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Geology of the

Matachewan Area

District of Timiskaming

By

H. L. LOVELL

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ABSTRACT

This report is a re-study of the geology of the former gold mining camp of Matachewan and vicinity, in the District of Timiskaming. The report-area comprises the townships of Alma, Baden, Cairo, and Powell and Indian Reserve 72 and covers 144 square miles.

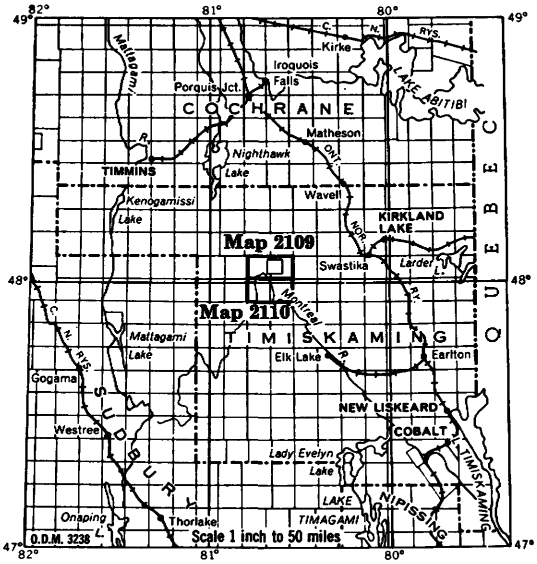

Figure 1 — Key map showing the location of the Matachewan report-area.

The bedrock is Precambrian, and contains rocks of every major division of the stratigraphic column for northeastern Ontario. Gold, silver, molybdenum, and copper are the only metals yet found to exist in economic amounts, but occurrences of lead, zinc, nickel, asbestos, barite, scheelite, magnetite, and fluorite have also been found.

Gold occurs in or near quartz veins that occupy shears, fractures, and faults in volcanic rocks, tightly folded sedimentary rocks, and silicic intrusive rocks. Most of the gold, molybdenite, and copper seems to be genetically related to syenite porphyry.

Reconnaissance work was done by the author on the geochemistry of stream sediments in Baden and Alma townships. Portable field kits were used to detect total heavy metals by means of the "quick test" in dithizone. Results were in fair agreement with laboratory analyses using a technique giving total extraction. In Baden and Alma townships, the geochemical background in stream sediments is low, so that low anomalies stand out unmistakably. During the survey, only those gold deposits with associated sulphide minerals in the stream beds were detected.

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H. L. Lovell[1]

INTRODUCTION

The Matachewan area consists of the townships of Baden, Alma, Powell, and Cairo and Indian Reserve 72, in the District of Timiskaming. Baden and Alma townships were mapped in 1963 by a field party led by the author. Powell and Cairo townships were mapped during the field season of 1964. Baden, Alma, Powell, and Cairo are six-mile townships that together with Indian Reserve 72 form a square whose centre is about 30 miles west of Kirkland Lake. Baden township occupies the northwestern quadrant, Alma the northeastern, Powell the southwestern, and Cairo the southeastern quadrant. The former Matachewan gold producers are in Powell township, and the community of Matachewan is on the Montreal River in Cairo township.

Highway 66 connects Matachewan with Kirkland Lake, and Highway 65 leads to Elk Lake. A logging road branching northward from Highway 66 near the eastern boundary of Cairo township reaches Chief and Separation lakes in Alma township. Another road branching northward from Highway 66 traverses the central part of Cairo township and the Matachewan Indian Reserve (I.R.72) and ends at Radisson Lake, which is north of the report-area. Highway 566 leads from Matachewan to the northwestern part of Powell township and beyond. Private logging roads connect Highway 566 with Timmins. Branch roads in Powell township reach Otisse Lake, and Mistinikon Lake near Bell Island.

Mistinikon Lake and the West Montreal River are navigable by motor boat. The West Montreal River has only one short portage between Matachewan and the northern part of Baden township, a distance of 12½ miles. A marine railway on the portage is operated by Harold King of Matachewan.

The Matachewan area was prospected for gold as early as 1909. The height of prospecting activity was in the 1930's, when several pits and shafts were sunk. From 1934 to 1957 the two mines of the Matachewan camp (Matachewan Consolidated Mines Ltd. and Young-Davidson Mines Ltd.) produced 956,117

[1]Temporary staff geologist, Ontario Department of Mines, c/o Resident Geologist, 4 Government Road East, Kirkland Lake, Ontario, 1963-64. Manuscript received by the Chief Geologist 26 April 1965.

ounces of gold and 165,598 ounces of silver with a total value of $34,688,256. Old properties were re-examined after the Second World War, but since the closing of Young-Davidson Mines Limited in 1957 little work has been done.

The Ryan Lake Mine has been operated by several companies. Total production[1] from 1948 to the end of 1964 was: 1,352 ounces of gold, 36,141 ounces of silver, and 4,995,745 pounds of copper.

Field Work. Basemaps of the four townships at the scale of 1 inch to ¼ mile, were compiled by the Cartographic Unit of the Ontario Department of Mines, from map-sheets of the Forest Resources Inventory of the Ontario Department of Lands and Forests. Air photographs from the same source and on the same scale were used in the field. Roads, trails, and the shorelines of most of the lakes were mapped geologically, and the four townships were covered by east-west traverses spaced ¼ mile apart. In areas of "Timiskaming" sedimentary rocks, traverses were 1,000 feet apart. The geology was tied to recognizable features on air photographs, and to the few patented claims where cornerposts were found.

Sediments from suitable streams in Baden and Alma townships were tested geochemically. In the field, portable geochemical kits were used. Check samples were analyzed by the Laboratory Branch of the Ontario Department of Mines in Toronto.

All old mineral showings that could be found were examined by the author, and samples taken from them were assayed for gold, silver, and other metals.

Uncoloured preliminary geological maps of Baden township (P. 195) and Alma township (P. 196) were published by the Ontario Department of Mines in December 1963. The maps are on the scale of 1 inch to ¼ mile, and have marginal notes. Preliminary maps of Powell township (P. 272) and Cairo township (P.273) were published in February 1965.

Acknowledgments. W. G. McLennan was senior field assistant in Baden and Alma townships, and is responsible for much of the mapping. Junior assistants were J. R. Letts, J. R. Low, and R. D. Bell. In Powell and Cairo townships, E. G. Bright acted as senior assistant; junior assistants were R. E. Johns, J. Ramsden, and J. von Heymann. Their co-operation is appreciated. Mining company reports from the files of W. S. Savage, resident geologist for Ontario Department of Mines at Kirkland Lake, were used by the author. Messrs. W. H. Brookbank of Kirkland Lake and R. H. Mills of Matachewan helped with the history and location of mineral deposits in the area.

Previous Geological Work. In 1875 Robert Bell of the Geological Survey of Canada explored the route from Lake Huron to James Bay, following the Montreal River through the Matachewan area (Bell 1876). In 1900 J. L. R. Parsons obtained gold from samples of quartz and pyrite taken from veins near Old Woman Rapids in Cairo township (Parsons 1900). In 1903 G. F. Kay made microscopical examinations of rocks found on Turtle and Separation lakes and on other lakes in Alma township (Kay 1904). The geology of the western part of Baden township was published in 1911 on a sketch map by W. M. Goodwin of the Ontario Bureau of

[1]Statistics by Ontario Dept. Mines, Toronto.

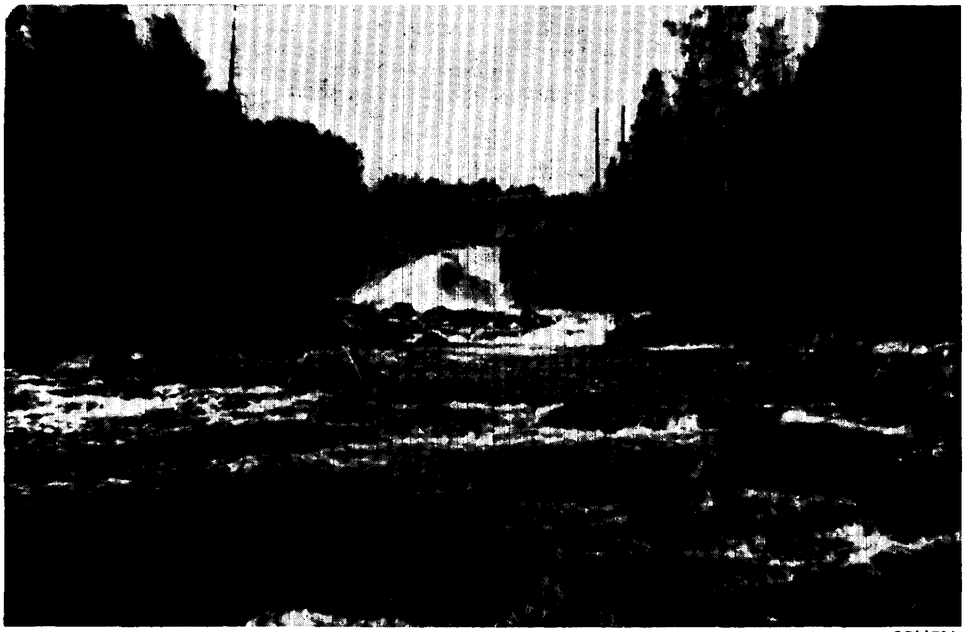

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Photo 1 — Matachewan Falls, Baden township, where water drops for 41 feet from Mistinikon Lake to the West Montreal River, over a storage bin, a diabase dike, and volcanic rocks.

Mines. Following the gold discoveries in Powell township in 1916, A. G. Burrows mapped Baden, Alma, Powell, and Cairo townships (Burrows 1918, 1920). H. C. Cooke spent the summers of 1917 and 1918 in the Matachewan area, and a memoir based on his observations was published (Cooke 1919). In 1933 and 1934, W. S. Dyer mapped the geology of the Matachewan-Kenogami area (Dyer 1935).

Topography. The western part of Baden township has the gentle relief typical of Superior province of the Precambrian Shield. Most of the country east of Mistinikon Lake and the West Montreal River, however, has rapid changes in elevation of 50 to 150 feet. Large syenite and granite bodies rise above the level of the area of volcanic rocks, and diabase dikes form north-trending ridges. A fire tower is situated on a hill in the southwestern part of Powell township, where Cobalt sedimentary rocks provide the highest elevations in the four townships.

The height-of-land separating the watershed of the St. Lawrence river system from that of James Bay passes through the northwestern part of Baden township. The drainage forms a trellis pattern, following the north and northwest trends of the main system of joints and faults. The following is Burrows' (1918, p. 218, 219) description of the diversion of the west branch of the Montreal River (i.e. Mistinikon Lake) to its present course over Matachewan Falls (Photo 1):

At one time the river flowed easterly from a point one and a half miles north of the south boundary of Powell, through what are now the Davidson claims, and emptied into the Montreal

River a mile north of the junction with the East branch [i.e. Mistinikon Lake emptied into the Montreal River at the mouth of Davidson Creek near the site of the present community of Matachewan]. The ancient channel followed for three-quarters of the distance the course of Davidson Creek...The diversion of the river from its former course has been quite recent, geologically speaking, since the falls have been carried back only a short distance from the lake, with practically no gorge.

Potholes exist in bedrock on the banks of Davidson Creek, near its mouth and at the western end of the pond that is about 7/8 mile east of Mistinikon Lake. The potholes range from 3 to 30 feet in diameter, and some of them are 25 feet above the present level of Davidson Creek. The potholes have been worn in the bedrock by stream action, and indicate that much more water once flowed in Davidson Creek than now.

Natural Resources. The original spruce and pine in the map-area were cut long ago by the J. R. Booth lumber company. The best stands of second-growth forest remaining in Baden and Alma townships are marked on the maps (Map 2109 and Map 2110, back pocket) according to the dominant type of tree. The largest stump that was sawn recently is of a spruce, two feet in diameter. It has 125 annual-growth rings. Alfred Baptiste, the Indian in charge of woods operations, estimates that all good pulpwood on the Matachewan Indian Reserve (I.R. 72) will be cut within 10 years.

The storage dam at Matachewan Falls is regulated according to the needs of the hydro-electric power plant at Indian Chute Falls on the Montreal River, 8 miles southeast of Cairo township.

When they employ an Indian guide, sporting fishermen frequently catch their legal limits of fish. Moose are fairly numerous in the area; the season now opens in warmer weather. Several bears, lynxes, beavers, ducks, and partridges were seen during the two summers of geological field work.

Inhabitants. The community of Matachewan served the mines in Powell township when they were or are operating. It is a base for supplies for logging operations, and has accommodation for tourists.

The Matachewan Indian Reserve occupies 16 square miles and is surrounded by Alma and Baden townships. The treaty Indians, a small band of Ojibway, live on the reserve during part of the year, and the remainder of the year in Matachewan. The Indian Reserve is not open for staking of mining claims, except as provided by the Indian Lands Act, 1924 (see Ontario Mining Act, section 37e).

GENERAL GEOLOGY

The report-area forms a small part of a large belt of "greenstones" extending from southwest of Timmins, Ontario, to Chibougamau, Quebec. The general geology of part of the belt in Ontario is shown on the compilation map, Timmins-Kirkland Lake sheet (Map 2046) of the Ontario Department of Mines.

Rocks of every major division of the Precambrian stratigraphic column for northeastern Ontario are present in the map-area, which is 144 square miles in extent. The oldest rocks in the area are volcanic, and they are overlain by tightly folded sedimentary rocks. Both are cut by mafic and silicic intrusions. The intrusive rocks, in turn, are cut by early diabase dikes. Flat-lying sedimentary rocks overlie all of the above rocks, and are intruded by a few late diabase dikes.

TABLE OF FORMATIONS

CENOZOIC

Recent: Swamp and stream deposits.
Pleistocene: Sand, gravel, clay.

Unconformity

PRECAMBRIAN

PROTEROZOIC

Mafic Intrusive Rocks (Nipissing):
Diabase.

Intrusive Contact

Huronian:
Cobalt Group (Gowganda Formation):
Argillaceous and arkosic quartzite, conglomerate, argillite, arkose.

Unconformity

ARCHEAN

Mafic Intrusive Rocks (Matachewan):
Diabase, undifferentiated.

Intrusive Contact

Silicic Intrusive Rocks (Algoman):
Granite: granodiorite and granitic gneiss; syenite porphyry and coarse-grained syenite; syenite; mafic syenite, lamprophyre, quartz diorite and diorite.

Intrusive Contact

Ultramafic and Mafic Intrusive Rocks (Haileyburian):
Serpentinite, diorite.

Intrusive Contact

Sedimentary Rocks (Timiskaming):
Conglomerate; greywacke and interbedded argillite and quartzite; arkose.

Unconformity

Volcanic Rocks (Keewatin):
Basalt and andesite; bleached, silicified, sericitized volcanic rocks; andesite porphyry, tuff (banded, and massive types); agglomerate; rhyolite and dacite; carbonatized and amygdaloidal volcanic rocks; amphibolite.

Archean

VOLCANIC ROCKS

Volcanic rocks, or "greenstones" as they are commonly referred to, are widespread. They consist mainly of andesite, andesite porphyry, tuff, and agglomerate. Basalt, dacite, rhyolite, and amphibolite are less abundant. Apart from rhyolite, which is pink or pale-grey or yellow, the rocks have rough, grey to brownish-grey weathered surfaces, and grey to greenish-grey fresh surfaces. All types of volcanic rocks are interbedded or have gradational contacts. Schistosity strikes generally east. The volcanic rocks are overlain by sedimentary rocks of two different ages, and are cut by all types of intrusive rocks that exist in the area. All volcanic rocks contain some chlorite, and belong to the greenschist facies of regional metamorphism. They are similar to other "greenstones" of northeastern Ontario, and were formerly classified as Keewatin in age.

Flow Rocks

Basalt is found at the junction of Highway 566 and the main road on the property of Matachewan Consolidated Mines Limited. Its fresh surface is darker green than fresh surfaces of other volcanic rocks.

Andesite contains small phenocrysts of white feldspar which, in andesite porphyry, have diameters up to ¼ inch. The groundmass consists of randomly oriented grains of white feldspar, quartz, chlorite, biotite, and sericite. The appearance of the andesite is similar to that of the groundmass in agglomerates; some of the andesite might actually be tuff.

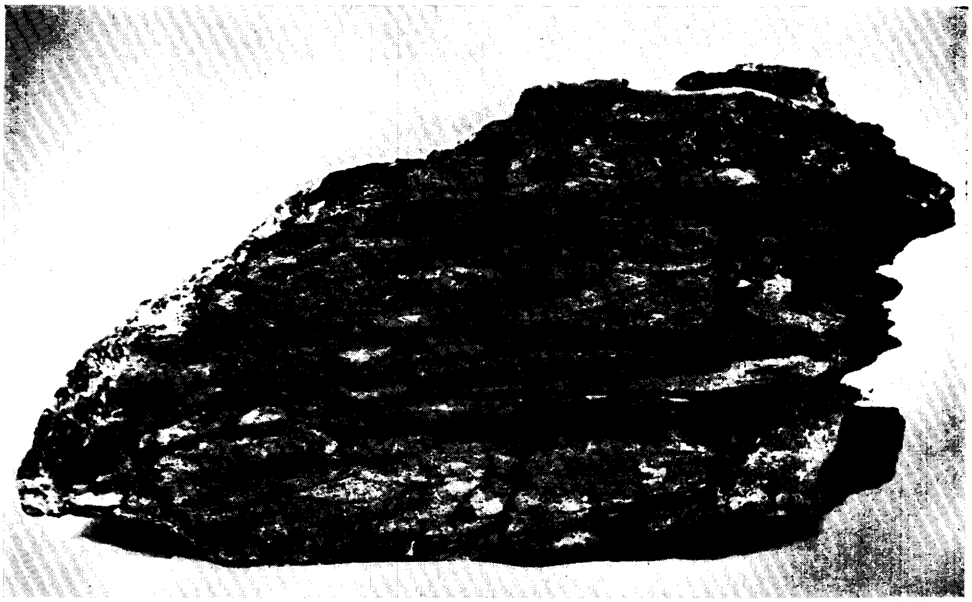
Volcanic rocks in some parts of Baden and Powell townships have pale-grey fresh surfaces and quartz "eyes". These rocks are dacite. A marker stratum of rhyolite striking N30°E extends from "The Forks" of the Montreal River to Highway 65. The rhyolite has rough pale-pink or grey weathered surfaces, with prominent quartz blebs in a fine-grained groundmass.

Pyroclastic Rocks

Tuffs and agglomerates are interbedded with the flow rocks. Tuffs exist in massive and in banded forms. Massive tuffs are andesitic or dacitic in composition, whereas banded tuffs are more mafic and have alternate greenish-black and brownish-white bands. Weathering emphasizes the banding (the pale-coloured bands are resistant). Fragments form 15 to 35 percent of the agglomerates, and range from ¼ inch to 1 foot long. In some areas, the fragments are aligned. The alignment is partly a result of metamorphism, and partly a reflection of original bedding. Fragments are embedded in a matrix having a composition similar to that of andesite porphyry. The fragments are paler grey and more silicic than the groundmass, and contain larger phenocrysts of white feldspar (up to ⅜ inch in length).

Carbonatized and Amygdaloidal Volcanic Rocks

For Baden and Alma townships, carbonatized and amygdaloidal volcanic rocks are grouped together because of difficulty in distinguishing between them in the field, and not because of any original relation between their carbonate



ODM 7370

Photo 2 — Carbonatized volcanic rock from Cairo township, near the asbestos on Highway 65; at this point Highway 65 runs parallel to the Montreal River – Whiskeyjack Creek Fault.

contents. On the map, the symbol "1g" in the western part of Baden township refers to amygdaloidal volcanic rocks. East of the Mistinikon Lake Fault, this type of rock is much less abundant.

Most of the amygdaloidal volcanic rocks have subspherical vesicles partly filled with white or pale-pink calcite. Apart from the amygdules, the appearance of the rocks is similar to andesite or dacite. No metallic mineral was seen in any amygdule. Amygdaloidal rocks are interbedded with the other volcanic rocks, and probably are flow tops.

Carbonatized volcanic rocks are found throughout the map-area (Photo 2). They contain carbonate stringers, and some irregular areas of replacement carbonate that can be mistaken for amygdules. Some of the carbonate contains metallic minerals. Carbonatized rock that is coloured green by chrome mica exists in the southern part of Cairo township (south of St. Paul Lake, and north of Fox Rapids on the Montreal River), and on the properties of Matachewan Consolidated Mines Limited and Young-Davidson Mines Limited, in Powell township. The green carbonate rocks are cut by quartz veins, some of which contain gold. Similar gold-bearing green carbonate exists at Kerr-Addison Gold Mines Limited, 45 miles northeast of Cairo township, and in Midlothian township, 10 miles southwest of Powell township. The contacts of carbonatized volcanic rocks with other volcanic rocks are gradational, owing to the gradually diminishing effect of solutions in directions away from their source.

Altered Volcanic Rocks

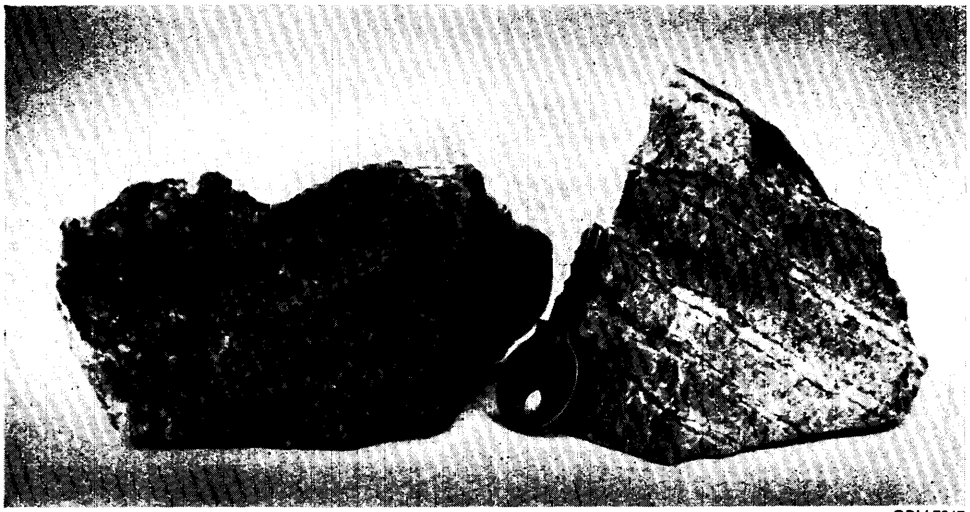
In the map legend volcanic rocks that have been silicified, sericitized, and albitized were given the symbol "1b". They are more fine-grained and massive

ODM 7366

Photo 3 — Sheared, silicified, and carbonatized rock from No. 6 vein on the property of J. G. Honsberger, Baden township.

than other volcanic rocks, and have yellowish-brown to white fresh surfaces that impart a "bleached" appearance to the rock. A thin section from a hand sample of altered andesite contains the following proportions of minerals: subhedral phenocrysts of albite (15 percent); quartz and albite groundmass (30 percent); sericite groundmass (18 percent); chlorite (15 percent); calcite (15 percent); epidote (3 percent); pyrite (3 percent); and zircon (1 percent). The parallelism of the sericite flakes makes the rock schistose. Chlorite, however, exists in the form of irregular lenses, and envelopes the epidote. Under crossed nicols, the chlorite has Berlin blue interference colours, indicating a high ratio of iron to magnesium. The albite was probably formed when andesine released its calcium during recrystallization. The excess calcium could then have united with carbon dioxide to form some of the calcite found as stringers and irregular areas of replacement in carbonatized volcanic rocks.

Contacts of altered volcanic rocks with other volcanic rocks are gradational. Most of the altered volcanic rocks are found in shear zones (Photo 3), on the contacts of diabase dikes, and near quartz veins (Photo 4). It is concluded that much of the alteration was done by hydrothermal solutions emanating from igneous intrusive rocks.



ODM 7367

Photo 4 — Unaltered volcanic rock is on the left and altered (bleached, quartz-veined) volcanic rock is on the right side of this photograph. The altered rock is from the J. Quilty property, Baden township. This sample assayed 0.17 ounces of gold per ton.

