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THIRTIETH ANNUAL REPORT
OF THE
ONTARIO DEPARTMENT OF MINES

BEING
VOL. XXX, PART III, 1921

Gowganda and Other Silver Areas

By A. G. Burrows

I. GOWGANDA SILVER AREA (Fourth Report)

II. AULD AND CANE TOWNSHIPS

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO



TORONTO:
Printed and Published by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty
1922

Printed by
THE RYERSON PRESS.

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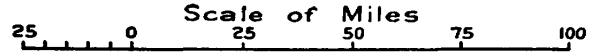
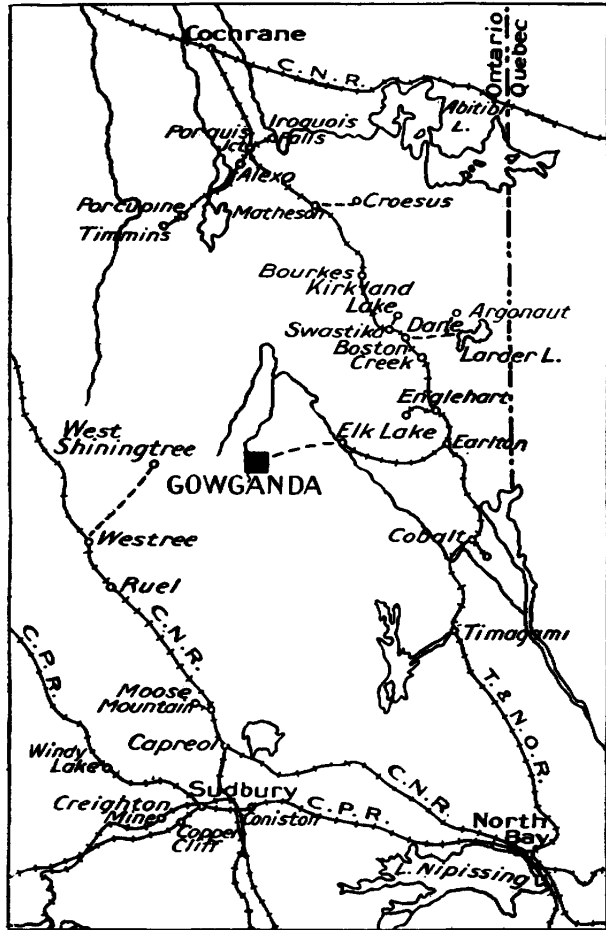
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No. 30b.—Part of the Gowganda Silver Area (Second Edition, 1921.)

(In pocket on inside of back cover.)

Section showing relationship of Nipissing diabase sill to older formations at Gow- ganda	<i>Insert facing</i> 18
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Sketch Map showing location of Gowganda.

I.—GOWGANDA SILVER AREA

(Fourth Report)

By A. G. Burrows

Introduction

The greater part of the field season of 1920 was spent by the writer in revising the geology of the Gowganda Silver area, special attention being given to the occurrence and structure of the Nipissing diabase sill with which the silver deposits are associated.

H. T. Leslie and H. C. Rickaby of Toronto acted as assistants and performed their work well. A number of cross-sections illustrating the position of the diabase sill in its relation to the other formations were prepared from their field work.

The map accompanying the report is a revision of that published in 1910 to accompany the Second Report on the Gowganda Silver Area. It has been enlarged to include portions of the townships of Donovan and Corkill, where discoveries of silver have been made in recent years. Part of the geology in Shillington, Chown, Lawson and Corkill townships has been taken from W. H. Collins' map (1) of the Gowganda area.



Gowganda Lake looking south-west from "Tower" hill.

Location

The Gowganda Silver Area is situated in the south-west part of the District of Timiskaming and forms part of the Timagami Forest Reserve. Gowganda (2) lake, from which the area derives its name, lies about 56 miles north-westerly from Cobalt. The nearest railway station is Elk Lake, the terminus of a branch line running westerly from Earleton, which

(1) Geol. Survey of Canada, issued in 1913.

(2) Gowganda is an Indian name, meaning "porcupine's home."

is on the main line of the Temiskaming and Northern Ontario Railway. From Elk Lake there is a motor road, 27 miles in length, to the village of Gowganda. The easterly part of the road from Wigwam to Elk Lake is in good condition for motor traffic, and it is planned to improve the westerly portion in 1922. A stage operates daily, except Sunday, between Elk Lake and Gowganda.

Topography

The general character of the surface of the country is quite similar to that of other parts of the pre-Cambrian of Northern Ontario. Viewed from hilltops, the surrounding horizon presents a series of gentle undulations with here and there a break, caused by a prominent hill or ridge. In detail, however, the surface is very rough and broken, and different geological formations present differences in surface contour. Rocky ridges alternate with swampy depressions abounding in small lakes over much of the area. The large lakes usually have considerable rocky shore-line, and the water in them is clear. Generally, the longer axes of the lakes are north and south, this being the prevailing direction of the ridges.

The area is situated near the head-waters of the Montreal river, and most of it is drained by the waters of the East Branch of that river, which, together with other streams, flow northward. There is a marked parallelism in the large lakes, which are quite numerous: Spawning, Elkhorn, Gowganda, Obushkong, Bloom, Wigwam, Lost and Calcite lakes. The depressed valleys in which these lakes are found probably originated in extensive north-south fault movements.

The most prominent features are the diabase, conglomerate and greywacké ridges; whereas the granite and syenite of the Laurentian, and the schists of the Keewatin generally occur in low rounded ridges and depressed parts of the area. The highest elevation is attained southwest of Spawning lake, in a greywacké ridge, which is 400 feet above the surrounding level, or about 1,550 feet above the sea. The conglomerate hill to the north east of Obushkong lake is 200 feet above the lake. The diabase ridge at the Gamey-Thompson property in the west part of Van Hise is 200 feet above the plain. Usually the ridges vary from 50 to 150 feet in elevation.

Superficial Deposits

The superficial or unconsolidated material is chiefly sand and gravel and sandy and gravelly loam of glacial origin. The area lies some miles south of the southerly limit of the great clay belt of Northern Ontario. There is no large tract of agricultural land, although in small patches near Gowganda village and at some of the mines fine vegetables are grown.

Jack pine plains and rolling sand ridges are characteristic of most of the south and east parts of the area.

Large parts of Charters, Lawson and Corkill townships are covered with sand deposits which conceal most of the rocks. Some of the low, swampy areas are extensive, as in the northeast part of Leith township.

The timber is chiefly white and black spruce, birch, balsam, jack pine and poplar. Red and white pine are found in small groves in isolated parts. Around Gowganda lake the timber is mostly small, but to the south, in Leith and Charters townships, it is of good commercial size.

Forest fires have destroyed large tracts of timber, particularly in the townships of Haultain, Nicol and Van Hise.

Glaciation

The marks of glaciation, varying from fine striæ to broad grooves or rounded hummocks, are evident at many points. The ice mass moved about due south in this area. Immediately west of Myrtle lake the glacial striæ are S. 10 deg. E. mag., and about 3 miles south on the Crawford claim, H. S. 359, they are S. 20 deg. W. magnetic.

