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Geology of Highstone Lake-Miniss Lake Area

Districts of Kenora and Thunder Bay

By

P. P. HUDEC

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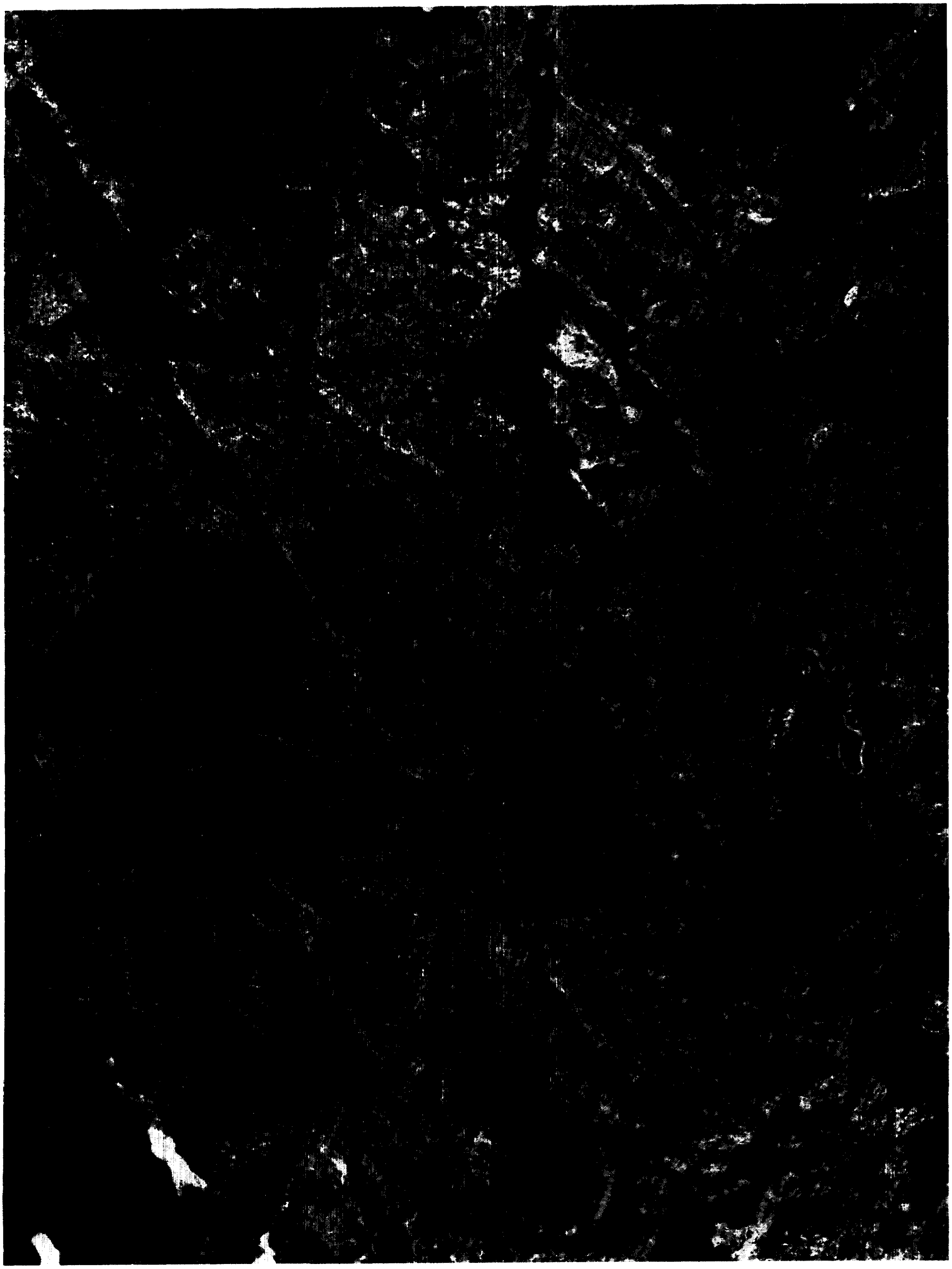

Air photo (A13875-95) showing Carling Lake and part of Ragged Wood Lake. *(Courtesy* Royal Canadian Air Force.*)*

ABSTRACT

The report is based on a reconnaissance geological survey of an area of 1,100 square miles, the centre of which is about 50 air miles northeast of Sioux Lookout, Ontario.

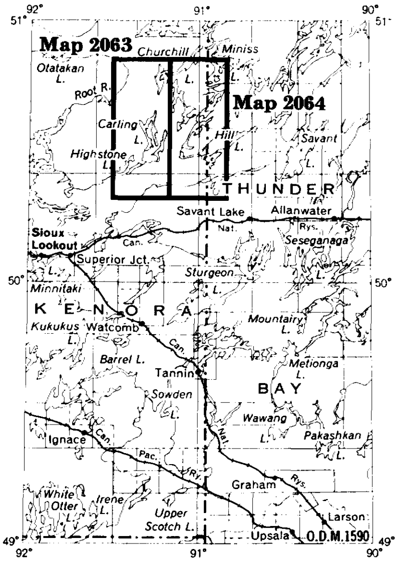

Fig. 1—Key-map showing the location of the Highstone Lake–Miniss Lake area. Scale, 1 inch to 50 miles.

All bedrock in the area is Precambrian in age and consists of remnants of dacitic volcanic rocks and metasediments enclosed in granitic batholiths of two ages. The metasediments are quartzo-feldspathic, biotite-rich. The older granitic rocks are granodioritic to quartz dioritic in composition, and the younger are microcline granites. The white colour of the feldspar is characteristic for the older granitic rock, while pink- and red-coloured feldspar predominates in the younger granite. All stages of transition between the above rock types can be seen.

The area has been glaciated and is covered by a mantle of sand, till, and varved clay.

Wide-scale faulting has dissected the area into angular blocks. A wide, well-defined fault zone trends in a northeasterly direction across the area.

Several shear zones in the metasediments are mineralized, and some massive iron sulphide deposits are from 5 to 200 feet wide. Disseminated sulphide mineralization is found in the volcanic rocks.

Highstone Lake–Miniss Lake Area

By

P. P. Hudec[1]

INTRODUCTION

The Highstone Lake–Miniss Lake area described in this report has an areal extent of about 1,100 square miles, the greater portion of which lies in the District of Kenora (Patricia Portion), but the eastern strip of about 9 miles wide lies in the Thunder Bay District. The area is covered by the National Topographic Series Sheet No. 52J, Sioux Lookout.[2]

Sioux Lookout, a divisional point on the Canadian National railway lies 30 miles southeast of the southwest corner of the map-area. The south boundary of the map-area is about 15 miles north of the main Canadian National railway line. Located by co-ordinates, the area lies between Lat. 50°22′30″N. and 50°52′30″N. and Long. 90°45′W. and 91°30′W.

The field mapping was carried out during the summer of 1959. The base maps used in the field were the Forest Resources Inventory sheets of the Ontario Department of Lands and Forests, which were reduced to the scale of 1 inch to ½ mile by the Cartography Unit of the Ontario Department of Mines. The mapping was done on perfatrace overlays to which the shore line and pertinent information were transferred from the base maps. The geological data were then transferred to the base maps. The original geological map was redrawn to the scale of 1 inch to 1 mile, the geology generalized, and issued as preliminary map No. P.54 (1960). The transitional nature of the rocks, and the fact that within a small area a number of different rock types may be found, required grouping the rocks under one colour on the map on the basis of the most prominently exposed rock in the vicinity. Consequently, the map shows only a generalized picture of the lithologic types.

Vertical air photographs on the scale of 1 inch to 1 mile were used in the field to delineate major structures, and also as a guide in the preparation of the map. The method of survey was almost entirely shoreline mapping of all the accessible lakes, coupled with occasional traverses where required. Lakes and rivers are plentiful, allowing access to almost all parts of the district, and so

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[1]Graduate student, McGill University, Montreal, 1960.

[2]Published by the Canada Department of National Defence, and available from the Canada Department of Mines and Technical Surveys, Ottawa.

arranged as to give series of traverses with average spacing of 4 miles between each traverse. The outlying smaller lakes were visited and mapped by means of aircraft.

Recent prospecting and staking have been carried out in the southeastern portions and the southwest corner of the map-area. A group of 142 claims was held by McCombe Mining and Exploration Limited on zinc-copper-nickel-silver-molybdenum showings around Moose and Highstone lakes. A number of claims are known to have been staked on the greenstone and iron formations at Armit Lake. Other than this, no evidence of prospecting has been found in the rest of the area. Occasional hammer marks found on white granites and pegmatites at Churchill and Miniss lakes are probably remnants of the lithium rush of 1955–56.

Acknowledgments

The author wishes to express his appreciation to W. E. Wiley, S. M. Higgins, and P. F. Hamblin for their able assistance. Mr. Wiley, as senior assistant, was responsible for mapping about half the shoreline of the area.

The Sioux Lookout Division of the Ontario Department of Lands and Forests rendered many services for the field party, which included forwarding messages, requests and food orders by the district radio operators; pilots of the Air Service were very helpful.

Robert McCombe, consulting geologist, and Thomas A. Wood, the Mining Recorder at Sioux Lookout, deserve the author's thanks for their help and information.

Previous Geological Work

No previous work had been done in the main part of the area. Parts of Churchill Lake were mapped by means of rapid-track survey by E. L. Bruce in 1922 (Bruce 1923a), who named the lake, "Shekak". He classified the rocks as granites and gneisses and correlated them with similar rocks found at Lake St. Joseph. Parts of Armit and Hill lakes were mapped by E. S. Moore in 1910, and again in 1927 (Moore 1910, 1929), to determine the extent of the Savant Lake iron formations. The granitic rocks were not differentiated on the map and are classed as granites and gneisses.