Amphibolite

Amphibolite is found in the west central part of Powell township. It is medium-grained and has greenish-black fresh surfaces. Amphibolite is found near granitic intrusive rocks, and is, therefore, thought to be recrystallized volcanic rock that owes its present characteristics to the granite intrusion.

SEDIMENTARY ROCKS

Belts of tightly folded grey and greenish-grey sedimentary rocks trend southeast across Powell and Cairo townships. The belt that is on the western shore of Mistinikon Lake and the two belts in the area between Mistinikon Lake and the West Montreal River are each about a mile wide. The southern belt is not exposed on the west side of Mistinikon Lake, but possibly underlies Cobalt sedimentary rocks. Volcanic rocks lie between the two belts except in the area east of the West Montreal River, where the sedimentary rocks form a single belt about two miles wide. In the western part of Powell township and the central part of Cairo township, the sedimentary rocks were obliterated by silicic intrusions. On Highway 66, a narrow belt of steeply dipping sedimentary rocks trends northeast across the boundary between Cairo township and Flavelle, the adjacent township on the east. All of these sedimentary rocks are tightly folded and highly metamorphosed. They are intruded by ultramafic, silicic, and mafic rocks, and are overlain by comparatively flat-lying (Cobalt) sedimentary rocks. The tightly folded sedimentary rocks have been classified as Timiskaming in age (Dyer 1935, p. 13), and might be correlated with the sedimentary rocks of the Kirkland Lake area formerly classified as Timiskaming in age.

Southern Belt

Sedimentary rocks of the southern belt are coarse-grained and poorly sorted compared with those of the northern belt. Most of the rocks are conglomerate

ODM 7371

Photo 5 — Interbedded argillite (dark) and quartzite (light) from the northern belt of "Timiskaming" sedimentary rocks in Powell township.

and arkose, and are poorly bedded. In sheared or schistose areas, however, some pebbles are aligned parallel to the schistosity. Pebbles comprise 10 to 30 percent of the conglomerate, and most of the pebbles are ¼ inch to 1 inch long, the largest being about 4 inches. Rock types represented by the pebbles are: schistose and massive greenstone, rhyolite, and brownish-red syenite. Most of the pebbles are subrounded, but the schistose pebbles have a low degree of sphericity. The groundmass of the conglomerate, to which the arkose is similar, consists of white feldspar, quartz, white mica, chlorite, and accessory pyrite. Most of the quartz and feldspar grains are of sand size, and are angular to subrounded. The framework of the conglomerate is disrupted (pebbles do not touch each other), indicating contemporaneous deposition of pebbles and groundmass.

The sedimentary rocks that are east of the West Montreal River are similar to those of the southern belt.

Northern Belt

Most of the sedimentary rocks of the northern belt are fine-grained. They consist of greywacke, arkose, and interbedded pale-grey quartzite and dark-grey argillite. The quartzite and argillite are well sorted and bedded (Photo 5). Much of the argillite is actually slate, because it has axial plane cleavage. Beds in the quartzite and argillite range from ¼ inch to 6 inches thick, and the thickness of each bed is fairly uniform along strike. The quartzite, which forms the bottom part of each bed, is thicker than the argillite. The quartzite and argillite might have originated as seasonal deposits or as graded geosynclinal beds. The greywacke and arkose are similar to the groundmass of the conglomerate in the southern belt.

Cairo-Flavelle Boundary Belt

Conglomerate and greywacke near the boundary between Cairo and Flavelle townships are similar to other "Timiskaming" sedimentary rocks in Powell and Cairo townships in that they are sheared, metamorphosed, and steeply dipping. However, they are dissimilar in many respects. About 30 percent of the conglomerate consists of subangular pebbles and boulders up to 3 feet long. Most of the pebbles and boulders are syenite and syenite porphyry (some of which are cut by quartz veins) and greenstone. The groundmass consists of argillaceous material. The pebbles, boulders, and lenses in the groundmass are well aligned, striking east and dipping 60° to 80°S. The alignment probably reflects original bedding. The rocks contain green (chrome) mica and a high proportion of pyrite, and are cut by quartz-carbonate veins containing fluorite.

The subangularity and poor sorting (the great range in size) of pebbles and boulders suggest that their source is nearby. The predominance of syenite pebbles and boulders, and the fact that the sedimentary rocks are at the periphery of a syenite stock, suggest that this is a "basal" conglomerate whose main source is the syenite stock. The syenite in the stock is fairly fresh and is otherwise similar to Algoman intrusions of the area. The sedimentary rocks would, therefore, be post-Algoman. However, they are highly metamorphosed and their beds dip steeply, unlike sedimentary rocks of Cobalt age. Pyrite, which forms a relatively high proportion of the conglomerate along Highway 66 near the boundary between Cairo and Flavelle townships, might be of primary origin. Alternatively, it might have been introduced by solutions originating in the syenite magma. Also, all of the fluorite seen in the map-area precipitated from hydrothermal solutions that originated in the syenite. This would indicate that the sedimentary rocks are pre-Algoman. The presence of green (chrome) mica is characteristic of "Timiskaming" sedimentary rocks in the areas of the Porcupine, Kirkland Lake, and Midlothian township.

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS

A northeast-trending body of intrusive rocks ranging in composition from serpentinite to diorite is situated in Cairo township between Highway 66 and a granitic batholith to the south. A few small bodies of similar rocks were found in the central part of Powell township and in the southern part of Cairo township. From the periphery toward the centre of the mafic intrusive body that is south of the Montreal River, a gradation exists from diorite through gabbro to serpentinite. The diorite is medium-grained and has a diffuse "salt and pepper" texture and black or green and white colour. Anhedral to subhedral hornblende and altered pyroxene form 20 to 30 percent of the rock, and white to pale-green feldspar makes up most of the remainder. "Magmatic layering" is present in the diorite. Bands composed mostly of white feldspar alternate with bands that are rich in dark minerals. The bands are from 2 to 6 inches thick. Dark minerals are

40 to 60 percent of the gabbroic phase of the mafic intrusion. The gabbro has a reddish-brown weathered surface and a green to greenish-black fresh surface. Serpentine and talc exist along shear planes. Fine- to medium-grained serpentinite forming part of the mafic intrusion probably is altered peridotite. It has a reddish-brown weathered surface and a greenish-black fresh surface. Some of its fractures contain asbestos.

The ultramafic and mafic intrusive rocks are intruded into volcanic rocks and "Timiskaming" sedimentary rocks, and are intruded by granitic dikes. The age of the ultramafic and mafic intrusive rocks is, therefore, early Algoman or Haileyburian.

SILICIC INTRUSIVE ROCKS

These rocks are found mainly in northern and eastern parts of the map-area. Compared with the rocks into which they are intruded, silicic intrusive rocks form high land, and a relatively large part of their area is exposed. Gneiss, inclusions of greenstone, and more mafic phases exist at their margins. The silicic intrusive rocks cut the volcanic rocks, the tightly folded sedimentary rocks, and the "Haileyburian" mafic intrusive rocks, and have been classified as Algoman in age (Dyer 1935, p. 17).

Granite, Granodiorite, Quartz Diorite and Diorite

These rocks are exposed along the northern edge of Baden and Alma townships, in the western part of Powell township, and in the southern part of Cairo township. Dikes and other offshoots of the main bodies are widespread. The rocks are pink or grey, and medium-grained. They are composed of microcline, orthoclase, albite, hornblende, and quartz. Accessory minerals are magnetite, pyroxene, apatite, zircon, and titanite. Granitic gneiss with steeply dipping foliation is found near some of the contacts with country rocks. A gradation exists from diorite or hybrid volcanic-and-silicic intrusive rocks at the contacts of large bodies, through quartz diorite and granodiorite to granite. Some parts of the granite contain 35 percent quartz. The diorite and quartz diorite are thought to be early differentiates of the original granitic magma.

Mafic Syenite, Syenite, and Syenite Porphyry

The main body of syenite is a stock in the southeastern part of Alma township and the adjacent northeastern part of Cairo. Dikes and other offshoots of the syenite stock are found throughout the map-area. Mafic syenite, syenite, and syenite porphyry exist as "separate" cupolas, but in the larger bodies, contacts between the syenitic rocks are gradational, and a crude spatial relationship prevails. Brownish- and greenish-black mafic syenite or a hybrid rock composed of syenite and country rock are at the periphery of each large body. Medium-grained pale-pink syenite forms an inner ring of rocks, and the central phase is coarse-grained pink syenite. Most of the dikes in the country rocks are syenite porphyry and greenish-black biotite lamprophyre.

Mafic syenite is a phase of the regular syenite. It contains a greater amount of biotite, hornblende, and magnetite, owing partly to assimilation of the volcanic rocks that it intruded and partly to differentiation of the original magma. Some of the mafic syenite contains enough magnetite to attract a pocket magnet. On the G.S.C. aeromagnetic map No. 287G the contact of the syenite stock in

Cairo township with volcanic rocks is marked by high magnetic contours. The magnetic anomaly is particularly strong in an area of mafic syenite, volcanic rocks, and diabase on both sides of the boundary between Alma and Cairo townships, west of the road that goes through the Indian Reserve. A thin section of mafic syenite contains the following minerals: perthite largely altered to sericite, 45 percent; a fine-grained matrix consisting of calcite, 15 percent, and quartz, 10 percent; hornblende, 10 percent; chlorite, 10 percent; aegirine-augite, 5 percent; and magnetite, 5 percent.

Syenite and syenite porphyry are massive pink or red rocks. Orthoclase, hornblende, biotite, and quartz are the major minerals. Quartz forms less than 5 percent of the rock. Accessory minerals are magnetite and apatite. Syenite and syenite porphyry have high proportions of potash, as has the gold-bearing syenite at Kirkland Lake.

Quartz and quartz-carbonate veins are concentrated near the boundaries of large syenitic bodies and in dikes and cupolas. Some of the veins contain gold, silver, chalcopyrite, galena, tourmaline, and fluorite. Some of the syenite adjacent to the veins is stained red to dark-brown by hematite, e.g. in the central part of Cairo township where the course of Whiskeyjack Creek changes from south to southeast. White carbonate veins accompany the quartz veins on the properties of Matachewan Consolidated Mines Limited, and Young-Davidson Mines Limited, and in the pits on the north side of Highway 66, about 300 feet west of St. Paul Creek.

Some of the brownish-grey syenite and porphyritic syenite near contacts of diabase dikes is a late silicic differentiate of the diabase magma. It does not contain economic amounts of gold.

Some gold-bearing syenite exists in granite bodies in the map-area, but no crosscutting relationship was found. However, Dyer (1935 p. 24) states that J. B. Webb and A. W. Derby told him that they saw a dike of typical red syenite, evidently an offshoot of the large porphyry stock, cutting grey granite in the northeastern part of Alma township. Syenite found in granite masses during the present mapping is near the contact of granite with volcanic rocks. After cooling and shrinkage of the granite, a later intrusion might be expected to come up along the granite contact. The final word on the ages of the syenite and the granite must await the application of modern methods of age determination by isotopic dating.

MAFIC INTRUSIVE ROCKS (MATACHEWAN)

These rocks were first recognized in the Matachewan area by A. G. Burrows (1918) and described in detail by W. G. Miller (1923, p. 299) as "Matachewan diabase". Dikes of "Matachewan" diabase are numerous in the map-area, and especially so in the area between Mistinikon Lake and Highway 566. Their distribution on the accompanying maps (back pocket) was determined from the locations of outcrops, the trend of ridges as seen on air photographs, the strike of the minor set of (tension) joints in the diabase, and the distribution of north-trending magnetic "highs" and flanking "lows" on the aeromagnetic maps for this area. The diabase dikes trend generally north, because they are intruded into a system of north-trending joints and faults in the country rocks.

Weathered surfaces of diabase are dark-grey or rusty-brown, and fresh surfaces are grey to greyish-black. Chilled margins of diabase are very fine-grained and dark, and therefore are often mistaken for basalt. A contact phase of fine-grained magnetic diabase interbanded with siliceous material is distinct from iron formation because the bands strike north. The dikes are gabbros with diabasic texture, in which discrete grains of pyroxene occupy the interstices between lath-shaped white feldspar crystals. Some dikes contain subhedral greenish-white feldspar phenocrysts, most of which are about ¼ inch long. On the hill on the west shore of the West Montreal River, overlooking the community of Matachewan, one dike contains phenocrysts, the largest of which are 5 inches long; this dike can be seen near the lookout on Highway 566, and near the radio tower that belongs to the Ontario Department of Lands and Forests. Quartz grains are large enough to be seen only in the coarse-grained central parts of diabase dikes. Pyrite is a ubiquitous accessory mineral.

Quartz veins, which are probably the late silicic differentiate of the magma from which the diabase was tapped, are found in joints in the dikes and in nearby country rocks. Red feldspar and green epidote stringers are characteristic of "Matachewan" diabase. A late differentiate of the diabase magma that is not abundant in the map-area is pinkish-grey syenite, some of which is porphyritic. Parts of this syenite that contain disseminated pyrite have often been mistaken for the gold-bearing Algoman syenite. Alteration at the contacts of diabase dikes is generally minor, but a few siliceous areas containing massive pyrite have been found. The pyrite contains little or no valuable metal.

"Matachewan" diabase dikes cut all types of rock of "Algoman" and earlier ages, and have been radiometrically dated at 2,485 million years (Fahrig and Wanless 1963).

Further description of diabase is given on page 51 of this report under the heading Notes to Prospectors.

Proterozoic

HURONIAN

Cobalt Sedimentary Rocks

Fairly flat-lying sedimentary rocks form high land in the southern parts of Powell and Cairo townships. Cliffs about 200 feet high expose sections entirely of this type of rock, and two vertical diamond-drillholes, ¼ mile south of the contact with tightly folded sedimentary rocks, went through more than 1,000 feet of the younger sedimentary rocks. All types of the younger sedimentary rocks are intermixed, and many outcrops contain more than one type.

The quartzite is a fine- to medium-grained rock with greenish-grey to brownish-yellow weathered surfaces and greenish-grey fresh surfaces. It is mostly not bedded, but contains lenses and a few beds of pink (hematite-stained) medium-grained quartzite. The quartzite grades into argillaceous quartzite, which is a softer, greyish-green rock.

Argillite is soft rock with brownish-yellow weathered surfaces and greyish-green fresh surfaces. Much of it is well bedded, and the thickness of each bed is uniform. Most of the beds are about ½ inch thick, and fissility along bedding planes is pronounced. Some of the argillite has closely spaced joints (a few inches or less apart) forming a roughly rectangular (checkerboard) pattern.

Arkose is a hard massive pink medium-grained rock in which the cleavage surfaces of feldspar grains are visible.

Subangular to subrounded pebbles (and boulders) from a variety of rock types comprise 5 to 40 percent of the conglomerate, and range from ¼ inch to 10 feet in diameter. Granite pebbles are predominant, but syenite, granodiorite, diorite, gneiss, greenstone, diabase, and a few pebbles of white vein quartz also are present. The matrix of most of the conglomerate that contains a high proportion of pebbles is fine- to medium-grained greenish-grey or pink quartzite or pink or dark-red arkose. The matrix of most of the conglomerate that contains a low proportion of pebbles is massive fine-grained argillaceous quartzite.

The rockcut on Highway 66 about ¼ mile southwest of the boundary between Cairo and Flavelle townships has exposed typical Cobalt conglomerate. Although the conglomerate is less than 500 feet from the syenite stock that occupies parts of Alma and Cairo townships, only about 20 percent of the pebbles are syenite. The syenite pebbles (and boulders) are no larger than those of granite, granodiorite, and diabase. Evidently the principal source of sediments is not the syenite stock. The immaturity of the sediment and subangularity of many pebbles indicate that the source rock was not subjected to much chemical weathering, and the pebbles have not been transported far from their source. On the road from Young-Davidson Mines Limited to Mistinikon Lake, current ripples in quartzite indicate that the current flowed S70°W. This indicates that the source of the sedimentary rocks is east of the map-area. The well-bedded argillite resembles varved glacial clays. The argillaceous quartzite, arkose, and conglomerate were formed from poorly sorted and poorly bedded immature sediments. In the opinion of the author, most of them are tillites.

The argillite, quartzite, arkose, and conglomerate are intermixed, and most outcrops contain more than one of them. These rocks overlie all other types of rock in the map-area except younger diabase dikes, and most of them form part

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ERRATA, GEOL. REPT. 51, Geology of the Matachewan area

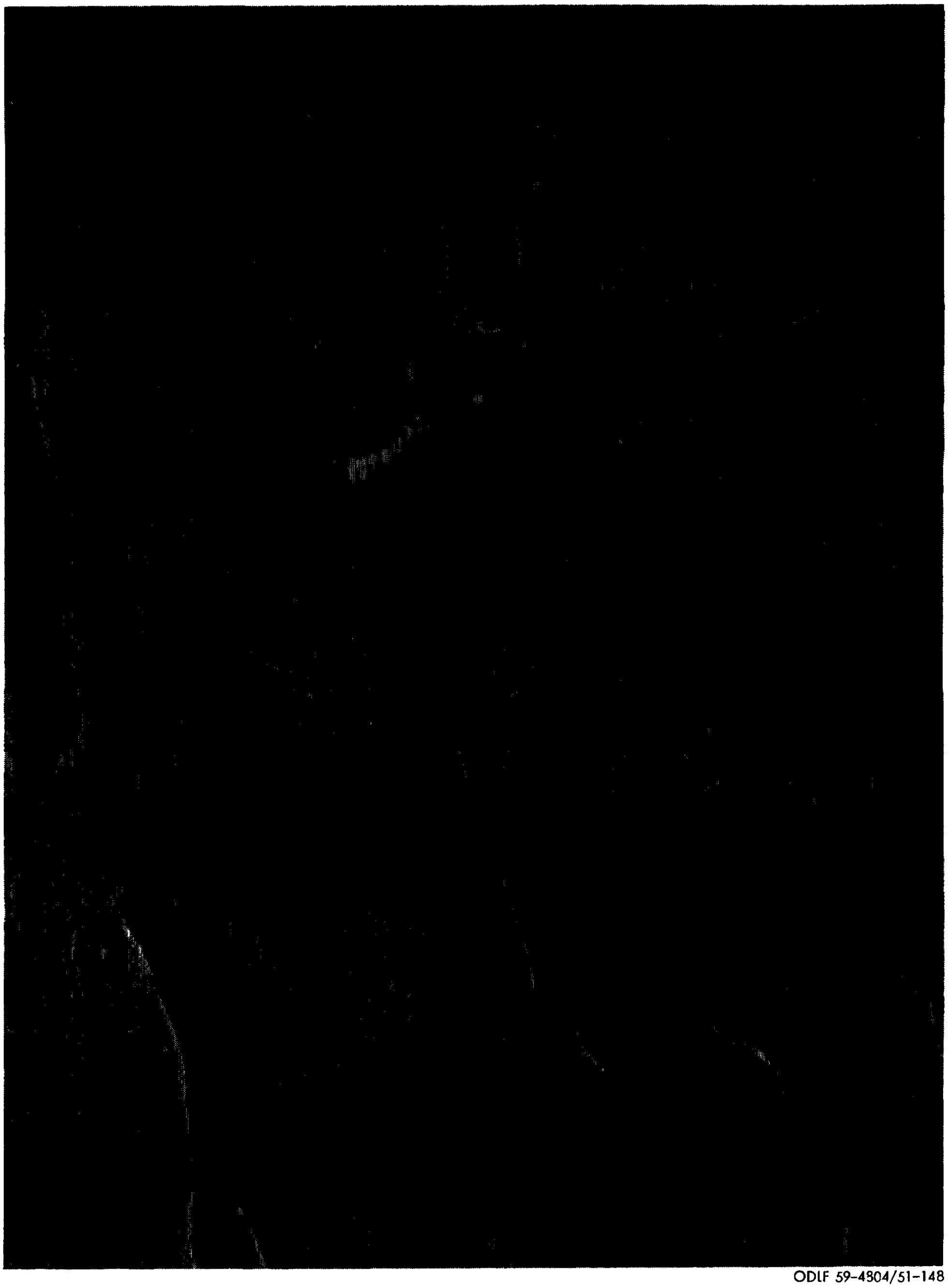
PAGE 15: Last sentence of last para. should read:

> "Parabolic sand dunes in the northwestern part of Baden township were formed by prevailing northwesterly winds after the retreat of the ice-sheet in Pleistocene time (Photo 7)."

PAGE 17: Caption of Photo 7 should read:

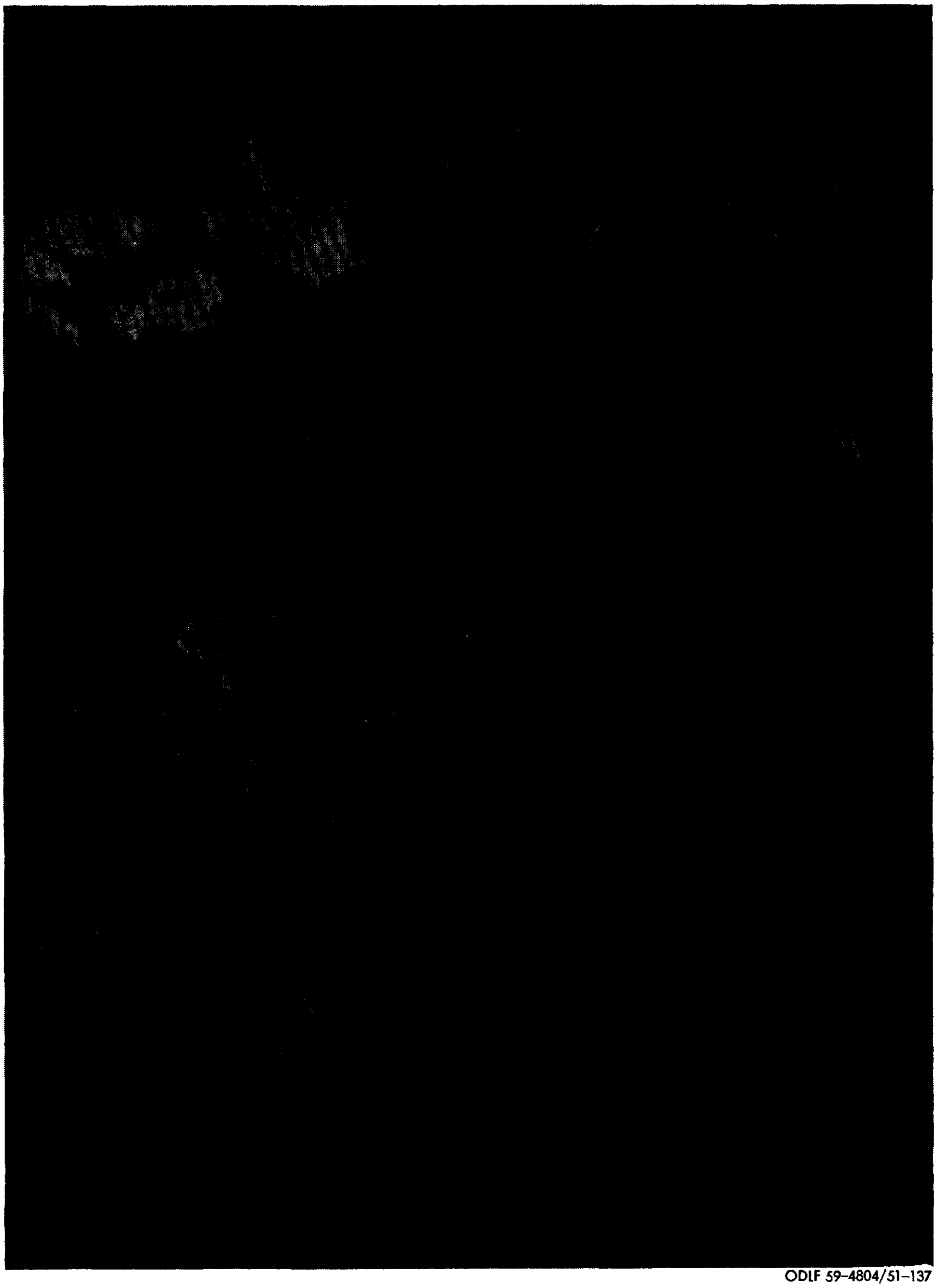
> **"Photo 7 – Parabolic dunes in the northwestern part of Baden township were formed by prevailing northwesterly winds during early post-glacial times. Present-day winds are from the northwest. Also, the direction of glacial movement was toward the southeast. North is at top of photo. Scale, 1 inch equals ¼ mile. (Photo by Ontario Department of Lands and Forests.)"**

As indicated by glacial striae, the direction of movement of the most recent glaciers was S15° to 50°E (Photo 6). Barchan sand dunes in the northwestern part of Baden township were formed by prevailing southeasterly winds after the retreat of the ice-sheet in Pleistocene time (Photo 7).