Literature

References to the Gowganda area are to be found in the following reports:

- 1876.—R. Bell, Report of Progress, G.S.C. 1875-6.
1900.—J. R. L. Parsons, Report of Surveys and Exploration of Northern Ontario, 1900.
1907.—W. R. Rogers, 16th Report Ont. Bur. Mines, Part II.
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1909.—W. H. Collins, Preliminary Report on Gowganda Mining Division, G.S.C. No. 1075.
1910.—W. H. Collins, Economic Geology, Vol. V.
N. L. Bowen, Jour. of Geol. Vol. XVIII.
1912.—G. M. Colvocoresses, Gowganda in 1911, Can. Min. Journ., April 15, 1912.
1913.—W. H. Collins, Geology of Gowganda Mining Division, G.S.C. Memoir 33.
A. G. Burrows, Gowganda Silver Area, Ont. Bur. Mines, Vol. XIX, 1913, Part II, p. 165.
1920.—A. G. Burrows, Gowganda Silver Area, Ont. Dept. of Mines, Vol. XXIX, Part III., 1920.

Production

Shipments have been made from the Gowganda area from the year 1910 up to the present. These have been derived from properties in the vicinity of Miller lake and west of Gowganda lake, together with a few isolated shipments from outlying townships. The great preponderance of ore shipped has come from northwest of Miller lake. Several shipments of high-grade ore have been made from the Mann ridge west of Gowganda lake. From 1910 to 1912 the Millerett mine was the chief producer, the ore coming chiefly from a shoot in the conglomerate which produced 500,000 fine ounces. The Miller Lake O'Brien, which has supplied most of the silver ore yet shipped from Gowganda, has been producing continuously since 1909. The latest property to make shipments is the Castle, ore being obtained not only from the diabase sill but from the Keewatin.

A table is appended giving the production of the mines of Gowganda from the beginning until the end of 1920, the total number of fine ounces of silver being 5,877,592, and of pounds of cobalt "paid for" 134,950.

PRODUCTION FROM GOWGANDA MINES, 1910-1920

Mine	Ore and Concentrates, Tonnage Shipped												Silver, ounces	Cobalt, lbs.			
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	Total Tons					
Bartlett	*																
Crews-McFarlan }									30.20	42.00		72.20	20219				
Bonsall.....	3.79										13.059	16.849	10046	101			
Boyd Gordon.....	27.00											27.00	4678				
Burk-Remey.....	1.8											1.8					
Calcite Lake.....	*																
Canadian Gowganda.....	*																
Castle (Trethewey).....											45.31	45.31	48373				
Miller Lake and Everett.....	*																
Kell.....											.792	.792	1621	254			
Mann.....			13.74	15.87	18.00							47.61	97792				
Millerett.....	347.0	128.0	192.00									667.00	611822	5000			
Miller-Lake O'Brien.....	31.0	141.5	112.60	166.90	113.90	109.66	170.57	350.00	160.40	189.79	115.087	1661.407	4993457	129595			
Powerful.....	*																
Reeve-Dobie.....	54.0						11.00	5.75		1.94	10.44	83.13	88584				
Welch.....	1.0											1.00	1000				
Total Ore & Concentrates, tons	465.59	269.5	318.34	182.79	131.90	109.66	181.57	355.75	190.60	233.73	184.688	2624.118	5877592	134950			
" Silver ounces	471688	468687	549976	502370	399300	242229	383393	1064635	638193	723764	433352	5877592					
" Cobalt (paid for) lbs	8432							56884	26994	27404	15236	134950					

* In addition to the shipments reported to the Department of Mines and shown in the table of production, A. A. Cole's reports for the Temiskaming and Northern Ontario Railway Commission show the following additional shipments:

- 1909—Bartlett, 2 tons
- 1910—Everett, 8.35 tons; Powerful, 1 ton:
- 1911—Calcite Lake, 8.5 tons; Canadian Gowganda, 8 tons

Note.—Shipments of about 6½ tons have been reported in addition from the Hudson Bay properties in Leith township. The silver contents of the Burk-Remey shipment were never reported to the Department.

Table of Formations

The compact rocks of the area are of pre-Cambrian age. The chief geological subdivisions are as follows:

POST-KEWEENAWAN—	Olivine-diabase, quartz-diabase, aplite.
KEWEENAWAN—	Quartz-diabase (sill)
	<i>Intrusive Contact</i>
ANIMIKEAN— (COBALT SERIES)	UPPER: Conglomerate, quartzite, arkose. LOWER: Conglomerate, greywacké, quartzite.
	<i>Unconformity</i>
LAURENTIAN (?)—	Granite, syenite, gneiss.
	<i>Intrusive Contact</i>
KEEWATIN—	Basic and acidic volcanic and intrusive rocks, iron formation, chlorite and hornblende schist, &c.

Note: A number of diabase dikes are older than the Cobalt series and are probably later than the Algoman. They intrude the Laurentian and Keewatin.

Dikes of lamprophyre and dikes and masses of serpentine intrude the Keewatin. They may be of the same age as similar rocks at Cobalt to which W. G. Miller and C. W. Knight have given the name Haileyburian.

General Geology

The rocks at Gowganda are in general similar to those at Cobalt and other parts of Northern Ontario where the pre-Cambrian predominates. The oldest are of Keewatin age, consisting of altered volcanic rocks; greenstones, volcanic fragmental, &c., also iron formation, and with dikes of light-coloured porphyritic rocks. The whole series has been greatly altered to schist, of which hornblende and chlorite schist form a large part. They are in marked contrast, from their ancient metamorphosed appearance and frequent vertical attitude where banded, to the later rocks.

The Keewatin was intruded by batholiths and smaller masses of granite and syenite, that are probably of Laurentian age. Some small masses of serpentine occur in the Keewatin, and numbers of basic dikes older than the Cobalt series intrude the Keewatin and Laurentian. These dikes were intruded long after the granite and syenite and are little disturbed.

This complex of older rocks was subjected to erosion, and on the irregular weathered surface the sediments of the Cobalt series were deposited. This series lies in gentle folds, with average dip of 10 deg. to 15 deg., and has been little disturbed except by the sill-diabase intrusion, when the dip is often higher on the hanging-wall side.

Later than all these rocks is a diabase sill or possibly sills, which occur for the greater part in the sedimentary rocks. Occasionally the diabase has been intruded below the contact of the Cobalt series with the Keewatin, since areas of the oldest rocks lie on the sill in the vicinity of Miller lake. A few basic dikes of olivine diabase and quartz diabase have intruded not only the older rocks but also the diabase sill. These are the youngest recognized rocks in the area.

Quartz-d diabase dikes are found in part of the area intruding the Cobalt series, being more common in Leith township than elsewhere. They may also be younger than the sill diabase, but, not being found in contact with the sill, their age cannot be definitely determined other than that they are later than the Cobalt series.

Keewatin

The rocks of Keewatin age occur in less volume than the Laurentian, Animikean and Nipissing diabase. They are distributed in isolated areas in several townships, the largest volume of these ancient rocks being in Van Hise, Haultain and Nicol.

The rocks are essentially of volcanic origin, and vesicular and ellipsoidal structures are occasionally seen. They are dominantly of basic composition, and are much altered to hornblendic and chloritic schists. Some of the rocks are massive, but most of them are altered to schist. Intermingled with the basic lavas are some fragmental rocks that resemble old conglomerate, together with some tufaceous or volcanic fragmental material. There are a few belts of banded iron formation, or jaspilite, now much crumpled. There are also numerous narrow bands of light-coloured rock, like old felsitic or porphyritic dikes, that are folded with the darker volcanic rocks, and which appear to have been intruded at an early time into the volcanic flows. When banded, the Keewatin rocks are in nearly vertical attitude, with a general strike about east and west. Very fissile rocks are common, and also schists that break into flat plate-like structures an inch or more in thickness.