Means of Access

Since no roads or trails exist in the map-area, the only means of access is by air or by water. Some portages are shown on maps No. 2063 (West) and No. 2064 (East). The area is drained by three river systems. The Vermilion River drains the southwestern part of the area westward and renders Highstone, Carling, Ragged Wood, and Moose lakes accessible by water via Lac Seul from Sioux Lookout. All portages around rapids on the river and between lakes are relatively short and well-cut. The portage between Attack Lake and Moose Lake is overgrown, but Moose Lake can be reached via Elam Lake and Moose Creek without much difficulty.

The Miniss River system drains the east half of the map-area northward. The major lakes made accessible by Miniss River are Hill, Armit, Lawson, Hooker, Vincent, and Miniss lakes. Downstream from Miniss Lake and immediately south of Lake St. Joseph, the Miniss River is joined by the drainage system of Churchill Lake. St. Raphael, Spirit, and Ghost lakes form part of this system. Miniss River empties into Lake St. Joseph north of the area.

Rapids at the outlet of Miniss Lake.

Root River, a major canoe route between Lac Seul and Lake St. Joseph, flows across the northwest corner of the area, draining into Lac Seul.

The Miniss River system and the Churchill Lake drainage system can be reached from Lake St. Joseph (north of the map-area); the two systems can also be reached from Sioux Lookout (south of the map-area) via the Marchington River and two short portages that connect Armit Lake with Fairchild Lake, a part of Marchington River system. A short well-cut portage leads from Vincent Lake over a low rise of land to Ghost Lake in the headwaters of the Churchill Lake system.

All lakes of the area can, of course, be reached by aircraft from bases at Sioux Lookout or Pickle Lake. The distribution of lakes and rivers thus makes all points within the area readily accessible.

Topography

Much of the topography of the area is governed by the bedrock. The general elevation of the district ranges from about 1,225 feet in the northwest to 1,280 feet in the southeast. The relief does not exceed 150 feet.

A wide fault-zone trending in a northeasterly direction through Hooker, Vincent, and eastern part of Miniss lakes, separates the area into two physiographic divisions. In the northwest section, the lakes and rivers are governed by the cross-cutting structural pattern of faults and joints. The lakes are narrow, characterized by steep shores and cliff faces, faithfully following the larger structural breaks and curving around the intersections of these in a highly angular fashion. The bays of adjacent lakes lie directly on strike with each other, and the intervening land is mostly low, swampy ground.

The structural control is not as pronounced in the southeastern part of the area. The rocks strike in about the same direction as the trend of glaciation, and although the same linear trend is still exhibited by lakes and rivers, the angular nature due to cross-joints is missing.

Two major swampy areas are found within the report-area. One is in the northwest corner, in the tributaries of the Root River. The country is flat, broken by an occasional granite knob or ridge. Varved clay, 10–20 feet thick, overlies the rocks, indicating that the area was once submerged under a glacial lake. The other low area, forming part of a washboard moraine, is found south of the Miniss River in the vicinity of Runway Creek. The closely spaced moraine ridges have resulted from till materials being deposited in crevasses near the edge of the ice during its retreat. These cracks formed when glacial lake waters buoyed marginal ice and cracked blocks of the main ice mass.

The Root River has gouged out a new channel, bypassing the old Lynx dam. Three dams were built on the river several years ago to facilitate moving of supplies from Sioux Lookout to Lake St. Joseph and beyond. The dams are not in use now and all but the Lynx dam have been broken through. The heavy rains in the spring of 1959 resulted in an unusually high water level throughout the area and were responsible for the eventual overflow of the small lake created by the Lynx dam. The new river bed shortens the course of Root River by about 1 mile, and is ¼ mile in length. The lake, dammed up by the Lynx dam, has completely disappeared, and the drop in water level has also dried up small, shallow, muskegy lakes farther upstream. Active erosion is going on, and the newly cut banks expose excellent sections of varved clays. The water is extremely fast along this part, making canoe travel up the river difficult.

Rock outcrop is abundant throughout most of the area, except in the above-mentioned low ground. As most of the rocks are granitic in composition and texture, they resist weathering well, and are exposed as knobs, ridges, hills and plateaus all through the area. Bush travel is not too difficult, except in areas of muskeg and windfall, and there are no recently burned areas nor older burns.

The remains of Flower dam on Root River.

Natural Resources

Fishing, and to some extent trapping are the chief exploited resources of the area. The local Indian residents have several summer camps along the lakes, and fish mostly for pickerel and whitefish. The fish are kept on ice until an aircraft flies them out for shipment by rail.

The wildlife is characteristic of these regions. The area is well known for its abundant moose population, and several were sighted by the field party. Waterfowl of several varieties abounds; the fish ducks are most plentiful, but the more desirable mallard and "wood" ducks are also found in large numbers.

The timber is mostly spruce, pine, birch, and poplar. Owing to the relative inaccessibility of the area, no logging has been done on a commercial basis except around Miniss Lake where a few stands of spruce were cut several years ago, and the logs floated down Miniss River to Lake St. Joseph.

A tourist lodge based at Sioux Lookout has its outpost cabins on Highstone Lake where vacationers, mostly from U.S.A., fish in the summer and hunt duck and moose in the fall. The numerous waterways attract many tourists and several canoeing groups were encountered during the summer.

Water power, if needed in the future, could be supplied by the following rapids: between Bury Lake and Mask Lake on the Vermilion River; between Arc and Miniss lakes, rapids at the outlet of Miniss Lake; and between St. Raphael and Churchill lakes. Of these, only the Miniss Lake outlet has a sufficient water volume to provide appreciable hydro power.

Indian Paintings

Old Indian paintings may be found on the cliffs that enclose the long, narrow arms of Carling and Vincent lakes. The paintings depict various scenes and objects of Indian life. Among the figures pictured are those of a dog, moose, warriors and handprints. According to Dr. S. Dewdney of the Royal Ontario Museum, who is currently making a study of them, the paintings are thought to be about 500 years old. They may be found on white-stained faces of cliffs where the rock has been worn smooth by waters from above, and are painted with a red organic dye. The paintings were reportedly made by young braves who were required to hang from the top of the cliff as they painted. Arrowheads wedged into the cracks in the rock, are also reported from the same area.

GENERAL GEOLOGY

All the bedrock of the area is Precambrian in age, and consists largely of a granitic complex, metasediments, and intermediate to basic volcanic rocks. All gradations of the above rock types were observed; the granitization, assimilation and migmatization has produced several intermediate hybrid rocks. The field classification of rocks was based primarily on lithology, biotite, and amphibole content, and plagioclase content, and (in the case of granites) on colour.

The oldest are the volcanic rocks, consisting mainly of dacites and greenstones. The contact metamorphism by the granite has formed amphibolite, and the shearing of the rock has produced a biotite schist. Two belts of iron formation are present within the main body of greenstone, composed of interbanded quartzite, greenstone, and magnetite. The volcanic rocks appear to have been intruded by a small mass of ultrabasic rock that consists entirely of olivine and its alteration products. The metasediments are considered to be younger than the volcanic rocks, although there is no definite field evidence to substantiate this statement. The two rocks were never found in contact. The paragneiss is composed of quartz, biotite and plagioclase, and as the granite content increases, it grades into a *lit par lit* gneiss. The use of the term *lit par lit* gneiss is largely descriptive, applying to a rock with sharply bordered bands of grey granodiorite and paragneiss, as distinct from a more diffusely banded grandiorite gneiss.

The granitic rocks of the area are divided into an older granodiorite and a younger microcline granite. The granodiorites are white to pinkish-grey and grey in colour and contain variable amounts of biotite and amphibole, depending on the amount of assimilated paragneiss. The total lack of potash feldspar in some areas gives rise to a rock of quartz dioritic composition. The pegmatite derived from the older granite cuts all rocks except the younger granite, and occurs as dikes, stocks and stringers. The younger granite is a pink to red microcline granite, which forms a large body trending northeast across the map-area. The varieties of the younger granitic rocks include coarse pegmatite, found cutting all rocks of the area, a fine-grained variety called aplitic granite and felsitic dikes and dikelets. The younger granitic rocks have affected all other rocks in the area by partial assimilation and granitization. Extensive areas of pink granodiorite gneiss and hybrid granite occur in the vicinity of the main body of granite.

At least two periods of faulting can be recognized. The earlier faulting accompanied the intrusion of the older granite, and some fault planes and joint fractures have been filled with grey granodiorite and pegmatite. In most cases there was renewed movement along the old fault planes, as indicated by the sheared appearance of grey pegmatites. Crushed and mylonitized rock along the Miniss River Fault zone, composed of all rocks in the area, indicates that repeated movements occurred during and after the emplacement of the last intrusion.

Some evidence of folding was obtained from the paragneisses, which have been folded into a series of narrow isoclines. However, an over-all regional picture of folding has been obscured by the intrusions.

During Pleistocene times the area was glaciated, and the ice sheets left a mantle of sand, gravel and varved clay distributed unevenly over the rocks.

The classification of the rocks is summarized in the accompanying table:

TABLE OF FORMATIONS

CENOZOIC

RECENT: Lake and stream deposits, swamp and muskeg accumulations.

PLEISTOCENE: Clay, sand, gravel, boulders.

Unconformity

PRECAMBRIAN

GRANITIC ROCKS

Younger Granitic Rocks

Pink microcline pegmatite, quartz veins and dikes, rhyolite and rhyolite porphyry (dikes).
Aplitic microcline granite.
Red and pink microcline granite, alkali granite, quartz monzonite.
Hybrid granite.
Pink biotite granodiorite.
Pink granodiorite gneiss, alkali granite gneiss.

Intrusive Contact

Older Granitic Rocks

Pink granodiorite.
Grey alkali pegmatite.
Grey granodiorite, monzonite, quartz diorite.
Grey hybrid granodiorite.

Intrusive Contact

Hybrid Gneisses

Grey granodiorite gneiss.
Lit par lit gneiss, garnetiferous.

METASEDIMENTS

Paragneiss (biotite-quartz-plagioclase gneiss).
Biotite schist.
Quartz amphibolite.

Possible Unconformity

ULTRABASIC ROCKS

Dunite.

VOLCANIC ROCKS

Greenstone, dacite.
Chlorite schist.
Iron formation, quartzite.

