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Geology of
South Lorrain Township

District of Timiskaming

By
W. H. McILWAINE

Geological Report 83

TORONTO
1970

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GEOLOGICAL MAP

(back pocket)

Map 2194 (coloured)—South Lorrain Township, District of Timiskaming.
Scale, 1 inch to ½ mile.

ABSTRACT

This report describes the general, structural, and economic geology of South Lorrain Township. The area is approximately 20 miles southeast of Cobalt and is one of the outlying camps of the Timiskaming silver belt. Geological mapping at a scale of 1 inch to $\frac{1}{4}$ mile was carried out in 1964 and 1965.

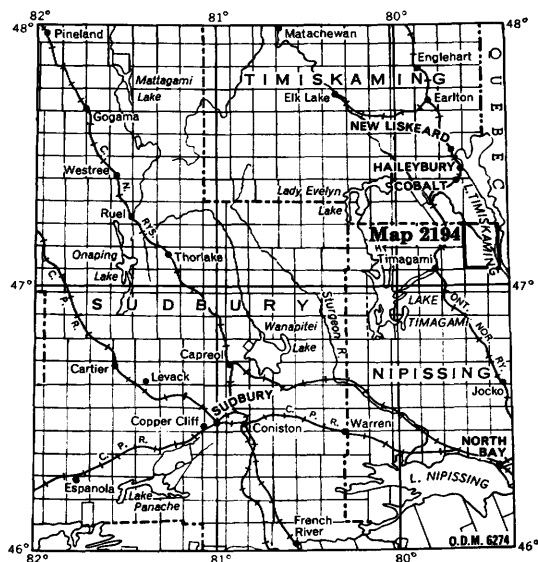


Figure 1—Key map showing location of South Lorrain Township.
Scale, 1 inch equals 50 miles.

The bedrock in the area is Precambrian in age with Archean metavolcanics and associated intrusions cut by lamprophyre dikes and felsic intrusive rocks. Unconformably overlying these rocks are the Cobalt Group sedimentary rocks that are intruded by Nipissing Diabase with associated and later diabase dikes. The diabase in the main area of the camp is an elongate dome with the central portion removed by erosion. The extreme southeast of the township is underlain by metasediments which are divided into two units by the Grenville Front, which trends northeast. The rocks to the northwest of the Front are unclassified.

No producing mines, but several past producers, notably the Keeley and the Frontier Mines, are found in the area. The main productive zone in this area is the bottom 300 feet of metavolcanics which overlie the west-dipping westerly flank of the diabase dome. Of the numerous veins found in the camp the Wood's was the richest. Recent attempts by several mining companies to revive the area have not been successful.

Geology
of
South Lorrain Township
District of Timiskaming
by
W. H. McIlwaine¹

INTRODUCTION

South Lorrain Township, in the District of Timiskaming, is located approximately 20 miles southeast of the town of Cobalt.

South Lorrain, one of the outlying silver camps of the Timiskaming silver belt, was developed because of widespread prospecting following the discovery of silver in Cobalt, in 1903.

Silver was first discovered in South Lorrain Township in 1907 at the Keeley Mine by R. J. Jowsey and C. Keeley. This started a period of widespread staking and mining. Production and interest dropped during World War I except at the Wettlaufer Mine. After the war there was further mining and exploration. From this time until 1931 the largest production of the South Lorrain camp was mainly from the Keeley and Frontier Mines. Production after the "depression years" was small, with no recorded production from 1943 to 1963.

Working from the Frontier No. 3 shaft in 1963, Keeley-Frontier Mines Limited, later Canadian Keeley Mines Limited, commenced underground exploration in the Keeley and Frontier Mines. Other companies, including Mining Corporation of Canada (1964) Limited, Copperfields Mines Limited, Silver Tower Mines Limited, Millerfields Silver Corporation Limited, and Mobiko Mines Limited have been engaged in exploration work. Much of the recent production has resulted from the remilling of old tailings by Canadian Keeley.

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The author is indebted to Robert Thomson, former Resident Geologist for the Ontario Department of Mines at Cobalt, for discussions on the area. The author also takes this opportunity to thank G. R. Kent, geologist, Canadian Keeley Mines Limited, and Ralph Day and Albert Cohen, geologists, Ontario Hydro-Electric Power Commission, for help in preparation of this report. Discussions with S. B. Lumbers,

¹Geologist, Ontario Department of Mines, Toronto, Manuscript received by the Director, 29 April, 1968.

South Lorrain Township

geologist, Ontario Department of Mines, on the Grenville area were also helpful. The Geological Survey of Canada analyzed the stream sediment samples and dated the granodiorite.

The author thanks Mr. and Mrs. Frank Lambert for their courtesy during the field parties' stay at their tourist camp, at Maidens Bay.

MEANS OF ACCESS

There are four roads providing access into South Lorrain Township. Highway 567, from North Cobalt, leads to Maidens Lake, from which point the road is maintained by the Ontario Hydro-Electric Power Commission as far as the Matabitchuan Power Station. Another Ontario Hydro road, from Cobalt, follows the Montreal River and joins Highway 567 at the Frontier Mine. Two roads lead into the southern part of the township. The first starts from Highway 11, at Granite Lake, which is approximately 6 miles north of Timagami; this rough logging road leads to Lorrain Lake and approximately 3 miles beyond. The other road starts from Highway 11 at Angus Lake, approximately 15 miles south of Timagami, and terminates about 1 mile inside the township at the Matabitchuan River.

Water access is provided by Lake Timiskaming, the Matabitchuan River, the Montreal River, and Lorrain Lake.

PRESENT GEOLOGICAL SURVEY

Geological mapping for this report, conducted during the summers of 1964 and 1965, was done on a scale of 1 inch to $\frac{1}{4}$ mile. Pace-and-compass traverses were run at approximately $\frac{1}{4}$ -mile intervals, according to outcrop density. In the area around the mines and to the east of them several traverses were run at 400-foot intervals. The geology was plotted on acetate sheets over aerial photographs obtained from the Ontario Department of Lands and Forests. This information was then transferred to base maps compiled by the Cartographic Unit of the Ontario Department of Mines from Forest Resources Inventory maps of the Silviculture Section of the Ontario Department of Lands and Forests. Preliminary uncoloured geological maps were published in 1965. P. 289 was issued for the north half of South Lorrain Township and P. 325 for the south half of the township. Map P. 289 was reissued in 1968 as a revised edition (McIlwaine 1968; 1965).

PREVIOUS WORK

During the last century that part of the shoreline of Lake Timiskaming, which was part of the future South Lorrain Township, was mentioned by geologists in notes on early exploration trips along the lake and to the north. The first geological map known to the author, that covered the area of South Lorrain was published by Barlow (1899) with his report on the "Nipissing and Temiscaming Regions". Coleman (1900, p. 172-179) made reference to the Matabitchuan and Montreal Rivers in his report on "Copper and Iron Regions of Ontario".

The first geological work devoted entirely to the South Lorrain area was by Burrows (1909); this report was revised in 1910. Knight (1922) published a more detailed report, with much of it devoted to the geology of the mine workings. These reports covered only that part of the South Lorrain area where the mines were located.

The first detailed geological map to cover the entire township was published by Todd (1925).

Aeromagnetic coverage of the area is provided by maps, at a scale of 1 inch to 1 mile, published by the Geological Survey of Canada in 1965 (Geol. Surv. Canada 1965 a and b).

TOPOGRAPHY

In general the topography of South Lorrain Township is rugged with a maximum relief of 850 feet. In the Archean terrain the hills are generally more rounded than in areas of Proterozoic rocks where the hills are formed by ridges. Many of these ridges are caused by faulting, with a steep gradient on the one side and a gentle dip slope down the other side. The ridges generally trend northwest or northeast; north strikes are less common. The hills are commonly of one rock type with contacts in the valleys between.

The main drainage is from the Montreal and Matabitchuan Rivers both of which are thought to follow faults. Lorrain Lake is part of the Matabitchuan watershed.

NATURAL RESOURCES

Hydro-electric power is generated from two stations in South Lorrain Township. The Upper Notch dam on the Montreal River, approximately $1\frac{1}{4}$ miles downstream from the north boundary, supplies power to points as distant as Sturgeon Falls. The other station is to the northeast of Fourbass Lake on the Matabitchuan River. The water is diverted from the lake and down a large duct to the station below. The horizontal distance from the intake to the turbines is 1,065 feet and the operating head is 316 feet. Detailed drilling, sampling, and geophysical work was done by the Ontario Hydro-Electric Power Commission during 1965, 1966, and 1967 in order to determine the possibilities of building a dam across the Montreal River above the Lower Notch Falls.

Logging operations are mostly to the south of the township, but some cutting was done in the southwest part of the township while field work was being carried out. Logs cut within the watershed of the Matabitchuan River are floated downstream to the northeast corner of Fourbass Lake. From here they are sent down a flume to the northern segment of the Matabitchuan River, and thence down Lake Timiskaming by tugboat.

The presence of open fields near the mouth of the Matabitchuan River indicates that farming operations were once carried out here.

Tourists are catered for by two small tourist camps.

South Lorrain Township

GENERAL GEOLOGY

Most of South Lorrain Township is in the Superior Structural Province but the southeastern corner of the township is in the Grenville Province. The bedrock is all Precambrian and is divided into five main groups:

1. Archean basement rocks which are deformed metavolcanics and associated mafic intrusions, cut by felsic intrusions.
2. The flat-lying Cobalt Group sedimentary rocks unconformably overlying the Archean rocks.
3. Diabase sheets or sills, and dikes which cut all older rocks.
4. An area of metasediments of which the age relationships are not known.
5. The rocks of the Grenville Province which are mainly paragneisses.

The metavolcanics are exposed in four areas, all in the eastern half of the township, where there are local basement topographic highs. These rocks are faulted and folded and intruded by granitic rocks which are commonly referred to as Algoman in age.

The Cobalt Group rocks overlie the basement with great unconformity, and underlie most of the township. There are three formations, Coleman, Firstbrook, and Lorrain.

The intrusion of Nipissing Diabase is thought to have been one of the important factors associated with the silver-cobalt veins of the area. The main structure of the diabase intrusion is the South Lorrain "diabase dome".

The age relationships of the small belt of paragneisses, characterized by open folds, are unknown. South of these rocks are paragneisses of the Grenville Province.

Variable thicknesses of glacial deposits cover the area. Generally the cover is thin and bedrock exposures are excellent.

SUPERIOR PROVINCE

Archean

METAVOLCANICS AND METASEDIMENTS

The oldest rocks in the map-area are metavolcanics, which are mainly intermediate to mafic flows with minor amounts of felsic rocks and very minor interbedded metasediments. There are three main areas of metavolcanics present in the township. These are (1) a 1-mile wide belt extending west from Maidens Bay on Lake Timiskaming for 2 miles; (2) an area trending north and south from Fourclaim Lake; (3) two separated belts extending from Oxbow Lake northeast towards Lake Timiskaming. Two small bodies were found near Golden Lake and Young Lake, 1 mile and $1\frac{1}{2}$ miles north of the south boundary of the township.

Table 1**TABLE OF LITHOLOGIC UNITS****CENOZOIC****RECENT**

Swamp, lake, stream deposits

PLEISTOCENE

Glacial deposits

*Unconformity***PRECAMBRIAN****Grenville Province****METASEDIMENTS**

Mainly feldspathic paragneiss

*Fault Contact**Not Assigned to Superior or Grenville Provinces***UNCLASSIFIED METASEDIMENTS**

Quartzose and quartzose feldspathic paragneiss

*Fault Contact***Superior Province****PROTEROZOIC****LATE MAFIC INTRUSIVE ROCKS**

Diabase

Intrusive Contact

Diabase (Nipissing)

*Intrusive Contact***HURONIAN****COBALT GROUP****LORRAIN FORMATION**

Feldspathic quartzite and arkose

FIRSTBROOK FORMATION

Laminated argillite and quartzite

COLEMAN FORMATION

Greywacke and quartzose siltstone, conglomerate, arkose, and argillite

*Unconformity***ARCHEAN****FELSIC TO INTERMEDIATE INTRUSIVE ROCKS (ALGOMAN)**

Granite, granodiorite, quartz monzonite, and quartz diorite

*Intrusive Contact***EARLY MAFIC INTRUSIVE ROCKS (HAILEYBURIAN)**

Lamprophyre

*Intrusive Contact***METAVOLCANICS AND METASEDIMENTS (KEEWATIN)**

Intermediate to mafic flows with minor felsic metavolcanics, metasediments, and very minor mafic intrusive rocks

South Lorrain Township

Maidens Bay Area

Intermediate to mafic metavolcanics with associated mafic intrusive rocks characterize the area around Maidens Bay. The rocks are fine- to medium-grained and dark greenish grey on the fresh surface with a brown to grey weathered surface. In thin section the rocks are seen to be composed mainly of altered amphibole and feldspar, with minor quartz, chlorite, and opaque oxides. The coarser grained facies or gabbroic flows may be intrusive in part but much of it is probably coarse-grained volcanic rocks.

Schistosity is generally weak and pillows are rare. The few pillows observed indicate tops face slightly west of south.

No contacts with later rocks were observed except in the western part of the area where chilled diabase was observed in contact with lavas.

The silver-cobalt deposits of the area are spatially related to the diabase and it is evident that the Nipissing Diabase that once covered this area has been eroded. The silver-cobalt bearing veins of the Gilgreer, Millerfields, and Canadian Lorrain Mines are in metavolcanics which were once covered by the diabase and are therefore deposits associated with the bottom contact of the diabase.

There is not much doubt that these rocks are part of the same unit as is exposed in the Fourclaim Lake area. They are discontinuous due to the cover of later sedimentary rocks and the diabase intrusion.

Fourclaim Lake Area

The metavolcanics around Fourclaim Lake represent the surface exposure of a wedge of metavolcanics which has been separated from the basement proper by the diabase. This wedge overlies the diabase and dips to the west. This feature is best illustrated in the cross-section on Map 2194 (back pocket). The thickness of the metavolcanics varies from zero up to at least 1,000 feet on the property of Veinlode Silver Mines Limited.

Nearly all of the silver production has come from these rocks, mainly in a zone within 300 feet of the upper diabase-contact.

The rocks are mainly fine-grained greenish grey intermediate to mafic flows. Coarse-grained facies are less common than in the Maidens Bay area. Several outcrops in this area display a green and brown colour banding. Agglomerate is exposed by the roadside north of the Frontier No. 3 shaft. The main minerals present, in the metavolcanics, are altered amphibole and plagioclase with chlorite and epidote also common.

Pillows are common and top determinations on several indicate tops face west and northwest. Schistosity, is poorly developed.

Oxbow Lake Area

The third main area consists of two narrow belts separated by overlying Cobalt Group sedimentary rocks. The northern of the two belts is mainly intermediate to mafic metavolcanics similar to those previously described. Near Lake Timiskaming chlorite schist, resulting from the numerous faults in the area, is found. An outcrop

along the shore of Lake Timiskaming is highly sheared and indicates numerous faults striking inland. The progressive widening of the belt to the east is caused by erosion of the Cobalt Group sedimentary rocks; this erosion followed the northwesterly faulting.

The more southerly of the two belts is characterized by several outcrops of felsic metavolcanics. These rocks are fine-grained, pale grey, and slightly schistose in hand specimen. In thin section the rock consists mainly of a very fine-grained quartz groundmass with numerous microscopic phenocrysts of feldspar, in the albite-oligoclase range, and lesser amounts of quartz phenocrysts. Interbedded with the felsic metavolcanics are layers of quartzite, which in hand specimen is difficult to distinguish from the former. The quartzite, however, has a slightly glassier appearance than the felsic metavolcanics and is not as deeply weathered. In thin section the quartzite consists of quartz grains in a matrix of quartz and mica.

On the shore of the small lake halfway between Oxbow Lake and Lake Timiskaming are several outcrops of metagabbro. No contact relations were seen and the rock may be a coarse-grained flow. It consists essentially of altered plagioclase and chlorite, with lesser amounts of epidote.

Both these belts lie above the Nipissing Diabase and give the same conditions as in the productive area of the township, except that the underlying diabase is more steeply dipping. These metavolcanics, however, have not been the host rocks of any producing mines.

EARLY MAFIC INTRUSIVE ROCKS (HAILEYBURIAN)

Lamprophyre

Biotite lamprophyre and hornblende lamprophyre are found in the area generally as small dikes, some of which are thought to be nearly flat-lying. On the surface the dikes are difficult to trace owing to scattered exposures.

A biotite lamprophyre dike found on the south shore of Fourclaim Lake has biotite phenocrysts up to a quarter inch in diameter in a soft greyish green chloritic matrix.

Another lamprophyre dike on the west shore of Fourclaim Lake (Photo 1) shows the relationships to the metavolcanics and the granodiorite. The dike cuts the metavolcanics but is cut by the granodiorite dike that is thought to be related to the small granodiorite stock to the east.

The Keeley No. 16 vein follows a biotite lamprophyre dike for most of its length; the dike is 3 to 6 feet wide. Other veins have been found in a similar environment, and the opinion has been expressed that the lamprophyre dikes take a part in localizing the silver-cobalt veins of the area (Kent 1965).

Miller (1910, p. 71) also made reference to this association:

Some of the mine operators at Cobalt are of the opinion that lamprophyre dikes, representing lines of weakness, in a few cases had an influence in promoting the fracturing of the rocks which gave rise to the fissures and cracks now occupied by cobalt-silver veins. It is interesting to note that veins are associated with similar dikes, kersantite, in the Saxon area, Annaberg

South Lorrain Township



ODM8198

Photo 1—Mafic metavolcanic rock cut by lamprophyre dike cut by lighter coloured granodiorite dike; west shore of Fourclaim Lake. The two hammers are on the dikes.

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS (ALGOMAN)

Granite Rocks

There are three main areas of granitic rocks. These are (1) quartz monzonite in the extreme northeast of the township, (2) granodiorite on the east shore of Fourclaim Lake, (3) granitic rocks in the southeastern part of the township.

1. In the northeast the quartz monzonite outcrop area is approximately $1\frac{1}{2}$ miles by $\frac{1}{2}$ mile with the longer dimension east-west.

In general the rock is massive with a uniform dark pink colour becoming darker, near the contact with the metavolcanics, due to a greater abundance of mafic minerals. There are also numerous inclusions of the metavolcanics. In thin section the rock has a composition of a quartz monzonite with an estimated modal composition of 20 percent quartz, 33 percent plagioclase, 25 percent potassic feldspar (mainly microcline), 20 percent amphibole, and 2 percent opaque oxides. There are minor amounts of chlorite. Burrows (1910, p. 139) named the rock syenite, but the author considers the quartz content to be too high for the rock to be called a syenite.

The contact between the quartz monzonite and the metavolcanics is generally buried and to the south it lies in a deep valley.

2. Outcrops of the granodiorite stock on the east side of Fourclaim Lake are few in number but from these and underground information from the No. 11 crosscut of Canadian Keeley Mines Limited the general size and shape of the body has been determined. Based on drifting and diamond drilling, Kent (1965) found the body to be 900 feet thick and extending from the surface to a depth of 600 feet.

The granodiorite is a medium-grained pink rock with numerous greyish green metavolcanic inclusions. In thin section the rock is composed of an estimated 40 percent sodic plagioclase, 25 percent potassic feldspar, 10 percent quartz, 24 percent amphibole, one percent opaque oxides, and abundant sphene; from microscopic studies the rock would be classified as a quartz monzonite. The feldspar grains have red turbid alteration (R. Thomson 1964, personal communication).

From underground data Kent (1965) has described the pipe-like body as having an "S" shape, in a north-south orientation, and plunging steeply to the east; the fold axes trend N65°E, the limbs thin rapidly and appear to have been faulted in post-diabase time; the "S" form indicates dragfold movement; the pipe-like body is bounded by faults forming a rectangular block.

The age of the granodiorite is not definite as the relationship with the diabase was not observed. A K-Ar age determination of the granodiorite, made for the Department by the Geological Survey of Canada, gave an age of 1,975 plus or minus 195 million years (Wanless *et al.* 1967, p. 87). This age is younger than expected and is somewhat younger than the age of 2,095 million years, plus or minus 5 percent, for the Nipissing Diabase in Cobalt (Lowdon *et al.* 1963, p. 1, 92). The younger age is possibly owing to alteration in the rock and until definite relationships with the diabase have been found the author thinks that an Archean age for the granodiorite is preferred.

3. The area of granitic rocks, which is bounded on the north and west by the unconformity with the overlying Coleman Formation rocks and on the east by the Aaron Lake Fault, is divisible into two main types, with the Northeast Cooper Lake Fault separating the two types.

To the west of the Northeast Cooper Lake Fault the rocks are massive pink to grey granites. Quartz, sodic plagioclase, microcline, and hornblende are the main minerals in the granite, with minor chlorite and epidote present. Near the Northeast Cooper Lake Fault the quartz grains are strained. These rocks are highly brecciated due to faulting.

Between the Aaron Lake and the Northeast Cooper Lake Faults the rocks are generally quartz monzonite in composition and similar in many respects to the quartz monzonite in the northeastern part of the township. Todd (1925) thought these rocks were younger than the granite to the west, but were also Archean in age.

Diabase dikes, possibly Matachewan in age, and lamprophyre dikes (too small to map) are common in this area.

Quartz Diorite

Quartz diorite occupies a 1 mile by ½ mile area to the west of Cooper Lake. That part of the intrusion in South Lorrain Township is elongate in a northeasterly direction.

South Lorrain Township

The rock is generally pale grey in colour with variations caused by differing amounts of mafic minerals, chiefly amphibole. In the field this rock looks like a quartz diorite but on examination it is classified as a quartz-bearing diorite. The rock is composed mainly of equal amounts of intermediate plagioclase and amphibole, which together constitute approximately 90 to 95 percent of the rock. There is up to 5 percent quartz and minor opaque oxides. The plagioclase is altered to kaolin and minor chlorite is also present.

Numerous inclusions of the metavolcanics are found in the quartz diorite. The contact with the granite to the east is transitional and therefore the quartz diorite appears to be a mafic border facies of the granite. This idea was first suggested by Todd (1925, p. 14). A chemical analysis of the quartz diorite by Todd is shown in Table 2.

Table 2

AN ANALYSIS OF A REPRESENTATIVE SAMPLE OF QUARTZ DIORITE
(AFTER TODD 1925, P. 15.)

<u>OXIDE</u>	<u>PERCENT</u>
SiO ₂	54.62
Al ₂ O ₃	18.64
TiO ₂	0.37
FeO	3.83
Fe ₂ O ₃	2.81
CaO	6.36
MgO	4.17
Na ₂ O	4.58
K ₂ O	2.48
CO ₂	0.44
H ₂ O	2.01
Total	100.31

MATACHEWAN-TYPE ROCKS

Several of the diabase dikes intruding the granitic rocks near Cooper Lake may be of the Matatchewan-type but they are included on the map with the "Late Mafic Intrusive Rocks" owing to the poor outcrops available in the area.

Proterozoic

HURONIAN

Cobalt Group

A long period of erosion followed the igneous activity of the Archean Era. During this time the Archean topography was greatly modified resulting in a series of basins and corresponding highlands. The Huronian sediments were deposited in the basin areas with the adjacent highlands providing the detrital material.

As originally defined the Cobalt Series (Group) was made up of the Gowganda and Lorrain Formations and upper members (Collins 1917). Thomson (1957, p. 40) modified this classification by introducing the Firstbrook and Coleman Formations which together are the former Gowganda Formation (see Table 3). The present author is employing the names introduced by Thomson (1957). This threefold division was first recognized by Barlow (1899, p. 45 and p. 90 to 104) and further recognized by Miller (1910), and Todd (1925) but it was not until 1957 that a formal nomenclature was introduced (Thomson 1957).

Nearly flat-lying beds of all three formations are found extensively in South Lorrain Township. The contact with the underlying basement is unconformable.

Table 3 COBALT GROUP: SUBDIVISION INTO FORMATIONS.

Collins 1917, p. 23	Thomson 1966, p. 8
LORRAIN QUARTZITE	LORRAIN FORMATION Arkose, quartzite
GOWGANDA FORMATION Conglomerate, greywacke, and limestone	FIRSTBROOK FORMATION Argillite
	COLEMAN FORMATION Conglomerate, bedded greywacke, quartzite

Coleman Formation

In the nomenclature of Thomson (1957) the Coleman Formation is the lower part of the Gowganda Formation, and is named after Coleman Township, in which the Town of Cobalt is located.

In South Lorrain Township the Coleman Formation occupies most of the eastern half of the map-area. Its estimated maximum thickness is approximately 1,000 feet. More detailed information on the thickness is supplied by diamond-drill cores and underground work; most of this data is from within the diabase dome. Unless otherwise credited all information on drilling is from the files at the Resident Geologist's office of Cobalt, now at Kirkland Lake.

A drill hole on claim T34065 southwest of Maidens Lake indicated a vertical thickness of 200 feet, and four holes on T34063 and T34064, nearby, gave thicknesses ranging from 180 to 270 feet. These holes were put down by E. B. E. de Camps in 1949 and 1954. Farther to the northeast a long hole collared near the south shore of Maidens Lake (claim T44062) indicated a vertical thickness of 780 feet, and another hole on the northeast side of the lake gave only 490 feet. Another drill hole southeast of Maidens Lake went through 350 feet of Coleman Formation; the shaft to the east on claim T19297 is reported to have gone through approximately 400 feet of sedimentary rocks before reaching the basement. These and other data (the drill hole data is from assessment files and the drill holes were not found by the author)

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suggest an irregular basement topography, on which the Coleman Formation was deposited, with the suggestion of a local trough trending east-northeast subparallel to the flanks of the diabase "dome".

The only information on thickness outside the diabase "dome" is from a drill hole (not found by author) just north of the north boundary of HR18, northwest of Maidens Lake. Here the thickness was found to be 460 feet. Drilling to the southeast of Maidens Lake by Mining Corporation of Canada (1964) Limited indicated the thickness on their property to be about 100 feet, but this did not represent total thickness. South of the diabase "dome" the author has no information from drilling, but using bedding attitudes and topography the author considers that it is in this area that the Coleman Formation reaches its estimated maximum thickness of approximately 1,000 feet.

Locally the contact of the Coleman Formation rocks with the Archean basement is irregular, but on a regional basis the outcrops of the formation in South Lorrain Township represent the eastern portion of a northeasterly-trending basin. This basin starts in Riddell Township, to the southwest, and continues northeast through Sunrise Lake (Riddell Township) through South Lorrain Township to Windy Lake, and continues north. The outline of this basin is evident on various maps (see Todd 1925, map; Thomson and Savage 1965). The lack of deformation in the Coleman Formation rocks, except in the vicinity of faults, would indicate that this basin structure is owing more to basement topography than to post-depositional folding.

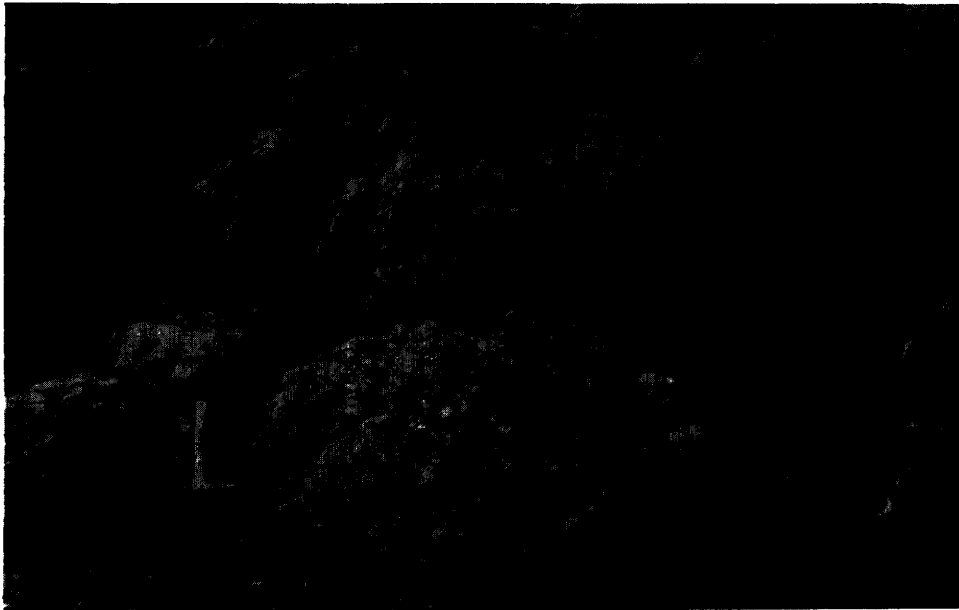
The rocks of the Coleman Formation are a heterogeneous mixture of greywacke and quartzose siltstone, arkose, argillite, and conglomerate. The quartzose siltstone and greywacke are fine-grained greenish grey rocks consisting of subrounded to sub-angular grains of quartz, feldspar, and rock fragments in a matrix of chlorite, mica, and silica; minor pebbles may be seen. The arkose is generally brown to pink in colour and slightly more coarse-grained than the quartzose siltstone and greywacke.

Conglomerate pebbles, cobbles, and rare boulders (Photos 2 and 3) are generally pink granitic rocks with minor white granite, "greenstone", and diabase. They are generally subangular to subrounded and on the average range up to 6 to 8 inches in diameter.