ODLF 59-4804/51-148

Photo 6 — Glacial ridges in northeastern Alma township show that the direction of movement of glaciers was toward the southeast. North is at top of photo. Scale, 1 inch equals ¼ mile. (Photo by Ontario Department of Lands and Forests.)



ODLF 59-4804/51-137

Photo 7 — Barchan dunes in northwestern Baden township indicate that the prevailing wind during early post-glacial times was from the southeast, whereas during present times it is from the northwest. Also, the direction of glacial movement was toward the southeast. North is at top of photo. Scale, 1 inch equals ¼ mile. (Photo by Ontario Department of Lands and Forests.)

STRUCTURAL GEOLOGY

FOLDS

Folds in the Volcanic Rocks

Judging from the G.S.C. aeromagnetic maps, Nos. 287G, 290G, and 291G, the volcanic rocks of several townships that are northwest of Matachewan are folded into a syncline. On the southern limb of the syncline a relatively strongly magnetic stratum trends southeast from the central part of Hincks township, about 10 miles west of Baden township, to the western part of Powell township. A relatively strongly magnetic stratum on the northern limb of the syncline trends due east from the central part of Cleaver, the township north of Hincks, to the central part of Robertson, the township north of Baden. Evidently the syncline plunges southeast. Both limbs seem to be offset (left-hand) by the fault that runs through Mistinikon Lake, and to be truncated a short distance farther east.

In Argyle township, ¼ mile west of milepost 2 on the western boundary of Baden township, the tops of pillows face S60°E. In Cairo township, south of the junction of Highway 65 and Highway 66, the tops of pillows face N30°W. Also in Cairo township, a marker stratum of pink rhyolite follows (approximately) the part of the Montreal River that flows northeast. In volcanic rocks in the southeastern part of Powell township and the adjoining part of Cairo township, the dragfolds plunge southwest and indicate that the rocks on the southeastern side moved southwest. In Powell township, on Highway 566 near the bridge across Mistinikon Lake, and in Alma township, east of Narrow Lake, the tops of pillows face N35°E. The volcanic rocks in the southeastern part of Argyle township are thought by the author to be on the northwestern limb of a synclinal crossfold, In Cairo township volcanic rocks containing pillows and the rhyolite marker stratum are on the southeastern limb. The pillowed volcanic rocks near the bridge across Mistinikon Lake and those east of Narrow Lake are near the axial trace, and indicate that the synclinal crossfold plunges northeast. The dragfolds in the southeastern part of Powell township and the adjoining part of Cairo township are on the southeastern limb of the syncline. They indicate that the nose (area of maximum curvature) of the syncline is to the southwest, i.e. the syncline plunges northeast.

In summary, the volcanic rocks in the map-area are folded into a syncline whose axial trace trends approximately northeast from the southwestern quadrant of Powell township to the central part of Alma township. At this point, judging from the attitude of the foliation in the northern part of Alma township, the crossfold is truncated by a fold whose trend is about S25°E.

Folds in "Timiskaming" Sedimentary Rocks

Two belts of "Timiskaming" sedimentary rocks trend east across the area between Mistinikon Lake and the West Montreal River. From attitudes and determinations of tops of beds it is concluded that each belt is tightly folded. West of Mistinikon Lake only the northern belt is exposed, and it is offset ⅗ mile southward. The southern belt is probably covered by Cobalt sedimentary rocks. East of the West Montreal River, the two belts are adjacent to one another, the volcanic rocks not being exposed between them.

FAULTS

Several faults, shear zones, and topographic lineaments are present in the map-area. The major faults are those whose topographic expression is along Mistinikon Lake; the Montreal River and Whiskeyjack Creek; the Montreal River and Narrow Lake; Knott Lake; and Browning Lake. Major shear zones exist in the vicinity of the former gold producers; along Highway 66; and in the eastern bend of the Montreal River. The Galer Lake–Fort Matachewan Fault was first noticed during the mapping of Holmes township (Moore 1966, and Ontario Dept. Mines preliminary maps P.206, P.207). It extends westward through the southeastern part of Alma township and the northern part of Cairo township to the West Montreal River near Fort Matachewan. The shear zone along Highway 66 is parallel to the Galer Lake–Fort Matachewan Fault. In both shear zone and fault, the south side moved east, and either or both might be the western extension of the Larder Lake fault zone. Also, topographic lineaments around St. Paul Lake are thought by the author to be manifestations of the Larder Lake fault zone.

The Montreal River–Whiskeyjack Creek Fault is parallel to possible tension cracks caused by folding of the "Keewatin" rocks. Several of the "Haileyburian" and "Algoman" intrusions in the Matachewan area trend northeast, parallel to the synclinal axis of the volcanic rocks and to the western extension of the Larder Lake Fault. The Mistinikon Lake, Montreal River–Narrow Lake, and Browning Lake faults are parallel to possible tension cracks caused by folding of the "Timiskaming" rocks. "Matachewan" diabase dikes are intruded into tension cracks parallel to these faults.

In the area of Baptiste Lake in Alma township, the displacement of aeromagnetic contours across the Montreal River–Narrow Lake Fault indicates apparent horizontal displacement of the west side southward. This direction of movement is also indicated by the relative positions of rock formations across the part of the fault that follows the Montreal River. The displacement of aeromagnetic contours indicates the same direction of movement for the Mistinikon Lake and Montreal River–Whiskeyjack Creek faults. For example, in Robertson township (north of Baden township) aeromagnetic contours on the west side of the chain of lakes that is along strike from the Mistinikon Lake Fault are offset southward. In Powell township the tightly folded sedimentary rocks on the west side of Mistinikon Lake are offset about three-fifths of a mile southward. Aeromagnetic contours in Baden township on the west side of the Montreal River–Whiskeyjack Creek Fault are offset southward. In general, field evidence (faults and dragfolds) supports the evidence provided by the aeromagnetic maps.

In Cairo township, on the west shore of the West Montreal River, an inlier of volcanic rocks is present between the two belts of tightly folded sedimentary rocks. Also, the southern belt of sedimentary rocks is narrower on the west than on the east shore. The east-trending syenite body that is ¾ mile north of Matachewan is much broader on the west than on the east shore of the West Montreal River. For these reasons, the east side of the Montreal River–Narrow Lake Fault is thought by the author to have been downthrown.

Cobalt sedimentary rocks occupy most of the area bounded by Knott Lake and the Montreal River. The southern boundary of the tightly folded sedimentary rocks in the area is ⅖ mile farther north than it is on the west side of the West Montreal River and on the east side of Knott Lake. The tightly folded sedimentary rocks dip south, so a possible explanation of the apparent horizontal displacement is that the area bounded by Knott Lake and the West Montreal River is a graben.

GEOCHEMICAL FIELD WORK

A geochemical survey was carried out in Baden and Alma townships by the author's party, using portable field kits. Sediments amenable to geochemical testing were taken from stream beds and tested by the standard colorimetric total heavy metals "quick test" (partial extraction) in dithizone. Heavy metals that were extracted were chiefly zinc, copper, and lead. On samples of sediments taken from the same locations as those for the field kit, total extraction (hot extraction) was carried out by the Laboratory Branch of the Ontario Department of Mines in Toronto.

Topographical gradients are steep near mouths of streams entering the West Montreal River, but farther west toward the sources of the streams in Baden township the gradients are gradual, and consequently the streams are sluggish and swamps are numerous. For this reason, sampling points were spaced farther apart in the upstream direction.

The following streams were tested:

Geochemical Anomaly No. 1:
The southern tributary into the beaver pond on property No. 12 on Map 2109, in Alma township (unsurveyed claim MR.39397).

Geochemical Anomaly No. 2:
The stream flowing northward from the beaver pond to Chief Creek.

Geochemical Anomaly No. 3:
Baptiste Creek, from the Indian settlement on the west end of Turtle Lake to the West Montreal River, and the tributary from Robb Lake to Baptiste Creek.

Geochemical Anomaly No. 4:
The stream from a lake in southwestern Baden township to Mistinikon Lake, passing about ¼ mile south of the showing on property No. 6 on Map 2109.

Geochemical Anomaly No. 5:
The stream that rises just south of claim MR.10202 to the west of property No. 4 on Map 2109, northward to its mouth on Matachewan Lake.

Geochemical Anomaly No. 6:
The stream from Belt Lake to Matachewan Lake.

Geochemical Anomaly No. 7:
Baden Creek, on property No. 10 on Map 2109 (claim MR.5872) as far as the small lake that is ⅞ mile east of Matachewan Lake.

Geochemical Anomaly No. 8:
The small stream that flows into the West Montreal River north of the test pits on property No. 8 on Map 2109 (claim MR.10455).

Results

Background values are less than 50 parts per million total heavy metals (chiefly zinc, copper, and lead). Of about 30 samples, two that gave a medium anomaly with the field kit gave only background values according to laboratory analysis. One of these samples had a high proportion of organic material. One background value obtained with the field kit was actually a high anomaly according to the laboratory analysis. Geochemical anomalies based on laboratory analyses are shown on Map 2109 (back pocket).

The background results of laboratory analyses are in parts per million, and the values given are averages for several samples, as follows:

Geochemical Anomaly No. 6:
Sediments for 1,000 feet west of Matachewan Lake on the stream that drains Belt Lake: zinc, less than 50; copper 8; lead 10. Westward from there to the junction of the two creeks: zinc, less than 50; copper 10; lead 8.

Geochemical Anomaly No. 5:
Sediments from the stream draining through claim MR.10202 (near property No. 4 on Map 2109): zinc, less than 50; copper 7; lead 10.

Geochemical Anomaly No. 7:
Sediments from Baden Creek on property No. 10 on Map 2109 (including claim MR.5872): zinc, less than 50; copper 10; lead 8.

Geochemical Anomaly No. 4:
Values from sediments in the stream south of property No. 6 on Map 2109: zinc, less than 50; copper 8; lead 5.

The anomalous results from the laboratory analyses (in parts per million) are as follows:

Geochemical Anomaly No. 2:
North of property No. 12 on Map 2109 (unsurveyed claim MR.39397): zinc, less than 50; copper 100; lead 8. The sampling location was 700 feet downstream from a beaver dam.

Geochemical Anomaly No. 1:
West of property No. 12 on Map 2109 (unsurveyed claim MR.39397): zinc, 50; copper 50; lead 30. Galvanized iron culverts, and also nails in wooden culverts, cause a geochemical anomaly for sediments taken within a few feet downstream. However, this sampling location is about 800 feet downstream from a road, and at this distance should not be affected.

Geochemical Anomaly No. 3:
The anomaly on Baptiste Creek about ⅗ mile east of its mouth on Matachewan Lake is: zinc 50; copper 10; lead 8.

Geochemical Anomaly No. 4:
A high anomaly about ⅗ mile south of property No. 6 on Map 2109 gave a background reading with the field kit, but hot extraction in the laboratory showed it to contain: zinc 100; copper 30; lead 30.

Conclusions

The metal background in the stream sediments of Baden and Alma townships is low and anomalies are poor. A moderate amount of heavy metals in sediments should, therefore, be unmistakably anomalous. Such anomalies would be useful in the search for gold, most deposits of which contain a minor amount of base metals. However, the dispersion area within which an anomaly can be detected is small. The only gold showings detected during this survey were in stream beds: the vein in Baden Creek (property No. 10 on Map 2109); and the one on property No. 12 on Map 2109 (unsurveyed claim MR.39397) in Alma township.

GEOPHYSICAL WORK

Aeromagnetic Survey

The G.S.C. aeromagnetic maps covering the map-area (Nos. 287G and 290G) are on the scale of 1 inch to 1 mile. Flight lines (north-south) were spaced ¼ mile apart, and the flight altitude was 500 feet.

Most of the volcanic rocks are intermediate in composition and characteristically contain small amounts of magnetite. At this flight altitude, no preferred orientation of magnetic intensity was detected for the volcanic rocks. In the area east of the West Montreal River, slightly magnetic diabase dikes are responsible for the long, narrow, north-trending high aeromagnetic anomalies that mask most of the low values attributable to the volcanic rocks. Because the high anomalies are flanked by similarly-shaped areas of low magnetic intensity, the diabase dikes can be assumed to dip steeply. The aeromagnetic data suggests that the diabase dikes are connected along strike to a greater extent than has been shown on the accompanying maps (back pocket).

A magnetic anomaly marks the boundary of the syenite stock whose centre is in Cairo township. The magnetic attraction is strongest between McDonnel and Narrow lakes, because magnetite is disseminated through the diabase and hybrid volcanic rocks and syenite. On the northern boundary of the syenite (in the southeastern part of Alma township) the magnetic contours are closely spaced, and cupolas of syenite north of the main body are scarce. This indicates that the syenite contact dips steeply. In volcanic rocks that are near the contact with the syenite stock, the strike of the schistosity tends to conform with the contact. Because of the low magnetic susceptibility of the granite, the aeromagnetic data are not useful in determining the dip of the granite contact in the northern part of Baden township and the northwestern part of Alma. However, the presence of cupolas south of the main body of granite does suggest that the contact of the granite with volcanic rocks dips south, under the volcanic rocks.

In Robertson township, where magnetic contours are offset by the Mistinikon Lake fault, the close spacing of the contours indicates that the fault dips steeply. In Alma township, where the magnetic contours are offset by the Montreal River–Narrow Lake Fault, a more gradual dip is indicated.

A large southeast-plunging fold that is offset by the Mistinikon Lake Fault was described (page 18) under the heading Structural Geology. Areas of low magnetic intensity exist north of the northern magnetic stratum and south of the southern magnetic stratum. Assuming that the reduction in magnetic intensity is more gradual in the direction of dip of the magnetic stratum, the distribution of magnetic contours supports the idea that the fold is a syncline.

Electrical Resistivity and Self-potential Surveys

In 1957 geophysical work was done by Geophysical Engineering and Surveys Limited for Geo-Scientific Prospectors Limited. The work was done on the "Woman River" group of claims in the southeastern part of Baden township, on both sides of the West Montreal River, and on adjoining claims in Powell township. An electrical resistivity survey was carried out along 16.8 miles of north-south picket lines spaced 400 feet apart. Sixty-cycle alternating current was introduced into the earth through electrodes spaced 4 miles apart in a north-south direction. Using a vacuum-tube voltmeter, voltage drops were read between 72 stations spaced at intervals of 100 feet. A self-potential check was made of one local area of low resistivity near the western boundary of the property, with negative results. The examining engineer, J. C. Frantz, concluded (in his company report on the Baden-Powell group, 1957) that the geophysical work did not indicate any anomaly that could be interpreted as the expression of sizeable concentrations of sulphide minerals.

ECONOMIC GEOLOGY

The Timmins-Kirkland Lake sheet (Map 2046, Ontario Department of Mines) shows the location of the map-area with respect to the Kirkland Lake–Larder Lake gold-mining camp, the Porcupine gold-mining camp, and gold occurrences in Midlothian township. In 1963 exploration for gold in Midlothian township led to revival of interest in the mineral possibilities of the Matachewan area.

HISTORY AND PRODUCTION

In the Matachewan area, prospecting has been carried on since the discovery of silver near Elk Lake in 1906. During the early years, gold was discovered in the southeastern part of Alma township and in the north central part of Cairo township. In 1916, Jake Davidson discovered gold near Davidson Creek, on what is now part of the property of Young-Davidson Mines Limited. Shortly thereafter, Sam Otisse discovered gold on claims that now belong to Matachewan Consolidated Mines Limited. The Young-Davidson property was investigated chiefly by Porcupine Goldfields Development and Finance Company Limited, and the property of Matachewan Canadian Gold Limited was investigated by Colorado-Ontario Development Company Limited. In 1919, Matachewan Canadian Gold Limited was reorganized under the name of Matachewan Gold Mines Limited. From about 1924 until the price of gold was raised in January 1934, the properties lay idle. Then, after intensive sampling of the Young-Davidson property, Hollinger Consolidated Gold Mines Limited erected a mill and, on 8 September 1934, production was begun at the rate of 500 tons per day. By 1956, when the mine was closed, 6,128,272 tons of ore containing 585,690 ounces of gold and 131,989 ounces of silver had been produced. Ventures Limited completed a program of drifting, diamond-drilling, and sampling on the property of Matachewan Gold Mines Limited, and then erected a mill. Production began on August 1934, at the rate of 85 tons per day. In 1954, when the mine was closed, 3,535,200 tons of ore had been mined, from which 370,427 ounces of gold and 133,710 ounces of silver were recovered. The Ryan Lake property of Pax International Mines Limited has been in production intermittently under various company names since 1950. The property had produced 4,753,650 pounds of copper, 1,309 ounces of gold, and 34,589 ounces of silver by the end of 1956. Since August 1964 a bulk concentrate of molybdenum and copper has been recovered from tailings produced by former operations on the property.

TYPES OF DEPOSITS

The modes of occurrence of the important metals and industrial minerals are as follows:

Gold and Silver

1. Gold-bearing quartz veins cutting syenite. Red syenite porphyry contains the highest grade of ore. The gold and silver are associated with pyrite, chalcopyrite, galena, sphalerite, hematite, molybdenite, scheelite, tourmaline, calcite, and fluorite. Examples: Young-Davidson Mines Limited, and Matachewan Consolidated Mines Limited.

2. Gold-bearing quartz veins cutting carbonatized rocks that are coloured green by chrome mica. Example: Matachewan Consolidated Mines Limited.

3. Traces of gold and silver in massive pyrite deposits in silicified country rocks near diabase dikes. Example: the pit on claim H.F.13 of Matachewan Hub Pioneer Syndicate.

Copper

1. In gold-bearing quartz veins cutting syenite or the country rocks that were intruded by syenite. Example: gold deposits of this type.

2. In quartz-carbonate stringers in greenstones. Example: the pit 500 feet west of Mistinikon Lake bridge.

3. In amphibolite intruded by granitic rocks. Associated with magnetite. Example: in Powell township the group of unsurveyed claims (property No. 2 on Map 2110) that belong to W. Brookbank, N. Evoy, and A. Hansen.

4. At the contact of sheared mafic intrusive rocks with granitic intrusive rocks. Example: Cairo township group of unsurveyed claims that belong to G. Sunisloe.

Molybdenum

1. In gold-bearing quartz veins in syenite. Example: Young-Davidson Mines Limited.

2. On sheared surfaces and in quartz veins in mafic intrusive rocks. Example: Pax International Mines Limited.

Nickel

1. In mafic intrusive rocks. Example: on hydro power transmission line in Cairo township, south of St. Paul Lake.

2. In greenstones near the contact with granitic intrusive rocks. Associated with pyrrhotite. Example: pit in Bannockburn township. The pit is near the southwest end of the lake about 2¼ miles south of Highway 566, on the boundary between Powell and Bannockburn townships.

Iron

1. Veins and lenses of magnetite in amphibolite near the contact with granitic intrusive rocks, associated with chalcopyrite. Example: Powell township group of unsurveyed claims (property No. 2 on Map 2110) that belong to W. Brookbank, N. Evoy, and A. Hansen.

2. Disseminated magnetite in country rocks near contacts with granitic intrusive bodies. Example: the area of strong magnetic attraction surrounding the syenite stock in Cairo and Alma townships.

Barium

Barite veins cutting syenite. Associated minerals: calcite, fluorite, galena, and sphalerite. Example: vein in Cairo township, on the west shore of Browning Lake (claim MR.16042).

Asbestos

In ultramafic intrusive rocks. Example: in Cairo township, south of the junction of Highways 65 and 66 (claim MR.6517).

SAMPLING

Sampling in the map-area is hampered because most of the pits, trenches, and stripping are partly filled by soil and forest debris, and overgrown by brush. In the following descriptions, a "grab sample" is representative of a small area, and a "selected sample" was considered to have a greater likelihood of containing valuable metal than were most other samples from that locality. All assays for gold from samples obtained by the author's party in Baden and Alma townships have been enumerated or referred to, including those that were trace or nil. Analyses of all rock samples taken by the author and his assistants were carried out by the Laboratory Branch of the Ontario Department of Mines, Toronto.

Description of Properties

BADEN TOWNSHIP

Thesaurus Property

This property is shown as property No. 10 on Map 2109, and consists of claims MR.5901, MR.5868, and MR.5870 to MR.5873 inclusive. Dyer (1935 p. 46) described gold showings on claims MR.5868, MR.5871, and MR.5872 (then owned by Thesaurus Gold Mines Limited.) Thesaurus also held MR.5901, MR.5870, and MR.5873. The main showing is on claim MR.5868, about 2,000 feet northeast of the head of Matachewan Lake. A shaft has been sunk to a depth of 308 feet on No. 1 quartz vein, which strikes N60°E and cuts grey and pink hornblende-and-mica granite. Disseminated pyrite constitutes up to 10 percent of some samples of grey granite in the dump. Volcanic rocks and vein quartz are also present in the dump. Burrows (1920, p. 63) gave the following description under the heading "Nelson Claims":

On claims MR.5868, most work has been done on a series of veins about a quarter of a mile south of the north boundary of Baden. A shaft was begun on vein No. 1, which strikes north 61° east, and at the time of visit (September, 1919) was down 12 feet. The work showed 37 inches of quartz, interbanded with granite, with some pyrite, on the north wall. No visible gold was observed at the time, but James Nelson states that a few feet deeper some coarse gold was obtained in quite rich specimens. The veins or lodes consist of narrow bands of quartz up to 15 inches in width, over an average width of about two and a half feet, with the quartz veins more or less continuous and branching roughly parallel to the strike of the lodes. The principal veins, No. 1 and No. 2, have been traced several hundred feet by means of trenches. Toward the east the series of veins is cut by a north and south dike of diabase, sixty feet in width. The granite is partly altered along the veins to a greenish colour, while unaltered granite is grey or pink. The quartz in the veins frequently has a streaky character, due to inclusion of dark-coloured minerals in fine lines. About one-half a mile to the south-west another vein with similar characteristics is exposed, and has been traced down the bluff almost to the lake, where a tunnel into the hill has been begun.

On the south claim [MR.5872] of the group, known as the Forest, there is a similar narrow quartz vein in the granite, which occurs in the bed of a creek between high sand ridges, and is traceable for several hundred feet. It contains a small amount of iron pyrites, and at one place a mass of well crystallized garnet, of the variety "andradite", showing isometric combinations, was observed. Some values in gold have been obtained in all these veins, and it is the intention of the owners to give them a careful exploration. The veins occur as shears in the granite and very probably are derived from it. The relation of the granite to the grey porphyrite that occurs to the south along the lake is not known, since they were not observed in contact. The granite is believed to be the younger rock. The presence of garnet in the veins indicates deposits formed at a high temperature.

Dyer (1935, p. 46) reported that drifting and crosscutting of 100 feet had been done on the 100-foot level, and 230 feet on the 300-foot level of the shaft. The chief difficulty was the narrowness of the veins and faulted ground, which made it difficult to follow the veins. Perhaps the green altered granite referred to by Burrows could have been used as a guide to ore. In the dump, granite that contains greenish-white feldspar is more fine-grained than most of the grey granite. This is what one would expect for wallrock near a quartz vein. Green colouring can be caused by kaolinization of feldspar, a process that takes place often during hydrothermal alteration. If Burrows' green altered granite is the same as Dyer's yellowish-green rock, it would seem, from the following statement of Dyer (1935, p. 46) that the "ore guide" was not used in planning underground development work:

A body, 60 feet wide, of peculiar fresh-looking, yellowish green rock with prominent quartz eyes was reported as having been cut in the crosscut at the 300-foot level; some of it can be seen lying on the dump. Under the microscope it is seen to consist of fresh phenocrysts of quartz and phenocrysts of orthoclase and plagioclase altering to sericite in a very fine-grained groundmass of feldspar, quartz, sericite, and pyrite. It is a rhyolite porphyry or quartz porphyry and is probably intrusive into the granite. No rock like it occurs anywhere else in the area.