Small masses of serpentine, together with narrow dikes of felsite, porphyry, lamprophyre and diabase, occur frequently in the Keewatin areas.

Types of Keewatin

Hornblende schist and amphibolite occur south of the southwest end of Everett lake. Part of the rock is banded, breaking into plates. A microscopic section shows green fibrous hornblende, the predominating mineral, with grains of zoisite, epidote, secondary feldspar and chlorite.

A greenish weathering massive rock occurs north of Miller lake. A specimen from the south line of claim R.S.C. 87 is scaly fibrous green hornblende, and may be called amphibolite. To the east of Miller lake the rock is more schistose, and is largely hornblende and chlorite schist.

West of Leroy lake the greenstone is much altered, and has a dull green mottled appearance. The rock is rather massive, but passes westward into schist, striking N. 65 deg. E. and dipping 70 deg. N.

To the west of Obushkong lake there is considerable hornblende schist and associated serpentine which is much weathered to a rusty brown color. The serpentine rock also contains some fibrous hornblende and magnetite.

A light-coloured rock is interbanded with greenstone to the west of Obushkong lake. It is fine-grained, consisting of crushed quartz and feldspar with glistening scales of white mica. A dark mineral in thin scales is chlorite, giving the rock a gneissic texture.

Pillow lava occurs half a mile north of Serpentine lake. It is interbanded with a dark-coloured volcanic fragmental rock, one-half mile northeast of Leroy lake. It occurs again on claim W. J. 7, southwest of this lake.

Amygdaloidal lava is associated with iron formation west of Elkhorn lake along the boundary line of Milner and Leith townships. The vesicles of the old lava are filled with quartz, calcite and epidote. Under the microscope the flow structure of the rock is beautifully shown in the parallel arrangement of the minute rods of plagioclase feldspar.

Iron Formation

Banded iron formation occurs in a small area of Keewatin southwest of Elkhorn lake and also one-half mile northeast of Gowganda lake. The formation is quite limited, consisting of interbanded silica and magnetite in thin layers less than 30 feet in width. No iron ore of importance occurs in these localities. The formation is quite crumpled in several separated small bands on claims W. D. 961-964. One silicious band on claim W. D. 963 contains a small deposit of massive iron pyrites.

Dikes in Keewatin

North of Brett lake are several narrow dikes of a reddish brown lamprophyre. The phenocrysts are augite set in a groundmass of feldspar and scales of fibrous hornblende. Calcite in grains and veinlets is also seen.

In the same area there are several dikes of rather fresh-looking diabase. A microscopic examination of one proves it to be a hornblende diabase. The age of many of the diabase dikes cannot be stated definitely, since several that are fresh-looking have proven to be of vastly different age in other parts of the area.

Quartz-Porphry

There is a large mass of greenish-grey quartz-porphry directly northeast of Gowganda lake. It forms the main rock of a number of mining claims, many of which show simply the porphyry and narrow north-south dikes of diabase. The porphyry intrudes green schist and iron formation on claims W. D. 961 and is therefore younger than certain of the Keewatin rocks. On the previous geological map of Gowganda it was classed with the Keewatin. It occurs rather as a stock than a dike since its outcrop is nearly round in shape.

No gold has been found in this rock, as in certain quartz-porphyrines in some parts of northern Ontario. The formation may possibly be of Laurentian age.

Phenocrysts of quartz are frequently recognized in the porphyry, although there are portions of the mass that are simply a light greenish-grey felsite.

A section of a sample from the south line of claim R. S. C. 123 shows abundant quartz phenocrysts and a few ragged outlines of feldspar. The groundmass is granular quartz and feldspar with a little chlorite.

Laurentian

The rocks at Gowganda classed as Laurentian are granite and syenite, which are in large volume in the townships of Haultain and Van Hise. They are of pink and grey colour, and at times the granite grades into a syenite.

There is a tendency in some parts for the acid rocks to show indications of a gneissic structure, but banding and intense metamorphism, such as occur in the Laurentian in some localities, are not found. There is also the possibility that the granite and syenite may be of later age, say Algomian, but there is no way of deciding this point since no rocks of Timiskaming age occur in the area.

The most common variety is a hornblende granite, generally pink or flesh-coloured. A microscopic examination of a granite from west of Bloom lake shows a hypidiomorphic mixture of quartz, feldspar (orthoclase and acid plagioclase) and green hornblende with a little titanite, apatite and magnetite as accessory minerals. North of Everett lake and extending westerly to Davidson lake, the rock is more syenitic. Dikelets of the syenite intrude the Keewatin west of Everett lake.

Another common type is a grey biotite granite which is intermingled with the hornblende syenite.

There is a small area of porphyritic syenite in Nicol township, just northeast of Wilson lake. Where it approaches the basic Keewatin rocks it becomes darker in colour, with blotches of basic material which have been absorbed from the Keewatin. The porphyritic texture is well marked on the weathered surface where the phenocrysts have been bleached out. Zonal structure is pronounced in the crystals of feldspar, and is due to the regular arrangement of included minerals. The ferromagnesian minerals are green hornblende and a little biotite altering to chlorite; quartz is present in small grains.

Pre-Cobalt Series Dikes

There are numerous dikes of diabase that are at least older than the Cobalt series. They occur in profusion throughout the Keewatin area northeast of Gowganda townsite, east of Miller lake and elsewhere. These dikes have an approximate north and south strike. They are fresh-looking rocks, and except by their association are difficult to distinguish from similar-appearing dikes that occur in the Cobalt series and that occasionally intrude the Nipissing diabase. They generally contain some quartz grains, but on the whole are darker-looking than the quartz diabase of the sill. They show a somewhat rusty surface, whereas the sill diabase usually has a lighter-coloured oxidized appearance. Porphyritic texture is not uncommon in the dikes, with phenocrysts of feldspar varying from half an inch to three inches in length. Such porphyritic texture is not recognized in the diabase sill, and this criterion will serve to distinguish the dikes from the sill where only scattered exposures occur through the drift and relationships cannot be seen. The dikes occurring rarely in the Cobalt series and those that cut the diabase sill strike more nearly east and west than north and south. A number of north and south dikes intruding the syenite-porphphyry, which is considered of Algomian age, were observed in the Matachewan area. No acid intrusive rocks that seem to be of Algomian age occur with similar dikes at Gowganda, but the north and south trend and nearness of localities together with the similarity of appearance suggest that the Gowganda dikes are probably also of post-Algomian age. This would place these dikes between the Algomian and Cobalt series in age, and younger than the basic intrusives called Haileyburian in the vicinity of Cobalt.

The dikes have no special characteristics, being of ordinary diabase consisting essentially of plagioclase and pyroxene, with or without inter-

stitial quartz. No olivine was observed in sections examined. Two porphyritic dikes are very striking in appearance, one on the transmission line, claim H.F. 209, and the other crossing the main road, on claim T.C. 458, west of Leroy lake. The former of these is older than an adjacent diabase dike with similar north-south strike.