Volcanic Rocks

The volcanic rocks, a continuation of the Savant Lake volcanic belt, are present in the southeast corner of the area at Armit Lake. The rocks consist of massive greenstone, dacite, chlorite schist, quartzite and iron formation.

The finer-grained volcanic rocks were more susceptible to shearing and occur as more or less schistose bands and plates. The quartz content is about 10 percent; plagioclase of labradorite composition forms 50–60 percent of the rock; the rest is made up of either biotite, or hornblende, and in extreme cases chlorite, depending on the degree of shearing and recrystallization.

Quartzites are found on the northern edge of the greenstone area. The rock is fine-grained, somewhat arkosic, and is interbedded with greenstone. No reliable sedimentary features were found from which the attitude of the beds could be determined. A narrow, highly schistose band of greenstone borders the quartzites on the north. Numerous quartz veins, some of them mineralized with sulphides, have intruded the greenstone along the planes of schistosity. To the south, the quartzites pass into greenstone by the increased proportion of greenstone interbeds. A structure reminiscent of the sedimentary boudinage was observed in the banded quartzites, possibly caused by rapid loading of the sand on the still unconsolidated volcanic flow or mud. The quartzite and greenstone layers curve around larger inclusions of greenstone, which may represent volcanic ejecta.

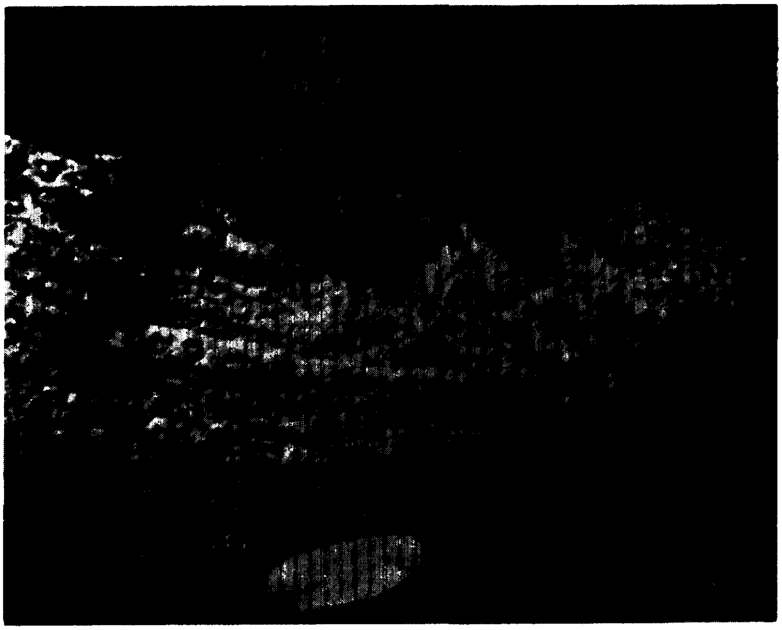
The belts of iron formation consisting of banded quartzite and magnetite have been mapped and described by Moore (1910). The iron is in the form of small, equant grains of magnetite, interbedded with quartz. Under the microscope, the quartz shows evidence of recrystallization, but is distinctly granular in the vicinity of the magnetite bands. The magnetite is bordered by and enclosed in green pleochroic hornblende. The rock is banded in the sense that the larger bands, those ¼–1 inch wide, are parallel and more or less continuous. However, closer examination shows that the bands are irregular, and magnetite concentrations cut across from one band to another and form local pods, swells, and pinchouts.

Ultrabasic Rocks

The rock is brown-weathering, but dark green in a fresh sample, with reddish specks of hematite. It is considered to be an altered dunite mainly because of the lack of feldspathic constituents, or possibly a coarse-grained, ultrabasic equivalent of the volcanic rocks. In thin section the rock is composed of olivine remnants set in a matrix of olivine alteration products—serpentine, fibrous and platy amphiboles and chlorite. The serpentine normally occurs in direct association with the olivine, filling the numerous cracks. Cummingtonite and grunerite make up the rest of the rock and are seen replacing olivine. Chlorite is developed in minute bands that cut across the rock and is probably the result of later, low temperature alteration. Magnetite and sulphides occur throughout the rock, but tend to be concentrated in the chlorite bands. Of considerable interest is the high nickel count obtained by x-ray fluorescence, roughly equivalent to 0.1 percent nickel content.

Metasediments

The metasediments, mainly paragneiss, biotite schist, and quartz amphibolite, are present throughout the area, but are more prevalent in the northern parts of the map-area. The commonest rock type is a paragneiss composed of varying amounts of biotite, quartz, and plagioclase (An_{35}).



Isoclinally folded, overturned paragneiss, lower Churchill Lake.

The paragneisses are remarkably constant in composition. The predominance of biotite in the majority of the rocks gives them an over-all dark appearance that easily distinguishes them from all other rocks. Lighter-coloured varieties, with correspondingly less biotite, are found in scattered localities. With decreasing biotite content, the rock loses its foliated nature and resembles an impure sandstone or quartzite or greywacke. The latter is found only at two localities, at the lower west arm of Carling Lake and on the U-shaped island in the north-central part of Miniss Lake. An arkosic rock, associated with the lighter-coloured metasediments, is found to grade into granite gneiss. It could be a granitized metasediment.

The more metamorphosed equivalents of the metasediments pass into quartz amphibolite. The hornblende is green-brown in colour, strongly pleochroic, and occurs in association with biotite from which it is apparently derived. Calcite, augite, apatite and epidote occur as minor constituents. Biotite and amphibole schists are found in the many shear zones throughout the area. Magnetite is the chief metallic mineral found in the shear zones; but sulphide mineralization, as pyrrhotite, with traces of chalcopyrite, sphalerite, and molybdenite, is sometimes present.

Hybrid Gneisses

Lit Par Lit Gneiss

Paragneiss with abundant *lit par lit* bands of granitic material is called *lit par lit* gneiss. The rock is composed of alternating bands of paragneiss and granite or granodiorite. The bands are on the average 1–6 inches wide; the boundary between the bands is sharp, and well-defined. The *lit par lit* gneisses are found in abundance west of the Miniss River Fault zone, but are not as common east of the fault. They are best exposed in the northern third of the area around Churchill and Miniss lakes.

Lit par lit gneiss, Trudy Lake.

The question whether the granitic bands represent a *lit par lit* replacement in the true sense of the term or were "sweated" out of the metasediments during the course of metamorphism can be answered by considering the association of these rocks with the granitic bodies. Wherever they occur, there is an intrusive body in the vicinity. The bands have the exact mineralogical composition and texture of the intrusive bodies; frequently, the bands are pegmatitic. The quartz-biotite bands are similar to the bulk of the metasediments already described, and "sweating" alone could not produce sufficient volume of rock of granitic composition. The amount of granitic material in the *lit par lit* gneisses ranges from 10 percent in the paragneiss end to 70 percent in the more granitic gneisses. No doubt metamorphic differentiation has contributed to the formation of these gneisses, but the proximity of the intrusions and the striking similarity of granitic bands to the intrusion leaves no doubt that there was a transfer of material from it to the gneisses. The transfer was effected either by direct intrusion along schistosity planes or by diffusion and granitization, or both. The granitic and often pegmatitic appearance of the lighter bands would suggest *lit par lit* intrusion as the main method of formation of these rocks.

Garnets are well developed in the areas of *lit par lit* gneisses. Small grains occur abundantly in the quartz-biotite bands, and crystals up to 1 inch in diameter can be found in the granitic bands.

Grey Granodiorite Gneiss

With the increased grade of metamorphism, the *lit par lit* gneisses grade into more diffuse, banded gneisses. However, since the composition of the two rocks is essentially the same, they are grouped under the same colour on the map.

The granodiorite gneiss predominates in the southeast portion of the area, east of the Miniss River Fault zone. The gneiss probably represents the more deeply buried portions of the metasediments which were subjected to intrusion, replacement and assimilation by the older granitic rocks. The biotite has recrystallized to much coarser plates. Plagioclase occurs as porphyroblasts throughout the rock. Garnet still persists, but is less common in more siliceous rocks. Epidote is a rather common accessory mineral of the gneisses, occurring as interstitial grains between the larger plagioclase crystals.

Both the *lit par lit* gneiss and the grey granodiorite gneiss occur as large inclusions in the grey granodiorite, in which they may be partially assimilated or show up as sharply defined bodies. The problem of assimilation of these biotite-rich rocks is perplexing. The inclusion may have sharp borders with the granite on one side, while the other side grades gradually into the granite. The highly contorted appearance of the gneissic bands (ptygmatic folding) indicates that the rocks have come from great depths where fairly plastic conditions existed.

In thin section the rocks appear to be recrystallized cataclastics. The larger feldspar grains are surrounded by granulated quartz and feldspar and curving flakes of biotite.

Occasionally, concentration of iron in the biotite bands gives rise to magnetite stringers which parallel the bands. The only noteworthy concentration of this type is found at the east end of Bury Lake south of the prominent linear. The magnetite bands are a few inches in width, across a total width of about 3 feet. Pyrite is also found in the gneisses, and where present, it tends to stain the rock, especially the feldspars.

Partial assimilation of the sheared volcanic rocks has resulted in a quartz-chlorite gneiss. The rock is exposed in the southeast part of Armit Lake and along the Miniss River Fault zone. It is highly mylonitized and shows strong flaser structure. Very little recrystallization is evident; the quartz grains, biotite and chlorite comprise the groundmass, whereas the plagioclase crystals stand out as phenoblasts.

Granitic Rocks

Granitic rocks occupy the greater part of the area, and have a strong influence on all other rocks and each other. It was suspected that two ages of intrusion could be discerned in this area, but no real proof of this can be offered. It is evident from the description of the granites from the Sioux Lookout area (Hurst, 1933, pp. 14–16), the Superior Junction–Sturgeon Lake area (Horwood, 1938, pp. 8–11), the Sturgeon Lake area (Graham, 1931, pp. 42–45), the Lake Savant area (Moore, 1929, pp. 64, 65), and the Lake St. Joseph area (Bruce, 1923b, pp. 19–21) that the granites mentioned belong to the same periods of intrusion, if not to the same intrusive bodies as those of this area.