No definite separation of the rock types was possible in mapping owing to their heterogeneous nature. At the top of the formation conglomerate dominates, as evidenced along the east shore of the Matabitchuan River, and to a lesser degree to the north. The beds are generally close to flat-lying, except in the area of faults where they dip steeply. The rocks are schistose close to the Northeast Copper Lake Fault on the north shore of Cooper Lake. Todd (1925) considered these schistose rocks to be Archean, but the author believes they are sheared rocks of the Coleman Formation.

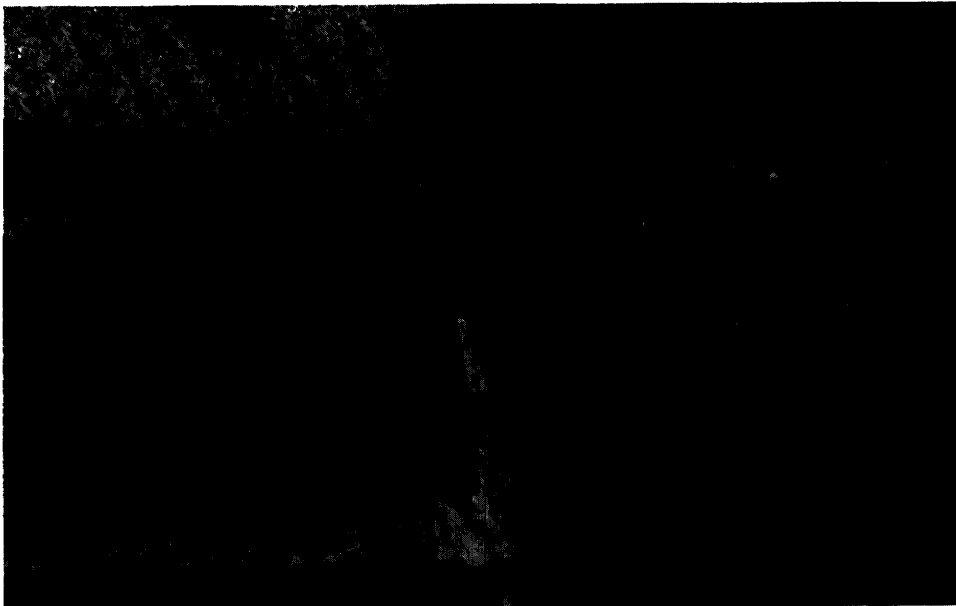
The bottom contact of the Coleman Formation is an unconformity, as shown by the nearly vertical dips of the underlying volcanic rocks and flat dips of the overlying sedimentary rocks. The granite forms the basement rock in the southeast (see Photo 2).

Previous workers have attributed a glacial origin to the Coleman Formation.



ODM8199

Photo 2—Coleman Formation conglomerate, on the right, overlying granite; shore of Lake Timiskaming approximately 2½ miles north of the southern township boundary.



ODM8200

Photo 3—Graded bedding in Coleman Formation conglomerate; shore of Lake Timiskaming approximately 2½ miles north of the southern township boundary.

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ODM8201

Photo 4—Laminated argillite of the Firstbrook Formation; approximately 1 mile north of Fourbass Lake.
Photo by J. M. Johnson, field assistant.

Firstbrook Formation

The Firstbrook Formation was first described by Thomson (1957, p. 41-42) as being the upper part of the Gowganda Formation of Collins (1917). The type locality of the Firstbrook Formation is located in Firstbrook Township, 15 miles northwest of the map-area.

In South Lorrain Township the main area of exposure is a belt, roughly $\frac{1}{4}$ to $\frac{1}{2}$ mile wide, striking north for almost the full length of the township, and offset by several faults. The best exposures are on the west shore of Fourbass Lake in central South Lorrain Township, and about $\frac{1}{2}$ mile west of Highway 567 in the northern part of the township. A smaller area of outcrop is found north of the Upper Notch power station in northwest South Lorrain Township; to the south there are several outcrops, in a north-south belt, that strongly resemble the Firstbrook Formation. The rocks designated Firstbrook Formation just west of Maidens Lake are considered to have been part of the main belt to the west prior to the intrusion of diabase.

The estimated thickness in the main belt varies from 500 to 700 feet, which is less than the 950 feet described by Thomson (1957, p. 41) for the type locality. The Firstbrook Formation is part of the same regional basin described in the section on the Coleman Formation.

The formation consists of laminated or varved, very fine-grained argillite, with alternating greyish red or greyish brown and greyish green layers, and quartzite. The varves are usually more easily seen on the weathered surface of the outcrop (Photo 4). The argillite is composed mainly of subrounded quartz grains, with minor



ODM8202

Photo 5—Thick bedded Lorrain Formation quartzite, note slight colour difference between weathered surface, on right, and fresh surface, exposed by blasting; on power line southeast of Upper Notch Power Dam. Photo by J. M. Johnson, field assistant.

feldspar, set in a chloritic matrix with minor sericite. There are also small amounts of opaque minerals. The quartzite is grey, well bedded and harder than the argillite. It is also fine-grained.

The beds are gently dipping, for the most part, with a maximum dip of 30 degrees, and average dip of 10 to 15 degrees.

No contacts were observed with the underlying Coleman Formation but the contact with the Lorrain Formation appears gradational. Lorrain Formation rocks are more rounded in weathered outcrops than Firstbrook Formation rocks owing to the better defined bedding in the latter.

Thomson (1966, p. 15-16) has suggested that the laminations or varves are due to seasonal deposition in a lake, possibly of glacial origin.

Lorrain Formation

The Lorrain Formation was first named by Miller (1910, p. 75) because the type section was found in Lorrain Township. It is the youngest formation of the Cobalt Group in South Lorrain Township.

The Lorrain Formation is the most extensive rock type in the map-area; it covers almost all of the area west of the Montreal and Matabitchuan Rivers, plus several square miles east of the Montreal River in the northern part of the township. The thickness of the formation is estimated to be from 0 to 1,200 feet. No confirming data is available from drilling.

South Lorrain Township

The main rock types are flat-lying grey feldspathic quartzite (Photo 5), pale green quartzite, and pink arkose. The green quartzite locally grades to white ortho-quartzite. These rocks are fine-grained with lenses of medium- to coarse-grained material, and the occasional quartz-pebble lens. Close to the contacts of diabase dikes the rocks are red owing to the oxidation of ferrous iron to ferric iron. The grains of quartz, the most abundant mineral, are generally rounded; the feldspar grains have been altered; and the matrix is fine-grained silica with minor chlorite.

Beds are massive in the Lorrain Formation and data on bedding is difficult to find. Where bedding planes are found they have a gentle dip, the maximum angle being about 25 degrees. Slickensides were found in several of the shear faces of exposures in the area west of the Montreal River, suggesting deformation by faulting.

No contacts were observed with the underlying formations, but the contacts are assumed to be gradational. A small outcrop north of the Maidens Bay road is a coarse-grained arkose, with feldspar grains up to a quarter inch; this arkose grades imperceptibly into the underlying granite. The width of the zone of gradation cannot be determined owing to the amount of overburden.

The Lorrain Formation appears to be a shallow water deposit derived from a granitic terrain.

LATE MAFIC INTRUSIVE ROCKS

Nipissing Diabase

Intrusive into all older rocks is a massive unaltered mafic rock named the Nipissing Diabase by Miller (1910).

In South Lorrain Township the diabase is considered by the writer to be all one sheet, with numerous rolls, both major and minor. Local rolls around the mines are shown in Figure 2 (Chart A, back pocket). In the eastern part of the township the diabase is in the form of a dome, with the central part removed by erosion (see section on Map 2194, back pocket). The axis of this dome strikes north-northeast, and it is interesting to note the subparallelism of this axis to the margin of the basin of deposition of the Cobalt Group sedimentary rocks. The south flank of the dome dips steeply southeast, and the northwest and wider flank dips approximately 30 degrees west. The north contact of the northwest flank dips to the south and thus forms a minor basin within the dome. In the western part of the township a diabase dike, $\frac{1}{4}$ mile wide, strikes northeast and widens out to almost 3 miles forming a northerly-plunging basin structure. Between the dome and this basin another larger lapolith-like basin is postulated, with a possible feeder below. It is suggested that the dike is the surface expression of this feeder. This western basin is connected to the eastern dome as shown on Map 2194 (back pocket) by the continuity of the diabase $\frac{1}{4}$ mile south of Hermit Lake.

In hand specimen the diabase is a typical grey to black, fine- to medium-grained, fresh to slightly altered rock. There are areas of coarse-grained diabase that contain minor amounts of pink feldspar. Varied texture is apparent in certain exposures; a good example is the roadside outcrop approximately 1 mile southeast of the Upper Notch power station. No detailed petrographic study of the diabase was undertaken. Such studies have been made in the Cobalt area by Hriskevich (1952); Satterly (1928) described the diabase in South Lorrain Township. Microscopic examination of a few thin sections shows it to be mainly a quartz diabase with lath-shaped plagioclase crystals of labradorite composition in a pyroxene groundmass. The

quartz is present mainly as micrographic intergrowths with the plagioclase. Minor amounts of opaque oxides, biotite, epidote, and chlorite are also present.

Much of the data on the thickness of the sill are from the area of the main mines; other figures given are mostly inferred. Information from the mines shows the diabase to be from 900 to 1,000 feet thick, with local variations. This figure represents the complete sill where it has been protected from erosion. Areas to the east have been exposed to erosion and the thickness of the sill is less than 900 feet. A drill hole on the north peninsula in Maidens Lake penetrated 95 vertical feet of diabase before encountering the underlying Coleman Formation. Approximately 400 feet south of the north boundary of T29490, east of Maidens Lake, a thickness of 130 feet was found, and on the boundary 200 feet of diabase were intersected. Near the adit on HR63, on the shore of Lake Timiskaming, drilling indicates a thickness of 175 feet and farther to the south, 50 feet. With these data, and taking topography into consideration, a maximum thickness of nearly 500 feet is inferred. The diabase northeast of Maidens Lake is the northern flank of the South Lorrain diabase dome, and is considered to be a basin in itself.

A K-Ar age determination on the diabase near Cobalt gave a result of 2,095 million years (Lowden *et al.* 1963, p. 92). Previous geological maps of South Lorrain Township (Knight 1922, map; Todd 1925, map) have indicated the Nipissing Diabase to be Keweenawan in age, but the diabase must now be considered as pre-Keweenawan.

Keweenawan

Diabase

Numerous late diabase dikes, with a predominant northwest strike cut all older rocks in the area. The majority of these dikes are olivine diabase in composition and are commonly 100 to 200 feet wide; one in the southwestern part of the township is 500 feet wide.

In hand specimen these rocks are similar in many respects to the earlier Nipissing Diabase. Certain characteristics which do, however, help to distinguish the Keweenawan diabase from the Nipissing Diabase are:

1. The Keweenawan diabase is often porphyritic in texture with labradorite phenocrysts up to 1 inch long (Photo 6).
2. In colour the Keweenawan dikes are much darker, often almost black.
3. In many cases a spheroidal weathered surface is apparent in Keweenawan diabase.

Where the Keweenawan dikes cut the Lorrain Formation rocks they weather low and do not appear in outcrop. Their presence in gullies can be detected, however, by a red coloration in the Lorrain Formation rocks, owing to the intruding dike oxidizing iron in the sedimentary rocks from the ferrous to ferric state.

In thin section the olivine content is found to vary from 10 to 25 percent. Other essential minerals present are labradorite and titaniferous augitic pyroxene, with biotite and opaque oxides, mainly magnetite. The large dike in the southwest part of the township is especially high in magnetite.

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ODM8203

Photo 6—Porphyritic olivine diabase dike cutting Nipissing Diabase; west shore of Lorrain Lake. Photo by David Lee, field assistant.

Dikes of similar composition and geological setting have been described by Lawton (1954, p. 13) in Delhi Township 30 miles to the west. A K-Ar age determination by the Geological Survey of Canada on one of these dikes at the north end of Obabika Lake in Delhi Township gave a result of 1,240 plus or minus 45 million years (Wanless *et al.* 1966, p. 65-66), which is Keweenawan age.

ROCKS NOT ASSIGNED TO THE SUPERIOR OR GRENVILLE PROVINCES

UNCLASSIFIED METASEDIMENTS

In the southeast corner of the township, between the Aaron Lake Fault and the Grenville Front, is an area of metasediments the age of which is not known. The rocks in this unit are quartzose paragneiss and quartzose feldspathic paragneiss characterized by open folding. There are several late granite and diabase dikes cutting these rocks; these dikes are small and do not appear on the map.



ODM8204

Photo 7—Conglomerate in the Grenville-type rocks; shore of Lake Timiskaming.

GRENVILLE PROVINCE

METASEDIMENTS

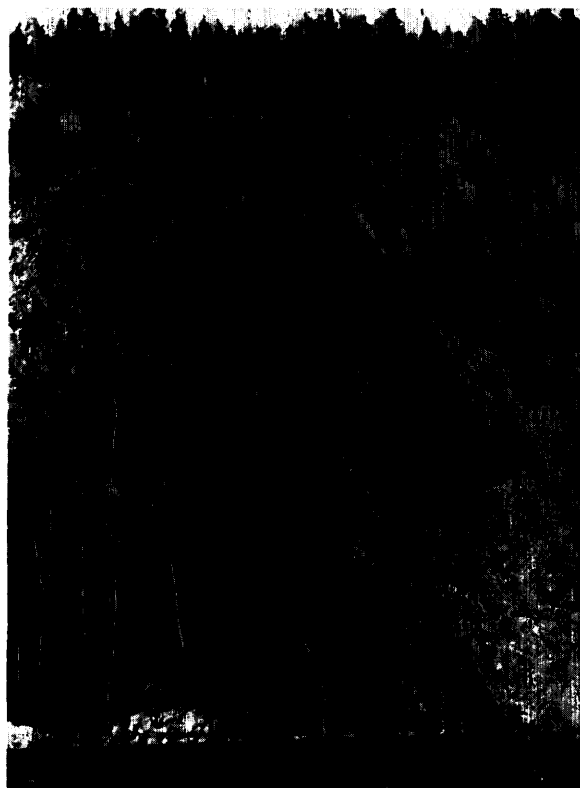
A small area of rocks that is considered to be in the Grenville Province lies to the south of the Unclassified Metasediments. The position of the Grenville Front is shown on the map where a prominent southeast lineation is first seen in outcrop. South of the "front" is a wide area of thrust faulting. The rocks are essentially biotite-quartz-feldspar paragneiss.

There is one area of conglomerate (Photo 7), outcropping on the shore of Lake Timiskaming, that is less metamorphosed than the rest of the rocks. Numerous boulders have been eroded, giving the rock a "honeycomb" weathered surface. The conglomerate is possibly younger than the other rocks.

Late granitic and diabasic dikes are found here (only one dike is shown in this area on Map 2194, back pocket). One dike (Photo 8), which can be seen in the cliff along Lake Timiskaming, is semi-elliptical in shape and does not reach the top of the cliff.

More detailed work is needed in this area in order to determine more precisely the position of the "front".

South Lorrain Township



ODM8205

Photo 8—Bulb-shaped late olivine diabase dike cutting Grenville-type metasediments; shore of Lake Timiskaming. Photo by P. R. White, field assistant.

CENOZOIC

PLEISTOCENE AND RECENT

Overburden in the map-area is generally very thin except in the Montreal River valley where the cover is much thicker. Boissonneau (1965) has indicated that the map-area is in an area of silty to sandy till with minor clay and silt. Numerous drill holes, put down by Ontario Hydro-Electric Power Commission, in the Montreal River valley have furnished information on glacial and post-glacial deposits. [One hole, approximately 200 feet north of the river, just above the gorge near the mouth, indicates a buried valley lying off the main course of the river. A modified drill log indicates 0 to 11 feet of interbedded fine post-glacial silts and sands; 11 to 20 feet stratified gravel and fine to coarse sand; 20 to 120 feet not sampled but consists mainly of numerous boulders and cobbles and fine to coarse sand; 120 to 158 feet glacial till; 158 to 195 feet is subglacial stratified, fine to very fine, sand with organic and silt layers. High sand banks are common along the Montreal River.

Thirty glacial striae measurements were taken and range from S40°E to S20°W. The mean of these readings is S5°E with a standard deviation of 16 degrees.

STRUCTURAL GEOLOGY

Schistosity

Schistosity is most prominent in the Archean metavolcanics where it strikes within a few degrees of east with steep dips. The Coleman Formation has well developed schistosity where it has been faulted. The best example of this is on the north shore of Cooper Lake where the rocks have been sheared by the Northeast Cooper Lake Fault.

Joints

No detailed study on joints was carried out but a few generalizations may be made. In the Nipissing Diabase it has been found that flat or nearly flat-lying joints are subparallel to the contacts of the sill. Though not common in South Lorrain Township cylindroidal joints were observed in the diabase. Eakins (1961) has attributed this feature in the Gowganda area to cooling, and more recently Hester (1967) ascribes them to deformation by stress after cooling.

Prominent northwest jointing in the Cobalt Group sedimentary rocks parallels the northwest-striking faults.

Folds

Folding is most prominent in the basement metavolcanics, which are all deformed. Top determinations suggest a synclinal structure trending northwesterly through the wedge of metavolcanics around Fourclaim Lake. There is also a slight reflection of this in the overlying sedimentary rocks, but this feature may be warping by the diabase intrusion. The granodiorite body has also been folded; this has been discussed under granitic rocks in the section on "General Geology".

Small scale open folding is characteristic of the unclassified paragneiss unit, and south of the Grenville Front the folds are tighter.

Faults

Numerous faults are present in the area with several periods of deformation postulated: the earliest faults are pre-ore, and most of this set strike north; there are possibly two ages of northwest-trending faults, pre- and post-olivine diabase intrusion; and finally a minor northeasterly-trending set of faults, for which the evidence indicates that these are the youngest Precambrian faults in the area. The possibility

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that there are two ages of northwest-trending faults exists because (a) the late olivine diabase dikes, in some places, are thought to be intruded along fault zones and (b) many northwest-trending faults in the Cobalt area are known to be Paleozoic in age. In the Cobalt area, Thomson (1961, p. 5) postulated a Paleozoic age for several faults, including the Cross Lake and Lake Timiskaming Faults. In South Lorrain Township, the author considers that the Montreal River Fault may be a branch of the Lake Timiskaming Fault and, therefore, Paleozoic in age. Hume (1925, p. 48) gave vertical displacements on the Lake Timiskaming Fault northwest of New Liskeard as 770 feet, and 5 miles farther north as 1,000 feet. Thomson (1960, p. 96-97) calculated, on the basis of drill hole information, the displacement to be 770 feet. In all instances, in discussing the Lake Timiskaming Fault, the east side has moved down relative to the west, and Silurian rocks have been displaced.

On the basis of the Lake Timiskaming Fault, and several northwest-striking faults in the Cobalt area being post-Silurian in age it is suggested that some of the faults in South Lorrain Township are also post-Silurian and probably branches of the Lake Timiskaming Fault.

Surface expression of many faults is in the form of well-defined lineaments on aerial photographs. Other evidence such as brecciation and offset contacts have been detected in many instances.

In the case of the northwest-trending faults, horsts and grabens are evident as the relative downthrown blocks are not consistently the same.

Montreal River Fault

This fault trends N35°W along the Montreal River valley. Results of the faulting are seen in the brecciation of rocks found in drilling by Ontario Hydro-Electric Power Commission and in outcrops close to the river, and in the truncation and displacement of Cobalt Group contacts. The contacts of Firstbrook Formation have been displaced about 5,000 feet north-side northwest. If vertical movement was involved then the southwest side is down relative to the northeast side; the left-hand displacement of contacts would then be owing to migration of the contacts, northeast of the fault, due to subsequent erosion.

Bulldog Fault

This fault is named after the shaft, locally known as the Bulldog, through which it passes; it strikes N35-65°W. The contact of the Coleman Formation with the basement metavolcanics has been truncated and there is an apparent right-hand displacement of 400 to 1,400 feet. Brecciation is found in a trench northwest of the Bulldog shaft.

Maidens Lake Faults

The northwest branch of the Maidens Lake Fault strikes N40°W; it can be traced about 5 miles, from Lake Timiskaming and through Maidens Lake to about $\frac{3}{4}$ mile southeast of Hermit Lake. A wide zone of brecciation was intersected by a drill hole on the north shore of Maidens Lake and by another hole collared about 1,000 feet southeast of the lake. The contact of the Cobalt Group with the diabase has been offset, but in an irregular manner, southwest of the fault. Vertical movement is indicated; most of the evidence points to the northeast side down relative to the southwest side. Where the fault crosses Highway 567 the displacement is left-handed, this conflicts with the right-hand displacement at Maidens Lake.

The northeast branch of the Maidens Lake Fault is indicated by a well-defined lineament. The difference in elevation of the lower contact of the diabase indicates the east side moved down about 150 feet relative to the west side.

Faults East of Maidens Lake

There are two northwest-trending faults east of Maidens Lake. South of the diabase dome the Coleman Formation-metavolcanic contact has been displaced 700 feet by both faults; the same is true for the lower, diabase-Coleman Formation contact in the central part of the dome. Suggested vertical movement is southwest side down relative to the northeast side in both instances.

Firetower Fault

A northwest-trending fault has offset the Nipissing Diabase-Coleman Formation contacts along the firetower ridge of diabase east of Fourbass Lake; there is a 500-foot left-handed displacement. A cliff, $2\frac{1}{2}$ miles west of the mouth of the Montreal River, indicates vertical movement of northeast side down. Beds of the Firstbrook and Lorrain Formations are repeated in the cliff face.

Fourbass Lake Fault

This northwest-trending fault has displaced the Firstbrook-Lorrain contact about 500 feet at the northwest corner of Fourbass Lake. The right-handed displacement indicates possible vertical movement of northeast side down relative to the southwest side. An olivine diabase dike was found in part of the gully formed by the fault.

Copper Lake Fault

The Copper Lake Fault strikes N55°W across the north end of Copper Lake and near the south shore of Fourbass Lake. Displacement of the Firstbrook-Lorrain contacts similar to that caused by the Fourbass Lake Fault has resulted from this fault.

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Cooper Lake Faults

The Northwest Cooper Lake Fault strikes about N35°W and the Northeast Cooper Lake Fault strikes N30°E. The northwest branch can be traced for about 8 miles from Cooper Lake. Right-handed displacement of projected contacts within the Cobalt Group and of the Coleman-granite contact has resulted. Also the Lorrain Lake Fault appears to be offset by this fault but the displacement seems to be left-handed.

Shearing of the Coleman Formation rocks and of the granitic rocks, on the north shore of Cooper Lake, has resulted from the Northeast Cooper Lake Fault. The fault divides the area underlain by quartz monzonite, on the southeast, from the rest of the granitic rocks, on the northwest.

Aaron Lake Fault

This fault strikes about N25°E through Aaron Lake. The outcrops at the south end of Aaron Lake have been mylonitized. The fault separates the unclassified metasediments on the southeast from the quartz monzonite on the northwest.

Matabitchuan River Fault

This fault follows the course of the Matabitchuan River south of Fourbass Lake. High cliffs of Coleman Formation conglomerate on the east shore of the river stand opposite the stratigraphically higher Firstbrook Formation on the west shore; this indicates the west side is down relative to the east side.

Lorrain Lake Fault

This fault follows Lorrain Lake and can be traced north to HR615 and possibly beyond. Two areas of Firstbrook Formation on the east side of the fault are difficult to explain; Todd (1925, p. 27) suggested they had been caught up in the intruding Nipissing Diabase which parallels the fault.

Horsts and Grabens

From the vertical movement described for the major faults it is suggested that there is a horst between the Montreal River and Maidens Lake Faults. By the same reasoning a graben is delineated between Maidens Lake Fault and the second fault to the northeast; there is also a wedge-shaped graben between the Montreal River and Firetower Faults.

GEOCHEMICAL DATA

Sediment samples were collected by the field party from three streams; the samples were taken at approximately 500-foot intervals and analyzed at the laboratories of the Geological Survey of Canada at Ottawa. They were analyzed for the following elements: cobalt, nickel, copper, zinc, arsenic, molybdenum, antimony, tungsten, lead, and mercury by colorimetric methods; beryllium, boron, titanium, vanadium, chromium, manganese, strontium, zirconium, silver, tin, barium, gold, bismuth, and cadmium were analyzed spectrographically.

Samples were taken from: (1) Maidens Creek between Maidens Lake and the road to Maidens Bay; (2) the stream flowing southeast parallel to the road to Maidens Bay to where it joins Maidens Creek; (3) the stream flowing south from Tooth Lake to the Montreal River.

Two anomalies were detected in the results:

1. Four samples on Maidens Creek gave anomalous arsenic (130-300 ppm), cobalt (15-45 ppm), nickel (55-60 ppm), and zinc (140-210 ppm).
2. Four samples between Tooth Lake and the Montreal River gave anomalous arsenic (80-110 ppm) and zinc (120-170 ppm).

For a discussion on background values and average composition of rocks and soils in the Cobalt area the reader is referred to Boyle (1966).

ECONOMIC GEOLOGY

SILVER AND COBALT

South Lorrain Township is one of the outlying camps of the Timiskaming silver belt. The main production has been native silver with minor amounts of cobalt, nickel, and copper also having been produced (Table 4). To the end of 1965 South Lorrain had produced a total of 23,338,906 ounces of silver with 82 percent of this coming from the Keeley and Frontier Mines, and over 50 percent from the Keeley Mine itself. There was no production in 1966 or 1967.

The silver occurs in the native state in carbonate veins and vein systems. Throughout the silver area these vein systems have been found to have a very close spatial relationship to the Nipissing Diabase sills or sheets. In the South Lorrain area the production has mainly come from the first 300 feet of metavolcanics overlying the diabase on the gently dipping western flank of the diabase dome. Little ore is associated with the lower contact of the diabase with the metavolcanics; in the case of the Keeley Mine development costs were not returned. Some production also came from the Nipissing Diabase; all ore was from diabase in the Wettlaufer Mine. More detailed descriptions of the important veins are found in the descriptions of properties.

Bastin (1950) presented a paragenetic sequence which indicated the following order of deposition of minerals: older calcite, cobaltite, lollingite, (fracturing), niccolite, breithauptite, silver, and younger calcite. The specimens for this study were from the Frontier Mine. Similar results were obtained from the Cobalt area.

South Lorrain Township

Table 4

PRODUCTION FIGURES FOR SOUTH LORRAIN TOWNSHIP (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS	COPPER POUNDS
1908	13,124	24,800	....	....
1909	194,955	7,296	....	....
1910	221,233	.....	....	....
1911	933,912	.....	....	....
1912	834,119	.....	....	....
1913	248,991	.....	....	....
1914	108,189	.....	....	....
1916	77,280	5,570	9,616	....
1917	10,000	.....	....	....
1918	72,188	5,410	....	....
1919	4,586	3,160	....	....
1920	8,253	9,897	....	....
1921	328,886	16,167	....	....
1922	1,284,307	198,591	....	....
1923	2,955,646	319,234	....	....
1924	2,633,058	296,573	....	....
1925	3,099,964	447,978	....	....
1926	3,044,585	301,125	....	....
1927	2,319,354	204,153	....	....
1928	1,133,953	224,208	....	....
1929	876,006	127,306	....	....
1930	1,763,801	391,466	....	....
1931	594,360	764,989	....	....
1932	22,144	6,517	....	....
*				
1935	61,339	9,326	....	....
1936	11,443	16,694	....	....
1937	47,046	6,878	....	....
1938	40,270	29,165	14,705	....
1939	21,039	27,342	14,393	....
1940	11,566	11,441	5,549	....
1941	4,233	7,910	....	....
1942	9,977	12,295	1,041	....
1943	1,454	5,883	3,788	....
*				
1963	136,274	9,003	14,332	10,292
1964	93,609	.....	26	....
1965	117,762	.....	....	....
Totals	23,338,906	3,490,377	63,450	10,292

*No production recorded for 1933-34 and 1944-62 inclusive.

Numerous authors have concluded that most silver in the Cobalt area is late primary in origin. The South Lorrain area, however, does present an unusual occurrence of secondary enrichment owing to deep pre-glacial oxidation on the Wood's vein. Bell (1923) gives the best description of this feature; it is also described by Knight (1922).

The association of biotite lamprophyre dikes and silver veins is suggested by the Keeley No. 16 vein which follows a biotite lamprophyre dike. (For positions of named veins see Figure 2, Chart A, back pocket.)

SULPHIDE MINERALIZATION

Several test pits containing chalcopyrite, pyrite, and galena were found during the fieldwork. The mineralization is generally in veins of quartz, carbonate, or both and in either the metavolcanics, the Nipissing Diabase, or Coleman Formation rocks.

SAND AND GRAVEL

One sand and gravel pit on the east side of Highway 567, at the north boundary of the township, consists of, in ascending order: very fine well-bedded sand (15 to 20 feet thick); 15 feet of sand with cobbles and boulders; and reddish sand. The material is used on the highway, but is not suitable as it is easily washed away during a rainstorm.

DESCRIPTIONS OF PROPERTIES

Descriptions of the mining properties in the area are covered alphabetically under the name of the 1967 owner of the property. The number in brackets following the property name indicates the corresponding number on Map 2194, back pocket, as do the numbers in Tables 5 and 6.

Agnico Mines Limited (1)

In 1967 Agnico Mines Limited held five properties in the township as follows:

1. Wettlaufer Mine
2. Curry Mine
3. Canadian Lorrain Mine
4. Gilgreer Mine
5. HR155 (not described)

WETTLAUFER MINE

The old Wettlaufer Mine is on HR85, approximately half way between Tooth Lake and Maidens Lake. Production figures (Table 7) show that over 2½ million ounces of silver came from the Wettlaufer Mine.

