (amphibole and plagioclase) and kersantite (biotite and plagioclase).

The predominant feldspar is unaltered to highly altered plagioclase (oligoclase or albite), but significant amounts of microcline may also be present. A characteristic feature of lamprophyres, is the restriction of feldspar to the groundmass; feldspar forms subhedral to anhedral grains from 0.2 to 1 mm across.

A specimen of pyroxene-bearing spessartite from southern Strathcona Township show phenocrysts of clinopyroxene about 3 mm across undergoing alteration to pale green uralite. The former presence of iron-titanium oxide minerals is indicated by patches of granular titanite. The feldspar is anhedral interlocking altered grains of oligoclase about 0.5 mm across. The rock might be considered an altered part of the adjacent diabase dike that it somewhat resembles in hand specimen. The texture and plagioclase composition identifies it as a lamprophyre.

An occurrence of biotite lamprophyre, exposed on the natural gas pipeline cut in southeastern Strathcona Township, is a breccia consisting of angular to subrounded fragments of biotite lamprophyre in a matrix of similar lamprophyre.

Lamprophyre intrudes all the major granitic intrusions, but has not been found to intrude the Huronian rocks of the Gowganda Formation.

Chloritic Mafic Dikes

Mafic chloritic dikes are fine-grained, foliated to massive, dark green rocks that generally form irregular dikes from a few inches to at least 20 feet (6 m) across. The dikes consist of fine-grained mixtures of albite, chlorite, carbonate, clinozoisite, white mica, and leucoxene. Quartz, opaque oxide minerals, sulphide minerals, and apatite are common accessories. The chloritic dikes differ from the chloritized lamprophyres in that the former are invariably finer grained, and rarely contain much biotite. Many chloritic dikes contain plagioclase phenocrysts that are absent in lamprophyre. The inclusions common in lamprophyre were not found in the chloritic dikes. The chloritic dikes seem to be particularly common in the granitic rocks south of the Northwest Arm of Lake Temagami. The dikes are almost indistinguishable from much of the Early precambrian mafic metavolcanic assemblage. Probably many of these dikes have not been correctly identified as mafic metavolcanics where they occur within the metavolcanic rocks. The known occurrences of chloritic dikes as shown on Ontario Division of Mines Maps P.595, P.596 (Bennett and McNally 1970a and b); maps P.666 and P.667 (Bennett and Innes 1971a and b) are probably weighted in favour of occurrences within the granitic rocks.

DISCUSSION

The term "Matachewan" is used here to indicate that the dikes in question are known to intrude the major granitic batholiths, but have not been found to intrude the Huronian rocks. No diabase was identified as Matachewan Diabase in the field. Two discontinuous diabase dikes on the eastern shore of Guppy Lake in northwestern Chambers Township are quartz diabase and have a north-south strike. They are shown on Ontario Division of Mines Preliminary Map P.666 (Bennett and Innes 1971a) as Nipissing Diabase, but their strike is consistent with that of the Matachewan Swarm. Todd (1925,p.15) reported positive identification of Matachewan Diabase dikes a short distance east of Strathy Township.

The known strikes of post granite pre-Huronian mafic dikes in the northeast Temagami area is shown in Figure 5. It is apparent from the figures that:

A) Northwest-trending fractures existed before the deposition of the Huronian assemblage and, therefore, before the Sudbury dikes.

B) A north-south maximum shown by strikes of the altered gabbro and the lamprophyre dikes is consistent with that of the Matachewan swarm.

The northeast Temagami area may be located uniquely with respect to the major fracture systems of the region. It can be seen from the Ontario Geological map (Ayres *et al.* 1971) that the present map-area lies near the northeastern edge of the northwest fracture system shown by the Sudbury dikes. If the Matachewan swarm continues southward under the Huronian cover, the Temagami area could lie close to the southern limit of the Matachewan swarm.

MIDDLE PRECAMBRIAN

Huronian Supergroup

COBALT GROUP

Gowganda Formation

Rocks of the Cobalt Group unconformably overlie the Early Precambrian rocks in the southeastern sectors of the map-area. Following the nomenclature recommended by Robertson *et al.* (1969) only rocks of the Gowganda Formation

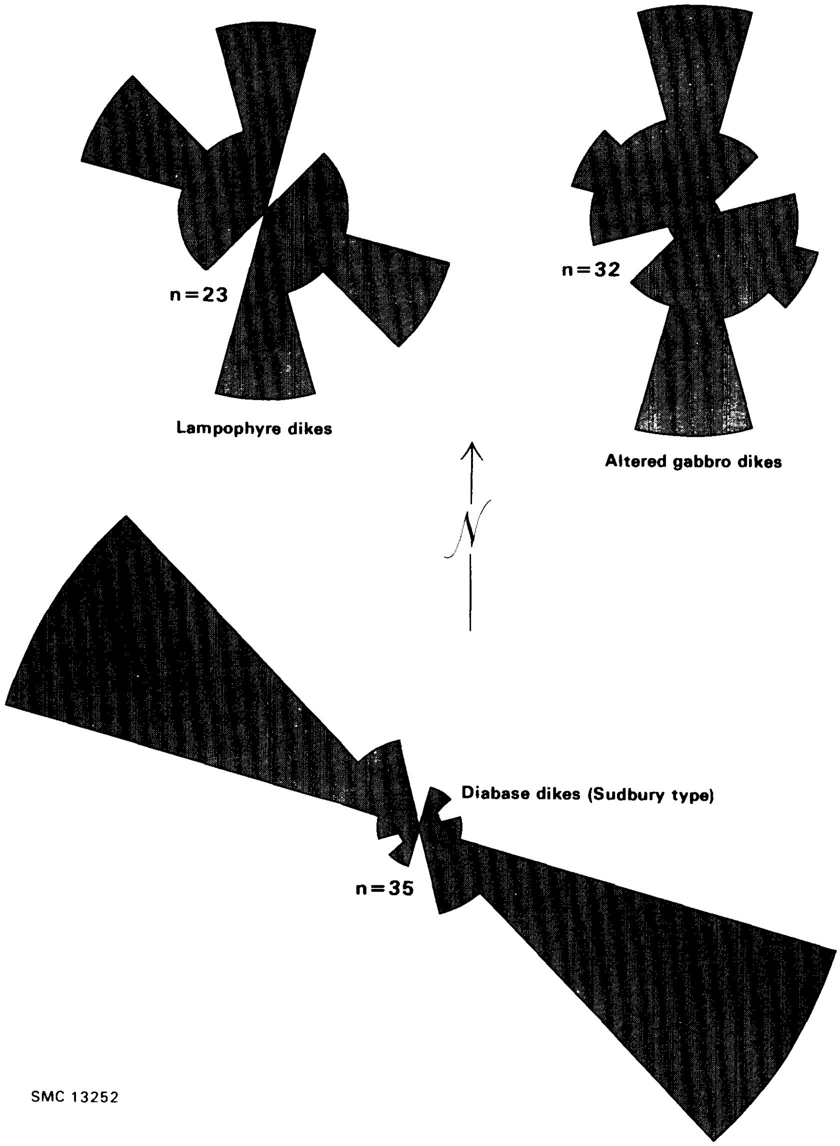


Figure 5–Rose diagrams for post-granite mafic dikes of the Northeast Temagami Area.

are recognized within the Huronian assemblage of the map-area.

In the Temagami area,the Gowganda Formation is best described as a layered complex consisting largely of polymictic paraconglomerate enclosing beds and lenses of arkose, siltstone, and greywacke. The discontinuous form of most of the units, coupled with the gradational nature of most contacts and the small size of the exposures generally prevent the delineation of individual units within the Gowganda Formation of the map-area.

The conglomerate of the Gowganda Formation is typically a polymictic paraconglomerate containing pebble- to boulder-sized, subrounded to angular clasts of various granitic rocks, and pebble- to cobble-sized clasts of metavolcanics, vein quartz and diabase (Photo 10). These megaclasts are set in a matrix of green to greyish green greywacke, arkose, or siltstone. All gradations exist between conglomerate, greywacke, or siltstone containing over 20 percent matrix, and finally to greywacke or siltstone free of megaclasts. In thin section, the matrix is seen to consist of subrounded to angular sand-sized to silt-sized clasts of quartz, plagioclase, microcline, and subordinate rock fragments in a mosaic of fine silt-sized quartz, feldspar, and either chlorite or white mica or both.

Pebbles, cobbles, and boulders in laminated units locally show downwarping and thinning of the underlying laminations and the overlying laminations are relatively undisturbed (Photos 11 and 12). Such "dropstones" are common

ODM9624

Photo 10–Polymictic paraconglomerate of the Gowganda Formation; Lowell Lake road, central Strathcona Township.

ODM9625

Photo 11–"Dropstones" in Gowganda Formation; Caribou Lake, southern Strathy Township.

ODM9626

Photo 12–"Drop Boulder" in siltstone and argillite of Gowganda Formation; east side of Highway 11, 0.8 km (½ mile) south of Temagami.

throughout the Gowganda Formation (Lindsey 1967, p.140) and have long been considered to be caused by ice rafting. Particularly good examples of "rafted" boulders can be seen in a rock cut on the east side of Highway 11 between Portage Bay and Inlet Bay of Lake Temagami.

The contact between the Gowganda Formation and the Early Precambrian metavolcanics was observed at two locations in northern Strathcona Township. On the cleared right-of-way for the gas pipeline near the southwestern end of Caribou Lake the contact between the Early Precambrian metavolcanics and the Gowganda Formation strikes northeast and dips steeply to the north, a feature suggestive of a fault scarp. This contact is better exposed in a rock cut on the west side of Highway 11 about 460 m (1,500 feet) west of the above location. Here a steeply dipping contact separates highly ankeritized and sheared metavolcanics from a breccia almost entirely composed of blocks up to 1.8 m (6 feet) long of similar metavolcanics. The basal breccia is overlain by a very poorly sorted conglomerate containing blocks up to 1.8 m (6 feet) across. The conglomerate and breccia become better sorted and rounded up the section, and contain granite boulders, any of which are ankeritized. The conglomerate is in turn overlain by a laminated argillite-greywacke containing conspicuous rhombohedrons of ankerite up to 5 mm across. The assemblage displays synclinal form as is shown diagrammatically in Figure 6.

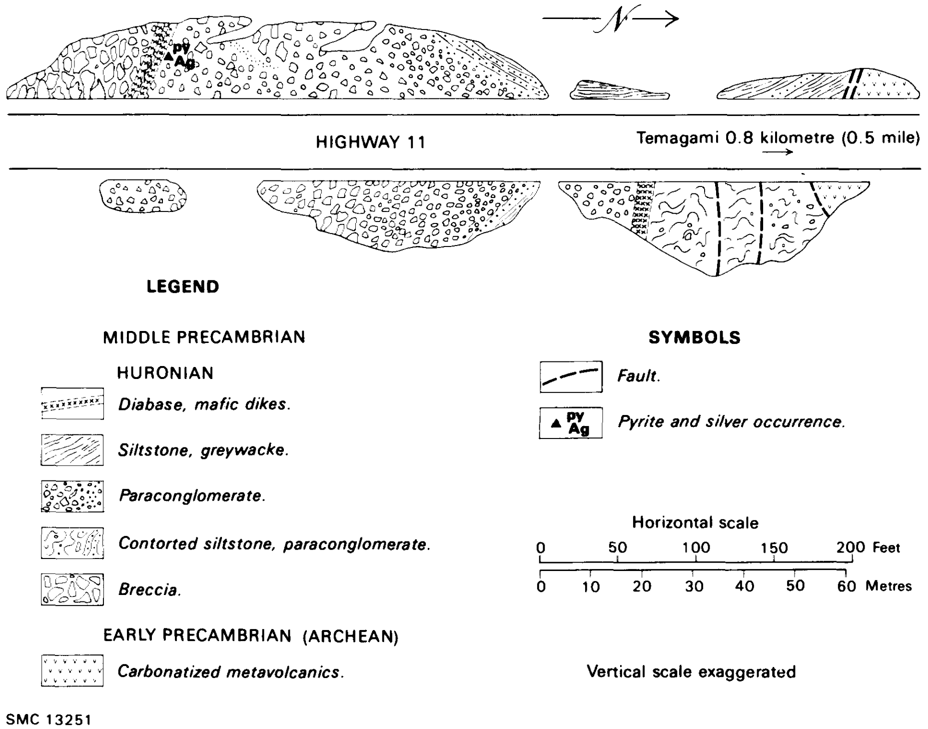
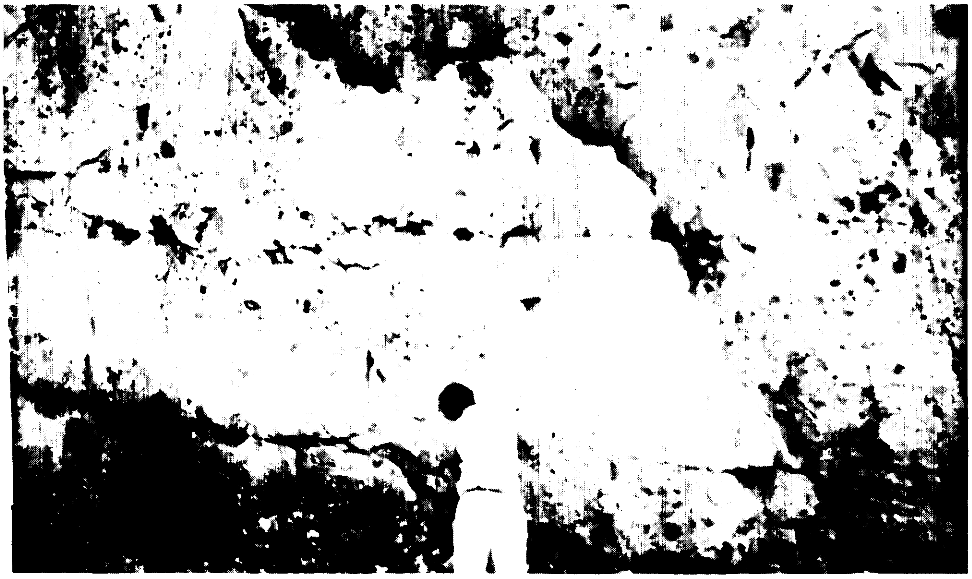


Figure 6–A diagrammatic view of the base of the Gowganda Formation near Temagami.



ODM9627

Photo 13–Unconformity at base of Gowganda Formation; near Hydro transmission line in Strathy Township.

The unconformity between the Early Precambrian granitic rocks and the Gowganda Formation was observed at two localities on Herridge Lake in southern Strathcona Township. On the western shore of the lake the unconformity dips at about 32 degrees to the north and strikes northeast. The contact is undulatory, but smooth with no indication of a regolith. On the eastern shore of Herridge Lake the unconformity was found to strike northeast and dip almost vertically. Laminated siltstones about 30 m (100 feet) away from the unconformity dip about 20 degrees to the south.

The unconformity is exposed for a distance of about 30 m (100 feet) just east of the Hydro transmission line southeast of Lowell Lake in Strathcona Township. The Gowganda Formation rests on granite and the contact is again relatively smooth with no indication of weathering of the granite. The surface of the unconformity dips very steeply to the west, but the Gowganda Formation dips only about 20 degrees to the west (Photo 13).

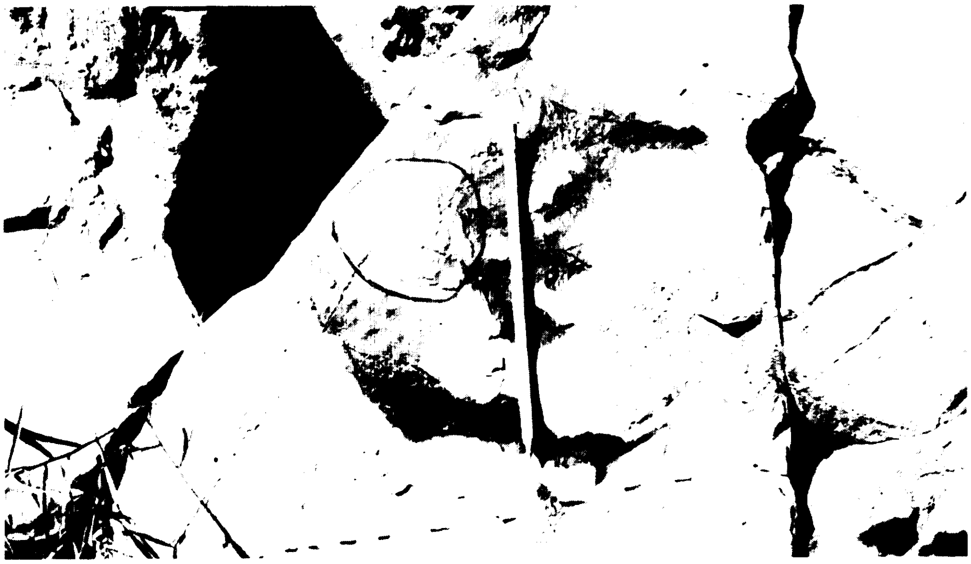
The base of the Gowganda Formation at this point consists of 0.9 m (3 feet) of breccia containing angular to subrounded pebble to cobble-sized fragments of granite in a matrix of arkose (Photo 14). Above the breccia is a 0.9 m (3 feet) thick layer of dense, hard siltstone the lowermost 15 to 20 cm (6 to 8 inches) of which is a bright apple green because a high epidote content. Above the siltstone layer are several feet of tightly packed cobble conglomerate containing many fragments of highly epidotized rock. About 16 m (50 feet) west of the unconformity, the Gowganda Formation consists of paraconglomerate containing boulders of granite, mafic metavolcanics, and pebbles of pale grey to black chert and quartz.

ODM9628

Photo 14–Breccia at base of Gowganda Formation; west side of Highway 11, northern Strathcona Township.

Pseudofossils

A number of unusual structures occur in relatively massive siltstone to greywacke in the Gowganda Formation at the northeastern end of Caribou Lake, a short distance east of the village of Temagami. The most interesting form is a very regular concentric structure that varies from less than an inch to about 7.6 cm (3 inches) across in plan view (Photo 15). The circular pattern seems to be produced by slight differences in the resistance to weathering as a result of some secondary process. An oblique sectional view of one specimen indicated that it consisted of a cone-in-cone structure. Because these structures are similar to some biogenic forms a specimen was forwarded to Dr. Hans J. Hofmann of the University of Montreal for examination. Dr. Hofmann was kind enough to report that the specimen was not of biogenic origin, although it resembled stromatolites to a certain extent. He suggested that the structure could be caused by soft-sediment deformation.



ODM9629

Photo 15–Pseudofossils in Gowganda Formation; north end of Caribou Lake, Strathy Township. Pseudofossils are the concentric circular feature within drawn circle, and the "wavy" forms parallel to, and below, dashed line at bottom of photo.

On the same outcrop which contains the circular structures, there are areas where a noticeable "ribbed effect" is produced by very narrow, wavy, subparallel ridges a few mm apart and a fraction of a mm in height. This structure is also similar to some organic forms, but a closer examination revealed that it is produced by closely spaced, subparallel fractures that have undergone partial silicification.

Mafic Intrusive Rocks

NIPISSING-TYPE DIABASE

The main areas where Nipissing-type Diabase is exposed in the map-area are in eastern Strathcona Township, northern Strathy Township, and in northwestern Chambers Township. The basal contact of the Nipissing-type Diabase was observed directly at a few localities west of Kanichee Lake. In all cases it was found to dip steeply to the east. The basal contact was also observed at the west end of Upper Twin Lake in Strathcona Township. At this point the contact was found to dip about 40 degrees to the east. The data are not sufficient to make a reliable estimate of the true thickness of the diabase bodies. The outline of the Nipissing-type Diabase bodies and the relationship of the contact to the topographic contours are consistent with the forms of cone sheets and dikes.

Megascopically, the most common type of Nipissing-type Diabase in the Temagami area is a medium-grained, massive, dark grey, or greenish grey rock with a gabbroic or subophitic texture. The weathered surface is generally grey or greenish grey, but locally it assumes a brownish hue.

In thin section, the plagioclase is seen to form stubby crystals or laths up to 1 cm long. The plagioclase shows a gradational zoning from a rim of An_{45} to a core of An_{60}. The major pyroxene is clinopyroxene with lamellae of exsolved orthopyroxene. Clinopyroxene forms equant interstitial grains and highly elongate laths displaying simple twinning on the 100 plane. Iron-titanium oxides form 10 percent of the rock and minor amounts of sulphide minerals are generally present. Actinolite is an important constituent forming needles and uralitic masses replacing pyroxene. Quartz is present as interstitial granophyric intergrowths with plagioclase (albite?). Accessory minerals include apatite, biotite, sulphide minerals, zircon, and chlorite.

No significant area of what might properly be termed Nipissing granophyre or "red rock" was recognized in the Northeast Temagami area. However, at the northern boundary of Chambers Township, about 600 m (2,000 feet) east of Guppy Lake, the diabase is noticeably more leucocratic, and quartz grains are visible in hand specimen. In thin section, the texture is hypidiomorphic granular (granitic) rather than granophyric. The rock consists of about 50 percent altered plagioclase (An_3, $2V=80°$) forming subhedral grains from 1 to 3 mm long. Dark green to pale brown hornblende forms about 30 percent of the rock, and quartz forms anhedral interstitial grains about 10 percent. Epidote, biotite, microcline and apatite are minor constituents. This rock is a quartz diorite phase of the Nipissing-type Diabase.

Another common phase of the Nipissing-type Diabase is diorite pegmatite, presumably developed locally as a result of high concentrations of water during crystallization. The diorite pegmatite phase generally forms pods, irregular patches or dikes within the main diabase mass. This phase is generally a very coarse grained mesocratic rock consisting of prisms of black hornblende up to 10 cm (4 inches) long in a matrix of white or pinkish plagioclase. Quartz and iron-titanium oxides may also be present.

LATE PRECAMBRIAN

Mafic Intrusive Rocks

Diabase Dikes (Sudbury-Type)

Northwest-trending diabase dikes from a few inches to as much as 120 m (400 feet) wide are the youngest rocks of the Northeast Temagami area. Some are continuous across the entire width of the map-area, while many can only be traced for a few hundred feet. In outcrop, the diabase is characterized by a distinct brownish to reddish brown colour on weathered surfaces. The rock appears

TABLE 5 CHEMICAL ANALYSES OF LATE MAFIC INTRUSIVE ROCKS FROM THE NORTHEAST TEMAGAMI AREA, CHEMICAL ANALYSES BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES.

Major Components in Percent

Sample Number	F6-21	F8-28
SiO_2	55.80	52.10
Al_2O_3	12.50	16.60
Fe_2O_3	2.57	2.73
FeO	4.45	7.70
MgO	10.80	4.21
CaO	5.24	7.15
Na_2O	3.43	3.34
K_2O	2.60	1.62
H_2O^+	2.26	0.91
H_2O	0.02	0.06
CO_2	0.04	0.11
TiO_2	0.48	1.36
P_2O_5	0.25	0.27
S	0.01	0.01
MnO	0.12	0.17
Total	100.90	98.40
Specific Gravity	2.79	2.87

Notes

F6-21 Kersantite lamprophyre; from an island in the Northeast Arm of Lake Temagami, in central Briggs Township.

F8-28 Olivine-bearing diabase; from the Tetapaga River, on the boundary between Briggs and Strathcona Townships.

to weather readily along joints and fractures, commonly resulting in pronounced spheroidal forms. The edges of the dikes invariably display a chill zone of black cherty rock a few inches thick, while the central parts commonly display a diabasic texture. Plagioclase phenocrysts are common, and are usually confined to distinct layers parallel to the walls of the dikes. An outcrop of diabase in central Chambers Township contains about 20 percent by volume of pale green cherty amygdules.

Under the microscope tabular crystals of zoned plagioclase (An_{48}, 2V=84 to An_{20}, 2V=62) from 2 to 10 mm long are present in a groundmass of clinopyroxene grains about 0.5 mm in diameter. Olivine and iron-titanium oxides are generally present in amounts less than 10 percent. Biotite, apatite, zircon, and iron sulphide minerals are accessory minerals.

A few occurrences were noted where the late diabase has undergone differentiation to form a much more leucocratic porphyritic and granophyric quartz diabase.

Near the mouth of the Tetapaga River in northeastern Briggs Township, the diabase is a pale brown colour, and contains about 20 percent phenocrysts of plagioclase up to 5 cm (2 inches) long (Table 5). In thin section, the rock is seen to consist of zoned plagioclase (An_{15} to An_{32}), granophyric quartz, hypersthene, and actinolite replacing pyroxene. Chlorite, biotite, and iron-titanium oxides are present in minor amounts. The quartz forms a graphic intergrowth with plagioclase and the rock is essentially a granophyre. A similar rock is exposed north of Iceland Lake on the northern side of the road to the former Temagami Copper Mine.

The largest northwest-trending diabase dike of the Sudbury swarm is exposed on Highway 11 near Herridge Lake in southern Strathcona Township. This dike contains several grey felsite dikes a few inches wide, which intrude the diabase perpendicular to its strike. The felsite appears to be restricted to the diabase itself, and does not intrude the adjacent hornblende trondhjemite. The same outcrop of diabase contains mafic pegmatite. A few narrow, grey felsite dikes similar to those in the diabase were noted intruding the Gowganda Formation in Strathcona Township.

Intrusive Breccia [1]

At least three occurrences of intrusive breccia have been identified in the Northeast Temagami area. The largest exposure occurs on the Ontario Hydro transmission line about 760 m (2,500 feet) north of Herridge Creek in southeastern Strathcona Township. This exposure was at first misidentified as a basal breccia of the Gowganda Formation by the author and was shown as such on earlier maps (Bennett and McNally 1970b). The intrusive nature of the breccia was first pointed out by Dr. S.B. Lumbers (Curator of Geology, Royal Ontario Museum, personal communication, 1970). The breccia forms an area at least 30 m (100 feet) long by 15 m (50 feet) wide, consisting entirely of tightly packed angular fragments of granitic rocks, aplite, and amphibolite. The breccia appears to have intruded near or along the contact between the granitic rocks and the amphibolite. The fragments are rarely less than a few inches across and some may be as much as 3 m (10 feet) long. The matrix is sparse, and appears to consist of coarse sand-sized quartz and feldspar. There is no apparent alteration of the fragments.

A much less extensive, but more interesting, occurrence of intrusive breccia occurs on the northern side of the road to the Sherman Mine about 1.6 km (one mile) west of Highway 11. The breccia here has the form of a steeply dipping curving dike from 20 cm (8 inches) to 0.3 m (1 foot) wide intruding Early Precambrian metadiorite (see Photo 16). The breccia consists of angular to well-rounded pebble and cobble-sized fragments of Early Precambrian metavolcanics and the surrounding metadiorite as well as fragments of quartz and granitic rocks set in a matrix of sand-sized rock fragments not dissimilar in appearance to greywacke. Variations in the percentage of larger clasts occur along strike. For most of its length, the breccia is separated from the surrounding rocks by veins of quartz and tourmaline up to 2.5 cm (1 inch) wide.

In thin section, the matrix of the breccia is seen to contain about 35 percent

[1]The term intrusive breccia as used here is synonomous with Sudbury-type breccia, pebble dikes, diatreme breccia, and exotic breccia. It refers to rocks intruded in a fragmental state without the aid of any obvious magmatic agency.

ODM9630

Photo 16–Massive pyrite outlined in black adjacent to altered mafic dike in basal breccia of Gowganda Formation, west side of Highway 11, 0.8 km (½ mile) south of Temagami.

quartz fragments from less than 0.1 mm to 10 mm across. Many of the grains are very angular, and exhibit "sickle shaped" or shard-like forms. Also present, but less abundant, are subrounded and well rounded quartz grains. Rock fragments make up 10 to 20 percent of the breccia and include a varied assemblage of metavolcanics. A very thin selvage of white mica surrounds most grains of quartz and feldspar. Plagioclase forms clear to highly saussuritized subrounded to angular grains from less than 0.1 mm to 5 mm in diameter. Chlorite is present as veinlike networks along fractures. Rock fragments have undergone varying degrees of alteration. Since the metavolcanics of the area have been subjected to hydrothermal alteration, it is not possible to state whether the alteration of the rock fragments was produced during formation of the breccia or earlier.

A very fine matrix forms about 15 percent of the breccia and consists largely of fine flakes of white mica, which produce a noticeable foliation. Within the matrix are numerous minute, stubby crystals of tourmaline.

At least two other proven occurrences of intrusive breccia were observed in the area. An outcrop of carbonatized metavolcanics near the railway track, about 2.4 km (1½ miles) west of the above occurrence, is crossed with a few 2.5 to 7.6 cm (1- to 3-inch) wide fractures of intrusive breccia composed of angular to subrounded volcanic fragments in a matrix of crushed rock fragments.