The dikes are not of economic importance as a source of silver since they are much older than the diabase sill. Considerable prospecting was done on them before their age relations were known. Unless in proximity to the sill the possibility of silver-bearing veins being found in them is remote. One of the most interesting localities where the dikes occur is on claims W. D. 961 and W. D. 964. Here they intrude a quartz-porphry, or felsite, and iron formation, but are overlain unconformably by conglomerate of the Cobalt series. All these formations are intruded by a younger quartz-diabase dike that strikes a few degrees north of east.

Cobalt Series

The Cobalt series covers a great part of the Gowganda area, resting unconformably on the Keewatin-Laurentian complex and being in marked contrast with them. The series has been little disturbed, except where it is in proximity to the intrusive sill of diabase. The strata usually dip at low angles, averaging 15 degrees, for the most part eastward. Near the diabase they are frequently tilted to higher angles, as shown in the outcrop of slate-like greywacké on the easterly side of the high ridge of diabase east of Lost lake. A similar high dip in reddish slaty rock is seen northeast of Lake Irene. In these cases the sediments overlie the sill diabase. No secondary cleavage has been developed, the parting in the slaty varieties following the stratification.

The series includes conglomerate, breccia, greywacké, slate, quartzite and arkose. The lowest formation is usually a basal conglomerate that rests on the Keewatin and Laurentian. Many of the fragments of the conglomerate can be duplicated in rocks that occur in place in the vicinity. The pebbles and boulders include granite, syenite, greenstone, iron formation, diabase, &c.

Greywacké, which in places carries pebbles very sparsely and is occasionally quartzitic, occurs over most of the western parts of Leith, Milner and Van Hise townships. Conglomerate is seen at intervals along the west shore of Gowganda lake, on the south end of the long point on the lake, and frequently also east of the lake.

Freshly banded slate-like greywacké occurs southeast of Myrtle lake on the east side line of claim T. C. 156, and at several other points. It is often brecciated. This is well seen in the locality just mentioned where the slate is in a bluff dipping eastward. The top of the cliff is much brecciated, and overhangs the normal slate below it, which has crumpled away. Similar breccia is seen west of Frying-Pan lake, and on the government road a mile east of Lost lake. These occurrences are near the late diabase, and the brecciation may be due to the diabase intrusion. However, the occurrence near Myrtle lake lies above the contact with the diabase, with layers of undisturbed slate between.

Typical arkose and quartzite occur in great volume in parts of the area, particularly in the southeast portion, including parts of Nicol, Charters and Corkill. The large island on Gowganda lake is composed of quartzite. The arkose and quartzite are generally coarse-grained and thick-bedded, so that the dip is not always readily recognized.

About half a mile north of Wilson lake in Nicol township, the rocks of the Cobalt series dip gently to the west from the Keewatin. The succession is greywacké-conglomerate, slate, quartzite and an upper coarse conglomerate which resembles the conglomerate on the west shore of Gowganda lake. This succession of strata is seen in other parts of the area. Sometimes the greywacké-conglomerate, usually called slate-conglomerate, is underlain by a coarse basal conglomerate which resembles the upper conglomerate.

The latest of the sediments are quartzite and arkose which are sometimes underlain by a reddish slaty-greywacké.

The upper series has a widespread distribution southeast of Gowganda consisting of quartzite arkose and thin beds of quartz-conglomerate which, according to Barlow, have a thickness of 1,100 feet at Maple Mountain. Collins states that the thickness of the lower and upper formations of the series in its present greatly eroded state probably does not exceed 1,000 feet.



"Tower" hill, showing unconformity between conglomerate of the Cobalt series, and Keewatin.

The upper series of quartzite and arkose appears to be barren of economic minerals, but at certain localities it is intruded by sill diabase that carries silver-bearing veins.

Unconformities at base of Cobalt Series

Numerous unconformities between the Cobalt series and older rocks occur in parts of the area, a few of which are herewith described. There is a thin patch of conglomerate, with the underlying granite exposed in places through it, on the northwest shore of Obushkong lake. The conglomerate has rounded and angular fragments of the granite, and also a rusty-weathering diabase which cuts the Laurentian immediately at the contact.

An even more striking conglomerate occurs on claims W. D. 961 and 964 northeast of Gowganda lake. The high conglomerate ridge, on which is located the fire ranging observation tower, rests on a greyish-green quartz-porphry, iron-formation and diabase dikes of pre-Cobalt series age. Fragments of all these rocks are found in the conglomerate, near its base.

North of Wilson lake, in Nicol township, there are patches of conglomerate on the syenite. The latter rock has a characteristic porphyritic texture, and fragments of it are quite numerous in the conglomerate. The presence of so varied a group of inclusions from rocks occurring in place near the conglomerate indicates that many of the constituents of the conglomerate were local, and not transported any great distance. The old Keewatin-Laurentian surface, on which the Cobalt series was deposited, seems to have resembled greatly in topography that of the present time.

Unconformity in Cobalt Series

In 1909, N. L. Bowen found an unconformity on the north line of H. R. 311, west of Obushkong lake, where greywacké and fine grained arkose show on a bluff about 12 feet in height. At the base of the arkose there are about two feet of a coarse reddish conglomerate containing some small pieces of greywacké which, under the microscope, prove to be the same as the underlying greenish rock, indicating a break in the normal deposition. A similar break was seen southeast of Flanagan lake, near the south line of claim H. S. 712. West of Gowganda lake, and on the long point extending into the lake, an upper conglomerate with a coarse reddish matrix occurs in considerable thickness. Similar conglomerate is seen in other parts of the area. The writer is not certain that the few feet of conglomerate below the arkose series on Obushkong lake is equivalent to all this coarse upper conglomerate. Where a great thickness of conglomerate occurs, a search failed to show any fragments of the underlying greywacké in it or many signs of an uneven and eroded surface.