Table 5 PROPERTIES FOR WHICH ASSESSMENT DATA IS ON FILE WITH THE ONTARIO DEPARTMENT OF MINES AS OF 31 DECEMBER 1967.

PROPERTY* NUMBER	PROPERTY NAME	DATE OF WORK	TYPE OF WORK	NUMBER OF DRILL HOLES	FEET DRILLED	TORONTO FILE NUMBER	FILED AT ¹ KIRKLAND LAKE ONLY
1	Agnico Mines	1961-62	DD	2	466½	12-1-326	x
4	Canadian Keeley						
5	Cloutier, A. and F.	1963	DD	1	200	?	x
7	Cooper, J. F.	1959	DD	2	1812	12-1-324	
8	Copperfields	1960	DD	1	1016	12-1-325	
9	de Camps, E. B. E. est.	1950	DD	2	435	?	
12	Fleming, S.	1949	DD	2	479	12-2-332	x
14	Gray, J. J.	1954	DD	5	2412	12-2-317 12-1-316 12-2-322	
22	Larum Mines						x
23	Levy, G. W.						x
25	MacBeth, G.	1966	GP; Mag, EL				x
33	Millerfields	1966	GP; Mag			63.1932 63.2030	
34	Mining Corp.						
35	Mobiko Mines	1966	GL; GP;			63.2012	x
			Mag, EM, IP, EL				
37	Mosher, M. C.	1952	DD	6	551	12-5-327	
		1952	DD	4	600	12-4-328	
39	Oslund, N.						x
40	Ox-bow Silver						x
41	Pennaque Mining						x
42	Price, J. H.						x
43	Pugh, H. J., est.	1954	DD	1	165½	12-1-329	
44	Ramardo Mines	1949	DD	2	305	12-2-321	
		1949	DD	2	500	12-2-335	
		1949	DD	11	1166	?	
		1956	DD	4	1201	12-4-331	
47	Silver Tower	1951	DD	2	449½	12-2-319	
49	United Macfie	1956	GL			63A.306	
50	Veinlode Silver	1956	DD	1	42	?	
		1957	DD	1	74	?	
		1959	DD	4	5895	?	
		1963	DD	1	121	?	
52	Weaver, E. P. and L. J.						x

Abbreviations used: DD-Diamond drilling; EL-Electrical; EM-Electromagnetic; GL-Geological; GP-Geophysical; IP-Induced Polarization; Mag-Magnetic.

*Number refers to property number on Map 2194, back pocket.

¹For more details of data filed at Kirkland Lake see Lovell 1968, p. 111-116.

Table 6

PROPERTIES FOR WHICH THERE IS NO INFORMATION IS AVAILABLE*

PROPERTY NUMBER	PROPERTY NAME	P-PATENTED	NUMBER OF CLAIMS
2	Americanadian Mining and Exploration Co. Ltd.	P	4
15	Hennessy, J. W.	P	1
16	Hill, H., estate	P	2
17	Hoffer, Mrs. G. L.	P	2
18	Hyndman, Miss N., estate	P	2
21	Kirkpatrick, C. H.	P	1
24	McAuley, H. B.	P	9
26	McEwen, R. H.	P	2
27	McGavern, W. J., estate	P	2
30	McPhee, J. A.	P	1
36	Morissette, J. H.	P	1
45	Scott, Mrs. D., estate	P	3
46	Sequin, A. H., estate	P	1
51	Violette, B. R., and Heritage, Mrs. M. E.	P	2
53	Wood, W. L. and A.	P	1
54	Wysocki, A. and O.	P	1

*These properties are not described in the text but are in the list of properties on the Map 2194, back pocket, marked with an asterisk and their approximate location is indicated on the map-face.

Table 7

PRODUCTION FIGURES FOR THE WETTLAUER MINE OWNED IN 1967 BY AGNICO MINES LIMITED, PROPERTY 1, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
1909	183,742	7,060	...
1910	199,920	....	...
1911	925,017	....	...
1912	834,119	....	...
1913	248,991	....	...
1914	104,665	....	...
*			...
1916**	68,129	....	...
1917	....#	....	...
1918	....#	....	...
*			...
1927	4,146	312	...
*			...
1935	7,496	....	...
*			...
1937	3,387	2,984	...
1938	7,142	9,653	...
1939	2,035	2,676	312
1940	4,252	1,225	614
Totals	2,593,041	23,910	926

*No figures available for 1915, 1919-26, 1928-34 inclusive.

**Part of 1916 production shown with production figures for Curry Mine, Table 8.

#Production for 1917 and 1918 shown included with production figures for Curry Mine, Table 8.

South Lorrain Township

History and Development

Work started on the claim in 1908 when the Wettlaufer Lorrain Silver Mines Limited was formed, and during that year stripping and test pitting were done on the Wettlaufer vein (O.B.M. 1909, p. 124-5). In 1909 the Wettlaufer Mine became the largest silver producer in South Lorrain Township, and remained in that position until 1913, when production stopped; sporadic, limited production occurred after that date. During 1909 the shaft was sunk 150 feet with development on two levels. By the end of 1911 the shaft was down 250 feet with four levels and development on the vein for 500 feet. Operations by Wettlaufer Lorrain Silver Mines* were discontinued in October 1913. In 1916 the mine was leased by the Comfort Mining and Leasing Company and from 1917 to 1919 by the Pittsburgh Lorrain Syndicate. Very limited production resulted from these operations. According to O.D.M. Annual Reports (1936, p. 182; 1938, p. 240; 1939, p. 60 and 229) the property was leased and worked, or worked by its owners, during the middle and late thirties, with minor production reported for 1935, 1937, 1938, and 1939. Keylobe Cobalt Silver Mines Limited** was incorporated in 1950 and they leased the Wettlaufer and Curry Mines from Silanco Mining and Refining Company Limited***. In 1957 when Cobalt Consolidated Mining Corporation Limited reorganized and changed its name to Agnico Mines Limited they acquired the Wettlaufer and the other properties described in this section.

Geology

Knight (1922, p. 225) writes the following on the geology of the property:

From information gathered from various sources, it appears that there is practically one vein on the property. This vein occurs only in the top of the Nipissing diabase sill, and does not extend into the overlying Keewatin, in which respect it differs from veins on the Keeley and Frontier, which occur both in the diabase and overlying Keewatin. One may note on the surface that the vein does not enter the Keewatin.

The Wettlaufer vein strikes about north 60° east. It outcrops along the side of the Wettlaufer valley, and it enters the valley at a gentle angle. The Wettlaufer valley probably represents a fault; and as it strikes north 41° east, it is seen that if the vein continues far enough to the northeast with a strike of north 60° east it would gradually enter the Wettlaufer valley fault.

It is reported that silver occurred on the surface in the Wettlaufer vein. The vein may still be examined on the surface, and in places shows a width of one to three inches of smaltite. Quartz is also found in the vein, stained with cobalt bloom and having a width of two inches.

The vein runs about at right angles to the contact between the Nipissing diabase and the Keewatin.

Knight (1922, p. 225) also published a report on the underground geology written for him by H. F. Strong, a former manager of the mine. This report follows:

The Wettlaufer mine was one of the early discoveries of high-grade silver in the South Lorrain field, and has the unique feature that its comparatively large production came entirely from the Nipissing diabase and from a depth of from 100 feet to 250 feet below the Keewatin contact.

It is essentially a "one-vein" mine, though a branch of the main vein produced ore for a length of 150 feet and a depth of 60 feet.

*Company liquidated in 1932.

**Charter cancelled January 1962.

***Shares exchangeable for Ansil Mines Limited.

The main vein runs in width from a fracture up to six inches, and is usually accompanied by two or more parallel fractures from a few inches to two feet away on either or both sides. The strike is northeast-southwest, and the dip is practically vertical.

The channel of mineralization would appear to be a minor reverse fault, striking approximately north and south and dipping to the west at about 20°. At the fourth or 230-ft. level the vein is displaced by a throw of 15 feet. The silver-bearing solutions circulated upward from this fault for a distance of 100 to 150 feet. A few patches of ore were found below the fault, but not more than a maximum of 45 feet below.

In the plane of the vein the ore-shoots rake to the southwest at from 15° to 30°, more or less, conforming with the dip of the contact between the diabase and the overlying Keewatin. At the shaft the contact was, before erosion, about 100 feet above the collar; and high-grade was found in the outcropping of the vein at the shaft. At the southwest corner of the property, 500 feet distant along the strike of the vein, the contact is about 100 feet above the top of the ore zone. This is an interesting feature, and shows a relation between ore zone and contact similar to many cases in Cobalt where the ore zones in the conglomerate of the Cobalt series conform to the Keewatin contact at a more or less regular distance from it.

After the vein leaves the Wettlaufer ground, at the southwest corner, it crosses the northwest corner of the Silver Eagle property, H.R. 97*, a length of 20 feet on the fourth, or 230-ft. level, and "feathers" out on the Curry or Pittsburgh Lorrain Syndicate property, H.R. 105, in a further fifty feet. Considerable high-grade was taken out of the silver Eagle, but no ore was found on the H.R. 105 property for more than 20 feet southwest of the line. Northeast of the shaft the vein continues, from two inches to four inches in width, for a further 500 feet, where it weakens, splits into fractures and practically dies out. No ore was found for more than 80 feet beyond the shaft in a northeast direction.

It might be added that the diabase in the vicinity of the vein shows little jointing or fracturing. Consequently, leaf silver penetrated only a few inches into the wall rock, and the quantity of mill-rock from the walls was negligible.

The trace of the Wettlaufer vein on surface is indicated on Figure 2 (Chart A, back pocket).

Underground Workings

Modified underground plans, taken from plans dated 1913, are shown on Figure 2 (Chart A, back pocket). The shaft was sunk to 250 feet with levels at 50, 130, and 180 feet. From 180-foot, or third level is a winze which gives access to the 230-, 260- and 360-foot levels. The latter two are the 5th and 7th levels. There also appears to be a short 6th level established at the 310-foot horizon trending either northwest or southeast. A level on a stope section (Knight 1922, p. 226) of the Wettlaufer vein, shown in Figure 3, is the only reference the writer has to a 6th level.

CURRY MINE

The Curry claim (HR105) is immediately southwest of the Wettlaufer property. The Curry Mine is one of the minor past producers of the South Lorrain camp; almost 50,000 ounces of silver were produced intermittently between 1916 and 1938. Production figures are shown in Table 8. Work started on the Curry Mine in 1912 when the inclined shaft was sunk 271 feet and a crosscut was driven 45 feet to connect with the Wettlaufer workings (O.B.M. 1913, p. 123). This work was done by the Pittsburgh Lorrain Syndicate that continued to operate the mine until 1918. During this period the bulk of the Curry production was made. The rest of the production was the result of the leasing of the property by various individuals.

*Described under A. Byberg, property 3, in this report.

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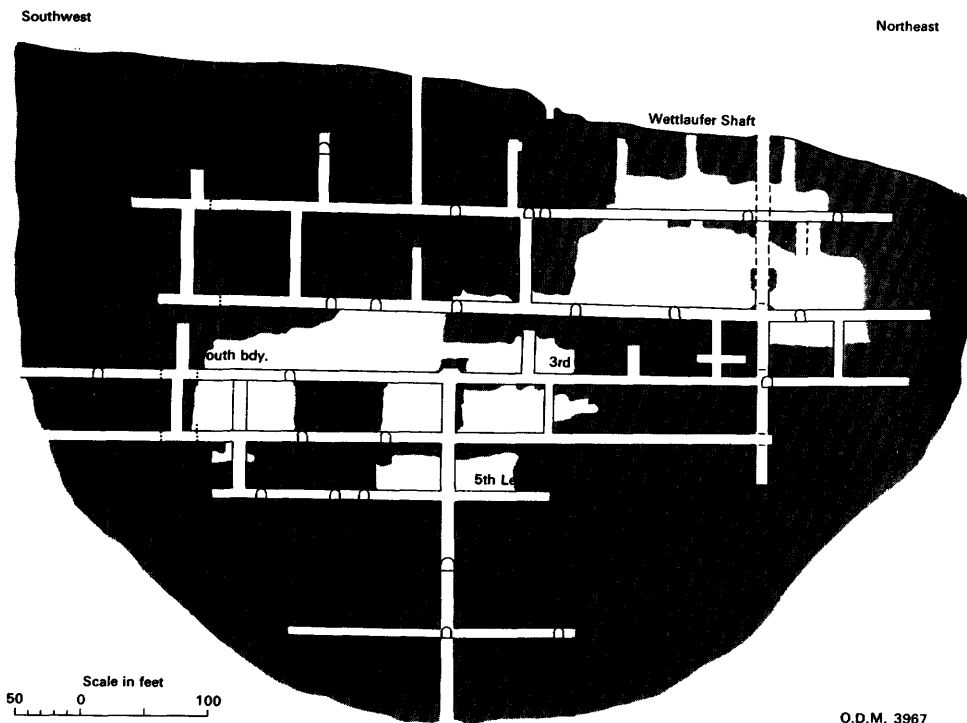


Figure 3—Stope section of Wettlaufer vein (after Knight 1922, Figure 54, p. 226).

Table 8

PRODUCTION FIGURES FOR THE CURRY MINE OWNED IN 1967 BY AGNICO MINES LIMITED, PROPERTY 1, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS
1916*	7,629	....
1917*	10,000	....
1918*	25,000	3,000
1930	7,192	....
1931	....	3,236
1938	62	1,455
Totals	49,883	7,591

*Represents production from both the Curry and the Wettlaufer by the Pittsburgh Lorrain Syndicate.

General Geology

The claim is underlain by intermediate to mafic metavolcanics. The upper, diabase-metavolcanics contact was intersected in the underground workings but the author was unable to determine its exact location. The following description from an O.B.M. Annual Report (1916, p. 125-26) gives a general idea of the location of the contact:

On the 4th or 175-foot level a winze was started about 500 feet southeast of the main shaft and was sunk for 115 feet at 80 degrees . . . Just above the winze a body of high-grade ore was encountered . . . It is in the Keewatin series just above the Keewatin-diabase contact.

Economic Geology

Knight (1922, p. 228) wrote the following:

It would appear that the Wettlaufer vein extended about 50 feet into the Curry and then "feathered" out; about 20 feet of the vein on the Curry is reported to have yielded some ore.

On the dump there are pieces of vein matter, showing eight to eleven inches of almost pure smaltite.

About 300 yards southwest of the inclined shaft, there is another shaft sunk in Keewatin rocks. On the dump from this shaft there are pieces of vein matter consisting of fine-grained, banded calcite, or dolomite. The dump also has blocks of diabase, but most of the dump consists of Keewatin basalt.

In 1951, Keylobe Cobalt Silver Mines Limited leased the Curry property from Silanco Mining and Refining Company. The company dewatered the No. 1 shaft to the 210-foot level. An O.D.M. Annual Report (1952, p. 100) states the following concerning the work done:

Surface work during the year consisted of 710 feet of trenching and two diamond-drill holes totalling 6,021 feet in depth. Underground work consisted of 15 feet of drifting on the 175-foot level of the Curry No. 1 shaft and two diamond-drill holes totalling 963 feet.

The underground drilling was from the 175-foot level and was carried out with the intention of examining the ground to the west of the present workings in the search for an extension of the Wood's vein from the Lorrain Trout Lake No. 1 workings (now Ramardo, property 44). The Northern Miner (1951) reported the following on the results:

Hole No. 1 cut an eight inch vein of calcite, containing smaltite which assayed 2.4 percent cobalt per ton, with low silver values. The second hole, drilled 100 ft. to the north, intersected two strong calcite veins. A favorable area requiring exploration underground is believed indicated. The crosscut will have to go 350 ft. to reach the section, before drifting on the veins can be undertaken.

With regards to the surface drilling the Northern Miner (1951) had the following to say:

A limited tonnage of cobalt nickel ore has been indicated in mapping and sampling of unwatered levels. Quantity is not sufficient to justify mining operations, but if the new area proves up, the two could be mined together.

Surface diamond drilling has been probing for extension of the Wettlaufer break into the south half of the Curry ground. A total of 5,700 ft. has been completed in eight holes, all of which intersected the vein. All contained either cobalt or silver values. The contact of the Keewatin and underlying diabase sill was located at 350 ft., deeper than has been anticipated.

Underground Workings

Plans of the underground workings, taken from company plans dated 1917, are shown in Figure 2 (Chart A, back pocket). The main shaft is 400 feet deep, with the first 175 feet inclined at 45° and the remainder at an 85° angle; the main level is the 4th or 175-foot level with a winze providing access to the 5th and 6th levels. The No. 2 shaft was 110 feet deep (O.B.M. 1916, p. 125-6; 1917, p. 132).

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CANADIAN LORRAIN MINE

This third property of Agnico Mines Limited consists of nine patented claims: HR14, HR66, HR67, HR69, HR70, HR77, HR509, HR520, and HR521, approximately ½ mile west of Maidens Bay. The main workings of this property are on HR69, and between 1926 and 1943 a total of 276,825 ounces of silver were produced (Table 9).

Table 9

PRODUCTION FIGURES FOR THE CANADIAN LORRAIN MINE OWNED IN 1967 BY AGNICO MINES LIMITED, PROPERTY 1, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
1926	87,404	3,399	...
1927	149,652	9,233	...
1930	86	840	...
1935	955	....	...
*			...
1937	1,287	....	...
1938	24,884	2,448	...
1939	10,484	393	53
1940	2,073	365	367
*			...
1943	....	223	...
Totals	276,825	16,678	420

*No production reported for 1936, 1941 and 1942.

History and Development

The mine was originally called the Maidens property and throughout the years it has been known by various names including Canadian Lorrain, Millwights, and Miller-Elliott. The first reported work on HR69 was described in an O.B.M. Annual Report (1909, p. 124):

On mining claim H.R. 70 [69], which lies about one mile northwest of the new government dock, the above company are doing mining work, south of the government road, consisting of adits driven south into the hill, which has an elevation of over 100 feet above the road. No. 1 adit was driven 63 feet through clay to the rock and 135 feet farther, part of it being on the vein which was encountered. Another adit has been begun 300 feet west of the No. 1 and has been driven 50 feet through clay to the rock.

The above work was done by the Maidens Silver Mining Company Limited*. By 1915 the company had started sinking the two shafts. No. 1 shaft was down 80 feet and No. 2 shaft had reached its present depth of 85 feet. Knight (1922, p. 232) quotes a report written for him by J. Mackintosh Bell who at that time said that there was 300 feet of drifting and crosscutting on the main level (at 72 feet) and 125 feet in the sub-level 71 feet below (at about 143 feet).

*Assets acquired by Canadian Lorrain Silver Mines Limited in 1922.

Canadian Lorrain Silver Mines, Limited*, began operations on the Maidens property on June 1st with the repairing of the old camps. The old shaft was enlarged to a depth of 88 feet, and sinking continued to a depth of 250 feet during the latter half of the year. (O.D.M. 1924, p. 82).

Development work continued until 1927 and some production resulted (see Table 9).

H. G. Miller leased the dumps on the property in 1935 and 1937 (O.D.M. 1936, p. 183; 1938, p. 243); Millwrights Mines Limited** was incorporated in December 1938 and operations were carried out from January 1, to March 10, 1939 (O.D.M. 1940, p. 235); and from May 1 to October 26, 1940 (O.D.M. 1941, p. 160). Minor production resulted from this work.

In 1952 Gilgreer Mines Limited*** dewatered the shaft to the 410-foot level and on the 250-foot level carried out 95 feet of drifting and 140 feet of raising (O.D.M. 1953, p. 109). Along with numerous other properties the Canadian Lorrain was acquired by Cobalt Consolidated Mining Corporation Limited in 1953. Underground drilling totalling 1,230 feet was done in 1953 and 2,396 tons of previously broken ore were raised and treated (O.D.M. 1954, p. 130). In March 1963, Kirkland Townsite Gold Mines Limited leased the property from Agnico.

An O.D.M. Annual Report (1963, p. 132) mentions that Kirkland Townsite did the following:

The old 60-foot headframe and shaft collar were rebuilt, the 260-foot shaft was dewatered and cleaned up. A double-drum, 42-inch air hoist and a cage were installed. Portable compressors supplied the motive power. The camp buildings were rehabilitated. Some five diamond-drillholes, totalling 3,111 feet, were completed from surface, and six holes, totalling 2,043 feet, were completed from underground. The work was stopped 22 August 1963, and all machinery and equipment was removed from the property.

The property has been idle since that time.

General Geology

The following three paragraphs are summarized from a report by Cunningham (circa 1953) written for Gilgreer Mines Limited.

The workings consist of steeply dipping, fine-grained Archean basalts with bands of coarse-grained "diorite". Cutting these rocks are narrow dikes of "micro-lamprophyre". Intruding these older rocks are dikes and sills of "granophyre" and diabase. All these rocks are older than the Nipissing Diabase. The Nipissing Diabase has been removed by erosion from HR69, except near the south boundary of the claim where the bottom contact dips 5 to 10 degrees to the southeast.

Faulting has been intensive and complex and the veins are in faults or branches of faults.

The "granophyre" sill is best exposed on the 250-foot level. It appears to be a flat, gently undulating body 40 to 70 feet thick, striking 75°E and dipping approximately 35°S.

*Company placed in voluntary liquidation in 1931.

**Charter cancelled October 1957.

***Shares exchangeable for Agnico Mines Limited.

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Economic Geology

The following three paragraphs are also condensed from the same report by Cunningham (circa 1953):

The main ore shoots in the mine are on the No. 5 and No. 10 veins (see Figure 4, Chart A, back pocket). Ore shoots of predominantly "millrock" have been found on No. 5 vein, over a length of 400 feet measured along the vein to the northwest from the junction with No. 10 vein; on No. 10 vein small but high grade ore shoots have been found, over a length of 150 feet from the junction with No. 5 vein.

The importance of the "granophyre" sill is in doubt as ore has been found above, below, and within the sill.

The veins are found in fault zones. No. 5 vein is in a northwest-striking fault with a parallel fault 250 feet to the north. Between the two faults are numerous cross-faults with veins in them; Nos. 3, 7, 28, and 32 being the main ones. The main ore of the property is found in these faults or between them.

Underground Workings

Plans of the underground workings, taken from plans on file in the Resident Geologist's office, Cobalt, now at Kirkland Lake, and dated 1953 are shown in Figure 4 (Chart A, back pocket). There is also a longitudinal section along No. 5 vein shown in the figure. The total depth of the main workings is 450 feet with five levels.

Table 10

PRODUCTION FIGURES FOR THE GILGREER MINE, OWNED IN 1967 BY AGNICO MINES LIMITED, PROPERTY 1, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER	COBALT
	OUNCES	POUNDS
1936	446	1,509
1943	....	223
Totals	446	1,732

GILGREER MINE

This mine is on part of the same group of claims as the Canadian Lorrain. The two claims of HR509 and HR520 are the original claims of Gilgreer Mines Limited, which was formed in 1923. The exact location of the shaft on HR509 is not known and is therefore not shown on the map. Production figures are given in Table 10.

Reid (1943, p. 14-15) gives the following description:

The Gilgreer property is situated about a quarter of a mile northwest of the Millwight mine [Canadian Lorrain] but is reached by a circuitous road about a mile long. The showings consist of a calcite vein in diabase near the lower contact. The workings seen consist of a shaft, 90 feet deep, which has been un-

watered to the 50-foot level. This has a drift on a calcite vein, from 1 to 3 inches wide, extending north for 28 feet; and for the five feet adjoining the shaft, both on the floor and back, there is a cobalt lens $2\frac{1}{2}$ inches wide; beyond that only calcite was seen. On the south side a drift extends southward for 15 feet following a calcite vein, which is cut by another one trending N. 75° E. This is also followed for 17 feet. The only cobalt seen is in the back adjoining the shaft. Here there is a cobalt lens 4 feet long and 2 inches wide. On the south side of the shaft between the cribbing at the collar and the back of the drift, a distance of 20 feet, cobalt shows for 15 feet with an average width of 3 inches. On the north side of the shaft there is only a 3 to 4 inch calcite vein. Ore is said to extend some distance below the 50-foot level on the north side of the shaft, but as it contained water to that level this could not be verified. The writer's [Reid's] impression of the showing was that it was too small to be of interest except possibly as a two-man leasing operation.

A. Byberg (3)

SILVER EAGLE

In 1961, A. Byberg, of Cobalt, held leased claim T46579, formerly HR97, and known as the Silver Eagle claim.

Knight (1922, p. 229) wrote the following:

The Silver Eagle is contiguous on the south to the Wettlaufer. Horace F. Strong states that the Wettlaufer vein crossed the northwest corner of the Silver Eagle and that some high-grade ore was mined from this part of the Silver Eagle claim. The claim produced 7,989 ounces of silver in 1918.

This production came from the fourth or 230-foot level.

Canadian Keeley Mines Limited (4)

In 1967 Canadian Keeley Mines Limited held 13 contiguous patented claims and one isolated patented claim, which is not described in this report, near the Montreal River. The claims in the main group were made up by purchasing the Keeley claims of HR19 and HR21 (the Beaver Lake* claim) from Anglo-Huronian Limited that controlled Keeley Silver Mines Limited**; six other claims HR16, HR17, HR20, HR25, HR68 and HS39, the Frontier property, were purchased from The Mining Corporation of Canada Limited; HR22, RL455 and RL456 were purchased from Keeley Extension Mines Limited and claims T32960 and T46400 (formerly HS40 or the Little Keeley) were purchased from N. Oslund of Haileybury, Ontario.

History

Keeley Mine

The history of the Keeley Mine up until 1922 was described by Knight (1922, p. 202-206) as follows:

The first discovery was made by J. M. Wood and R. J. Jowsey on the original Keeley claim, H.R. 19, in the fall of 1907, and the first shipment of ore from the discovery was made by the owners of the claim,

*Beaver Lake is Fourclaim Lake on Map 2194, back pocket.

**Shares exchangeable for Anglo-Huronian Limited.

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Charles Keeley, R. J. Jowsey, and J. M. Wood, in the spring of 1908, and was received by the Deloro Mining and Reduction Company, Limited, Deloro, Ont., on the twenty-second of June of that year. The shipment consisted of twelve tons, dry weight, assaying 1,061 ounces of silver per ton. The value of the shipment was \$6,068.52, of which amount \$170.32 was credited to the cobalt and arsenic content. In the latter part of March, 1908, Mr. James Bartlett and the writer [Knight] examined the open pit from which this shipment was made. The pit was about 40 feet long and 14 feet deep, and the vein had a width of two to six inches showing some pure smaltite and wire silver.

The following account of the discovery of the Keeley mine has been kindly furnished by R. J. Jowsey:—

The find on the Keeley was made in the fall of 1907. J. M. Wood had been digging while I had gone to Haileybury for some provisions. I went to Haileybury on the last trip of the boat, and the lake froze, so I had to pack the supplies down on my back. When I returned Wood had found a chunk of smaltite, and had it in the camp when I arrived. I went out and helped him dig that evening, and next day, about three o'clock, he uncovered the vein when I was a little farther ahead in the trench. We left it on the window sill a couple of days, as it looked to be just smaltite. On Sunday we were looking at it when it had dried out, and noticed all those fine hairs in it. We were not sure of its value, so we had it assayed. If I remember right it was around 11,000 ounces of silver per ton.

Messrs. Keeley, Jowsey, and Wood then sold the property to interests connected with the now defunct Farmers Bank. The bank was only interested in the property on account of having made advances on a million dollars worth of bonds issued by Keeley Mine, Limited*, and the bank was never owner of the mine. Keeley, Jowsey, and Wood received \$300,000 for the property. The total amount advanced by the bank, including the purchase price, wages, cost of plant, etc., was much greater than the above mentioned sum.

The property, under the name of Keeley Mine, Limited, was worked by interests associated with the bank until 1911, and about 24,337 ounces of silver were produced, mainly from the original discovery, No. 1 shaft. Wood's vein was not worked during this period in the history of the mine.

The affairs of the Farmers Bank then became involved, and the bank failed. The liquidators of the bank found themselves in possession of the Keeley mine, H.R. 19, but they did not allow the operating company, Keeley Mine, Limited, to fail. It was kept in good standing.

In 1913, J. Mackintosh Bell acquired an option on the property for the Associated Gold Mines of Western Australia, Limited. An option had been granted on the 26th March, 1913, by Keeley Mine, Limited, and the Farmers Bank to one, E. G. Aman, which option was assigned to the Associated Gold Mines of Western Australia, Limited, on the 12th June, 1913. The Associated Gold Mines of Western Australia, Limited, obtained several renewals of that option, and on the 23rd April, 1918, they obtained the last option. These were given by the Keeley Mine, Limited, and the Farmers Bank. The final payment on the property was made on August 1st, 1919; the total price paid was \$110,000. Upon the Associated Gold Mines of Western Australia, Limited, making the final payment they received a transfer from Keeley Mine, Limited, and the Farmers Bank of the property, and they also received the majority of the stock in Keeley Mine, Limited, and the bond issue of a million dollars made by Keeley Mine, Limited, which was held by the Farmers Bank. Eventually these bonds were burned by J. Mackintosh Bell and the solicitor of the present company, W. H. Stafford. The writer [Knight] is greatly indebted to these two gentlemen for much of the information regarding the history of the property.