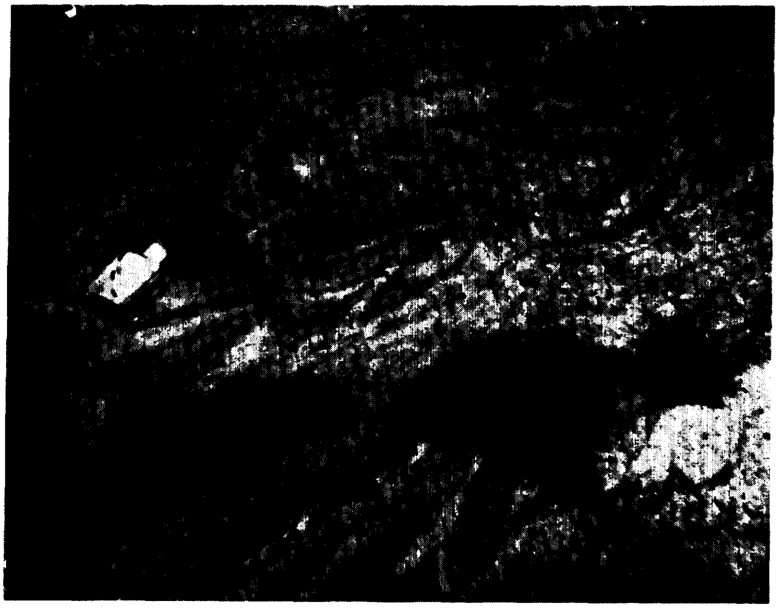
Two ages of granite were generally recognized in all but the St. Joseph areas. The older intrusive rock has been described as grey to pinkish-grey granite and granodiorite and gneiss, whereas the younger intrusive rock is some variety of pink and red microcline granite and gneiss. These observations are in accord with those made in the present area. However, the relationship of the older intrusive to the metasediment was interpreted incorrectly. Horwood (1938), and also Williamson and Hudec (1959) were led to the conclusion that because the metasediments and the older granite were not found in contact and the metasediments are of similar granitic composition, the older granite may have been intruded before the sediments were deposited. The relationship of the older intrusion to the metasediments as described earlier in this report clearly shows that the older granite is younger than the metasediments.

The validity of the argument depends on the correct identification of the rock as an older intrusion. There is good evidence for classification of the intrusive rocks in this area on the basis of colour rather than on local relationships, which are often misleading. Having examined granites in the Wapesi Lake–Tully Lake area and in this area for the past two field seasons, the author found it axiomatic that the pink or red variety of granites represents the younger, and the grey and white granodiorites the older intrusive rocks. Both the younger and the older granitic rocks in their pure form are remarkably free of dark minerals. Some biotite and hornblende are found, but rarely more than 5 percent. However, the "pure" granites are found in the centres of the intrusive bodies and are relatively rare. The borders contain all proportions of assimilated biotite and sometimes amphibole. The older granitic rocks are much more basic than the younger granite, but the basicity depends largely on the amount of assimilated material.

Older Granitic Rocks

A major body of granodioritic to quartz dioritic rock is found in the northwestern part of the area, chiefly around the northern part of Carling, Kim, Churchill and Miniss lakes. The intrusion does not form one continuous body, but has areas of the metasediments associated with it. Scattered smaller bodies 1–2 miles wide are found enclosed in the wide, northeast-trending belt of the younger granitic rocks. At Armit, Hill, and Lawson lakes only remnants of the older granitic rocks are exposed, most of them having been converted to biotite and amphibole-biotite gneiss through the assimilation of the paragneisses.

Banded, garnetiferous grey granodiorite gneiss, St. Raphael Lake. Note the large garnet crystals in the lighter granitic bands.



Contorted grey granodiorite gneiss, Churchill Lake. Note the metasediment inclusion in the upper right corner.

The rock is composed of white plagioclase feldspar (which is responsible for its colour), quartz, and variable amounts of dark minerals, mainly biotite. The amount of assimilation seems to be the controlling factor for the anorthite content of the plagioclases. Although the calcium content of the paragneisses is low, it contributes markedly to the higher anorthite content of the plagioclases in the hybrid rocks. X-ray fluorescence tests for calcium show it most abundant in the paragneisses, virtually absent in the pure granites, but present in intermediate quantities in the hybrid rocks of the older granitic rocks.

All stages of assimilation may be observed. The prevalent method appears to be by *lit par lit* intrusion along minute schistosity planes and then general dissipation of the original rock into slightly linear, biotite-rich, hybrid rock. The process is accompanied by recrystallization of quartz, feldspar, and biotite. The rocks resulting from total assimilation of the quartz-biotite gneisses and showing very little of the original schistosity have been classed as hybrid granodiorite or quartz diorite. Owing to their transitional nature, they have not been differentiated on the map. In the vicinity of Carling Lake, the assimilation is rather patchy. This is due to the fact that not whole bodies, but a large number of various-sized inclusions of the older rock are involved in the process.

The pegmatites of the older granitic rocks are similar in colour and mineralogy to the main mass of the rock. They are always found associated with the border phases of the intrusion, intruding the paragneisses and granodiorite gneiss. The rock contains plagioclase and quartz, with minor biotite, tourmaline, and beryl. In larger bodies, the individual feldspar crystals may reach 2–3 inches in diameter. The dikes at Carling Lake are rather fine-grained, aplitic in part, but most of the dikes at Churchill Lake are coarse, in places zoned, with free quartz in the centre and plagioclase on the borders. The dikes are thought to be later than the main intrusion, coming up along cracks and joints developed in the partially solidified igneous mass.

The granodiorite gneiss and the hybrid quartz diorite mineral assemblage indicate that the temperature reached was that of the almandine-amphibolite facies conditions of regional metamorphism.

Younger Granitic Rocks

The younger granitic rocks, occupying a broad, northeast-trending belt through the centre of the area, were the latest rocks to form. They are pink to red in colour, range from fine-grained aplitic through to pegmatitic in grain-size, and are characterized by the presence of microcline feldspar. Like the older granitic rocks they are leucocratic varieties of granite containing very few ferromagnesian minerals. The granite is somewhat gneissic, especially in the general vicinity of the Miniss River Fault zone. Apparently, the intrusion was accompanied and followed by large regional adjustments that have resulted in large-scale block movements. That the movements persisted after the intrusion of the granite can be seen from the fact that the joints or faults seem to displace the granite mass into individual blocks. In the fault zone itself, the granite is streaked into what at first looks like flow structure. Closer examination and thin-section study reveal it to be a sheared augen structure. The rock can be called a flaser granite.

Pink Granodiorite Gneiss, Alkali Granite Gneiss

Like the older granitic rocks, the younger granite has had a wide zone of influence on the surrounding rocks. The most pronounced effect is the granitization of the paragneisses and the older gneisses into a pink granodiorite gneiss. The granitization apparently took place by potash metasomatism. The microcline is seen growing at the expense of the plagioclase feldspar through an intermediate step of myrmekite formation. Additional potassium is obtained from the decomposition of biotite, which breaks down into sericite and magnetite. A few grains of enstatite are also in evidence. There seems to be little change in the silica content of the rock.

The higher metamorphic grades of this rock, those closer to the intrusion proper, can be classified as granulites. Several characteristics point to this: the presence of antiperthite with the corresponding absence of microcline, the more abundant enstatite in place of biotite. The latter mineral is still present in ragged, dark-brown pleochroic plates, altering into enstatite and magnetite. X-ray diffraction indicates the presence of rutile and ilmenite in the rock, which may also have been derived by the alteration of biotite. Garnet, the other characteristic mineral of the granulites, is inexplicably missing. The texture of the rock is typically granulitic, somewhat lenticular, with rather coarse quartz alternating with layers of finely crystalline quartz and feldspar.

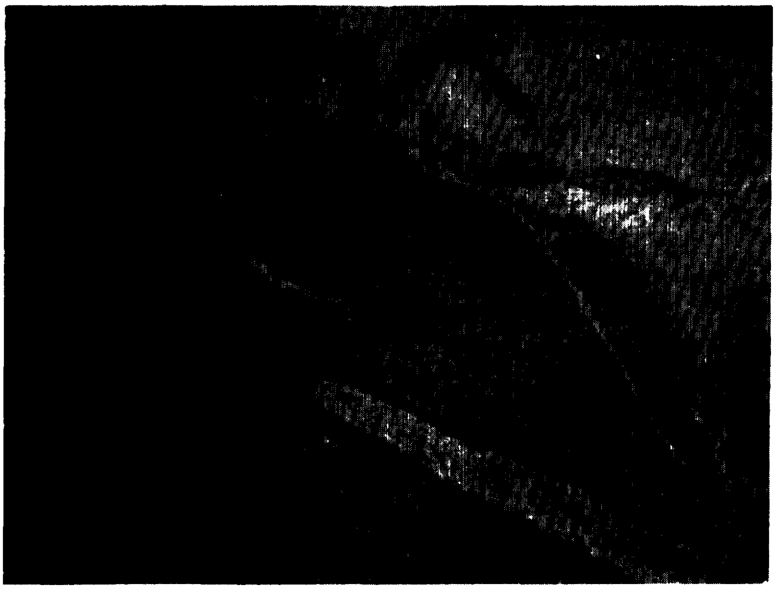
The presence of the pyroxene granulite facies in these quartzo-feldspathic gneisses indicates a water-deficient environment. In contrast to the older granitic rocks, amphiboles are rather uncommon, and biotite persists into the higher metamorphic grades. Equally interesting is the absence of garnet in these rocks, although they were derived from essentially the same, garnet-producing paragneisses. The inclusions of paragneisses, those that resisted granitization, have merely recrystallized and formed amphibole, pyroxene and no garnet. Similar inclusions in the older granitic rocks are highly garnetiferous. However, small garnet grains develop in rocks derived from the older granodiorite gneisses. The garnet is thought to have been already formed before the intrusion of the younger granite.