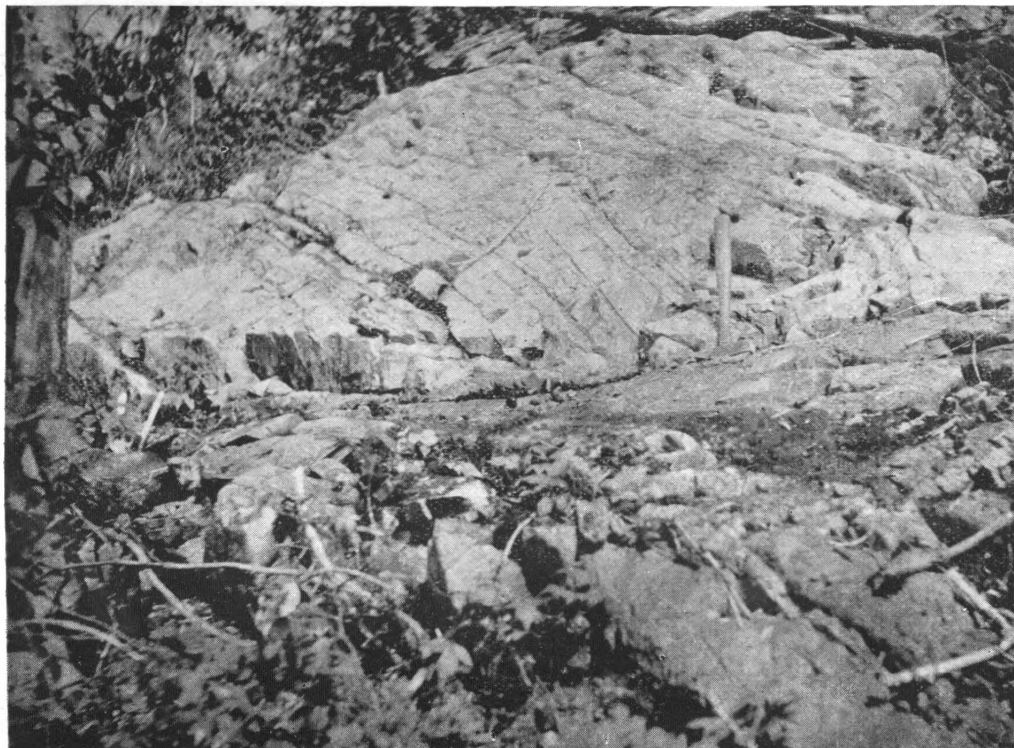
It would appear that there is a local discontinuity in deposition at some points, but the general stratification and dip remain the same in the lower and upper parts of the Cobalt series. Owing to the widespread occurrence of the quartzite and arkose, it is possible to distinguish them from the conglomerate and slaty greywacké by different colours on the map, but the conglomerate, which appears to be part of the upper series, is difficult to separate, consequently it has been grouped with the other sediments apart from the quartzite and arkose. In the earlier reports on the Cobalt area the upper quartzite and arkose were called the Lorrain series. These rocks are similar to those at Gowganda.

Adinole

Where the sill diabase has been intruded into slate-like greywacke, the overlying rock has been sometimes altered by diabase to adinole. The rock occurs abundantly around Lost Lake, being reddish in colour and consisting principally of quartz and crystallized feldspar. Round blackish spots are often developed in the sediments near the contact. A rock of this description is seen along the road a mile west of Lost lake and on claim M.R. 2239 (O'Gorman) in Leith township.

Nipissing Diabase

The most important rock from an economic point of view is the fresh quartz diabase that occurs in the form of laccolithic sills over a great part of the Gowganda area. The resemblance of the outlying areas of diabase to the silver-bearing diabase sill at Cobalt led to the finding and prospecting of all such outcrops over a very wide area stretching from Cobalt to Shining Tree. The Gowganda area is only one part of this wider area in which isolated masses of quartz diabase have been discovered. Consequently, the diabase at Gowganda is similar to that at Cobalt, with the exception that at Gowganda there is a considerable development of the red facies of the diabase, known as granophyre or red rock, in addition



Top of diabase sill with overlying banded slate-like greywacké, exposed on claim G. G. 4108, north of Irene Lake.

to the normal dark-grey diabase. Numerous microscopic descriptions of the Nipissing diabase have been published, including those by C. W. Knight (1), N. L. Bowen (2), and W. H. Collins (3).

The rock is generally intermediate to coarse-grained, except at or near contacts where it may be fine-grained and trap-like in texture.

The principal minerals of the normal diabase are plagioclase, usually laboradorite or a feldspar near it in composition, together with augite, affording an ophitic texture. Generally primary quartz, either alone or in microscopic intergrowth with feldspar, is present in the interstices. From the almost constant presence of quartz in micrographic intergrowth with feldspar, C. W. Knight has referred to the rock as a

¹ Report, Ont. Bur. Mines, Vol. XIX, 1913. Part II, p. 98.

² Journal of Geology, Oct.-Nov., 1910.

³ G. S. C. Memoir, No. 33.

quartz diabase. Small quantities of biotite and magnetite, and occasionally apatite and pyrite, are present. N. L. Bowen has found a subordinate pyroxene, which he believes to be enstatite, in sections from the Gowganda diabase. Ordinarily the diabase is of a dark-grey colour, weathering to a lighter shade, with brownish spots of weathered pyroxene showing on the surface.

This normal type of diabase is observed all across from the foot to the hanging-wall in the sill just west of Miller lake, with no red rock produced as differentiated material. The hanging-wall here is basic Keewatin.

In some places in addition to the grey feldspar there is red feldspar, imparting a mottled character to the diabase. The red is a more acid plagioclase and occurs with quartz in the interstices. This facies can be observed in places along the ridge west of Gowganda lake, e.g. at the Crews-McFarlan and Reeve-Dobie properties, along with the normal dark grey diabase.

Red Rock

A bright red to brown igneous rock occurs frequently with the normal diabase in several parts of the area. It is well exposed to the east and west of Lost lake. It resembles granite, but, owing to its prominent micropegmatitic texture, is called granophyre. Microscopically, it shows crystals of albite surrounded by a radiating intergrowth of quartz and acid plagioclase, together with small quantities of chlorite. The granophyre is so coarse-grained in some localities that the micrographic intergrowth can be recognized in hand specimens. This abundant granophyric rock occurs at the top of the diabase sill in the vicinity of Lost lake, at any rate where remnants of sedimentary rock can still be observed.

The origin of the red rock has been discussed fully by N. L. Bowen and W. H. Collins in the reports previously mentioned. In brief, Bowen believes the red rock, or granophyre, together with adinole, to have been formed by hydrothermal action at the contact on superincumbent slaty rocks. Collins states that most of the red rock has resulted from a differentiation of the diabase magma, with a small portion at the top of the sill being formed by assimilation of overlying greywacké and slate.

Certainly in the vicinity of Lost lake there is strong evidence of contact assimilation and at points it is difficult, if not impossible, to define the boundaries of the intrusive and the sediments.