The Associated Gold Mines of Western Australia, Limited, did not operate the original discovery at the Keeley mine, No. 1 shaft, nor have these old workings been connected with the main, present-day workings on Wood's and other veins at No. 3 shaft.

Between the years 1913 and 1919, work at the property was retarded and carried on intermittently on account of the Great War which lasted from 1914 to 1918. In 1914, the mine was worked with a force of 85 men, but, following the outbreak of war, the force was reduced in August from 85 to 20 men, and in September to 6 men, who were sinking by hand in No. 2 shaft. The mine ceased operations about the middle of October, 1914.

In 1915, the mine was worked from May to October 1st. In 1918, a shipment of ore, in stock from previous operations, was made; and the property was in operation between July and September. In 1919, work was carried on during the summer months with a force of 15 men.

Subsequent operations have been highly successful, and the mine has been operated without cessation up to the time this report went to press.

On account of the fact that Wood's vein, the "mother lode" of the productive section, was first discovered on the Beaver Lake claim, a few words may be added about its history. The claim, as already noted, is now owned by the Keeley Silver Mines, Limited, and is contiguous to the original Keeley, H.R. 19, on the west.

Wood's vein was discovered in 1908 by J. M. Wood on the Beaver Lake claim, H.R. 21. The southern two-thirds of the vein outcrops on the Beaver Lake claim; the northern third of the vein passes into the original Keeley claim. In 1908 and 1909, Jowsey and Wood sank a shaft on Wood's vein, on the Beaver Lake claim, near the west boundary of the Keeley. The shaft was sunk to a depth of 110 feet, and on the 75-ft. level a drift 75 feet long was run. Had Jowsey and Wood drifted a short distance farther north they would have encountered a very rich ore-shoot known as D 3 . . . although only a small part of the shoot is in the Beaver Lake claim, most of it passing into the Keeley. But had Jowsey and Wood found this shoot, the Keeley would undoubtedly have heard about it, and would have worked that part of the shoot which is in the Keeley and which constitutes the largest part. The shoot has proved to be an important producer, and,

*Charter surrendered November, 1920.

if it had been discovered in those days, the discovery certainly would have led to an exploration of Wood's vein. Perhaps the rich ore-shoots four or five hundred feet below the surface might have been encountered by Farmers Bank interests, and the bank might have thus been saved from failure. But these are idle speculations. It remained the good fortune of the present company to discover at depth the fabulously rich silver ore of Wood's vein. Such are the vicissitudes, such the tragedy and romance of mining!

The credit for the discovery of Wood's vein must be given to Wood; and although this pioneer and his partners Jowsey and Keeley did not find any ore, they did find flakes of native silver in the vein.

From the time of Knight's report, 1922, the mine was in continuous production until October 1931.

In 1935, A. G. Miller leased the Keeley Mine and his search through the dumps yielded 2,412 ounces of silver (O.D.M. 1936, p. 183).

In 1959, Keeley-Frontier Mines Limited* was incorporated and the company acquired the claims mentioned in the first paragraph of this section. Canadian Keeley Mines Limited was formed following a reorganization and change of name of Keeley-Frontier in 1964.

Frontier Mine

The following is from Knight (1922, p. 220-221):

As the early history of a mine is always of interest, the writer asked Mr. Horace F. Strong if he would give the Department [of Mines] an account of how he became interested in the Frontier, how he found certain ore-shoots, and how he was instrumental in turning the property over to the Mining Corporation of Canada, Limited. The Department is indebted to Mr. Strong for the following account of the early history:—

What is now known as the Frontier mine was originally the south half of the property of the Haileybury Silver Mining Company's claim, No. HR 16. It contains about twenty acres, and is situated to the north of the Keeley claim and separated from the same by the Crompton fraction. The latter is about 500 feet wide.

One, Henry Newburger, of Memphis, Tenn., bought the south half of HR 16 from the Haileybury Silver Mining Company in 1912 for \$100,000 cash and formed the Haileybury Frontier Company. This company sank two shafts, one to the southwest to a depth of ninety feet and one near the northern boundary to a depth of 150 feet. From the latter was done about 100 feet of crosscutting and fifty feet of drifting on the 75-foot level, and about 250 feet of drifting on the 150-foot level. Both levels showed a strong vein carrying smaltite, but no silver was in evidence. In the meantime Henry Newburger died and the company went into liquidation in 1914. Joseph Newburger, a cotton king of Memphis, Tenn., and brother of the deceased, bought in the property in the interests of his brother's widow, and the mine remained closed until the autumn of 1920. During the summer of 1920, Joseph Newburger had the mine dewatered and examined by representatives of several silver-mining companies. At this time J. G. Harkness, who had dewatered the mine, had collected options on control of the Haileybury Silver property and advised Mr. Newburger to purchase same. The latter, however, failed to do so and after a couple of weeks allowed the Frontier to fail.

During the autumn of 1919 and spring and summer of 1920, the writer [Strong] was doing considerable investigation into the various sources of cobalt ore for a large consumer of the metal in the U.S.A., and during a shortage had supplied his client with several carloads of high cobalt, low silver ore. During the month of August, 1920, the situation became so acute that the writer [Strong] asked his client to be allowed to purchase the Haileybury Silver and Frontier properties, using the argument that several hundred tons of high cobalt, low silver ore could be cheaply developed, with reasonable chances at the same time of running into shoots of high-grade silver ore. The force of the argument was seen, and the writer [Strong] was allowed to proceed. The Haileybury Silver property was bought outright early in September for \$15,000 cash, and negotiations started for the Frontier. The latter proved more difficult, but eventually, in November, 1920, the writer [Strong] had secured a reasonable lease for a year and further option to purchase. Dewatering was proceeded with immediately, and the first machine started on December 16th. A thorough sampling of the old working showed a short shoot of mill ore on the 75-foot level. Drifting proceeded at the rate of 200 feet per month until May 1st, 1921, and the work put into sight about 400 tons of high cobalt, low silver ore, and two short shoots of 500-ounce silver ore.

Having worked out the geology of the property, the writer [Strong] prevailed upon his client, the cobalt ore situation being in the meantime settled temporarily, to allow the 150-foot shaft to be sunk to the contact zone. This entailed a further 150 feet of sinking and 27 feet of crosscutting. The sinking was very

*Shares exchangeable for Canadian Keeley Mines Limited.

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much retarded by extremely hard rock, the Keewatin greenstone proving very baffling. Eventually the desired horizon was reached about the end of August, and the vein cut within a few inches of the projected point. A short patch of high-grade silver was encountered in the second or third round of the drift, and in 300 feet of drifting, driven during September and October, at least 200,000 ounces in high-grade was indicated. The writer [Strong] then put two propositions before his client. First, that he should put up an additional \$200,000 for the purchase of adjoining properties, install a suitable mining plant, etc., and proceed to develop and mine on a larger scale, or, second, to sell the property. The latter course was decided on, and in November, 1921, the writer concluded the sale under option to the Mining Corporation of Canada, Limited, at a price of \$525,000 over a period of two years.

The Mining Corporation kept the mine in continuous production until 1931 and between then and 1943 the property was leased to various individuals. No production resulted between 1943 and 1963 at which time Keeley Frontier commenced production. No production resulted from the other claim in the group although exploration work has been carried out on them. On claim T46400, or the Little Keeley, a shaft was put down on the extension of the Wood's vein with development on two levels, this shaft was not found by the writer.

Production from Keeley and Frontier Mines

The total production for these two mines accounts for over 80 percent of the silver produced in the South Lorrain silver camp, with a total 19,197,413 ounces of silver from the two mines. Production figures are shown in Tables 11 and 12.

Table 11

PRODUCTION FIGURES FOR THE KEELEY MINE OWNED IN 1967 BY CANADIAN KEELEY MINES LIMITED, PROPERTY 4, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
1908	13,124	24,800	...
1909	11,213	236	...
*			...
1914	3,524	.....	...
*			...
1918	39,199	2,410	...
1919	4,586	3,160	...
1920	8,253	9,897	...
1921	281,659	16,167	...
1922	775,349	167,062	...
1923	1,655,323	175,689	...
1924	1,903,793	231,005	...
1925	1,446,679	167,020	...
1926	1,705,531	210,764	...
1927	1,153,024	99,402	...
1928	690,168	99,841	...
1929	837,331	119,766	...
1930	1,351,121	91,700	...
1931	265,458	196,089	...
*			...
1935	2,412	.....	...
*			...
1942	6,606	2,776	736
Totals	12,154,353	1,617,784	736

*No production reported for 1910-1913, 1915-1917, 1932-1934, and 1936-1941 inclusive.

Table 12

PRODUCTION FIGURES FOR FRONTIER MINE OWNED IN 1967 BY CANADIAN KEELEY MINES LIMITED, PROPERTY 4, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS	COPPER POUNDS
1921	47,227	.....	....	....
1922	508,958	31,529	....	....
1923	1,300,323	143,545	....	....
1924	466,047	54,687	....	....
1925	1,158,854	253,191	....	....
1926	1,104,597	80,582	....	....
1927	902,591	88,980	....	....
1928	395,692	117,418	....	....
1929	14,295	7,162	....	....
1930	404,903	292,351	....	....
1931	320,302	550,773	....	....
1932	22,144	6,517	....	....
*				
1935	14,000	2,000	....	....
1936	7,306	10,253	....	....
1937	8,368	3,804	....	....
1938	2,097	5,235	3,157	....
1939	5,278	15,881	7,954	....
1940	4,327	1,470	1,047	....
1941	4,233	7,910	12,158	....
1942	3,007	7,516	....	....
1943	866	2,965	....	....
*				
1963	136,274	9,003	14,332	10,292
1964	93,609	.....	26	....
1965	117,762	.....	....	....
Totals	7,043,060	1,692,772	26,516	10,292

*No production reported for 1933, 1934, and 1944 to 1962 inclusive.

Some of the production of the recent operations resulted from the remilling of the old tailings near Fourclaim (Beaver) Lake.

Development and Underground Workings

Both mines have extensive underground workings as shown in Figure 2 (Chart A, back pocket). In this figure only every other level has been shown for the sake of clarity.

In the early days, five shafts were sunk on the Keeley property and three on the Frontier. A summary of these shafts (and the winzes) is shown in Table 13; No. 5 shaft is not mentioned in the table. No. 1 shaft (K1)* was connected to the main workings but was latterly used as an emergency exit and ventilation shaft. No. 2 shaft (K2) was a prospect shaft on No. 4 vein. The main working shaft was the No. 3 shaft (K3). Shafts No. 4 and 5 (K4 and K5) were prospect shafts on the Wood's vein. On the Keeley and Frontier properties there were originally six winzes but only two, the 828 and 830 remained operative, and the others were stopped out or otherwise made useless. The 828 winze was reactivated in the recent work by Keeley-Frontier

*K1, F1, etc., refer to shaft numbers as used in Table 13.

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and Canadian Keeley. It is at the junction of No. 16 and No. 28 veins on the 8th level, 850 feet west of Wood's vein, and extends down to the 12th level. The present company deepened the winze from the 11th to the 12th level.

Table 13 | SHAFTS, CANADIAN KEELEY MINE, PROPERTY 4, (FROM O.D.M. 1965, p. 124).

SHAFT	CLAIM	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH FEET	VERTICAL DEPTH FROM SURFACE FEET
Frontier Property					
F1	HR16	Vertical	2	Surface	376
F2	HR16	Vertical	2	Surface	62
F3	HR16	Vertical	3	Surface	641
Crompton	HR25	Vertical	2	Surface	40
F8	HR25	Vertical	2	540	1,360
F9	HR25	Vertical	2	1,360	1,455
Keeley Property					
K1	HR19	Vertical	2	Surface	240
K2	HR19	Vertical	2	Surface	100
K3	HR19	Vertical	2	Surface	570
K4	HR21	60°	2	Surface	55
K828	HR21	Vertical	3 and 2	560	910
K830	HR19	Vertical	1 and 2	560	705
K826	HR21	Inclined	2	560	620
K1162	HR21	Inclined	2	822	930
Little Keeley Property No. 2	HS40 [T46400]	Inclined	2	....	90

Three shafts, of which No. 3 (F3) is the main one, were put down in the Frontier Mine. The operations of the present company were performed from the Frontier No. 3 shaft (see Table 14).

In 1962 the two mines were connected in three places with the connection between the 6th level of the Frontier and the 8th level of the Keeley serving as the main haulage.

Table 14 | DEVELOPMENT COMPLETED BY THE OPERATIONS OF KEELEY-FRONTIER MINES LIMITED AND CANADIAN KEELEY MINES LIMITED. (INFORMATION FROM O.D.M. 1961, p. 122; 1962, p. 129; 1963, p. 130; 1964, p. 122; 1965, p. 124-125.)

YEAR	DRIFTING	CROSS- CUTTING	RAISING	SHAFT SINKING	SURFACE HOLES	FOOTAGE	UNDER- GROUND HOLES	FOOTAGE
1961	33	....	265	....	1	51	....	....
1962	709	....	2,070	....	4	3,723	39	5,689
1963	333	....	360	....	....	....	62	8,893
1964	1,273	1,121	90	128	....	....	129	23,665
1965	1,293	....	881	....	....	....	46	10,216
Totals	3,641	1,121	3,666	128	5	3,774	276	48,463

General Geology

The oldest rocks on the property (Keeley and Frontier) are metamorphosed Archean intermediate to mafic lavas, tuffs, and agglomerates. These rocks are folded, faulted, and steeply dipping. Numerous lamprophyre dikes intrude the meta-volcanics, and in several places have been the loci for veins. A pipe-like body of granodiorite, assumed to be Archean in age, was discovered during the recent operations. This body has been described in the main "General Geology" section earlier in the report. Rocks of the Coleman Formation are exposed in the northwest corner of the property but have no economic significance. Nipissing Diabase, found to be 910 feet thick in the Frontier Mine, dips westerly across the property. The contours of the top of the diabase indicate an anticlinal structure plunging to the west. More data would no doubt delineate further local irregularities in the sill. The average dip of the sill is 15 to 34 degrees, but Kent (1965, p. 4) states that there is evidence of a marked flattening to about 8 degrees on claim T46400 and that there is possibly a major downthrow farther west. The general geological relationships are illustrated on the cross-section (see Map 2194) and in Figures 2 and 5, (Charts A and B, back pocket).

Structural Geology

As discussed by Boydell (1931) the main structural features in the Keeley Mine are the upper and lower contacts of the diabase sheet and the three veins (Wood's, No. 16, and No. 28) which are mutually intersecting. All of these veins occupy faults. The Wood's Fault vein strikes north and dips 55 to 69°E. Knight (1922, p. 214) describes the Wood's Fault as a reverse fault with an approximate 30-foot displacement. Kent (1965, p. 8) describes No. 16 Fault as follows: "a seven foot biotite lamprophyre for most of its length striking just south of west and dipping 65 degrees south in volcanics and steepening up to near vertical in diabase. The fault itself has a vertical reverse throw of some 20 feet." No. 28 Fault vein strikes west from the southern section of Wood's vein and dips 50 to 60°N. Kent (1965, p. 9) states that a 50-foot reverse throw is indicated by diamond drill information. All of these features have been more fully described in previous literature mainly by Knight (1922), Boydell (1931), Whitehead (1928), and Dobbins (circa 1931).

A more recent discovery in the mine is the Beaver (Fourclaim) Lake Fault vein. Kent (1965, p. 9) describes this as follows:

This vein, conjectured until recently, has a rather uniform trend of north 28° west and variable dip from 55-85° east. It seems to be a left hand oblique slip fault with an apparent post diabase normal throw of some 20 feet. The major changes in dip occur near the intersections of east west faults with the vein sometimes pinching out entirely in the axial zones of broad anticlinal folds and attaining greatest thicknesses in the synclinal zones. It is apparent that the ore shoots already discovered are controlled by marked variations in attitude (rolls) in the fault-vein structure and to a limited extent by hornblende lamprophyre which seems, in some places, to have exerted an arresting control on deposition.

The structure has been developed north and south of the 16, 35 and 28 fault-vein systems for a length of some 700 feet and varies in width from one half inch to two feet or more with average about 5 inches. Cutting relationships suggest that it is later than both 16 and 35 veins but earlier than No. 28 vein, however, only minor dragging occurs with the veins proper remaining essentially in line. Drill information suggests that the structure parallels the west margin of the granodiorite pipe-like elongated mass and curves to the north east parallel with that configuration.

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The preceding discussions describe the major features in the mine workings. Numerous other structural features and faults are found underground, and these are both pre- and post-dyabase. The more important of these faults might include the north-striking Watson Fault and, No. 35 Fault which strikes west (Figure 2, Chart A, back pocket).

No. 28 and No. 1 Faults mark the south and north boundaries of the granodiorite body. The body appears to be bounded on the west by the Beaver (Fourclaim) Lake Fault. The east portion is also bounded by a fault.

Pre-Glacial Weathering of Wood's Vein

This feature was described by Knight (1922, p. 208) as follows:

An interesting and unique condition occurs on the south part of the Wood's vein. Pre-glacial weathering has been preserved in this part of the vein. . . . It has reached a depth of at least 480 feet below the surface. In no other mine in the entire Cobalt area has pre-glacial weathering been preserved, although, as stated elsewhere in this report, good examples are found in connection with ore bodies in other parts of Ontario. There is no absolute proof that the weathering is pre-glacial. It is simply assumed that sufficient time has not elapsed since the retreat of the glaciers to have allowed such deep weathering to form. J. Mackintosh Bell was the first geologist to observe these conditions and he has given the first description of them. For convenience, the term "weathering" may include disintegration, solution, leaching, oxidation, and hydration. The mine workings have penetrated this weathered zone on the third, fourth, fifth, sixth, and seventh levels. The third level penetrated the weathered zone for 600 feet; no indication was there noted that it was becoming less intense at the south end of the drift. The weathering has altered the country rock to a more or less soft clay. In places the clay has a reddish-brown and yellow colour. Elsewhere it has a pale greenish-grey colour. Towards the bottom of the weathered zone, the pale greenish-grey clay is more common than the red clay. That is to say, the red variety of oxidation occurs, for the most part, at and near the surface, and the grey variety occurs, for the most part, at depth.

Judging from chemical analyses and tests made by W. K. McNeill, the red colour of the clay is due to ferric oxide, while the pale greenish-grey colour is due to ferrous oxide.

In places there is a sharp line of demarcation between the red clay and the grey clay; in other places there is a more or less gradual transition between the two. In the case of the sharp line of demarcation, the fault sometimes separates the grey clay from the red.

The alteration of the country rock to clay was noted in one place across a width of six or seven feet. It is, on the average, much less than that.

The zone of contact, which is a very gradual one, between the weathered rock on the south and fresh solid rock on the north, is about vertical.

The writer [Knight] has been asked the question, whether the weathered zone will extend south to Trout [Tooth] lake, a distance of about half a mile, and whether it will follow along the bottom of Trout [Tooth] lake, a distance of a mile farther south. This can be answered only by exploration of the ground. It is very doubtful, however, if the weathering will persist unless the Wood's or some other fault extends south to Trout [Tooth] lake. The reason that pre-glacial weathering has been preserved is that it followed down Wood's fault along a narrow zone on each side of the fault. Glaciation was not intense enough to remove the solid fresh rock on each side of the fault. Hence the preservation of the weathered zone in Wood's fault.

More detailed accounts of this feature have been described by Bell (1923) and Bell and Thomson (1924).

Economic Geology

Much has already been written on the economic geology of these mines. The following four paragraphs are summarized from Whitehead (1928, p. 14-23).

Following the folding and fracturing of the dyabase, hydrothermal solutions of calcium and magnesium carbonate and metals intruded the fractures, forming veins.

Filling of the open spaces, and wall-rock replacement occurred. The infilling of open spaces is prominent in the major veins of the mines. There was replacement on the narrower parts of the Wood's vein when the vein was in the characteristic banded material. These banded areas on the Wood's vein often lead to wider portions of vein containing ore.

Replacement has been the predominant process on No. 16 vein. Lamprophyre, between two sub-parallel joints diverging from the fault plane, has been partially replaced by vein material. Open filling is evident in some localities. Other veins similar to No. 16 in the Keeley Mine are Nos. 6, 9, and 14 and also parts of the Watson vein.

Chemically it appears that the effect of the wall-rock on the richer ore shoots has not been great, but the mechanical effect is important. Small fractures split when they enter the diabase and are unfavourable to the deposition of ore. Veins such as Nos. 6, 9, and 14 in Keeley Mine have not produced ore from the diabase. Ore is emplaced where the fractures of stronger veins enter the diabase. Examples of this are Wood's, Nos. 16, 20, and 26 veins in Keeley Mine (No. 26 and No. 20 appear to be the same vein but on different sides of the Wood's vein; see level plan 31a-16 in Knight 1922, map case). Lamprophyre has also produced a similar effect.

It appears the main causes of ore shoots are: the intersections of two or more veins (for example Nos. 16 and 28 veins); the intersection of a vein with an unmineralized fault or with flat shear zones or faults; the intensity of fracturing as indicated by fault displacement; also the changes of direction of strike and magnitude of dip of the vein. These latter two are important as more open spaces tend to occur where these changes take place. The richest region of the mine was the intersection of Nos. 20, 26, and Wood's veins near the diabase-metavolcanic contact.

Much of the work of the present company was concentrated on the western part of the mine where the Beaver (Fourclaim) Lake vein is found. Kent (1965, p. 11) described the vein as follows:

The ore discovered on this fault-vein [Beaver (Fourclaim) Lake vein] is typical of that which was found on Woods vein. So far only relatively narrow shoots of somewhat average length are indicated and have been found to occur in highly lenticular calcite veins. The vein lacks the vuggy porous nature of some parts of Woods vein and does not show a comparable tendency towards branch or network veining. The ore occurs where the vein attitude is irregular and the dip less than 70 degrees.

Brief descriptions of the three important vein systems condensed from Dobbins (circa 1931) follow:

The Wood's vein is in a strong fault zone varying in width from 2 to 8 feet of faulted material with contained calcite vein(s) from 3 inches to 24 inches over the entire length. A longitudinal section is shown in Figure 6 (Chart B, back pocket).

No. 16 vein is also a strong calcite vein and varies from 4 to 12 inches in width.

No. 28 vein is a fault vein carrying vein material in the broken wall-rock.

A. and F. Cloutier (5)

In 1967, A. and F. Cloutier held unsurveyed claims T59997 and T60058. The claims are in the northeast part of the township and are part of the former Maidens-Mackay group.

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The southern half of the claims are underlain by coarse-grained mafic metavolcanics, porphyritic in part, and are intruded to the north by granitic rocks.

In the southwest corner of T59997 a 2-inch calcite vein was observed during the fieldwork. Results from trenching and diamond drilling of this vein have not been encouraging.

C. W. Coe (6)

In 1967, C. W. Coe held five patented claims as follows:

1. An isolated claim, RL458, three-quarters of a mile west of Maidens Lake.
2. Four patented claims (HR113-116 inclusive) three-quarters of a mile northeast of Oxbow Lake.

RL458

An interesting historical point regarding RL458 is that this claim is the site of the old town of Silver Centre. There used to be several streets, numerous houses, along with stores and other facilities. There are very few signs of these buildings remaining today.

A depression, striking northeast across the claim indicates the Wettlaufer Fault. Outcrops of Nipissing Diabase are abundant on both sides of this depression.

In 1925, C. W. Coe made a geological survey of this claim and the Oxbow Lake group; the author is indebted to Mr. Coe for use of these reports. The following descriptions of the claims (RL458 and Oxbow Lake group) are mainly from these two reports by Coe.

On RL458 a vertical shaft, 64 feet deep, approximately 75 feet east and 160 feet north of the No. 3 post, was put down on a series of calcite stringers striking N67°E. Cobalt bloom was found in this fractured rock. At an 8-foot depth these veins dipped out of the shaft; at 40 feet another calcite vein was encountered. This second vein gave an assay of 20 ounces of silver per ton. A drift at 57 feet was driven to the west, and several calcite veins with silver were encountered. Drifting and crosscutting to the north also exposed several calcite veins, one of which was 6 inches wide.

Another shaft, known as the Nesbitt, was put down approximately 260 feet northeast of the first shaft. The Nesbitt shaft is reported by Mr. Coe to be just south of Highway 567; this shaft was not found by the author. The shaft was put down on a series of northwest-striking quartz-calcite stringers carrying cobalt bloom.

According to Coe several test pits have also been put down to examine other calcite veinlets, but these were not found by the writer.

A diamond drill hole to examine the Wettlaufer Fault zone is worthy of consideration.

OXBOW LAKE GROUP

A narrow northeast-trending belt of metavolcanics occupies the central part of this group. Conglomerate and greywacke of the Coleman Formation overlie the

metavolcanics to the southeast. Nipissing Diabase in the northwest part of the claim group dips steeply (about 60°) under the metavolcanics.

Five test pits have been put down on this group (Coo 1925a). Vein material in the dump of one of these pits showed some cobalt and silver mineralization. The other pits were put down on small fractures, and minor cobalt and silver mineralization was indicated in the fractures. These pits were not found by the writer.

J. F. Cooper (7)

In 1967, J. F. Cooper held T50990 and T49654 which are two separated surveyed claims approximately 1 mile south of the north boundary of the township and a short distance west and east of Highway 567 respectively.

CLAIM T50990

This claim was originally staked as L0144. The underlying bedrock is mainly Firstbrook Formation argillite and quartzite dipping to the west under the Lorrain Formation quartzite. There are no known mineral occurrences on this claim. In 1963 a drill hole for assessment credit was put down. The hole (not found by author) was collared 326.5 feet south along the west boundary from post No. 4 and 475 feet east from the boundary. It was drilled in a direction of N87°W at a dip of 55° for 200 feet. Only Firstbrook Formation rocks were encountered.

MARATHON CLAIM

This claim covers much of the former claim GF9, once operated by Marathon Silver Mines Limited. That the claim has been thoroughly prospected is indicated by pits, shafts, trenching, and diamond drilling. These pits and trenches are close to the shafts and are not shown on Map 2194, (back pocket).

General Geology

Light grey to pink, massive arkose of the Lorrain Formation is exposed in the northeast corner. The rest of the claim is underlain by diabase. The contact was not observed but in areas to the south the top of the diabase dips west at about 25°.

A topographic depression striking northeast across the northwest corner of the claim is suggestive of faulting.

Economic Geology

According to the statistical files of the Ontario Department of Mines, 16 pounds of cobalt were shipped from this property in 1939.

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A report by F. Loring (1911) of Marathon Silver Mines says the following on the veins:

Extending easterly and westerly through almost the entire width of the claim are two zones showing many fractures, with seams of calcite and often carrying at the surface the cobalt and nickel ores characteristic of the district. There are also a number of secondary fractures extending northerly and southerly. . . .

The eastern shaft is reported to be 87 feet deep. Robert Thomson, Resident Geologist, Cobalt, made notes after a visit to this claim, July, 21, 1959. In his notes he reports cobalt and nickel mineralization in the dump material. The shaft appears to have been sunk on the junction of two fractures striking N50°E and N87°W. Thomson also reported a trench, 100 feet east of the shaft, 10 feet deep; in the trench cobalt-nickel mineralization was found on a vein striking N87°W and dipping 73°N (the writer did not find this trench).

There is a second shaft reported at 200 feet south and 400 feet east of the No. 4 post. It is estimated to be 35 feet deep and is inclined on a quartz-calcite vein which strikes N6°E and dips 75°E.

In 1961 a drill hole was put down for assessment credit. The hole is located 530 feet from the No. 4 post at a bearing of S55°E. It was drilled at a 50° angle on a S55°E bearing for 121 feet. A log indicates all the drilling took place in diabase with a few aplite dikes. Minor chalcopryite was reported. The hole was presumably put down to test a quartz vein, up to 6 inches wide containing chalcopryite, that was seen on surface.

Copperfields Mining Corporation Limited (8)

In 1967, the company held 10 claims in two groups as follows:

1. Five surveyed claims, T44059-62, and T31854, on and around the west arm of Maidens Lake.
2. Five surveyed claims, T47417-18 and T47420-22, southeast of Group 1.

GROUP 1 — MAIDENS LAKE GROUP

The bedrock of this group is mostly Cobalt Group sedimentary rocks. West of Maidens Lake all three formations of the group are found in an unusually thin sequence. Diabase underlies the north, east, and west-central parts of the group.

The west arms of Maidens Lake represents part of the Maidens Lake Fault. This fault is indicated by a breccia zone in the core of drill hole No. 2 (see log) put down by the company in 1960. It was thought that this fault zone would be a favourable area for silver-cobalt ore, but it proved disappointing.

The following are modified versions of the drill logs submitted for assessment credit.

Hole No. 1

Location-290 feet S62½°W of post No. 1 of claim T44061

Dip at collar 45° bearing N

Dip at 500' 43° bearing N6°E

Dip at 1000' 42°

Dip at 1400' 40° bearing N10°E

FOOTAGE	DESCRIPTION
0- 15	Casing
15-1029	Coleman Formation, conglomerate, arkose, and greywacke
1029-1492	Keewatin(?) metavolcanics, intermediate to mafic in composition
1492	End of hole

Hole No. 2

Location-280 feet N38°W of post No. 2 of claim T44059

Dip at collar 45° bearing S29°W

Dip at 525' 53°

Dip at 925' 54°

FOOTAGE	DESCRIPTION
0 - 25	Casing
25 - 134.4	Diabase, medium-grained
134.4- 501.5	Coleman Formation, conglomerate and greywacke
501.5- 627	Fault breccia zone in Coleman Formation
627 - 820	Coleman Formation
820 -1010	Pre-Huronian basement rocks
1010	End of hole

W. Hammerstrom, prospector, (personal communication to R. Thomson, Resident Geologist, Cobalt, 1959) reported a strong east-striking "break" on the west side of Maidens Lake. Test pits within this area show the presence of chalcopyrite.