Another occurrence of intrusive breccia occurs in Chambers Township about 8 km (5 miles) northwest of the occurrence on the road to the Sherman Mine. The breccia at this occurrence is very similar to the latter, but is not as well exposed.

Sudbury-type breccia, with which the intrusive breccia of the Northeast

Temagami area may be equated, is not unknown in the adjacent townships. Simony (1964, p.13) reported Sudbury-type breccia in Joan and Belfast Townships, and Lawton (1954, p.8-13) reported extensive Sudbury-type breccia in Delhi Township. All of the above townships are west of the Northeast Temagami area.

Reynolds (1954) presented evidence to show the intrusive breccias such as Sudbury-type breccias, breccia pipes, and pebble dikes may be formed by the action of gas streaming through fractures in rocks resulting in brecciation, transportation, comminution, and mixing of the wall rocks. Reynolds termed the process "fluidization" because it is considered to be analagous to an industrial process of that name. The process seems the only one that can adequately explain all of the features of the various intrusive breccias of the Temagami area.

The possibility that the intrusive breccias of the Temagami area are sedimentary breccias or clastic dikes such as those recognized in the Elliot Lake area has been considered by the author. The most significant distinction between the intrusive breccias of Temagami and the clastic dikes, is that the latter are confined to the Huronian Supergroup, and in particular to individual formations in the Huronian rocks (Eisbacher 1970;Young 1972). However, the intrusive breccias of the Temagami area transect Early Precambrian basement rocks and have not been recognized in younger rocks of the map-area.

Consideration was also given to the possibility that the intrusive breccias are intrusive downward, and represent filling of deep fractures by sediment from the Gowganda Formation. Little independent evidence can be found for this hypothesis. There is no spatial association between the breccias and the base of the Gowganda Formation. Some of the breccias occur up to 1.2 km (2 miles) from known rocks of the Gowganda Formation; nor is there any evidence that the present erosional surface lies close to the pre-Gowganda erosional surface.

Evidence exists for the association of the breccias with hydrothermal activity. This can be seen from the quartz veins bordering the breccia on the road to the Sherman Mine as well as the presence of tourmaline and a thin sericitic selvage around the quartz and feldspar grains.

Phanerozoic

PALEOZOIC

Cambrian

CARBONATITE

A 10-20 cm (4 inches to 8 inches) wide dike of carbonatite, striking north-northeast and dipping about 75 degrees due west, is located on a rock cut on the east side of Highway 11 about 300 m (1,000 feet) north of Karol Lake in Strathcona Township. The dike intrudes Early Precambrian mafic to intermediate metavolcanics, and on fresh surfaces the carbonatite is a medium grey, medium-grained massive rock, cut by a few discontinuous seams of a reddish brown mineral. The weathered surface is a variable brownish grey upon which dark green silicates (actinolite-tremolite) and an unidentified reddish mineral stand in relief. In thin section, the rock is seen to consist of about 90 percent equant grains of carbonate about 1 mm across and about 9 percent prisms of very pale green to colourless amphibole, probably tremolite. In addition, there is less than 1 percent of an unidentified mineral displaying extreme pleochroism from yellowish brown through deep brown to black. The mineral forms irregular grains from less than a mm to about 2 mm across, with what may be a very indistinct cleavage or parting.

X-ray diffractometry by the Mineral Research Branch, Ontario Division of Mines indicated the presence of calcite, but no dolomite. Strontianite and synchisite (a rare earth carbonate) were tentatively identified.

A sample of the dike was forwarded by the author to the Mineral Research Branch, Ontario Division of Mines in order to determine the content of some elements considered characteristic of carbonatites. The results are given in Table 6.

The relatively high content of strontium, lanthanum and cerium is sufficient evidence to class the rock as a carbonatite, and more specifically as "sovite", a calcite carbonatite (Heinrich 1966). The low barium content is somewhat unusual.

The nearest known carbonatites to the Temagami occurrence are probably those of Lake Nipissing (Lumbers 1971, p.47-54) which have yielded potassium-argon age dates of about 565 million years B.P. (Gittins *et al.* 1967, p.651). This rock has been tentatively assigned as having a Cambrian age.

CENOZOIC

Quaternary

PLEISTOCENE AND RECENT DEPOSITS

The most predominant Pleistocene glacial deposit of the Northeast Temagami area is poorly sorted, unstratified, sandy till with abundant pebbles, cobbles and boulders (Boissonneau 1965, 1968). In most cases, the dominant boulder content of the till reflects the underlying bedrock. Ground moraine is generally thin and discontinuous. Rock exposures are abundant in most parts of the area, but large areas of continuous rock exposure are rare. Areas of relatively thick till, where rock exposures are lacking or rare, occur about 1.6 km (1 mile) north of Iron Lake (now drained and not shown on Map 2323, back pocket) in southeastern Chambers Township, immediately north of the Ko-Ko-Ko iron formation in southwest Chambers Township, and between Broom Lake in Briggs Township, and Driftwood Lake in Strathcona Township.

Eskers and drumlinoid features are insignificant in the map-area. Local oc-

TABLE 6 TRACE ELEMENT CONTENT OF CARBONATITE, STRATHCONA TOWNSHIP, NORTHEAST TEMAGAMI AREA; ANALYSIS BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES.

Element	Percent
Strontium	0.4
Barium	None detected
Niobium	Trace amount
Yttrium	Trace amount
Ytterbium	Trace amount
Lanthanum Oxide (La_2O_3)	0.13
Cerium Oxide (CeO_2)	0.51

currences of stratified outwash gravels are exposed in gravel pits along Highway 11 in northeastern Strathy Township, near the road at the South Tetapaga River at the western boundary of Strathcona Township, and in southwestern Briggs Township.

Glacial striae directions are shown on Maps 2323 and 2324 (back pocket) accompanying this report, and range from S5°W to S20°W with the mean direction about S15°W.

CARBONATIZATION

Two visibly distinct forms of carbonatization have affected the rocks of the Northeast Temagami area. The most widespread and most obvious type is the introduction of iron-bearing carbonate minerals, dominantly ankerite, but probably also siderite and ferrodolomite. It is this type of carbonatization which has generally been referred to as ankeritization or carbonatization.

Ankerite forms veins and disseminated grains that replace earlier silicates. The veins or dikes range up to 6 m (20 feet) wide and at least 1.6 km (1 mile) long. Veins which are exposed at Axe Narrows and along the northern shore of Portage Bay near the village of Temagami may be continuous; if so, it has a length of at least 3 km (5 miles). The ankerite veins are fine grained, massive, and weather a brillant orange to reddish brown, while fresh surfaces are pale grey to pale brown. The larger veins are generally laced with narrow, intertwining quartz veins.

No ankerite veins are known to cut the Huronian rocks of the area, and fragments of vein-type ankerite are abundant at the base of the Gowganda Formation between Portage and Inlet Bays. The introduction of the carbonate veins probably predated the Gowganda Formation. Ankerite veins were not found within the major granitic bodies of the Temagami area, but boulders and cobbles of ankeritized granitic rocks were found in at the base of the Gowganda Formation near the village of Temagami. The significance of the latter observation is not certain at present, but it may be that most veins are pre-granite, while some local post-granite ankeritization also occurred, but has not been located.

Most of the veins are concordant with the foliation and shearing of the enclosing metavolcanics. This could suggest that the veins were introduced following the main period of folding as steeply dipping "dikes" along zones of weakness and shearing, particularly the major shear zones along the Northeast Arm of Lake Temagami. If it is held that the veins are pre-folding, then they could have formed as horizontal veins or sills. Such an occurrence seems to be at variance with most observations on vein deposits.

Ridler (1970) has recently interpreted some of the carbonate zones of the Kirkland Lake-Larder Lake area as carbonate facies iron formation formed by Early Precambrian volcanic exhalations. The occurrences described by Ridler have some features in common with the Northeast Temagami area (e.g. the predominance of iron-magnesium carbonate and interlacing narrow quartz veins). The author believes that insufficient evidence exists to suggest such an origin for the ankerite veins at Temagami. On the contrary, the carbonate bodies of the Temagami area clearly cut across fragments in metavolcanic breccias. No evidence of bedding or relict bedding was seen in any of the carbonate bodies examined.

The ankerite veins of the Northeast Temagami area were introduced along mainly northeast-trending regional and local shear zones following the folding of the metavolcanic complex, but before the emplacement of the major granitic plutons.

Ankerite also is a widespread alteration product of many of the metavolcanics. The locations of the main areas of ankeritization are shown on Figures 7 and 8. Disseminated ankeritization apparently was found to be restricted to the upper part of the volcanic sequence, and to be most intense within, but not entirely restricted to, the major northeast-trending shear zones. There also appears to be a spatial association of disseminated ankerite with rhyolite.

The ankeritized rocks are conspicuous by their brownish weathered surface and generally pale fresh surfaces. Fine-grained, disseminated sulphide minerals appear to be more common in ankeritized areas. In thin section, the carbonate forms anhedral equant grains ranging from a few hundredths of a mm to 1 mm or more. The carbonate does not preferentially replace any particular mineral.

The metavolcanic breccias on Highway 11 south of the village of Temagami are important because of the age of the disseminated ankeritization contained in them; the volcanic breccias contain many fragments that have clearly undergone a greater degree of ankeritization than the surrounding matrix. Little doubt exists that at least some of the ankeritization has preceded the deposition of some of the metamorphosed volcanic breccias. This being so, doubt is put by the author on the earlier conclusions that the carbonate veins are post-folding. In spite of many exposures of volcanic breccias examined during the field mapping, none were found to contain fragments of pure ankerite as found in the veins. Nor were fragments of vein quartz found, which in some places appear to be associated with the ankerite.

A further conclusion, then, is that some of the pervasive ankeritization in the Temagami area is related to the Early Precambrian volcanic activity, particularly the rholitic rocks that occur at relatively high stratigraphic levels. Some ankeritization may also be related to later, post tectonic ankerite vein formation.

TABLE 7 CHEMICAL ANALYSES OF CARBONATIZED ROCKS FROM THE NORTHEAST TEMAGAMI AREA RECALCULATED ON A VOLATILE FREE BASIS. FOR ORIGINAL ANALYSES AND LOCATIONS OF SAMPLES, SEE TABLES 2 AND 3. ANALYSES BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES.

Major Components in Percent

Sample Numbers	C3-42	TZ10-1
SiO_2	77.89	61.80
Al_2O_3	14.25	15.26
Fe_2O_3	0.41	2.47
FeO	1.11	10.17
MgO	0.88	1.49
CaO	1.87	5.86
Na_2O	0.89	1.99
K_2O	2.52	0.06
TiO_2	0.08	0.61
P_2O_5	0.01	0.10
MnO	0.04	0.19
S	0.04	0.01

The presence of the veins within the ankerite zone suggests that the veins and possibly some associated ankeritization may be the result of the remobilization and concentration of the older disseminated carbonate.

In addition to ankerite, white sugary calcite fills fractures, joints, and tensional ladder veins within the metavolcanics. Most of the calcite was observed in road cuts along Highway 11 and its true distribution is unknown owing to its high solubility and lack of strong colouration. The calcite appears to be relatively late because it fills undeformed fractures, but it appears to precede the Huronian rocks and probably the granite plutons as well.

Two of the specimens from the Temagami area that were analyzed chemically were found to contain significant amounts of CO_2 that indicated carbonatization (see analyses C3-42 and TZ10-1, Table 7). Ankeritization of specimen C3-42 was visible to the naked eye, but the specimen was analyzed since this degree of ankeritization is typical of the rhyolitic rocks of the area. Carbonatization of specimen TZ10-1 was also suspected from the pitted, weathered surface, but no iron staining indicative of ankeritization was present.

When plotted on variation diagrams with relatively unaltered rocks, the carbonatized specimens occupy aberrant positons (see Figures 2 and 3). The displacement of the positions of the analyses shown on the phase diagrams is caused largely by the removal of alkalies during carbonatization. This can be most readily seen on Figures 3 and 4 and from examination of the chemical analyses.

As noted earlier the porphyries associated with the Iceland Lake Pluton also contain relatively large amounts of CO_2. There does not, however, appear to be a proportionate displacement of these analyses when plotted on variation diagrams. This is especially true of Figure 3. This could indicate that the carbonate in the porphyries was derived from a magma; carbonate did not extensively replace alkalies. Nevertheless, carbonatization of the diorite and rhyolite is associated with zones of shearing and ankeritization in an open system involving extensive loss of alkalies.

STRUCTURAL GEOLOGY

Major Folds

The most prominent structural feature of the Northeast Temagami area is an east-northeast trending syncline within the Early Precambrian (Archean) metavolcanic-metasedimentary belt. The presence of the syncline is indicated by top determinations from pillow shapes in mafic metavolcanics and by grain size gradation in metasediments. The available data suggest that the axis of the syncline extends from about 1070 m (3,500 feet) west of Pigot Lake in Briggs Township, where it abuts against the Spawning Lake Stock,northeastward through Tetapaga Lake and Turtle Lake to about 900 m (3,000 feet) north of Temagami, and then into Cassels Township. A puzzling feature of the syncline is the marked asymmetry of the axis with respect to the main marker horizons, the iron formation units. North of the town of Temagami, the axis of the syncline lies within 300 m (1,000 feet) of the iron formation unit on the southern limb, but is about 3000 m (10,000 feet) distant from the iron formation on the northern limb (Figure 7, Chart A, back pocket).

The asymmetry of the syncline could be caused by two factors. The first, is that the apparent thickening of the northern limb of the syncline could be the result of faulting. This would mean that a wedge-shaped block of metavolcanics of considerable thickness was either introduced into the metavolcanic pile just south of the iron formation of the northern limb of the syncline, or removed from the sequence just north of the iron formation of the southern limb. Although such faulting may be possible, there is little independent evidence that it took place in the areas in question. Sharp deflections in the strike of the iron formation would occur if the thickness of the metavolcanic assemblage were modified by the presence or absence of a fault wedge.

A second factor is that the asymmetry of the syncline was caused by a lack of balance between the depositional and erosional processes during the accumulation of the volcanic pile. The present distribution of rock types may indicate that during the development of the volcanic assemblage, a period of relative quiescence and stability marked the deposition of extensive beds of Algoma-type iron formation. The distribution of the main iron formation units northeast of Vermilion Lake could indicate that this area was one of almost continuous volcanic activity. At the interface between the active volcanic area and that of deposition of the iron formation, the iron formation sequence would be interrupted and disturbed by repeated flows of pillow lavas. Evidence of such events is suggested by the separation of thin units of iron formation by flows in the area west of Arsenic Lake and by the brecciation and mixing of pillows and iron formation in that area. A thick accumulation of mafic lavas on the northern limb of a basin, while the southern side was stable or undergoing erosion, would produce an apparent southward migration of the synclinal axis with respect to the iron formation horizons.

The possible emplacement of unrecognized mafic intrusive bodies into the sequence of the northern limb of the syncline would further accentuate the difference in apparent thickness of the limbs of the syncline.

The original form of the main syncline appears to have been modified by the emplacement of the granitic plutons. This would partly account for the divergence of the limbs of the syncline in the vicinity of the Spawning Lake Stock.

The general northeasterly trend of the main structural elements of the belt also can be discerned in central Strathcona Township. An occurrence of pillow lava in southeastern Strathcona Township indicates stratigraphic tops are to the south in that area. An anticlinal axis probably exists in central Strathcona Township. Additional top determinations or structural data would be needed to establish the presence of such an anticline with certainty. The diapiric rise of the Iceland Lake Pluton probably produced a second stage of folding of the already folded metavolcanics of Strathcona Township.

Faults and Fractures

The major fracture directions in the Northeast Temagami area are north-northeast, northwest and northeast. The attitude and extent of individual faults is based on direct evidence, such as shearing and displacement of lithologic units as well as indirect information such as topographic lineaments on air photos, geophysical information supplied by maps of mining companies, and ODM-GSC Aeromagnetic Maps 1490G, 1491G, 1502G, and 1503G (GSC 1965a, b, c, and d). In a few areas detailed mapping by mining companies succeeded in indicating the presence of faults, which, because of their limited displacement, would have been overlooked on the scale of 1:15,840 (1 inch to ¼ mile). The presence of dikes of at least two ages provides additional information about the age and displacement of fractures.

NORTH-TRENDING FAULTS AND FRACTURES

The presence of roughly north-trending fractures is indicated by the occurrence of altered gabbro dikes with this trend in central Chambers Township and central Strathcona Township. Topographical lineaments of this general trend occur between Alfreda Lake and Kanichee Lake in Strathy Township as well as around Spawning Lake in Briggs Township. Evidence of significant movement along some of these fractures is indicated by the apparent displacement of part of the contact of the Spawning Lake Stock and by the abrupt change in thickness of the iron formation at the western end of the north pit of the Sherman Mine (see Map 2323, back pocket). The location of the latter fault appears to be defined by an approximately north-south trending creek draining into Tetapaga Lake. The iron formation in the pit shows no evidence of shearing or brecciation adjacent to the inferred fault zone.

NORTHWEST-TRENDING FAULTS AND FRACTURES

An extensive northwest-striking fracture system is shown by the continuous northwest-trending diabase dikes of the Sudbury Swarm, some altered gabbro dikes, as well as the major topographic lineaments formed by the drainage systems between Jackpine and Net Lakes, and those of the South Tetapaga River, Iceland Lake and Herridge Lake. Many of these fractures intersect the strike of the main lithologic units of the metavolcanic belt at a relatively high angle with little evidence of displacement. The horizontal movement (if any) on these fractures was relatively minor, and, in most cases, the vertical component of any movement may have been less than 30 m (100 feet) or an apparent horizontal displacement would have been detected during detailed mapping of iron formation by mining companies. Thickening of the iron formation north of the town of Temagami appears to have been the result of northwest to north-northwest striking faults. The northwest strike of some of the altered gabbro dikes shows that some preGowganda fractures with this strike existed.

EAST- TO NORTHEAST-TRENDING SHEAR ZONES AND FAULTS

East- to northeast-striking, steeply dipping faults and shear zones, which for the most part are bedding faults, are prominent topographic and structural features of the map-area. The major topographic feature, the Northeast Arm of Lake Temagami, is undoubtedly underlain by a fault zone or zones of sheared and ankeritized felsic to intermediate metavolcanics, up to 1200 m (4,000 feet) wide.

Little reliable information exists about the total displacement of the fault under Lake Temagami. Some movement occurred on the fault zone, because of the displacement of the altered gabbro dikes that cross the northeastern arm in southwest Briggs Township. Two of these dikes appear to have undergone left lateral strike separation of at least 150 m (500 feet). Little or no displacement is apparent on a diabase dike of the Sudbury swarm which crosses the Northeast Arm of Lake Temagami in the same area as the altered gabbro dikes.

The relatively unsheared condition of an altered gabbro dike crossing the Northeast Arm of Lake Temagami indicates that major shearing and carbonatization took place before the intrusion of the altered gabbro dikes.

The last recognizable displacement on the northeast-trending strike slip faults underlying the Northeast Arm of Lake Temagami followed the deposition of the Gowganda Formation. This can be seen from the narrow, northeast striking, vertical fractures[1] which show minor, vertical displacement of the Gow-

[1]Not shown on Map 2324 (back pocket) because of their minor displacements.

ganda Formation on the highway west of Caribou Lake, at the southern boundary of Strathcona Township. These fractures show evidence of minor hydrothermal alteration.

Another important, steeply dipping, shear zone extends through Link Lake and along Johnny Creek in Strathy Township. The western extension of this zone is uncertain. It may continue southwest to join the Spawning Bay Fault of central Briggs Township, or it may swing towards the south through Tetapaga Lake and the Tetapaga River to join the main shear zone along the Northeast Arm of Lake Temagami. The Link Lake shear zone also contains a large amount of sheared and ankeritized felsic metavolcanics; but at several localities near the shear zone unsheared, carbonatized mafic pillowed metavolcanics were noted. There is little or no evidence from which to delineate movement on the Link Lake fault zone. There has been no significant movement following the intrusion of the Sudbury dikes. The Spawning Bay Fault, which may be equivalent to the Link Lake fault zone, appears to have displaced the eastern contact of the Spawning Lake Stock by as much as 900 m (3,000 feet). Movement on the Spawning Bay Fault is indicated by narrow zones of angular breccia at the western end of McLaren Lake.

The third major northeast-striking shear zone of the Northeast Temagami area extends from north of O'Connor Lake in southwestern Strathy Township to the southern end of the south arm of Net Lake in central Strathy Township. The shear zone is over 600 m (2,000 feet) wide in places, and consists mainly of ankeritized and sheared rhyolite. The zone is also notable for the numerous occurrences of lenses and seams of pyrite, some of which contain significant amounts of gold and silver. Otherwise, the shear zone is similar to the shear zones previously described.

Another shear zone similar to those previously described, extends west from Tasse Lake in Chambers Township. This zone is less well defined than the others and it appears to pinch out east of Tasse Lake.

A common feature of all major shear zones of the map-area is their extensive width, carbonatization (generally ankerite), and an association with felsic metavolcanics. This leads to the conclusion that these features may be related genetically to the formation of the felsic metavolcanics. Because some carbonatization occurred during the main period of Early Precambrian volcanic activity, especially felsic volcanic activity, the author infers that the shearing was localized in structurally weak zones of carbonatized felsic metavolcanics. This may be the case, but the presence of post-tectonic veins of ankerite in the shear zone on the Northeast Arm of Lake Temagami suggests that some remobilization of carbonate has taken place in the shear zones following the main period of shearing.

The shearing and carbonatization of the northeast-trending shear zones appear to pre-date the intrusion of the granitic rocks. This suggests that these shear zones may be older than the other fracture systems of the area, and are related to the development of the volcanic assemblage, or to the main period of folding.

Structural Geology of the Gowganda Formation

Bedding attitudes are difficult to obtain because of the thick-bedded nature of much of the Gowganda Formation in the northeastern part of the Temagami area and the generally small exposures. The attitudes measured, however, show that much of the Gowganda Formation was tilted to relatively steep angles. The steepest dips are found on Highway 11 west of Caribou Lake at the southern boundary of Strathy Township. In this area interbedded siltstones, arkose, and minor argillite dip to the east at angles of as much as 60 degrees (see Figure 7). The strikes form an arcuate pattern concave to the east and seem to delineate a synclinal or basinal structure. The surface of the unconformity between the Early Precambrian and the Gowganda Formation south of the village of Temagami, dips almost vertically; whereas the Gowganda Formation dips at about 45° to 20° to the southeast. There is obviously an angular discordance between the bedding of the Gowganda Formation and the surface of the Early Precambrian basement. This may be caused by faulting, pronounced depressions in the basement, or a combination of these two factors. Apparently the Huronian rocks of Strathy and Strathcona Townships lie on a basement of great topographic relief.

Lindsey (1967, p.22) mapped the section of the Gowganda Formation in the Caribou Lake area, and concluded that the main cause of post-Gowganda deformation was reactivation of Early Precambrian shear slopes rather than compaction of sediment in basement troughs. Lindsey cites the shearing and drag folding in the Gowganda sedimentary rocks on the highway between Portage Bay and Inlet Bay, and the presence of carbonate "metacrysts" in the laminated siltstones of that area.

In the writer's opinion, the faults referred to by Lindsey (1967) do not seem to have produced significant displacement of the Gowganda Formation and may be due to minor adjustments along the main northeast-trending shear zone under Lake Temagami. The strike of the siltstones on Caribou Lake is in part perpendicular to this shear zone, suggesting that the basinal structure previously referred to was produced by a process other than that related to the faulting along Lake Temagami.

The "metacrysts" of Lindsey are more likely to have formed during diagenesis by the action of pore fluids saturated with iron carbonate. This statement is supported by the observation that the basement rocks underlying the Gowganda Formation south of the village of Temagami are highly ankeritized with no evidence of recrystallization of ankerite.

Since the top of the Gowganda Formation is not exposed in the map-area, the stratigraphic thickness cannot be estimated. The basinal depression east of Caribou Lake probably contains at least 300 m (1,000 feet) of well-bedded sedimentary rocks, but this may be only a fraction of the true thickness.

ECONOMIC GEOLOGY

Distribution of Mineral Occurrences

The high concentration of mineral occurrences in the Northeast Temagami area, and the wide variety of rock types, provide an ideal setting in which to study the relationships and distribution of mineral occurrences. A detailed study is certainly beyond the scope of the present survey, but a few general conclusions can be made from existing data.

A total of 130 mineral occurrences is shown in Figure 8 (Chart A, back pocket). Only those which can be interpreted as fissure fillings or veins, and those of possible hydrothermal origin are included. Sulphide facies iron formation is shown by a different symbol. The occurrences shown on Figure 8 include all visible concentrations of sulphide and arsenide minerals as well as quartz veins known to contain significant values of gold or silver or both. Also included are pits and trenches located in the field or indicated on maps of mining companies in the assessment files at Kirkland Lake (see Resident Geologists Files, Ontario Ministry of Natural Resources, Kirkland Lake). In almost all cases, the pits and trenches appear to indicate that an anomalous concentration of economic minerals was present to warrant the trenching, even if present economic conditions do not indicate this.

Table 8 correlates mineral occurrences with rock type. More than one-half of the total number of mineral occurrences are found within metamorphosed mafic flows or associated intrusions. Three of the five "past producers"[1] also occur within mafic metavolcanics. Dacitic and rhyolitic metavolcanics enclose a significant number of occurrences, as do mafic intrusions which are in part post-tectonic. Of interest is the "concentration" of occurrences associated with each major lithologic type; that is, the number of mineral occurrences per unit area of rock type. The highest "concentration" of presently known mineral occurrences is found within the rhyolitic metavolcanics followed by mafic intrusions, and then by mafic metavolcanics. The high concentration of mineral occurrences in the rhyolitic rocks is interpreted because of the prevalent view that massive sulphide deposits are genetically related to rhyolitic vulcanism (Sangster 1972). Apparently there is a very low concentration of mineral occurrences in the granitic plutons and the Gowganda Formation.

Figure 8 (Chart A, back pocket) shows that 80 percent of the mineral occurrences within the metavolcanic assemblage are found in central Strathy Township. The high proportion of occurrences within the mafic metavolcanics strongly suggests a close, genetic relationship with the metavolcanics. There are, however, additional factors which must be considered. The area in which most of the economic mineralization is found in Strathy Township is northeast of Ver-

[1]Those occurrences which have had underground development, a mill and that shipped some "ore". In most cases the shipment was merely for test purposes, or the value of the shipment is unknown. Only the Ajax Minerals deposit should be strictly considered a past producer.

TABLE 8 THE DISTRIBUTION OF HYDROTHERMAL MINERALIZATION WITH LITHOLOGY OF ENCLOSING ROCKS IN THE NORTHEAST TEMAGAMI AREA.

Rock Type	Total Mineral Occurrences	"Past Producers"	No. of Mineral Occurrence per Unit Area of Rock Type[1]
Metamorphosed mafic flows	70	3	14
Metamorphosed dacitic flows	22	-	6
Metamorphosed rhyolitic breccias (and flows)	24	-	30
Mafic intrusions	8	2	20
Metamorphosed sedimentary rocks	1	-	2
Granitic plutons	4	-	1
Gowganda Formation	1	-	1

[1]These figures were obtained by dividing the number of mineral occurrences in each rock type by the area of that rock type, and multiplying by a constant to bring the lowest number to unity.

milion Lake. A large amount of sulphide facies iron formation occurs in this area. The high concentration of sulphide minerals in the rhyolitic rocks north of Vermilion Lake is also interesting, since these rocks lie a short distance stratigraphically below the iron formation. The occurrences within the mafic metavolcanics around Arsenic Lake and south of Net Lake do not appear to be as closely associated with sulphide facies iron formation as the others. These are present within a wedge of mafic metavolcanics which may not be represented elsewhere in the exposed volcanic pile (see section on "Structural Geology and Stratigraphy"). These deposits may be associated with the particular period of vulcanism which produced the mafic "wedge".

Possible Structural Controls on Mineralization

Moorhouse (1942, p.41) pointed out the possible economic importance of the main Lake Temagami shear zone and subsidiary shear zones such as the Link Lake shear zone. The rhyolite north of Vermilion Lake is extensively sheared as is the area east of Link Lake. Both areas contain a large number of economic mineral occurrences. Ankerite is almost invariably present within the shear zones, and in many cases is accompanied by fine-grained disseminated pyrite. Some ankeritization and mineralization may be related to zones of shearing within the metavolcanics, especially the felsic volcanic rocks.

Ten mineral occurrences located west of Lowell Lake in central Strathcona Township, are spaced over an almost straight line for a length of about 4 km (2½ miles) (see Table 8). The trend of these occurrences is north, northeast, and is similar to that of a few lineaments in that area.

These occurrences, which have some features in common (see Section on "Economic Geology"), may have been emplaced along a fracture that has little evidence at the surface.