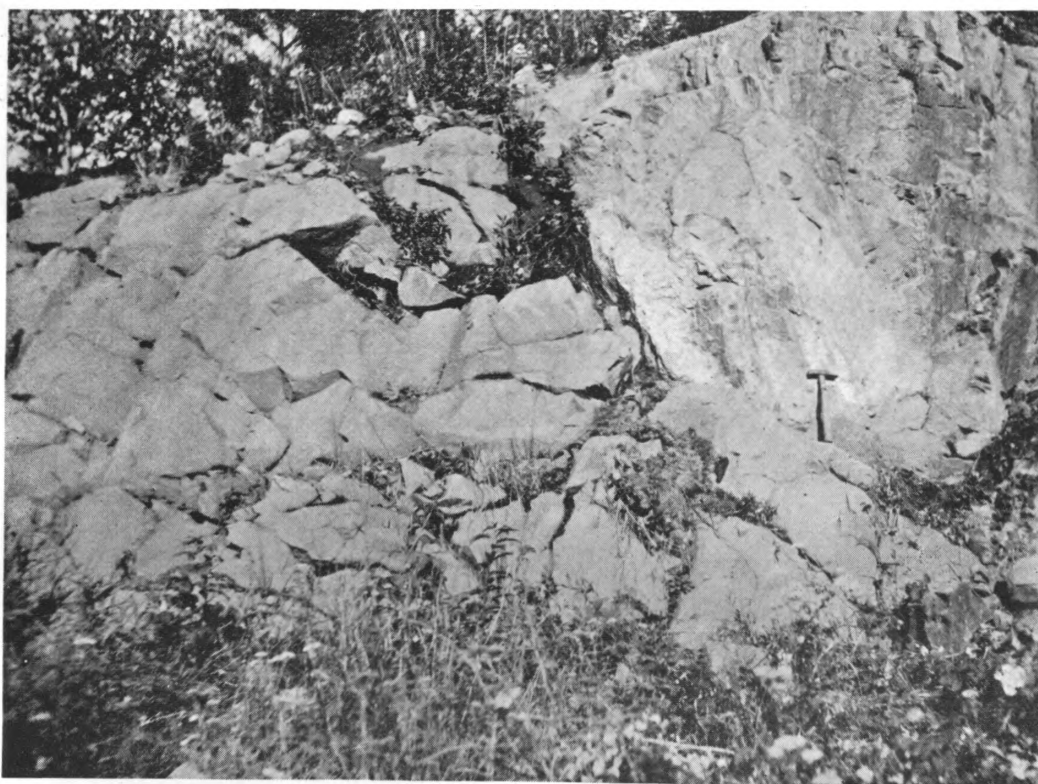
Structure of Diabase

Miller Lake Area

Since the first examination was made by the author over ten years ago, repeated forest fires have devastated much of the Gowganda area so that parts have been burned off cleanly, affording many opportunities to note the relationship of the various rocks. Numerous contacts of the diabase with older rocks are well exposed in Haultain and Nicol townships. The sill character of the diabase can be determined from exposures showing both the bottom and the top of the intrusion.

Footwall Contacts.—The footwall of the sill outcrops at various points from the wagon road on claim H. J. B. 46, northerly to claim R. S.

C. 102, near Everett lake, where it swings eastward and northeastward to Shanty lake and beyond. The contact varies from nearly horizontal to 60 deg. Near Shanty lake the diabase overlies the slate-like greywacké almost horizontally, and on claim L. M. 108 it overlies Keewatin banded rocks, dipping 60 deg. N. One of the best footwall contacts occurs on Claim H. J. B. 46 to the south of the road, one and a half miles east of Gowganda lake. The diabase in thin isolated patches overlies the sedimentary rock nearly horizontally in places, with a general undulating dip to the northeast. Judging from the contacts along the footwall edge of the diabase, the sill was intruded very irregularly, only conforming to the dip of the sedimentary strata where they are highly stratified, e.g., the greywacké slate near Shanty lake. The attitude of the sill on claim L. M. 108 has been influenced by the highly banded, nearly vertical character of the Keewatin rocks.



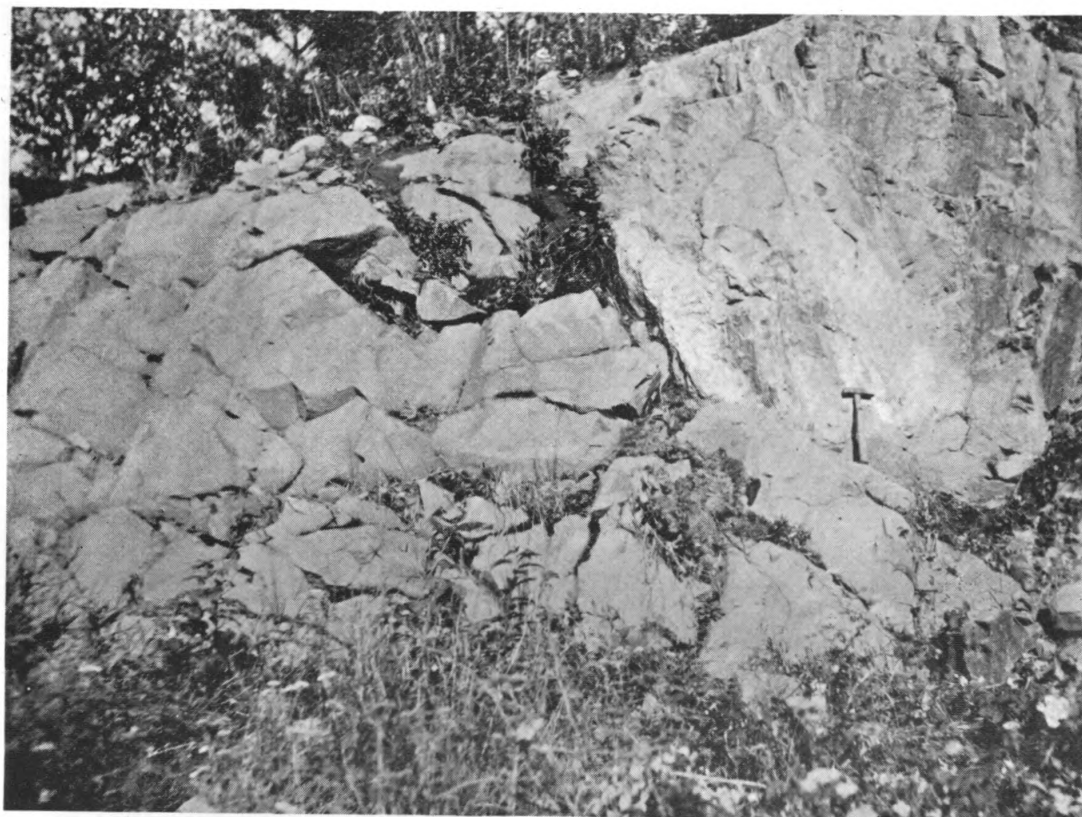
Diabase sill overlying Keewatin N.E. of Castle No. 2, near Everett lake.

Hanging-wall Contacts. —The observed contacts at the upper side of the diabase sill are even more numerous than the bottom. The upper contact is well exposed 100 feet west of No. 2 shaft, Castle mine, R. S. C. 101, on claims R. S. C. 95, 91 and 94 of the Miller Lake O'Brien mine, on R. S. C. 136 (Hart) claim, on claims W. J. 13 and W. J. 6, southwest and south of Leroy lake respectively, and on claim P. B. 140 southeast of Leroy lake.

The circular area of Keewatin rocks, overlain in part by the Cobalt series, occurring in the vicinity of Miller lake, rests on the diabase sill, and it is around this area that most of the contacts just referred to are located. The area of Keewatin and Cobalt series to the east of Leroy lake also lies on the sill, as do the greywacké and conglomerate around Lake Irene. To the east of Lost lake and extending northward to Bloom lake,

the diabase sill dips under the sediments of the Cobalt series. For this area the diabase sill has an undulating character, being exposed in places by partial erosion, and at other places concealed by the overlying Keewatin and later sediments. Westward, toward Gowganda lake, the sill has been entirely removed by erosion.

A great number of silver discoveries have been made in the diabase where it is in proximity to the contact with the overlying rocks; that is, in the upper part of the sill around the margin of the Keewatin-Cobalt series area in the vicinity of Miller lake. A few discoveries of silver have also been made in the overlying rocks.



Diabase sill underlying Keewatin, along road south of Leroy lake.

Columnar jointing in the diabase, representing structure at right angles to the cooling surface, is well developed at various places. It is particularly well shown in the cliffs on the Bonsall property, R. S. C. 83, also on claim H. R. 716, S. E. of Leroy lake.

The relationship of the sill diabase to the other rocks is illustrated in a number of cross-sections accompanying this report.

Area West of Gowganda Lake

A sufficient number of contacts have been observed to show that the various outcrops to the west of Gowganda are parts of one sill that has been exposed here and there by erosion of some of the overlying sedimentary rocks. Several ridges of diabase with a north and south strike and with intervening bands of sediment occur from the long point on Gowganda lake westward to Elkhorn and Spawning lakes. The intrusion of the diabase sill was not regular but undulating, principally eastward and westward.