It is not clear whether the formation of garnet is a factor of the original composition of the metasediments or whether it is due to the composition of the intrusion and its water and silica content.

Pink Biotite Granodiorite

Recrystallization of the above gneiss produced a biotite-rich massive rock. It is similar mineralogically to the pink granodiorite gneiss, except that the texture has lost most of its linearity. The presence of antiperthite and enstatite in some thin sections indicates that the rock has recrystallized from the granulite gneiss.

The field relationships of this rock are somewhat uncertain. It has an "old" appearance, and is cut by the younger granite and pegmatite dikes. Large inclusions of the rock are found in the microcline granite, suggesting at first that the rock is much older. However, its gradation from the granodiorite gneiss, the characteristic presence of potash feldspar, and over-all pink to reddish colour classify it as a granitized, recrystallized rock. Similar rock in the Wapesi Lake–Tully Lake area has been called "hybrid granite".



Large inclusion of pink biotite granodiorite in the pink microcline granite, Spirit Lake. The light tone of the granite is well contrasted against the biotite-rich granodiorite.

Pink Microline Granite

The intrusive body itself is a pink, microcline granite, composed of quartz, microcline and very few flakes of biotite. The border phases of the granite grade into a granite gneiss with corresponding increase in the biotite and plagioclase content. Such rock of faint gneissosity has been termed the younger hybrid granite. This is not to be confused with the hybrid granite of the older granitic rocks, or what has been called the hybrid granite in the Wapesi Lake-Tully Lake area.

A fine-grained, aplitic variety of microcline granite is found at Highstone and Bury lakes, intruding the paragneisses. Besides the usual microcline and quartz, the granite contains finely disseminated flakes of biotite. The biotite is being replaced by quartz, liberating magnetite and hematite stain. The rock is commonly found in the neighbourhood of shear zones containing massive magnetite and sulphides. The granular, even-grained texture of the rock and sericitized remnants of plagioclase feldspar suggest that it is a result of a thorough replacement or granitization of the paragneiss by the granite. If this is the case, the magnetite and sulphides could have been driven out of the paragneiss and deposited in the shear zone. This, however, is purely a speculation.

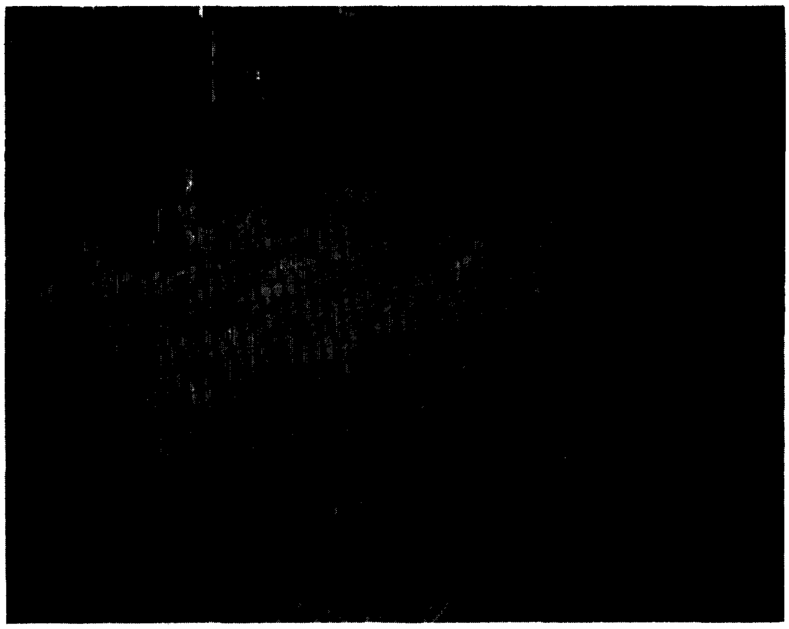
Inclusion of paragneiss in pegmatitic pink microcline granite, upper Highstone Lake.

Dikes of red granite cutting grey granodiorite gneiss, Armit Lake.

Felsitic dikes, thought to belong to the younger granitic rocks because of their pink colour, intrude the granodiorite gneiss of Armit and Hill lakes. The dikes range in thickness from a few inches to 2 feet. Coarse pink pegmatites, composed entirely of quartz and microcline, cut all the rocks of the area as dikes or as massive stocks. Free magnetite is found occasionally where the pegmatite cuts the paragneiss. Tourmaline occurs in dikes at Flower dam on Root River. The rock is obviously a more volatile differentiate of the younger granitic rocks.

Pleistocene and Recent

The Pleistocene deposits cover the area in a mantle of varying thickness. The Root River area is covered by a thick section of varved clay, and it is assumed from the low relief of that section that these deposits occupy most of the northwest corner of the map-area. The varves are uniform, about 2 inches wide. The maximum thickness of the exposed clay is about 30 feet. The varved clay is best exposed along the new channel of the Root River.



Varved clays, Root River near Lynx dam.

In the southern part of the area, sand and silty clay are common. The country around Runway Lake forms part of a washboard moraine that extends south of the map-area. The washboard effect is best seen from air photographs, as on the ground the low parallel ridges responsible for the pattern are too small to be noticed.

A partly stratified quartz sand, brown to yellow in colour, overlies a light-tan to grey, massive lake clay. The sand is fine-grained and contains some magnetite. At Hooker Lake, and at Armit Lake the sand is exposed at the lake shore, as cliffs from five to twenty feet high; and several small beaches and sand spits have been derived from it.

A number of sand ridges and eskers trend S.30°W., which is also the general direction of glaciation for the area. The most continuous esker has been traced, with interruptions for more than 12 miles along the Miniss River from Arc Lake to Hooker Lake. The esker contains clean gravel and sand and is well suited for construction purposes.

STRUCTURAL GEOLOGY

Folding

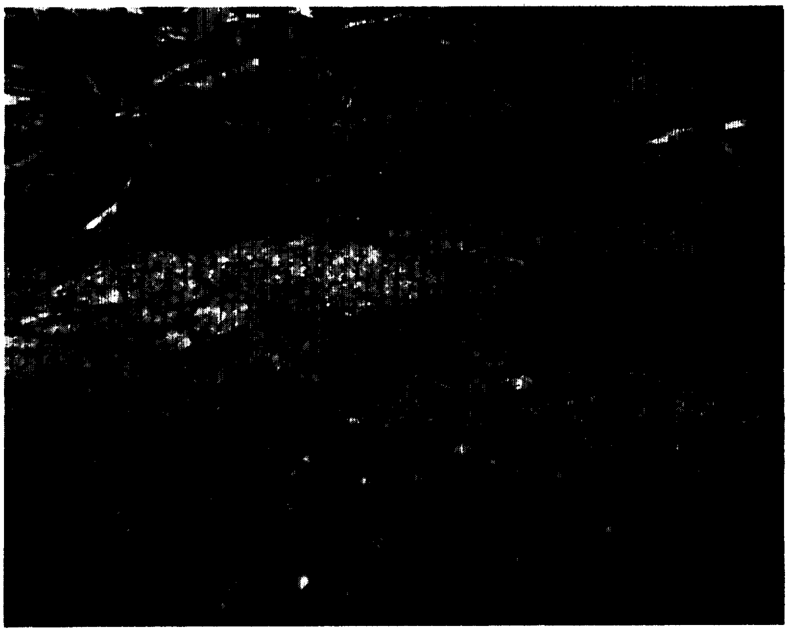
Although granitization and granite intrusion have obscured much of the original structure, it is apparent that intense folding took place both on local and regional scales. Locally, the paragneisses are folded into tight, overturned isoclinal folds. The surface expression of the folds is merely a paragneiss with uniformly parallel strike and dip, and unless the fold is exposed in cross-section it is completely overlooked.

Owing to the reconnaissance nature of the survey, the regional structure can only be inferred from air photographs. The abundant granites have effectively disrupted and obscured the major features. One definite large fold, presumably an anticline, can be clearly seen south of Bury Lake in the paragneisses and granite gneisses. Indistinct traces of large isoclinal folds can be discerned in the gneisses, but it would be difficult to establish these on the ground.

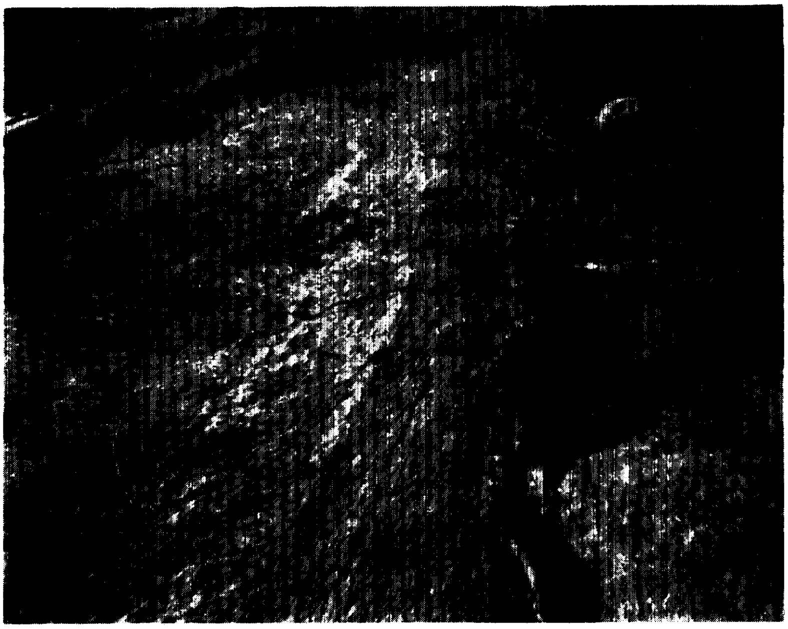
Large-scale dragfolds are indicated, associated with faults in Highstone and Carling lakes area. The strike of gneissosity of rocks along the direction of fault trace is nearly parallel; it is thought that the movements took place deep in the earth where the rock was still in semi-plastic state.