Age Relationships

The observed intrusive relationships of mineral occurrences that can be interpreted as hydrothermal are summarized in Table 9. One occurrence of sulphide minerals is known to postdate the Gowganda Formation, but no occurrences are known to postdate the Nipissing Diabase (see Table 8). Quartz veins within the Iceland Lake Pluton (chlorite trondhjemite phase and the Spawning Lake Stock) indicate that some hydrothermal activity postdates these intrusions. None of these veins were found to contain any significant content of sulphide minerals or economic metals.

Many of the gabbroic rocks have been intruded by quartz veins and sulphide veins.

The lamprophyre and chloritic dikes (Matachewan?) are known to intrude some hydrothermal veins at the Cominco Limited (12) property (Hermiston-McCauley Deposit).

Most of the hydrothermal deposits within the metavolcanics contain little

TABLE 9 INTRUSIVE RELATIONSHIPS SHOWN BY SOME HYDROTHERMAL MINERAL DEPOSITS OF THE NORTHEAST TEMAGAMI AREA. (ALL DEPOSITS ARE INTRUDED BY DIABASE DIKES OF SUDBURY SWARM).

Reference code - (1) this report, (2) Moorhouse (1942).

Deposit	Mineral & Metal	Form of deposit	Enclosed by or Intruding	Intruded by	Reference
Bunker Hill Extensions Mines Limited (44)[2]	py,cp	Disseminated	Quartz feldspar porphyry, feldspar porphyry		1
Titanic Construction Company Limited [1962] (50)	py,Au	Disseminated quartz vein	In felsite		1, 2
Nickel Rim Mines Limited (59)	mag,Au	Disseminated quartz vein	In quartz porphyry		1
The International Nickel Company of Canada (22)	cp,py,sp	Disseminated quartz vein	In altered gabbro		1
A.E. Perron (39)	Au,py	Quartz vein		Lamprophyre	1, 2
E. L. MacVeigh (29)	po,py,cp,sp	Disseminated quartz vein	In altered gabbro		1
Sey-Bert Occurrence (41)	py,Au	In quartz vein	In granite		1, 2
Ajax Minerals Limited (6)	py,po,Cu,Ni	Disseminated	In serpentine	Chloritic dikes	1
Cominco Limited (12)	py,Au	In vein	In diorite	quartz porphyry lamprophyre chloritic dike	1, 2

Table 9 - continued

C.J. Niemetz[1]	py,Au	Vein	In chloritic dike	2
C.J. Niemetz	py,Au	Disseminated	In quartz porphyry	2
Mildred E. MacVeigh	Au	Disseminated	In felsite dike	2

Footnote
[1]In Phyllis Township near southwest corner of Briggs Township.
[2]Numbers in parentheses refer to property number on Map 2323, 2324 in back pocket.

Abbreviations

Au - gold
Cu - copper
Ni - nickel

cp - chalcopyrite
mag - magnetite
po - pyrrhotite

py - pyrite
sp - sphalerite

evidence about age relationships with the other rocks. Table 10 shows the results of assuming a prefolding age for these deposits and finding the original attitude by rotation through the present dip of the enclosing rocks. Several errors are possible using this technique, not the least of which is the extrapolation of the strike of the enclosing rocks from the nearest measured attitude or interpretated contact. The accuracy of the result is probably no better than ±10 degrees for the dip and strike.

Table 10 shows that at the present time the dip of all veins except one is greater than 45 degrees. When the veins are rotated to a pre-tectonic attitude, nine veins have a dip of less than 45 degrees, and two others dip significantly less than before rotation. Therefore, where the attitudes of the hydrothermal deposits of the Northeast Temagami area are known, they suggest a post-tectonic age for the deposits. In spite of the fact that almost all of the deposits occur within the metavolcanic belt, it appears that most of the mineralization probably postdates the main period of volcanic activity.

This suggests that many of the mineral occurrences in the map-area could be formed by remobilization of syngenetic material into younger fracture systems during post-volcanic thermal events. The presence of abundant arsenides in some deposits suggests a similarity to the deposits of the nearby Cobalt Camp, which are generally accepted to be the result of a remobilization process.

Iron

The two important zones of iron formation in the area have attracted the attention of prospectors and promoters since the turn of the twentieth century. The low grade (about 25 percent) made the deposit unworkable until the development of modern techniques of beneficiation. Labour, energy supply, and proximity to markets are also crucial factors. The Sherman Mine is described in the section "Cliffs of Canada (1, 11, 45, and 55)".

Gold and Silver

Moorhouse (1942) classified the principal types of gold deposits in the map-area as follows:

1) Arsenic-bearing gold ores, in places with high silver values.
2) Pyritic ores.
3) Ores containing lead and zinc sulphides as well as pyrite.

The first group includes the Big Dan, the Little Dan, Longlac Adair, and the Milne showing (Moorhouse 1942). Moorhouse (1942) also included a showing on the Bean land (Alex E. Perron property) and some showings north of the northeast end of Vermilion Lake.

Moorhouse (1942) noted that some of these deposits appear to be replacements of iron formation by arsenic-bearing minerals.

The pyritic ores include deposits in the carbonatized rhyolite zone north of Vermilion Lake. Moorhouse (1942) noted that the third group is frequently asso-

TABLE 10 PRE-FOLDING ATTITUDE OF MINERALIZED ZONES ASSUMING A PRE-TECTONIC AGE, NORTHEAST TEMAGAMI AREA.

Property and Occurrence	Attitude 1[1]	Attitude 2[1]	Attitude 3[1]
Ajax Minerals Limited (Main vein) (6)[2]	335 @ 80 E	072 @ 90	353 @ 85 S
United Reef Petroleums Limited - Big Dan (42)	000 @ 90	080 @ 90	350 @ 80 W
Penrose Gold Mines Limited (37)			
Little Dan No.1	325 @ 55 W	085 @ 90	030 @ 63 W
Unnamed	090 @ 90	085 @ 90	000 @ 50 W
A.E. Perron (39) - Beanland	060 @ 90	051 @ 80 S	290 @ 10 W
Cominco Limited (12) - Hermiston - McCauley	060 @ 85 W	040 @ 90	333 @ 25 E
Net Lake Occurrence (33)	075 @ 70 N	045 @ 80 S	005 @ 45 E
The International Nickel Company of Canada (22)			
Thomas Vein	040 @ 85 S	045 @ 80 S	355 @ 8 E
Canada Vein	030 @ 30 S	045 @ 80 S	055 @ 50 W
Mo showing on Highway 11	050 @ 50 S	045 @ 80 S	038 @ 30 W
E. L. MacVeigh (29)	343 @ 75 W	040 @ 85 S	295 @ 57 W
Cliffs of Canada Limited (11)			
No.1 Showing	045 @ 90	045 @ 90	Horizontal
No.2 Showing	048 @ 90	048 @ 90	Horizontal
Sey-Bert Occurrence (41)	045 @ 70 S	050 @ 85 S	070 @ 15 W

Attitude 1: Strike and dip of mineralized zone.
Attitude 2: Strike and dip of country rocks (extrapolated).
Attitude 3: Strike and dip of mineralized areas following rotation of enclosing rocks to horizontal (pre-folding attitude).

Footnote
[1] 335 @ 80 E - Zone strikes at an azimuthal bearing of 335 degrees and dips 80 degrees to the east.
[2] Numbers in parentheses refer to property number on Maps 2323 and 2324, back pocket.

Abbreviations
@ at
Mo Molybdenum

ciated with the second. Included in the third group are veins on the Cominco, and A.E. Perron (Beanland) properties (see map 2323, back pocket).

The author sampled two occurrences of what is probably primary banded sulphide facies iron formation and collected one sample of pyrite from pyrite nodules in the south pit of the Sherman Mine. None of these samples was found to contain concentrations of economic metals above normal trace values.

Moorhouse's (1942) classification of gold and silver deposits is still considered to be valid. However, there may be another type of gold deposit, which is recognizable, but was not specifically noted by Moorhouse. These are gold and gold-silver deposits associated with quartz-porphyry and quartz-feldspar porphyry. The occurrences of this type include the Big Dan, the Little Dan (Moorhouse 1942), Copperfields Mining Corporation (56) in Strathcona Township, H. Niemetz (48) property in Briggs Township, and possibly that of R.G. Gilson (3) in Chambers Township.

The presence of arsenical ores at Temagami is interesting in view of the prevalence of arsenide deposits in the Cobalt and South Lorrain area. The Gowganda Formation and Nipissing Diabase are present in Strathy Township, and probably overlaid the sulphide and arsenide deposits. At present, however, there is little direct evidence to show that these arsenide deposits or sulphide deposits are related to the Nipissing Diabase or that they post-date the Gowganda Formation. The only known mineral occurrence in the Gowganda Formation is found at the base of that formation, occurs in association with a mafic dike, and contains silver as its predominant economic metal. These three characteristics are comparable with those of the Cobalt ores.

Molybdenum

The only known molybdenum deposit of economic significance is that of the Net Lake Occurrence (33) on the northern shore of Net Lake, east of Highway 11 in Strathy Township. A small amount of molybdenite and chalcopyrite was found in pegmatitic patches in quartz monzonite about 1.6 km (1 mile) northeast of the main molybdenite occurrences. Examination of Map 2323 (back pocket) will indicate that the salient of mafic metavolcanics in which the molybdenite occurrences are found is probably underlain by the granite body that could have hosted the molybdenite-bearing pegmatite. The volatile phase rising from the granite along fractures in the metavolcanics possibly resulted in the emplacement of molybdenite- and chalcopyrite-bearing quartz veins.

Small flecks and crystals of molybdenite and chalcopyrite were noted in quartz monzonite of the Chambers-Strathy Batholith on the west side of Highway 11, about 2400 m (8,000 feet) (straight line distance) from the northeastern corner of Strathy Township. The ore minerals are too sparse and restricted in distribution to be of economic significance, but it is interesting to note they occur within pegmatitic patches of the quartz monzonite. Therefore, minerals appear to be a product of the differentiation of granitic magma, rather than being introduced by secondary processes. A selected sample taken by the author was analyzed by the Mineral Research Branch, Ontario Division of Mines, and found to contain 0.16 percent copper and trace molybdenum.

Copper and Nickel

Copper and nickel are closely associated with mafic to ultramafic intrusive rocks. The most significant deposit is that of Ajax Minerals Limited (6) in central Strathy Township. Although part of this deposit consists of disseminated sulphide minerals that could be interpreted as having a magmatic origin, the high-grade deposits mined in the 1930s were clearly vein deposits with the characteristics of hydrothermal deposits.

The copper-nickel bearing pyrite deposits associated with the altered or metamorphosed gabbroic sills of Temagami Island diorite appear to have a magmatic origin. The main argument supporting this statement is the association of the main deposits with the base of the sill.

PROPERTY DESCRIPTIONS FOR CHAMBERS TOWNSHIP

Cliffs of Canada Limited (Sherman Mine) (1)[1]

The reader should consult the account "Cliffs of Canada Ltd., (Sherman Mine) (11)" which is given in the Property Descriptions for Strathy Township.

Copperfields Mining Corporation Limited (2)

In 1971, Copperfields Mining Corporation Limited held 17 claims adjacent to the group of claims held by the Jones and Laughlin Steel Corporation (5) in southwestern Chambers Township. In addition, Copperfields Mining Corporation Limited held three unsurveyed claims at the western end of the Cliffs of Canada Limited (1) property in southern Chambers Township. In 1971 additional groups of claims were staked by Copperfields Mining Corporation Limited covering most of central Chambers Township from the eastern boundary of the Township to Tasse Lake. Geological mapping was done on these claims to investigate the gabbroic bodies indicated on Ontario Division of Mines Map P.666 (Bennett and Innes 1971a).

R.G. Gilson (3)

In 1971, R.G. Gilson held 11 claims on the southern shore of Chambers Lake in Chambers Township. The group includes a mineral occurrence at the southern shore of a small lake about 600 m (2,000 feet) southwest of Nellem Lake.

Moorhouse (1942, p.38) described the property occurrence as follows:

[1]Number in parentheses refers to property list on Map 2323, back pocket.

In August, 1941, F.W. Thompson restaked ground on the south shore of Chambers Lake, Chambers Township, which had been prospected in 1934 by the Consolidated Mining and Smelting Company of Canada.

Rocks exposed on the property are predominantly intermediate tuffs, agglomerates, and andesites, with some coarse dioritic rocks and granite. The principal workings are located at the southwest corner of a small lake. The mineralized zone strikes roughly N.35° E., and fairly heavy mineralization is exposed for a length of about 300 feet [90 m]. A vein of quartz from 7 to 14 feet [2.1 to 4.3 m] wide is mineralized on one wall (usually the south) with pyrite, sphalerite, galena, and chalcopyrite. In the eastern exposure of the vein, pyrite is the only sulphide. An irregular body of quartz porphyry, which closely resembles the porphyry on the Niemetz claim, outcrops south of the vein and occurs as sericitized inclusions in it. The quartz porphyry is cut by numerous quartz stringers. Greenstone dikes were noted in the vein zone at one place. Andesite forms the south wall. Two smaller veins, generally not more than a foot [0.3 m] wide, have been stripped at points about 30 and 100 feet [9 and 30 m] north of the main vein. They are locally mineralized with massive sphalerite, galena, and pyrite. A grab sample of heavy sulphide assayed by the Provincial Assay Office was found to carry 0.13 ounce gold per ton and a trace of silver.

In 1952 Halkin Mines Limited drilled three short diamond-drill holes and did additional trenching and assaying on this showing. A map of Halkin Mines Limited (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) indicates that the best of ten assays from surface exposures gave trace amounts of silver, nil gold, 0.40 percent lead, 4.00 percent zinc, and 0.15 percent copper. The type of sample and width was not given.

In 1956, Canadian Astoria Minerals Limited (renamed Cam Mines Limited) diamond drilled nine holes totalling 610.8 m (3,004 feet). The Northern Miner (1956a) reported that a mineralized zone has a strike length of 370 m (1,200 feet) long containing sphalerite, galena and chalcopyrite had been outlined.

Goldray Mines Limited did additional work on the showing in 1963. Goldray Mines Limited drilled three holes totalling 804 m (2,680 feet) which intersected a zone of carbonatized and brecciated metavolcanics intruded by numerous quartz veins, feldspar porphyry and mafic dikes. Diamond drill logs also indicate that some of the quartz veins and the mineralization is found within a diabase dike. Notes in the assessment work files (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) indicate that this may be a "Keweenawan" type dike.

D.G. Innes, an assistant of the author, collected a grab sample from the main showing in 1970. Analysis of the sample by the Mineral Research Branch of the Ontario Division of Mines indicated 0.46 percent zinc, but only trace amounts of gold, silver, copper, and lead.

S.A. Gilson (4)

In 1971, S.A. Gilson held 18 claims which almost surrounded the block of R.G. Gilson. It is not known if any work has been done on these claims.

Jones and Laughlin Steel Corporation (5)

In 1951 the Dominion Gulf Company held 31 claims in southwestern Chambers and southeastern Cynthia Townships. Twenty of these claims lie within the boundaries of Chambers Township and include the major part of the iron formation sequence known as the Ko-Ko-Ko range. In 1952, Dominion Gulf Company carried out geological mapping and a magnetometer survey at a scale of 1:4,800 (1 inch to 49:4,800)over the claim group. A total of 1090 m (2,927 linear feet) of earth trenching was done to obtain five continuous sections across the iron formation. A programme of rock trenching was also carried out and totalled 407 m (1,339 linear feet) or 18.76 m^3 (670 cubic feet). The five sections across the iron formation were chip sampled for a total length of 826.3 m (2,711 feet).

The detailed results of the sampling are not available, but an unpublished report by H. Reiner (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) indicates that three possible ore bodies, including material estimated at over 25 percent magnetite are present. At the western end two parallel zones are indicated. The northern zone averages about 40 m (130 feet) over an exposed length of 330 m (1,100 feet). The southern zone averages about 110 m (360 feet) over an exposed length of 460 m (1,500 feet). Another deposit of possible ore-grade is located near the central section of the iron formation. It averages 126.8 m (416 feet) wide for a length of approximately 900 m (3,000 feet).

The following description is taken from the report by H. Reiner:

> The iron formation forms a ridge trending in a general NW-SE direction through the property. It varies in width from 300 feet [90 m] to 1,000 feet [300 m]. It is composed of well-banded magnetite, some hematite and silica, the magnetite comprising 10 to 50 percent by volume, of the total. The banding varies from infinitesimal to 2 inches [5 cm] in width, with an average width of ¼ to ½ inch [0.7 to 1.3 cm].
>
> For mapping purposes it was divided into three groups depending on estimated percent magnetite content as follows: 0 - 15 percent, 15 - 25 percent, over 25 percent. The first grouping, occurring mainly along the outer margins, is composed of alternating bands of white quartzite and limonitic bands. Magnetite occurs in small quantities in the limonitic bands and probably is sparsely disseminated through the quartzite. This rock has been termed a ferruginous quartzite. The second and third groupings are composed of banded magnetite, white silica, black chert, and bright red jasper. Banded jasper and black chert with magnetite are characteristic of the higher grade zones and often grade from one to the other. The banded jasper is a very striking rock making very attractive ornaments on polishing. Magnetite bands often form 30 to 40 percent of the higher grade sections. Appreciable amounts of magnetite occur finely disseminated throughout the interbanded silica.
>
> Brecciation is often noted with fragments of iron formation cemented by silica and magnetite. The silica is of the same type that occurs in the iron formation. This suggests that brecciation has taken place, probably during initial deformation of and prior to final recrystallization of the iron formation.

In 1970 the property was held by the Jones and Laughlin Steel Corporation.

PROPERTY DESCRIPTIONS FOR STRATHY TOWNSHIP

Ajax Minerals Limited (6)

In 1970, Ajax Minerals Limited held 15 claims that cover a copper-nickel prospect and a past producer in central Strathy Township. The claim numbers are TRT4381, TRT4370-71, TRT6773, TRT4369, TRT3187, TRT4310-11, TRT5953-56 inclusive, TRT6763, TRT244803, and EB26. The most important deposits discovered so far occur on claim TR 3187. Part of the mineralized zone lies on TR 1623 held by N.B. Keevil (25).

HISTORY

The early history of Claim TRT3187 is given by Sandefur (1943, p.2) from reports of the Ontario Nickel Company. The claim was first staked in 1910 by H.C. Watkins and W.C. Langley. A lease was granted in 1915, and at this time a company from Buffalo, New York, held an option on the prospect and 17,000 lbs of ore was shipped as a bulk sample.

In 1919, C.C.Filteau of Cobalt did considerable surface work and drilled several diamond-drill holes totalling almost 90 m (300 feet).

In 1928 Gibson Mining Ventures Limited examined the property and reported copper values that warranted trenching.

Files in the Assessment Files Research Office, Ontario Division of Mines, Toronto, indicate that in 1930, a test shipment sent to American Smelting and Refining Company, New Jersey, showed 8 percent copper, 3 percent nickel, 0.3 ounce of gold per ton and 0.41 ounce of platinum per ton. In 1933 Cuniptau Mines Development Company had completed 670 m (2,200 feet) of lateral underground development on the 30 and 68.6 m (100 and 225 feet) levels. A shipment of 30,008 pounds of ore was received by the Mines Branch, Ottawa, in January 1934. Assay results indicated 1.12 percent copper, 1.02 percent nickel 0.01 ounce of gold per ton, 0.18 ounce of silver per ton, and 0.13 ounce of platinum and palladium per ton.

In 1937 Ontario Nickel Corporation, later Ontario Nickel Mines Limited, took over the property, but little work was done until the property was sold to Trebor Mines Limited in 1947. Trebor Mines Limited drilled an additional 128 diamond-drill holes totalling 12 470.9 m (40,915 feet) during 1947 and 1948. The shaft was dewatered and sampled, and additional geological mapping was done and magnetometer surveys were carried out on surface (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

In April 1961, the name of the company was changed to Ajax Minerals Limited on the basis of one share of Ajax Minerals Limited for four shares of Trebor Mines Limited,(Northern Miner 1962). A self potential survey and additional diamond drilling were carried out by Ajax Minerals Limited, but little additional work was done. Ajax Minerals Limited, came under the control of new management in February, 1970 and following a preliminary production feasibility study, a working option agreement was signed with Falconbridge Nickel Mines Limited in March, 1971. In late August, 1972, a right-of-way was being cleared for a hydro-electric line to the property in preparation for further development.

In 1953, Trebor Mines Limited did stripping and trenching to reveal quartz veins in a northeast-trending shear zone in metagabbro about 3.2 km (2 miles) southwest of the main Ajax property (Ajax Minerals Limited (6)). Four diamond drill holes totalling 320.0 m (1,053 feet) were drilled in 1953, but diamond-drill logs are not available. The only assay available is 0.42 ounce of gold per ton over 30.5 cm (12 inches) (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake). There does not appear to have been any work done on this showing since that time.

In 1970, Ajax Minerals staked 15 claims immediately west of the original claim group. The Northern Miner (1970) reported that activity was directed toward the location of serpentine plugs.

PRODUCTION

The only production to date was that of Cuniptau Mines Limited in 1936. A small blast furnace of 30 tons per day capacity produced matte which yielded a total of 99,284 lbs of copper, 65,434 lbs of nickel, 37.0 ounces of gold, 910.0 ounces of silver, 82.7 ounces of platinum and 196.3 ounces of palladium from 3,318 tons milled (Thomson *et al.* 1957).

GENERAL GEOLOGY

The major mineralized zones of the Ajax property have been found within a northwest-trending extension of the main gabbro mass or within the gabbro body near the extension. The extension or "ore-shoot" consists almost entirely of serpentinized peridotite and serpentinite with local amphibolitic areas. It is about 240 m (800 feet) long by 90 m (300 feet) wide and plunges 23 degrees to the southeast (Figure 9).

Surface exposures of the peridotite extension near the shaft are weathered to a deep red, and locally are much stained by limonite. Fresh surfaces are almost black with a slight bluish tint or deep green colour. The presence of serpentine or talc is easily determined by the distinctly greasy feel of scratched surfaces. Medium-grained, reddish weathering, brownish green amphibolite outcrops as a dike about 30 m (100 feet) northwest of the extension and on the south side of the road a few hundred feet east of the old mill-site.

Two thin sections of serpentinite from the mineralized zone were examined. Both display a well-developed poikilitic texture. Anhedral grains of clinopyroxene (2V + 60°) about 5 mm across enclose numerous grains of serpentine less than 1 mm across which are pseudomorphs after olivine. Tiny grains of iron-titanium oxides are scattered throughout the serpentine grains. Chlorite, tremolite, and talc are additional alteration products of olivine. Trace amounts of biotite, iddingsite, and sphene are present. The pyroxene of one specimen is partly altered to carbonate and amphibole, but that of the other is remarkably fresh, showing no evidence of any type of alteration (Photo 7). Sandefur (1943, p.26-27) reported the presence of anthophyllite, and titaniferous augite in addition to the above minerals in thin sections of the peridotite. Sandefur (1943) also pointed out that the degree of alteration is the only significant difference in the specimens of peridotite studied by him.

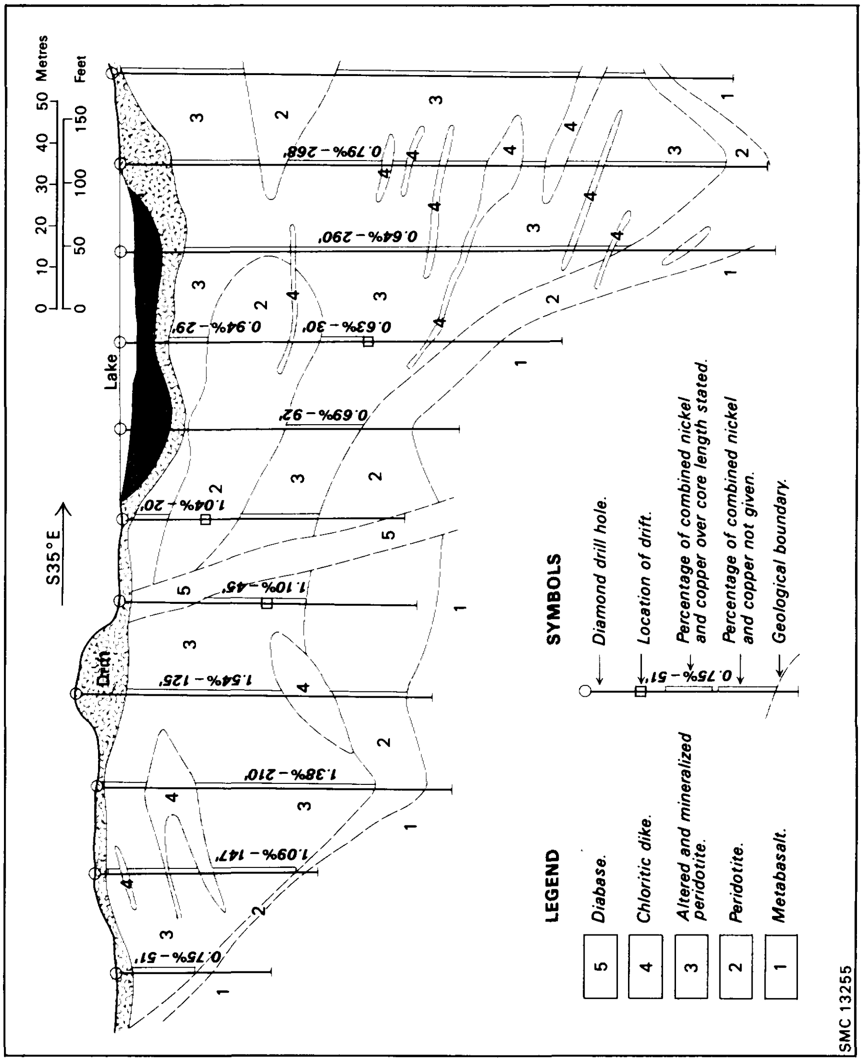


Figure 9–Longitudinal section through the Ajax Minerals Limited property.

In his study of the "ores", Sandefur (1943) identified pyrite, pyrrhotite, chalcopyrite, pentlandite, sphalerite, calaverite, tetrahedrite, marcasite, and hematite in addition to chromite and the silicate minerals noted above. Of these "ores", pyrrhotite and chalcopyrite and pyrite are the most abundant minerals. Pentlandite is associated with particularly high concentrations of pyrrhotite, and in a few places is partly replaced by violarite. Pyrite and marcasite are of widespread distribution, but do not form large concentrations. Sphalerite is present in very minor amounts (Sandefur 1943).

As a result of textural relationships in thin sections and polished sections, Sandefur (1943) concluded that all of the sulphide minerals along with hematite were the product of late hydrothermal solutions and subsequent alteration. Sandefur (1943) believed that the serpentine, chlorite, talc and calcite were the result of an earlier period of alteration.

Reports on the property by J.E. Thomson and P.E. Hopkins on file at the Resident Geologist's Office at Kirkland Lake indicate that the sulphide minerals present form disseminated grains and narrow veinlets.

Hopkins (1929) stated:

> The disseminated material in the various trenches is rusty weathering carbonatized serpentine and diabase with from 1 to 5 percent chalcopyrite....
>
> Cutting the rusty zones and striking in a north-south and an east-west direction, are small veinlets of pyrrhotite and chalcopyrite or calcite carrying copper and nickel iron sulphides. These vary from a fraction of an inch to 12 inches [30.5 cm] in width.

Neither J.E. Thomson, when he visited the property in 1949, nor the writer noted any important systems of fractures that might have acted as controls on ore deposition. However, Sandefur (1943, p.14) stated that there are two well-defined systems of fractures in the mine, one in a north-northwest direction. The north-northwest fractures are said to be the most important and dip from 30 to 60 degrees to the east.

Sandefur (1943, p.15) also stated that the "largest ore bodies" are developed in the fractures which he considered to be shear zones. The largest of these massive sulphide veins has been traced for a distance of 75 m (250 feet) along the 30 m (100 feet) level. Diamond-drill core examined by Sandefur showed no evidence of enrichment in disseminated sulphide minerals adjacent to the veins.

The early exploration efforts were concentrated on the high-grade veins; it is from these that the trial shipments were made. None of the disseminated mineralization was ore grade during the 1930s, but as a result of increases in metal prices at the time of writing this may no longer be the case.

Mrs. M.A. Bateman (7)

Mrs. M.A. Bateman holds one surveyed claim (TR2911) in central Strathy Township. This claim is enclosed by the Ajax Minerals Limited property and is bounded on the south by claim TR3187 on which the main Ajax deposit occurs.

There is no record of economic mineral occurrences on the Bateman claim, nor is there any record of work recently done.

H.E. Bounsell (8)

H.E. Bounsell holds one surveyed claim at the southeastern end of Kanichee Lake in central Strathy Township. There is no record of any mineral occurrences on the claim, or of any exploration, or prospecting having been done on it.