GROUP 2

Striking northeast across this group are intermediate to mafic metavolcanics, overlain to the south by Coleman Formation quartzite, and intruded on the north by Nipissing Diabase. Pitting and trenching (not shown on map 2194, back pocket) indicate the area has been prospected, but no showings of economic value are known to the author.

E.B.E. de Camps, Estate (9)

In 1967 the property consisted of six claims on and around the east part of Maidens Lake. Two of these claims, T29489 (formerly TC70) and T29490 (formerly TC71) are surveyed.

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History and Development

The first record of work on the property was in Burrows (1909, p. 31). He noted that "on TC71, east of Loon [Maidens] lake, a tunnel has been driven 100 feet on a strong calcite vein about a foot in width". It is believed that the adit referred to is actually the one on T29489 as shown on Map 2194, (back pocket). To the writer's knowledge this property was dormant until 1949 when H. G. Miller put down two drill holes. E. B. E. de Camps acquired the property in 1952 and in 1953 put down five drill holes. One further hole was drilled in 1963. The logs for these eight holes were submitted for assessment credit, and are on file at the Resident Geologist's office, Kirkland Lake. More drilling was done in 1965. Several holes were drilled, but the log of only the first one was available to the author.

By cleaning out the adit in 1960, Mr. de Camps found it to be about 60 feet long with a winze at the end which is about 10 feet deep.

There is also a small pit in the metavolcanics near the south boundary of the property.

General Geology

Coleman Formation conglomerate, with minor feldspathic quartzite and arkose, overlies the metavolcanics in this area. A small window of intermediate metavolcanics is exposed near the south end of the property. Nipissing Diabase is on top of the sedimentary rocks in the eastern part of the property (see cross-section on Map 2194, back pocket). The diabase-sedimentary rock contact dips north at about 10 degrees and the diabase reaches a maximum thickness of about 300 feet on the northeast side of the northeast-striking Maidens Lake Fault. To the west of this fault the diabase is approximately 30 to 50 feet thick. For a more complete description of the Maidens Lake Faults the reader is referred to the section on "Structural Geology", earlier in the report.

Economic Geology

Two calcite veins have been reported on the adit. The one along which the adit was driven strikes N40°E and dips 78°N; it has been reported to be up to 18 inches in width. In a personal communication to R. Thomson, Mr. de Camps stated that he had obtained assay returns of 0.48 and 0.42 percent cobalt from vein material near the end of the tunnel. A second vein found in the adit strikes across the adit with a bearing of N75°W. This vein was intersected by one of the drill holes put down by H. G. Miller, who reported that it contained cobalt.

M. J. Dolan (10)

In 1967, M. J. Dolan of North Bay held one leased claim, (T29473) approximately a quarter mile northwest of the west arm of Maidens Lake.

Fine- to medium-grained diabase underlies the entire claim. A valley, striking north through the centre of the claim, is an inferred extension of the Wettlaufer Fault.

Miss H. Fernholm (11)

In 1967, Miss H. Fernholm held leased claim T29471 which is approximately half a mile west of Maidens Lake.

Most of the claim is underlain by diabase. The bottom contact of the diabase strikes northwest and north along the eastern part of the claim, and dips to the west. The diabase is overlying quartzite of the Lorrain Formation.

Several pits and trenches (trenches not shown on Map 2194, back pocket), which appear to have been made in the early days, were found by the author. Narrow, 2- to 4-inch, east-striking quartz-calcite veins were found in two pits in the east central part of the claim. The more easterly of the two veins is in a shear zone in the Lorrain Formation quartzite, and the other is in diabase.

S. Fleming (12)

In 1967, S. Fleming held three unpatented claims in the northeast corner of the township. Most of the claim area is south of the quartz monzonite-metavolcanic contact.

This claim group contains part of the ground formerly held by the Mailor Prospecting Syndicate and later by Cobil Uranium Mines Limited.

In 1953, the Mailor Syndicate submitted logs of eight drill holes, totalling 1,983 feet, for assessment credit. All but two of these holes were collared in metavolcanics which contained numerous dikes of granite, lamprophyre, and minor diabase. Two holes were started in granitic rocks and cut into the metavolcanics.

According to a report in the Northern Miner (1953) there is a 60-foot shaft on the property; this shaft was not found by the writer.

Recent trenching by the present owner has exposed a 10-inch calcite vein partly in a lamprophyre dike. The vein has been traced for approximately 500 feet.

V. L. Girard (13)

In 1967, V. L. Girard held patented claim T21632 near the Upper Notch Power Dam on the Montreal River.

Numerous quartz and calcite stringers were found, mainly parallel to the shear planes, in a highly sheared and brecciated outcrop of Lorrain Formation grey quartzite near the base of the power dam.

J. J. Gray (14)

In 1967, J. J. Gray held 10 surveyed claims grouped as follows:

1. Nine leased claims (T33435 and T34063-70 inclusive) a quarter mile northeast of the east arm of Oxbow Lake.
2. One patented claim (HR106) at the northeast corner of Tooth Lake.

GROUP 1

During the course of the field work the No. 1 post of T34068, along with the respective posts for the adjacent claims, was located by the author.

The bottom contact of the southeast arm of the South Lorrain diabase dome strikes northeast across claims T34070 and T34067. On the remainder of the property, where the Nipissing Diabase has been eroded, the rocks are mainly conglomerate and greywacke of the Coleman Formation. The conglomerate is mainly exposed in the northern part of the property, and has a matrix of greywacke, and locally arkose. On claim T34069 the bedding dips gently to the southwest.

E. B. E. de Camps, mining engineer and a former owner of the claims, reported a north-facing cliff, on the south side of a small lake on claim T34063, with vertical north-trending fractures. A pit, 12 feet deep, has been put down on one of these fractures and a fault breccia with some carbonate was exposed. The fracture is in conglomerate underlain by bedded greywacke. Spotted alteration was reported in the conglomerate (de Camps 1953, personal communication to R. Thomson). This showing was not seen by the author.

Diamond drilling was done in 1949 and in 1954 by Mr. de Camps and the logs of these holes were filed for assessment credit and are on file in the Resident Geologist's office in Kirkland Lake. Figure 7 shows modified plans of these drill holes.

TALLEN CLAIM

Patented claim HR106 is locally known as the "Tallen" claim.

Pillow lavas in the northwest have been intruded by diabase, and the drift-covered contact strikes northeast.

Burrows (1910, p. 143) wrote the following:

On H R 106, adjoining Trout [Tooth] Lake to the northeast, a five by seven shaft has been sunk 50 feet on a calcite vein carrying smaltite.

Further mention of the shaft is given in an O.B.M. Annual Report (1915, p. 130):

Mr. J. D. Dodd had a contract for sinking a shaft on the property of the Tallen Mining Company, Limited, half a mile southwest of the Currie [Curry], in the latter half of the year. Work was started in a prospect shaft 60 feet deep, from the bottom of which 120 feet of drifting had been done. This shaft had a depth of 180 feet on March 1st, 1915.

In another Annual Report (O.B.M. 1916, p. 126) more information is given on this claim:

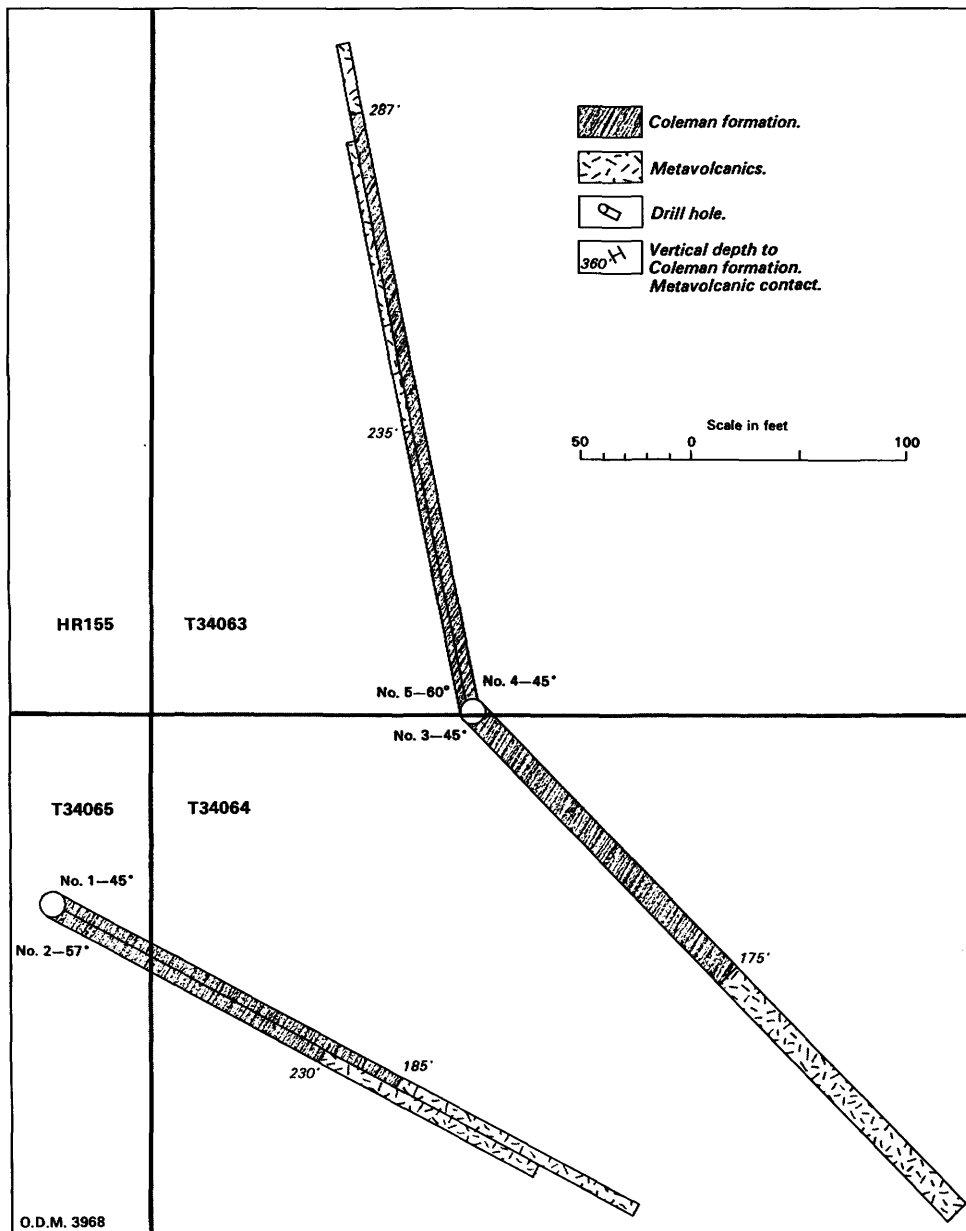


Figure 7—Plan of drill holes on property of J. J. Gray (14). Modified from plans submitted for assessment credit, 1949 and 1954.

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On claim H R 106, South Lorrain, the Tallen Mining Company, Limited has sunk a two-compartment shaft 200 feet. On the 200-foot level a drift is being run N. 40 degrees W. In February, 1916, the face of this drift was 200 feet from the shaft. Eight men are employed. All the work done in this shaft is in diabase, with the exception of the last 20 feet at the face of the above-mentioned drift, which is in Keewatin.

The above shaft was not located by the author during the course of the field work. The position of the shaft as indicated on Map 2194 (back pocket) is taken from old maps of the Tallen Mining Company at the Resident Geologist's office, Kirkland Lake.

In 1949, H. G. Miller, a former owner of the claim, put down four drill holes in the northwest section of the claim. All four holes were collared and finished in meta-volcanics. Galena and pyrite, in minor quantities, were found in two of these holes.

As none of this drilling reached the underlying diabase, there is no further information on the nature of the contact in this area. On claim HR85 (2 claims to the north of HR106) the dip is approximately 64° to the northwest, and this indicates that on HR106 the contact may also be fairly steep.

Numerous pits and trenches show that this claim has been well prospected.

A. Johnson (19)

In 1967, A. Johnson held leased claim T29472 on the west side of the west arm of Maidens Lake.

The east side of the claim is underlain by brownish feldspathic quartzite of the Lorrain Formation. Overlying the quartzite is diabase, which is fine-grained.

An inferred extension of the Wettlaufer Fault strikes north through the north-west corner of the claim.

The only workings found on the property was a shallow test pit with trenching striking N35°W. No vein material was observed, but presumably the exploration was to test a small fracture zone.

Kerr Addison Mines Limited (20)

In 1967, the claims held by this company were located as follows:

1. Former Ogistoh Mine. Two patented claims, 17688 and 17689, west of Cooper Lake, on the south boundary of the township.
2. Two patented claims, T19262 and T19263, a quarter mile north of Maidens Bay.

OGISTOH MINE

Todd (1925, p. 33-34) gave the following description:

... These claims are situated about half a mile to the west of the outlet of McDonald [Cooper] lake on the northern edge of a belt of Nipissing diabase, which cuts quartz diorite of Algoman age.

The property was staked in 1913 by Leo Beland, who started a shaft in the diorite near the contact with the diabase on No. 17,688. In 1921, the property was under option to the Ontario Smelters and Refiners, Limited, which made a sample shipment of ore weighing 25,000 pounds to Welland. The ore, which

has never been treated, is said to contain about 5 per cent. cobalt. The property was known as the Ogistoh mine at that time. Huronian Belt interests have recently acquired ownership of the two claims.

The shaft on 17,688, now full of water, is said to be 80 feet deep, and about 40 feet of drifting on the northwest side has been done. The rock on the dump consists of diorite which, in the freshly broken state, resembles diabase. . . .

On the surface, the vein, traced by a number of pits, is seen to strike N. 60°W., a direction about at right angles to the edge of the diabase. In one of these pits, a sample obtained from the vein which is about 3 inches wide contains cobaltite, arsenopyrite, pyrite, and a nickel mineral not identified. The sample on assay shows 10.2 ounces of silver and \$1.10 gold per ton [gold at \$20.67 per ounce]. An analysis of part of the sample, partially separated from the quartz and calcite gangue, follows:

	Per cent.
Insoluble	21.48
Cobalt	10.90
Nickel	2.34
Iron	11.40
Arsenic	25.42
Sulphur	10.48

To the west of the shaft, there is a large mound of the diorite containing inclusions of basic [mafic] material. This rock is considerably stained by iron oxide along a zone running east and west. This stain, resulting from the weathering of iron sulphides, is probably not associated with the silver-bearing vein.

It is stated by Mr. Beland that an assay of 92 ounces of silver per ton was obtained at one place in the shaft over a sampled width of six feet.

Near the northwest corner of claim 17,689 is a shaft put down 40 feet by the Huronian Belt in 1924. This work is done on a vertical fault showing well-defined walls about three feet apart. The material on the dump consists of blue mud with fragments of calcite and a brown carbonate similar in composition to ankerite.

MAIDENS BAY GROUP

These two claims were formerly held by Anglo-Huronian Limited.

The claims are almost entirely drift covered, with only three small outcrops of intermediate to mafic metavolcanics found. Nothing of economic significance has been recorded.

Larum Mines Limited (22)

TAYLOR CLAIM

In 1967, the company held patented claim RL471, approximately half a mile northeast of the Frontier No. 3 shaft. The claim was formerly known as the Taylor claim (Knight 1922, p. 234).

The claim is underlain by intermediate to mafic metavolcanics which are unconformably overlain by Coleman Formation conglomerate. Spotted alteration is present in the conglomerate. The top contact of the diabase strikes north near the east boundary of the claim and dips 15-30°W under the metavolcanics and sedimentary rocks. Data from drilling by Larum Mines Limited and Mining Corporation of Canada (1964) Limited have helped to delineate a sharp roll in the subsurface diabase (Figure 2, Chart A, back pocket).

Two shafts were put down on the claim by previous operators. The North shaft in the central part of the claim near Highway 567 is said to be 75 to 100 feet deep (W. H. Hammerstrom, prospector, personal communication, 1950, to R. Thomson, Resident Geologist, Cobalt). The shaft was put down on a fracture in the metavolcanics. Trenching has also been carried out from the shaft to the northeast.

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The No. 1 shaft is near the south boundary of the claim. A depression to the north probably represents the continuation of the Forneri Fault zone found on HS42 to the west.

Recent work on the property is mentioned in an O.D.M. Annual Report (1962, p. 132):

The property, consisting of mining claim R.L.471 at Silver Centre in South Lorrain township, District of Timiskaming, adjoins the Keeley-Frontier property on the northeast and is readily accessible by highway. There are 2, one-compartment shafts on the property, the deeper inclined No. 1 shaft, 95 feet deep, was pumped out and sampled. Surface-trenching, some 200 feet in length, and averaging 6 feet in depth, was completed on a showing east of the shaft. A core shed (16 x 12 ft.) was constructed, and surface diamond-drilling is planned.

Drilling by the company in 1963 failed to reveal anything of economic significance.

G. W. Levy (23)

HARRIS MINE

In 1967, G. W. Levy held patented claim HR24, locally known as the Harris claim, and being the ground of the past producing mine of Lorrain Consolidated Mines Limited. Production figures for the Harris Mine are shown in Table 15. The most recent work on the claim was in 1952 by Norbert Silver Mines Limited.

Table 15

PRODUCTION FIGURES FOR HARRIS MINE, OWNED IN 1967 BY G. W. LEVY, PROPERTY 23,
(FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
1925	8,840	8,884	.....
1926	3,654	5,293	.....
1937	187	.....	.....
1938	586	7,618	11,268
1939	392	4,491	6,074
Totals	13,659	26,286	17,342

History and Development

The claim was first staked about 1908 by Mark Harris, and prospecting during that year consisted of the pitting and trenching of veins on the claim. Between 1908 and 1917, the claim was essentially inactive. Lorrain Consolidated Mines Limited, formerly Harris Consolidated Mines Limited, began work on the claim in 1917. This work is described (O.B.M. 1917, p. 132) as follows:

"The shaft was sunk to a depth of 263 feet, and about 800 feet of drifting and cross-cutting done on the bottom level."

The property was again closed down and it remained that way until 1924. The reopening was probably due to the impetus given to South Lorrain Township by the nearby Keeley and Frontier Mines.

Underground development continued on the 100- and 175-foot levels. The mine was in production during 1925 and 1926; the production came mainly from the 100-foot level.

The property was again inactive until 1937 when the claim was leased first to J. V. Legris for two years and then in 1939 to A. Brockelbank Limited. Production during these leases came mainly from the dumps.

The property remained inactive until 1952 when Norbert Silver Mines Limited began operations in an attempt to bring the mine back into production. They had little success. Underground exploration consisted of geological mapping, further drifting, and diamond drilling. Surface drilling was also done. The logs of this drilling were not available to the author.

Underground plans for the mine, with access from three shafts are shown on Figure 2 (Chart A, back pocket). The No. 1 shaft is vertical for 30 feet and is then inclined at 80 degrees to the north. The No. 2 shaft is inclined 88 degrees to the south. Levels are established in the No. 1 shaft at 100, 175, and 250 feet, with a small sub-level at 137 feet. In the No. 2 shaft, there is one level at 150 feet which is connected to the No. 2 level of the No. 1 shaft.

General Geology

The western half of the claim is underlain by very fine-grained intermediate to mafic metavolcanics. Pillows exposed in the northwest corner of the claim show that tops are westerly facing. Underground plans indicate that lamprophyre and feldspar porphyry dikes intrude the metavolcanics, although these dikes were not found on surface.

The Nipissing Diabase sill occupies the eastern half and southern margin of the claim. The contact, representing the top of the sill, strikes east near the south boundary of the claim, and then turns sharply north. This turn, as seen on the structure contours, represents the uppermost part of a local trough in the sill. The average dip of the diabase sill down the axis of the trough is approximately 28°NW. The dip of the sill taken through the No. 3 shaft is approximately 34°W (Figure 2, Chart A, back pocket).

A fault, striking northeast, was observed on the 250-foot level, about 80 feet west of the No. 1 shaft. The fault is again seen on the same level at a position about 150 feet northeast of the No. 1 shaft. The magnitude of the northwest dip of the fault is unknown to the author.

Economic Geology

An old plan of the claim by Harris Mines Limited (dated August 31, 1910) is on file in the Resident Geologist's office, Kirkland Lake. According to this plan, 11 veins were found on the property. Veins No. 1 and No. 2 were considered the most important, with production coming from No. 1 only.

The No. 1 vein, consisting of calcite, strikes east, and dips north. Silver, cobalt,

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and nickel were recovered from this vein. The only description available is that in the Northern Miner (1952c), when Norbert Silver Mines Limited was active.

Examination of the upper levels at the No. 1 shaft has disclosed the following showings in the old working: on the 100-foot level a vein three to four feet wide with massive smaltite for a length of 20 feet; on the 137-foot sub-level the west face of the No. 1 vein shows two inches of solid smaltite.

During the mapping of the mine workings by company geologists, small occurrences of cobalt and nickel were observed, but none of these were of ore grade.

The No. 2 vein, which strikes north, is near the west boundary of the claim. In the early days of the mine, nothing of economic importance was encountered while drifting along the vein up to the north boundary. From the area around the No. 2 shaft Norbert Silver Mines Limited were reported to have made shipments of ore which averaged 9.74 percent cobalt, 8.8 percent nickel, 0.03 percent copper and 1.5 ounces of silver per ton (figures from notes of Robert Thomson, Resident Geologist, Cobalt 1953). In this area, the vein is reported to be 12 inches wide with a foot or more of fractured rock giving a total width of up to 3 feet. South of the No. 2 shaft the vein narrows to a width of 1 foot with 3 to 8 inches of calcite (Northern Miner 1952b).

The No. 2 vein has been described in the Northern Miner (1952c) as follows:

... on the 175-foot level the No. 2 vein shows a number of 10 and 20 foot sections with widths from two to eight inches wide. The vein is mostly calcite containing disseminated smaltite, niccolite, and bismuthinite.

Access to the No. 4 vein is through the No. 3 shaft. The following is from the Northern Miner (1952a):

What is described as a strong calcite vein was discovered in an old drift put out from a 50 foot shaft. Former operators had drifted for 75 feet on what they described as the No. 4 vein. The two shoots occur where the calcite body widens to 12 inches with intermittent concentrations of cobalt.

The No. 2 vein in the region of the No. 2 shaft was considered by Norbert Silver Mines Limited to be the most promising. There was, however, no further work done after 1952.

G. Macbeth (25)

In 1967, G. Macbeth held one unpatented claim T51835 at the north end of the east arm of Oxbow Lake.

Arkose and quartzite of the Coleman Formation, with diabase in the southeast corner, form the bedrock of this claim.

In 1964, a drill hole was put down on the east shore of Oxbow Lake. The bearing of the hole was N8°W and the dip 61 degrees; it was collared in diabase and the metavolcanic contact was intersected at 145 feet.

Calcite veinlets were reported throughout the hole, but . . . "there were no values in the sections of core which I [Macbeth] had assayed . . ." G. Macbeth 1965, personal written communication.

Miss M. McGonigal (28)

In 1967, Miss M. McGonigal held one patented claim, HR222, approximately a half mile east of Windy Lake.

The greater part of this claim is underlain by coarse arkose of the Lorrain Formation. Quartz diabase intrudes the Lorrain Formation in the northern part of the claim with the contact running approximately parallel to the northern claim boundary.

In the northwest corner of the claim a pit, approximately 15 feet deep, has been put down. The pit indicates an attempt to follow a vertical shear zone, which averages 8 inches in width, with some quartz-carbonate vein material present. The shear zone is in the diabase. Other workings include shallow exploration trenches parallel to the arkose-diabase contact.

J. E. McMahon (29)

In 1967, J. E. McMahon held four patented claims, HR614 to 617, approximately 1½ miles south of the Upper Notch hydro-electric power station.

The claims are situated along a northeast-striking belt of diabase, which is coarse- to fine-grained. The intruded Lorrain Formation is pale green quartzite and arkose.

Todd (1925, p. 31-32) gave the following description of HR616:

In the diabase mass to the east and northeast of Lorrain lake considerable old work is in evidence in the form of trenches and pits. Veins carrying cobalt minerals appear to be more plentiful in this body of diabase than elsewhere in the area, and a description of the deposit on H.R. 616 will serve to illustrate the character of the veins found in this vicinity.

Near the middle of the west side of the claim, a pit has been sunk in diabase on a narrow aplite dike, which strikes a few degrees north of west. The vein-material consists of calcite and quartz along with aplite, and the whole is impregnated with cobalt and other heavy minerals. Examination of a polished section, together with chemical tests, showed the opaque minerals to consist chiefly of cobaltite, arsenopyrite, and bismuthinite.

An analysis of the heavy material, after a partial separation from the gangue was effected, was as follows: insoluble 13.65 percent, sulphur 10.48, arsenic 32.54, iron 4.85, cobalt 21.09, nickel 1.18, bismuth 6.26, and zinc 0.09.

H. Meehan (31)

In 1967, H. Meehan held patented claim HR42 which is halfway between Lake Timiskaming and Maidens Lake.

Massive siltstone of the Coleman Formation, dipping gently to the east forms the bedrock.

In a written communication from Mr. Meehan, in 1966, the author was advised that in 1929 The Mining Corporation of Canada Limited had an option on the claim. A shaft was sunk on the adjoining claim T19297 (then HR64). In this shaft a calcite vein at the 375-foot level, in the metavolcanics, was reported to have been traced on to HR42 for approximately 80 feet.

Mr. Meehan also said that trenching had been done before 1929 but the results are unknown.

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Mid-North Engineering Services Limited (32)

In 1967, three patented claims were held by the company as follows:

- 1) RL466 and RL467 in one group about 1 mile northwest of Maidens Lake.
- 2) HR36 an isolated claim about ½ mile west of Maidens Lake (it is not described in this report).

RL466 AND RL467

This group is underlain by diabase except for the extreme west of RL467 where the bedrock consists of fine-grained andesitic metavolcanics and Coleman Formation sedimentary rocks. The diabase is medium- to coarse-grained with abundant pink orthoclase. The diabase-metavolcanic contact strikes north and dips to the west.

Knight (1922. p. 234) wrote the following on RL467:

The claim is about one-quarter mile north of the Bellellen.

The Inspector of Mines reported in 1912 that a shaft had been sunk on the property to a depth of 75 feet. This shaft is in the Nipissing diabase sill at a point about 100 yards east of the contact between the Keewatin and Nipissing diabase. The diabase is the acid variety containing pink spots which consist of a micrographic intergrowth of quartz and pink feldspar. About 125 yards southwest of the shaft, the contact between the Keewatin and diabase is exposed for 40 feet, and the contact may be seen to dip steeply westward.

On the dump, there are pieces of a calcite vein one to six inches wide.

A plant had been erected, but has since been burnt.

Striking through RL466 is an inferred extension of the Wettlaufer Fault. On this claim the fault is offset by the northwest branch of the Maidens Lake Fault.

Millerfields Silver Corporation Limited (33)

NIPISSING LORRAIN MINE

In 1967, the company held 38 claims, 6 of which were surveyed and 32 unsurveyed. Four of the surveyed claims (HR51, HR73, HR95, and T19261) include the past producer known as the Nipissing Lorrain Mine which was operated during the late twenties by the Nipissing Mining Company. It is adjacent to Maidens Bay. The other two surveyed claims, RL478 and RL479, are in the area of mafic metavolcanics north of the diabase dome and are not described in this report. The unsurveyed claims are contiguous and many are water claims on Lake Timiskaming.

History

The northern part of the property was first operated by the Nipissing Mining Company from 1925 to 1929, with limited production. The property, to the author's knowledge, lay dormant, except for small leasing operations (see Table 16), until 1961 when H. G. Miller of Cobalt formed Miller-Lorrain Mines Limited. This company dewatered the shaft and performed underground exploration, but no production resulted. After the death of Miller the property was acquired by Millerfields Silver

Table 16

PRODUCTION OF NIPISSING LORRAIN MINE OWNED IN 1967 BY MILLERFIELDS SILVER CORPORATION LIMITED, PROPERTY 34, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
*			
1935	32,506	....	....
1937	33,814	....	....
1940	343	5,521	3,521
Totals	66,663	5,521	3,521

*No figures for the early years as production was usually included in the total for the parent company, Nipissing Mining Company Limited.

Corporation Limited in 1966. The present company dewatered the shaft and carried out geological mapping, 7,868 feet of diamond drilling, and sampling, but found little of interest and the workings were allowed to flood.

General Geology

The general geological relationships are shown in Figure 4 (Chart A, back pocket). The Nipissing Diabase overlies Coleman Formation conglomerate and intermediate to mafic metavolcanics. The diabase-conglomerate contact dips to the southeast and several rolls in it were indicated by drilling. This contact can be seen in the adit. Metavolcanics are found on the first level and the contact with the sedimentary rocks dips below the second level 200 feet south of the shaft. The winze and lower levels are all in conglomerate.

Economic Geology

The main vein in the mine is known as the Staples vein (Figure 4). An O.D.M. Annual Report (1926, p. 163) stated that there were a number of veins "... which show from one to ten inches of cobalt and other minerals usually associated with silver."