The mass of diabase lying between the north and northwest arms of Gowganda lake dips under the sediment to the east and west. At the north end of this ridge, as shown on claim H. F. 250, the diabase sill rises and the footwall is exposed, showing a thin sheet of diabase on the greywacké. Remnants of the diabase sill occur to the west and north of Diabase lake. The westerly edge of the diabase sill is the hanging-wall side, and the conglomerate along the northwest arm lies on the sill, which is again exposed on the Mann ridge where good contacts of the sediments with the sill can be seen on the LaBrick and Hewitt properties. To the west of the south end of Gowanda lake the Mann diabase ridge divides into two parts. The easterly part dips under the conglomerate to the east, but overlies the quartzite to the west. The westerly ridge also overlies the quartzite, but dips westward under the greywacke that occurs around Long lake. The areas of sediment from Long lake northward to-



Diabase underlying Keewatin, S. E. of Leroy lake on claim P. B. 140.

Stuart lake all overlie the sill, which outcrops again near Elkhorn northward to Spawning lake.

No contact was observed along the westerly edge of the diabase with the greywacké near Margueratt lake, but it is believed that this edge is the footwall side of the sill, the conclusion being derived from the attitude of the diabase bluffs facing westward which show columnar structure inclined to the east.

From Elkhorn lake eastward to Frying Pan and Hangingstone lakes only one contact was observed, namely, on claim T. C. 129, and this indicated the diabase to be dipping under the greywacke at an angle of 60 deg. S. E.

The most convenient locality to observe contacts of the sill diabase with the sediments is Gowganda lake. Numerous contacts occur along the

east shore of the long point in Gowganda lake showing the sill below the greywacke. The best of these are on claims H. R. 292, and H. S. 377. On the latter claim there is a wide exposure of diabase from which the overlying greywacké has been removed by erosion simply to the contact, exposing the trap-like character of the diabase at the top of the sill.

Good contacts occur also on claim H. S. 451 at the southwest end of the lake, where there is a thin sheet of sediment, a few feet thick, lying on the sill. Some adinole has been developed by contact metamorphism.

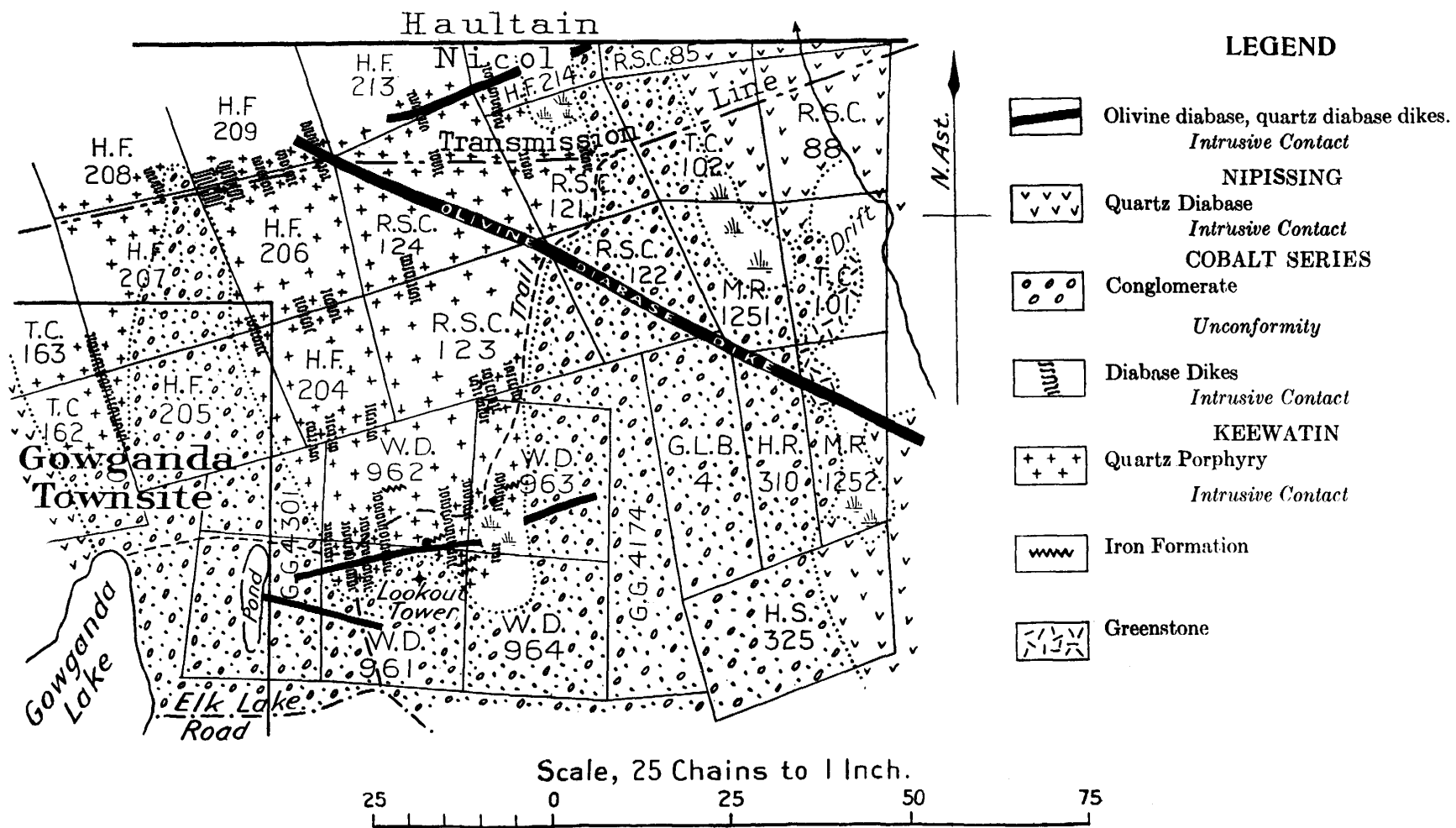


Remnants of diabase sill overlying quartzite on south side main road,
2 miles east of Gowganda.

Relations of Nipissing Diabase Areas

An examination of the map of Gowganda will show that the outcrops of sill diabase in the Miller and Lost lake area is separated from the area of sill diabase that lies west of Gowganda lake. Whether these separate areas of diabase are parts of one sill or represent two sills is not known. The topography to the north of Gowganda townsite shows a ravine from Gowganda lake northward to Dinny and Davidson lakes. The same depression can be followed southward by way of the east branch of the Montreal river. The sediments to the east and west of the depression are dissimilar.

The depression and dissimilarity of rocks could be explained by the possibility of a north-south fault in which the area west of the fault has been dropped. The ravine follows along the easterly edge of a long narrow ridge of diabase. Only one contact was observed along the east side, that being to the west of Davidson lake. The diabase-quartzite contact here is nearly vertical, the inclination, if any, being to the east. Along the west edge several contacts show the diabase overlying the quartzite at an angle of 45 degrees.



Geological plan of part of Nicol township, illustrating certain diabase dikes older than the Cobalt series, and others later than the Nipissing diabase.