T.D. Brown (9)

In October 1970, T.D. Brown staked 23 claims along the western boundary of Strathy Township west of the Ajax Minerals Limited (6) property.

T.E. Chester (10)

In 1970, T.E. Chester held two unsurveyed claims at the eastern edge of Strathy Township just south of Net Lake. They adjoin the block held by Lake Beaverhouse Mines Limited (26), which lies to the south.

Cliffs of Canada Limited (11)(Sherman Mine), (1), (45), and (55)

The Sherman Mine is a joint venture of Dominion Foundries and Steel Limited (Dofasco) of Hamilton and the Tetapaga Mining Company, a wholly owned subsidiary of the Cleveland-Cliffs Iron Company of Cleveland, Ohio. Dofasco holds a 90 percent interest in the venture and the Tetapaga Mining Company the remaining 10 percent. The operation is managed by Cliffs of Canada Limited who also acquired under lease the 112 claims which form the property. The claims were leased on a royalty basis from Voyageur Explorations Limited, Temco Mines Limited (in which Voyageur has two-thirds control), Ibsen Cobalt Silver Mines Limited, Mayfair Mines Limited, Canateenah Limited and The International Nickel Company of Canada Limited.

Canateenah Limited holds nine claims northwest of the village of Temagami in southern Strathy Township. These claims enclose part of the major iron formation of the Temagami area and have been leased to Cliffs of Canada Limited on a royalty basis.

In 1960, V.A. Carlson held a group of eight claims south of Cooke Lake. The claims are underlain by mafic metavolcanics with discontinuous units of iron formation up to 30 m (100 feet) thick. A geological map at a scale of 1:2,400 (1 inch to 200 feet) and an accompanying report by E.L. MacVeigh, consulting geologist, is in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

The report indicates that the main showing on the property is located at the south end of a small lake in central Strathy Township, about 430 m (1,400 feet) southwest of the shaft of the Beanland Mine (see description of A.E. Perron (39) property in this report). At the main showing, gold values have been obtained from a quartz vein striking north-south and dipping 65° to the east in iron formation. MacVeigh stated that:

> Where the vein crosses the iron formation flat quartz veins carrying abundant arsenopyrite appear to be coming into the footwall.

A chip sample by MacVeigh returned 0.18 ounce of gold per ton and 0.42 ounce of gold per ton, and was obtained from a sample of hand picked quartz with abundant pyrite.

This occurrence was formerly held by Longlac Adair Mines Limited in 1935 and is described by Savage (1935). Savage stated that the quartz vein is about 0.3 m (one foot) thick, and strikes N20°E, rather than north-south as stated by MacVeigh. The vein is said to be heavily mineralized with arsenopyrite, pyrite and some chalcopyrite. The iron formation adjacent to the vein consists of closely interbanded cherty quartz, dense magnetite and massive sulphide minerals, mainly pyrite and some arsenopyrite. Flat-lying quartz and calcite stringers also cut the iron formation (Savage 1935, p.55).

This showing is now part of the holdings of Cliffs of Canada, but there is no indication that Cliffs of Canada have done any further work on the occurrence.

In 1935 Mayfair Mines Limited held 23 claims in the Vermilion Lake area of Strathy Township. These include those acquired by lease, namely: TRT5619-20; TRT4621; and wholly owned unpatented claims TRT6195 to TRT6200 inclusive; TRT6201; TRT6288-89; TRT6505; T-34463-64-65-66; T34314; and T34150. With the exception of TRT4621,which is currently held by B.N. Leslie, these claims are now under the control of Cliffs of Canada through a lease arrangement with Mayfair Mines Limited.

Between 1953 and 1957, Mayfair Mines Limited did geological mapping, prospecting and a ground magnetometer survey over the claim group. Most of the attention was directed to the sulphide iron formation which lies directly under the cherty iron formation in the vicinity of Vermilion Lake. The sulphide zone was drilled, and its position under Vermilion Lake was located. A report by a geologist of Mayfair Mines Limited stated that low values of copper and zinc were indicated by assays of the sulphide iron formation, but there is no mention of "ore grade" assays (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake). Six diamond drill holes totalling 665.1 m (2,182 feet) were drilled.

Temco Mines Limited hold two patented, surveyed claims south of O'Connor Lake in the southwestern corner of Strathy Township. These claims, WD353-4, are located at the eastern end of the west pit of the Sherman Mine, and are presently leased to Cliffs of Canada Limited on a royalty basis.

HISTORY

The presence of iron formation in the Temagami area was first recorded by A.E. Barlow (1899). Boyum and Hartviksen (1970) stated that the Dan O'Connor Company of Sudbury was the first to stake claims on the iron formation, and in 1910 the report of W.G. Miller was the first thorough description of the deposits.

Boyum and Hartviksen (1970) stated:

> During the summer of 1903, M.H. Newan, on behalf of the United States Steel Corporation, made an extensive examination of the two iron ranges. It was soon evident that the iron bearing material would require beneficiation, and in 1903 and 1907 representative samples were sent to the Bureau of Mines, Ontario, for concentration tests. The first attempts were unsuccessful but with improvements of the methods, some encouraging results were obtained in 1908. As a result of this work German interests sought and obtained an option in 1913. They sank diamond-drill holes but were forced to terminate the program abruptly in 1914 due to the outbreak of World War I.

GEOLOGY

Three open pits are currently in production on the Sherman Mine property. A fourth pit (the East Pit) is planned. The west pit contains the thickest section of iron formation, up to 180 m (600 feet) in thickness. The north pit is located at the southwest end of Vermilion Lake in southwest Strathy Township. The iron formation at the north pit has a thickness of about 76 m (250 feet) and is mineable for a strike length of about 600 m (2,000 feet). The third producing open pit is the south pit located south of Tetapaga Lake in northwestern Strathcona Township. At the south pit the iron formation averages about 58 m (190 feet) thick for a length of 1500 m (5,000 feet). The maximum thickness of iron formation in the south pit is 85 m (280 feet) (Boyum and Hartviksen 1970).

OPERATING PITS

The iron formation in the south pit consists mainly of well-banded pale grey to dark grey or dark green magnetite-metachert iron formation. Locally dull red jaspillitic iron formation is present.

Individual layers range fron a few tenths of an inch to several feet in thickness. The chert layers are generally dull white to grey or greenish grey, depending upon the content of magnetite, chlorite, and stilpnomelane. Locally some hematite is present, with the magnetite producing a dull red jaspillitic type. Disharmonic folding and brecciation are locally developed, but are not as impressive as that in the west pit.

The main iron formation units in the south pit are overlain by a thin unit of graphitic slate containing rounded to irregular nodules of granular pyrite. The association of graphite and pyrite may indicate biogenic activity. However, similar nodules of pyrite were noted in green to grey shale and greywacke units between Turtle Lake and Highway 11. Overlying the iron formation and slate is about 15 m (50 feet) of highly epidotized metabasalt which may constitute only one flow. Above the basalt is about 120 m (400 feet) of well-bedded shale and greywacke with local tuffaceous units.

The mineable iron formation in the south pit is underlain by a "transition zone" (Boyum and Hartviksen 1970). This transition zone consists largely of a complex interbedded assemblage of greywacke, siltstone, tuff, and thin beds of iron formation. Much of the iron formation of the transition zone is silicate facies and particularly poor in iron oxides. The silicate facies iron formation is fine-grained, bright green weathering, and dark green on fresh surfaces. In thin section it appears to consist mainly of a felted mass of tiny amphibole needles, chlorite, stilpnomelane, and granular quartz, and magnetite. The fine grain size of the rock (0.02 mm) makes thin-section identification of the mineral phases uncertain. A specimen analyzed by x-ray diffractometry by the Mineral Research Branch, Ontario Divsion of Mines, was found to consist mainly of chlorite (probably ripidolite, an iron-rich variety) and quartz. Similar thin beds of silicate facies iron formation occur within the main iron formation assemblage of the area.

The north pit is notable for the common occurrence of bright orange, red jaspillite iron formation, a very attractive rock consisting of alternating layers of bluish black magnetite and hematite and bright orange jasper. Large, polished blocks of this rock have been used to form the monument to Sherman at the entrance to the mill site. Sulphide facies iron formation forms an important part of the base of the iron formation assemblage at the north pit. An exposure of sulphide iron formation occurs just south of the dam on Vermilion Lake. The rock consists of pyrite (80 to 90 percent) and dark green chlorite (10 to 20 percent) similar to that forming much of the silicate facies iron formation. The texture is that of a breccia with isolated fragments of chlorite several inches to a foot long enclosed in granular pyrite. The fragments of chlorite have cuspate ends, and are generally elongated in the direction of the strike of the iron formation.

The west pit has a maximum width of about 180 m (600 feet) and an average width of about 90 m (300 feet) with a strike length of about 1500 m (5,000 feet). The predominant ore is banded chert-magnetite iron formation with minor, but variable amounts of silicate facies iron formation. Interbeds of greywacke and tuff are common in places. Outcrops of banded sulphide-chert iron formation occur about 0.8 km (half a mile) west of the west pit. An unusual rock occurs at a stratigraphic level above that of the banded iron formation of the west pit and at several locations at a similar stratigraphic position along the northern band of iron formation. This rock is brownish weathering, and dark grey to almost black on the fresh surface. It has a prominent fragmental texture, and consists of flattened fragments up to 2.5 cm (1 inch) long and averaging about 0.7 cm (¼ inch) long. Where the fragmental nature of the rock is not obvious, the rock very much resembles a serpentinite. In thin section, the fragments are seen to consist of tiny needles of pale green, weakly pleochroic amphibole, chlorite, and finely granular magnetite. One specimen contains abundant stilpnomelane, which suggests that it is a variety of silicate facies iron formation.

The iron formation in the vicinity of the west pit is overlain by highly altered and carbonatized lavas, pyroclastic rocks, and greywacke intruded by small plug-like masses of altered rhyolitic porphyries and dioritic rocks. The complex nature of the rock assemblage present is difficult to show on Maps 2323 and 2324 (back pocket). The iron formation of the west pit is underlain by mafic flows, and there does not appear to be an extensive transitional zone as at the south pit.

ORE GRADE AND CONCENTRATION

The soluble iron content of the crude ore in the proven reserves is 25.09 percent. Of this, about 20.5 percent is in the form of magnetite. In 1969, the pellet grade was improved to 5.50 percent silica from 7.01 percent silica (Boyum and Hartviksen 1970).

The ore concentrating plant at Temagami has a rated capacity of 1,000,000 tons of pellets per year. Reserves are stated to be sufficient for 35 years (Dofasco Illustrated News, Sherman Mine Supplement, Sept. 5, 1968).

Following blasting, the crude ore is taken to the plant in 85-ton trucks. The primary gyratory crusher reduces the crude ore to 17.8 cm (minus 7 inches). From the primary crusher the ore is transferred to a surge pile and eventually to three 3 m (10 feet) wide by 8.2 m (27 feet) diameter autogenous grinding mills. Final grinding is by three 3.75 m (12 feet 6 inch) diameter by 7.6 m (25 feet) long pebble mills. The slurry from the pebble mills is pumped into magnetic separators for concentration of the magnetic component. Following dewatering in disc filters the moist iron ore is mixed with a bentonite binder and transferred to three 3 m (10 feet) diameter balling drums and from there to one 4.6 m (15 feet) diameter gas-fired rotary kiln. When cooled, the pellets are stored in silos, and eventually shipped in specially constructed enclosed railway cars to Dofasco's steel plant at Hamilton. All of the production of the Sherman Mine is used by the Hamilton plant.[1]

Cominco Limited (12)

Cominco Limited holds two claims TRT4411 and TRT4412, located along the southwestern arm of Net Lake and the southeastern arm of Kanichee Lake in central Strathy Township. The property was originally staked by P.D. Hermiston and R. McCauley in 1934 (Moorhouse 1942, p.33).

GENERAL GEOLOGY

The geology in the vicinity of the Cominco property was discussed by Moorhouse (1942) who stated:

> ...sheared rhyolites, which locally show spherulitic and agglomerating structures, underlie much of the property. In the southeast and northwest corners, andesitic rocks are associated with the rhyolites. The volcanics have been intruded by a sill of altered quartz diorite, which has a maximum horizontal width of 600 feet [180 m] or more. The sill strikes roughly N.50°E. and probably dips south. To the north it disappears under Net Lake....It is much narrower in the southwesterly part. The irregular north contact of the sill is a fine-grained chilled phase, which passes in to a medium-grained massive quartz diorite....The mineralization is located in the central and northwestern part of the sill.
>
> The diorite in the vicinity has been heavily sheared, carbonated, silicified, sericitized and pyritized. The alteration seems to be more intense where the mineralized zones and fractures are most abundant. The intrusive has been cut by greenstone and lamprophyre dikes....Porphyries are shown cutting the quartz diorite in plans showing the underground geology.

[1] Dofasco Illustrated News, Sherman Mine Supplement, Sept. 5, 1968.

Moorhouse (1942, p.33 and 34) continued:

There are two important veins on the property....The main or south vein, which strikes N.40°E., has been exposed for a continuous length of 250 feet [76 m] and has a maximum width of 5 feet [1.5 m], although in some sections parallel veins increase the total width of quartz to 6 feet [1.8 m]. The vein has been cut by a number of minor cross-faults, which strike northwest-southeast and show a maximum displacement of about 20 feet [6 m]. The direction of displacement is in every case right-handed, i.e. the east side of the fault has moved southeast with respect to the west side. At its west end; the vein is sinuous and lenticular. Southwest of this vein, narrow curving veins and short thick lenses of quartz occur in some abundance in highly altered quartz diorite. The mineralization in this zone as far as can be seen on surface is principally pyrite, which occurs as patches, streaks, and bands in the quartz and disseminated in the country rock for a few inches [6 cm] on each side of the vein. Traces of copper were also noted in the outcrop. Carbonate is not abundant in the vein, although it is common in the wall rock. According to the management, sampling on surface indicated a shoot roughly 70 feet [20 m] long with gold values ranging from a trace to 1.15 ounces over 8.8 feet [2.7 m]....

The second important vein, known as the Shaver, is located 270 feet [80 m] north of the main vein. On surface it strikes N.60°E. and has a maximum exposed width of 1½ feet [0.46 m]. Mineralization is largely pyrite, though galena was observed in one exposure. Specimens from the underground workings are well mineralized with pyrite and galena. The quartz is grey to white and well fractured. The country rock is less altered than that of the south zone....

The quartz diorite intrusive is cut by a number of mineralized and rusty shear zones and fractures. Most of these are less than 1½ feet [0.46 m] in width, but one or two are 3 feet [0.9 m] wide. Some values are obtained from them. The principal sulphide is disseminated pyrite, but splashes of chalcopyrite were noted in one vein. These veinlets and seams are featured by a rather variable strike. Even individual shear zones and fractures may vary in strike dip.

DEVELOPMENT

A report prepared for the Beanland Mining Company by Lendall P. Warriner (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake), dated 1947, gives the following figures pertaining to development of the Cominco (Hermiston-McCauley) property:

Shaft sinking 115.2 m (378 feet); levels at 46 and 107 (150 and 350 feet).
Crosscutting 595.6 m (1,954 feet).
Drifting 1355.4 m (4,447 feet).
Drilling 3449.1 m (11,316 feet) (underground and surface).

In addition to underground development and diamond drilling there has been extensive surface stripping, sampling, and prospecting. Warriner stated that the two claims have been so thoroughly prospected that the chances of further discoveries are probably limited to diamond drilling.

GRADE AND RESERVES

Warriner conducted a detailed assessment of the Cominco property for Beanland Mining Company. His sources were detailed maps and correspondence of the Consolidated Mining and Smelting Company of Canada Limited. The results, as summarized by Warriner are given in Table 11:

Although one shoot of 10.2 m (33.5 feet) on the 46 m (150 feet) level and another of 9.0 m (29.5 feet) on the 107 m (350 feet) level in the south vein could be considered of ore grade, they are not included in the calculated reserve because of the lack of vertical continuity between them. Similarly, an isolated shoot of 9.8 m (32.2 feet) on the 107 m (350 feet) level on the Shaver Vein has been omitted for the same reason.

While no raises have been driven through from level to level on the Shaver Vein, nevertheless, the uniformly good values across narrow widths on surface, and on both levels and the location of the shoots, give a reliable indication of vertical continuity. Consequently, the entire reserve has been calculated in the Shaver Vein, and are given in Table 11.

A diamond drill hole intersection below the 107 m (350 feet) level returned a ¼ ounce across average vein width; no ore was calculated below the level.

Ore reserves tabulated by Consolidated Mining and Smelting Company of Canada Limited are given in Table 12.

The property is still held by Cominco, although there is no record of work done since the 1940s.

Patricia E. Dolan (13)

Patricia E. Dolan holds one surveyed claim, TRT5219, just south of the narrows on Net Lake. This claim is the last remaining of a group of nine claims staked in 1939 by Sey-Bert Temagami Mines Limited. No occurrences of economic mineralization on the Dolan claim are known to the author.

Gillies Brothers and Company Limited (14)

Gillies Brothers and Company Limited hold one surveyed claim, HS2183, north of Snake Island Lake in southeastern Strathy Township. There is no record of any work done, or of any mineral occurrences on the property.

D.A. Goddard (15)

D.A. Goddard holds four surveyed claims in southeastern Strathy Township on the southern shore of Link Lake. There are no known mineral occurrences on the claims.

P.L. Gordon (16)

In 1970 P.L. Gordon held ten claims over Net Lake between Highway 11 and Kanichee Lake. In 1960, Goldfields Mining Company carried out airborne electromagnetic and magnetometer surveys over this part of Strathy Township,

TABLE 11 ASSESSMENT INFORMATION, COMINCO PROPERTY; AFTER P. WARRINER, (1947) IN RESIDENT GEOLOGIST'S FILES, ONTARIO MINISTRY OF NATURAL RESOURCES, KIRKLAND LAKE.

Vein	Level in feet[1]	Length in feet[1]	Width in feet[1]	Grade ounce of gold per ton
South Vein				
	150-foot (46 m) level			
		65.5	3.32	0.152
		15.2	5.78	0.339
		47.0	3.54	0.285
		56.7	3.52	0.128
	350-foot (107 m) level			
		60.0	1.43	0.105
		29.5	2.68	0.388
		35.5	1.87	0.295
		27.0	1.34	0.203
Vein South of South Vein				
		32.0	1.31	0.317
		41.5	1.30	0.160
Shaver Vein				
	150-foot (46 m) level			
		101.0	1.26	0.71
	350-foot (107 m) level			
		26.0	1.11	0.287
		58.8	1.23	1.318
		53.5	3.16	0.323
		93.3	1.41	0.532
		24.5	1.06	1.262
		32.2	1.83	0.438
Vein North of Shaver Vein				
	150-foot (46 m) level			
		25.5	2.49	0.124

Footnote
[1]To convert feet to metres multiply by 0.3048

and drilled four diamond-drill holes through the ice of Net Lake about 0.8 km (½ mile) west of the narrows at Highway 11. The diamond-drill log of one hole (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) indicates that the rocks under that part of Net Lake mainly consist of mafic to intermediate metavolcanics cut by diorite dikes. Local zones of breccia-

TABLE 12 | ASSESSMENT INFORMATION, SHAVER VEIN, COMINCO PROPERTY.

Depth	Width	Grade in Ounce of Gold Per Ton	Tons
Surface to 150-foot (46 m) level	2.20 feet (0.67 m)	0.926	2,447
150-foot (46 m) level to 350-foot (107 m) level	1.20 feet (0.37 m)	1.050	1,210
Above 350-foot (107 m) level	1.90 feet (0.58 m)	0.480	2,042
Total	1.90 feet (0.58 m)	0.790	5,699
Mining Width of 3.0 feet (0.9 m); dilution 100 percent	3.00 feet (0.91 m)	0.50	8,998

tion in the volcanic rocks are filled with pyrite and pyrrhotite carrying traces of chalcopyrite (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

F.C. Hayes (17)

In 1970, F.C. Hayes held a surveyed claim (formerly L366642) in central Strathy Township. There is no record of work done on the claim in recent years. However, during geological mapping, several old pits and trenches were noted in the central and eastern parts of the claim. The trenches were filled with debris and little of economic significance was seen. The name of the individual or company who did the work is unknown, but the Beanland Mining Company and Clenor Mine Limited did considerable prospecting in that area in the 1930s and 1940s (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

A.L. Herbert, Estate (18)

The estate of A.L. Herbert holds a surveyed claim TRT5218 on the south shore of Net Lake about 60 m (200 feet) east of Highway 11. This ground was originally part of the Sey-Bert Temagami Mines Limited holdings, but there is no report that any significant mineral occurrences occurred in that particular area.

L.J. Hermiston (19)

In 1970, L.J. Hermiston held three unsurveyed claims on the western shore of Net Lake. No record exists of any work done at that time.

P.D. Hermiston (20) and P.D. Hermiston [1950] (21)

In 1970, P.D. Hermiston held a group of eight surveyed claims, 216691-216696 inclusive, TC89, and TS157 extending east and northeast from the eastern end of Link Lake. Most of this group includes ground held by Maralgo Mines Limited in 1956 (see "E.L. MacVeigh, (29)").

In 1950, Statacona Rouan Mines Limited drilled one diamond-drill hole totalling 73.4 m (241 feet) near the south bank of Johnny Creek, east of Link Lake. Minor pyrite was intersected, but no significant assays were reported. Part of the Statacona Rouan ground is now covered by the claims of P.D. Hermiston.

The International Nickel Company of Canada Limited (22)

A report made for The International Nickel Company of Canada Limited in 1945 by W.S. Savage (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) stated that patented claims WD257, WD264, WD260, and WD258 had been held by the company since 1902 and 1905. These claims are situated south of Net Lake and west of Highway 11 in central Strathy Township. They were still held by The International Nickel Company of Canada Limited in 1970.

The claims are underlain by mafic to intermediate metavolcanics, metagabbro with minor felsic intrusions and iron formation.

In 1945, Consolidated Mining and Smelting Company of Canada held an option on the claims with the intention of prospecting for gold. Savage (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) visited the claims while work was being carried out by the Consolidated Mining and Smelting Company of Canada. Savage stated that work was being done on two quartz veins located in the northern half of of WD260, the most important showing is known as the "Canada vein". Savage described the Canada vein and the nearby Thomas vein as follows:

> The "Canada" vein is a rusty, well mineralized quartz vein 3 feet to 5 feet [0.9 to 1.5 m] in width, striking N30°E and dipping 30°SE. It lies in a greenstone schist along the contact with quartz porphyry which forms the footwall. The schist is well mineralized above and below the vein. Mineralization consists of pyrite, chalcopyrite, pyrrhotite, and galena. Systematic channel sampling shows erratic gold values varying from "traces" (which are much in the majority) to over 2 ounces of gold per ton. The two short diamond-drill holes (– 45°) put down to date have not shown high values in their vein intersections. Trenching is being continued in both directions along the strike of the vein which is now exposed for approximately 200 feet [60 m]. Some work was done on the "Canada" vein in the early days by the Canadian Copper Company, who drove an inclined adit down the dip of the vein for about 30 feet [9 m].

> The "Thomas" vein, which was discovered and stripped by Consolidated Mining and Smelting Company of Canada is now exposed for about 200 feet [60 m]. This vein lies in an agglomerate and is from 12 feet to 15 feet [3.7 m to 4.6 m] in width. It strikes N40°E and dips 85°SE. It consists of well fractured quartz with spotty mineralization consisting chiefly of pyrite and chalcopyrite. Channel sampling produced disappointing assays, but it is a strong vein, open at both ends, and warrants further investigation. All three claims are being systematically prospected and Consolidated Mining and Smelting Company of Canada are satisfied that the results of their work to date justify continuance of their programme.

A selected grab sample taken from the Canada vein by the author was analyzed by the Mineral Research Branch, Ontario Division of Mines and was found to contain 1.41 percent copper, 0.14 percent lead, 0.07 ounce of gold per ton, and 0.99 ounce silver per ton, with trace amounts of zinc, nickel and cobalt.

A northeast-trending sill of altered gabbro is exposed on claim WD257 south of Net Lake (see section on "Mafic Intrusive Rocks"). Sulphide mineralization was noted at several localities within the gabbro body. A great deal of trenching and stripping has been done in the area, presumably by Consolidated Mining and Smelting Company of Canada and earlier prospectors. About 0.4 km (¼ mile) northwest of the southeast corner of claim WD257 there are several old trenches and pits, most of which are partly filled with water and debris, so that little information could be gained from them. The surrounding rocks are unusual hornblende gabbro and a pale grey altered anorthosite or anorthositic gabbro. Barren north-south-trending quartz veins about 18 cm (7 inches) wide were noted. The mineralization observed consisted of disseminated grains of pyrrhotite and pyrite, with minor amounts of chalcopyrite and what was tentatively identified by D.G. Innes as niccolite. Arsenopyrite was also noted in debris from the trenches. The amount of sulphide minerals present ranged from trace amounts to about 5 percent (by author's visual estimate). Two specimens of gabbro with disseminated sulphides submitted by the author were analyzed by the Mineral Research Branch, Ontario Division of Mines, but were found to contain only trace amounts of base metals and gold. One sample gave 0.15 ounce of silver per ton. A specimen of galena-bearing quartz float was found near one of the pits; there was no evidence of such a vein in the immediate vicinity of the trenches. An assay of the float by the Mineral Research Branch, Ontario Division of Mines yielded 9.05 percent lead and 29.92 ounces of silver per ton with 0.07 ounce of gold per ton.

A 5 to 7.6 cm (2 to 3 inch) wide quartz vein is exposed in rock cuts on Highway 11 on claim WD264. The vein strikes N50°E, and dips 50°S in mafic pillow lavas, and contains blebs and stringers of pyrite, chalcopyrite and molybdenite over an exposed length of about 15 m (50 feet). West of Highway 11, the vein has been opened up by a trench. A sample taken from the vein by the author was analyzed by the Mineral Research Branch, Ontario Division of Mines and found to contain 0.96 percent copper, 0.02 ounce of gold per ton, 0.40 ounce of silver per ton.

Knight (1920, p.213-214) reported the occurrence of another sulphide occurrence on claim WD264 on the shore of Net Lake. He stated:

> On claim WD264 there is a gossan-stained zone two or three hundred yards [180 or 270 m] long. The gossan area is ten feet [3 m] or more in width. A pit about eight feet [2.5 m] deep and ten feet [3 m] square has been sunk on the deposit, revealing fresh ore and disclosing pyrite, copper pyrites and pyrrhotite. The ore occurs at the contact of the Keewatin lavas and an "old" looking diabase intrusion. The sulphide minerals impregnate the Keewatin at the contact of the diabase. There are hardly any pure sulphide masses and the deposit appears to be too low-grade to work....

This occurrence was not located during the 1970 field season, but occurrences of disseminated pyrite and pyrrhotite were noted in gabbroic metavolcanics on the natural gas pipe line immediately east of the shore of Net Lake. These sulphide mineral occurrences may be part of that referred to by Knight.

In 1970, The International Nickel Company of Canada Limited held one claim VD267 on the south shore of O'Connor Lake. The claim encloses part of the Temagami Iron Formation currently being mined by Cliffs of Canada.

In 1970, The International Nickel Company of Canada Limited held two patented claims (WD261 and WD262) south of Net Lake and west of the Ontario Northland Railway track in eastern Strathy Township. Claim WD261 lies immediately west of Claim WD271 which includes the Big Dan gold-silver deposit now held by United Reef Petroleums Limited (42). Claim WD261 is underlain by mainly mafic metavolcanic flows. A geological sketch map of the Big Dan property, on file at the office of the Resident Geologist at Kirkland Lake, indicates that two shafts about 12 m (40 feet) deep are located about 30 m (100 feet) west of the east boundary of WD261. The shafts are reported (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) to be located at either end of a sulphide zone, with a width of 1 m (3½ feet) striking north-south for a distance of about 60 m (200 feet). This zone appears to be related to the larger Big Dan deposit about 150 m (500 feet) to the east. There is no report of recent work carried on The International Nickel Company of Canada Limited claims.

J.A. Jones (23)

In 1970, J.A. Jones held six surveyed claims (L365968, S398770-398774 inclusive) south of Net Lake and east of Highway 11 in southeastern Strathy Township. Much of this group was held by Sey-Bert Temagami Mines Limited. The main showing of Sey-Bert Temagami Mines Limited occurs on claim S398776 now held by J.A. Jones and is described under Sey-Bert Occurrence (41).

Keevil Consultants Limited (24)

Keevil Consultants Limited hold a 60 percent interest and Cliffs of Canada hold a 40 percent interest in a group of seven claims that form a northeast-trending block through Doris Lake in Central Strathy Township. These claims include T53814-53816 inclusive, T52187 and T52189-52191 inclusive. In 1964, the Keevil Mining Group conducted geological mapping over the claims, followed in 1965 by ground magnetometer, self potential, and electromagnetic surveys. Trenching and sampling were carried out over about ten occurrences, many of which were known for some time and were the object of earlier prospecting.