Again an Annual Report (O.D.M. 1927, p. 172) published the following:

At South Lorrain, fairly encouraging results were obtained from the year's work. Exploration of a conglomerate area, similar geologically to the most productive part of Cobalt, disclosed nothing of value or interest. Exploration of a Keewatin area underlying the diabase sill was attended with more success. In addition to the large cobalt vein found late in 1925, which has shown only low silver values to date, another strong vein was discovered, which has been partly developed by several levels and raises over much of its length of 500 feet.

In the progress of this work, a number of more or less disconnected ore lenses of varying size and richness were encountered. Some of them showed ore of remarkable richness over widths of two to ten inches. A small shipment of high-grade was made at the close of navigation, to be followed by more substantial amounts in the spring of 1927. It seems probable that additional lenses will be encountered from time to time as development work proceeds.

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The next year the O.D.M. Annual Report (1928, p. 181) stated:

Indifferent results were obtained at South Lorrain. A number of veins were found in the Keewatin area, only one of which contained high-grade ore. Shipments to date from this vein contained 171,000 ounces of silver. Hand-sorting of broken ore in stopes is not yet completed, and it is probable that another 20-ton shipment will be made in the spring. Vertical development on a large cobalt vein in another part of the property revealed no silver values of importance. Two cars of cobalt ore were produced from this work.

Deeper levels were established in the conglomerate area, and a number of small veins were found. At times they contained cobalt, niccolite, and occasional native silver and argentite, with a general low assay. Work in this formation is continuing.

In the following year the property was mentioned again (O.D.M. 1929, p. 180):

At South Lorrain, work in the conglomerate in the southern part of the property was not gratifying. A number of small calcite veins containing low assays in silver were encountered, but none were important. Several diamond-drill holes were completed under Lake Timiskaming without favourable results. Stopping operations were concluded in the fall. Production in 1928 amounted to 65,000 ounces of silver and one car of cobalt ore. Shipments to date contained 240,000 ounces of silver and 135 tons of cobalt ore. In addition, about 120,000 ounces of silver are contained in a mill dump, of no value at the present price of silver. All operations ceased in the early part of 1929.

Reid (1943, p. 14) wrote the following:

From the dump H. G. Miller shipped 7.33 tons, running 10.9 per cent. cobalt, 6.24 per cent nickel and 17.8 ounces silver to the ton. It is reported that the property produced a total of 350,000 ounces of silver and from 12 to 14 railway cars of cobalt but did not show a profit. The mine, including a 100-foot winze, is 550 feet deep.

The Staples vein strikes north. The No. 5 vein of the adjoining Canadian Lorrain Mine is thought to continue on to this property.

Assessment Work

In 1961, Miller Lorrain Mines Limited submitted the logs of two drill holes for assessment credit. Both were drilled from the shore of Lake Timiskaming out under the lake. The hole for T46784 was drilled east at a 45-degree dip and encountered 63 feet of Nipissing diabase before intersecting a late diabase dike and at 213 feet Cobalt sedimentary rocks. The other hole to the south (on T46785) was in Cobalt sedimentary rocks. Further drilling was done in 1965 by Miller Lorrain on T46874. Several calcite stringers with minor pyrite were intersected in the two holes.

Two drill logs were submitted for assessment credit by Millerfields in 1967. Both of these were for flat holes drilled from the second level of the mine onto T48289. Cobalt sedimentary rocks cut by diabase dikes were intersected in both holes.

Two geophysical surveys were made in 1966 by Millerfields and the reports and accompanying maps were submitted for assessment credit. This work covered the water claims to the east and south and the claims surrounding those of the H. J. Pugh Estate (43). Magnetometer and resistivity surveys were performed. Several anomalous areas were delineated in the metavolcanics.

All of the above work is on file in the Resident Geologist's office in Kirkland Lake.

Mining Corporation of Canada (1964) Limited (34)

In 1967, the company held 18 patented claims in four groups as follows:

1. Forneri group. Nine claims to the north of Canadian Keeley Mines Limited.
2. Two claims on the northwest arm of Maidens Lake.
3. Four claims southeast of Maidens Lake.
4. Three claims to the northeast of Group 3.

FORNERI GROUP

Of the nine claims (GF10, GF11, GF12, HS42, HS320, HS321, HR18, HR39, HR167) in this group only one, HS42, has been explored extensively. This claim is locally known as the Forneri claim.

Geological mapping of all four groups was carried out by the company at a scale of 1 inch equals 400 feet.

The extreme southern part of HS42 is underlain by metavolcanics (see Figure 8). The bedrock on the rest of the group consists of Coleman quartzite and conglomerate overlain by Firstbrook argillite. The northwest branch of the Maidens Lake Fault crosses the northern part of the property with diabase outcropping on the down-thrown or north side of the fault.

The first work on the claim was done in the early days and was recorded by Burrows (1910, p. 143) as follows:

On H S 42 (Forneri claim) there is a vein about 3 inches in width, with strike N. N. E., and occurring in the conglomerate. The vein material is smaltite and copper pyrites in calcite and quartz. A surface sample on assay showed no silver values. A shaft has been sunk to a depth of 75 feet. At 35 feet the vein dipped from the shaft. It is reported that silver values were obtained on assay at 14 feet depth.

The vein is in a fault zone known as the Forneri Fault.

This work was done by the Forneri Mining Company Limited on the No. 1 shaft. Around 1922, The Mining Corporation of Canada Limited acquired the Forneri and other claims in the present group.

An O.D.M. Annual Report (1925, p. 143) mentioned that a shaft had been sunk to 200 feet and 300 feet of drifting had been done on the bottom level.

In the following year (O.D.M. 1926, p. 157) it is reported that another shaft was sunk to 73 feet on a cobalt vein with low silver values.

Veins in the No. 1 and No. 2 shafts are copper-cobalt bearing. Shaft No. 1 vein strikes just east of north and may possibly be a northerly extension of the Wood's vein. Shaft No. 2 vein trends east-west. These veins are unusual for the township in that they are in Coleman Formation rocks, approximately 100 feet thick, and separated from the underlying diabase by about 900 to 1,000 feet of metavolcanics (information from drill records).

More recent work in 1963 and 1964 by the present owners consisted of geological mapping, and the drilling of numerous holes (Figure 8). Some of these holes were deep and went through to the diabase. A number of lamprophyre dikes were encountered. Data from this drilling have helped delineate a westerly-plunging dome in the underlying diabase (see Figure 2, Chart A, back pocket).

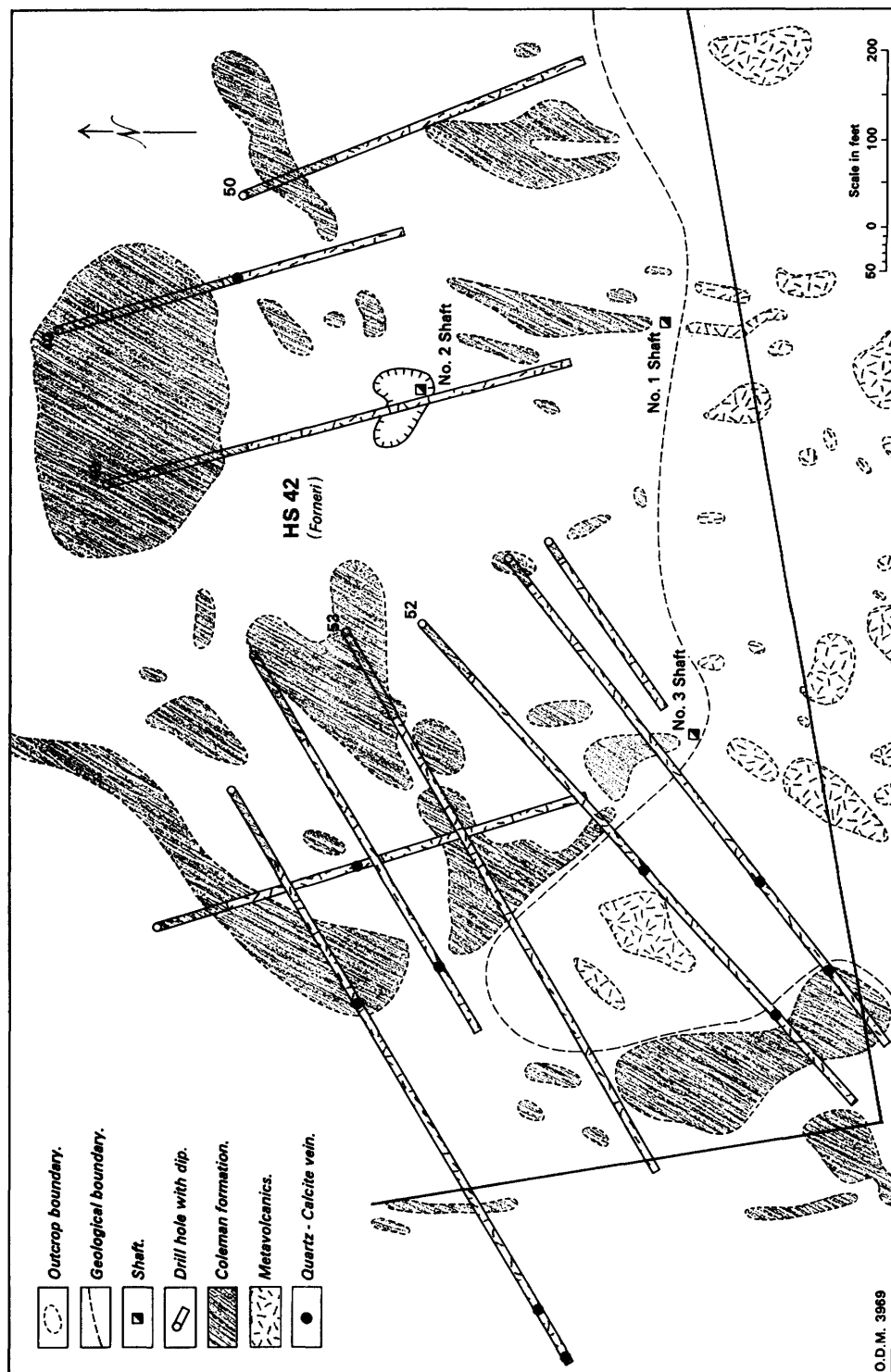


Figure 8—Plan of 10 of the drill holes on HS42, property 34. Modified from a plan of Mining Corporation of Canada (1964) Limited, 1964.

O.D.M. 3969

GROUP 2

These two claims, T19640 and T19608, are underlain by diabase. The northwest branch of the Maidens Lake Fault strikes northwest across the centre of the claims.

GROUP 3

The four claims making up this group are T19297 (formerly HR64) HR26, HR28, and HR29.

The general geology of the claims shows that the south flank of the diabase dome dips steeply to the southeast, and separates the metavolcanics from the overlying Coleman Formation rocks to the northwest.

The main work of the past has been concentrated on T19297 where a shaft has been sunk to a depth of 420 feet.

An O.D.M. Annual Report (1929, p. 174) quoted the following from a company report:

On claim H.R. 64 [T19297], a two-compartment shaft is being sunk for the exploration of a group of claims lying two miles east of the Frontier and owned by the corporation [The Mining Corporation of Canada Limited]. The existence of strong fault veins in Cobalt series sediments has been proven, and these veins will be explored at an horizon near the contact with the Keewatin formation. At the end of the year, 130 feet of sinking had been completed.

For the following year the publication (O.D.M. 1930, p. 156) again quoted information on the claim:

On claim H.R. 64 [T19297], the centre of a group controlled by the corporation [The Mining Corporation of Canada], extensive exploration was done. Sinking was completed to 420 feet and a level established at 406 feet. At this horizon, near the sedimentary-Keewatin contact, drifting, crosscutting, and diamond-drilling were done. Calcite veins, one of them carrying cobalt ore, were proved to exist, but commercial silver values were not developed and work was discontinued for the present.

GROUP 4

T19337 (formerly HS310), T17921 and HR62 are the three claims in this group.

The north and south portions of the group are underlain by diabase. The bottom contact in the north dips gently to the north, whereas in the south there is a steep southwesterly dipping bottom contact. These two areas of diabase represent the two flanks of the diabase dome; in between are sedimentary rocks of the Coleman Formation.

A shaft was put down in 1927 on T19337. An O.D.M. Annual Report (1927, p. 166) quoting from the Annual Report of The Mining Corporation of Canada Limited reported the following:

On claim H.S. 310 [T19337], which is the centre of a group owned by the corporation [The Mining Corporation of Canada], a shaft has been completed to a depth of 325 feet. These claims are located two and a half miles east of the Frontier near Lake Timiskaming. The geological structure is identical with that of the sedimentary area of Cobalt, and exploration by diamond-drill will be carried out in the sediments at an horizon about 50 feet above the Keewatin contact.

Again the following year an O.D.M. Annual Report (1928, p. 174) quoted the following:

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On claim H.S. 310 [T19337], located east of the Frontier near Lake Timiskaming, diamond-drilling was carried out in Cobalt series sediments. Four holes were drilled on H.S. 310 and adjoining claims belonging to the corporation [The Mining Corporation of Canada]. Though negative results were obtained in drilling, some crosscutting may be done during the coming year from the 325-foot shaft already sunk on the property.

Mobiko Mines Limited (35)

This property is formed by eight unpatented claims, T54862 and T54863, T55019 to T55022, T55568 and T55569, and is located about half a mile southeast of Hermit Lake.

General Geology

The claims for the most part are underlain by quartzite and arkose of the Lorrain Formation which is intruded by Nipissing Diabase, a branch from the main dome. That this diabase continues across the property was shown by a ground magnetometer survey, which was submitted for assessment credit. Also detailed geological mapping by the company shows that two old pits were sunk on diabase; the writer found only one pit.

Faulting is indicated mainly by lineaments. In the northern part of the property the Maidens Creek Fault is indicated by a lineament. Numerous other lineaments are also present.

Development

Walker (1966, p. 9-10) gives a description of the old workings on the property.

Two shafts have been sunk on the property, apparently many years ago, though no records exist. [One of these is possibly the shaft mentioned in an O.B.M. Annual Report (O.B.M. 1912, p. 147) as the Sharp Lake shaft. The publication states that it is 50 feet deep with drifts at this level running 145 feet south and 60 feet east.] One was noted in my [Walker's] earlier report as 100 feet north of the No. 2 post of Claim T-55569. The collar is in diabase and the shaft inclines 65 degrees to the south west. From the size of the dump there appears to be about 150 feet of combined workings, shaft and drifting. On the dump west of the shaft, rose and brown carbonate (ankerite or dolomite?) is associated with cobalt bloom and quartz. The vein south of the shaft strikes at 165°M [Magnetic] and appears on the aerial photographs to continue northwards. It is followed by the claim line. The shaft 400 feet to the northwest not previously known to the company, (though Mr. Hammerstrom was aware of its existence), is vertical and has a dump which indicates at least 200 feet of workings. The shaft is about 50 feet north of a strong east-west depression, regarded as a fault. All the visible dump material is diabase, but from the magnetic data and quartzite outcrops 50 feet to the west it seems likely that the shaft is in the lower contact of the diabase.

The pits [only one found by McIlwaine] and trenches a few hundred feet south of the base line on lines 30 and 32 west were newly relocated during the present work. The rock is medium grained diabase. Dull gray metallic-looking veinstuff from the dumps has been sent for identification. The area is near the intersection of a strong northwest break, followed by the hydro right of way [not shown on map], and a zone of faulting generally followed by line 30W from the north property boundary. This zone crosses the Maiden Creek fault zone just within the boundary.

In the summer of 1966, Mobiko conducted a ground magnetometer survey, the main purpose of which was to delimit the diabase and indicate its attitude. This was accomplished successfully, and showed that the diabase continued over most of the property, but not to the extreme northwest claim. This survey was submitted for assessment credit and is on file at the Resident Geologist's office, Kirkland Lake.

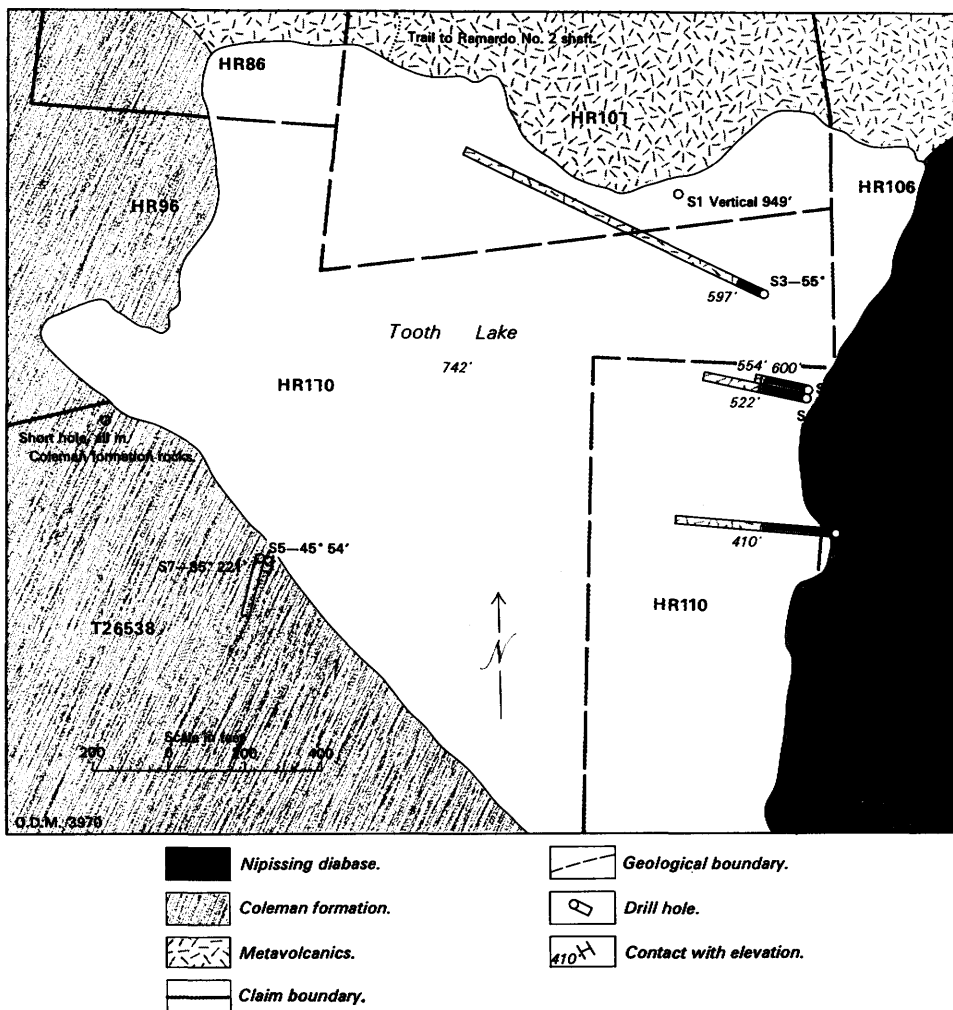


Figure 9—Drilling on and around Tooth Lake property of M. C. Mosher (37). From assessment files of Silver Circle Mines Limited, 1949 and 1952.

M. C. Mosher (37)

KING GEORGE CLAIMS

In 1967, M. C. Mosher held nine claims on and around Tooth Lake. These claims were drilled on by the Summer Group in 1949 and were formerly held by Silver Circle Mines Limited, and drilled by them in 1952; the local name is the King George claims.

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General Geology

Intermediate to mafic metavolcanics, exposed on the north shore of Tooth Lake, continue into the lake for a short distance before disappearing under the Coleman Formation. Rocks of the Coleman Formation are exposed extensively on the west side of the lake and underlie much of the lake. Where these rocks are intruded by the Nipissing Diabase there is a very steep, probably faulted, contact as indicated by diamond drilling. This contact represents the top of the Nipissing Diabase sill which dips 75°W. The dip then flattens suddenly at about elevation 150 feet, or 600 feet below lake level. This dip is very steep when compared with the gentle dip on the properties to the north. The existence of a fault is also indicated by the configuration of Tooth Lake.

Other faults which appear to strike towards the property are the Wood's, the Beaver [Fourclaim] Lake and the Wettlaufer, all of which appear to meet in a common small area in the northern part of the lake on HR170.

Minor faulting may be represented by small linear topographic depressions, many of which strike within a few degrees of west.

Development

There is a shaft on the east shore of Tooth Lake on HR110, which is known locally as the King George Shaft. Claim HR110 along with HR170 are the former King George claims and work on them in 1911 is described in an O.B.M. Annual Report (O.B.M. 1912, p. 147):

Active development work was carried on during 1911 on claims H.R. 110 and 170. The main shaft has been sunk to a depth of 272 feet, with 30 feet of cross-cutting at the 250-foot level.

Local people have reported that on blasting the crosscut the mine became flooded and work had to be suspended.

The shaft was presumably sunk to investigate a vein structure as diabase with quartz veinlets can be seen on the dump.

As previously mentioned, the property was explored by diamond drilling in 1949 and 1952. Figure 9 represents a modified compilation of the results of this drilling, which is on file with the Resident Geologist, Kirkland Lake.

Economic Geology

With three important faults of the area appearing to merge on this property, possibilities for finding ore seemed to be good. Core from the second of the two drilling programs indicated numerous calcite veinlets, but the assay results were very discouraging. These results are on file at the Resident Geologist's office, Kirkland Lake.

With the main target zone of the property under deep water, exploration is very expensive, but it seems to the author that further diamond drilling in this area is worthy of consideration.

D. A. Mutch Estate (38)

This property consists of one patented claim HR63. Knight (1922, p. 235) wrote the following:

On H.R. 63, on the shore of Lake Timiskaming near Maidens creek, a tunnel has been driven 300 feet into the Nipissing diabase at the foot of a high cliff. The tunnel strikes west 35° south, and was driven to intersect a narrow calcite vein, striking west 32° north, which outcrops about 100 yards south of the portal of the tunnel. The tunnel apparently was not run far enough to reach the vein; at any rate the vein was not encountered. The vein occurs in a joint plane of the diabase along which some horizontal shearing has taken place. The vein is rusty in places. At the end of the tunnel, there is a pink calcite vein from one-quarter of an inch to an inch in width. A horizontal fault, with a little calcite in it, was noted in the tunnel. At the tunnel portal, there is a diabase dike cutting the Nipissing diabase.

Just west of the centre of the south boundary of the claim two small test pits have been reported. These pits have been put down on narrow fracture zones striking N10°E, (I. D. MacDiarmid 1964, lawyer for estate, personal communication).

N. Oslund (39)

In 1967, N. Oslund held two separated unsurveyed claims:

1. T51217, located half a mile northwest of the west arm of Maidens Lake. The claim is immediately north of surveyed claim T29473.
2. T60413, part of former RL459 of the Montrose Mining Company Limited. The claim is north of the Wettlaufer claim (HR85).

MAIDENS LAKE CLAIM

On claim T51217 the bedrock is entirely Nipissing Diabase, which is mostly medium-grained. A valley, striking north through the centre of the claim is inferred to be an extension of the Wettlaufer Fault.

Diamond drill work for assessment credit was recorded in 1962 and 1965. These two short holes were all in diabase and the logs reported numerous calcite veinlets. Chalcopyrite was mentioned in one log. The logs for these holes are on file at the Resident Geologist's office, Kirkland Lake.

MONTROSE CLAIM

Claim T60413 (northern part of former claim RL459) locally known as the Montrose claim, is entirely underlain by Nipissing Diabase.

Knight (1922, p. 234) wrote the following:

The Montrose, R.L. 459, joins the Keeley on the east. A shaft has been sunk to a depth of 110 feet in the Nipissing diabase. On the dump there is a vein of brown weathering calcite or dolomite evidently carrying some ferrous iron. [Neither the shaft nor the dump was found by McIlwaine.]

Two holes, drilled in 1951, were both completely in diabase; several aplite dikes

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and calcite stringers and veinlets were intersected. The logs for these holes are filed for assessment credit at the Resident Geologist's office in Kirkland Lake.

Ox-Bow Silver Mining Company Limited (40)

In 1967, the company held nine surveyed claims T26506-9, T26516-20 on, and south of Oxbow Lake.

General Geology

Outcrop on the claim group is plentiful and metavolcanics, Nipissing Diabase, and sedimentary rocks are all exposed. The southern part of the property is underlain by metavolcanics, mainly felsic lavas and tuffs with minor agglomerate; there are also some rocks of intermediate composition. All of these metavolcanics are schistose, with schistosity striking east, or very close to it, and dipping steeply north. Conglomerate of the Coleman Formation is exposed on a high hill in the southwest corner of T26518. The southern end of the diabase dome axis strikes east across the north end of the property. Knight (1922, p. 236) states in his description of claim T26507 (formerly HS500) that "the diabase contact is exposed on the hillside, dipping 37° to 40° southeastward".

Development

Knight (1922, p. 236) reported as follows concerning a shaft on T26507 (formerly HS500).

This claim is about one-quarter of a mile southeast of Oxbow Lake.

There is a shaft on the property reported to be 38 feet deep in the Keewatin. On the dump beside the shaft, there is a calcite vein about half an inch in width. The shaft is 400 or 500 feet south of the Nipissing diabase.

The present company was incorporated in 1946. Diamond drilling was done in 1946 and in 1953. Eleven holes were put down in 1953 with cobalt reported in two of them and bismuth noted in one log (drill logs on file at Resident Geologist's office, Kirkland Lake). The property has been idle since 1953.

Pennaque Mining Corporation Limited (41)

CARIBOU LORRAIN MINE

In 1967, the property held by Pennaue Mining Corporation consisted of nine contiguous patented claims in the northeast part of the township (GF8, HR508, RL460, RL468, RL469, RL481, RL482, RL487, T25308).

In the early 1900s an inclined shaft was sunk near the north boundary of RL482. According to an O.D.M. Annual Report (1909, p. 125) this shaft is 50 feet deep. Several "cobalt carrying veins" are indicated on a sketch map made by Caribou Lorrain Mines Limited circa 1924. These veins strike a few degrees west of north and are all close to the shaft, which is indicated as inclined on the sketch map. The above mentioned sketch map is on file at the Resident Geologist's office, Kirkland Lake.

Burrows (1909, p. 26) mentions "veinlets of rusty quartz and iron pyrites" just north of the No. 1 post of RL469. This would put these veinlets on HR508.

J. H. Price (42)

J. H. Price of Cobalt held three unsurveyed properties in 1967 as follows:

1. T56455, formerly patented claim RL470, and known as the Bellellen; it is adjacent to the northeast claim of Canadian Keeley Mines Limited (T46400).
2. T46581 (formerly RL474) which adjoins the Bellellen on the northeast.
3. Nine unpatented claims approximately 1 mile east of Oxbow Lake. The Bulldog shaft is on one of these claims.

BELLELLEN MINE

History

Prior to 1909 considerable trenching was done on the claim. The sinking of No. 1 shaft to 75 feet with 100 feet of drifting started in 1909. The main, or No. 2 shaft was started in 1911. Statistics (Table 17) show that production was not continuous from year to year. Development work was also discontinuous over the years. The last

Table 17

PRODUCTION FIGURES FOR BELLELLEN MINE OWNED IN 1967 BY J. A. PRICE, PROPERTY 42,
(FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
1910	21,313	....	....
1911	8,895	....	....
*			
1916	1,522	5,570	9,616
*			
1931	....	14,450	....
*			
1935	3,970	7,326	....
1936	2,188	....	....
1937	3	90	....
*			
1940	67	224	....
*			
1942	59	207	....
1943	10	614	3,788
Totals	38,027	28,481	13,404

*No production reported for 1912-1915, 1917-1930, 1932-1934, 1938-1939, inclusive.

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attempt by Bellellen Silver Mines Limited to work the mine appears to have been in 1926. I. Mosher leased the mine in 1931 and was successful in producing 14,450 pounds of cobalt. From 1935 to 1937 Bellellen Mines Limited worked the mine with limited success. Small production was reported in 1940. J. W. Brydges and D. J. Leahy leased the mine in 1942 and operations were carried on in 1943 by Bellayre Mineral Interests, Limited. In 1949, Silba Silver Mines Limited acquired the property, but no production resulted from the work carried out. The present owner obtained the mine when the property became open for staking.

General Geology

Most of the claim is underlain by intermediate to mafic metavolcanics. The Nipissing Diabase-metavolcanic contact cuts across the southeast corner of the claim and the diabase dips west under the metavolcanics. The diabase was not encountered in the mine workings.

Economic Geology

The following description is from Knight (1922, p. 229),

On the dump from the main shaft there are blocks of vein material, showing the vein to have a width of 12 to 15 inches of white calcite. Both smaltite and chloanthite are found in these blocks. The presence of chloanthite was determined by W. K. McNeill, Provincial Assayer. On the dump are blocks of mica-lamprophyre and feldspar-prophyry.

Reid (1943, p. 14) wrote the following:

The mine when visited was only unwatered to the first level. At that horizon there is a calcite vein, 6 to 7 inches in width with occasional showings of ore, the maximum width being about 6 inches. The ore runs low in silver and higher in nickel than cobalt, the average of 12.27 tons shipped running 9.25 per cent. cobalt and 11.55 per cent. nickel. The property has made a small production and has possibilities as small-scale leasing operation.

The underground workings are shown in Figure 2 (Chart A, back pocket); and Figure 10 shows a longitudinal section of the main Bellellen workings.