Judging from these descriptions, more encouraging results might have been obtained if the yellowish-green rock had been explored more thoroughly along its strike.

In 1963 several grab samples taken by the author from the dump were assayed. A sample of grey granite, containing about 8 percent pyrite, and one of vein quartz both gave only traces of gold and silver. Grab samples of grey granite yielded assays ranging from a trace to 0.14 ounces of gold per ton. The sample of highest grade contains "dusty" quartz.

Claim MR.5872 was described by Burrows (see above), who called it the Forest claim. In 1959, according to a diamond-drill log signed by D. Hurd, two drillholes cut narrow sections that gave assays of 0.3 to 0.6 ounces of gold per ton. In 1963, grab samples taken by the author's party from the vein gave assays ranging from 0.04 to 0.08 ounces of gold per ton.

Richore Gold Mines Limited

Richore Gold Mines Limited holds the following claims: MR.10539 to MR.10541 inclusive, MR.7101, MR.5977, MR.7913, MR.6078, and MR.10501, as well as three patented claims MR.9599, MR.9877, and MR.9674 near milepost 3 and milepost 4 on the western boundary of Baden township. They are shown as property No. 7 on Map 2109. The main group of claims was described by Dyer (1935, p. 46) under the name of Central Matachewan Mining Corporation Limited. On claim MR.7101, a sheared, fractured zone about 300 feet long and 3 feet wide strikes N55°E and dips 85°N. The shear zone cuts altered volcanic rocks and granite, and contains a few quartz-carbonate stringers and a small amount of pyrite. Quartz constitutes 60 percent of some parts of the granite. Selected samples taken by the author from the dump gave assays ranging from 0.10 to 0.27 ounces of gold per ton. Several holes have been drilled on the property.

J. G. Honsberger

This property is shown as property No. 3 on Map 2109 and consists of the following claims: MR.6543, MR.8664, MR.9600, MR.6544, MR.7914, MR.8663, MR.8796, MR.8155, MR.7915, MR.9680, MR.8157, MR.8156, MR.8428, MR.7085, MR.9545, MR.9565, and MR.9564.

Nine quartz veins were discovered in andesite, tuff, agglomerate, and syenite in an area east and north of Belt Lake. The showings were described by Dyer (1935, p. 45) under the name of "Baden Gold Mines" (see Figure 2). Quartz vein

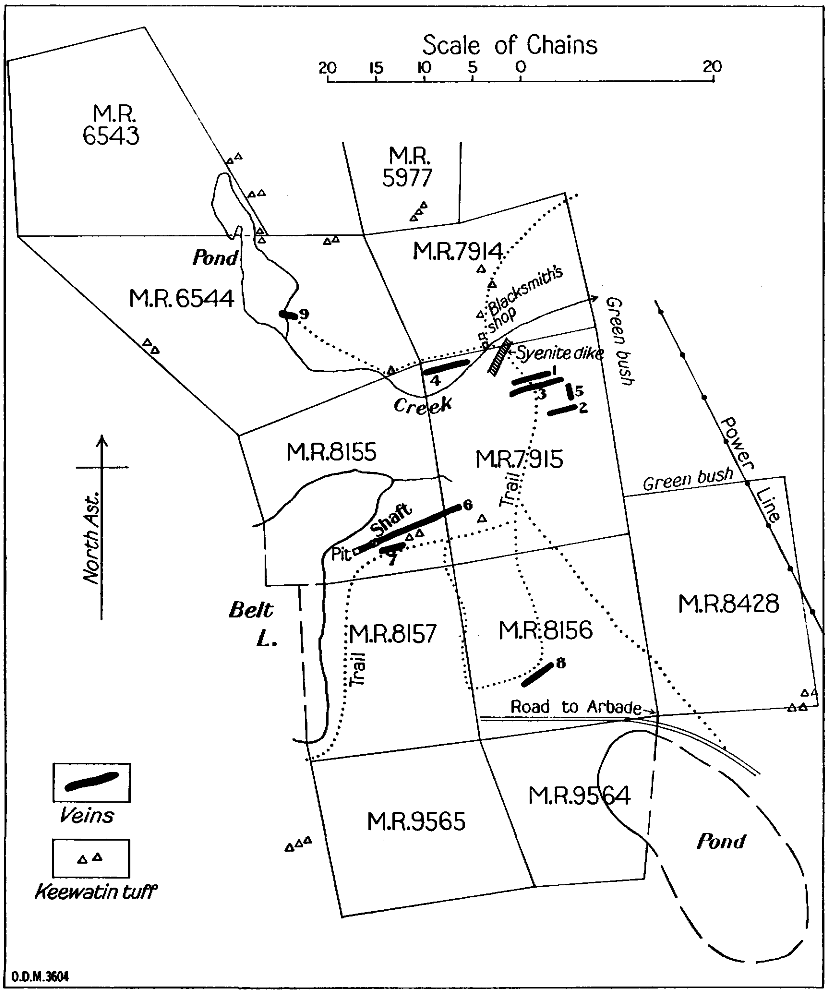


Figure 2 — Sketch map of the claims of Baden Gold Mines Ltd. (O.D.M. figure reproduced directly from O.D.M. Vol. 44, 1936, pt. 2, p.45.)

No. 1 is on claim MR.7915. It has a maximum width of 1 foot, and is in a shear zone 3 feet wide. The vein strikes N60°E and dips 80°S. Quartz stringers are exposed in a trench 350 feet long in sheared agglomerate. Pyrite constitutes 5 percent of many parts of the quartz stringers. Selected samples taken by the author from the dump gave assays ranging from 0.02 to 0.15 ounces of gold per ton.

No. 2 vein is also on claim MR.7915. A trench has been blasted for a length of 100 feet in pyrite-bearing quartz that has a maximum width of 1 foot.

No. 3 and No. 5 veins are also on claim MR.7915. The main host rock is agglomerate. Rickaby (1932, p. 23) described the veins as follows:

> No. 3 vein has been stripped for 150 feet disclosing 4 inches of quartz in schist, which strikes N.70°E. and dips 70°S. The vein is heavily mineralized with pyrite, and a little native gold was noted in place. At the east end of the trench a cross-shearing discloses a 3-foot vein (No. 5) of mineralized schist and quartz striking N.15°W. and dipping 45°W. A small lamprophyre dike forms the footwall of this vein. A grab sample of the quartz from the junction of these two veins assayed $1.20 [0.06 ounces] in gold.

Two massive sulphide samples containing some chalcopyrite were taken by the author. They gave assays of 0.10 and 0.20 ounces of gold per ton. A sample of quartz containing pyrite, chalcopyrite, and country rock fragments gave an assay of 0.06 ounces of gold per ton.

The description by Rickaby (1932, p. 23) of No. 4 vein, also on claim MR.7915 follows:

> In No. 4 vein, the quartz has widths up to 6 inches in a schisted zone 4 feet wide, which strikes N50°E and dips steeply to the southeast. It contains coarse pyrite and some chalcopyrite and sphalerite. The vein has been uncovered for 150 feet and a pit sunk to a depth of 15 feet. A channel sample across 4 feet at the bottom of this pit was reported to assay $4.80 [0.23 ounces] in gold.

Rickaby says that No. 6 vein, which crosses the boundary between claims MR.7915 and MR.8155 (see Figure 2), is mineralized with pyrite and a little chalcopyrite. He saw a considerable amount of fine native gold in the vein at the west end. Dyer (1935, p. 44) wrote of No. 6 vein:

> No. 6 vein...is the most important; it has been uncovered by trenches and test pits for a length of 800 feet in an east-northeast direction; it dips steeply to the north. The quartz ranges in width on the surface from 1 to 14 inches, with the greatest width at the west end, but it is reported to widen to about 2 feet at the bottom of the 30-foot shaft, now flooded...
>
> It is reported that the three completed holes at the west end of the vein, which were approximately 100 feet apart, showed at a vertical depth of 100 feet widths of about 2 feet of quartz carrying from 0.04 to 0.65 ounces per ton, and that in one hole the footwall rock averaged 0.30 ounces over 4 feet.

The wallrocks of No. 6 vein are very fine-grained, massive, bleached, silicified volcanic rocks that are cut by a syenite dike near the east end of the vein. Pink and white calcite, chlorite, sericite, pyrite, and chalcopyrite are present. Subsidiary shears diverge from the main shear. Assays of grab samples taken by the author were: 0.02 ounces of gold per ton for a sample from the shaft on the west end of No. 6 vein; 0.35 ounces at a point 550 feet northeast along the trench from the shaft; and 0.01 to 0.03 ounces in the trench at a point 720 feet northeast of the shaft.

No. 8 vein, which is on MR.8156, was described by Dyer (1935, p. 45) as follows:

> No. 8 vein consists of stringers of quartz in a sheared zone 3 to 5 feet wide, striking east-northeast; values of $2.50 [0.12 ounces] of gold across 4 feet and some native gold are reported.

J. E. McVittie

A showing, listed as property No. 5 on Map 2109, is on claim MR.21186 (formerly MR.8193), within 400 feet of the muskeg-fringed shore of a small lake about ⅖ mile northwest of the north end of Mistinikon Lake. The showing was described by Dyer (1935, p. 47) under the heading "French Property", and was drilled by Hollinger Consolidated Gold Mines Limited in 1934.

A quartz vein that strikes N40°E and dips steeply northwest has been blasted for a length of 90 feet. The quartz vein is in the contact zone between massive volcanic rocks (possibly tuffs) on the west and syenite porphyry on the east. A diabase dike is 60 feet east of the contact. Dyer's report (1935, p. 47) contains the following information:

> Hollinger officials report that over a length of 90 feet and a width of 11 inches, values of $30.00 [1.50 ounces] in gold per ton were found. The ore body was also located in drilling. At both ends of the 90-foot section the fracture continues farther, but little quartz and no values were found.

The area of quartz stringers in syenite porphyry that is stripped of overburden is 35 feet in diameter. Up to a maximum of 1½ feet on either side of quartz stringers, the wallrock has been reddened. As in the gold ore at Kirkland Lake, the red colour is probably caused by hematite contributed from the hydrothermal solutions that introduced the quartz. A grab sample of red syenite porphyry containing quartz stringers was taken by the author. It gave an assay of 0.14 ounces of gold per ton. A loose sample of vein quartz containing a small amount of chalcopyrite and pyrite gave an assay of 8.41 ounces of gold and 9.79 ounces of silver per ton.

F. W. Hines

This property is shown as property No. 2 on Map 2109. A shaft has been sunk on claim MR.6686. Most of the work was done when the property was owned by Arbade Gold Mines Limited, and W. S. Dyer examined it at that time. Part of his description (Dyer 1935, p. 47) follows:

> In the west central part of Baden township several dikes of fine-grained pink syenite, often porphyritic, intrude the Keewatin tuffs. In places the syenite is traversed by a stockwork of mineralized quartz veins, somewhat like the porphyry on the Young-Davidson property, and at such places assays of gold up to $3.00 [0.15 ounces] of gold have been reported. On the property of Arbade Gold Mines, Limited, a series of such dikes, striking northwest, can be followed for over one and a half miles. A section across the strike of the dikes just west of the shaft showed at least 10 of them, including some of basic syenite, in a width of 400 feet.

In 1948 W. S. Savage, resident geologist for the Ontario Department of Mines at Kirkland Lake, examined the property and described it as follows:

> An old trench extending 450 feet on a bearing N.70°W. from the shaft has been cleaned out and exposes the "vein" on which the shaft was sunk. This "vein" consists of a stockwork of quartz stringers over widths up to six feet in fine-grained syenite, lying along the north side of a shear, which dips vertically or steeply to the south. Pyrite mineralization was noted, with which the gold is said to be associated, and visible gold has also been reported.

In 1931 twelve holes totalling 2,000 feet of core were drilled by Arno Mines Limited at intervals along a distance of 2,200 feet in the syenite porphyry. Most of the assays from sections of the porphyry contained gold, with values ranging from a trace to 0.03 ounces per ton except for one assay that was 0.10 ounces of gold per ton.

In 1963 selected samples were taken by the author from several types of rock in the dump and along the trench on claim MR.6686. Of these, ten assays ranged from a trace to 0.03 ounces of gold per ton, and one sample of syenite containing quartz stringers gave an assay of 0.49 ounces of gold per ton.

C. A. Floyd

This property is shown as property No. 1 on Map 2109 and includes the eastern part of the syenite body that is west of the north end of Mistinikon Lake. It was formerly known as the O'Neill property. It consists of claims MR.6786, MR.6628, MR.8098, MR.7449, MR.6635, MR.6613, and MR.6666.

Quartz stringers and lenses in volcanic rocks and syenite porphyry, and along their mutual contact, contain minor amounts of pyrite. In places the quartz is fractured, and the wallrock bleached and brecciated for about a foot on either side of the vein. In 1938 W. T. Robson logged 3,007 feet of core from 10 diamond-drillholes for Lake Shore Mines Limited. In his opinion no sections in the core looked as good as some of the surface exposures.

Assays of grab samples taken by the author range from a trace to 0.02 ounces of gold per ton.

Quilty Property

This showing is listed as property No. 6 on Map 2109 and is approximately 2 miles north and 1 mile east of the southwest corner of Baden township. It was described by Dyer (1935, p. 48) as the J. Quilty property. In 1948, during the time that J. Quilty was working on the property, W. S. Savage, resident geologist for the Ontario Department of Mines at Kirkland Lake, examined the property and described it as follows:

> The vein, which is two feet in width, strikes N60°W and dips 80°N. It is a breccia zone with a quartz matrix, well mineralized with pyrite, containing silicified fragments of fine-grained, basic dike which apparently first occupied the fissure. This dike, which is andesitic in appearance, was intruded into medium-grained tuffaceous pillow lava.
>
> The vein has been traced for 200 feet along strike to where it goes down into a swamp. A channel sample across the face of the pit was said by J. Quilty to have assayed $16.00 [0.45 ounces of gold] per ton for the first foot from the hanging wall side, and $3.00 [0.08 ounces of gold] per ton across the remaining three feet.
>
> Stripping 65 feet to the north of the pit has exposed a silicified zone in the lavas containing a stockwork of quartz stringers with a westerly trend. A channel sample across three feet was said to have assayed $26.00 [0.74 ounces of gold] per ton.

Selected samples taken by the author from dumps along the shear gave assays ranging from 0.01 to 0.20 ounces of gold per ton. Quartz stringers in altered volcanic rock gave the highest assays.

Sutherland Property

This property is shown as property No. 9 on Map 2109 and was formerly known as the Sutherland property. The western claims, near milepost 2, are MR.10508 and the unsurveyed claim south of it, MR.14384. The eastern claims, near the westernmost bay of Mistinikon Lake, are unsurveyed and have lapsed. Two holes drilled in 1949 on claim MR.10508 and two holes drilled on the eastern claims were logged by J. Blackwall. According to the core logs, the drillholes cut andesite and amygdaloidal flow tops containing a few quartz-carbonate stringers and small amounts of pyrite.

M. King

This property is shown as property No. 4 on Map 2109 and is about a mile northwest of Matachewan Falls, on unsurveyed claim MR.33181. The property was described by Dyer (1935, p. 47) under the name of Theodore Kallies. On it, a series of parallel shears across widths ranging from 30 to 50 feet extend for a length of more than 500 feet, and cut greenstones and syenite. The shears strike approximately N80°E and dip 80°S, and contain quartz stringers. The wallrock is greatly altered and contains pyrite. Near the east end of the 500-foot length of shear zone, a grab sample taken by the author gave an assay of 0.45 ounces of gold per ton, and others taken from dumps and bedrock, working westward along the shears, gave assays of 0.04, trace, trace, 0.36, 0.13, 0.05, nil, and nil ounces of gold per ton.

Recent blasting at the west end of the shear zone has exposed a width of 15 feet of pink fine-grained syenite that has been intruded into the zone of strongest shearing. The syenite is sheared, sericitized, and chloritized, and contains a stockwork of quartz stringers. Fine-grained pyrite constitutes about 3 percent of the intermixed quartz stringers, syenite, and greenstones. Five representative samples taken by the author at approximately equal intervals across the 15-foot width of stockwork gave assays of 0.06, 0.39, trace, 0.17, and 0.11 ounces of gold per ton. In the opinion of the author, drilling should be planned to intersect the shear zone below the stockwork of quartz stringers.

S. Stanwick

This property is shown as property No. 8 on Map 2109. Claims on both sides of the West Montreal River were owned by Woman River Gold Mines Limited, when Dyer (1935, p. 48) described a gold occurrence on claim MR.10401. Some of the ground is now held as unpatented claims by S. Stanwick of Matachewan, and some is open for staking. Claim MR.10401, on the west side of the West Montreal River, was examined also by W. T. Robson in 1934. He saw visible gold in a lens 2 feet long in an irregular quartz stringer 40 feet long. West of the gold showing, he found that the vein pinched to a crack, and to the east it ended at a shear zone. Two hundred yards north of the gold showing, he saw a strong shear about 50 feet wide. It is exposed for a vertical depth of 20 feet on the face of a cliff overhanging the West Montreal River. Robson reported that samples from this and a strong shear that is ½ mile north of the gold showing gave low gold assays.

During the author's geological survey of 1963, a narrow offshoot of a diabase dike was seen cutting the basic syenite beside a pit on claim MR.10455. The bleached rock in the pit contains some quartz stringers and about 3 percent of pyrite, and a trace of gold and silver. A deeper pit nearby is in a fine-grained dark-grey to grey-white phase of diabase that contains many lenses of pyrite.

On the east side of the West Montreal River, work has been done on several claims in which the country rock is andesite and agglomerate cut by diabase dikes. An electrical resistivity survey was carried out on 25 claims by Geophysical Engineering and Surveys Limited for Geo-Scientific Prospectors Limited. One local area of low resistivity near the western end of the baseline was checked by means of self-potential equipment (see page 23, for description of methods). According to J. C. Frantz in a report to Geo-Scientific Prospectors Ltd. in 1957, the geophysical work did not indicate any anomaly that could be interpreted as the expression of sizeable concentrations of sulphide minerals.

ALMA TOWNSHIP

H. G. Willetts, Jr.

Claim E.B.10, formerly owned by K. Wilson, is on the east side of Narrow Lake. It is listed as property No. 14 on Map 2109. The area is one of interfingered volcanic rocks and syenite, intruded by diabase. A test shaft was sunk in an area of quartz-carbonate stringers at the contact of diabase and greenstone. The quartz-carbonate stringers contain a small amount of pyrite and chalcopyrite and traces of gold and silver. In 1961 a hole was drilled to a depth of 114 feet in andesite.

J. W. Rodie Estate

Claims MR.7080, MR.7081, MR.7079, MR.5611, MR.5612, MR.7082, MR.7078, and MR.7077 are shown as property No. 13 on Map 2109 and are in the southeastern part of Alma township, at the south end of the lake ⅜ mile east of McNaughton Lake. They were formerly owned by K. Wilson. A number of pits exist in syenite and on the contact with diabase. In places on the diabase contact, pyrite constitutes 5 percent of the silicified, bleached rock. Grab samples of carbonatized, silicified syenite taken by the author contained a trace of silver and from a trace to 0.06 ounces of gold per ton.

McIntyre Porcupine Mines Limited

This property is shown as property No. 12 on Map 2109. Unsurveyed claim MR.39397 covers the approximate area that was formerly known as the Chief claim. It is near the junction of the logging roads to Chief Lake and to Separation Lake. A pit in the beaver pond is said by local inhabitants to have contained visible gold. In May and June 1961, Triana Exploration Limited mapped MR.39397 and other claims on both sides of the boundary between Alma and Holmes townships.

Grab samples taken by the author yielded little more than a trace of each of the elements gold, silver, molybdenum, and copper. In order to examine and sample the showing adequately, the beaver dam would have to be breached and the pond drained.

W. Brookbank

This property is shown as property No. 11 on Map 2109. Claims in this group are T.17816 and T.17801 in the southeastern corner of Alma township, and the adjacent claim T.17802 in the northeastern corner of Cairo township (see page 47). The showing on claim T.17801 was discovered about 1914. A trench follows quartz stringers in silicified syenite for a length of 80 feet in a fracture zone 8 feet wide. The fracture zone strikes N15°W and dips 75°W. A lens 3 feet in diameter contains quartz, chalcopyrite, galena, calcite, and fluorite. The average of assays of 5 grab samples taken by the author from the vein material was 0.27 ounces of gold and 12 ounces of silver per ton.

POWELL TOWNSHIP

Matachewan Consolidated Mines Limited

This property is shown as property No. 5 on Map 2110. The main group of claims owned by Matachewan Consolidated Mines Limited consists of 16 claims in the southeastern part of Powell township and 6 claims in the adjacent southwestern part of Cairo township.

Claims MR.5379, MR.5380, and MR.5402 have underground workings. Three shafts were sunk on claims MR.5380 (Nos. 1, 2, and 3 shafts to depths of 170 feet, 33 feet, and 2,452 feet respectively) and lateral work was done on 17 levels.

Figure 3 is a plan of the second level (267 feet below surface) and Figure 4 is a plan of the eighth level (1,050 feet below surface). These were drawn by the Ontario Department of Mines Cartographic Unit from mine plans of Matachewan Consolidated Mines Ltd., dated 31 August 1948, and are reproduced with the permission of the company.

Geological Relations

The deposits are close to the contact between a belt of tightly folded "Timiskaming" sedimentary rocks that strike approximately east and dip steeply south, and "Keewatin" andesite, basalt, tuff, and agglomerate. The "Keewatin" and "Timiskaming" rocks are intruded by dikes and cupolas of "Algoman" syenite porphyry having approximately the same strike and dip as the rocks they intruded. All rocks are cut by north-trending "Matachewan" diabase dikes that are post-ore.

Character of the Mineralization

The following excerpt is from the report by Derry *et al.* (1948, p. 638, 640):

> The gold-bearing mineralization forms bodies of two different types:
>
> (1) Within the volcanic rocks irregular orebodies with limited vertical extent. These consist of a series of flat-dipping quartz stringers and adjacent lavas and/or tuffs fractured, bleached, and mineralized with pyrite and gold. They are higher grade than the second type (average about 0.16 oz. gold a ton) and formed the main source of ore for the first 5 years of production...
>
> (2) Orebodies within the porphyry masses. This type of ore occurs mainly in the western part of the property and is similar to the ore being mined at the adjoining Young-Davidson mine. The porphyry mass here lies within the sediments a short distance north of the sediments-volcanics contact. Most of the porphyry is fractured to some extent and the cracks are filled with quartz and pyrite that is to some degree auriferous...

The first type mentioned by Derry is along the contact of volcanic and sedimentary rocks, and was described in greater detail by Dyer (1935, p. 37, 38):

> The Keewatin for this width of 200 feet has been altered by the porphyry to a light-green carbonate schist, which weathers to a dark rusty green at the surface, but there are patches of less altered rock, resembling tuff in some places, flows in others. Green mica, either mariposite or fuchsite, is a common accompanying mineral. Bands of distrinctive light-grey, pyritized schist are found at scattered localities in the green carbonate schist, and the light-grey schist also constitutes an irregular discontinuous zone near the outside (south) limit of the alteration. South of this zone the alteration fades out gradually, the rock becoming a dark-green basaltic schist. The light-grey schist, however, is not confined to the carbonate schist zone, since in the vicinity of the No. 2 shaft, lenses of it appear in dark-green basaltic schist. Most of the orebodies are found in the light-grey schist.
>
> The light-grey pyritized schist has been formed by the intrusion of veins and stringers of quartz, and is a distinctly later development than the green carbonate schist.

According to Dyer, an analysis of the green schist showed that it had been silicified as well as carbonatized, and an analysis of the light-grey schist showed that it had been carbonatized, pyritized, and possibly albitized. Dyer (1935, p. 39–41) continued:

> These bodies [of gold ore of the highest grade] consist of lenses of light-grey pyritized schist lying in basalt south of the zone of carbonate schist. The gold values occur in and adjacent to narrow veins and stringers of quartz, which cut the light-grey schist. Mineralization consists almost entirely of pyrite, although chalcopyrite, tourmaline, and scheelite have been observed.