A report for the Keevil Mining Group by I.F. Downie, on file at the Resident Geologist's Office, Kirkland Lake, indicated that most occurrences are found in sheared and carbonatized felsic metavolcanics The mineralization consists mainly of massive stringers of pyrite with traces of chalcopyrite. (Moorhouse

1942, p.42, noted arsenopyrite as well as pyrite; but none was mentioned by the Keevil geologists). The pyritic zones are generally concordant, striking northeast with a steep dip to the south.

A prospect on the southeastern corner of claim T53186 was channel sampled by the Keevil Mining Group. Downie's report stated that all fourteen samples contained some silver, from a low of 0.07 ounce of silver per ton to a high of 0.91 ounce of silver per ton. Gold values were erratic. The best value was 0.64 ounce of gold per ton, but most samples returned less than 0.05 ounce of gold per ton.

Another prospect located approximately 200 m (650 feet) east of the east tip of Doris Lake occurs in a quartz-carbonate zone. The assay results again indicate that of the fifteen channel samples taken, eleven contained from 0.13 to 0.40 ounce of silver. However, the best gold value recorded was 0.03 ounce of gold per ton.

Several smaller occurrences were also sampled, but results were similar to those above.

Moorhouse (1942, p.37) gave a description of a sulphide occurrence at the eastern end of Vermilion Lake. The raised level of Vermilion Lake appears to have resulted in the original showing being covered by several feet of water. Moorhouse stated:

> The Oslund-Hurst property, located on claim P.6, at the east end of Vermilion Lake, Strathy Township, was staked by N. Oslund and F. Hurst. The claim is underlain by Keewatin volcanics and along the south shore of the lake by iron formation. Part of the iron formation, which is about a chain in width, consists of banded jasper, quartz, and magnetite, and part is replaced by pyrite. On an exposure near the northeast end of the lake, the iron formation has been drag-folded and intruded by a greenstone dike, which is from 10 to 15 feet [3 to 4.6 m] in width and terminates about 20 feet [6 m] from the shore. West of the dike, the magnetite has been replaced by coarse pyrite; east of the dike the magnetite is unaffected. Other exposures of the iron formation, in some places pyritic and in others unreplaced, occur at intervals along the shore.
>
> The property was trenched and drilled by Coniagas Mines, Limited. Some interesting values are reported from the drilling, although most were low. A sample of pyritized iron formation assayed by the Provincial Assay Office gave 0.02 ounce gold per ton and a trace of silver.

The location of the occurrence indicated on Moorhouse's map shows that it is located near the boundary between claims TRT5619 now held by Cliffs of Canada Limited, and claim T52191 now held by Keevil Consultants Limited (60 percent) and Cliffs of Canada Limited (40 percent).

N.B. Keevil (25)

Norman Bell Keevil holds one surveyed claim (TR1623) at the eastern end of the property held by Ajax Minerals Limited (6). Considerable trenching and prospecting was undertaken by previous owners, especially Cunuptau Mines Limited. Part of the main mineralized zone of Ajax Minerals Limited lies on claim TR1623 (see property description for Ajax Minerals Limited).

Lake Beaverhouse Mines Limited (26)

In 1970, Lake Beaverhouse Mines Limited staked nine unsurveyed claims in the southeastern corner of Strathy Township. No record exists of any work done on the claims in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

L.Lavinge (27)

L.Lavinge holds one surveyed claim TRT5646 between Highway 11 and Net Lake in northeastern Strathy Township. No record exists of any work done, or of any economic mineral occurrences on the claim (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

B.N. Leslie (28)

B.N. Leslie holds one surveyed claim (formerly TRT5621 now TRT4621) on the western shore of Vermilion Lake. The claim was held by Mayfair Mines Limited in 1955. Mayfair Mines Limited did geological mapping and prospecting over the area, but no mineralized areas are shown on the geological maps of Mayfair Mines Limited on file in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake (see Cliffs of Canada Limited, Sherman Mine).

E.L. MacVeigh (29)

In 1970, E.L. MacVeigh held two surveyed claims TRT6922 and TRT6923 near the intersection of Johnny Creek and the Ontario Northland Railway line in eastern Strathy Township. This is part of the property formerly held by Maralgo Mines Limited and includes one of the sulphide occurrences drilled by Maralgo Mines Limited.

E.L. MacVeigh of Cobalt holds one surveyed claim, No. T50535 (also numbered TRT6033), in central Strathy Township. Geological mapping, ground magnetic and electromagnetic surveys were carried out by MacVeigh in 1964. A geological map and geophysical maps with accompanying reports are in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

Claim T50535 (TRT6033) is mainly underlain by mafic to intermediate metavolcanic flows that strike northeast and dip vertically or steeply southeast. The southeastern part of the claim is underlain by a gabbroic intrusion. The geological report by E.L. MacVeigh stated that the surface work was done by him in 1962 on a gold deposit which consists of a series of quartz stringers striking N17°W and dipping 75° southwest. The quartz vein zone is about 0.9 m (3 feet) wide and for the most part contains only low gold values. MacVeigh stated that:

> But the central part of the outcrop area shows highly interesting gold values in the greenstone on the hanging wall of the quartz vein.

The report stated that the sulphide minerals with which the gold is associated are pyrite, pyrrhotite, and chalcopyrite. Chip samples are reported to have yielded 0.323 ounce of gold per ton over 3.2 m (10.4 feet) and 0.223 ounce of gold per ton over 3.6 m (11.7 feet).

The gabbroic rocks in the southeastern corner of the claim are locally mineralized. Two diamond-drill holes totalling 163 m (537 feet) were put down by Clenor Mines Limited in 1952. MacVeigh's report also stated that varying amounts of "replacement mineralization" were intersected in both holes; the best values being 1.37 percent copper and 0.34 percent nickel over 5.8 m (19 feet) of core length. The same section gave 0.36 percent zinc and 0.64 ounce of silver per ton (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

In 1956, Maralgo Mines Limited held 27 unsurveyed claims in southeastern Strathy Township. Geological mapping and a ground magnetometer survey were carried out in 1956. Thirteen diamond drill holes totalling 1500.5 m (4,923 feet) were put down in 1956 (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake). A report by the consulting geologist, Mr. E.L. MacVeigh, stated:

> Two mineral locations of interest were drilled. One of these straddles the highway in claim T35810 and the other is at the east boundary of the property in claim TRT6923. The drilling in claim T35810 intersected a wide pyritized shear zone, but only very low values in copper and gold were found. A large part of the drilling was carried out at the east boundary of the property in claim TRT6923. This drilling showed interesting values in copper, zinc, and silver, but the values were found to be inconsistent and erratically associated. The best drilling results obtained were in holes Nos. 7 and 8 as follows:

HOLE NO.7

230.0 feet (70.1 m) - 245.0 feet (74.7 m) [(15.0 feet) (4.6 m)]

Copper	0.56 percent at 40¢	$4.48 per ton
Silver	3.63 ounces at 90¢	$3.26 per ton
Zinc	0.07 percent	$7.74 per ton

HOLE NO.8

335.0 feet (102.1 m) - 345.0 feet (105.2 m) [(10.0 feet) (3.0 m)]

Copper	0.22 percent at 40¢	$1.60 per ton
Silver	1.40 ounces at 90¢	$1.26 per ton
Zinc	3.57 percent at 13¢	$12.14 per ton

> Numerous other interesting values were found in the drilling at the eastern side of the property, for the most part confined within a pyritized shear striking north 50° east. This shearing may be observed on surface where gold values have been obtained up to $7.00 per ton. All diamond drill results showed very low assays in gold.
>
> The diamond drilling program was stopped July 17th when it was decided in view of inconclusive drilling results to carry out a geological and a geomagnetic survey of the property.

The claims were allowed to lapse.

Mildred E. MacVeigh (30)

In 1970, 15 surveyed claims were held by Mildred E. MacVeigh in central Strathy Township. Between 1965 and 1968, geological mapping and electromagnetic and magnetometer surveys were undertaken over the claim group by E.L. MacVeigh. The area is underlain mainly by mafic to intermediate flows with intercalated intermediate to felsic pyroclastic rocks, intruded by at least two northwest-trending diabase dikes. Most of the claim group had formerly been held by Strathy Basin Mines Limited (circa 1935). Savage (1935, p.55) reported that Strathy Basin Mines Limited uncovered some sulphide ore minerals such as pyrrhotite and chalcopyrite, which contained some values in gold. The report of E.L. MacVeigh on file at the office of the Resident Geologist at Kirkland Lake states that no electromagnetic conductors were located. No additional sampling was carried out.

William Milne and Sons Limited (31)

William Milne and Sons Limited hold one claim north of Link Lake in south-central Strathy Township. A gold and silver occurrence is located near the central part of the claim. Moorhouse (1942, p.35-36) reported that the showing had been known many years before 1942. The following description is taken from Moorhouse (1942, p.35-36):

> A narrow vein, ranging in width from a crack to 1 foot [0.3 m] and striking N.30°E., was prospected many years ago on Claim J.S. 107, which is now the property of John Milne and Sons, in the south-central part of Strathy Township. This vein, which is nearly 200 feet [60 m]long, is mineralized with disseminated to massive arsenopyrite and pyrite. It is terminated at the north end by sheared rhyolite, which strikes N.80°E. The vein was sampled by P.D. Hermiston in the summer of 1941 and is said to have yielded from 0.04 ounce to 1.30 ounces of gold per ton and from a trace to 20.04 ounces silver per ton over widths up to 1 foot [0.3 m]. A character sample of heavy arsenopyrite was assayed for the writer by the Provincial Assay Office and yielded 0.58 ounce gold per ton, 10.7 ounces silver per ton, and no cobalt or nickel.
>
> Where the road to the Milne lumber yards crosses the small creek that traverses claim J.S. 107, an outcrop of rhyolite and carbonate schist, striking north of east, is mineralized with disseminated arsenopyrite, which is said to carry a little gold.

When the writer examined the occurrence in 1970, it was found that most of the pits and trenches had been overgrown and partly filled with water and earth. Stringers of arsenopyrite and pyrite were seen in some of the rock piles beside the pits.

W.G. Morrison (32)

In 1970, W.G. Morrison held a number of unsurveyed claims between Arsenic Lake and the road to the Sherman Mine in Strathy Township. The western part of the property was held by V.A. Carlson and Associates in 1960. Geological mapping and prospecting of the Carlson ground was undertaken by E.L. MacVeigh (see "Cliffs of Canada, (Sherman Mine) (11)"). The eastern part of the Morrison claim group was formerly held by Maralgo Mines Limited (see "E.L. MacVeigh (29)"). In 1956 two diamond-drill holes totalling 244.1 m (801 feet) were drilled by Maralgo Mines Limited near Highway 11, about 0.8 km (½ mile) north of the junction with the road to the Sherman Mine. The Maralgo drill holes intersected some pyrite and graphite in diorite and felsic metavolcanics but no significant amounts of economic mineralization were intersected. Several pits and trenches are also present on the Morrison claims. These have, for the most part, been the result of prospecting by V.A. Carlson, Maralgo Mines Limited and probably early prospectors of whom there are no records. Most of the surface work was undertaken to examine narrow, shear zones containing minor pyrite and pyrrhotite. There are no assay results, available but judging from the size and number of trenches, the mineralized zones do not appear to have been extensive.

In 1953, Mining Geophysics Corporation Limited held part of the ground now covered by the Morrison claims. Mining Geophysics Corporation Limited carried out magnetometer, and self-potential surveys over their claim group. No significant geophysical anomalies were detected and no further work was done by Mining Geophysical Corporation Limited (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

Net Lake Occurrence (33)

The Net Lake Occurrence, also known as the Barton property, has been known since the turn of the twentieth century. In 1906, J.W. Barton sunk a 15 m (50 feet) shaft on the main deposit and 200 tons of material were removed. Between 1906 and 1918 a head frame, boiler house, and pump were erected (Parsons 1917, p.308).

In 1942, Net Lake Molybdenite Mines Limited held the property and a report by M.E. Hazelton for Net Lake Molybdenite Mines Limited (M.E. Hazelton, president) recommended immediate development of the property. However, there is no record of any development by Net Lake Molybdenite Mines Limited (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

In 1965, Myteque Mines Limited carried out geological mapping as well as a ground magnetic and electromagnetic survey over the property. A report for Myteque Mines Limited by E.L. MacVeigh is in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

The molybdenite occurrences are found in northeastern Strathy Township within an arm of mafic metavolcanics extending in a northeastern direction into the granitic batholith from the main body of the metavolcanic belt. The most complete description of the properties are those of Volkes (1963, p.99-101) and MacVeigh. The following description of the deposits is taken from a report by E.L. MacVeigh (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake), who stated:

> The recent geological mapping by the writer shows the molybdenite occurrence to be present in a series of parallel and persistent quartz occurrences, all striking N.75°E, and most dipping 70° to the north. The molybdenite occurrence is confined to the quartz in veins up to 22 inches [55.9 cm] wide. Chalcopyrite frequently accompanies the molybdenite and low assays have been obtained in silver, gold, and bismuth. The intervening Keewatin rocks between the quartz veins show an absence of disseminated molybdenite, although joint cracks may contain molybdenite mineralization in narrow vein occurrence.
>
> Three rock trenches were blasted on the property by the writer to investigate molybdenite occurrence. These...locations...are 197 feet [60.0 m],77 feet [23.5 m] and 34 feet [10.4 m] long respectively. Considerable molybdenite was found in each of the trenches and at locations 1 and 2 zone of quartz veining up to 25 feet [7.6 m] wide might be worth bulk sampling to determine the average molybdenite content. The amount of molybdenite showing on the dump from these new rock trenches is impressive but only careful bulk sampling would be useful in approximating an average.
>
> No.3 location is a rock trench 100 feet [30 m] north of the old shaft location in claim HF3. This is

in the breccia zone where there appears to be a wider dissemination of molybdenite and an increase in the amount of chalcopyrite. A sample taken of this material ran 1.35 percent copper, 0.54 percent MoS_2, and 0.34 ounce of silver with a trace of gold. Samples were taken for qualitative reasons only as it is not believed possible to moil samples with any degree of reliability. A high gold sample of $3.50 per ton was obtained and bismuth did not exceed 0.02 percent.

Dr. Robert Thomson visited the Myteque property in 1967 and a report is on file at the office of the Resident Geologist at Kirkland Lake. Thomson remarked in the report that the quartz breccia which hosts some of the molybdenite deposits, did not seem to be comparable with fault breccia along simple faults. Thomson also noted that many of the molybdenite-bearing quartz veins were independent of the breccias.

The areas of the molybdenite veins are now part of the new townsite for the Sherman Mine, and is closed to staking under Section 37a, of the Ontario Mining Act.

New Athona Mines Limited (34)

In 1970, New Athona Mines Limited held two surveyed claims T39247-48 in the vicinity of Turtle Lake and Link Lake in southern Strathy Township. Records on file at the office of the Resident Geologist at Kirkland Lake show that in 1959 one diamond-drill hole totalling 301.8 m (1,006 feet) was put down on Claim T39247. The hole intersected intermediate to felsic metavolcanics, mafic metavolcanics, and short sections of iron formation. In addition, five of the claims originally held by New Athona Mines Limited were leased to Cliffs of Canada on a royalty basis.

L.B. Norrie (35) and Norrie Occurrence (36)

Moorhouse (1942, p.24) reported that L.B. Norrie held a nine claim group on Net Lake in northeastern Strathy Township. This original claim group included a sulphide showing which has been known for some time and is described by Knight (1920, p.213) as follows:

> On the shores of Net Lake, on claim WS269, considerable work has been done on a coarse-grained diabase or gabbro. This basic rock becomes more basic in places by a segregation of the dark green minerals into isolated masses. Thin sections show that the dark green mineral in these segregated masses is chiefly hornblende. The ore, which is mainly pyrrhotite and a little copper pyrites, occurs generally in these segregated masses of hornblende. At least ten pits, mostly shallow, have been sunk on various parts of the intrusive mass, the largest pit noted being about 30 feet [9 m] long, 10 feet [3 m] wide and 6 feet [1.8 m] or less in depth. This large pit is at the north end of the claim, at the water's edge. Two diamond-drill holes have been put down at this pit; one was drilled at an angle of 45° and the other was drilled vertically. There are also other diamond-drill holes on the hillside. The texture of the hornblende rock varies from fine grained to very coarse-grained, the crystals being as long as one inch [2.5 cm] in places. The sulphides appear to cut and ramify through the hornblende, suggesting that the sulphides crystallized later and are younger than the hornblende. On the other hand, there is a granite dike two or three feet [0.6 or 0.9 m] wide cutting the ore and hornblende rock; the dike has little or no sulphide in it. The inference is that the granite is later than the hornblende rock and the sulphides.
>
> A grab sample of the ore, from the occurrence described in the above paragraph, gave only traces of nickel.

The occurrence was visited during the 1970 field season. Two pits about 35 feet long by 15 feet wide by 5 feet deep (10.7 m by 4.6 m by 1.5 m) are located on the east shore of the north arm of Net Lake, east of Highway 11. The rocks in the pits are hybrid granitic rocks with numerous inclusions of mafic metavolcanics or metagabbro. Some of this mafic material is similar in appearance to the mineralized and altered gabbroic body of central Strathy Township which lies directly on strike with the Norrie Showing. It may be that massive patches of pyrrhotite and pyrite were originally formed in the gabbro, hence the close association of the sulphides with the hornblende-rich inclusions. Some sulphides also occur in the adjacent granitic rocks. A grab sample taken by D.G. Innes of the writer's field party, was analyzed by the Mineral Research Branch, Ontario Division of Mines and found to contain 0.07 percent copper, 0.11 percent nickel with trace gold, silver, lead and zinc.

Another sulphide occurrence is located directly across the arm of Net Lake, and lies about 300 m (1,000 feet) northwest of the occurrence described above. Here the main sulphide minerals are pyrite and pyrrhotite with visible chalcopyrite both disseminated and as massive areas confined mainly to gabbroic inclusions. A few narrow veins of quartz and carbonate are also slightly mineralized. The rusty staining in the outcrops makes a more detailed description impossible. A selected character sample taken by the writer from a patch of disseminated sulphide minerals was analyzed by the Mineral Research Branch of the Ontario Division of Mines and was found to contain 1.00 percent copper, 0.20 ounce of silver per ton, trace nickel, trace zinc, and nil lead, and molybdenum.

These occurrences are found in an area reserved from further staking under section 37a of the Mining Act. L.B. Norrie holds one claim (TR5862) at the northern end of the original group. No mineral occurrences are known to occur on this claim.

Penrose Gold Mines Limited (37)

Penrose Gold Mines Limited holds 17 patented claims (TRT4368, TRT5018, TRT4524 to TRT4526 inclusive, WS13 to WD14, WD597 to WD599 inclusive, WD460 to WD465 inclusive) in the vicinity of Arsenic Lake in Strathy Township. The claim group includes the gold-silver arsenide deposits generally known as the Little Dan and which have a history of exploration and development going back to the start of the century. In 1905, Carter (1905, p.73-74) described the Little Dan property and stated that at the time it was owned by Major R.G. Leckie. Corkill (1909, p.132-133) mentioned the deposit and stated that about four cars of ore per day were being mined and shipped. The production appears to have been from open cuts rather than from underground workings. When Knight (1920, p.217) examined the property in 1920, the deposit had lain idle for some time and the pits were filled with water.

In 1934, Manitoba and Eastern Mines Limited held the property, and at that time underground workings included over 550 m (1,800 feet) of drifting and cross-cutting on two levels at 60 m (200 feet) and 90 m (300 feet). About 900 m (3,000 feet) of diamond drilling had been done from the surface, and a number of holes had been drilled from underground. Savage (1935, p.54) stated that the management reported that three ore shoots had been outlined: one on the 90 m (300 feet) level averaging 0.23 ounce of gold per ton over a width of 1.3 m (4.17 feet) and a length of 62.5 m (205 feet); on the 60 m (200 feet) level, two shoots, one averaging 0.274 ounce of gold per ton over a width of 0.9 m (2.9 feet), for a length of 24.7 m (81 feet), and another 0.33 ounce of gold per ton over a width of 0.9 m (2.9 feet), for a length of 15.9 m (52 feet).

The gold arsenide deposits of the Arsenic Lake area occur in mafic to intermediate metavolcanics, much of which displays a well-developed diabasic texture. Closely associated with the arsenide minerals are bodies of quartz porphyry. A narrow dike of biotite lamprophyre was noted by the author near the southern end of the deposit.

The most complete description of the arsenide deposit near Arsenic Lake is that of Savage (1935). He stated:

The No.1 showing is located at the east end of Arsenic Lake on claim WS13. The vein zone on this showing appears to strike approximately N.14°W. and dips westward at an angle between 50 and 60 degrees. It is made up of much fractured quartz and silicified greenstone, well mineralized with iron pyrites, arsenopyrite, and chalcopyrite.

The No.2 showing, formerly known as the "Little Dan", is located near the southeastern corner of Arsenic Lake on claim No. WS14. Vein material from this showing appears to consist of quartz and siliceous lava carrying a considerable amount of massive sulphides, in which arsenopyrite is the predominating mineral. Old assay plans show the shaft to be approximately 56 feet [17 m] in depth, and about 90 feet [27 m] of drifting and cross-cutting are indicated. Gold values (at $20.67 per ounce) are shown, which range from 40 cents to $84.80 per ton. Vein widths are shown to range from 0.45 feet [13 cm] to over 4 feet [1.2 m]. Minor faulting is in evidence.

No.3 showing is located on claim WD598, approximately 1,500 feet [460 m] southwest of No. 1 showing. More mineralization can be seen on the surface at this showing than is evident at No.1 showing. Arsenopyrite is again the chief sulphide, accompanied by iron pyrites and chalcopyrite. Assay plans of previous operations show that a 55-degree inclined shaft was put down and a level established at 50 feet [15 m], from which 50 feet [15 m] of drifting and cross-cutting were done. Gold values ($20.67 per ounce) were shown to range from 40 cents to $12.00 per ton and vein widths from 1 to 5 feet [0.3 to 1.5 m] were indicated.

Present operations[1] have been confined to the No.1 showing which was tested by 11 diamond drill holes in the spring of 1934. The diamond drilling results were considered encouraging and of sufficient importance to warrant considerable underground work. A mineralized vein zone at least 300 feet [90 m] long, containing ore of commercial grade over mineable widths, was indicated to a depth of 300 feet [90 m].

A complete mining plant believed to be capable of adequately taking care of the preliminary underground exploration work on the No.1 showing is in operation. A two-compartment shaft was sunk to the south of the area drilled, and levels have been established at 200 and 300 feet [60 and 90 m]. The vein zone was intersected in the shaft at 190 feet [58 m], where it was 3 to 4 feet [0.9 to 1.2 m] wide with a dip of approximately 70°W. A drift is being carried north and south in this zone on the 200-foot [60 m] level.

The sulphide mineralization is chiefly arsenopyrite with some pyrite and chalcopyrite. There is a considerable amount of quartz present in this section of the vein zone. Irregular intrusions of quartz porphyry, which do not outcrop at the surface, were encountered in the shaft and on both levels. A crosscut carried to the west on the 300-foot level [90 m] intersected the vein zone 40 feet [12 m] west of the shaft, where another drift is being carried to the north and south.

No new work has been undertaken as yet on showing Nos. 2 and 3. The management is of the opinion that this work can be carried out to better advantage when a more general knowledge is acquired from the underground workings on No.1 showing.

Operations at this property, which were financed by Bobjo Mines, Limited, were suspended in February, 1935. The amount of ore indicated by the development was considered to be insufficient in volume or too low in value to be profitable under the terms of the option.

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[1]Manitoba and Eastern Mines Ltd.

A number of pits and trenches were found about 240 m (800 feet) south of the west end of Arsenic Lake during the 1970 season. The work was probably done by Manitoba and Eastern Mines Limited or by Penrose Mines Limited , but records are not available. The object of the surface work was apparently a sulphide-bearing sheared and fractured zone in mafic metavolcanics. The zone strikes east-west and dips vertically for a total observed length of about 76 m (250 feet) at a width of about 12 m (40 feet). Veinlets and stringers of quartz and white calcite occur throughout the zone. The predominant mineralization is pyrite and chalcopyrite occurring as massive stringers and blebs either associated with quartz veins and within the mafic metavolcanics. A selected grab sample was taken by D.G. Innes and assayed by the Mineral Research Branch of the Ontario Division of Mines. The results showed that the sample contained 5.6 percent copper, 0.26 percent zinc, 0.08 ounce of gold per ton and 3.78 ounces of silver per ton.

Manitoba and Eastern Mines Limited held the claims until 1948 when they were purchased by Penrose Gold Mines Limited. The Northern Miner stated that Penrose Gold Mines Limited carried out a geophysical survey (of an unspecified nature) (Northern Miner 1947). The Canadian Mines Handbook, 1961-1962, stated that the last work done on the claims was in 1947. The Canadian Mines Handbook, 1971-1972, listed Penrose Gold Mines Limited as "address and status unknown".

R.A. Percy (38)

Mr. Ralph A. Percy holds one surveyed claim (TRT4968) immediately west of Highway 11, just south of Net Lake. The claim is underlain mainly by granitic rocks of the Strathy-Chambers Batholith. During mapping near Highway 11, which forms the east boundary of the claim, the author noted a few occurrences of pyrite in the granitic rocks. Minor amounts of black tourmaline occur with the pyrite at one locality. The area was held by Sey-Bert Temagami Mines Limited about 1939.

Percy holds two surveyed claims (TRT6816 and TRT6448) near the intersection of Highway 11 and Johnny Creek. These claims lie immediately west of the property of E.L. MacVeigh and were part of the claim group held by Maralgo Mines Limited in 1956. The property is underlain by sheared and carbonatized rhyolite and diorite. Geological maps of Maralgo Mines Limited do not show any important mineral occurrences in this area (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

Percy holds one surveyed claim (TRT4220) on the southern shore of Kanichee Lake in central Strathy Township. The claim is underlain by felsic metavolcanics, mafic metavolcanics, and intrusive felsite sills. In about 1935 Strathy-Basin Mines Limited were active in this area. The author knows of no significant mineral occurrences on the claim.

A. E. Perron (39)

A.E. Perron of Kirkland Lake, holds four surveyed claims in central Strathy Township. These claims (JS62, TRT4257, TRT4250, TRT4249 and WD265) include the important gold deposit formerly held by the Beanland Mining Company (name changed to Clenor Mining Company). The Ontario Charter of the Clenor Mining Company was cancelled in 1970.

Moorhouse (1942, p.27) stated:

> The claims were staked by Sydney Beanland, June 1929. The main showing was discovered in 1934 by Paul D. Hermiston and Robert McCauley while doing assessment work. The property was optioned to the Consolidated Mining and Smelting Company of Canada. After doing a considerable amount of surface work and diamond drilling, the company relinquished its option.

GENERAL GEOLOGY

The Perron Claims are underlain mainly by intermediate to felsic metavolcanics, that locally display pillow structure, as well as amygdules and variolitic texture. Narrow, apparently discontinuous, beds of cherty iron formation are found a few hundred feet northeast of the shaft. A peculiar breccia or conglomerate occurs about 200 m (700 feet) northeast of the shaft. The breccia consists of subrounded to angular fragments of mafic metavolcanics, felsic metavolcanics and iron formation. It may be a fault breccia or an intrusive breccia. The northeastern part of the claim group is underlain by sheared and ankeritized felsic metavolcanics. Moorhouse (1942, p.29) reported the presence of lamprophyre cutting the metavolcanics and the ore deposits.

DESCRIPTION OF THE DEPOSITS

The most complete description of the Beanland deposits is given by Moorhouse (1942, p.29 and 30). Moorhouse stated:

> Most of the work on the property has been done on a quartz vein located on the northward-facing slope of the main ridge of basic volcanics overlooking the swamp. The vein strikes N.50°-70°E., and has a nearly vertical dip. It has a length of about 560 feet [170 m] and a maximum width of 5 feet [1.5 m]. It is not a single continuous vein but branches to form two or more narrow veins separated by altered country rock. Cross-faults striking north-south and west of north have offset the mineralized zone about 50 feet [15 m] just east of the shaft and 40 feet [12 m] a distance of 170 feet [50 m] west of the shaft. The east end of the vein also terminates against a fault. Movement in each case has been left-handed, i.e., the west side has shifted south with respect to the east. As mineralized quartz veinlets are present in the shear zone, the movement on the west fault appears, in part at least, to have been pre-mineralization.
>
> The mineralization includes pyrite, sphalerite, and galena. In some exposures just west of the shaft, the last two are dominant, but for the most part, pyrite, frequently accompanied by a little galena, is the most persistent sulphide. The principal gangue is quartz, which is cut by stringers of carbonate. The wall rock for a few inches on each side of the vein is silicified, carbonated, and sprinkled with pyrite.
>
> Interesting values were obtained on the surface showings. Sampling by the Consolidated Mining and Smelting Company indicated an ore shoot west of the east fault 160 feet [50 m] long and 4.6 feet [1.4 m] wide, averaging 0.31 ounce gold and 1.8 ounces silver. Individual values were rather consist-

ent, ranging from a trace to a maximum of 0.82 ounces. Values from other sections of the vein were not so encouraging. Sampling on the 175-foot [53 m] level would seem to indicate a tendency for the ore shoot to pitch northeast. Elsewhere on this level, values are rather spotty though high assays were obtained from sections of the north-south shear zone at the southwest end of the vein zone. Surface work was also done on a band of iron formation carrying arsenopyrite.