CLAIM T46581

The claim is underlain almost entirely by medium-grained Nipissing Diabase. The metavolcanic-d diabase contact strikes north and can be observed near the west boundary of the claim. The dip of the contact was difficult to determine but is approximately 60 degrees west. The metavolcanics are massive and andesitic.

A shaft was found during fieldwork. Pink and white calcite vein material was observed in the dump. A trench about 250 feet east of the shaft strikes N70°W and is in diabase. Logs for a drill hole put down in 1952, and for two holes put down in 1962 were submitted for assessment credit. The 1952 hole was collared in metavolcanics and drilled to the east. Several quartz and calcite veinlets were encountered before the diabase was intersected at 15 feet. The logs for this and the other holes, which were entirely in diabase, are on file at the Resident Geologist's office in Kirkland Lake.

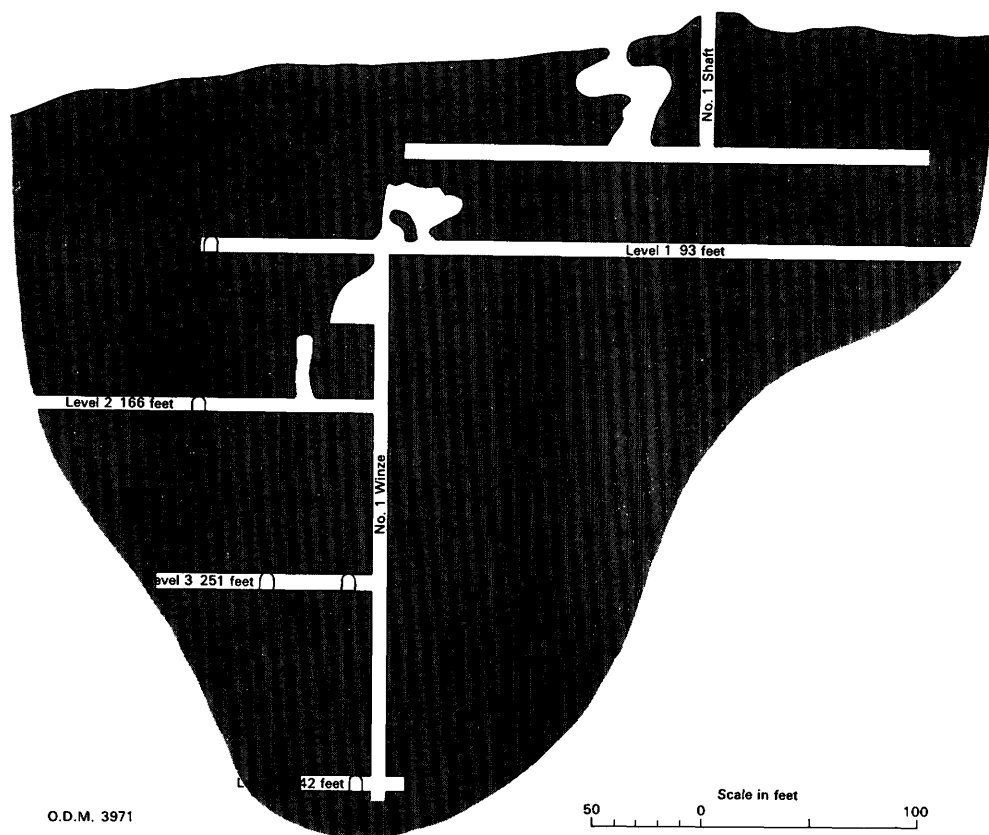


Figure 10—Longitudinal section along No. 1 vein of Bellellen Mine, owned in 1967 by J. H. Price (42).
From plans filed at Resident Geologist's office, Kirkland Lake.

BULLDOG

These claims are underlain mainly by the southern Oxbow Lake belt of meta-volcanics. The rocks are mainly felsic metavolcanics and diabasic "greenstone" that is intrusive in part. Overlying the metavolcanics on the north and south is the Coleman Formation which here is mainly conglomerate. The Bulldog Fault, named after the local name for the shaft, strikes northwest across the property.

The Bulldog Shaft, which was put down in the early days, is on a brecciated area of the fault. Considerable trenching has been done to the northwest along the fault zone; this trenching is not shown on Map 2194, back pocket.

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H. J. Pugh Estate (43)

In 1967, this group consisted of four surveyed claims, T26450-1, T26500-1, on the shore of Lake Timiskaming approximately 1 mile south of Maidens Bay.

Chlorite schists and metavolcanics, well exposed on a cliff on Lake Timiskaming, overlie Nipissing Diabase that is dipping steeply to the southeast.

Knight (1922, p. 236) reported the following on HS308 (now T26450):

At the north end of H.S. 308 [T26450], near the shore of Lake Timiskaming, there is a calcite vein exposed at the top of the hill which rises up from the shore. The vein is three or four inches wide and strikes westward, dipping steeply to the north. The vein occurs in banded Keewatin basalt, the banding dipping steeply to the north and the vein following about the dip of the banding of the basalt. A little blasting has been done on this vein. Near the foot of the hill, there is a shaft reported to be about 30 feet deep, following a small calcite vein and an aplite dike. This shaft is in coarse-grained Nipissing diabase. It is some 60 or 70 feet below the vein at the top of the cliff. Further work will show whether these two veins join. The contact between the diabase and the overlying Keewatin is covered on the hillside above the shaft, but is exposed a short distance to the north, where it dips 25° to 30° to the southwestward.

In 1954, L. Gough drilled three holes; the log of a hole drilled below the adit was submitted for assessment credit. This latter hole was entirely in diabase, with no economically important amounts of minerals reported.

Ramardo Mines Limited (44)

In 1967, the company held 41 patented claims in five groups. Descriptions of each group are given below.

LORRAIN TROUT LAKE PROPERTY

The No. 1 group of Ramardo Mines Limited consists of claims HR86, HR96, HR103, HR104, HR107, and HR117 of which HR103, HR104 and HR107 formerly comprised the property of Lorrain Trout Lake Mines Limited. Ramardo Mines Limited was incorporated in January 1946 and operations were carried out on the old Lorrain Trout Lake property from June to October, 1954. To the author's knowledge no further work has been done.

History

In the early days work on HR103 was undertaken in a search for the continuation of the Wood's vein from the Keeley property to the north. This continuation was verified by trenching, and an inclined shaft was sunk, on the vein, commencing in 1923 and by the end of the year was down 319 feet with 220 feet of drifting on the 240-foot level. During 1924 four other levels were opened up in addition to continuing with the shaft sinking. Ore was encountered on all levels. Production was started in 1924 from a stope on the 100-foot level. The shaft was completed to the 475-foot level in 1925. During 1926 drifting was done from the Keeley Mine in an attempt to find ore on the Wood's vein below the 475-foot level. This work proved unsuccessful in

finding ore although small amounts of silver and cobalt were found. Work was discontinued in No. 1 shaft in 1927.

No. 2 shaft was sunk during 1925 on claim HR107 and all work until the closing of the mine was carried out from there. Lorrain Trout Lake Mines Limited, which was controlled by The Mining Corporation of Canada Limited, was liquidated in 1931-32.

From 1938 to 1943 the property was leased by various individuals in an attempt to find ore. They were successful to a degree with minor amounts found in old stopes and pillars.

General Geology

For the most part the claim group is underlain by intermediate to mafic meta-volcanics. Pillows found in these rocks indicate tops are to the north-northwest. Coleman Formation rocks are found in the southwest part of the claim group. Diabase outcrops in the eastern part of HR103 with the top contact of the diabase-metavolcanics striking north across the claim. The diabase dips gently to the west under the claim. The diabase-metavolcanic contact underground in shaft No. 1 is discussed in an O.D.M. Annual Report (O.D.M. 1925, p. 139):

The contact between the Keewatin and the diabase was proven at a depth of 340 feet in the shaft. The north workings on the 390-foot level are in diabase, the major part of the south workings on this level are in Keewatin.

Cunningham (1954) mapped the underground workings in the No. 2 shaft and gives a brief description of the geology. His report states that the rocks above the 750-foot level are mainly volcanic cut by numerous "black fine-grained" dikes and a lesser number of lamprophyre dikes; this assemblage is intruded by the Nipissing Diabase which is found on the 750-foot and 850-foot levels in the form of a dome. An interpretation of the outline of this dome can be seen in the contours of the top of the diabase in Figure 2 (Chart A, back pocket).

Economic Geology

Production from this property was just over one million ounces of silver along with some cobalt and very minor nickel. Production statistics are given in Table 18. The bulk of this production came from the Wood's vein in No. 1 shaft and No. 2 vein in No. 2 shaft.

Descriptions of Veins

For a description of Wood's vein the reader is referred to the section on "Canadian Keeley Mines Limited"(4). The results of sampling the vein material of the Wood's vein in the shaft during shaft-sinking in the spring of 1923, are given in Table 19 as published by Knight (1922, p. 238). The channel samples were taken at 5-foot intervals across the footwall section of the vein.

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Table 18

PRODUCTION FIGURES FOR LORRAIN TROUT LAKE MINE, OWNED IN 1967 BY RAMARDO MINES, LIMITED, PROPERTY 44, (FROM STATISTICAL FILES, ONTARIO DEPARTMENT OF MINES).

YEAR	SILVER OUNCES	COBALT POUNDS	NICKEL POUNDS
1924	263,218	10,881	...
1925	485,591	18,883	...
1926	143,399	1,087	...
1927	109,941	6,226	...
1928	48,093	6,949	...
1929	24,380	378	...
1930	499	6,575	...
1931	8,600	441	...
*			...
1938	5,499	2,756	280
1939	2,850	3,885	...
1940	451	2,610	...
*			...
1942	305	1,796	305
1943	578	2,081	...
Totals	1,093,404	64,548	585

*No production reported for 1932-1937 inclusive or 1941.

In the No. 2 shaft seven veins, all of which are in faults, have been identified in the mine workings (Cunningham 1954). Brief descriptions, mainly summarized from Cunningham (1954), are given for veins Nos. 1, 2, 4, 5, 6, 7, and 8.

No. 1 Vein

Considerable development was done on this vein on the 350-foot level. The vein follows a cherty aplite dike to the northeast of the shaft. It is a calcite vein, and from the plans of the underground workings, varies in width from 1 to 10 inches; it strikes N45°E.

The No. 1 vein has also been recognized on the 500-, 625-, and 750-foot levels, but development has been very minor. Cobalt mineralization was noted on the 625-foot level in the 1954 mapping.

No. 2 Vein

Cunningham (1954) described the No. 2 vein as a strong fault structure which closely follows a narrow black fine-grained dike. The calcite vein system strikes northwest and dips steeply to the southwest. The vein strikes across the top of the diabase dome and silver was produced from both the diabase and the metavolcanics near the 750-foot level. Cunningham also says that "... above this, cobalt arsenides exist and continue to above the 350' level. It would appear that the cobalt shoots are cigar-shaped having a long vertical dimension and a short horizontal dimension."

Below the production area in the diabase the calcite was barren indicating a zoning of mineralization with respect to the diabase contact.

Table 19

ASSAY RESULTS FROM CHANNEL SAMPLES* ACROSS FOOTWALL OF WOOD'S VEIN IN SHAFT NO. 1
OF LORRAIN TROUT LAKE MINE OF RAMARDO MINES, PROPERTY 44 (AFTER KNIGHT 1922,
P. 238).

DEPTH, FEET	INCHES	SILVER OUNCES PER TON
35.	30.	8.0
40.	16.	15.0
45.	28.	6.0
50.	36.	65.8
55.	38.	260.8
60.	25.	132.2
65.	20.	72.0
70.	19.	2214.0
75.	18.	1155.2
80.	20.	1017.2
85.	20.	133.2
90.	25.	54.5
95.	20.	...
100.	18.	28.6
105.	20.	49.2
110.	17.	17.0
115.	15.	11.6
120.	18.	4.2
125.	20.	3.8
**		...
135.	24.	5.8
140. Timbered.	No sample.	
145. Timbered.	No sample.	
150.	54.	64.8
155.	48.	11.6
160.	24.	29.4
165.	36.	22.0
170.	36.	22.8
175.	30.	23.6
180.	36.	44.6
185.	32.	11.0
190.	15.	22.0
195.	12.	9.2
200.	24.	16.8
205.	18.	77.6
210.	12.	198.4
215.	18.	36.0
220.	18.	72.5
225.	4.	21.15
230.	10.	74.0
235.	28.	48.5
240.	16.	37.5
245.	12.	18.5
250.	12.	25.5
255.	12.	86.2
260.	24.	3.0
265.	20.	6.0
270.	21.	11.0

***Channel samples were taken at five foot intervals across the footwall section of the vein. First 35 feet of shaft not on vein."

**No entry in original table for 130 feet.

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Table 20

SAMPLING RESULTS OF NO. 2 VEIN IN NO. 2 SHAFT OF LORRAIN TROUT LAKE MINE OF RAMARDO MINES LIMITED, PROPERTY 44 (MODIFIED AFTER STEWART 1954).

LEVEL	LENGTH	AVERAGE WIDTH	ASSAY RESULTS	
			SILVER	COBALT
	FEET	FEET	OZ./TON	PERCENT
350*	67.0	3.0	2.8	0.60
350*	40.0	3.0	12.3	2.35
625	60.0	3.0	0.5	0.56
750	55.0	3.0	98.2	low

*Two samples taken on 350-foot level.

During underground exploration by Ramardo Mines in 1954 the No. 2 vein was sampled. The assay results reported by the company are shown in Table 20; these were disappointing but considered by Stewart (1954, p. 2) to be possible ore. It was thought that certain areas in vein No. 2 would be considered mill grade if high-grade ore shoots were found in new ground.

No. 4 Vein

No. 4 vein is a 2- to 4-inch calcite vein with a northeast strike. Very limited development has taken place on the 500- and 625-foot levels. Cunningham (1954) noted that there are cobalt arsenides in the vein.

No. 5 Vein

No. 5 vein is a 2- to 4-inch calcite vein found at the southeast end of the workings on the 350- and 500-foot levels (500-foot level not shown on Figure 2, Chart A, back pocket). It has a northeast strike. Cunningham (1954) described the vein as occupying a strong fault that on the 350-foot level closely follows a lamprophyre dike. He also reported that very little vein material was observed, and that some chalcopryite was found.

No. 6 Vein

This northeast-striking vein has been identified on the 500- and 750-foot levels. It also follows a fault zone. The No. 6 vein has been observed to vary from 1 inch to 6 inches and Cunningham (1954) reported it contains minor amounts of cobalt arsenides.

No. 7 Vein

Cunningham (1954) described this vein, which is found on the 750-foot level in the extreme southeast, as occurring in a fault on the south side of a northeast-striking "black fine-grained dike". There is less than 100 feet of development on it, but the vein shows 3 to 6 inches of massive cobalt arsenides, with niccolite and native bismuth. Owing to its position and strike direction, the vein enters the adjacent property.

No. 8 Vein

No. 8 vein is found in the southwest part of the 850-foot level. Its width varies from 2 to 12 inches, and it shows grey and white laminations. Cobalt arsenides were observed (Cunningham 1954).

Diamond Drilling

During the 1954 underground exploration work of Ramardo, three drill holes totalling 1,800 feet were put down from the northwestern part of the 850-foot level. These holes were drilled at a flat angle to explore a structure known as R-1 which is to the west of the workings. The R-1 structure as seen on surface, approximately 500 feet west of the shaft, shows up in a depression as a fracture zone; this zone strikes north and dips 72°E. The three holes all encountered veins. Holes U1 and U2 cut a calcite vein, 1½ to 2 inches wide, with cobalt mineralization. Hole U3 cut a quartz-calcite vein which was considered the same vein as in U1 and U2, but here values were low (Stewart 1954, p. 3). Assay results as reported by the company are shown in Table 21.

Stewart (1954, p. 4) described another new vein found during drilling:

"An entirely new vein was cut near the collar of hole U2. It was also intersected in hole U3, hole U1 was started too far west to cut this occurrence. The vein was located in the walls of the main drift after it was cut in hole U2. It had apparently been missed by the previous operators during former work."

There is cobalt mineralization over 1½ to 2 inches. Assay results as reported by the company are shown in Table 21.

Table 21

ASSAY RESULTS FROM DIAMOND DRILLING ON THE 850-FOOT LEVEL, NO. 2 SHAFT OF LORRAIN TROUT LAKE MINE OF RAMARDO MINES LIMITED, PROPERTY 44 (MODIFIED AFTER STEWART 1954, P. 4).

DRILL HOLE NUMBER	CORE LENGTH ASSAYED IN FEET	ASSAY RESULTS		VEIN
		SILVER OZ./TON	COBALT PERCENT	
U1	1.25	1.5	0.28	R-1
U2	1.25	24.0	1.24	R-1
U3	1.25	0.2	0.08	R-1
U2	1.50	0.5	2.00	New Vein
U3	0.75	Tr.	0.75	New Vein

Underground Workings

Level plans of the No. 1 and No. 2 shafts are shown on Figure 2 (Chart A, back pocket). The plans emphasize the attitude of the veins, especially the Wood's vein and the No. 2 vein. Figure 2 is from plans on file with Ontario Department of Mines.

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OXBOW LAKE GROUP

This group of seven claims, HR46, HR48, HR78, HR88, HR98, TC73, TC74, extends north from Oxbow Lake. The eastern half of the claim group is underlain by Coleman Formation sedimentary rocks which dip west under the Nipissing diabase.

Development

Claim HR88, was formerly owned by the Harris-Lorrain Syndicate; the following information is from an O.B.M. Annual Report (O.B.M. 1909, p. 123):

On H.R. 88, adjoining the Wettlaufer on the east, the above syndicate [Harris-Lorrain Syndicate] have done considerable trenching, and preparations have been made for sinking shafts on some of the discoveries.

Burrows (1910, p. 143) wrote the following regarding TC73:

On TC 73 there is a shaft down 40 feet on a calcite vein with disseminated smaltite and copper pyrites. These veins have not proved to carry appreciable silver values. The rock is the Nipissing diabase.

None of these shafts were located by the author.

In 1949, the present company put down two drill holes on HR46 for assessment credit. Both of these holes were entirely in diabase, and nothing of economic interest was recorded.

GROUP 3

This is the largest of the five claim groups and is mostly to the northeast of Maidens Lake. It consists of 25 claims: GF7, HR32, HR34, HR52, HR53, HR56, HR65, HR76, HR83, HR138, HR172, HR173, PB101, RL462, RL476, RL485, TC72, T19133, T19258, T19264, T19265, T19383, T19618, T33473, and T33474.

Drift-covered metavolcanics occupy the extreme northern part of this group, and disappear under the Nipissing Diabase. There is also a small window of intermediate to mafic metavolcanics on HR34. Coleman Formation rocks are inferred to underlie parts of HR56, HR32, and T33473; outcrop, however, is very limited.

By far the most common rock type is diabase, and east of Maidens Lake hypsitherene is quite noticeable in the diabase.

Several of the claims have been explored as is indicated by pitting and trenching (trenches not on Map 2194, back pocket). With regards HR56 Knight (1922, p. 236) wrote the following:

On H.R. 56, which is about one-quarter of a mile south of Loon [Maidens] Lake, there is a shaft reported to be about 40 feet deep. The shaft is in Keewatin, and is 100 feet east of the west boundary. There is a vein of calcite an inch or two wide, in places six inches wide.

This shaft was not found during the field work and is not shown on the map. In 1949, Ramardo Mines Limited put down five drill holes for assessment credit. Calcite veinlets were logged in most of these holes, with pyrite reported at 170 feet in holes

Nos. 6 and 7. The company prospectus for 1953 reported an "... 18 inch section of mineralized vein material which assayed 73.4 oz. of silver and 0.11% cobalt."

The logs for these holes are on file at the Resident Geologist's office, Kirkland Lake.

RL477

This isolated claim, half a mile northwest of Maidens Lake, is underlain entirely by diabase. No workings were found during the field work.

GROUP 5

HR186 and HR188, approximately a mile southeast of Maidens Lake, are underlain by schistose metavolcanics, and Coleman Formation quartzite and conglomerate.

A pit was found near the south boundary of HR186; there was quartz vein material in the dump.

Silver Tower Mines Limited (47)

In 1967, Silver Tower Mines Limited held six unsurveyed claims (T54160-5) located approximately half a mile southeast of Oxbow Lake.

Archean rocks on the property include pillow lavas, felsic tuffs, chloritic schists, and mafic intrusive rocks. Greywacke, arkose, and conglomerate of the Coleman Formation occupy the southern part of the property.

The diabase-metavolcanic contact in the northwestern part of the claim group dips steeply and this indicates that the top of the diabase sill is probably at great depth in most of the property.

In October 1949, R. Thomson, Resident Geologist, Cobalt, visited the property that was then known as the Oslund-Hermiston group. The following three paragraphs are summarized from Thomson's notes, which are on file in the Resident Geologist's office in Kirkland Lake.

In the south-central part of the property galena is exposed in a prospect pit. The galena is in a chlorite schist in irregular streaks over a maximum width of 5 feet. Minor pyrite and carbonate is also present. The galena is in small grains (less than half a millimetre) and constitutes up to 10 to 15 percent of the rock. The galena is inconspicuous on the weathered surface.

About 80 feet west of the pit is a small fracture along which are traces of pink carbonate vein material containing galena and minor cobalt bloom.

The genetic relationship between the galena and the common silver-cobalt mineralization of the area is not known.

In 1956, Elite Cobalt Mines Limited recorded four drill holes for assessment credit on the property held in 1967 by Silver Tower Mines. All of these holes were started and completed in metavolcanics, and all but one recorded intersections of galena. Other minerals mentioned in the logs were pyrite, chalcopyrite, and pyrrhotite and all were in carbonate or quartz-carbonate zones.

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Four drill holes were put down by Silver Tower Mines in 1965 for assessment credit. Assay results from the core samples ranged from nil to 1.8 ounces of silver per ton. The logs for the 1956 and 1965 holes are on file at the Resident Geologist's Office, Kirkland Lake.

Tormont Mines Limited (48)

The company's holdings in 1967 comprised seven patented claims in two groups. Group one consists of five claims, T26652-6, half a mile northwest of Tooth Lake. The claims are underlain by Coleman Formation conglomerate and greywacke.

H. G. Miller, a previous owner, carried out diamond drilling on this property, but no records are available. It is possible this drilling was done in a search for the western extension of the veins on the Canadian Keeley property.

Group two comprises two claims, T19259 and RL488 on and east of Highway 567, $\frac{3}{4}$ mile south of the northern township boundary. Bedrock consists of Lorrain Formation quartzite and arkose, and Nipissing Diabase.

United Macfie Mines Limited (49)

In 1967, the company held two patented claims (F84 and T28472) on the shore of Lake Timiskaming, approximately half a mile south of Maidens Bay.

Claim T28472 is underlain by diabase, with hypersthene. Claim F84 is largely drift-covered but greywacke of the Coleman Formation is indicated by scattered outcrop. A small lens of andesitic metavolcanic rock is present in the southeast corner of F84.

A pit was put down in the metavolcanic rocks with a showing of pyrite and chalcopryrite along a joint plane striking N80°E. Pyrite and chalcopryrite were also found in calcite stringers on the dump.

In 1951, two drill holes were put down by former owners on T28472. Both of these holes intersected the diabase-greywacke contact. Four assays gave 0.9, 0.9, 1.2, and 17.9 ounces of silver per ton. The logs for these holes are on file at the Resident Geologist's office, Kirkland Lake.

Veinlode Silver Mines Limited (50)

In 1967, the company held 27 surveyed claims, T29994 to T29995, T31651, T43338, T43553, T44411 to T44413, T44477 to T44494, and T45225, east of the Montreal River and west of Fourclaim Lake.

General Geology

Claims T29994, T29995, and T31651 are partly underlain by intermediate meta-volcanics, with both pillowed and massive varieties present. The southwestern part

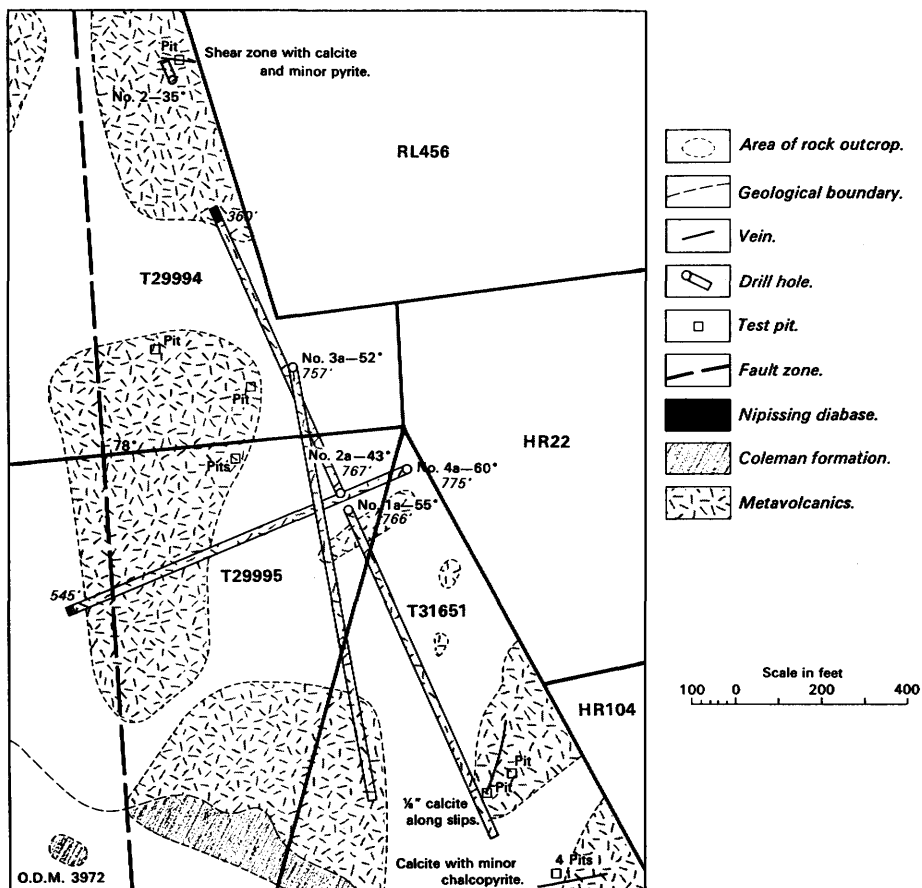


Figure 11—Location of drill holes and test pits on Veinlode Silver Mines Limited property (50) (generalized from assessment work data 1956, 1958, 1962, and 1963).

of claim T31651 and the western part of T29994 and T29995, along with the rest of the claim group, are underlain by Cobalt Group rocks. Although most of this area is covered by glacial deposits it is inferred that all three formations of the Cobalt Group are present.

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Development

Several deep drill holes have been put down. The main purpose of these holes was to locate the top of the diabase sill, and to test the extension of the No. 2 vein of Ramardo Mines Limited and the Keeley No. 16 vein. Drilling was also carried out to examine, at depth, some of the numerous rusty vein fractures on the property. Pitting and trenching have also been performed. The information shown in Figure 11 is compiled from drill logs (in assessment files for 1956, 1958, 1962, and 1963) and geological maps of claims T29994 and T31651 and adjacent claims (in assessment files for 1956).

Economic Geology

Exploration is difficult because the top of the sill, which is the favourable zone, is at great depth. Drilling intersected the contact at 1,400 feet and 1,632 feet (information from drill logs).

Deep drilling to test the possible extensions of the No. 16 vein of Canadian Keeley Mines Limited and the No. 2 vein of Ramardo Mines Limited gave disappointing results, according to the work filed for assessment credit.

All of the work, on this property, reported above is on file at the Resident Geologist's office, Kirkland Lake.

E. P. and L. J. Weaver (52)

In 1967, the Reverends E. P. and L. J. Weaver held eight patented claims in two groups as follows:

1. Six claims, HR233-4 and HR236-9, west of the Upper Notch power station.
2. Two claims, HR230 and HR231, approximately 1 mile down river from the Upper Notch power station.

GROUP 1

All bedrock under these claims is Nipissing Diabase. There were no workings noted and nothing of economic significance has been reported from these claims.

GROUP 2

These two claims are underlain by fine-grained diabase except for the southern half of HR230 where the bedrock is Lorrain Formation pink arkose.

In 1927, Lamprecht Mining Corporation was reported to have sunk a shaft 90 feet deep, all in diabase, on HR231 (Company prospectus for 1927). The location of this shaft is uncertain and therefore is not shown on the face of Map 2194 (back pocket) but it is said to be near a small creek flowing east through the claim. Crushed diabase is exposed along the creek possibly indicating a fault zone.

Other Areas of Interest

NEWTON LORRAIN

Approximately $\frac{1}{2}$ mile southwest of Hermit Lake, on the northern boundary of the township, there is a shaft reported to be 520 feet deep. Due to inadequate information on the exact location, the shaft is not shown on Map 2194 (back pocket).

An O.D.M. Annual Report (O.D.M. 1926, p. 161) records work by Newton Lorrain Syndicate as follows:

. . . A two-compartment shaft was sunk to a depth of 63 feet by hand, and continued to a depth of 180 feet after the installation of a 25 h.p. boiler and a small hoist . . .

For the following year an O.D.M. Annual Report (1927, p. 169) stated:

The shaft was continued from 180 feet to a depth of 520 feet, and a level was established at 500 feet on which a crosscut was driven 100 feet south before the property closed down at the end of the year.