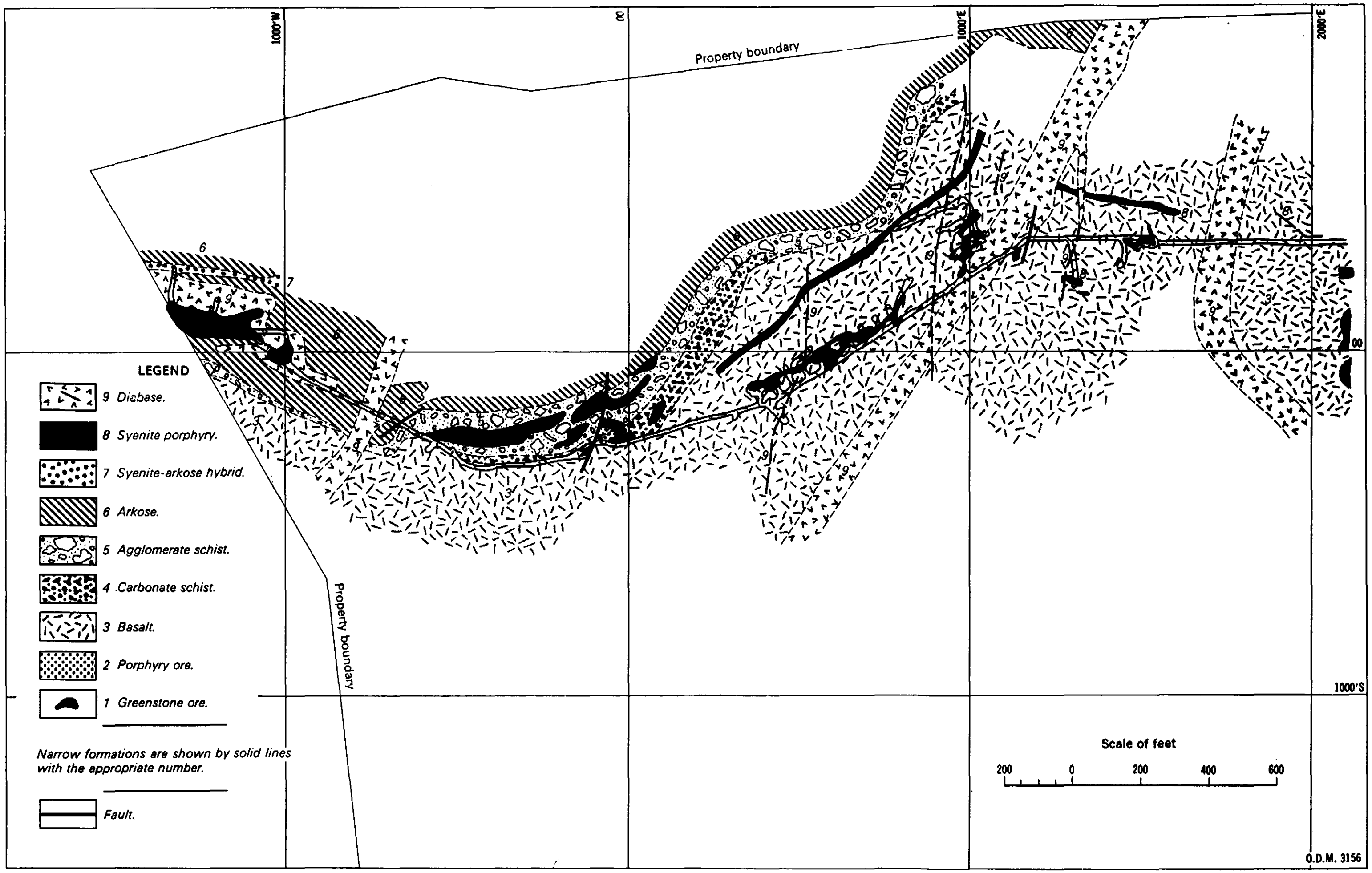


Figure 3 — Matachewan Consolidated Mines Ltd., plan of second level (267-foot). (From company mine plans dated 31 August 1948, by permission of Matachewan Consolidated Mines Ltd.)

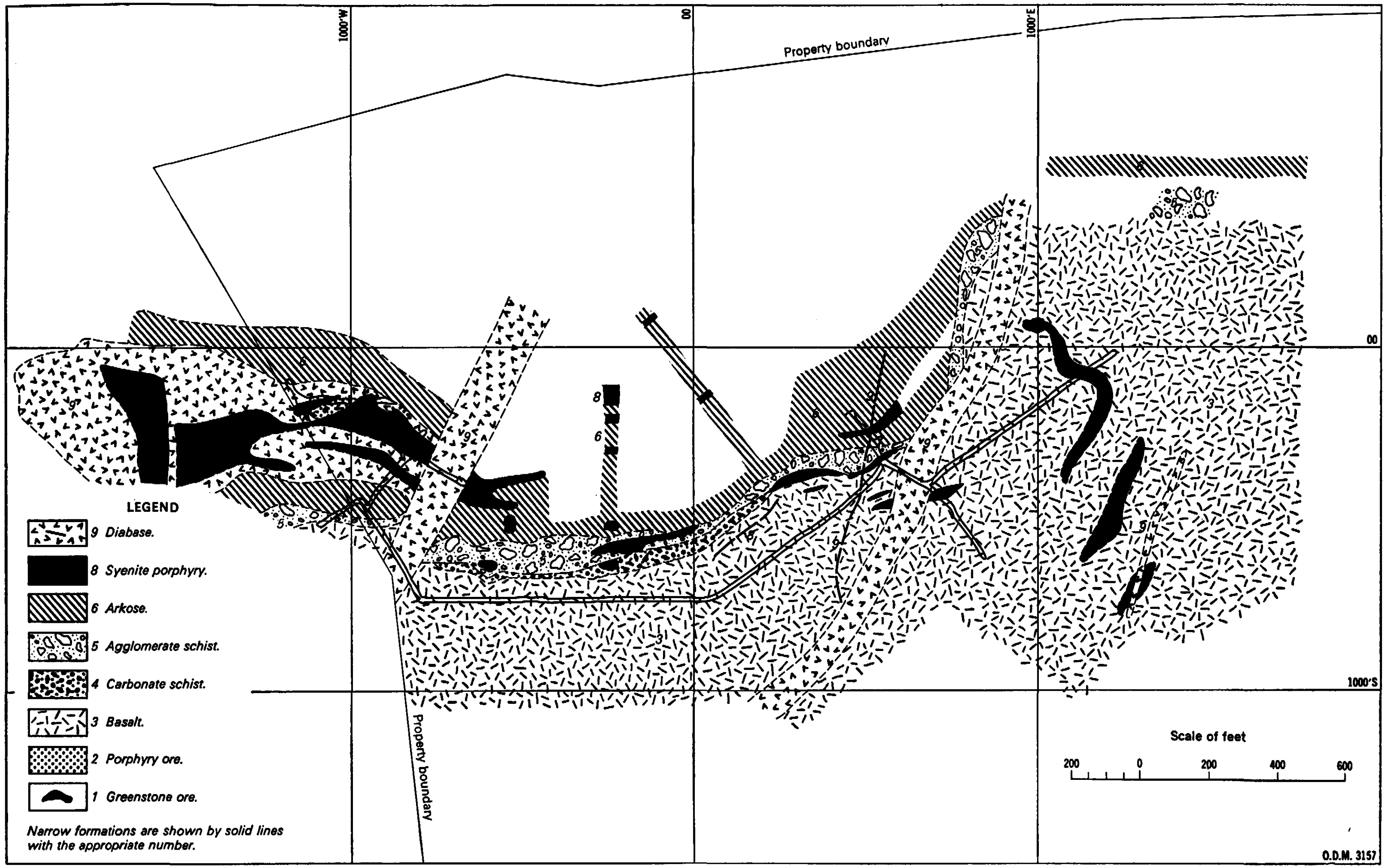


Figure 4 — Matachewan Consolidated Mines Ltd., plan of eighth level (1,050-foot). (From company mine plans dated 31 August 1948, by permission of Matachewan Consolidated Mines Ltd.)

Better values have been obtained where the pyrite is coarse. The schist in the walls of the vein may assay as high or higher than the vein itself. There is usually very little pyrite in the vein, but coarse cubic pyrite is plentiful in the schist next to it, gradually becoming less abundant and finer away from the vein. Native gold is often found in the quartz stringers cutting the light-grey schist as well as in the schist itself; the pyrite is also auriferous...

The gold values are connected with quartz stringers in what has been called "grey porphyry" as well as with stringers in the carbonate schist. Mineralization is similar to that of the orebodies in the vicinity of No. 2 shaft. The "grey porphyry" which is yellowish to white in colour, is sometimes in separate dikes, but can also be seen grading into the ordinary type of red syenite porphyry. The microscope indicates that the grey porphyry is not a distinct type of porphyry but merely a replacement of the red syenite porphyry by quartz, albite, and calcite.

STRUCTURE

The following summarized excerpts are from Derry *et al.* (1948, p. 640–643).

Structural Features of General Effect

(1) The main regional syncline. The orebodies lie on the overturned southern limb of a [Timiskaming] syncline that can be traced with fair confidence westerly from Kirkland Lake.

(2) Cross folds. Surface mapping in this and adjoining properties has shown that cross folds exist. These may represent an old system of folding earlier than the main east-west folding, or may be superimposed on the latter. They now show up as indentations and flexures in the sedimentary-volcanic contact. In a general way the orebodies within the volcanics lie near the point where the formations swing north to form one of the more pronounced cross folds. Similarly the porphyry ore occurs at a point where the formations, going westerly, swing toward the north in a flexure that represents a more gentle expression of the cross folding. The flexures or cross folds pitch in a southwesterly direction at about 70°, which gives a westerly rake in the plane of the ore zone...

Structural Features Affecting Orebodies in the Volcanics

(1) Bedding. There seems little doubt that differential movement along the parting planes of the tuff bands and the local flow tops (represented by "streaky" lava) has caused at least part of the fracturing resulting in orebodies...

(2) Minor drag folds. These show up when the tuffs and flow tops are mapped in detail and in several cases form the ends of orebodies on strike. They pitch west or southwest at about 70°, similar to the cross folds, and so probably belong to the same system of folding.

(3) North-dipping fractures. These appear to be tension fractures. They strike east to north of east and dip north at 5° to 20°. They are quartz-filled and usually have the adjoining rock bleached and mineralized with pyrite. Most of the gold in volcanic rocks is carried in or near these fractures.

(4) South-dipping fractures...

To summarize the effects of the above four factors, it may be pointed out that both footwall and hanging-wall of an orebody may be formed by tuff bands or flow tops, with tension fractures angling across from one to the other...The lower limit of the ore is formed by the divergence on dip of the two structures to a point where the intervening rock is too wide to fracture well.

Structural Features Affecting Ore in the Porphyry

(1) The boundaries of the porphyry mass...

(2) Quartz-filled tension cracks striking 300° to 340° (true) and dipping between 20° and 35°N.E...

(3) Slips or shears having strikes from north to northeast and dipping vertically to steeply eastward.

Culver Gold Mines Limited

This group is shown as property No. 3 on Map 2110 and consists of the following claims: MR.6552, MR.6553, MR.6004, MR.6002, MR.5998, MR.6003, MR.6000, MR.5997, MR.6170, MR.6169, MR.6199, MR.6001, MR.5999, MR.5996, MR.5421, MR.5513, MR.5514, MR.5651, and MR.5389. The country rocks are tightly folded greywacke and conglomerate cut by syenite and by quartz veins in which gold has been found. Under "O'Connell Gold Mines Limited" Dyer (1935, p. 43) gave the following description of work done on claim MR.5651:

A shaft is being sunk to explore a quartz vein, from which values have been reported by the company; this shaft had reached a depth of 75 feet in July, 1934. The vein reached a width of 1.4 feet and is mineralized with chalcopyrite, pyrite, and tourmaline. It is vertical and strikes northeast, parallel to the schistosity in the soft, grey altered greywackes, which form the country rock. The vein could be followed only a short distance, owing to the fact that it has been faulted.

British Matachewan Gold Mines Limited

This group is shown as property No. 1 on Map 2110 and consists of the following claims: MR.5568 to MR.5570 inclusive, MR.5400, MR.5657, MR.5922, MR.6032, MR.5386, MR.9835, MR.5659, and a group of unsurveyed claims between the above claims and Mistinikon Lake. Most of the bedrock is composed of Cobalt sedimentary rocks. During the summer of 1964, two vertical holes were drilled on unsurveyed claims MR.33921 (part of former surveyed claim MR.5568) and MR.34252. Both holes went through more than 1,000 feet of Cobalt sedimentary rocks, although the hole on claim MR.34252 is less than 1,300 feet south of a large outcrop of "Timiskaming" sedimentary rocks.

Pax International Mines Limited

In 1964 the Ryan Lake mine belonged to Pax International Mines Limited. The property is shown as property No. 7 on Map 2110 and comprises the following claims: MR.16224, MR.16223, MR.6322 to MR.6324 inclusive, MR.5494, MR.5493, and MR.12547 to MR.12549 inclusive. Production began in 1950, when the property was owned by Ryan Lake Mines Limited, and has been carried on intermittently by several companies since then. Underground workings are on claims MR.12548, MR.5495, MR.6322, and MR.6323. A shaft was collared in ore and sunk to a depth of 459 feet, with lateral work on four levels. Between 1948 and 1956 the mine produced 4,753,650 pounds of copper, 1,309 ounces of gold, and 34,589 ounces of silver for a total value[1] of $1,548,800. The following are the various operators of the mine: Ryan Lake Mines Ltd., 1948-1950; New Ryan Lake Mines Ltd., 1951-1954; Min-Ore Mines Ltd., 1955; G. S. Welsh, 1956, 1957; International Ranwick Ltd., 1958; International Molybdenum Mines Ltd., 1959; Pax International Mines Ltd., 1960-1964.

In 1964 a roasting and leaching plant was installed and used for the separation of molybdenum and copper from tailings produced by former operations on the property; 5,938 tons of ore and 14,025 tons of tailings were treated. Also, some stripping was done, and induced polarization surveys were carried out.

Total of metals production[1] from the Ryan Lake mine to the end of 1964 was: 1,352 ounces of gold, 36,141 ounces of silver, 4,995,745 pounds of copper.

Geological Relationships

The Pax International property straddles the contact between tightly folded sedimentary rocks and the volcanic rocks to the north. An ultramafic intrusive body exists along the contact, and several syenite cupolas intrude the volcanic sedimentary, and ultramafic intrusive rocks. All of these types of rock are cut by diabase dikes.

The following excerpts are from a report by Vokes (1963, p. 88, 91, 93, 94):

[1]Statistics by Ontario Dept. Mines, Toronto.

The ore-bearing zones on the New Ryan Lake property are related to easterly trending, steeply dipping shear zones in the belt of Keewatin rocks that occupies most of the claim group. The original discovery and development took place on a shear some 800 feet north of Ryan Lake...

The "main ore zone" was examined on the surface and at various places underground. Along the surface are two trenches; the westerly one was by far the larger but it is now partly filled with water. The surface workings begin at the western side of a large diabase dyke about 150 feet east of the shaft and extend for about 600 feet to the west...In the more westerly of the two trenches the shear zone can be seen to occur along the contact between the serpentinized peridotite and a porphyry to the south. The sheared zone is about 4 to 5 feet wide, with an almost vertical dip. The shear mostly occurs in the peridotite, which shows a multitude of parallel commonly curving, polished slip-planes, all striking mainly parallel with the strike of the zone as a whole. The serpentinite in the zone is crushed and soft, with probably a considerable amount of talc. The shearing has also affected the porphyry body, which in places is crushed and sheared for as much as a foot from the contact...

The porphyry in the westerly trench is to some extent mineralized with chalcopyrite and a little pyrrhotite in the form of small veinlets and fracture coatings...

The "north mineral zone", which has been opened up by crosscuts from the drifts on the main zone, lies in andesitic volcanic rocks some 200 feet north of the main zone. In reality there are several such mineralized shears in this position lying parallel with each other; some of them may be due to splitting or branching along the dip of the zone...

The country rocks of the north zone are andesitic and dacitic lavas cut by feldspar-porphyry dykes, fractured and weakly mineralized with chalcopyrite.

Character of the Mineralization

The following excerpts are from Vokes (1963, p. 95, 97, 98):

Both rock types [in the main ore zone] are involved in the shearing and both carry the quartz veins, although the effects are much more pronounced in the peridotite than in the porphyry. The quartz veins and lenses carry high concentrations of molybdenite and chalcopyrite, but these minerals are also disseminated in the sheared rocks on either side. The vein quartz is a greyish, greasy-looking, opaque type. Molybdenite and chalcopyrite with very minor amounts of pyrite, are scattered through the quartz, heavily in places, as fine-grained patches, strings of grains, and as individual flakes. The ore minerals are much finer grained than, say, the molybdenite in the quartz veins of the Lacorne-Preissac area of Quebec. The vein quartz exhibits many small vugs or geodes of the order of a few millimetres across. The walls of these show perfect, crystal clear prisms of quartz, perfect, minute tetrahedra of chalcopyrite, and flattened, tabular crystals of pink feldspar. The latter mineral also occurs as small indefinite patches in the vein quartz outside the geodes. Other minerals observed in the geodes include a white fibrous or hair-like zeolite and clear rhombohedra of calcite.

Another notable constituent of the quartz veins is light to medium green, fine-grained, prismatic to fibrous talc (?). This mineral occurs in patches in the vein quartz near its walls and in the sheared country rock. Chalcopyrite and molybdenite are also present, commonly in abundance, in the sheared country rocks on the vein walls. Typically, the molybdenite occurs in these as fibrous or very thin layers showing slickensiding and polishing. It has obviously been "smeared-out" by post-depositional movements along the shear zone. These layers or films look very spectacular but they are extremely thin and actually make up little of the vein matter. Molybdenite, is also present in the sheared wall rocks, especially the peridotite, as a series of clusters of flakes about ½ mm. across and in places as almost solid patches. These must represent the pre-shearing form of the mineralization in the vein walls...

The reserve of mineable ore at the commencement of underground operations was an estimated 2-year supply for a 125-ton-per-day milling operation. Estimated average grade of this ore was 0.5 percent Mo, 1.25 percent Cu, and $1-value gold [about 0.03 ounces] per ton.

A small boss of porphyritic syenite outcrops on the Ryan Lake Property some 1,700 feet north of the mine workings...The rock is a massive and blocky porphyritic syenite with phenocrysts of brick-red to pink feldspar up to ½ inch long, set in a medium-grained, equigranular groundmass of hornblende and/or biotite...

The exposures are cut at intervals by irregular, thin stringers and veins of white quartz, averaging about ½ inch wide. They strike at about N.20°W. and their dips are generally vertical, but many branch and split. Associated with these veins in places are "spots" patches, and individual grains of chalcopyrite and molybdenite. These minerals are also disseminated irregularly in the groundmass of the rock...

The introduction of the chalcopyrite and molybdenite seems to be definitely connected with that of the quartz veins and stringers.

C. Findlay

This property is shown as property No. 4 on Map 2110 and consists of the following claims: MR.9915, and MR.8106 to MR.8108 inclusive. A shaft has been sunk on claim MR.8107, near the east shore of Hawley Lake. Most of the country rock is syenite, which is cut by diabase dikes.

Young-Davidson Mines Limited

Claims belonging to Young-Davidson Mines Limited are in the southeastern part of Powell township and are shown as property No. 12 on Map 2110. The following claims constitute the main group: MR.5374 to MR.5376 inclusive, MR.5372, MR.5371, MR.5383, and MR.5399. The open pit occupies parts of claims MR.5372 and MR.5374. Figures 5 and 6 show the open pit in plan and section.

In 1934, shortly after production began, Dyer (1935, p. 31, 32) reported on the operation as follows:

> At present ore is being recovered by an electric shovel in an open pit, a very low-cost operation made possible by the large size of the orebody, which is 500 feet by 300 feet. The method of milling chosen was that of all-cyanidation. Production is now at the rate of about 600 tons per day, but this tonnage could be increased by comparatively small additions to equipment. Mill heads are reported to be about what was expected from sampling, i.e. 0.10 ounces.

Two shafts have been sunk on claim MR.5372 (No 1 shaft to a depth of 1,075 feet, and No. 2, an internal shaft collared on the second level, to a depth of 1,063 feet), and lateral work has been done on seven levels.

Geological Relationships

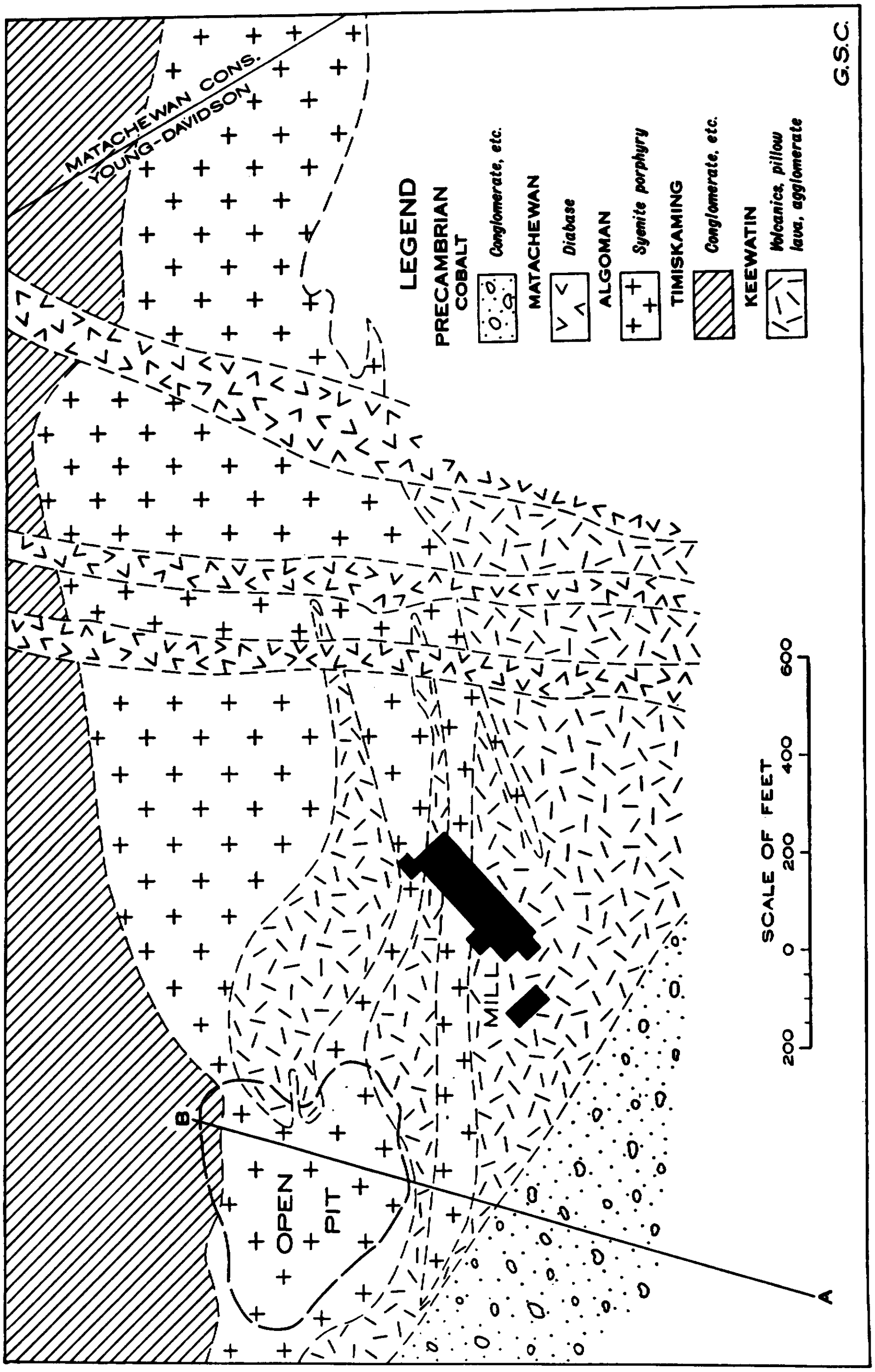
The ore is in syenite porphyry that has been intruded along the southern contact of the southern belt of "Timiskaming" sedimentary rocks with "Keewatin" volcanic rocks. About 300 feet south of the open pit, Cobalt sedimentary rocks overlie all other formations.