The property has a complete mining plant, and underground development has been carried out on three levels, the 175-, 325-, and 475-foot [53.3, 99.1, and 144.8 m]. Lateral work, including drifting and cross-cutting, totals roughly 2200 feet [670 m]. Of this, about 800 feet [240 m] is on the first, 1,150 feet [350.5 m] on the second, and 200 feet [60 m] on the third level....

DEVELOPMENT

A report by L.P. Warriner prepared for A.E. Perron in 1946 is on file at the office of the Resident Geologist at Kirkland Lake. The report stated that underground workings at the Beanland included a shaft sunk to 150 m (500 feet) with levels at 53.3, 99.1, and 144.8 m (175, 325, and 475 feet). Lateral work on these levels is tabulated as follows:

Level	Drifting and Crosscutting
175-foot (53.3 m)	879 feet (268.0 m)
325-foot (99.1 m)	1,295 feet (394.7 m)
475-foot (144.8 m)	240 feet (73.1 m)
Total	2,314 feet (705.3 m)

Level	Station Crossing	Diamond Drilling
175-foot (53.3 m)	20 feet (6 m)	323 feet (98.4 m)
325-foot (99.1 m)	20 feet (6 m)	2,189 feet (667.2 m)
475-foot (144.8 m)	20 feet (6 m)	323 feet (98.4 m)
Total	60 feet (18 m)	2,835 feet (864.1 m)

Perron Gold Mines Limited diamond drilled nine holes totalling 3,720 feet (1,133.8 m) from the surface in 1946 under an option agreement dated November 1945. The drilling by Perron succeeded in extending the known limits of the vein for a further 900 feet (270 m) but the assays were uniformly low (Warriner 1946, p.9), (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

RESERVES

Warriner (1946, p.3) gave the following reserves for the Beanland deposit:

Tons	Grade in ounce of Gold per ton	Mining Width
24,000	0.21	5.2 feet (1.6 m)

Using a "cut-off" of 0.31 ounce of gold per ton, Warriner recalculates the reserves as:

Tons	Grade in ounce of Gold per ton	Mining Width
8,778	0.31	5.6 feet (1.7 m)

No metallurgical tests have been run on the ores, but Warriner estimated that the recovery would be about 95 percent due to the complex nature of the ore.

Estate of A.J. Perron (40)

One claim, TRT4415, is held by the estate of A.J. Perron. The claim is situated on the eastern shore of the south arm of Net Lake in central Strathy Township. The claim is underlain by mafic metavolcanics and some carbonatized felsic metavolcanics.

Sey-Bert Occurrence (41)

The Northern Miner (1939) stated that Sey-Bert Temagami Mines Limited carried out a program of surface work and sampling over a group of nine claims in Strathy Township. The Northern Miner (1939) stated that the main showing consisted of a northeast-striking quartz vein lying along a granite-greenstone contact. One channel sample is reported to have assayed $66.16 of gold per ton; 1.89 ounce of gold per ton. A prospectus of Sey-Bert Temagami Mines Limited, dated February 1, 1940, stated that surface sampling resulted in assays of $33.00 of gold per ton (0.94 ounce per ton), over an unspecified width and $13.00 of gold per ton over 8 feet (0.37 ounce of gold per ton). The value of gold at the time was $35.00 per ounce.

In 1949, Dr. Robert Thomson, then Resident Geologist at Cobalt, visited the claims with Mr. J. Dolan of Cobalt and made a brief examination of the property. Dr. Thomson's report is on file at the Resident Geologist's office at Kirkland Lake. The main showing on the Sey-Bert property is about 760 m (2,500 feet) northeast of the east end of Arsenic Lake. Thomson stated that the main showing is in a pit, some 5.5 by 1.8 m (18 by 6 feet) and 2.7 m (9 feet) deep at its southwest end. In the pit are two quartz veins from 4 to 6 inches (10.1 to 15.2 cm) wide striking northeast and dipping about 70 degrees south. The veins cut fine-grained greenstone just south of the contact of the greenstone with the granitic rocks. The mineralization occurs in the veins and in the country rock for two or three inches (5.0 or 7.6 cm) on either side of the veins. Pyrite, arsenopyrite, and galena are the dominant sulphide minerals present.

Thomson stated further:

> The north vein including veinlets and silicification had a width of some 14 inches [35.6 cm]. At the north end of the trench irregular black dikelets, (½ inch to 6 inches 1.3 to 15.2 cm]) cut through granite, giving an odd looking breccia. The granite at the north end of the trench appears to have a dike-like form — with a width of some 35 feet [10.7 m] north of the trench and with pillow lava on its north side. Small quartz veinlets occur in the granite.
>
> West of the trench for some 60 feet [18 m] is a series of small trenches or pits. A few feet north of the projected strike of the quartz veins, pyrite with a few specks of molybdenite were seen in the granite.

Another of the Sey-Bert showings visited by Thomson is located on the western side of Highway 11 about 900 m (3,000 feet) south of the bridge over the narrows at New Lake. Thomson stated that two pits about 0.6 m (two feet) deep expose a quartz vein which strikes N82°E. Minor pyrite and galena were seen by Thomson in the vein. In referring to this occurrence, Moorhouse (1942, p.38) stated:

> A narrow quartz vein with splashes of lamprophyric material contains some pyrite, galena and sphalerite.

United Reef Petroleums Limited (42)

United Reef Petroleums Limited holds one patented claim, WD271, which is about six times the area of a normal claim. The claim is located south of Net Lake and is bisected by the tracks of the Ontario Northland Railway. This claim includes the gold-silver arsenide deposit which has been known from the turn of the century as "The Big Dan". In 1965, six adjacent claims were also held by United Reef Petroleums Limited, but these have since been allowed to lapse.

The Big Dan deposit was noted by A.P. Coleman (1900, p.173), who briefly described the deposit, and stated that a considerable amount of surface work had been done at that time. By 1906, a mill and plant were installed, but there is no report of any significant production (Gibson 1906, p.23).

When Knight visited the area in 1919 (Knight 1920, p.214) the plant had been burnt to the ground; he makes no mention of any activity being carried out in the area at that time. He described the occurrence as follows:

> The ore body occurs in a sheared and brecciated zone in basalt of Keewatin age. The basalt in the neighbourhood is massive except along the shear zone. The ore occurred in small veinlets and in grains disseminated through the rock. There is some pure ore containing many angular fragments of rock, showing that the country rock had been brecciated and that the ore has subsequently filled the interstices between the fragments.
>
> The ore consists of mispickel [arsenopyrite], iron pyrites, copper pyrites, and pyrrhotite. Quartz and calcite also occur.
>
> The shear zone in which the ore is found strikes about north and south, with a steep dip to the west. This zone is gossan-stained on the surface, and has a width, at the tunnel, of about 50 feet [15 m], and a length of about 1,000 feet [300 m]. There is a shaft at the north end of the deposit and one near the south end, and there is also a tunnel and an open-cut about midway between the two shafts. The open-cut is about 18 feet [5.6 m] wide. The tunnel referred to leads into a stope from which the ore has been removed.
>
> There are at least three dikes on the property, namely a quartz porphyry dike, a diabase dike, and a very basic dike. The quartz porphyry dike occurs from 25 to 200 feet [7.6 to 60 m] west of the ore body, and strikes a little east of north. It is from 50 feet [15 m] to 100 feet [30 m] in width. To the east of the ore-body, from 300 to 1,000 feet [90 to 300 m] there is a very basic dike striking northwestward....The third dike mentioned is a fresh-looking diabase at the south end of the deposit....

The dike referred to as "very basic dike" is probably the altered gabbro dike exposed immediately east of the railway track. Knight considered this dike to be pre-granite, but the writer has identified the dike as a post granite in age. In addition to the altered gabbro dike, a north-east-trending biotite-bearing lamprophyre is exposed in rock cuts of the railway line east of the Big Dan deposit.

The deposit appears to have lain idle from about 1906 to 1949 when Big Dan Mines Limited was formed to re-examine the property. Big Dan Mines Limited carries out a resistivity survey of the property and drilled eleven diamond-drill holes totalling 805.9 m (2,664 feet). Additional surface work and sampling was also undertaken. Assays submitted with diamond-drill logs on file at the Resident Geologist's office at Kirkland Lake indicated no important zones of mineralization were intersected. The best assays reported are 0.64 ounce of gold per ton and 11.2 ounces of silver per ton over 0.4 m (1.3 feet), but most assays returned trace or nil values. The Northern Miner (1951) reported that Big Dan Mines Limited had sold the property by that date. In the Northern Miner (1961) it is reported that the charter of Big Dan Mines Limited had been cancelled.

Dr. Robert Thomson visited the Big Dan property in 1949, and a report at the office of the Resident Geologist at Kirkland Lake indicates that diamond drilling undertaken by Big Dan Mines Limited showed the deposit may be symmetrically zoned with a central zone of arsenopyrite and carbonate veinlets passing outwards into a zone of pyrrhotite, then pyrrhotite with carbonate veinlets, and finally an outer zone of country rock intersected by narrow veinlets of carbonate.

In 1965, United Reef Petroleums Limited took over the property and carried out geological mapping and a ground magnetometer survey coupled with additional sampling, the best assay being from a grab sample which yielded 0.21 ounce of gold per ton and 2.19 ounces of silver per ton. A report prepared for United Reef Petroleums Limited, on file at the office of the Resident Geologist at Kirkland Lake, recommends that the property be allowed to lapse.

Although United Reef Petroleums still held the property in 1970, no work appears to have been done since 1965.

J.B. Watkins (43)

J.B. Watkins holds one surveyed claim, TRT4397 on the south shore of Kanichee Lake in central Strathy Township. The claim is underlain by intermediate to mafic metavolcanic flows and intermediate to felsic pyroclastic rocks. The northern part of the claim is underlain by Nipissing Diabase. One prospect pit about 1.5 m (5 feet) deep was located by members of the field party in the southeastern corner of the claim. A few stringers of quartz and carbonate were found in the intermediate metavolcanics in the walls of the pit, but the only mineralization seen was a few grains of pyrite. Strathy-Basin Mines Limited did considerable prospecting in the area in about 1935 (Savage 1935).

PROPERTY DESCRIPTIONS FOR BRIGGS TOWNSHIP

Bunker Hill Extension Mines Limited [1957] (44)

In 1935 Bunker Hill Extension Mines Limited held 18 unpatented claims in southwestern Briggs Township. Geological mapping and a magnetometer survey were carried out by Bunker Hill Extension Mines Limited over the claim group, but reports on file at the office of the Resident Geologist at Kirkland Lake indicated that no significant mineralization was located. The magnetometer survey indicated that the magnetic susceptibility of the Spawning Lake Stock does not differ significantly from that of the adjacent metavolcanics.

In November, 1956, one diamond-drill hole was drilled to a depth of 220.8 m (724.5 feet), several hundred feet north of Lake Temagami on Claim T35588. This hole intersected iron formation and mafic metavolcanics. An extension of this hole diamond drilled to a depth of 416.4 m (1,366 feet) in November, 1957, intersected quartz and feldspar porphyry carrying disseminated pyrite and minor chalcopyrite, but there are no reports of assays. The claims were allowed to lapse.

Cliffs of Canada Limited (Sherman Mine) (45)

The reader should consult the account given for Cliffs of Canada Limited in the property descriptions for Strathy Township.

Copperfields Mining Corporation Limited (46)

In 1970, Copperfields Mining Corporation held 76 surveyed claims and 14 unsurveyed claims in central and southwestern Briggs Township. Most of these claims extended in a northeast-trending continuous group along the northeastern Arm of Lake Temagami. This group forms part of a block of 211 parcels (205 claims) held by Copperfields Mining Corporation Limited, and which cover parts of Phyllis, Joan, Yates, and Briggs Townships.

The main object of exploration in southwestern Briggs Township and the adjacent townships of Phyllis and Yates has been a copper- and nickel-bearing pyrite zone at the base of the sill of Temagami Island diorite. Moorhouse (1942) first called attention to the pyrite mineralization in the area of the diorite sills. C.J. Niemetz held property in the area during the time of Moorhouse's mapping in 1941 (Moorhouse 1942). In 1951, Niemetz held 15 claims in the southwestern quarter of Briggs Township. Six diamond-drill holes totalling 250.2 m (821 feet) were drilled by Niemetz in 1951. The diamond-drill holes intersected the pyritic zone at the base of the diorite sill, but assays are not included with the drill logs on file at the office of the Resident Geologist at Kirkland Lake. The Niemetz property was incorporated as Niemetz Base Metal Mines Limited in 1952, and a magnetometer and resistivity survey was carried out for the company by Mining Geophysics in that year. The Northern Miner (1952) reported that channel sampling of the Niemetz showing indicated 0.22 to 1.10 percent copper, but the samples were not analyzed for nickel. The Northern Miner (1953) reported that the properties of Niemetz Base Metal Mines, along with the adjacent properties of Abex Mines, Derosier Nickel and Copper Mines, and Offshore Mines, were optioned to Frontenac Exploration and Development Company Limited, then to the Canadian exploration subsidiary of Anaconda American Brass Limited. Seventy-seven holes totalling 10 924.3 m (35,841 feet), (Simony 1964) were drilled on the optioned properties; of which 12 holes totalling 1254.9 m (4117 feet) were drilled along the pyrite zone in Briggs Township. Analyses submitted with the diamond drill logs indicate that the best intersection gave 14 feet (4.2 m) of 0.38 percent copper and 0.16 percent nickel. Frontenac Exploration and Development Company Limited did not renew the option in 1953 and the Temagami Mining Company was formed in 1954 to consolidate the holdings of several companies, of which N.K. Keevil was president. Following the discovery of high-grade copper ore bodies on Temagami Island in 1954 by the Temagami Mining Company, additional resistivity and self potential surveys were carried out over much of the property in Briggs Township. Between 1954 and 1959 four additional diamond-drill holes were drilled through the pyrite zone in Amphibolite Bay. By 1963 most of the area in the vicinity of Amphibolite Bay had been mapped at a scale of 1:1,200 (1 inch to 100 feet).

During the winter of 1954 resistivity and self potential surveys were carried out over much of the Northeast Arm of Lake Temagami between Temagami Island in Joan Township and Axe Narrows. Assessment work files at Kirkland Lake indicate that between 1954 and 1959, 15 diamond-drill holes totalling 2084.8 m (8,840 feet) were drilled along the Northeast Arm of Lake Temagami to test geophysical anomalies detected as a result of these surveys. The location of these diamond-drill holes is shown on Ontario Division of Mines Preliminary Map 595. Diamond drill logs submitted for assessment indicate that only minor amounts of pyrite and very minor amounts of chalcopyrite were intersected in a few of the holes.

In 1964 The Temagami Mining Corporation Limited became Copperfields Mining Corporation Limited. Copperfields Mining Corporation Limited has maintained a continuing program of exploration along the Northeast Arm of Lake Temagami with the aim of locating the extension of the Temagami Island diorite or similar sills, which appear to play some part in the control of the high-grade copper ore bodies on Temagami Island.

In 1953 The International Nickel Company of Canada took an option on part of the property now held by Copperfields Mining Corporation Limited. The International Nickel Company of Canada drilled three holes totalling 374.0 m (1,227 feet). One diamond drill hole was drilled over Lake Temagami on claim T31807; the remaining two were drilled on the south shore of an island near the north boundary of claim T31819. Diamond-drill logs on file at Kirkland Lake indicate that the holes intersected sheared, carbonatized, and silicified felsic tuff and mafic metavolcanics. No significant mineralization was intersected.

Copperfields Mining Corporation Limited (Geoscientific Prospectors Limited) [1952] (47)

In 1952 Geoscientific Prospectors Limited held about 75 claims along the north shore of the Northeast Arm of Lake Temagami. The group extended from the Tetapaga River southeastward as far as the Boat Islands. Ground magnetic, and resistivity surveys were carried out over much of this group in 1952 (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake). In 1961 Geoscientific Prospectors Limited was absorbed by Goldfields Mining Corporation Limited which, in turn, became part of Copperfields Mining Corporation Limited in 1964.

H. Niemetz (Nickel Rim Mines Limited, option) [1965] (47)

In 1965 Nickel Rim Mines Limited optioned from H. Niemetz 18 unsurveyed claims located just north of the road, between Snowshoe Lake and Amphibolite Bay in southwestern Briggs Township. The Northern Miner (1965a and b) reported that values of up to 0.52 ounce of gold per ton had been obtained from grab samples. It was thought that the gold was associated with magnetite, and a magnetometer survey was carried out to provide targets for a drilling programme. A magnetic anomaly about 600 m (2,000 feet) long was outlined, but six diamond-drill holes totalling 491.0 m (1,611 feet) failed to intersect gold values greater than 0.02 ounce of gold per ton.

The claim group is underlain mainly by altered, intermediate to felsic metavolcanics intruded by quartz porphyry and younger mafic dikes. The Northern Miner (1965a) stated that gold values were obtained from both the intrusive porphyry and the surrounding metavolcanics. The claims have since lapsed.

Snowshoe Lake Occurrence (49)

A small pit is located in the hornblende-quartz diorite phase of the Iceland Lake Pluton on the north side of the road to the former Temagami Copper Mine (Copperfields Mining Corporation) and about 1.6 km (1 mile) west of Snowshoe Lake in southern Briggs Township. The mineralization, consisting mainly of disseminated chalcopyrite and patches of malachite, appears to be associated with inclusions of mafic metavolcanics in epidotized quartz diorite. A selected grab sample assayed by the Mineral Research Branch of the Ontario Division of Mines was found to contain 0.08 ounce of gold per ton, 0.8 ounce of silver per ton and 0.96 percent copper; trace amounts of lead, zinc, and nickel were determined. The overall extent of the mineralization did not appear to exceed a few square feet.

Titanic Construction Company Limited [1962] (50)

In 1962 the Titanic Construction Company Limited held 33 unsurveyed claims on the north shore of the Northeast Arm of Lake Temagami in a continuous block extending southwestward from the Tetapaga River. The property included the showing referred to by Moorhouse (1942) as the "Lloyd Sprout Showing". Moorhouse (1942, p.34) stated that the Consolidated Mining and Smelting Company of Canada held an option of the property in 1941 and did considerable surface work. The results of that work are not known.

Seven diamond-drill holes, totalling 781.5 m (2,564 feet), were put down by the Titanic Construction Company Limited in the area of the old showing in 1962. Diamond-drill logs in the Resident Geologists Files at Kirkland Lake indicate that the rocks intersected included iron formation, mafic metavolcanics and volcanic breccia which are intruded by lamprophyre and feldspar porphyry. Short sections of disseminated pyrite were intersected, but the best assay indicated on the logs is 0.005 ounce of gold per ton. The author visited the showing in 1970, and found a trench 60 m (200 feet) long and a pit at least 1.5 m (5 feet) deep. The trench and pit were partially filled with debris and it was not possible to observe directly the nature of the occurrence. An adjacent rock dump contains a large amount of fine-grained grey to pink rock cut by numerous quartz veinlets. A grab sample taken from the dump by the author was found to contain only trace amounts of gold and silver when assayed by the Mineral Research Branch, Ontario Division of Mines.

N.A. Wicken [1953] (51)

In 1953 N.A. Wicken diamond-drilled four short holes totalling 60.3 m (198 feet) near Lake Temagami, a few hundred feet southwest of the mouth of the South Tetapaga River. The diamond-drill logs on file at the office in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake indicate that the rocks intersected consist of diabase and breccia. There is no report of significant mineralization and the property was allowed to lapse.

PROPERTY DESCRIPTIONS FOR STRATHCONA TOWNSHIP

Agnico Mines Limited [1956] (52)[1]

In 1955, Cobalt Consolidated Mining Corporation Limited held an option on a 12-claim group in southeastern Strathcona Township. A self-potential survey and an electromagnetic survey were conducted over the claim group as well as a geological mapping programme. Three diamond-drill holes totalling 97.8 m (321 feet) were drilled in 1955 and three diamond-drill holes totalling 272.5 m (894 feet) were drilled in 1956. Geophysical reports and diamond-drill logs on file at the Resident Geologist's Office in Kirkland Lake record that a copper-bearing zone striking north to northwest was investigated by diamond-drilling. However, diamond-drill logs give a maximum value of 0.14 percent copper over 1.5 m (5 feet). Short sections of massive sulphide minerals are reported to be interbedded with chert and may represent sulphide facies iron formation. The country rocks include mafic metavolcanics, and the report states that a granite dike roughly parallels the sulphide zone.

The information in the files is somewhat ambiguous as to the location of the main surface showing. The most probable location is that shown on the map of Strathcona Township included with this report. Moorhouse's map (ODM Map 51c) shows two showings in this general area and it is probable that one of these is that investigated by Cobalt Consolidated Mining Corporation Limited. The

[1]Numbers in parentheses refer to property number on Map 2324 in back pocket.

showing was not located during the present survey.

In 1970 the original claims had lapsed and parts of the ground were held by L. Savard and H. Johnston. Diamond-drill logs indicate that brown and green schists (probably felsic metavolcanics) were the main rocks intersected. There was no report of significant mineralization.

Andover Mining and Exploration Limited [1956](53)

The New Minda Scotia Mines Limited held a group of 32 claims in the vicinity of Axe Narrows on the Northeast Arm of Lake Temagami in 1956. The Northern Miner (1956b) reported that a programme of magnetic and electromagnetic surveys followed by diamond drilling was planned.

Diamond-drill logs kept in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake, indicate that three holes totalling 865.8 m (2,848 feet) were collared on islands in the Axe Narrows of the Northeast Arm of Lake Temagami. The diamond-drill logs record that the holes intersected sheared, brecciated, and carbonatized rhyolite cut by minor mafic intrusions. Minor amounts of pyrite and chalcopyrite were reported, but no assays were included. There is no report of further work done. In 1958, New Minda Scotia Mines Limited merged into Andover Mining and Exploration Limited.

Armex Limited [1967](54)

Records in the Resident Geologist's Files at Kirkland Lake indicate that in 1967 Armex Limited held one claim on the southern shore of O'Connor Island in the Northeast Arm of Lake Temagami. Two diamond-drill holes, totalling 67 m (220 feet), were collared from a small island about 150 m (500 feet) southeast of the eastern shore of O'Connor Island.

Cliffs of Canada Limited (Sherman Mine) (55)

The reader is referred to the section on "Cliffs of Canada Limited (Sherman Mine) (11), (1), (45) and (55)", where a complete account is given.

Copperfields Mining Corporation Limited (56)

In 1970 Copperfields Mining Corporation held a block of five surveyed claims and four unsurveyed claims on the eastern shore of the Northeast Arm of Lake Temagami in north-central Strathcona Township. The claim numbers of the surveyed claims are T47113, T47114, T46998, T46999, and T47000. The unsurveyed claims lie south of this group.

In this area, stringers and disseminated grains of pyrite occur in a chloritic zone at or near the base of a sill of Temagami Island diorite; a setting similar to that at Temagami Island and in southwestern Briggs Township. The pyrite zone of the sill in Strathcona Township varies from a few inches to as much as 15 m (50 feet) in width with an overall length of at least 90 m (3,000 feet). Over much of this length, however, the pyrite is disseminated and discontinuous.

In 1952, the Candela Development Company, a wholly owned subsidiary of Freeport Sulphur Company, carried out a ground magnetometer survey over the main mineralized areas and drilled one diamond-drill hole to a depth of 47.2 m (155 feet). In 1956 Diadem Mines Limited (charter cancelled in 1965) carried out an electromagnetic survey and diamond-drilled 13 holes totalling 1560 m (4,475 feet). The diamond drilling indicated disseminated grains and stringers of sulphides over a strike length of 200 m (700 feet), with a width of about 4.6 m (15 feet) and continuous for about 150 m (500 feet) down the dip. A report in the Resident Geologist's Files at Kirkland Lake stated that a sulphide deposit of 500,000 tons grading 0.5 percent copper and 0.1 percent nickel was outlined by this drilling.

Geoscientific Prospectors Limited (name changed to Gold Fields Mining Corporation Limited in 1961, and in turn to Copperfields Mining Corporation Limited in 1964) drilled four holes totalling 400.4 m (1,317 feet) in 1960 and Copperfields Mining Corporation Limited drilled an additional hole at a depth of 93.3 m (306 feet) in 1965. Copperfields Mining Corporation Limited carried out geological mapping at a scale of 1:2,400 (one inch to 200 feet) over the five claim group in 1966.

Two character samples were taken from the pyrite-rich sections near the old pits by the author in 1969. The Mineral Research Branch, Ontario Division of Mines indicated 0.80 and 0.84 percent copper and 0.36 and 0.34 percent zinc respectively. Only trace amounts of gold, silver, lead, and nickel were detected.

In 1965, Copperfields Mining Corporation Limited drilled two diamond-drill holes totalling 84.4 m (277 feet) in length on a small promontory on the eastern shore of the Northeast Arm of Lake Temagami directly east of Ferguson Island. Diamond-drill logs in the Resident Geologist's Files at Kirkland Lake indicate that the holes intersected dacitic metavolcanics intruded by mafic dikes and possibly some granite. Disseminated, fine-grained pyrite and chalcopyrite, intersected at several positions in the diamond-drill holes, appears to be associated with tourmalinization. Assays submitted with the diamond-drill logs indicate values as much as 0.22 ounce of gold per ton and 0.12 percent copper over 0.6 m (2 feet). In 1970 the property was still held by Copperfields Mining Corporation Limited.

K. Graber (57)

In 1969 K.Graber of North Bay staked a group of 31 unsurveyed claims in central Strathcona Township. Located within the claim group are three sulphide occurrences which were originally held by L.C. Firby and optioned to Sylvanite Gold Mines Limited in 1955. Sylvanite Gold Mines Limited did trenching and assaying but the results are not available. Sylvanite Gold Mines relinquished its option, and later in 1955 the ground was optioned to Newkirk Mining Corporation. The latter company carried out magnetometer, electromagnetic and resistivity surveys, and drilled five diamond-drill holes totalling 82.0 m (269 feet) in length. The best intersection was 2.6 m (8.6 feet) of massive pyrrhotite with blebs of chalcopyrite yielding 0.45 percent copper (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

The main showing is located about 300 m (1,000 feet) south of Maille Lake in central Strathcona Township. The surface work consisted of a shallow pit and a northwest-striking trench about 15 m (50 feet) long. The enclosing rocks appear to be mafic metavolcanics with a felsic intrusion or felsic metavolcanics present in the southeast end of the trench. Blebs and stringers of pyrite are distributed over an area of about 3 by 4.6 m (10 by 15 feet). The pervasive sulphide staining made a detailed description of the showing impossible. The only structural feature appears to be an almost flat-lying foliation or shearing. A character sample selected by the author and analyzed by the Mineral Research Branch, Ontario Division of Mines returned 0.34 percent copper, 0.01 ounce of gold per ton, 0.09 percent zinc and trace amounts of lead and nickel.

Pits have also been sunk in sulphide occurrences at the eastern end of Maille Lake and about 150 m (500 feet) east of Maille Lake. These were not visited by the author but were visited by W.S. Savage in 1955. Savage's report (see Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) stated that the pits were water-filled, but that the sulphides were pyrite, pyrrhotite, and chalcopyrite in "blocky jointed, altered andesite". Savage noted that the occurrence seemed to be similar to that of the main showing. One of these showings was drilled by Newkirk Mining Corporation, but no significant mineralization was intersected (Resident Geologist's Files, Kirkland Lake).

In 1957 Temanda Mines Limited held an 18-claim group centred around Maille Lake. The Northern Miner (1957) reported that diamond drilling by Temanda Mines Limited intersected massive and disseminated sulphide minerals and reported samples containing up to 1.98 percent copper, 0.06 percent nickel, and 0.038 percent cobalt. No further information is available, but probably this showing was examined by Newkirk Mining Corporation.

During the summer of 1969 B.W. Chechak of North Bay was engaged in geological mapping over the Graber claims.