Faulting

Intense faulting has cut up the area into several large blocks. The faults find surface expression as roughly two intersecting systems of subparallel linears occupied by lakes and troughs. They are most prominent in the northwest half of the area. One system of faults strikes in the north-northeasterly direction from N.10°E. to N.30°E., roughly parallel to the Miniss River Fault zone. The other system of faults strikes from N.50°W. in the Highstone Lake area to N.30°W. in the Churchill Lake area.



Surface expression of Miniss River Fault zone, west shore of upper Hooker Lake. Finely ground rock in the upper portion, underlain by crushed and sheared pegmatite augen gneiss. A purer pegmatite lens at lower right.



Small fault in grey granodiorite. Fault plane filled with grey alkali pegmatite and quartz, Churchill Lake.

A wide and prominent fault zone, named the Miniss River Fault zone, is the major structural feature of the area. It traverses the map-area in a general northeasterly direction and can be traced, by linears, southwest towards Sioux Lookout and northeast past the eastern arm of Lake St. Joseph. The fault zone and the associated faults are of sufficient extent to have been plotted on the Tectonic Map of Canada, 1950 edition. On the ground, the fault zone can be recognized as highly sheared granite gneiss. Although the rock is sheared, it is massive, and the general impression is that of a ropy flow structure.

From the study of slickensides, the movement along the faults appears to have been principally in a vertical direction. If degree of metamorphism or granitization on the opposite blocks across the fault can be taken as evidence, then the faults can be classified as high-angle thrust faults. As an example, the northwest-trending west arm of Carling Lake divides a more metamorphosed east block from a less metamorphosed west block. The general dip of the joints or fault plane is about 65°E., indicating that the east block is the upthrown hanging wall. By all indications, the movement took place along several shear planes rather than along any one fault plane. The sheared mylonitized rocks are found extending several tens and sometimes hundreds of feet to each side of the fault. Lakes and depressions now occupy the zones of maximum shearing. Because of lack of marker horizons it is impossible to determine the magnitude of movement. An interesting occurrence of sheared greenstones in the Miniss River Fault zone suggests that the earth movements were of considerable magnitude, since the nearest greenstones found on strike are at Lake St. Joseph and near Sioux Lookout.

The strike of the rocks is affected by the fault movement, but in general it can be said that the strike of gneissosity is in an easterly and northeasterly direction. The dip is nearly always steep, from 65° to vertical, and because of this, only the direction of dips was entered on the map, except where the dips are less than 65°.

ECONOMIC GEOLOGY

It is only in the last few years that the area has received attention from prospectors and mining concerns. The greenstone extension at Armit Lake was staked in 1956, according to the date on claim posts, and staking continued through to 1958. As far as could be determined, the disseminated sulphide content of the greenstones, the mineralized quartz veins and possibly the iron formation were the reason for staking.

The quartz veins strike about N.14°W., roughly parallel to the contact of the greenstone with granodiorite. They are exposed in three places along the strike, and if assumed continuous, their lateral extent is more than half a mile. The width of the zone is about 100 feet. The quartz is white "bull" quartz, with some pyrite mineralization. A grab sample taken by the author from the best mineralized zone and assayed by the Laboratory Branch gave no gold and only a trace of silver. The disseminated sulphides, consisting mostly of pyrrhotite, assayed 0.09 percent nickel and no gold or silver. Of considerable interest is the ultrabasic intrusion found in the greenstones. Finely disseminated sulphides and the over-all nickel content of the rock warrant further field study. Due to the lateness of the season, the author was unable to do more than outline the shore exposures. A grab sample taken by the author of the iron formation at Armit Lake was analyzed by the Laboratory Branch as follows: 35.1 percent iron, 39.24 percent silica, and a trace of manganese, titanium, phosphorus pentoxide, and sulphur. Although the iron formation appears to be continuous for at least a mile, the width is too narrow to be of commercial interest.

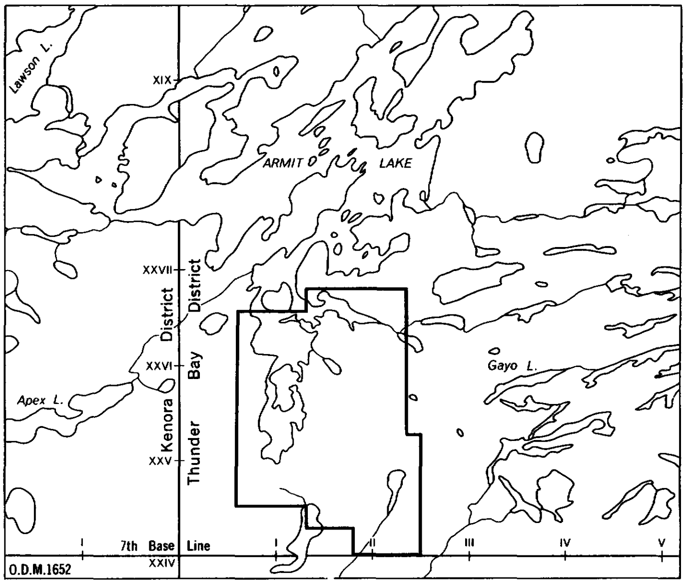


Fig. 2—Old iron location at Armit Lake.

The majority of claims around Armit Lake (*see* Figure 2) were staked in 1958, and by September 1959 no work appeared to have been done on them. The claims are now cancelled.

A distinctly different type of mineralization can be found in the paragneisses and granite gneisses of the area. The biotite of the paragneiss is partly metamorphosed into amphibole, and sulphides replace both the biotite and the amphibole. Veins of quartz, partly mineralized, are a constant associate of the mineralized shear zones. The mineralization is in the form of magnetite and pyrrhotite, with traces of nickel, copper and zinc sulphides. A trace of silver was also reported on analysis. The distribution of the shear zones in the area is erratic; the direction of shear is generally parallel to some major structure in the vicinity. There is little economic importance attached to the shear zones themselves, but further study of them may provide a clue to the massive sulphide deposits found at Bury and Moose lakes, or perhaps point a way to similar deposits elsewhere in this area.

Description of Properties

McCombe Mining and Exploration Limited

In 1959, McCombe Mining and Exploration Limited held a group of 6 claims on the south shore of Bury Lake and a block of 142 claims extending northeast from the southern extremity of Bury Lake to north of Moose Lake (*see* Figure 3). The property included the following claims (now cancelled): P.A. 24710 to P.A. 24810 inclusive; P.A. 24818 to P.A. 24824 inclusive; P.A. 25187 to P.A. 25204 inclusive; and P.A. 25223 to P.A. 25240 inclusive.

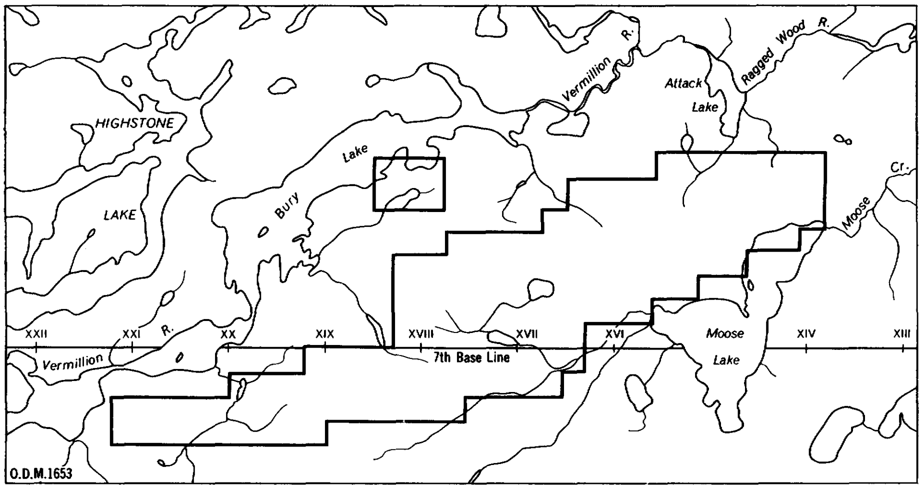


Fig. 3—Claim groups held by McCombe Mining and Exploration Limited in 1959.

On the Bury Lake group, the showing consists of massive sulphides embedded in highly siliceous rock and associated with quartz veins. The sulphide zone trends in a northeasterly direction, and has been exposed in trenches for a distance of 200 feet. In the southwest, the zone is about 10 feet wide, but narrows down to half that width in the last trench in the northeast. The deposits occupy a shear zone similar to the less spectacular zones in other parts of the area. The mineralization comprises massive pyrrhotite, pyrite, and magnetite, with traces of chalcopyrite, pentlandite, and silver. A grab sample taken by the author from the pits, and assayed by the Laboratory Branch gave 0.45 ounces per ton silver, 0.05 percent copper and 0.15 percent nickel.

The Moose Lake group covers a mineralized zone that has been exposed in trenches to about 150 feet in width. The mineralogy of the zone is similar to that of the Bury Lake showing, except that here, flakes of molybdenite are found. A distinct mineralogical zoning can be detected across the width. In trench No. 1, the distribution of sulphides is as follows from south to north:

Footage	Description
0–20	Pyrite and pyrrhotite, some magnetite.
20–40	Pyrite, pyrrhotite, and molybdenite.
40–60	Predominantly coarse pyrite.
60–80	Fairly siliceous with pyrite, pyrrhotite and some magnetite.
80–108	Siliceous with scattered pyrite and pyrrhotite.
108–128	Massive pyrrhotite, some magnetite.

Grab samples taken from the trenches were assayed, and the assay values supplied by Mr. McCombe are as follows: silver, 0.04, 0.12, 0.03 ounces per ton; copper, 0.05, 0.85, 0.05, 0.03 percent; zinc, 2.54 percent; molybdenum, 0.41, 0.02 percent; MoS_2 0.69, 0.03 percent; cobalt, trace.