On the south side of the diabase there is an adit, striking N15°W, the length and internal workings of which are not known. Quartz and carbonate vein material, with chalcopyrite, was observed on the dump.

FRIDAY SHAFT

A shaft, approximately $\frac{1}{2}$ mile east of Lorrain Lake and 4 miles north of the southern township boundary, was put down in the late 1920s by Friday Mines Limited. The depth of the shaft is uncertain. The latest information known to the author was in an O.D.M. Annual Report (1930, p. 152) which stated there was a two-compartment shaft 156 feet deep with 201 feet of drifting and 54 feet of crosscutting on the 80-foot level.

The shaft was reported to be put down on a calcite vein containing cobalt mineralization. Friday Mines put down several drill holes in 1950 and two of these were submitted for assessment credit; the logs for these are on file in the Resident Geologist's office, Kirkland Lake. The logs indicated traces of silver, but no cobalt was obtained in assays. The writer saw cobalt bloom in the dump.

In 1960, Gibson Mines Limited staked the property and carried out geological mapping. The report and map is on file at the Resident Geologist's office, Kirkland Lake. To the writer's knowledge no further work has been done.

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GLEESON-McRAE

There is an undated sketch labeled the Gleeson-McRae Group, south of Copper Lake, on file in the Resident Geologist's office, Kirkland Lake. The sketch indicates several pits and veins south of Copper Lake. Todd (1925, p. 34) mentions a shaft 35 feet deep but this was not found by the author.

NORBAY

Approximately 1 mile down river from the Upper Notch Power Dam an adit has been driven into a cliff of diabase on the northeast bank of the Montreal River. This adit was driven by Norbay Lorrain Silver Mines Limited sometime in the late nineteen twenties, and some silver was reported to have been found. The portal was caved at the time of the author's visit.

FUTURE EXPLORATION

The great number of prospect pits, shafts, and trenches in the geologically favourable areas make the prospects of future discovery of rich silver-cobalt veins by conventional methods appear to be poor. The prospectors of past generations have done a very thorough job. The erratic nature of silver-cobalt veins makes exploration by diamond drilling very difficult as a high-grade zone can be so easily missed. Past experience has shown that the favourable horizon in South Lorrain Township is the metavolcanics which overlie the Nipissing Diabase, but further exploration is made difficult with increasing depth.

Exploration geochemistry is becoming more and more a useful tool in prospecting. The use of this method is also proving successful in silver prospecting. For further discussion of this the reader is referred to Boyle (1966).

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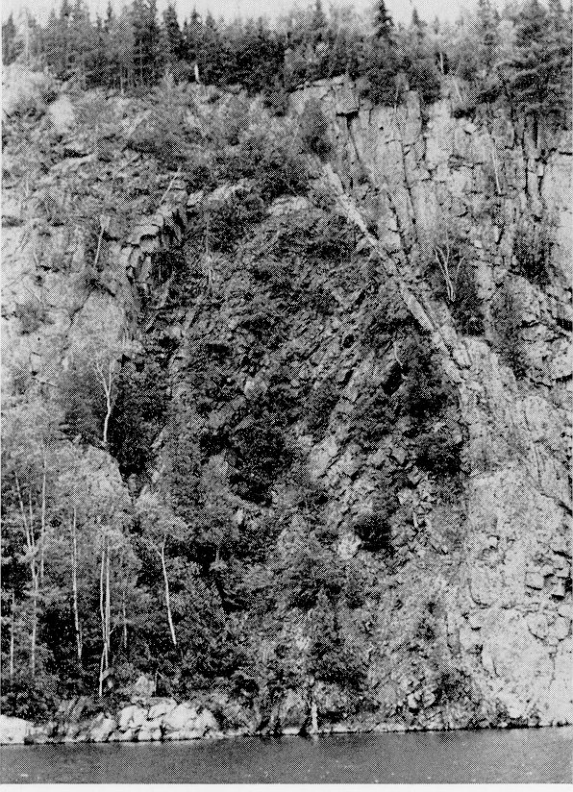














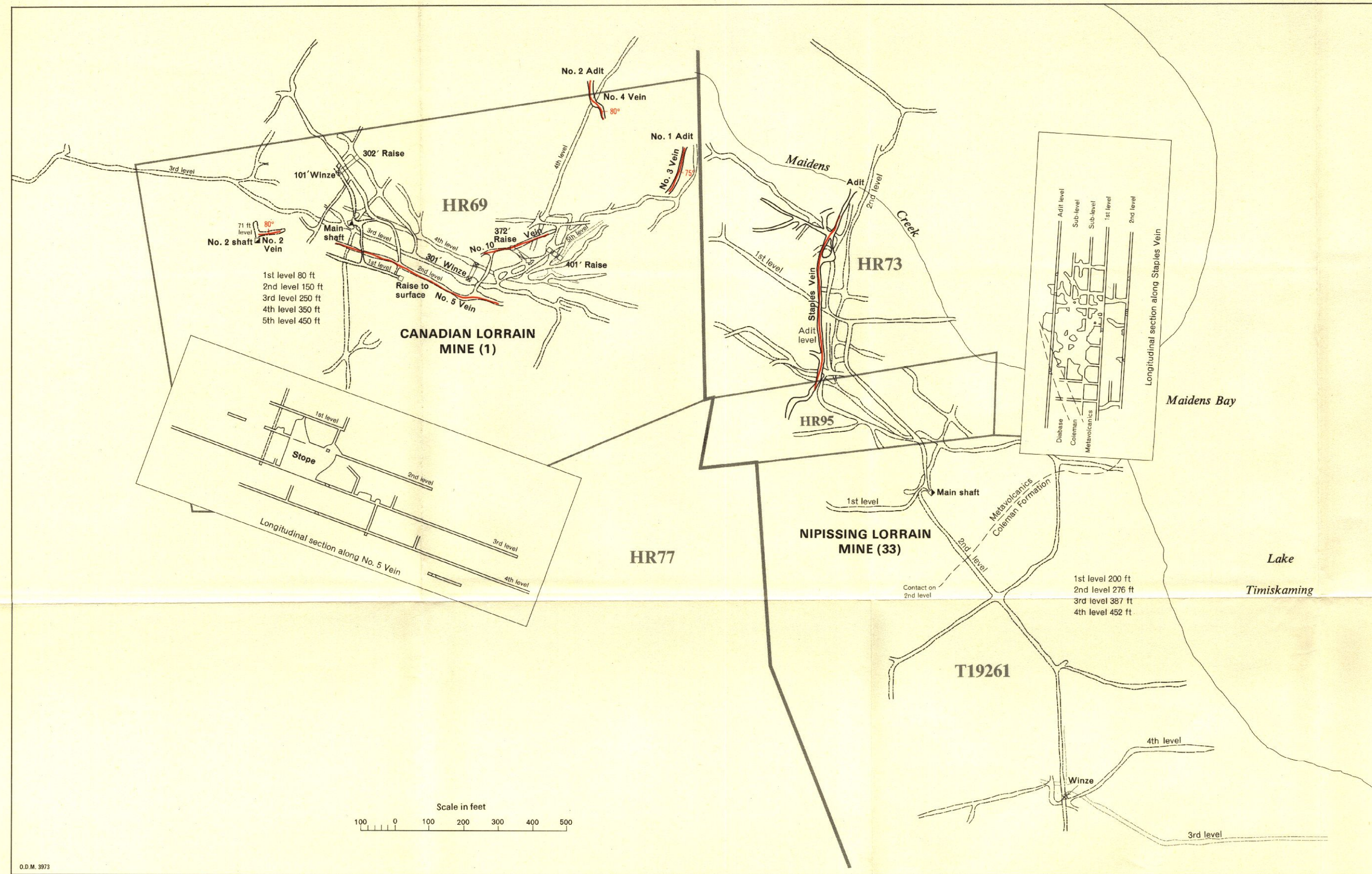


Figure 4. Underground plans and sections of Nipissing Lorrain mine, (Millerfields Silver Corporation Limited) and Canadian Lorrain mine (Agnico Mines Limited) from plans on file in Resident Geologists office, Kirkland Lake (dated 1967 and 1952, respectively).

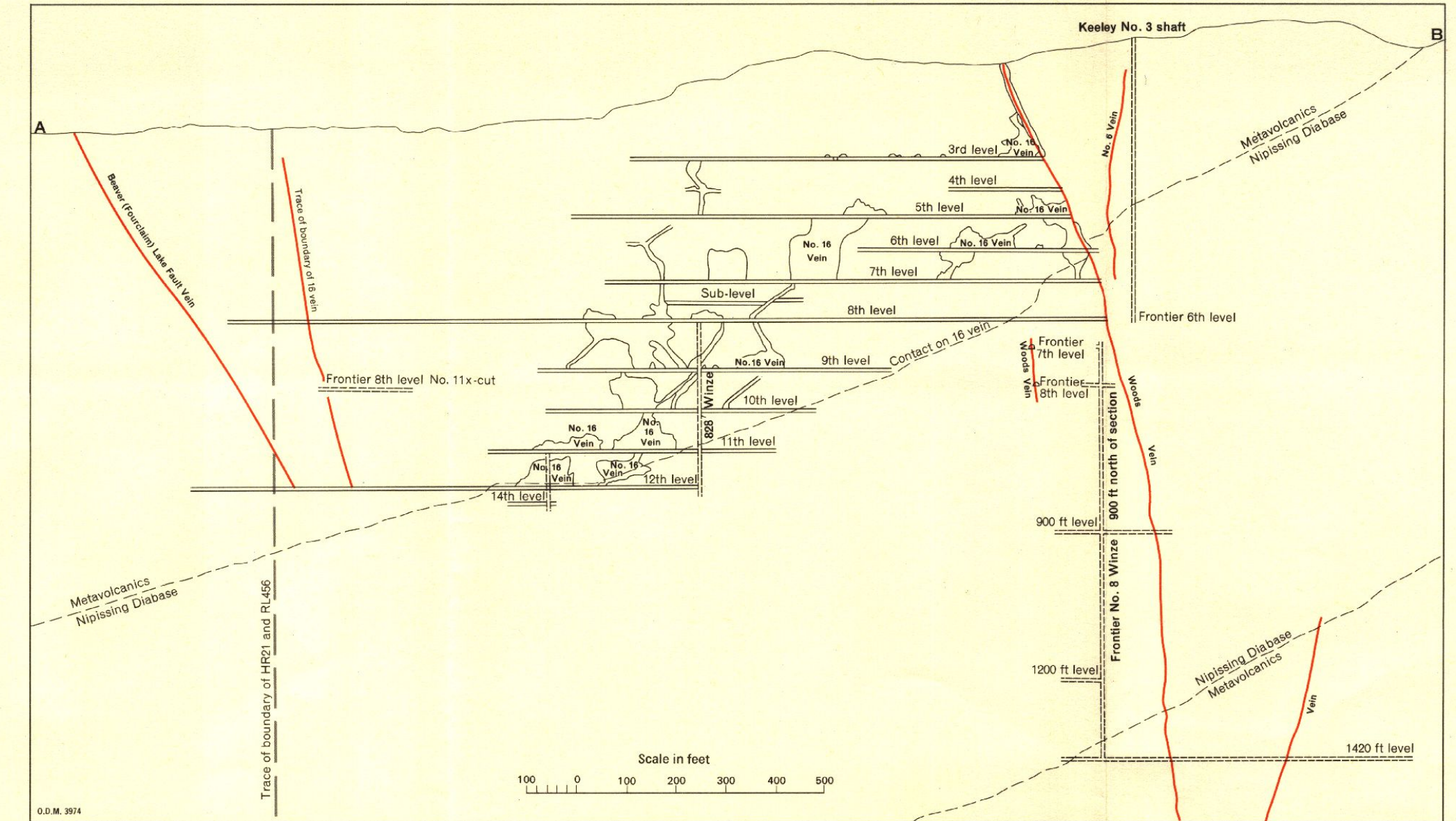


Figure 5. Projected section on Line AB through Keeley mine (see Chart A). From plans of Canadian Keeley Mines Limited.

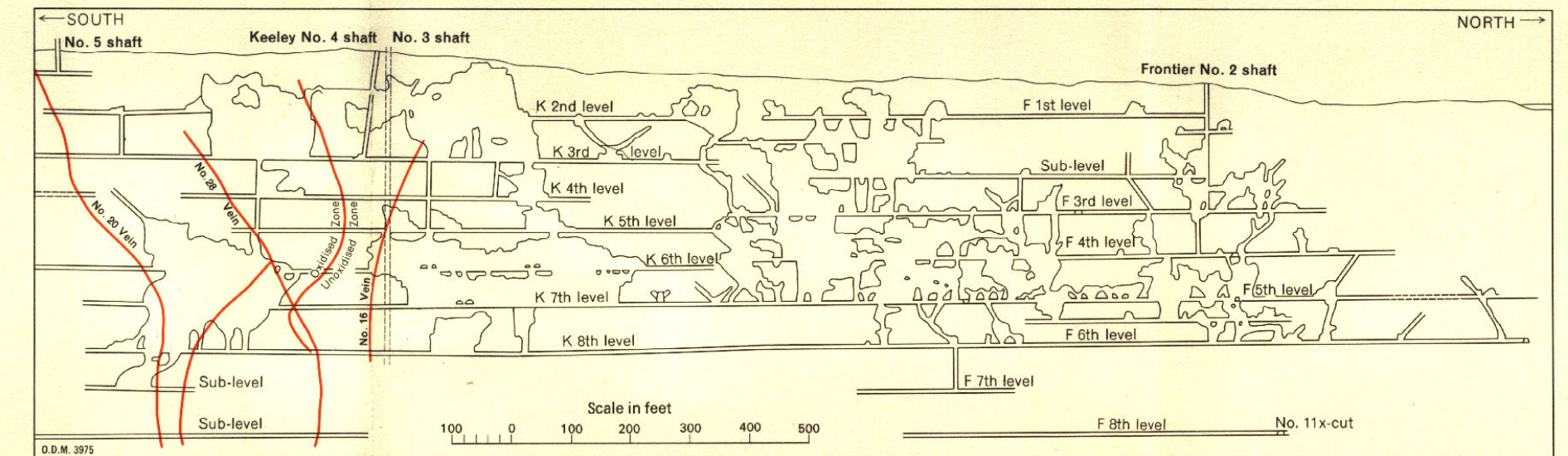


Figure 6. Longitudinal Section of Wood's Vein on Keeley, Crompton and Frontier Claims, looking west. From plans of Canadian Keeley Mines Limited.

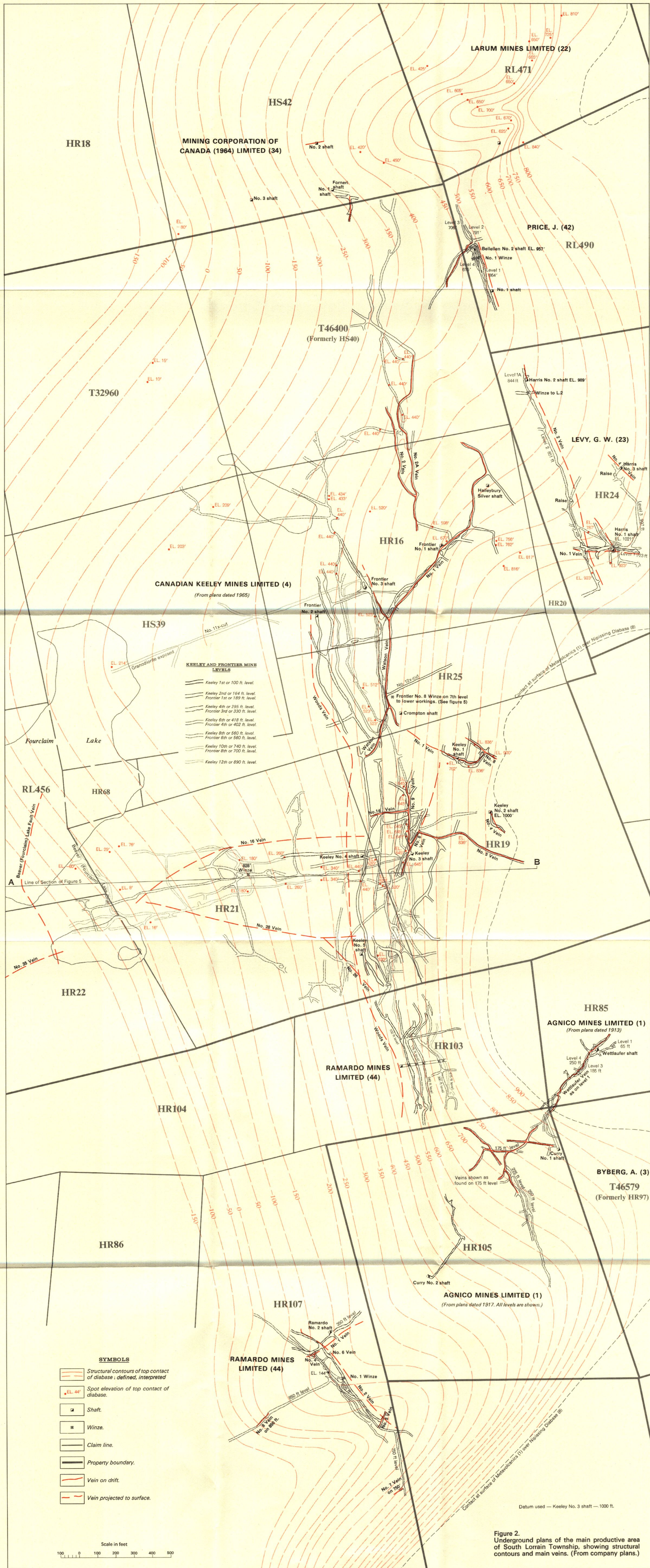
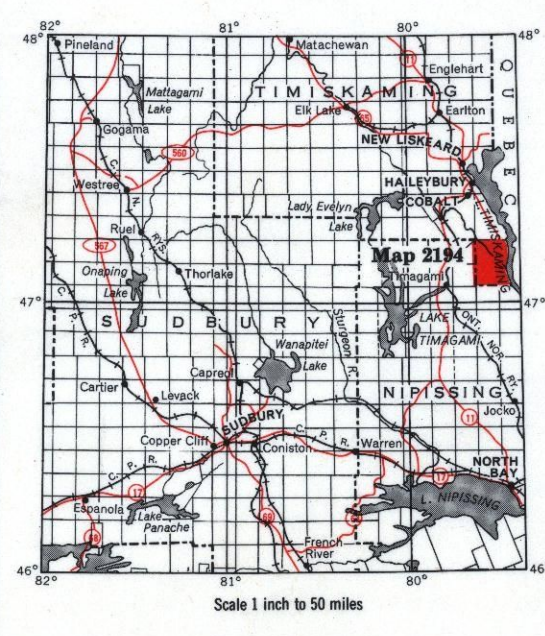
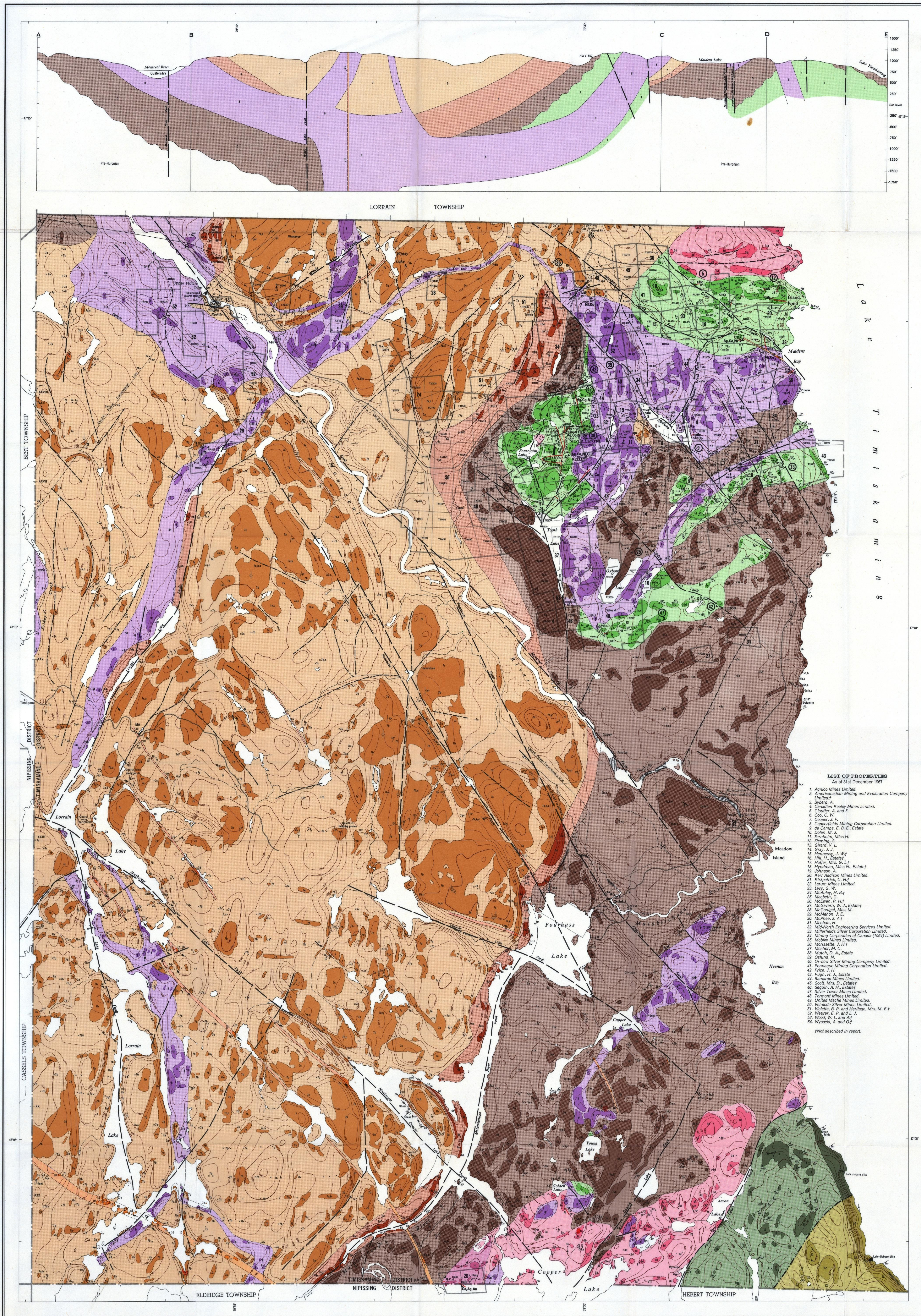


Figure 2.
Underground plans of the main productive area of South Lorrain Township, showing structural contours and main veins. (From company plans.)



LEGEND

CENOZOIC*

PLEISTOCENE AND RECENT
Sand, gravel, till.

UNCONFORMITY

PRECAMBRIAN*

GRENVILLE PROVINCE

METASEDIMENTS

12 Biotite-quartz-feldspar paragneisses.

FAULT CONTACT

ROCKS NOT ASSIGNED TO SUPERIOR OR GRENVILLE PROVINCES

UNCLASSIFIED METASEDIMENTS*

11 Quartzose and quartzite-feldspathic paragneisses, characterized by open folds.

FAULT CONTACT

SUPERIOR PROVINCE

PROTEROZOIC

LATE MAFIC INTRUSIVE ROCKS

10 Olivine diabase (Keweenawian).
9 Diabase, undifferentiated (may be Keweenawian age in part).
8a Quartz diabase.
8 Quartz diabase (Nipissing).

INTRUSIVE CONTACT

HURONIAN

COBALT GROUP
LORRAIN FORMATION*
7a Undifferentiated.
7a Grey feldspathic quartzite.
7b Pale green to white quartzite.
7c Arkose.
7d Red quartzite.

FIRSTBROOK FORMATION*
6a Undifferentiated.
6a Laminated quartzite.
6a Quartzite.

COLEMAN FORMATION*
5a Undifferentiated.
5a Quartzite siltstone and greywacke.
5a Arkose.
5a Conglomerate.
5a Schistose rocks.
5a Laminated argillite.

UNCONFORMITY

ARCHAEO

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS*

4 Quartz diorite.
3a Granitic rocks, undifferentiated.
3a Hornblende granite.
3a Gneissic granite.
3a Gneissic diorite.
3a Quartz monzonite.

INTRUSIVE CONTACT

EARLY MAFIC INTRUSIVE ROCKS*

2a Laminophyre, undifferentiated.
2a Hornblende lamprophyre.
2a Biotite lamprophyre.

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS*

1a Undifferentiated.
1a Intermediate to mafic metavolcanics.
1a Amphibolite to basaltic rocks.
1a Metadiabase, metabasalt, or diabase flow.
1d Quartzite and greywacke.
1e Felsic metasediments with or without interbedded quartzite.
1f Pyroclastic rocks.
1g Quartz-feldspar porphyry.
1g Schist, mainly chloritic.
1f Pillow lava.

LIST OF PROPERTIES
As of 31st December 1967

1. Agricola Mines Limited.
 2. American Mineral Mining and Exploration Company Limited.
 3. Byberg, A.
 4. Canadian Nickel Mines Limited.
 5. Cloutier, A. and F.
 6. Coe, C. W.
 7. Cooper, J. F.
 8. Copperfields Mining Corporation Limited.
 9. de Camps, E. B. E., Estate.
 10. Dolan, M. J.
 11. Fennell, Miss H.
 12. Heming, S.
 13. Gray, J. L.
 14. Gray, J. L. & W.
 15. Hemmings, J. W.
 16. Hill, H., Estate.
 17. Holler, Mrs. G. L.
 18. Hyndman, Miss N., Estate.
 19. Johnson, A.
 20. Kerr Addison Mines Limited.
 21. Kirkpatrick, C. H.
 22. Larum Mines Limited.
 23. Levy, G. W.
 24. McAulley, H. B.
 25. McArthur, G.
 26. McEwen, R. H.
 27. McEwen, W. J., Estate.
 28. McGonigal, Miss M.
 29. McMahon, J. C.
 30. McPherson, J. A.
 31. Meenan, M. C.
 32. Mid-North Engineering Services Limited.
 33. Minnesota Silver Corporation Limited.
 34. Mining Corporation of Canada (1964) Limited.
 35. Molloy Mines Limited.
 36. Morissette, J. H.
 37. Mouch, M. C.
 38. Mouch, D. A., Estate.
 39. Ouland, H.
 40. Ox-Bow Silver Mining Company Limited.
 41. Pennington Mining Corporation Limited.
 42. Price, J. H.
 43. Price, J. H.
 44. Ramond Mines Limited.
 45. Reardon, D., Estate.
 46. Sequin, A. H., Estate.
 47. Silver Star Mines Limited.
 48. Toronto Mines Limited.
 49. United Media Mines Limited.
 50. Veinhold Silver Mines Limited.
 51. Weller, E. P. and L. J.
 52. Wood, W. L. and A. J.
 53. Wysocki, A. and O. J.
- *Not described in report.

*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 map unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.

*Age unknown.

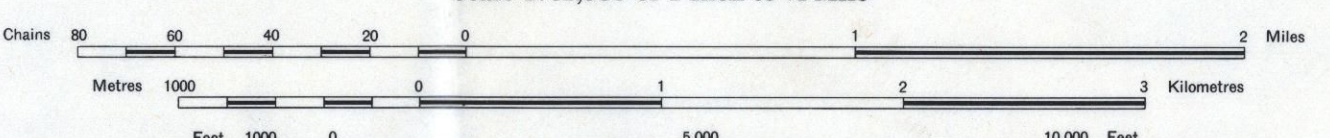
*The rocks in these groups are subdivided lithologically and the order does not imply age relationship within the group.

SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, horizontal.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top indicated by arrow; (inclined, vertical, overturned).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Lava flow, top (arrow) from pillows shape and packing.
- Direction of paleocurrent.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position inferred.
- Grenville Front; approximate location of metamorphic, intrusive or structural boundary.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Lineament.
- Jointing; (horizontal, inclined, vertical).
- Drill hole; (vertical, inclined).
- Drill hole; (projected vertically, projected up dip).
- Vein, vein network. Width in inches.
- Shaft; depth in feet.
- Magnetic attraction.
- Triangulation station.
- Muskeg or swamp.
- Motor road. Provincial highway number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Topographic contours, elevations in feet above mean sea level.
- Building.
- District boundary, with mileposts, approximate position only.
- Township boundary, approximate position only.
- Property boundary, approximate position only.
- Claim line, surveyed, approximate position only.
- Location of mining property, surveyed. See list of properties.
- Location of mining property, unsurveyed. See list of properties.

Map 2194
SOUTH LORRAIN TOWNSHIP
TIMISKAMING DISTRICT

Scale 1:31,680 or 1 inch to 1/2 mile



SOURCES OF INFORMATION

Geology by W. H. McIlwaine and assistants 1964, 1965, with revisions to December 31st, 1967.
Geology is not tied to surveyed lines.
Geological maps and assessment work of mining companies.
Preliminary maps, P. 289, South Lorrain Township (North part) issued 1968, P. 305, South Lorrain Township (South part) issued 1968, scale inch to 1/2 mile.
Cartography by D. V. Innes and C. A. Love, Ontario Department of Mines, 1969.
Basemaps derived from Forest Resources Inventory maps and claim survey plans of Ontario Department of Lands and Forests with additional information by W. H. McIlwaine.
Magnetic declination approximately 9°W, 1965.