Milestone Exploration Limited (58)

In 1970, Milestone Exploration Limited held five surveyed claims immediately southwest of the claims held by Copperfields Mining Corporation Limited previously described in this report. Milestone Exploration Limited held claims T31528 to T31531 inclusive, and TRT6979. The last numbered claim contains the pyrite deposits known as the O'Connor prospect that has a history of exploration going back to the turn of the century (Miller 1901, p.169). Moorhouse (1942) noted that much surface work had been done sometime in the 1920s.

The pyrite occurs at the base of a sill-like body of Temagami Island diorite in a setting very similar to that of the Copperfields deposits that occur in the adjoining claim to the east. J.T.O'Connor probably shipped 542 tons of pyrite from small open pits during the First World War (Shklanka 1968, p.204). H.S. Wilson, consulting geologist, in a report for Milestone Exploration Limited (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake), stated that some diamond drilling was done on the deposit in 1927 and 1928, but the records are not available.

In 1952, the Candela Development Company cut several trenches and diamond drilled four holes totalling 376.1 m (1,234 feet) on claim TRT6979. A magnetometer survey was also carried out by Candela Development Company that same year, but it was concluded that the rocks and mineralized zones could not be traced out by a magnetic survey. Diamond-drill logs on file at the Resident Geologist's Office, Kirkland Lake, indicate that one hole intersected 11.3 m (37 feet) of sulphide mineralization averaging 0.50 percent copper over that length. A second diamond-drill hole intersected sulphide minerals containing an average of 0.47 percent copper and 0.22 percent nickel over 2.4 m (8 feet).

In 1956, Candela Development Company sold the claims to M.C. Mosher who, in turn, sold them to Milestone Mines Limited (renamed Milestone Exploration Limited in 1968). No record of work done by Milestone Mines or Milestone Exploration Limited exists at present.

Nickel Rim Mines Limited [1956] (59)

In 1956 Nickel Rim Mines Limited held a 56-claim group extending in Strathcona Township between Highway 11 south of Jesse Lake, westward to Axe Narrows in Lake Temagami. During the winter of 1956, a magnetometer survey was carried out on the ice over most of a five-claim group extending southwest from Ferguson Island. A report on file at the office of the Resident Geologist at Kirkland Lake indicates that six diamond-drill holes totalling 730 m (2,396 feet) were drilled through the ice of Lake Temagami in the area covered by the magnetic survey. Diamond-drill logs indicate that the predominant rock underlying Lake Temagami southwest of Ferguson Island is felsic metavolcanics cut by a few mafic dikes.

Results kept by the Resident Geologist at Kirkland Lake indicate the best assay was 0.26 percent copper over a length of 1.7 m (5.5 feet). Most assays ranged from nil to less than 0.1 percent copper. The mineralization does not appear to have been extensive and the property has been allowed to lapse.

Pingue Lake Occurrence (60)

At several places along the railway line between Pingue Lake and the village of Temagami, east- to northeast-striking zones of shearing and ankeritization are exposed in the rock cuts. A few of these shear zones are impregnated with finely disseminated pyrite, and are easily identified by the intense iron oxide staining. One such shear zone, located about 518.2 m (1,700 feet) northwest of the west end of Pingue Lake, is about 1.2 m (4 feet) wide and dips steeply to the south. Its length cannot be measured because of the drift cover. A selected sample taken from this occurrence by the writer was assayed by the Mineral Research Branch, Division of Mines and was found to contain 0.48 ounce silver per ton, 0.07 ounce gold per ton, 0.05 percent copper and 0.04 percent lead.

Portage Bay Occurrence (61)

Two narrow dikes of fine-grained, altered, mafic material intrude the basal breccia of the Gowganda Formation in a rock cut on the western side of Highway 11 about 0.8 km (½ mile) south of the village of Temagami. Immediately adjacent to one of these dikes is an irregularly shaped area of massive pyrite 2.3 to 3 cm (6 to 8 inches)long and 1:6 to 6.4 km (1 to 4 miles) wide (Figure 9 and Photo 16). Since this is the only significant concentration of pyrite in the area shown in Figure 9, it is reasonable to suggest that the sulphide is associated with the mafic dike. An assay by the Mineral Research Branch of the Division of Mines of a selected sample of the sulphide collected by the author indicated that it contained 0.56 ounce of silver per ton with trace of gold and nil copper, lead, and zinc.

R. Sabourin (62)

A trench about 0.9 m (3 feet) wide by 2.4 m (8 feet) long is located on the western side of the Hydro transmission line, about 900 m (3,000 feet) north of Herridge Creek in southeastern Strathcona Township. Exposed in the trench is a shear zone 0.6 to 0.9 m (2 to 3 feet) wide, striking N70°W and dipping about 60° south. Stringers and disseminated grains of pyrite and pyrrhotite are present throughout the shear zone, but no other sulphide minerals were noted. A selected grab sample taken by the author was forwarded to the Mineral Research Branch of the Division of Mines and was found to contain 0.10 percent copper and 0.07 percent nickel with trace amounts of gold and silver. In 1969, the area surrounding this showing was staked by Ronald Sabourin.

L. Savard (63)

In 1969 L. Savard of North Bay staked a group of 13 claims between Lowell Lake and Herridge Lake. This claim group included a number of small sulphide occurrences, some of which are reported (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) to have been known as early as the 1920s. These showings and those on the Graber claims form a north-northeast trending array referred to in the subsection "Possible Structural Controls on Mineralization".

Two of these sulphide occurrences are found near Highway 11 from 150 to 300 m (500 to 1,000 feet) south of the point where the road to Lowell Lake joins

Highway 11. On the western side of Highway 11 amphibolites and felsic intrusive rocks (?) are highly stained by iron oxide, and contain disseminated masses and lenses of pyrite and pyrrhotite 0.7 by 5 cm (¼ inch by 2 inches) long as well as with some disseminated sulphides. The mineralized area is at least 6 m (20 feet) long and from 0.3 to 1.2 m (1 to 4 feet) wide. It strikes about N52°E and dips about 40 degrees to the south. The zone is slightly sheared and seems to contain a moderate amount of graphite, which, combined with the iron staining, obscures most of the relationships. A grab sample taken by the author from a sulphide-rich area of the showing was analyzed by the Mineral Research Branch, Division of Mines and found to contain 0.01 ounce of gold per ton, 0.80 percent copper, 0.40 percent zinc and trace amounts of silver, lead, and nickel.

A similar occurrence occurs in a wide, shallow pit on the eastern side of Highway 11 a few hundred feet south of the showing described above (not shown on map). Pyrite and pyrrhotite appear to be the major sulphide minerals that seem to be associated with graphitic areas in mafic metavolcanics and feldspar porphyry. The amount of debris and staining made estimation of the distribution of the sulphide minerals difficult. Notes on file at the office of the Resident Geologist at Kirkland Lake indicate that W.S. Savage examined the showing in 1953. Savage reported the presence of chalcopyrite, but his observations were also hampered by the staining and debris in the pit.

A third showing is located on the eastern side of the clearing for the natural gas pipeline about 30 m (100 feet) south of the Lowell Lake road. Here, scattered massive blebs or pyrite, probably with some pyrrhotite 2.5 cm (1 inch) wide by 10 cm (4 inches) long, and thin stringers of pyrite occur in a siliceous dark, fine-grained rock that may be a silicified mafic metavolcanic rock. Feldspar porphyry sills intrude the mafic metavolcanics in the adjacent outcrops. The mineralized zone trends roughly north-south in an irregular fashion and is at least 4.6 m (15 feet) long with a width of about 0.3 to 0.6 m (1 to 2 feet). A grab sample taken by the author and analyzed by the Mineral Research Branch of the Division of Mines was found to contain 0.10 percent copper, 0.44 percent zinc, 0.05 ounce of gold per ton, with trace amounts of lead, nickel and silver.

The fourth showing of this group that was examined by the writer occurs at the western end of Lowell Lake. Here, three pits 1.5 to 3 m (5 to 10 feet) across have opened up a sulphide zone in a graphitic rock with the appearance of an argillite or greywacke. This rock seems to be associated with the mineralization, because outside the pits the rocks are mafic metavolcanics intruded by quartz-feldspar porphyry. Pyrrhotite occurs as seams and lenses a few inches long, while pyrite tends to occur as blebs and cubes in the graphitic rock. The extent and trend of the mineralization is difficult to determine but weak shearing in the pits strikes S30°E. A character sample taken by the writer and analyzed by the Mineral Research Branch of the Division of Mines was found to contain 0.84 percent copper, 0.36 percent zinc with trace amounts of nickel, cobalt, lead, silver and gold.

Trebor Mines Limited held an option on the ground enclosing most of these showings in 1955 and 1956. Information in the Resident Geologist's Files at Kirkland Lake indicates that Trebor Mines Limited carried out ground electromagnetic, and radiograph surveys and geological mapping over the property in 1956. Five diamond-drill holes totalling 437.1 m (1,434 feet) in length at the south end of a small lake about 300 m (1,000 feet) southwest of Lowell Lake. Diamond-drill logs indicate that small amounts of pyrrhotite, pyrite, chalcopyrite and sphalerite were intersected, but no assays are reported.

Also in 1956, E. McWilliam diamond-drilled three holes totalling 51.2 m (168 feet) in the area immediately southwest of the ground held by Trebor Mines Limited. The precise location of the diamond-drill holes is uncertain, but they were probably drilled near Highway 11, near the showing close to Highway 11 referred to earlier in this account.

During the summer of 1969, B.W. Chechak of North Bay was engaged in geological mapping on the Savard claims (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

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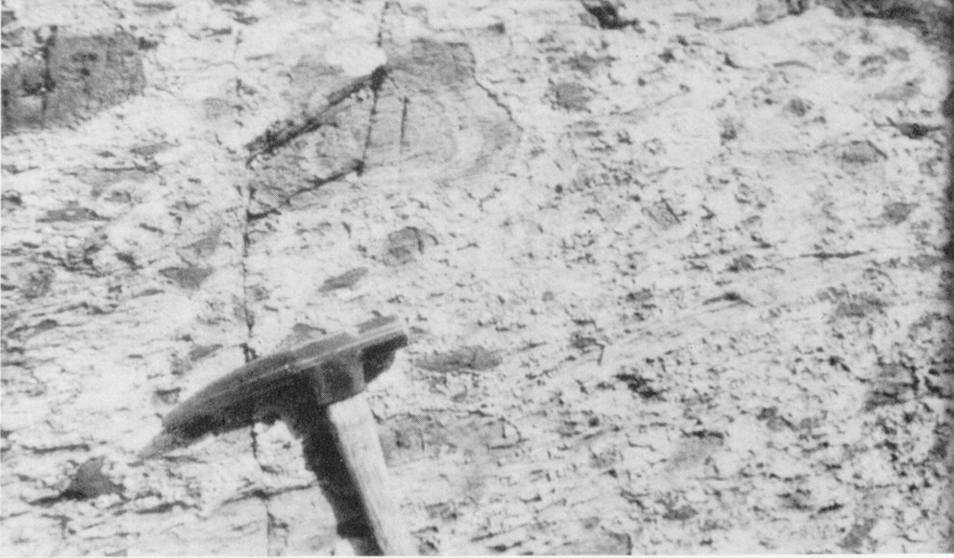
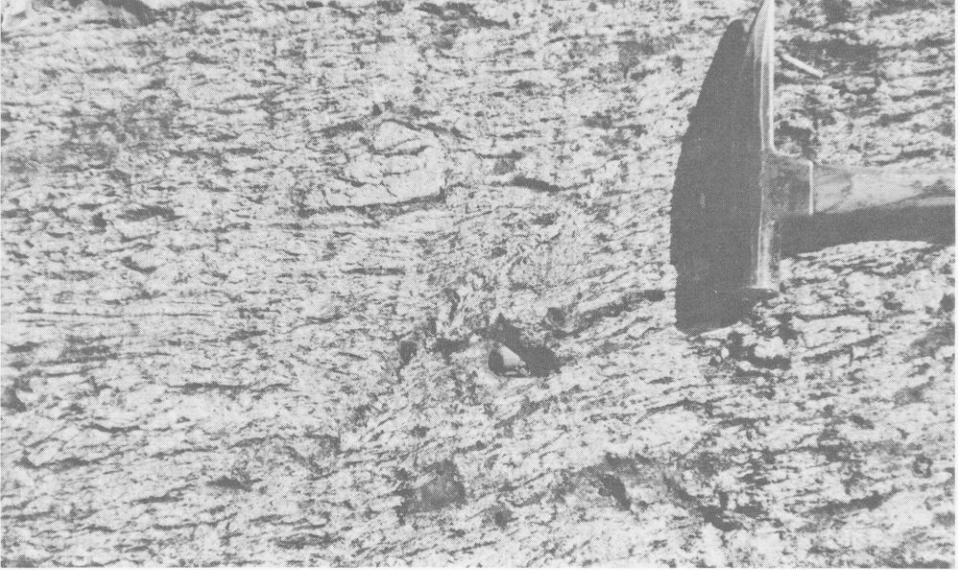
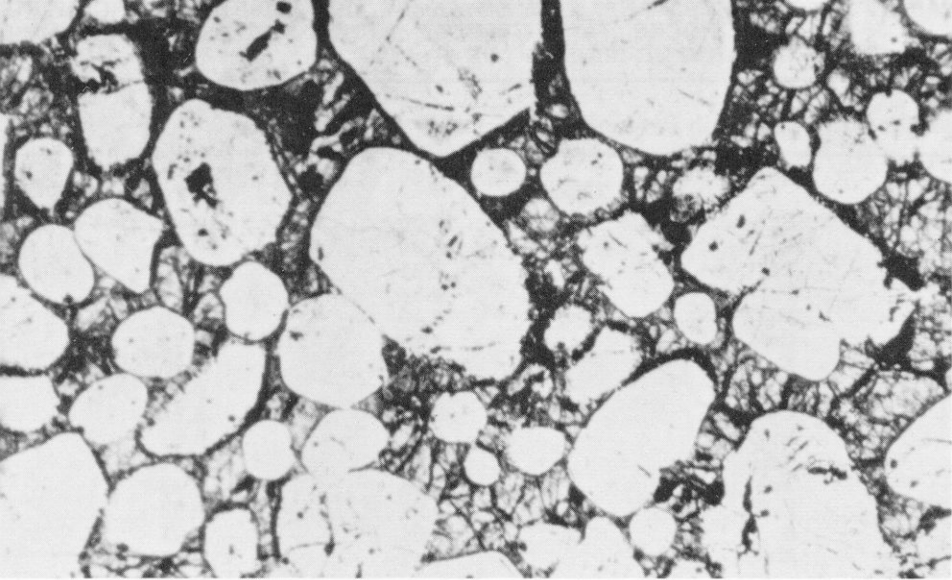
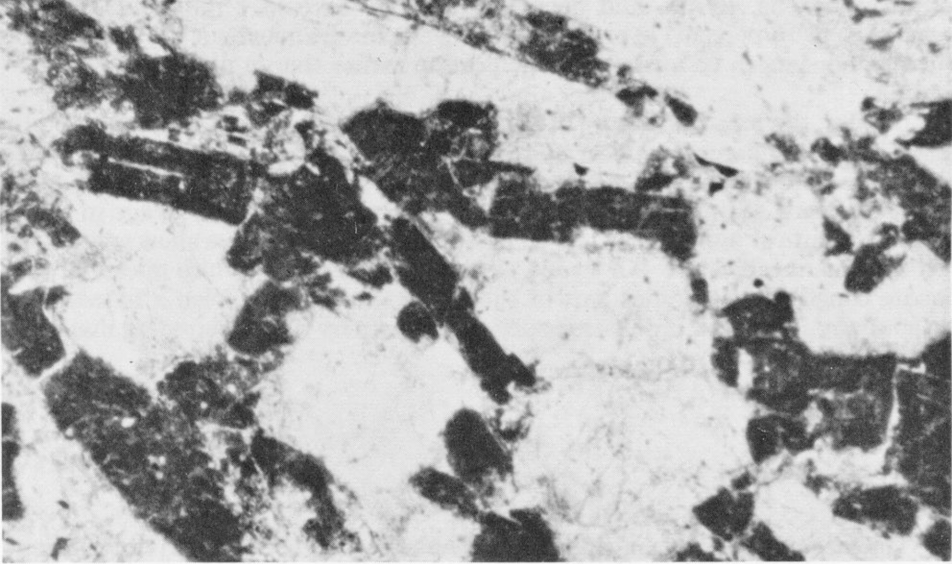
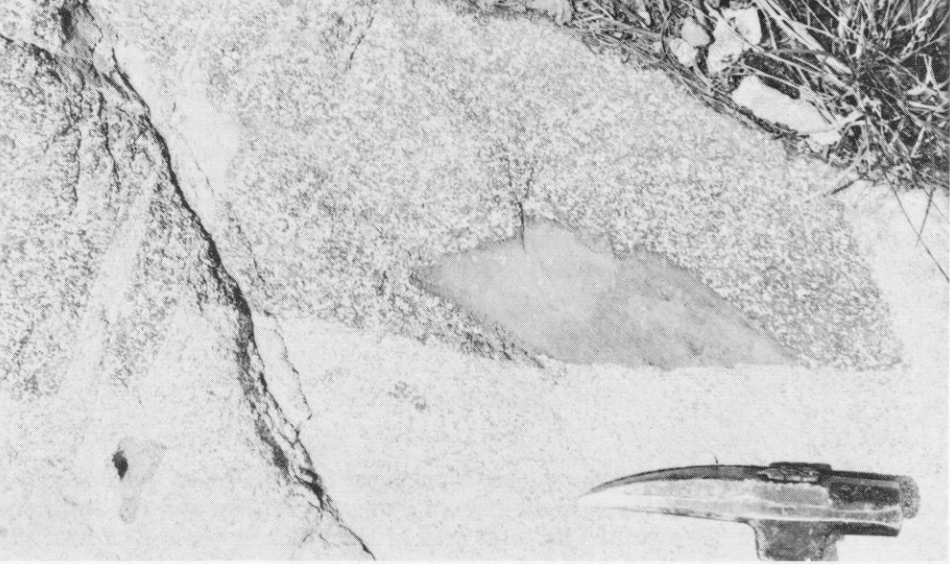


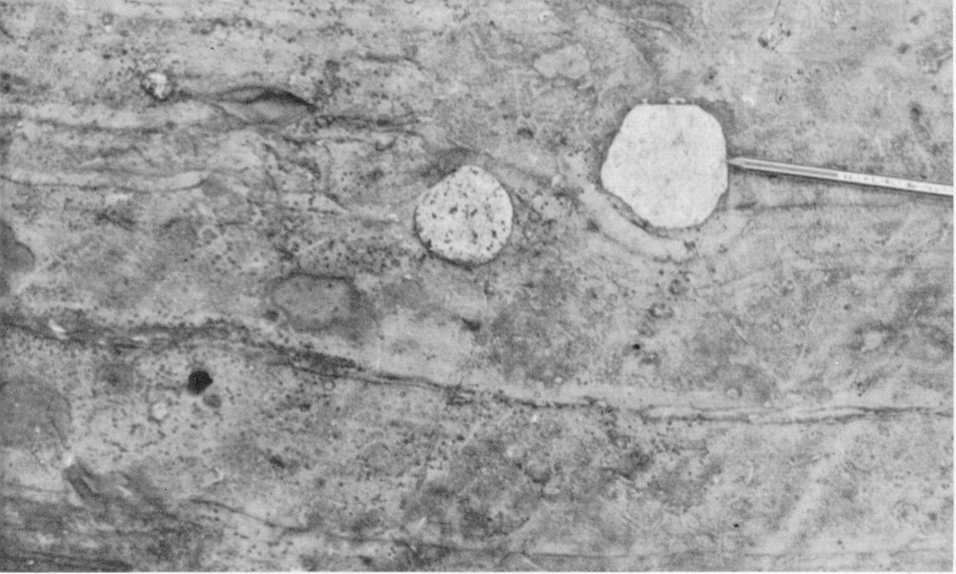


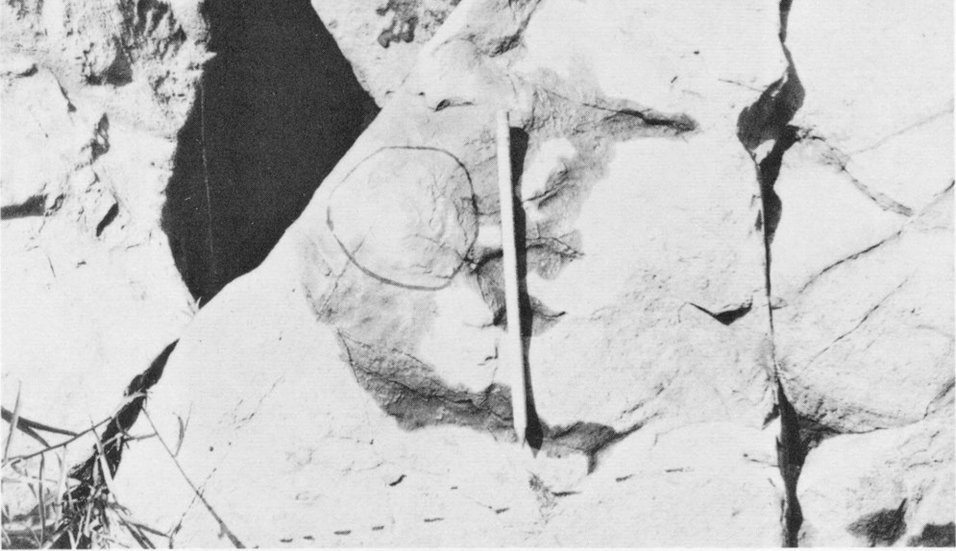


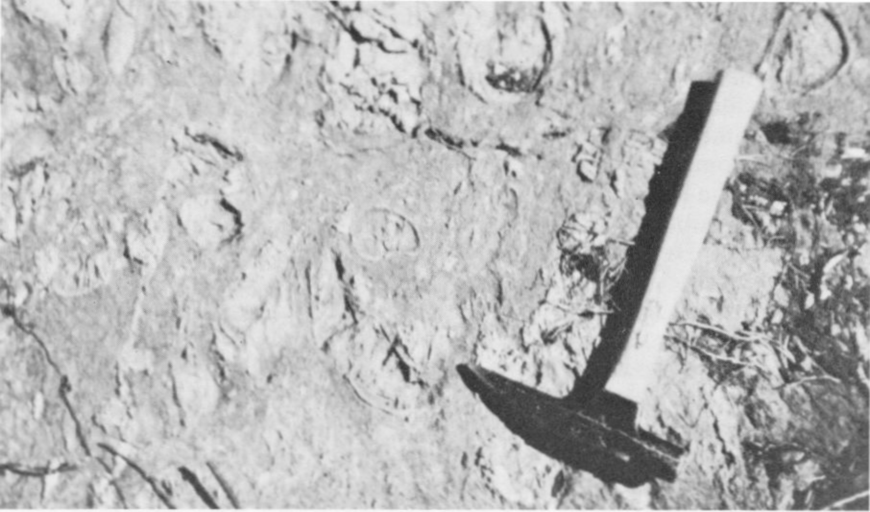




ODM0634







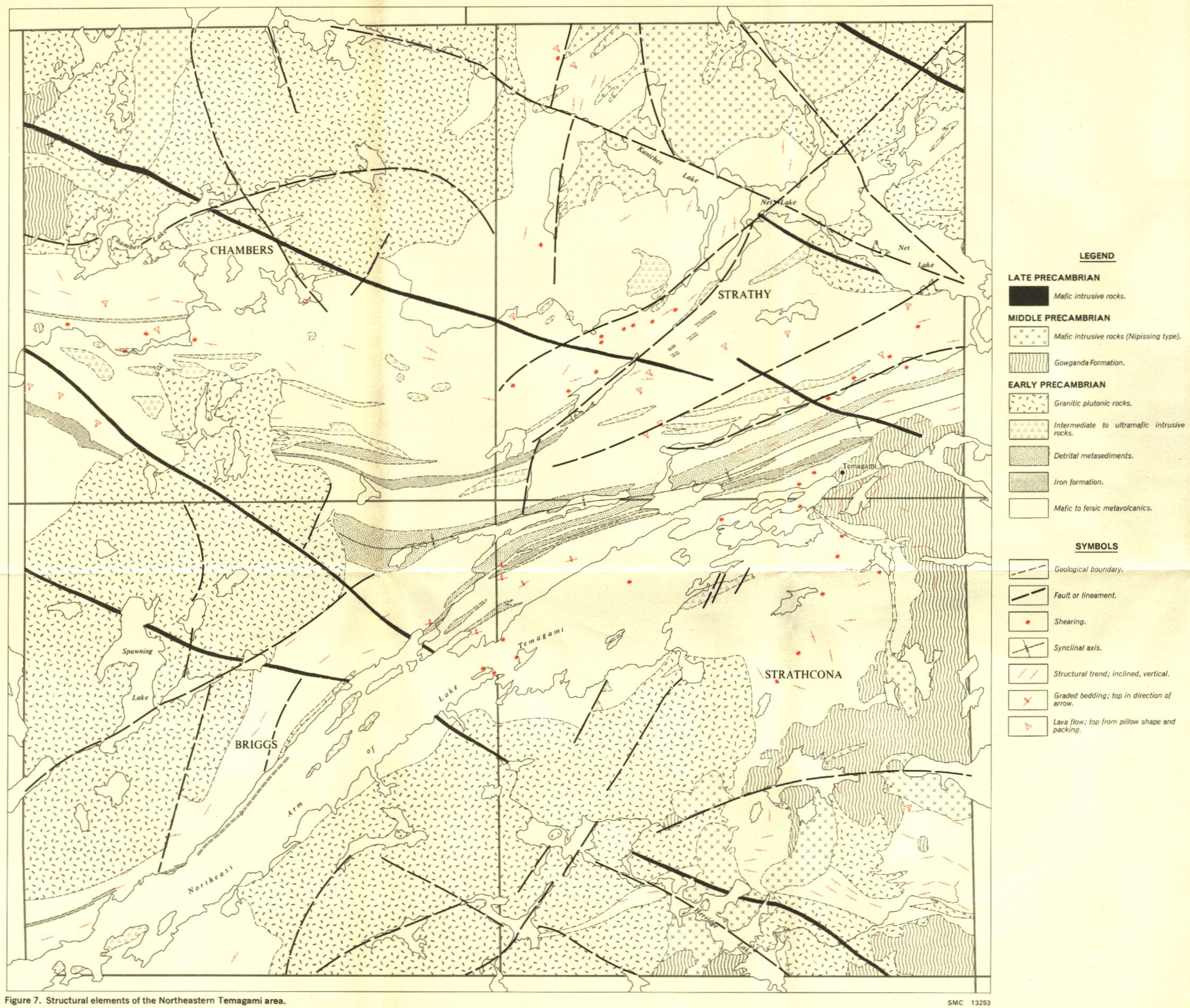


Figure 7. Structural elements of the Northeastern Temagami area.