The following is a description of the orebodies taken from North and Allen (1948, p. 635), and Figures 5 and 6 are direct reproductions of the 1948 diagrams by North and Allen.

> All ore at the Young-Davidson consists of mineralized syenite, though all syenite is not ore. The main orebody is a tapering cone extending downward from the open pit. Smaller lenses of syenite, which are of ore grade, occur east of the open pit in the lower levels.
>
> The syenite is comprised of several different phases, including a cherry- or brick-red syenite, a brown peripheral phase, and very minor amounts of grey syenite. The brown syenite is a hornblende variety and appears to be a marginal phase of the brick-red type. It may be in part contaminated by assimilation of country rock. The relationship between the brown and brick-red syenite is not entirely clear, but in places there is a sharp contact between the two, indicating that the brick-red syenite is intrusive in and slightly later in age than the brown phase. Ore occurs only in the brick-red syenite, but not all of the brick-red phase is ore.
>
> The syenite is porphyritic, containing orthoclase and minor amounts of albite phenocrysts. The phenocrysts are oriented in a flow pattern and strike roughly east-west, conforming to the elongated nature of the syenite tongues and parallel with the contacts. At the north contact the phenocrysts dip 70°S.; at the south contact they dip north.

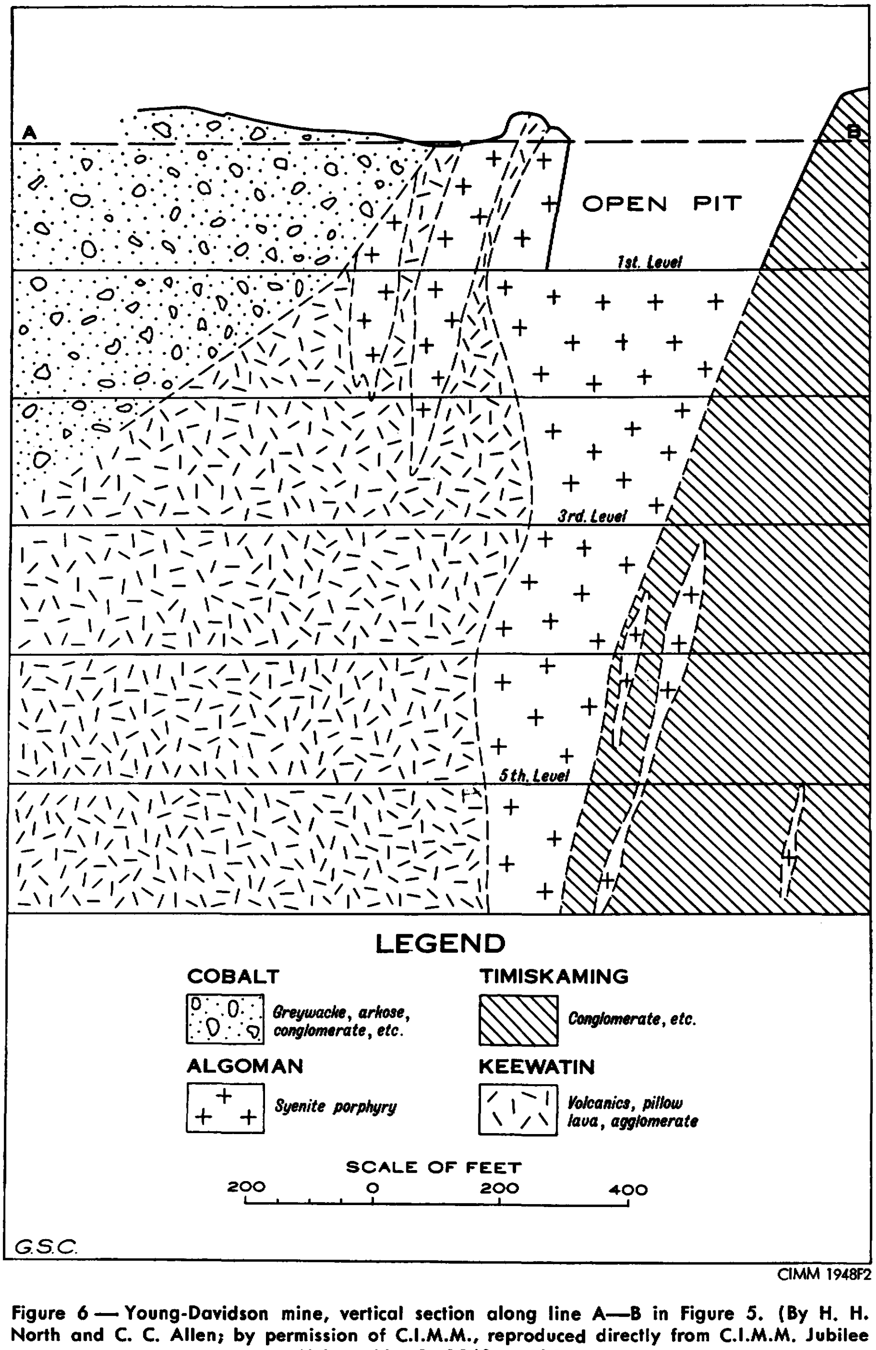
Rocks that are hybrids of syenite and sedimentary rocks or syenite and volcanic rocks are not of ore grade (Dyer 1935, p. 34, 35). "Green carbonate" rocks on this property are described by Dyer (1935, p. 35) as follows:

> Along the south boundary of claim No. 5,372 there is a stock-work of quartz in rusty carbonatized greenstone, with a considerable development of green mica. It is partly hidden under drift, but it would appear to be lenticular in shape and over 50 feet wide; some gold values were



CIMM 1948F1

Figure 5 — Young-Davidson mine, surface geological plan. (By H. H. North and C. C. Allen; by permission of C.I.M.M. Jubilee Volume No. 1, 1948, p.634.)



CIMM 1948F2

Figure 6 — Young-Davidson mine, vertical section along line A—B in Figure 5. (By H. H. North and C. C. Allen; by permission of C.I.M.M., reproduced directly from C.I.M.M. Jubilee Volume No. 1, 1948, p.636.)

obtained in it, although it is sparsely mineralized. It was in this quartz that Jake Davidson made his original discovery in 1916. Farther east, on claim No. 5,375, flanking the porphyry, there is a zone of carbonate schist. A width across the strike of 100 feet of the schist shows in a trench, and pyritized light-grey schist with a small dike of porphyry was uncovered by a pit 100 feet southwest of the trench. This zone of carbonate and pyritized schist is very similar to the one that carries ore bodies on the Matachewan Consolidated claims.

Character of the Mineralization

With regards to the three main types of syenite porphyry (brick red, brown, and grey), Dyer (1935, p. 32) gave the following description:

> Under the microscope all these types look much alike. In all three the main constituent is orthoclase; a minor amount of albite may be present; hornblende is relatively small in amount and is somewhat more plentiful in the darker phases. A little quartz is sometimes present, but it is thought to be secondary, and calcite is present in quite large amounts. Accessory minerals are magnetite, pyrite, apatite, titanite, and zircon.

North and Allen (1948, p. 635) gave the following description of the brick-red syenite:

> The brick-red syenite contains 2 per cent of disseminated pyrite, and 30 to 50 per cent of the gold is associated with the pyrite as fine included grains. This disseminated pyrite occurs all through the syenite and alone does not make ore. Superimposed on the syenite containing disseminated pyrite are almost microscopic fractures containing fine gold. The disseminated pyrite with these richer streaks is ore if averaging 0.11 oz. gold a ton. Chalcopyrite is commonly encountered with the disseminated pyrite, but is not nearly as abundant. Galena, and to a lesser extent molybdenite, scheelite, and specularite, occur in places. Short tourmaline crystals are commonly associated with visible gold.

In the orebody, Dyer (1935, p. 33) observed magnetite and barite. He compared the orebody with those at Kirkland Lake (Dyer, 1935, p. 36) but noted the following differences:

> The Kirkland Lake ore differs, however, in that it is largely confined to a more definite fault zone and is, therefore, more concentrated and higher in grade. The tourmaline, feldspar, and more coarsely crystalline pyrite, together with the absence of the lower-temperature suite of minerals found at Kirkland Lake, indicate that the Young-Davidson (and the Matachewan Consolidated) ore bodies were formed at higher temperature than those of Kirkland Lake.

Structure

North and Allen (1948) described the structure as follows:

> The chief structural feature of the Young-Davidson mine is the intrusion of the main syenite tongue along or near the Keewatin-Timiskaming contact but in the Keewatin volcanics. The syenite is commonly referred to as a "stock", but is in reality several parallel east-west trending dykes, branching in places. Adjacent to both contacts of the main syenite mass many smaller, parallel syenite dykes occur...
>
> The syenite shows two sets of fractures. The most noticeable are flat fractures, striking east-west to northeast-southwest and dipping very gently to the north. These are of the short gash type, up to a maximum of 2 inches wide, filled with quartz, quartz-calcite, or calcite. They do not carry gold nor does gold appear to be associated with them.
>
> Fractures of the second set are very fine and hair-like in nature, containing visible gold. In some of these, slight movement has occurred, now shown by slickensided surfaces. Of this second set of narrow fractures the main fracture trends east-west, parallel with the flow cleavage, and dips are either vertical or steeply south. Weak cross fractures in places up to an inch wide extend out from this main set. Associated with the main east-west set is found a much weaker set of flat horizontal fractures which in places contain very narrow seams of visible gold.
>
> There is no apparent faulting on a major scale at the Young-Davidson. Slips occur at the south side of the open pit at the syenite-greenstone contact, and visible gold occurs in slickensided surfaces in one set of fractures, but in neither of these cases has the movement been appreciable...

Conclusions

Because no major faults exist in the orebody, no channelways were available by which later epigenetic gold-bearing solutions from outside the syenite could have entered the syenite. The gold, therefore, originated in the syenite.

Dyer (1935, p. 34) commented on the possible continuation of the ore-bearing porphyry, as follows:

> It is possible that ore-bearing porphyry may be found under the Cobalt conglomerate to the west and northwest, although sediments and schists were found between the porphyry and the conglomerate in these directions. The contact between the Timiskaming and the Keewatin along which the orebodies are aligned may continue its westward strike under the Cobalt or it may bend northwestward to agree with the north-west flexure of the contact on the opposite side of the Timiskaming syncline. In this case the Timiskaming-Keewatin contact would be found only a short distance south of the edge of the Cobalt.

Matachewan Consolidated Mines Limited drifted in ore as far as the party line with Young-Davidson Mines Limited (the boundary between claims MR.5379 and MR.5375). Some of the syenite on claim MR.5375, which belongs to Young-Davidson Mines Limited, is of the brick-red type that constituted ore when the mines were operating. During the autumn of 1964, on claim MR.5407, about 125 feet northwest of its boundary with claim MR.5375, a hole was drilled by Young-Davidson Mines Limited. The hole was drilled on a bearing of S20°W and at a dip of 45°, for a core length of 607 feet. Most of the core is syenite, and some of the syenite is of the gold-bearing type, containing disseminated pyrite and magnetite, and blebs of chalcopyrite.

W. Sixt Estate

The property is shown as property No. 8 on Map 2110 and consists of two claims, MR.5579 and MR.5576. The country rocks are greenstones that are intruded by syenite. Some old pits exist on claim MR.5576.

Welsh-Sauvé Copper Gold Mines Limited

The property is shown as property No. 11 on Map 2110 and consists of 6 claims in the central part of Powell township, west of the Ryan Lake mine. The claims are MR.16251 to MR.16256 inclusive. Most of the country rock is greenstone.

Formerly (in 1955) Welsh-Sauvé Copper Gold Mines Limited owned claims covering the area west from the Pax International property to Mistinikon Lake. These claims included the contact between volcanic rocks and the northern edge of the southern belt of tightly folded sedimentary rocks. This part of the former Welsh-Sauvé Copper Gold Mines Limited property now belongs to Mr. S. Welsh. On the claims, as at the Pax International mine, serpentinite has been intruded along the contact. Small amounts of chalcopyrite, molybdenite, galena, sphalerite, pyrrhotite, nickel, gold, and silver have been found. D. K. Burke (in a company report, 1958) summarized the history of the Welsh-Sauvé property as follows:

> Over the last twenty-five years the property has been subjected, at intervals, to various types of exploration procedure, such as prospecting, geological mapping, trenching and test pitting, geophysical surveys and diamond drilling. During the last ten years while it was owned by Welsh-Sauvé, it was prospected and the more interesting occurrences diamond drilled. Within this period it was optioned to Kirkland Lake interests who arranged for additional geological mapping and extensive sampling of the surface showings.

G. E. Moody made the following statement (in a company report of 1948):

The detailed mapping showed the "break" at the Timiskaming-Keewatin contact to continue into the Welsh-Sauvé property with the same sequence of rocks and faulting [as on the property of Pax International Mines Limited].

In 1954 W. S. Savage examined some pits on the Welsh-Sauvé property and described them as follows:

The east or No. 1 showing is located south of the trail about 1,600 feet west of the bridge across the 1st lake on claim MR.16422...

The pit at the foot of the knoll exposes a shear zone striking N.22°W. and dipping 65° to the west which has been replaced by buff and green carbonates. Blocky jointing can be seen in the hanging-wall, with sphalerite occurring as thin platings on the joint planes and in fine stringers associated with quartz. Some traces of galena also can be observed.

The south or No. 2 showing is located on the SE¼ of claim MR.16441, 2,200 feet south from the Baseline on Line 11. A pit about 20 feet long striking N10°E has been opened up at the foot of the rusty west face of a drift-covered knoll. Where exposed, the rock is massive blocky-jointed fine-grained quartzitic greywacke, being part of the south syncline of Timiskaming sediments.

Specimens of massive pyrrhotite cut by stringers of chalcopyrite were seen on the dump.

Burke (company report, 1958) described some showings on the property as follows:

Near the north boundary of MR.26843 [MR.16422] a rock pit has been sunk to a depth of six feet in the exploration of a 24-inch shear in an intermediate lava. This shear, striking at N78°W, has a dip of 80° to the south and contains moderate amounts of pyrite, pyrrhotite, and minor chalcopyrite. Copper assays from here are reported to be less than one percent. This zone has been further explored by at least one diamond drillhole.

In the central portion of MR.26843 [MR.16422] a test pit has explored pyrite-pyrrhotite mineralization on a carbonatized contact between serpentinized lava and feldspar porphyry. This is close to the main serpentine-sedimentary contact and probably along the main carbonate fault zone. Two drillholes at this point have explored conditions both to the north and to the south of the showing.

At this location, in the western part of MR.26843 [MR.16422], a strong 5-foot shear in serpentinized lava has been explored by rock trenching. Only minor amounts of mineralization were observed. The shear, which carries a high development of actinolite, strikes approximately east-west and dips at 85° to the north.

A rock pit in the southwest portion of MR.26843 [MR.16422] has explored a 6-foot shear in serpentinized lava. Mineralization, in the form of pyrite and pyrrhotite, is present in minor amounts...

Near the south boundary of MR.2648 [MR.16435] a 20-foot wide rust zone on the contact between acid tuffs and metadiorite contains pyrite, pyrrhotite and minor chalcopyrite. This zone has been explored by stripping, rock trenching and one diamond drillhole. Minor amounts of chalcopyrite are reported from the drilling.

On claim MR.26850 [MR.16437] a 25-foot-wide pyrrhotite zone in acid tuffs can be traced over a length of 400 feet. No values are reported here.

On claim MR.26846 [MR.16427], a 14-inch shear in conglomerate containing quartz-calcite streaks occurs along the south boundary. This zone carries weak sphalerite mineralization and has been explored by means of one trench and a drillhole, facing north and collaring on the shear.

W. Brookbank, N. Evoy, and A. Hansen

This property is shown as property No. 2 on Map 2110 and consists of unsurveyed claims near milepost 3 on the western boundary of Powell township.

A body of coarse-grained amphibolite exists near the contact of granite and greenstones. The amphibolite body is about 1,000 feet long and 500 feet wide. It is cut by granitic dikes, and contains several north-trending trenches in a gossan zone. The rock in the trenches contains lenses of disseminated and massive magnetite, disseminated pyrite, and some chalcopyrite. The chalcopyrite seems to be concentrated near the granitic dikes.

A showing exists near the southwest end of a small lake about ¼ mile north of milepost 3 on the boundary between Powell and Bannockburn townships. The showing is in Bannockburn township. A gossan exists in a shear zone that strikes

N60°W and dips 60°SW. In the gossan, disseminated pyrite and stringers of pyrrhotite are present in silicified fine-grained andesite.

In 1957 an electrical resistivity survey was made for Geo-Scientific Prospectors Limited by Geophysical Engineering and Surveys Limited. From the results of the survey, Frantz (in a company report on the Powell-Bannockburn group, 1957) recommended a geophysical examination of the anomalous areas, followed by detailed self-potential or electromagnetic work to outline the favourable anomalies in detail and to guide future trenching or diamond-drilling.

S. Welsh

Several showings exist on a group of unsurveyed claims in the northeastern part of Powell township. These are shown as property No. 10 on Map 2110. The showings are in pits and trenches near the south end of a small lake about one mile north of Log Lake. Pyrite, chalcopyrite, a small amount of molybdenite, and traces of gold and silver are present in quartz veins cutting syenite. Some veins also contain small amounts of calcite and fluorite.

Dyer examined the main showing when the property was owned by Bloom Lake Consolidated Mines Limited (North Powell group). The following description is from his report (Dyer 1935, p. 42, 43):

> A lens-like vein of quartz of some interest occurs on the property. This vein can be followed for 500 feet, striking in an east-west direction and dipping vertically. Its greatest width is 40 feet, but it tapers off at both ends. It is well mineralized with pyrite, and is reported to have yielded on assay some low values in gold. It intrudes greenstone but is close to the contact with the sediments. Narrow dikes of granite porphyry and feldspar porphyry parallel it along its south wall. A shallow pit was sunk on it at one point, and some diamond drilling was done. It is reported, however, that in drilling, unsuspected diabase dikes were entered and the vein was never reached.

Noranda Explorations Company Limited

On the eastern boundary of a group of unsurveyed claims, shown as property No. 6 on Map 2110, owned by Noranda Explorations Company Limited, several pits have been sunk. The area of the pits was formerly part of surveyed claim MR.11904 and is near the western contact of a syenite boss that is west of Log Lake. The syenite is intruded into tightly folded sedimentary rocks. Quartz-carbonate veins cutting the pink syenite contain pyrite, chalcopyrite, molybdenite, and fluorite. Three selected samples taken by the author were assayed and found to contain no gold or silver.

In 1947 several holes were drilled on claims then owned by Childs Red Lake Gold Mines Limited. On claim MR.11904, a hole dipping 50° was drilled on a bearing of S55°E. The core was logged by G. E. Moody, who saw several sections of syenite that were cut by quartz stringers, some of which contained chalcopyrite, tourmaline, and traces of gold. Near the southern boundary of claim MR.12343, a hole 81 feet deep dipping 45° was drilled on a bearing of S80°W. The hole went through the contact of greenstones with sedimentary rocks. Mr. Moody reported highly pyritized conglomerate in the core. On claim MR.11368, a hole 408 feet deep dipping 45° was drilled on a bearing of N10°E. It, too, went through the contact.

On claim MR.12343, a shear zone about 30 feet wide strikes N60°W and dips 75°S. The shear is in highly silicified and pyritized volcanic rocks on the contact of a diabase dike. A sample of white-stained pyrite in a matrix of quartz and carbonate was taken by the author. It yielded an assay of 0.01 ounces of gold and a trace of silver.

ODM 7372

Photo 8 — "Timiskaming" arkose cut by parallel quartz veins. Ethel Copper property, Powell township.

Stancop Mines Limited (Ethel Copper property)

A group of unsurveyed claims, shown as property No. 9 on Map 2110, in the southern belt of tightly folded sedimentary rocks was formerly held by Ethel Copper Mines Limited. During this time about 20 holes were drilled, and some stripping and trenching was done. An east-trending body of syenite has been intruded into the sedimentary rocks, and several showings exist on surveyed claim MR.5409 (cancelled) of the Ethel Copper group. About 1,000 feet west of Highway 566, on the southern slope of a hill in the southeastern part of the claim, is a clearing. In the clearing are several small pits, and a trench 45 feet long, 6 to 10 feet wide, and about 7 feet deep. The trench is on the east side of a diabase dike, in a highly silicified area of the "Timiskaming" arkose (Photo 8) that is more than 100 feet wide. Most of the quartz stringers in the silicified area strike about N25°W and dip steeply, and are joined by cross veinlets. About 1 to 3 percent of the silicified rock in the trench consists of blebs of chalcopyrite. A selected sample taken by the author assayed 0.52 ounces of gold and 1.08 ounces of silver per ton. Syenite porphyry dikes in the part of the clearing south of the large trench are cut by quartz stringers that contain small amounts of pyrite, chalcopyrite, galena, and sphalerite. Assays showed that two samples selected by the author contained traces of gold and silver.

In the northwestern part of claim MR.5409, where the trail passes between two low diabase ridges, shallow pits have been blasted in syenite porphyry. The syenite porphyry contains a zone of quartz veins striking N55°E and dipping about 55°N. The zone is about 50 feet long and 40 feet wide. Two samples selected by the author were assayed. A sample of quartz with blebs of chalcopyrite contained 0.04 ounces of gold and 0.48 ounces of silver per ton, and a sample of smoky quartz with disseminated pyrite and chalcopyrite contained traces of gold and silver.

CAIRO TOWNSHIP

W. Brookbank

The part of this property that is in Cairo township is shown on Map 2110 as property No. 13. A description of the whole property is given on page 32 of this report.

V. Knott

The property is shown as property No. 15 on Map 2110. It consists of one claim, MR.6061, east of Knott Lake in southwestern Cairo township. The southern contact of the tightly folded sedimentary rocks traverses the southern part of the claim. South of the tightly folded sedimentary rocks is a small area of sheared greenstone, which is overlain by Cobalt conglomerate near the southern boundary of the claim.

Several pits, trenches, and test shafts are in the sheared, altered greenstone. Some of the greenstone is cut by quartz-carbonate stringers, and contains a small amount of pyrite and chalcopyrite. Assays showed that two samples of grey quartz and calcite taken by the author contained traces of gold and silver.

On three claims of the former Fournier property, which was adjacent to the northern boundary of the Knott property, seven holes were drilled in 1947 in bosses of mineralized syenite.

W. St. Aubin

The property is shown as property No. 17 on Map 2110 and consists of two claims, H.S.1178 and H.S.1177, which are crossed by Highway 65 about one mile east of Matachewan. Much of the bedrock on claim H.S.1177 is carbonatized greenstone, and some of the carbonatized rock is coloured green by chrome mica. Several pits and trenches exist in the parts of the carbonatized rock that are cut by quartz veins containing small amounts of disseminated pyrite.

Matachewan Hub Pioneer Syndicate

The property is shown as property No. 16 on Map 2110. It is about ¼ mile east of Matachewan, and consists of the following claims: H.F.11 to H.F.16 inclusive, and T.12500 to T.12502 inclusive. Bedrock on the property is composed of greenstone and rhyolite cut by diabase dikes, and Cobalt sedimentary rocks.

On claim H.F.13, a trench 110 feet long trends N35°W across the contact of volcanic rocks with a diabase dike. In the trench is a concentration of white-stained pyrite with a small amount of magnetite, in a quartz-carbonate matrix.

H. Willetts

The property is shown as property No. 21 on Map 2110. It consists of claims P.P.63 and E.B.9, near Old Woman Rapids. On claim P.P.63, a window of volcanic rocks exists in an area whose bedrock is composed predominantly of tightly folded sedimentary rocks. On claim E.B.9, a diabase dike cuts the tightly folded sedimentary rocks, and its western edge forms a cliff near the eastern shore of the West Montreal River. A pit 8 feet deep has been sunk in a zone of quartz stringers between the diabase cliff and the shore of the river. Small amounts of chalcopyrite, galena, and sphalerite are present, and traces of gold and silver.