The work done on the property to this date includes trenching and prospecting. In 1959, an aeromagnetic survey was flown over the area. The results indicate a series of anomalies both over and on strike from the showing, as well as scattered anomalies. The highest values obtained were from 400 to 500 gammas.

The origin of the massive sulphides can only be speculated upon. There are no basic intrusions in the immediate vicinity, and the acid volcanic rocks show no traces of any unusual metal content. Yet the sulphides were undoubtedly mobile at one stage or another. In a polished section, when viewed with a binocular microscope, the sulphides are present as rounded globules in quartz.

Semi-quantitative x-ray fluorescence analysis by the author of all types of rocks from the area shows that the metasediments contain appreciably more iron, nickel, copper and zinc than the granites. On the average 4–5 percent iron and 30–50 parts per million of zinc, nickel and copper were obtained from five samples of metasediments. There is a possibility that the massive sulphides could be of syngenetic origin. Or perhaps mobilization and concentration under metamorphism of the sulphides in the metasediments, was the effective agent in the formation of these deposits. The cursory examination does not permit more than suggestions as to the origin.

The order of deposition of the sulphides as indicated by polished section study is pyrite, and magnetite, followed by pyrrhotite. Chalcopyrite, pentlandite and sphalerite are probably contemporaneous with pyrrhotite. Molybdenite is latest, occurring in individual plates, generally suspended in quartz. The source of molybdenum was probably the younger granitic rocks, where the metal is found uniformly distributed. The molybdenum content of metasediments and other rocks is low or nil.

INTERPRETATION AND CORRELATION OF MAGNETIC DATA FOR PART OF HIGHSTONE LAKE-MINISS LAKE AREA[1]

General Magnetic Properties of Rocks

In general, the younger granites and associated rocks give higher magnetic values. This includes the rocks (5) and (6) designated on maps No. 2063 and No. 2064. The pink granodiorite gneiss and alkali granite gneiss (6a) give the highest readings.

The pink granodiorite gneiss (6a) gives variable response, and cannot be used satisfactorily in interpretation. The same holds true for the pink granite (6d). This rock gives occasional high values, but in general is indistinguishable from other rocks.

The pink granodiorite (5d) also gives high response, but not uniformly so.

Low magnetic response is recorded by the older granite (5) and the associated rocks (3) and (4). The response is fairly uniform, except in the northern part of the area where the grey granodiorite gneiss (4) gives slightly higher readings.

The metasediments (3) are generally featureless. In the extreme southeast part of the map-area a possible extension of the Savant Lake iron formation shows up as a very high magnetic anomaly (aeromagnetic map 1119G).

The structure as indicated by isomagnetic contours corroborates, in general, the structure obtained from air photographs and ground mapping.

The linears indicated on the map are found to displace the magnetic contours, and thus represent faults rather than joints. In some cases, some measure of displacement can be calculated. The large Miniss River Fault zone is well delineated and is the controlling feature of the magnetometric maps.

[1]Aeromagnetic maps of Ontario Dept. Mines and Geological Survey of Canada numbered: 900G, 901G, 910G, 911G, 1119G, and 1129G.

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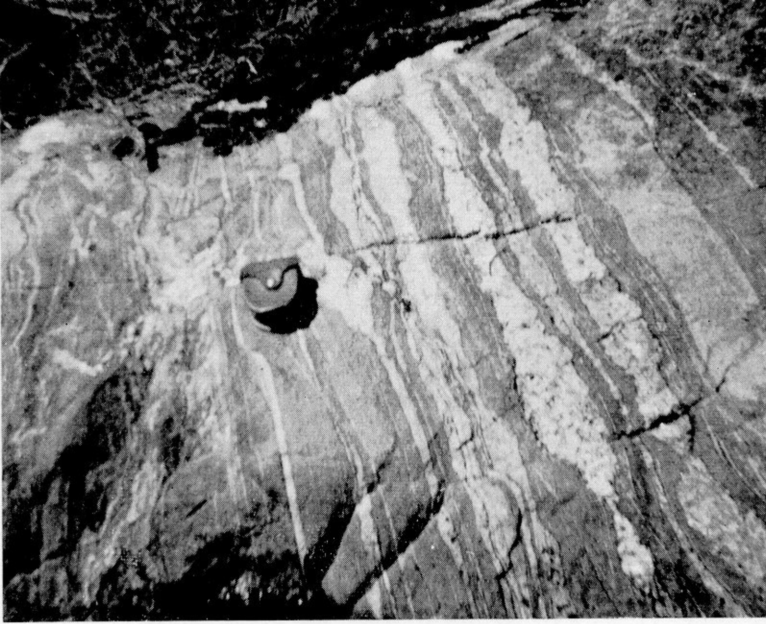

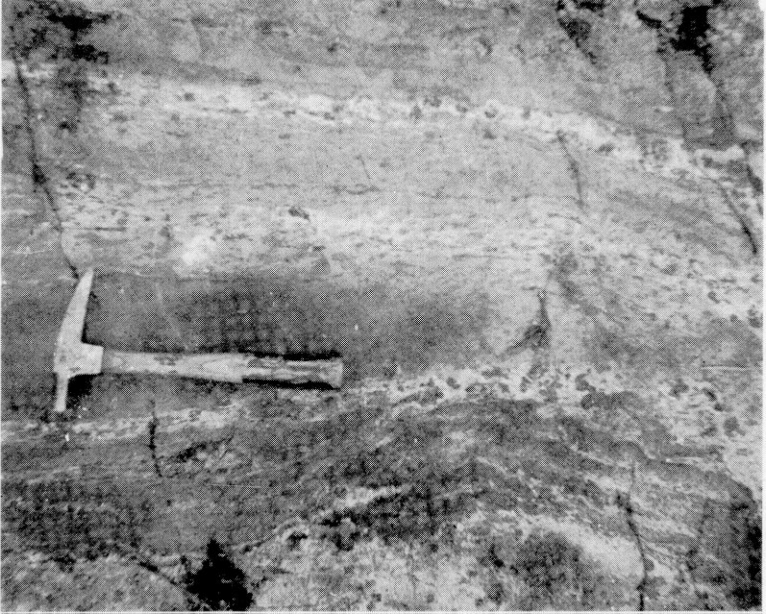

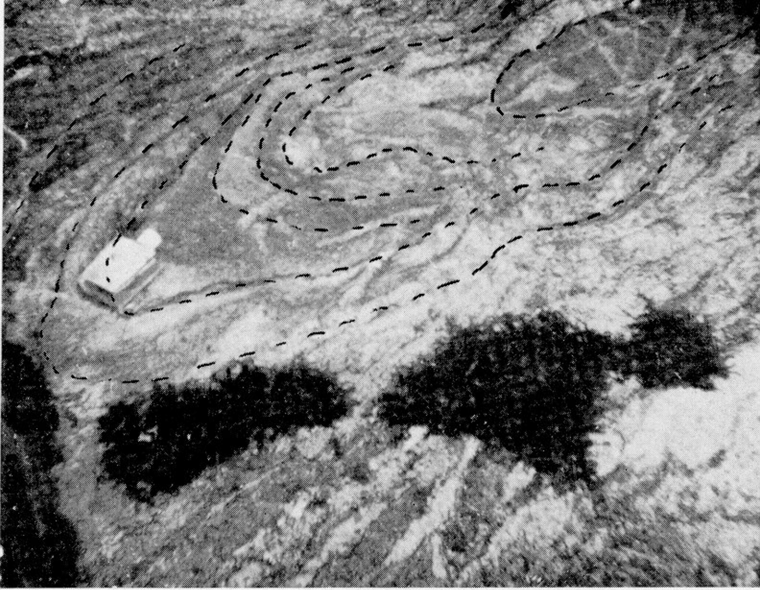

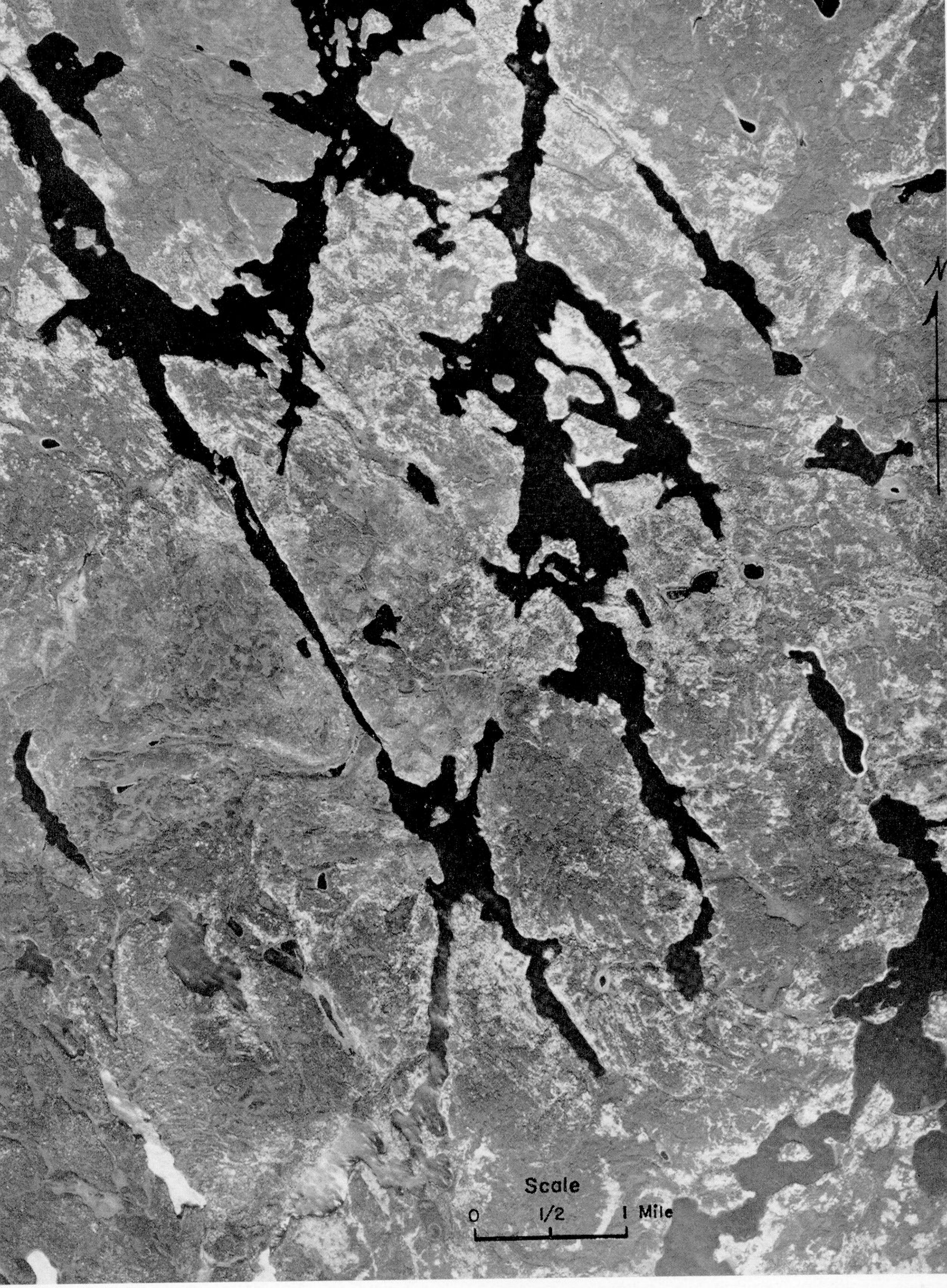
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0 1/2 1 Mile
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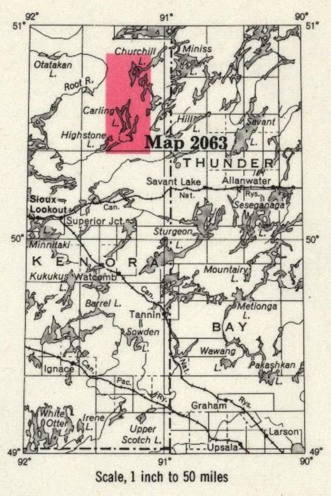
DEPARTMENT OF MINES