SMC 13253

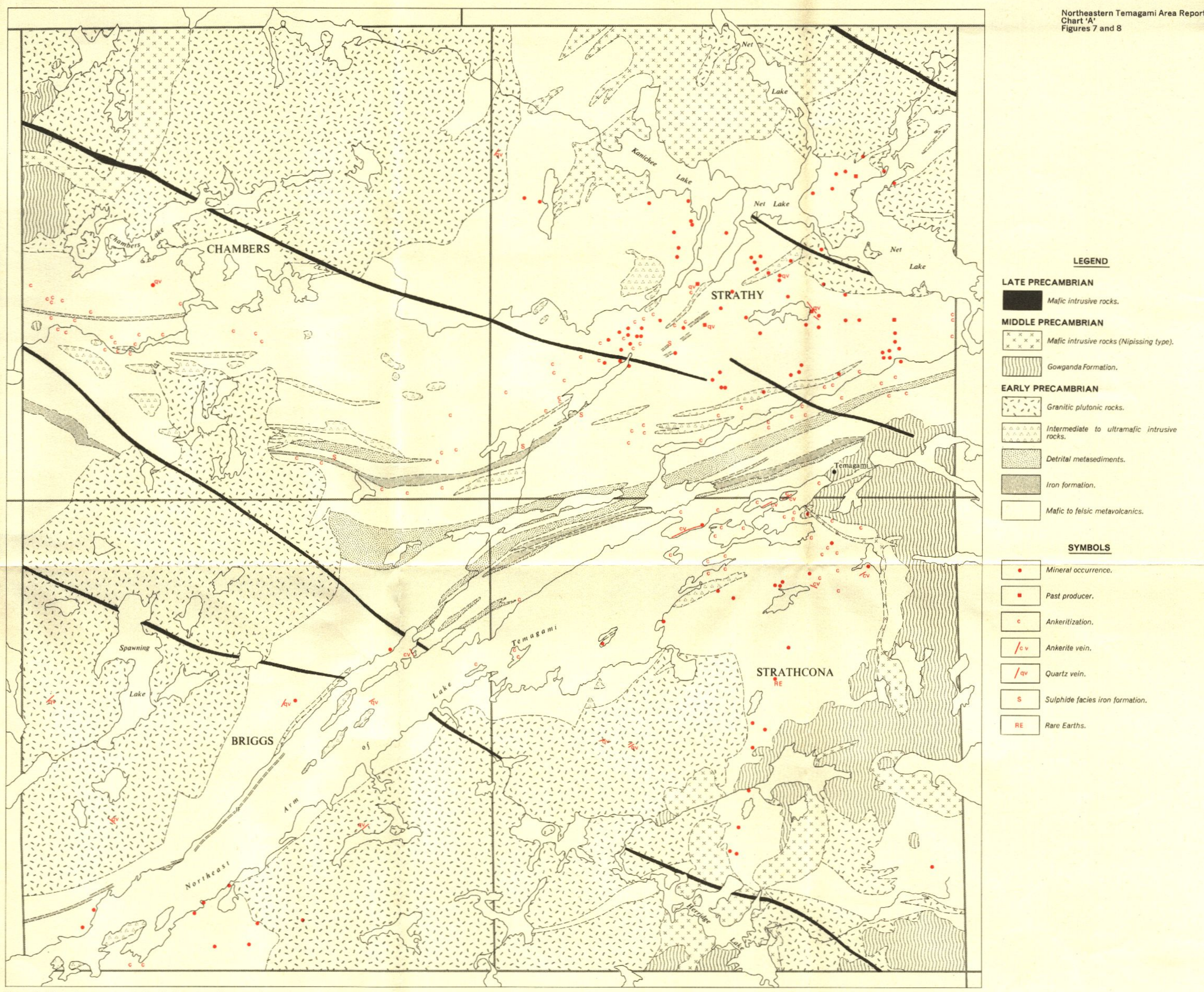


Figure 8. Mineral occurrences in the Northeastern Temagami area.

SMC 13254

Scale 1 : 63,360 or 1 Inch to 1 Mile

Chains 80 40 0 1 2 3 4 5 Miles

Feet 10,000 0 10,000 20,000 Feet

Metres 1000 0 1 2 3 4 5 6 Kilometres

ONTARIO
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HONOURABLE LEO BERNIER, *Minister of Natural Resources*
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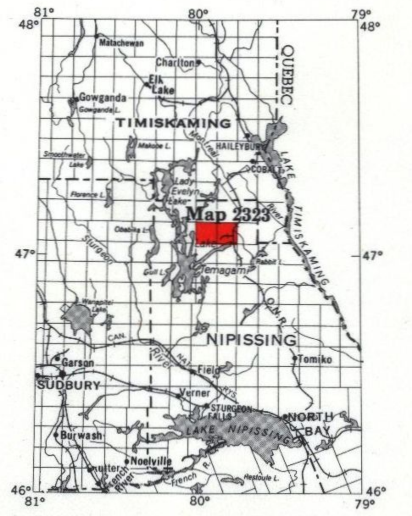
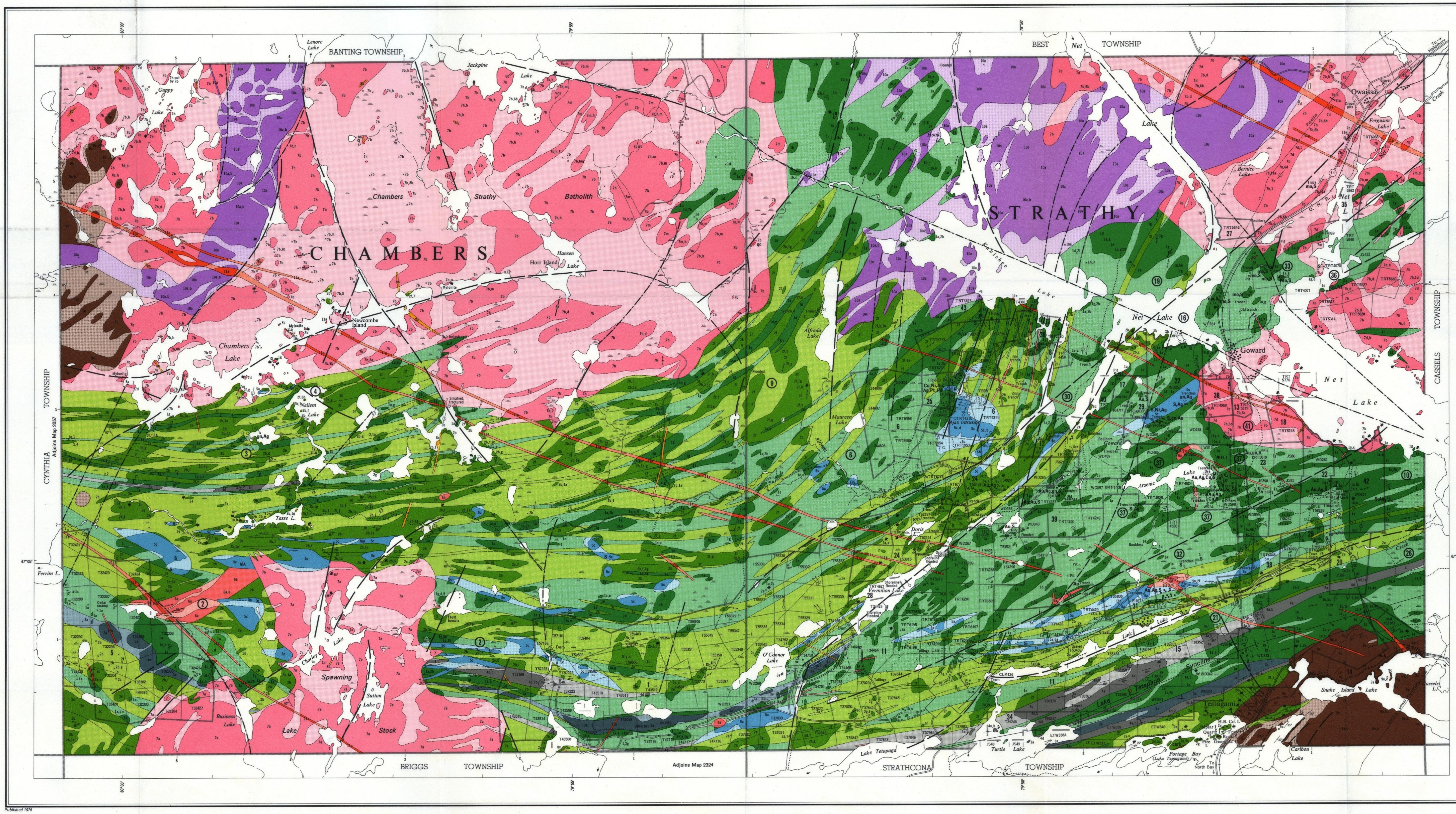
G. A. Jewett, *Executive Director, Division of Mines* E. G. Pye, *Director, Geological Branch*

Map 2323
Chambers and Strathy Townships



Scale, 1 inch to 50 miles
N.T.S. Reference 31M/4,41P/1



Published 1975

LEGEND

PHANEROZOIC
CENOZOIC[a]
QUATERNARY
PLEISTOCENE AND RECENT
Swamp and stream deposits, till, sand and gravel.

UNCONFORMITY

PALEOZOIC[b]
CAMBRIAN (?)

12 *Carbonatite.†*

INTRUSIVE CONTACT

PRECAMBRIAN[b]
LATE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS

11a *Olivine diabase (Sudbury type).*
11b *Granophyric diabase.†*
11c *Intrusive breccia.[c]*

INTRUSIVE CONTACT

MIDDLE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS
(Nipissing Type)

10a *Quartz diabase, gabbro.*
10b *Pegmatitic gabbro, diorite.*

INTRUSIVE CONTACT

HURONIAN SUPERGROUP
COBALT GROUP
GOWGANDA FORMATION

9 *Unsubdivided.*
9a *Greywacke, siltstone, argillite.*
9b *Feldspathic quartzite.*
9c *Polymictic paraconglomerate, minor pebble and boulder conglomerate.*
9d *Sedimentary breccia.†*

UNCONFORMITY

EARLY PRECAMBRIAN (ARCHEAN)
MAFIC INTRUSIVE ROCKS

8 *Unsubdivided.*
8a *Altered diorite and gabbro (dikes).*
8b *Chloritic mafic dikes.*
8c *Biotite and hornblende-rich lamprophyre.*

INTRUSIVE CONTACT

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS
GRANITIC PLUTONIC ROCKS

7 *Unsubdivided.*
7a *Porphyritic quartz monzonite.*
7b *Quartz monzonite.*
7c *Quartz monzonite, trondhjemite (border phase).†*
7d *Trondhjemite.*
7e *Hornblende trondhjemite, quartz diorite.†*
7f *Hornblende-quartz diorite, trondhjemite.†*
7g *Chlorite trondhjemite.†*
7h *Quartz diorite, granodiorite (contaminated phases).*
7j *Fine-grained leucogranite.†*
7k *Aplite, pegmatite.†*
7m *Hybrid rocks, agmatite, migmatite.*

INTRUSIVE CONTACT

HYPABYSSAL FELSIC INTRUSIVE ROCKS[d]

6a *Quartz porphyry.*
6b *Quartz-feldspar porphyry.*

INTRUSIVE CONTACT

INTERMEDIATE TO ULTRAMAFIC INTRUSIVE ROCKS

5 *Unsubdivided.*
5a *Diorite, quartz diorite (Broom Island diorite).*
5b *Altered gabbro, quartz gabbro (Temagami Island gabbro).†*
5c *Gabbro, diorite, and altered equivalents.*
5d *Serpentinite, pyroxenite, peridotite.*
5e *Quartz diorite.*
5f *Anorthositic gabbro.†*

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS[e]
DETRITAL METASEDIMENTS

4 *Unsubdivided.*
4a *Lithic greywacke, siltstone.*
4b *Siltstone, slate (graphitic in part).*
4c *Conglomerate, volcanic conglomerate.*
4d *Tuffaceous sandstone.*

IRON FORMATION

3 *Unsubdivided.*
3a *Banded silicate-oxide facies.*
3b *Sulphide facies.*

FELSIC TO INTERMEDIATE METAVOLCANICS

2 *Unsubdivided.*
2a *Rhyolite.*
2b *Rhyodacite, dacite, minor andesite.[f]*
2c *Felsic volcanic breccia, tuff-breccia, minor agglomerate.*
2d *Felsic tuff, lapilli-tuff.*
2e *Carbonatized, sheared metavolcanics.*
2f *Intermediate volcanic breccia, tuff-breccia.*
2g *Intermediate lapilli-tuff, crystal tuff.*

MAFIC TO INTERMEDIATE METAVOLCANICS

1 *Unsubdivided.*
1a *Massive to foliated andesite and basalt.*
1b *Porphyritic andesite and basalt.*
1c *Pillowed mafic flows.*
1d *Fine-grained amphibolite, hornfels.*
1e *Amygdaloidal basalt and andesite.*
1g *Massive, coarse-grained amphibolite.*
1h *Mafic lapilli-tuff, agglomerate.*

Breccia

Ag	*Silver.*
Au	*Gold.*
carb	*Carbonate.*
Ce	*Cerium.†*
Cu	*Copper.*
gn	*Galena.*
La	*Lanthanum.†*
Mo	*Molybdenum.*
mo	*Molybdenite.*
Ni	*Nickel.*
Pd	*Palladium.*
Pt	*Platinum.*
q	*Quartz.*
qc	*Quartz-carbonate.*
S	*Sulphide mineralization.*

[a] *Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured parts of the map.*

[b] *Bedrock geology. Outcrops and inferred extensions of each rock map unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show colour a short black bar appears in the appropriate block.*

[c] *May also include older breccias.*

[d] *May include rocks equivalent in age to metavolcanics.*

[e] *The rocks of these units are subdivided lithologically and the order does not imply age relationships within the groups.*

[f] *May include some intrusive rocks.*

† *Occurs only on companion sheet.*

SYMBOLS

Glacial striae.
Esker.
Small bedrock outcrop.
Area of bedrock outcrop.
Bedding, top unknown; (inclined, vertical).
Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
Lava flow; top (arrow) from pillows shape and packing.
Schistosity; (horizontal, inclined, vertical).
Gneissosity, (horizontal, inclined, vertical).
Foliation; (horizontal, inclined, vertical).
Shearing; (inclined, vertical).
Lineation with plunge.
Geological boundary, position interpreted.
Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
Lineament.
Drag folds with plunge.
Anticline, syncline, with plunge.
Drill hole; (vertical, inclined).
Vein. Width in inches.
MA *Magnetic attraction.*
Swamp.
Motor road. Provincial highway number encircled where applicable.
Other road.
Trail, portage, winter road.
Township boundary, with milepost, approximate position only.
5 *Mining property, surveyed.*
33 *Mineral deposit; mining property, unsurveyed.*
Surveyed line, approximate position only.

Map 2323
CHAMBERS AND STRATHY TOWNSHIPS
NIPISSING DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet

PROPERTIES, MINERAL DEPOSITS

CHAMBERS TOWNSHIP

1. *Cliffs of Canada Ltd. (Sherman Mine).*
2. *Copperfields Mining Corp. Ltd.*
3. *Gilson, R. G.*
4. *Gilson, S. A.*
5. *Jones and Laughlin Steel Corp.*

STRATHY TOWNSHIP

6. *Ajax Minerals Ltd.*
7. *Bateman, Mrs. M. A.*
8. *Bousell, H. E.*
9. *Brown, T. D.*
10. *Chester, T. E.*
11. *Cliffs of Canada Ltd. (Sherman Mine).*
12. *Cominco Ltd.*
13. *Dolan, Patricia E.*
14. *Gillies Bros. and Co. Ltd.*
15. *Goddard, D. A.*
16. *Gordon, P. L.*
17. *Hayes, F. C.*
18. *Herbert, A. L., Estate.*
19. *Hermiston, L. J.*
20. *Hermiston. P. D.*
21. *Hermiston, P. D. [1950].*
22. *International Nickel Co. of Canada Ltd., The.*
23. *Jones, J. A.*
24. *Keevil Consultants Ltd.*
25. *Keevil, N. B.*
26. *Lake Beaverhouse Mines Ltd.*
27. *Lavinge, L.*
28. *Leslie, B. N.*
29. *MacVeigh, E. L.*
30. *MacVeigh, Mildred E.*
31. *Milne, William and Sons Ltd.*
32. *Morrison, W. G.*
33. *Net Lake occurrence.*
34. *New Athona Mines Ltd.*
35. *Norrie, L. B.*
36. *Norrie occurrence.*
37. *Penrose Gold Mines Ltd.*
38. *Percy, R. A.*
39. *Perron, A. E.*
40. *Perron, A. J., Estate.*
41. *Sey-Bert occurrence.*
42. *United Reef Petroleums Ltd.*
43. *Watkins, J. B.*

Information current to December 31st, 1970.

Only former properties on ground now open for staking are shown where exploration information is available—a date in square brackets indicates last year of exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by G. Bennett and D. G. Innes, Geological Branch, 1970.
Geology is not tied to surveyed lines.

Geological and geophysical maps and reports of mining companies.

Aeromagnetic maps 1491G, 1503G, Geological Survey of Canada.

Map 51e, Northeast portion of the Timagami Lake Area, Ministry of Natural Resources, (ODM), 1942.

Preliminary maps (ODM) P321, Haileybury Sheet, scale 1 inch to 2 miles, issued 1965; P666, Chambers Township and P667, Strathy Township, 1 inch to ¼ mile, issued 1971.

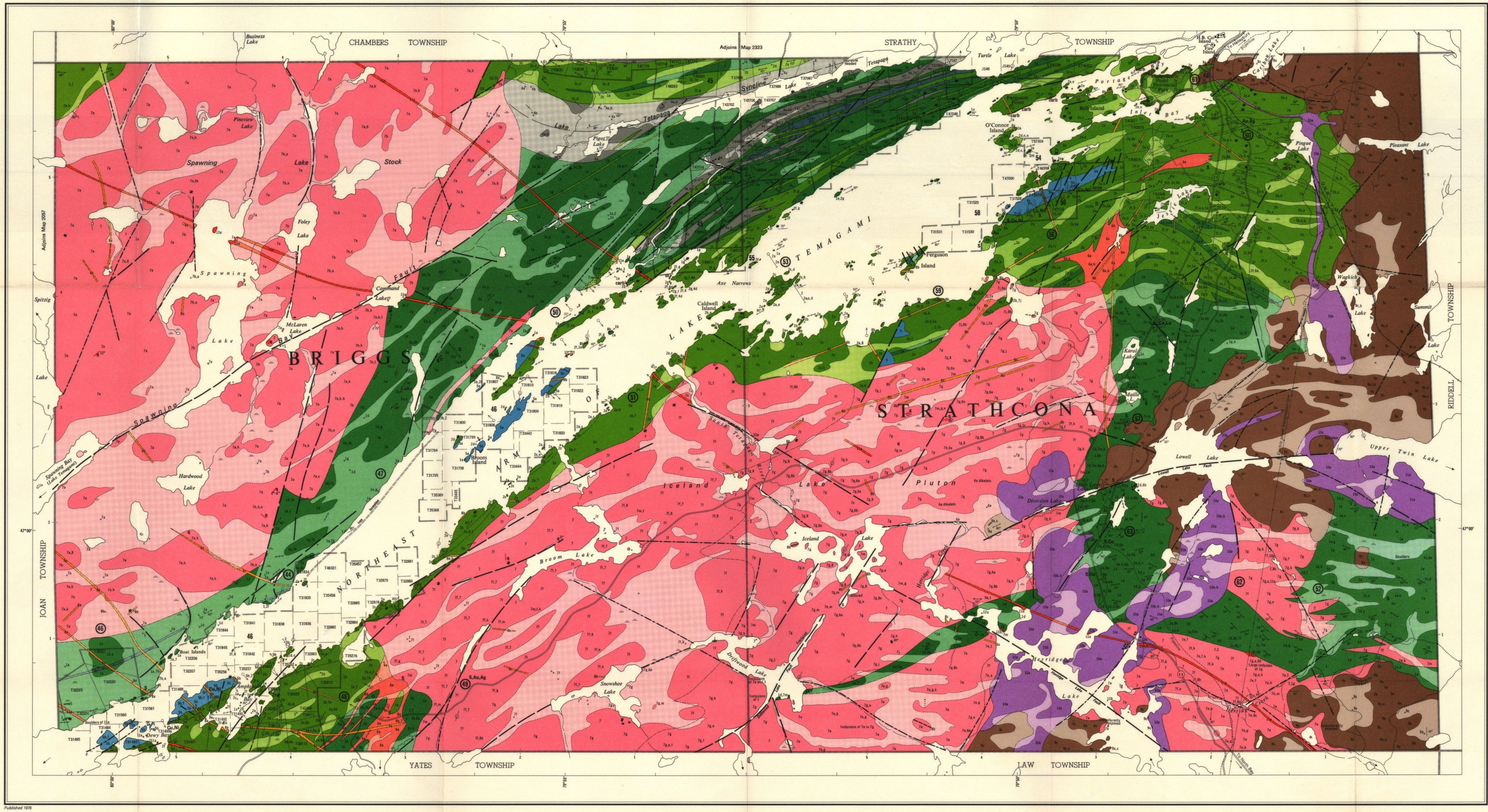
Cartography by P. A. Wisbey and assistants, Surveys and Mapping Branch. 1975.

Base maps derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by G. Bennett.

Magnetic declination in the area was approximately 9° West in 1971.

Map 2324
Briggs and Strathcona Townships

ONTARIO
DIVISION OF MINES
HONOURABLE LEO BERNIER, *Minister of Natural Resources*
DR. J. K. REYNOLDS, *Deputy Minister of Natural Resources*
G. A. Jewett, *Executive Director, Division of Mines*   E. G. Pye, *Director, Geological Branch*



Published 1976

LEGEND

PHANEROZOIC
CENOZOIC[a]
QUATERNARY
PLEISTOCENE AND RECENT
Swamp and stream deposits, till, sand and gravel.

UNCONFORMITY

PALEOZOIC[b]
CAMBRIAN (?)
12 *Carbonatite.*

INTRUSIVE CONTACT

PRECAMBRIAN[b]
LATE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS
11a *Olivine diabase (Sudbury type).*
11b *Granophyric diabase.*
11c *Intrusive breccia.*[c]

INTRUSIVE CONTACT

MIDDLE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS
(Nipissing Type)
10a *Quartz diabase, gabbro.*
10b *Pegmatitic gabbro, diorite.*

INTRUSIVE CONTACT

HURONIAN SUPERGROUP
COBALT GROUP
GOWGANDA FORMATION
9 *Unsubdivided.*
9a *Greywacke, siltstone, argillite.*
9b *Feldspathic quartzite.*
9c *Polymictic paraconglomerate, minor pebble and boulder conglomerate.*
9d *Sedimentary breccia.*

UNCONFORMITY

EARLY PRECAMBRIAN (ARCHEAN)
MAFIC INTRUSIVE ROCKS
8 *Unsubdivided.*
8a *Altered diorite and gabbro (dikes).*
8b *Chloritic mafic dikes.*
8c *Biotite and hornblende-rich lamprophyre.*

INTRUSIVE CONTACT

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS
GRANITIC PLUTONIC ROCKS
7 *Unsubdivided.*
7a *Porphyritic quartz monzonite.*
7b *Quartz monzonite.*
7c *Quartz monzonite, trondhjemite (border phase).*
7d *Trondhjemite.†*
7e *Hornblende trondhjemite, quartz diorite.*
7f *Hornblende-quartz diorite, trondhjemite.*
7g *Chlorite trondhjemite.*
7h *Quartz diorite, granodiorite (contaminated phases).†*
7j *Fine-grained leucogranite.*
7k *Aplite, pegmatite.*
7m *Hybrid rocks, agmatite, migmatite.*

INTRUSIVE CONTACT

HYPABYSSAL FELSIC INTRUSIVE ROCKS[d]
6a *Quartz porphyry.*
6b *Quartz-feldspar porphyry.*

INTRUSIVE CONTACT

INTERMEDIATE TO ULTRAMAFIC INTRUSIVE ROCKS
5 *Unsubdivided.*
5a *Diorite, quartz diorite (Broom Island diorite).*
5b *Altered gabbro, quartz gabbro (Temagami Island gabbro).*
5c *Gabbro, diorite, and altered equivalents.†*
5d *Serpentinite, pyroxenite, peridotite.†*
5e *Quartz diorite.†*
5f *Anorthositic gabbro.*

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS[e]
DETRITAL METASEDIMENTS
4 *Unsubdivided.*
4a *Lithic greywacke, siltstone.*
4b *Siltstone, slate (graphitic in part).*
4c *Conglomerate, volcanic conglomerate.*
4d *Tuffaceous sandstone.*

IRON FORMATION
3 *Unsubdivided.*
3a *Banded silicate-oxide facies.*
3b *Sulphide facies.*

FELSIC TO INTERMEDIATE METAVOLCANICS
2 *Unsubdivided.*
2a *Rhyolite.*
2b *Rhyodacite, dacite, minor andesite.*[f]
2c *Felsic volcanic breccia, tuff-breccia, minor agglomerate.*
2d *Felsic tuff, lapilli-tuff.*
2e *Carbonatized, sheared metavolcanics.*
2f *Intermediate volcanic breccia, tuff-breccia.*
2g *Intermediate lapilli-tuff, crystal tuff.*

MAFIC TO INTERMEDIATE METAVOLCANICS
1 *Unsubdivided.*
1a *Massive to foliated andesite and basalt.*
1b *Porphyritic andesite and basalt.*
1c *Pillowed mafic flows.*
1d *Fine-grained amphibolite, hornfels.*
1e *Amygdaloidal basalt and andesite.*
1g *Massive, coarse-grained amphibolite.*
1h *Mafic lapilli-tuff, agglomerate.*

Breccia

Ag	*Silver.*
Au	*Gold.*
carb	*Carbonate.*
Ce	*Cerium.*
Cu	*Copper.*
gn	*Galena.†*
La	*Lanthanum.*
Mo	*Molybdenum.†*
mo	*Molybdenite.†*
Ni	*Nickel.*
Pd	*Palladium.†*
Pt	*Platinum.†*
q	*Quartz.*
qc	*Quartz-carbonate.*
S	*Sulphide mineralization.*

[a] *Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured parts of the map.*

[b] *Bedrock geology. Outcrops and inferred extensions of each rock map unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show colour a short black bar appears in the appropriate block.*

[c] *May also include older breccias.*

[d] *May include rocks equivalent in age to metavolcanics.*

[e] *The rocks of these units are subdivided lithologically and the order does not imply age relationships within the groups.*

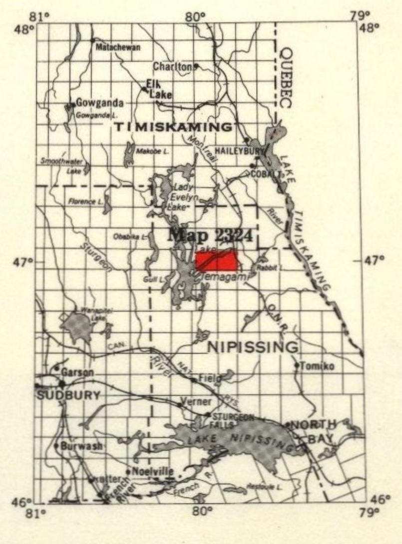
[f] *May include some intrusive rocks.*

†Occurs only on companion sheet.

Map 2324
BRIGGS AND STRATHCONA TOWNSHIPS
NIPISSING DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet



Scale, 1 inch to 50 miles
N.T.S. Reference
31L/13,31M/4, 41I/16,41P/1

SYMBOLS

Glacial striae.
Esker.
Small bedrock outcrop.
Area of bedrock outcrop.
Bedding, top unknown; (inclined, vertical).
Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
Lava flow; top (arrow) from pillows shape and packing.
Schistosity; (horizontal, inclined, vertical).
Gneissosity, (horizontal, inclined, vertical).
Foliation; (horizontal, inclined, vertical).
Shearing; (inclined, vertical).
Lineation with plunge.
Geological boundary, position interpreted.
Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
Lineament.
Drag folds with plunge.
Anticline, syncline, with plunge.
DH *Drill hole; (vertical, inclined).*
12″ *Vein. Width in inches.*
MA *Magnetic attraction.*
Swamp.
11 *Motor road. Provincial highway number encircled where applicable.*
Other road.
Trail, portage, winter road.
3 *Township boundary, with milepost, approximate position only.*
58 *Mining property, surveyed.*
52 *Mineral deposit; mining property, unsurveyed.*
Surveyed line, approximate position only.

PROPERTIES, MINERAL DEPOSITS

BRIGGS TOWNSHIP

44. *Bunker Hill Extension Mines Ltd. [1957].*
45. *Cliffs of Canada Ltd. (Sherman Mine).*
46. *Copperfields Mining Corp. Ltd.*
47. *Copperfields Mining Corp. Ltd. (Geoscientific Prospectors Ltd.) [1952].*
48. *Niemetz, H. (Nickel Rim Mines Ltd., option) [1965].*
49. *Snowshoe Lake occurrence.*
50. *Titanic Construction Co. Ltd. [1962].*
51. *Wicken N. A. [1953].*

STRATHCONA TOWNSHIP

52. *Agnico Mines Ltd. [1956].*
53. *Andover Mining and Exploration Ltd. [1956].*
54. *Armex Ltd.*
55. *Cliffs of Canada Ltd. (Sherman Mine).*
56. *Copperfields Mining Corp. Ltd.*
57. *Graber, K.*
58. *Milestone Explorations Ltd.*
59. *Nickel Rim Mines Ltd. [1956].*
60. *Pingue Lake occurrence.*
61. *Portage Bay occurrence.*
62. *Sabourin, R.*
63. *Savard, L.*

Information current to December 31st 1970.

Only former properties on ground now open for staking are shown where exploration information is available—a date in square brackets indicates last year of exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by G. Bennett and assistants, Geological Branch, 1969.
Geology is not tied to surveyed lines.

Geological and geophysical maps and reports of mining companies.

Aeromagnetic maps 1490G, 1491G, 1502G, 1503G, Geological Survey of Canada.

Map 51e, Northeast portion of the Lake Timagami Area, Ministry of Natural Resources, (ODM), 1942.

Preliminary maps (ODM) P321, Haileybury Sheet, scale 1 inch to 2 miles, issued 1965; P595, Briggs Township and P596, Strathcona Township, 1 inch to ¼ mile, issued 1970.

Cartography by P. A. Wisbey and assistants, Surveys and Mapping Branch, 1975.

Base maps derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by G. Bennett.

Magnetic declination in the area was approximately 9° West in 1971.