E. Graig Estate

The property is shown as property No. 14 on Map 2110 and consists of three claims, MR.16229, MR.16228, and MR.16227, in north central Cairo township. Several quartz veins cut the syenite on the claims. The claims straddle a topographic lineament that marks the location of the Browning Lake Fault.

On claim MR.16964, which adjoins the Graig property on the south, a showing contains gold, silver, chalcopyrite, galena, and fluorite. This type of mineralization is found at the periphery of the syenite stock, and in openings formed during the late cooling stages of the syenite. The Browning Lake Fault is one of these fractures.

The former R. Ferguson group contained the showing about ¾ mile south of claim MR.16227 on the Graig property, and consisted of unsurveyed claims MR.23627 to MR.23632 inclusive. In 1957, Canadian Johns-Manville Company Limited carried out geological, magnetic, and electromagnetic surveys on the claims. Some of the conclusions and recommendations of the geologist, F. J. Evelegh (in a company report, 1957), were as follows:

1. The two main showings consist of galena and chalcopyrite mineralization in narrow quartz veins. Associated with the galena was a high percentage of silver. Gold assays were also shown. Assay results were most favourable, from grab samples and chip samples taken over a six-foot section.

2. Mineralization occurred in white quartz; highly rusted and closely associated with orthoclase pegmatite dikes of a later age. These intrusions were few in number and most of the syenite or host rock was completely absent from quartz or dike rock.

3. Upon completion of line cutting, magnetometer and electromagnetic surveys were conducted on the claims group. Results of these surveys indicated that no important anomalies occurred in the map area.

H. Talbot

The property is shown as No. 20 on Map 2110. It consists of claims MR.14468 to MR.14481 inclusive, which are east of Old Woman Rapids. On the property, greenstones and tightly folded sedimentary rocks are intruded by syenite and diabase dikes. The Montreal River–Whiskeyjack Creek Fault traverses the three northeastern claims. Several gold and copper showings exist on the property. In the 1930's, some stripping and trenching was done on claims MR.14469 and MR.14468 by Canadian Rand Mining Properties. In 1953 five holes were drilled by Jacaranda Mines Limited on claims MR.14476 and MR.14481. The following statement is by Burke, from a company report, 1935:

> Along the major fault of the area [on the map accompanying Dyer's report (1935), this fault runs approximately parallel to, and 1,000 feet east of, the West Montreal River] which traverses the claim in a north-south direction, zones of pyrrhotite-pyrite mineralization are found. They are not continuous along the strike and as a rule are rather weakly mineralized. The best showing of this type occurs on a Hudson Bay Co. claim (No. 8924) [MR.14481].

H. Sutherland

The property is shown as No. 19 on Map 2110. It consists of the following claims on the west side of the West Montreal River, about one mile north of Matachewan: MR.5528 to MR.5531 inclusive, MR.5574, and MR.5575.

Bedrock on the property consists of greenstones and tightly folded sedimentary rocks intruded by syenite and diabase dikes. A northeast-trending topographic lineament traverses the property. The two former gold producers in Powell township are near the west end of the lineament. Assays showed that samples taken by the author's party from quartz veins and adjacent syenite contained traces of gold.

Matachewan Consolidated Mines Limited

Only part of this property lies in Cairo township; the remainder is in Powell township. For a full description of the property see pages 32-36 in this report; the information given below applies only to the claims in Cairo township.

The main group of claims owned by Matachewan Consolidated Mines Limited extends from Powell township into Cairo township about ½ mile north of Matachewan. In Cairo township, the claims are: MR.5454, MR.5455, MR.-5707, MR.5417, MR.5559, and T.18264. Greenstones and tightly folded sedimentary rocks intruded by diorite, syenite, and diabase dikes form the bedrock on the property.

In the southeastern part of claim MR.5559, pyrite, chalcopyrite, galena, and specular hematite are present in green carbonate and syenite that are cut by quartz veins. Assays showed that two samples taken by the author's party from pits contained traces of gold and silver, and one sample contained a trace of gold and 1.07 ounces of silver per ton.

G. Sunisloe

The property is shown as property No. 18 on Map 2110. It consists of unsurveyed claims south of the eastern bend of the Montreal River. For a length of more than a mile southwest from Fox Rapids and for a maximum width of 400 feet, mafic intrusive rocks on the south shore of the Montreal River are highly sheared. The strike of the shearing is approximately parallel to the shore of the Montreal River, and the dip is south. Near the southwest end of this major shear zone, about 700 feet north of a granite batholith, a boss of massive granitic rocks about 600 feet in diameter has been intruded into the sheared mafic intrusive rocks. Small amounts of chalcopyrite exist in the boss near its contact with the sheared diorite and serpentinite, and quartz-carbonate stringers cutting the diorite and serpentinite contain chalcopyrite, pyrite, hematite, and magnetite. Many pits have been dug in the area, and 1 to 4 percent of the rocks in all the pits seen by the author is chalcopyrite. G. Sunisloe reported a few low assays of gold in samples of quartz bearing metallic gold from veins cutting the granodiorite. In 1956, on the shore of the Montreal River near the main group of pits, three holes were drilled at dips of 45°N for lengths of about 30 feet under the Montreal River. J. Welsh, who logged the core, reported very small amounts of galena and other metallic minerals in the core.

Other Areas of Interest

A shear zone exists along Highway 66, near the contact of a syenite stock with the greenstones into which it was intruded. An aeromagnetic survey by Dominion Gulf Company (G.S.C. aeromagnetic map No. 287G) detected a northeast-trending anomaly, and the company mapped the anomalous area in detail, as well as conducting a ground magnetometer survey. In 1952, a hole 1,054 feet long and another hole 1,100 feet long were collared about 50 feet south of Highway 66 and drilled at a 45° dip under Morrison Lake. According to C. G. McIntosh, who logged the core, both holes intersected a strong shear zone. A highly silicified outcrop exists about ½ mile east of the junction of Highway 66 and Highway 65. A hole collared on this outcrop and drilled north at a 45° dip intersected 23 feet of silicified rock, and then tuff cut by mafic syenite dikes. A hole drilled south at a 45° dip from the same location intersected 83.5 feet of silicified breccia, then a shear zone for about 80 feet of core length, and then fragmental volcanic rocks.

The following excerpt is from Dyer (1935, p. 44):

In the southeastern part of Cairo township in a strip of greenstone about 1½ miles wide lying between the stock of red syenite porphyry to the north and granite to the south, a large amount of work has been done on several groups of claims held under the names of J. B. Moyneur, Hugh Kells, Ed. Otisse, J. O'Brien, Frank Westcutt, and D. Miller. The greenstone in the area has been locally sheared and mineralized to a considerable degree and intruded by quartz veins and dikes of quartz porphyry, feldspar porphyry, and granite. Native gold has been found in a number of places.

On the electric power transmission line, a few feet south of the No. 2 post on claim MR.6610, the Rochester and Pittsburgh Coal Company drilled a hole 524 feet long bearing due south and dipping 45°. Also, B. M. Welsh drilled a hole on unsurveyed claim MR.23515 (cancelled 1962) near the No. 2 post, and a hole on unsurveyed claim MR.23516 (cancelled 1962) near the No. 1 post. According to H. Tregellas, some of the core contained disseminated sulphide minerals.

Asbestos

On claim MR.25840 (MR.6517), about ⅓ mile southeast of the junction of Highway 65 and Highway 66, three holes were drilled in 1957 by the Rochester and Pittsburgh Coal Company. According to F. C. Perry, a length of about 120 feet of core in diamond-drillhole No. 2, bearing S25°W (magnetic) and dipping 45°, contained numerous fractures filled with cross-fibre asbestos.

In 1954, when the property was known as Demarco Claims (South group), two holes were drilled by Asbestos Corporation Limited. On claim MR.6517, a pit has been sunk in dark-green serpentinite containing asbestos. The asbestos fibres are coarse and have a maximum length of about one inch. Similar asbestos exists in a pit about ¼ mile to the southeast, next to the shoulder on the southwest side of Highway 66.

Barite

Barite veins were seen on the west shore of Browning Lake, on claim MR.-16042 (formerly known as the "Biederman" deposit), and on the lake shore about 1,000 feet farther north. No recent work has been done on the showings. Burrows (1918, p. 237) described the "Biederman" deposit as follows:

This claim (16042) is situated on the west shore of Browning lake, in the north part of Cairo township. The country rock is a red syenite in which there is a barite vein with strike N.65°W. and dip 80°N. The deposit can be observed about 100 feet from the shore of the lake where a shallow shaft has been sunk at a point where the vein has been concealed by drift to the east. Here there is a width of 15 feet, and the barite can be traced westerly for 100 feet, decreasing to a width of 7 feet. Beyond this there is drift followed by an exposure of barite about 30 feet in length and three feet wide at the east end, and two feet wide at the west end. The barite is for the most part quite white in colour and of good quality. At the shaft there are minor quantities of zinc blende, galena, and specularite and a little fluorite, as impurities. The deposit also contains at this point some large inclusions of syenite. A sample across eight feet, on analysis contains 90.50 percent barium sulphate.

For further information on barite occurrences in this area see pages 17 and 18 of "Barite in Ontario" by G. R. Guillet, Ontario Department of Mines, Industrial Mineral Report No. 10, 1963.

Notes to Prospectors

Prospecting in the Matachewan area has been concentrated in quartz veins near the borders of granite and syenite stocks and cupolas, in shears or faults, and in gossan zones. The gold deposits are all in or near quartz veins that follow shears or closely spaced fractures or faults. Assays showing the highest concentrations of gold were obtained from quartz veins carrying a minor amount of sulphides, and their wallrocks of bleached, altered material, or red syenite containing fine-grained disseminated pyrite. Most of the gold-bearing quartz veins in the map-area are in or near small intrusions (cupolas) of syenite porphyry. Syenite porphyry is a favourable host rock, owing partly to its habit of fracturing adjacent to a fault. Perhaps also, gold-bearing solutions were a late phase of differentiation of the syenite magma, and therefore are often found in fractures near a syenite intrusion, or in fractures formed in the cooling syenite.

Guides to Ore

Many of the gossans in the map-area are caused by diabase intrusions and contain only small quantities of gold, silver, and copper, although a high content of gold has been reported from some individual assays. For the following reasons, much unsuccessful work has been done, perhaps unwittingly, on diabase dikes:

1. Diabase dikes are post-ore in the Kirkland Lake and other mining camps and appear to have the same relationship in the Matachewan Consolidated mine (Derry *et al.* 1948, p. 638).
2. Diabase dikes contain concentrations of pyrite, and some contain small amounts of gold, silver, and copper.
3. Diabase is found in zones of dislocation (joints, fractures, and faults) in the rocks, as are other intrusive rocks such as gold-bearing syenite.
4. A silicic phase differentiated from the diabase melt resembles pyritized gold-bearing syenite in colour and mineral composition. It contains red feldspar, and a smaller amount of mafic minerals than most diabase.
5. The diabase, during its intrusion, caused quartz veining, carbonatization, and pyritization in the nearby country rock.

Some means of recognizing diabase in the field (and thereby avoiding futile exploration work) are:

1. Most diabase attracts a pocket magnet. However, so does magnetite-bearing mafic syenite.
2. Most diabase ridges in the Matachewan area trend north.
3. The fresh surfaces of most of the volcanic rocks are not as dark (greyish-black) as those of fine-grained diabase, and the weathered surfaces are paler brown.
4. On weathered surfaces of medium-grained diabase, the typical diabasic texture (in which pyroxene fills the interstices between lath-shaped feldspar crystals) is distinct.
5. Rock in which light-coloured bands alternate with dark-coloured bands and strike within 10 degrees of north is the contact phase of a diabase dike, not a banded tuff.

Matachewan area

For gold occurrences in the Matachewan area, exploration should take into account the following facts:

Structural Control:

1. Pre-mineralization faults must be distinguished from post-mineralization faults. Some faults have undergone both pre-mineralization and post-mineralization, e.g. the Montreal River–Whiskeyjack Creek Fault. Some faults are pre-mineralization, but not pre-Algoman, e.g. the Browning Lake Fault, which might have formed as a tension crack during the cooling stages of the syenite stock.

2. Pre-mineralization movements on a fault may produce subsidiary fractures that are mineralized, whether or not the fault is, e.g. the sulphide-bearing barite vein on claim MR.16042 and a sulphide-bearing quartz-carbonate vein on the east shore fill subsidiary fractures of the Browning Lake Fault.

Guides for Exploration:

1. Where the fault is weak, wallrock alteration might be used to trace the fault zone:

   (a) Reddened syenite (much of which is gold-bearing) results from fine-grained hematite having been deposited in wallrocks from hydrothermal solutions.

   (b) Yellow ferromolybdate and ferric sulphate "bloom" are found near some of the gold deposits.

   (c) Bleached rock (rock that has been altered by sericitization, silicification, albitization, and carbonatization) indicates proximity to an intrusive rock, possibly gold-bearing syenite.

2. Some of the minerals associated with the gold are: bluish-grey quartz (most barren post-mineralization quartz is glassy), tourmaline, green (chrome) mica, sericite, carbonate minerals, graphite, hematite, and the sulphide minerals, pyrite, chalcopyrite, molybdenite, galena, and sphalerite.

3. Close to their source, base metals associated with gold deposits can be detected by geochemical field methods.

4. The presence of gold in the oxidized zone is a useful guide but does not necessarily indicate ore, e.g. gossans indicate loss of soluble materials and consequent residual enrichment in gold.

APPENDIX

Mineral Occurrences

Information on some features of some mineral occurrences in the report-area are given in the following table.

Wallrock Alteration Symbols	Mineral Symbols	
ab—albitization	Ag—silver	Pb—lead
carb—carbonatization	Au—gold	W—tungsten
chl—chloritization	Cu—copper	Zn—zinc
hem—hematite	Fe—iron	
py—pyritization	fl—fluorite	
ser—sericitization	Mo—molybdenum	
si—silicification	Ni—nickel	

Name of Property Owner	Main Host Rocks	Wallrock Alteration	Relative Importance of the Elements Present	
			MAJOR	MINOR
Alma Township				
W. Brookbank	syenite porphyry	si, py	Au, Ag, Cu, Pb	
McIntyre Porcupine Mines Ltd.	syenite porphyry	si	Au	Ag, Mo
Baden Township				
M. King	syenite, andesite		Au	Ag, Pb, Mo
J. E. McVittie	syenite porphyry, tuff	si, ab, py, hem, ser, carb, chl	Au, Ag, Cu	Mo
J. G. Honsberger	andesite, agglomerate, syenite	ser, si, py, carb, hem	Au	Ag, Pb
F. W. Hines	syenite, tuff	si, py, chl, carb	Au	Ag, Pb
Quilty	andesite	si, py, ab, carb	Au	Ag, Pb
Richore Gold Mines Ltd.	andesite, syenite, granite	carb, py	Au	Ag, Mo
Thesaurus Gold Mines Ltd.	granite, andesite	si, py	Au, Cu	Ag, Pb, Mo
C. A. Floyd	syenite, andesite	si, py, carb, chl	Au	Ag, Cu
S. Stanwick	diabase, syenite	si, ab, py	Au	Ag, Ni
Baden Creek Vein	granite, syenite	si, py	Au	Cu, Mo, Ag
Cairo Township				
V. Knott	sheared andesite	chl, si, carb, py		Au, Cu
W. St. Aubin	green carbonate rock	si, carb, py		Au
Matachewan Hub Pioneer Synd.	tuff, diabase	si, py		Au
H. Willetts	greywacke, diabase		Cu, Zn	Pb
H. Talbot	syenite	si, carb, fl	Au, Ag	Cu
Matachewan Cons. Mines Ltd.	syenite, green carbonate rock	si, carb, py, hem	Au, Ag	W, Cu, Pb, Zn, Mo
G. Sunisloe	diorite, gabbro	chl, si	Cu	Au
Powell Township				
Culver Gold Mines Ltd.	syenite, greywacke	si, py	Au, Ag	
Pax International Mines Ltd.	serpentinite	chl, si	Mo, Cu	Au, Ag
Young-Davidson Mines Ltd.	syenite, andesite	si, carb, py, hem	Au, Ag	Cu, Mo, W, Pb, Zn
Welsh-Sauvé Copper Gold Mines Ltd.	greywacke, serpentinite, rhyolite	chl, si	Cu, Au, Ag	
W. Brookbank, N. Envoy, A. Hansen	amphibolite, granite	chl, si	Fe, Cu	
S. Welsh	syenite	si	Au, Ag	Cu, Mo, fl
Noranda Explorations Co. Ltd.	syenite	si	Au, Ag	Cu, Mo, fl

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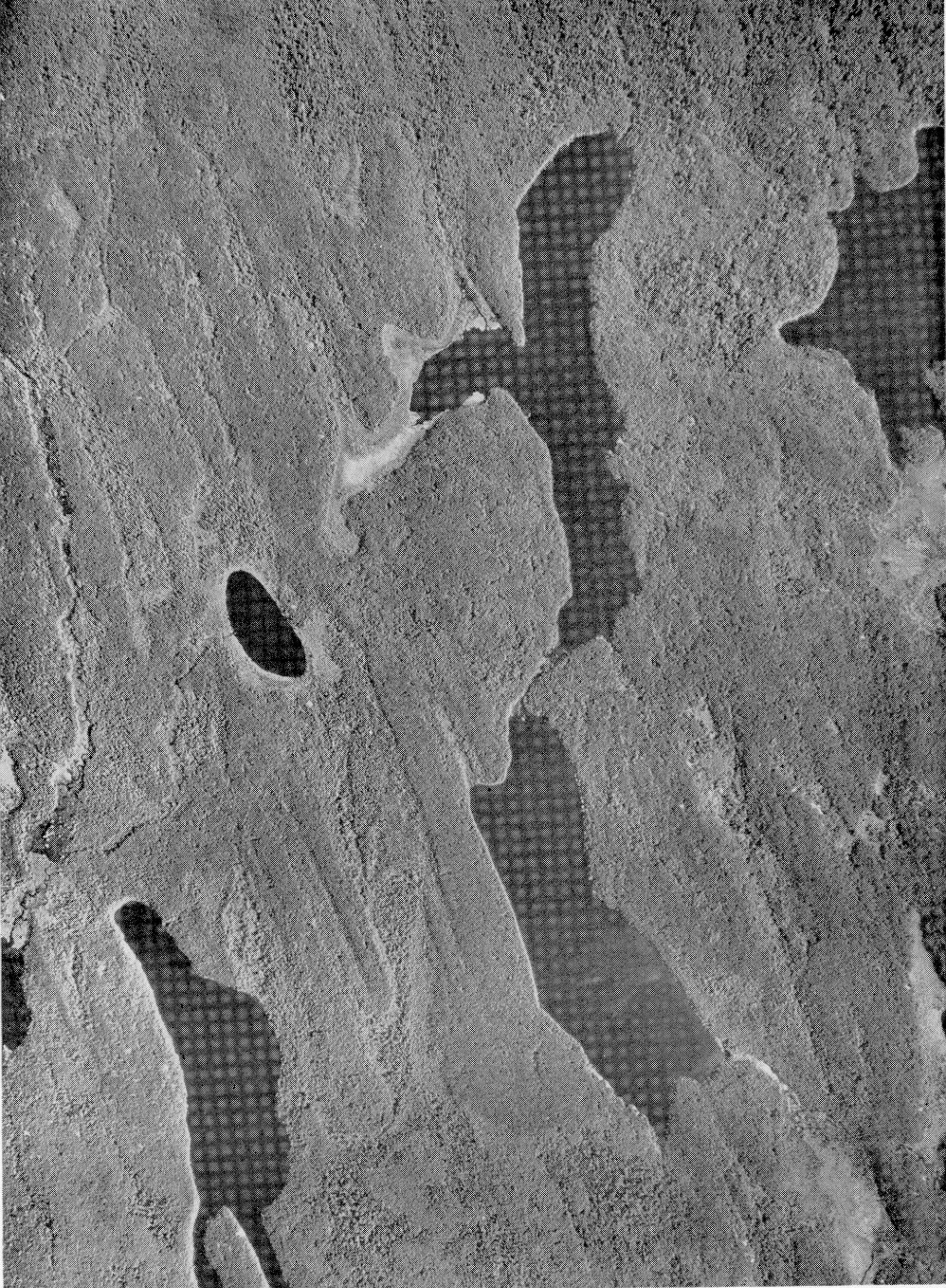

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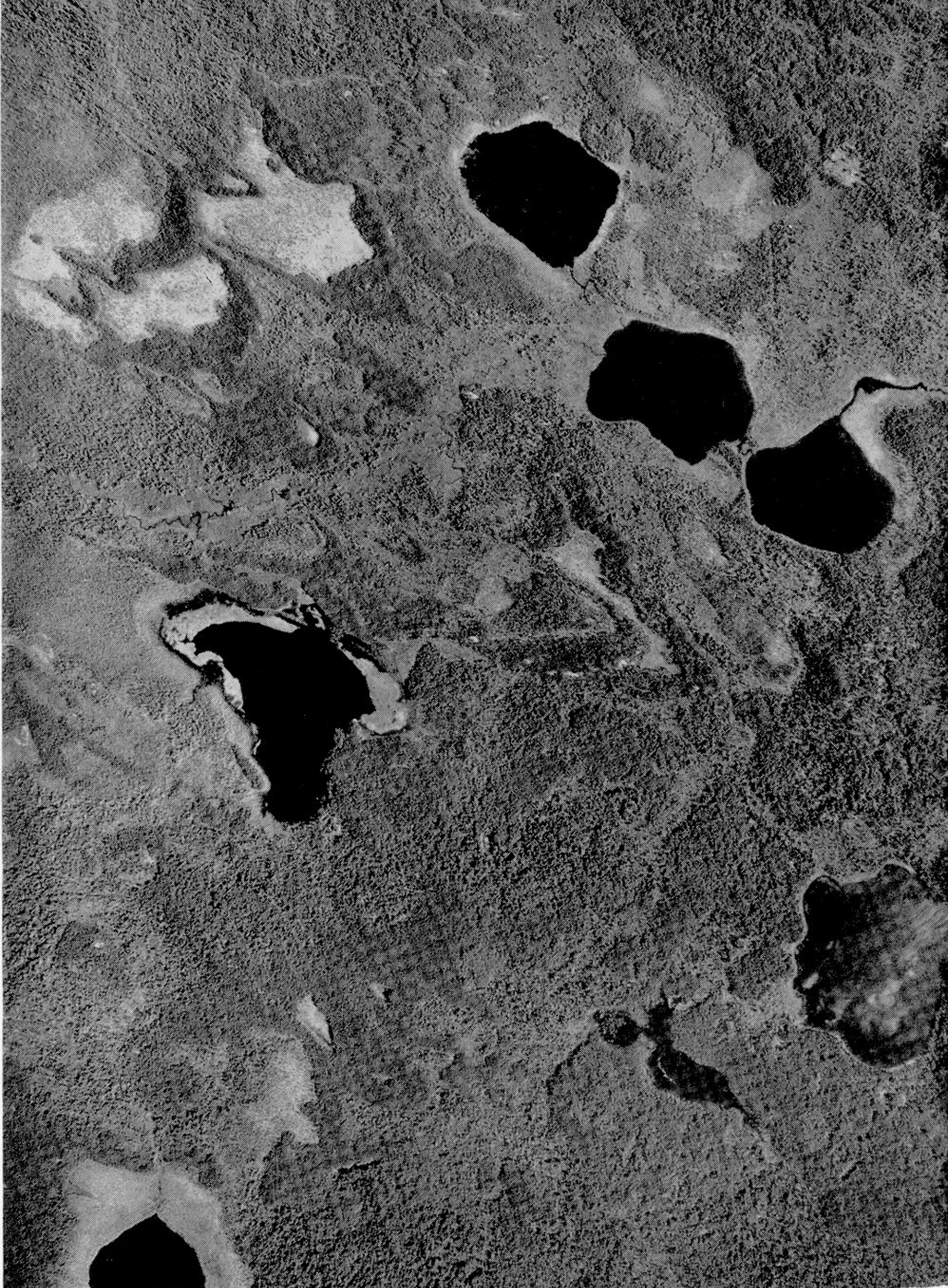