HON. G. C. WARDROPE, *Minister of Mines*
D. P. Douglass, *Deputy Minister* M. E. Hurst, *Director, Geological Branch*



Scale, 1 inch to 50 miles

N.T.S. reference 52/J

LEGEND

CENOZOIC*

RECENT
Lake and stream deposits, swamp and muskeg accumulations.

PLEISTOCENE
Clay, sand, gravel, boulders.

UNCONFORMITY

PRECAMBRIAN**

GRANITIC ROCKS

YOUNGER GRANITIC ROCKS

6
- *6f Pink microcline pegmatite, quartz veins and dikes, rhyolite and rhyolite porphyry (dikes).*
- *6e Aplitic microcline granite.*
- *6d Red and pink microcline granite, alkali granite, quartz monzonite.*
- *6c Hybrid granite.*
- *6b Pink biotite granodiorite.*
- *6a Pink granodiorite gneiss, alkali granite gneiss.*

INTRUSIVE CONTACT

OLDER GRANITIC ROCKS

5
- *5d Pink granodiorite.*
- *5c Grey alkali pegmatite.*
- *5b Grey granodiorite, monzonite, quartz diorite.*
- *5a Grey hybrid granodiorite.*

INTRUSIVE CONTACT

HYBRID GNEISSES

4
- *4b Grey granodiorite gneiss.*
- *4a Lit-par-lit gneiss, garnetiferous.*

METASEDIMENTS

3
- *3c Paragneiss (biotite-quartz-plagioclase gneiss).*
- *3b Biotite schist.*
- *3a Quartz amphibolite.*

POSSIBLE UNCONFORMITY

ULTRABASIC ROCKS

2
- *2a Dunite.*

VOLCANIC ROCKS

1
- *1d Greenstone, dacite.*
- *1c Chlorite schist.*
- *1b Quartzite.*
- *1a Iron formation.*

be	*Beryl*
Fe	*Iron*
mag	*Magnetite*
S	*Sulphides*
tour	*Tourmaline*

**Unconsolidated deposits. Cenozoic deposits are not differentiated on the map. For the most part they coincide with the lighter coloured and uncoloured parts of the map.*

***Bedrock geology. Outcrops and inferred extensions of each rock unit are shown, respectively, in deep and light tones of the same colour.*

Formation without colour in the legend block is mapped on the East Sheet.

SYMBOLS

- *Sand ridges, eskers.*
- *Small rock outcrop.*
- *Boundary of rock outcrop.*
- *Geological boundary, approximate or assumed.*
- *Strike of vertical schistosity.*
- *Strike of schistosity, dip unknown.*
- 40° *Strike and dip of gneissosity.*
- *Strike of vertical gneissosity.*
- *Stratiform foliation, dip unknown.*
- *Jointing, inclined.*
- *Jointing, vertical.*
- *Shear zone.*
- *Fault, indicated or assumed.*
- *Muskeg or swamp.*
- P. *Portage.*
- XIII *Surveyed line, location approximate and not to be relied on.*
- ② *Location of mining property.*

LIST OF PROPERTIES

1. *McCombe Mining and Exploration Ltd.*
2. *McCombe Mining and Exploration Ltd.*

SOURCES OF INFORMATION

Geology by P. P. Hudec, 1959.

Preliminary map P. 54, Highstone Lake—Miniss Lake Area, scale 1 inch to 1 mile, issued 1960.

Cartography by D. F. Jupe and A. D. Sedlmaier, Ontario Department of Mines, 1964.

Base map compiled from Ontario Forest Resources Inventory maps.

Magnetic declination approximately 2°E., 1960.

Published 1964

Map 2063

HIGHSTONE LAKE—MINISS LAKE AREA

West Sheet

KENORA AND THUNDER BAY DISTRICTS

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

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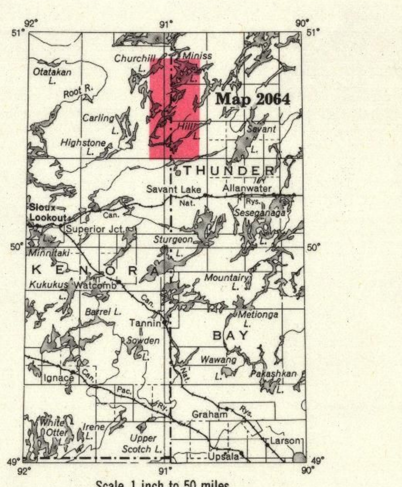
HON. G. C. WARDROPE, *Minister of Mines*
D. P. Douglass, *Deputy Minister* M. E. Hurst, *Director, Geological Branch*

Map 2064
Highstone Lake—Miniss Lake Area
East Sheet



Scale, 1 inch to 50 miles

N.T.S. reference 52/J

LEGEND

CENOZOIC*

RECENT

Lake and stream deposits, swamp and muskeg accumulations.

PLEISTOCENE

Clay, sand, gravel, boulders.

UNCONFORMITY

PRECAMBRIAN**

GRANITIC ROCKS

YOUNGER GRANITIC ROCKS

6

6f Pink microcline pegmatite, quartz veins and dikes, rhyolite and rhyolite porphyry (dikes).
6e Aplitic microcline granite.
6d Red and pink microcline granite, alkali granite, quartz monzonite.
6c Hybrid granite.
6b Pink biotite granodiorite.
6a Pink granodiorite gneiss, alkali granite gneiss.

INTRUSIVE CONTACT

OLDER GRANITIC ROCKS

5

5d Pink granodiorite.
5c Grey alkali pegmatite.
5b Grey granodiorite, monzonite, quartz diorite.
5a Grey hybrid granodiorite.

INTRUSIVE CONTACT

HYBRID GNEISSES

4

4b Grey granodiorite gneiss.
4a Lit-par-lit gneiss, garnetiferous.

METASEDIMENTS

3

3c Paragneiss (biotite-quartz-plagioclase gneiss).
3b Biotite schist.
3a Quartz amphibolite.

POSSIBLE UNCONFORMITY

ULTRABASIC ROCKS

2

2a Dunite.

VOLCANIC ROCKS

1

1d Greenstone, dacite.
1c Chlorite schist.
1b Quartzite.
1a Iron formation.

be *Beryl*
Fe *Iron*
mag *Magnetite*
S *Sulphides*
tour *Tourmaline*

**Unconsolidated deposits. Cenozoic deposits are not differentiated on the map. For the most part they coincide with the lighter coloured and uncoloured parts of the map.*

***Bedrock geology. Outcrops and inferred extensions of each rock unit are shown, respectively, in deep and light tones of the same colour.*

SYMBOLS

Glacial striae.
Sand ridges, eskers.
Small rock outcrop.
Boundary of rock outcrop.
Geological boundary, approximate or assumed.
Strike of vertical schistosity.
Strike of schistosity, dip unknown
50° *Strike and dip of gneissosity.*
Strike of vertical gneissosity.
Stratiform foliation, dip unknown.
Jointing, inclined.
Jointing, vertical.
Shear zone.
Fault, indicated or assumed.
1283′ *Altitude in feet above mean sea level.*
Muskeg or swamp.
P. *Portage.*
District boundary, location approximate and not to be relied on.
XIV *Surveyed line, location approximate and not to be relied on.*
③ *Location of mining property.*

LIST OF PROPERTIES

3. Staking area mentioned in report.

SOURCES OF INFORMATION

Geology by P. P. Hudec, 1959.

Preliminary map P. 54, Highstone Lake—Miniss Lake Area, scale 1 inch to 1 mile, issued 1960.

Cartography by D. F. Jupe and A. D. Sedlmaier, Ontario Department of Mines, 1964.

Base map compiled from Ontario Forest Resources Inventory maps.

Magnetic declination approximately 2°E., 1960.

Published 1964

Map 2064

HIGHSTONE LAKE—MINISS LAKE AREA

East Sheet

KENORA AND THUNDER BAY DISTRICTS

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