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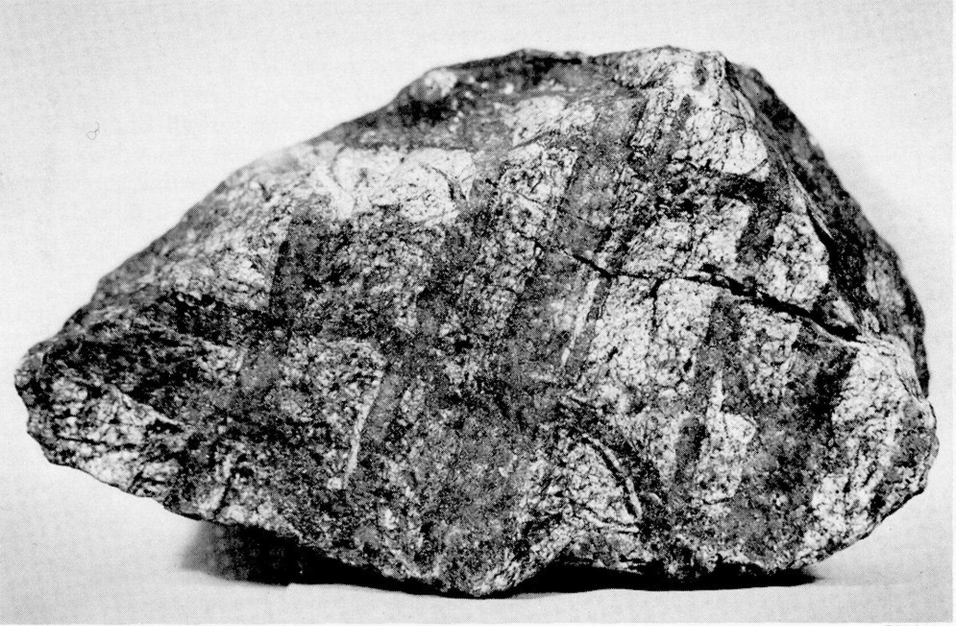

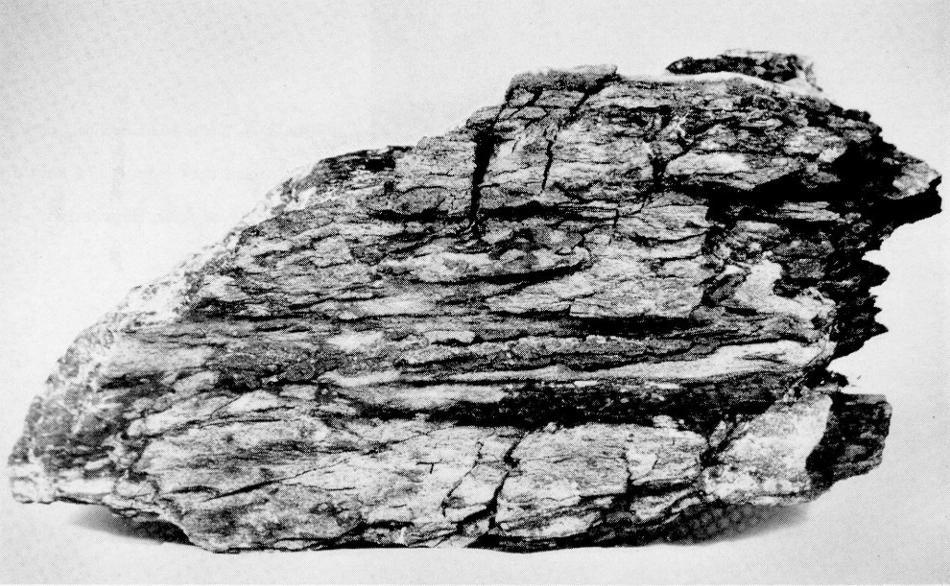

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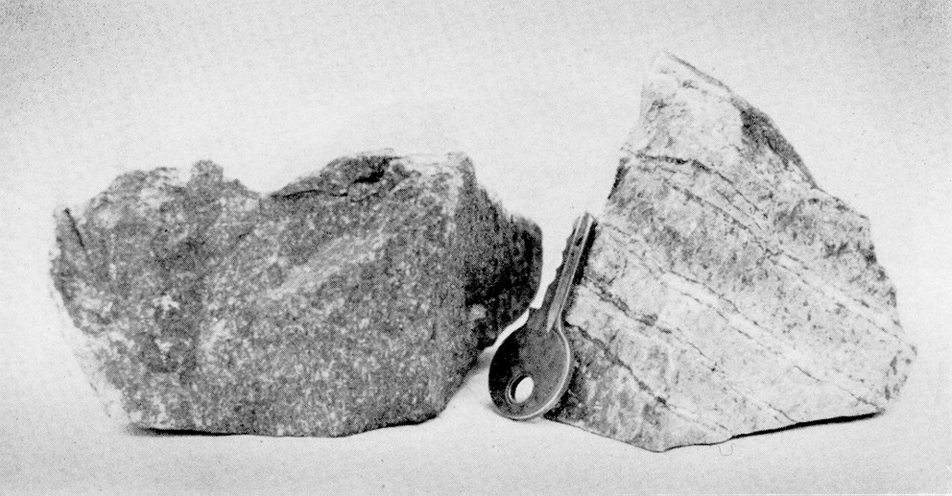
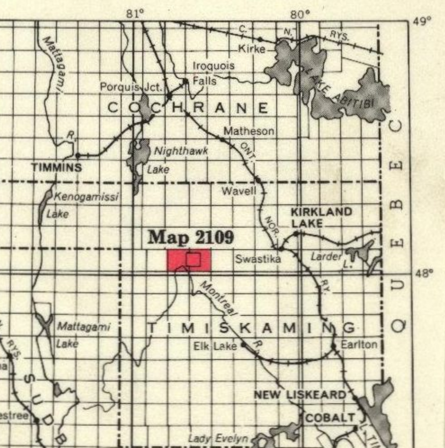


ONTARIO
DEPARTMENT OF MINES

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

Map 2109
Baden and Alma Townships



Scale, 1 inch to 50 miles

N.T.S. reference 42 A/2, 42 A/3

SYMBOLS

- Glacial striae.
- Small rock outcrop.
- Boundary of rock outcrop.
- Geological boundary, approximate or assumed.
- Strike and dip; direction of top unknown.
- Strike and vertical dip; direction of top unknown.
- Strike and dip; top in direction of arrow.
- Direction in which lava flows face as indicated by shape of pillows.
- Synclinal axis.
- Strike and dip of schistosity.
- Strike of vertical schistosity.
- Strike and dip of gneissosity.
- Jointing, inclined.
- Jointing, vertical.
- Drag-folds. (Arrow indicates direction of plunge.)
- SZ Shear zone.
- Fault, indicated or assumed.
- Fault, inclined.
- Fault, defined; spot indicates down throw side; arrows indicate horizontal movement.
- Motor road.
- Other road.
- Trail, portage, winter road.
- Electric power transmission line.
- Building.
- Shaft, vertical.
- Pit Test pit.
- Trench Trench.
- Drill hole.
- MA Magnetic attraction.
- No 5 Geochemical anomaly described in report.
- Township boundary, approximate location only.
- Claim line surveyed, approximate location only.
- Property boundary, approximate location only.
- 2 Location of mining property, surveyed. See list of properties.
- (6) Location of mining property, unsurveyed. See list of properties.

LIST OF PROPERTIES

(see report)

BADEN TOWNSHIP

1. Floyd, C. A.
2. Hines, F. W.
3. Honsberger, J. G.
4. King, M.
5. McVittie, J. E.
6. Quilty property.
7. Richore Gold Mines Ltd.
8. Stanwick, S.
9. Sutherland property.
10. Thesaurus property.

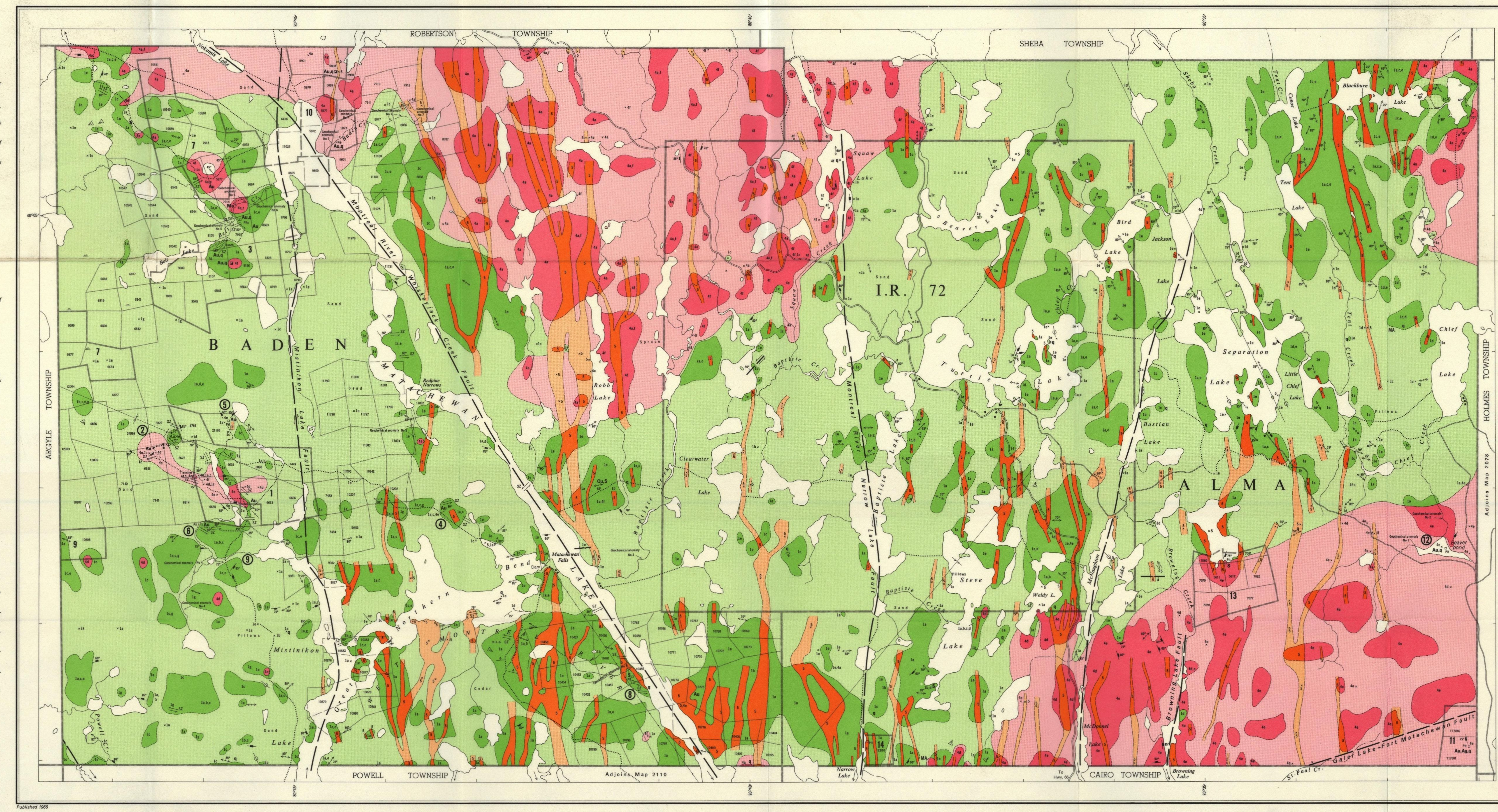
ALMA TOWNSHIP

11. Brookbank W.
12. McIntyre Porcupine Mines Ltd.
13. Rodie, J. W., estate.
14. Willetts, H. G., jr.

NOTE

The designating letters MR have been omitted on this map from the numbers marking the mining claims recorded at the office of the Montreal River Mining Division.

Many claims shown on this map have been cancelled. Their locations are indicated for reference purposes only.



Published 1966

SOURCES OF INFORMATION

Geology by H. L. Lovell and assistants, 1963.

Map 44b, Matachewan-Kenogami Area, Ontario Department of Mines, 1935.

Geological Survey of Canada, aeromagnetic map 290G.

Maps and plans of mining companies.

Preliminary maps, P195, Baden Township; P196 Alma Township, Scale 1 inch to ¼ mile, issued 1963.

Cartography by B. Jackson, P. Ralph, Ontario Department of Mines, 1966.

Base map derived from Ontario Forest Resources Inventory maps, with additional information by H. L. Lovell.

Magnetic declination in the area was 9°30'W., 1964.

Map 2109

BADEN AND ALMA TOWNSHIPS

TIMISKAMING 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

LEGEND

CENOZOIC*

RECENT

Swamp and stream deposits.

PLEISTOCENE

Sand, gravel, clay.

UNCONFORMITY

PRECAMBRIAN**

PROTEROZOIC

MAFIC INTRUSIVE ROCKS (Nipissing)

7 *Diabase.*

INTRUSIVE CONTACT

HURONIAN

COBALT GROUP

Gowganda Formation

6a *Argillaceous and arkosic quartzite.*
6b *Conglomerate.*
6c *Argillite.*
6d *Arkose.*

UNCONFORMITY

ARCHEAN

MAFIC INTRUSIVE ROCKS (Matachewan)

5 *Diabase, undifferentiated.*

INTRUSIVE CONTACT

SILICIC INTRUSIVE ROCKS (Algoman)

4a *Granite.*
4b *Granodiorite and granitic gneiss.*
4c *Syenite.*
4d *Mafic syenite and lamprophyre*
4e *Syenite porphyry and coarse-grained syenite.*
4f *Quartz diorite and diorite.*

INTRUSIVE CONTACT

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS (Haileyburian)

3a *Serpentinite.*
3b *Diorite.*

INTRUSIVE CONTACT

SEDIMENTARY ROCKS (Timiskaming)

2a *Conglomerate.*
2b *Greywacke, interbedded argillite and quartzite.*
2c *Arkose.*

UNCONFORMITY

VOLCANIC ROCKS (Keewatin)

1a *Basalt and andesite.*
1b *Bleached, silicified, sericitized volcanic rocks.*
1c *Andesite porphyry.*
1d *Tuff (banded, and massive types).*
1e *Agglomerate.*
1f *Rhyolite and dacite.*
1g *Carbonatized and amygdaloidal rocks.*
1h *Amphibolite.*

Ag *Silver*
Au *Gold.*
Cu *Copper.*
Mo *Molybdenum.*
q *Quartz.*
S *Sulphide mineralization.*

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

Formations without colour in the legend blocks are mapped on the southerly adjacent sheet.

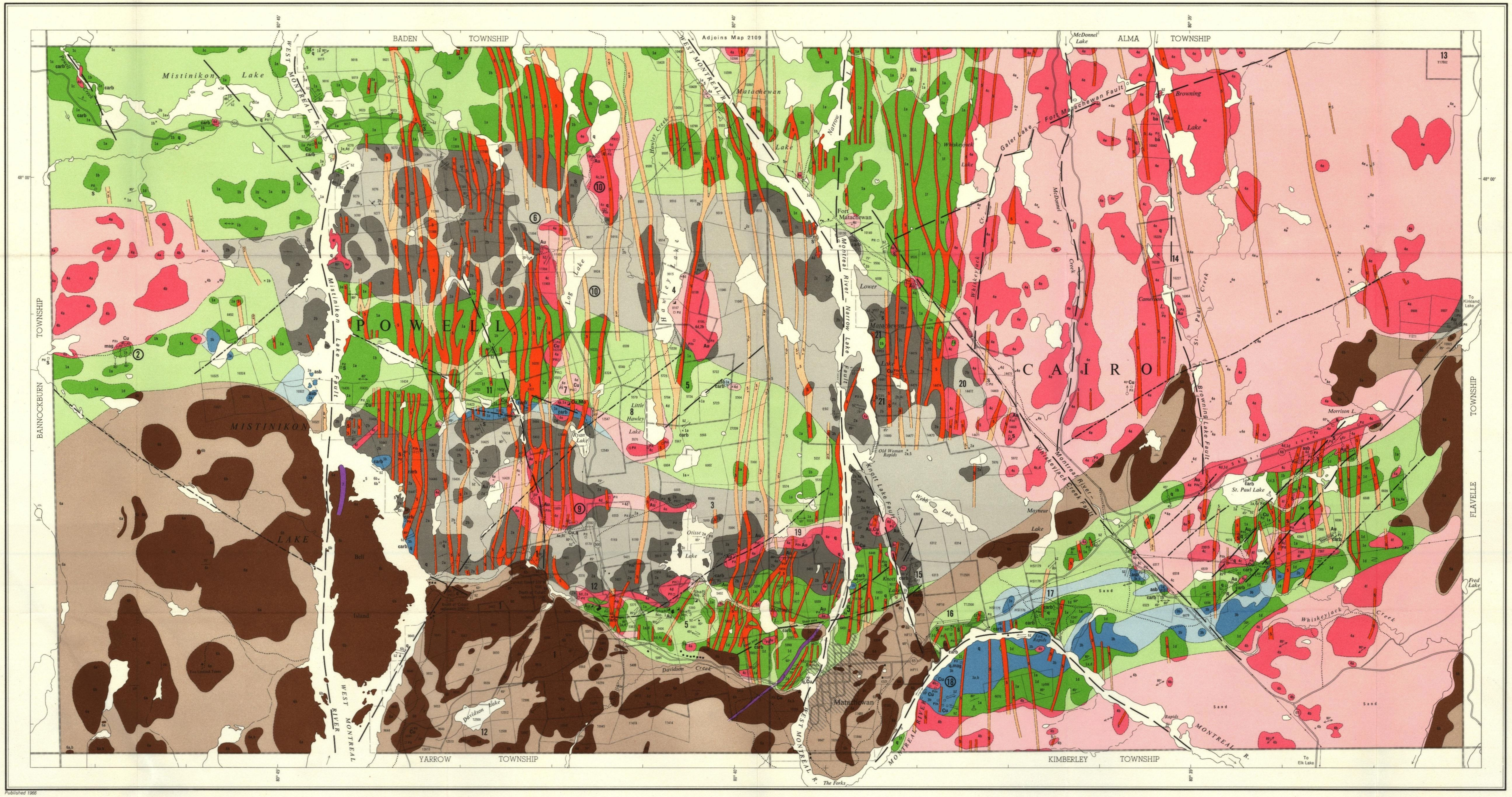
ONTARIO
DEPARTMENT OF MINES

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

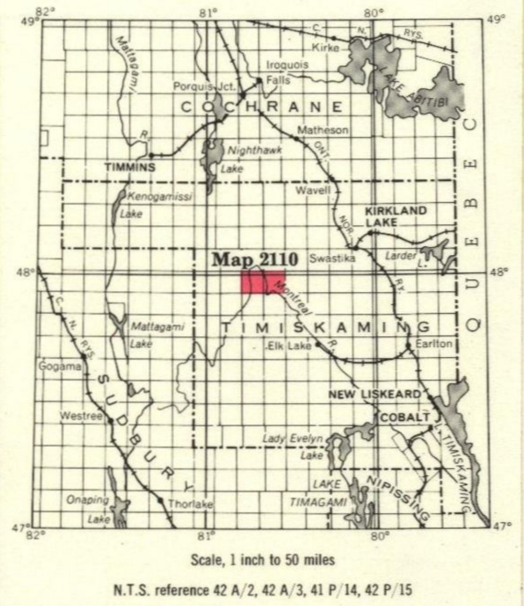
Map 2110
Powell and Cairo Townships

SYMBOLS

- *Glacial striae.*
- *Small rock outcrop.*
- *Boundary of rock outcrop.*
- *Geological boundary, approximate or assumed.*
- *Strike and dip; direction of top unknown.*
- *Strike and vertical dip; direction of top unknown.*
- *Strike and dip; top in direction of arrow.*
- *Strike and vertical dip; top in direction of arrow.*
- *Strike and dip of overturned bedding; beds face in direction of arrow and dip in direction of loop.*
- *Direction (arrow) in which beds face as indicated by gradation in grain size. Direction of dip unknown.*
- *Direction in which lava flows face as indicated by shape of pillows.*
- *Synclinal axis.*
- *Strike and dip of schistosity.*
- *Strike of vertical schistosity.*
- *Drag-folds. (Arrow indicates direction of plunge).*
- SZ *Shear zone.*
- *Lineament.*
- *Fault, indicated or assumed.*
- 50° *Fault, inclined, vertical.*
- *Fault, defined; spot indicates downthrow side; arrows indicate horizontal movement; angle of dip may be added.*
- *Muskeg or swamp.*
- 66 *Motor road, provincial highway number encircled where applicable.*
- *Other road.*
- *Trail, portage, winter road.*
- *Electric power transmission line.*
- *Building.*
- *Shaft, vertical.*
- Pit *Test pit.*
- DH *Drill hole, vertical.*
- 45° *Drill hole, inclined.*
- *Township boundary, approximate location only.*
- *Claim line surveyed; approximate location only.*
- *Property boundary, approximate location only.*
- 11 *Location of mining property, surveyed. See list of properties.*
- 9 *Location of mining property, unsurveyed. See list of properties.*



Published 1966



Scale, 1 inch to 50 miles

N.T.S. reference 42 A/2, 42 A/3, 41 P/14, 42 P/15

LEGEND

CENOZOIC*

RECENT
Swamp and stream deposits.

PLEISTOCENE
Sand, gravel, clay.

UNCONFORMITY

PRECAMBRIAN**

PROTEROZOIC

MAFIC INTRUSIVE ROCKS
(Nipissing)

7 *Diabase.*

INTRUSIVE CONTACT

HURONIAN
COBALT GROUP
Gowganda Formation

6a *Argillaceous and arkosic quartzite.*
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6c *Argillite.*
6d *Arkose.*

UNCONFORMITY

ARCHEAN

MAFIC INTRUSIVE ROCKS
(Matachewan)

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4c *Syenite.*
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4e *Syenite porphyry and coarse-grained syenite.*
4f *Quartz diorite and diorite.*

INTRUSIVE CONTACT

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS
(Haileyburian)

3a *Serpentinite.*
3b *Diorite.*

INTRUSIVE CONTACT

SEDIMENTARY ROCKS
(Timiskaming)

2a *Conglomerate.*
2b *Greywacke, interbedded argillite and quartzite.*
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UNCONFORMITY

VOLCANIC ROCKS
(Keewatin)

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1d *Tuff (banded, and massive types).*
1e *Agglomerate.*
1f *Rhyolite and dacite.*
1g *Carbonatized and amygdaloidal rocks.*
1h *Amphibolite.*

asb	*Asbestos.*
Au	*Gold.*
ba	*Barite.*
carb	*Carbonate.*
Cu	*Copper.*
mag	*Magnetite.*
Mo	*Molybdenum.*
Ni	*Nickel.*
q	*Quartz.*
S	*Sulphide mineralization.*

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

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NOTE

The designating letters MR have been omitted on this map from the numbers marking the mining claims recorded at the office of the Montreal River Mining Division.

Many claims shown on this map have been cancelled. Their locations are indicated for reference purposes only.

LIST OF PROPERTIES
(see report)

POWELL TOWNSHIP

1. *British Matachewan Gold Mines Ltd.*
2. *Brookbank, W., Envoy, N. and Hansen, A.*
3. *Culver Gold Mines Ltd.*
4. *Findlay, C.*
5. *Matachewan Consolidated Mines Ltd.*
6. *Noranda Explorations Co. Ltd.*
7. *Pax International Mines Ltd.*
8. *Sixt, W., Estate.*
9. *Stancop Mines Ltd. (Ethel Copper property).*
10. *Welsh, S.*
11. *Welsh-Sauve Copper Gold Mines Ltd.*
12. *Young-Davidson Mines Ltd.*

CAIRO TOWNSHIP

13. *Brookbank, W. H.*
14. *Graig, E., Estate.*
15. *Knott, V.*
16. *Matachewan Hub Pioneer Syndicate.*
17. *St. Aubin, W.*
18. *Sunisloe, G.*
19. *Sutherland, H.*
20. *Talbot, H.*
21. *Willetts, H.*

Map 2110

POWELL AND CAIRO TOWNSHIPS

TIMISKAMING 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