Dikes Later Than Nipissing Diabase

Olivine Diabase

Only one olivine-d diabase dike was observed in the Miller lake section. This dike is about 100 feet in width and has been traced about five miles in a N.W.-S.E. direction. It intrudes all the other formations, intersecting the diabase sill that occurs around Miller lake. The dike is well exposed along the road on the ridge just west of the Canadian Gowganda property. The rock has a porphyritic texture, showing phenocrysts of light-greenish plagioclase up to an inch in length in an ophitic ground-mass of plagioclase, augite and olivine.

A second olivine diabase dike occurs to the northwest of Obushkong lake and is described by N. L. Bowen (1) in an earlier report on the Gowganda Silver Area. This dike may be a faulted portion of that previously described.

Quartz Diabase Dikes

There are also several quartz-d diabase dikes, that intrude the Cobalt series, whose relation to the diabase sill is unknown, and several that intrude the diabase sill. These are non-porphyritic, and have a more rusty weathered surface than the sill diabase. Two of these dikes, striking NE-SW, cross the Bonsall property, claims R. S. C. 83 and R. S. C. 84. Their relation to the silver-smaltite-bearing veins is not known. A calcite vein about 3 inches wide carrying masses of galena lies along the contact of one of these dikes with the sill diabase on claim R. S. C. 84. The pure galena carries 11.6 ounces of silver per ton.

Occurrence of Silver Ore

Silver-bearing veins have been found in widely separated areas from Cobalt westward to Shining Tree. Of the outlying areas Gowganda is the most important in discovery of veins and shipment of silver ore. Nearly all the silver deposits are in the Nipissing diabase which occurs in a number of townships around Gowganda lake. The most important townships are Haultain, Nicol and Milner from which a number of shipments of high-grade ore have been made. Silver has also been discovered in several other townships, including Leith, Van Hise, Charters, Lawson, Corkill and Morel. Small quantities of ore have been shipped from Leith, Lawson and Corkill townships.

In addition to those found in the diabase, a few silver-bearing veins have been discovered in the Keewatin greenstone, and the conglomerate of the Cobalt series. Where the discoveries have been made, these formations overlie the diabase sill and the veins are near the hanging-wall contact. In Gowganda no silver-bearing veins have as yet been found in rocks that lie below the diabase sill. At Cobalt most of the ore has been obtained from deposits, chiefly in conglomerate and greywacke, below the sill, which has been removed by erosion.

While a few places in Gowganda reveal the footwall rocks on which the diabase sill rested, most of the sediments and some of the Keewatin rocks are above the sill. The erosion has extended chiefly into the upper part of the sill, exposing it in more or less irregular and connected areas. An example of this is the sill of diabase in the Miller lake section which

The Cobalt-Nickel-Arsenides and Silver Deposits of Temiskaming, Vol. XIX, 1913, Part II, Ont. Bur. of Mines Report, page 179.

rises toward the west, but eastward to Lost and Wigwam lakes it has several patches of older rocks overlying it. Discoveries of silver ore have indicated the desirability of prospecting the diabase and older rocks in the vicinity of the upper or hanging-wall contact, at least in the Miller lake section.

The workings at the Miller Lake O'Brien mine are all in the upper part of the diabase sill. The rich ore shoot at the Millerett mine, which was mined out several years ago, was in conglomerate that lay above the diabase sill. On the Castle property, R. S. C. 101, a high-grade vein discovered in 1920 was in Keewatin overlying the diabase sill, while operations later proved the vein to continue below the contact into the underlying diabase. Some rich ore was also encountered in Keewatin overlying the sill on the Silver Bullion property northeast of Leroy lake.

The silver-bearing veins at No. 1 shaft of the Castle property, R. S. C. 101, are in the diabase which has been eroded well down from the original top of the sill, and are apparently near the centre of the sill.

The veins at No. 1 shaft, Bonsall mine, are in the lower part of the sill, while those at No. 3 shaft are in the upper part of the sill near the upper contact with the Keewatin.

Silver ore has been found at several horizons in the diabase to the west of Gowganda. At the Boyd-Gordon and Mann properties the veins that produced the ore are in the upper part of the sill; the hanging-wall contact with the greywacké was encountered a few hundred feet west of the Boyd-Gordon shaft.

At Nos. 1 and 3 shafts of the Crews-McFarlan (formerly Bartlett) property, near the south end of Gowganda lake, work was done on several veins that are in the lower part of the diabase sill. The footwall here is quartzite, but the workings have not been carried at either shaft to the contact which can be seen on the surface to the east. The diabase from the bottom workings of No. 1 shaft is fairly fine-grained.

Origin of Silver Ore

Regarding the origin of the silver-cobalt veins at Cobalt, W. G. Miller remarks as follows:—

The material in these veins has, in all likelihood, been deposited from highly heated and impure waters which circulated through the cracks and fissures of the crust and were probably associated with—followed—the Nipissing diabase eruption. It is rather difficult to predicate the original source of the metals—silver, cobalt, nickel, arsenic and others—now found in these veins. They may have come up from a considerable depth with the waters, or they may have been leached out of what are now the folded and disturbed greenstones and other rocks of the Keewatin. Analyses of various rocks of the area have not given a clue as to the origin of the ores. However, the widespread occurrences of cobalt veins in the diabase, or in close association with it, shown by discoveries during the last seven or eight years, throughout a region three thousand square miles or more in extent, appears to be pretty conclusive proof that the diabase and the ores came from one and the same magma.

The waters are said to be associated or connected with the diabase eruption in the sense that they probably represented the end product of the eruption. In many volcanic regions hot springs are present long after the rocks have been solidified. In the Cobalt area the fissures and joints now occupied by the ores were probably produced by the gradual shrinkage in cooling of the diabase, the ores being deposited by the waters which represented the last stage of vulcanicity. (1)

(1) The Cobalt-Nickel-Arsenides and Silver Deposits of Temiskaming, Ont., Bur. of Mines, Vol. XIX, 1913, Part II, p. 8.

Veins

Certain characteristics of some veins in Gowganda, Elk Lake and elsewhere seem to point to a genetic relationship with the diabase. A number of the veins are aplitic in composition. The aplite is considered a differentiation from the diabase magma. Frequently the aplite grades into diabase along the walls; at other times it is sharply defined against the diabase walls. Some veins show aplite next to the diabase, followed by a layer of crystallized quartz, the crystals of which extend into the calcite which may occupy the centre of the vein. This type of vein frequently carries some native silver, smaltite and niccolite. The silver in the aplite and diabase is usually in thin scales or sheets. The occurrence of the diabase, aplite and quartz, successively, points to differentiation, while the calcite and the ores have come in later, probably from the same source. The aplite type of vein, however, varies greatly in the arrangement of the constituent parts, the calcite and ores often being irregularly distributed in the aplite.

Most of the veins are not aplite, but the chief gangue is calcite, frequently accompanied by some quartz; in fact, some silver-bearing veins carry considerable quartz. Some of the veins are quite narrow and interrupted, following the columnar jointing planes, and evidently represent the filling of cooling cracks after solidification and shrinkage of the sill.

Many veins are quite strong, and can be traced in a fairly straight course for several hundred feet. They sometimes occur in a series more or less parallel. Several parallel veins with strike N. 15 deg. E. were found on the Mann property west of Gowganda lake. Some of the parallel veins are sufficiently close to mine together. Veins of this character have been worked at the Miller Lake O'Brien and Castle mines.

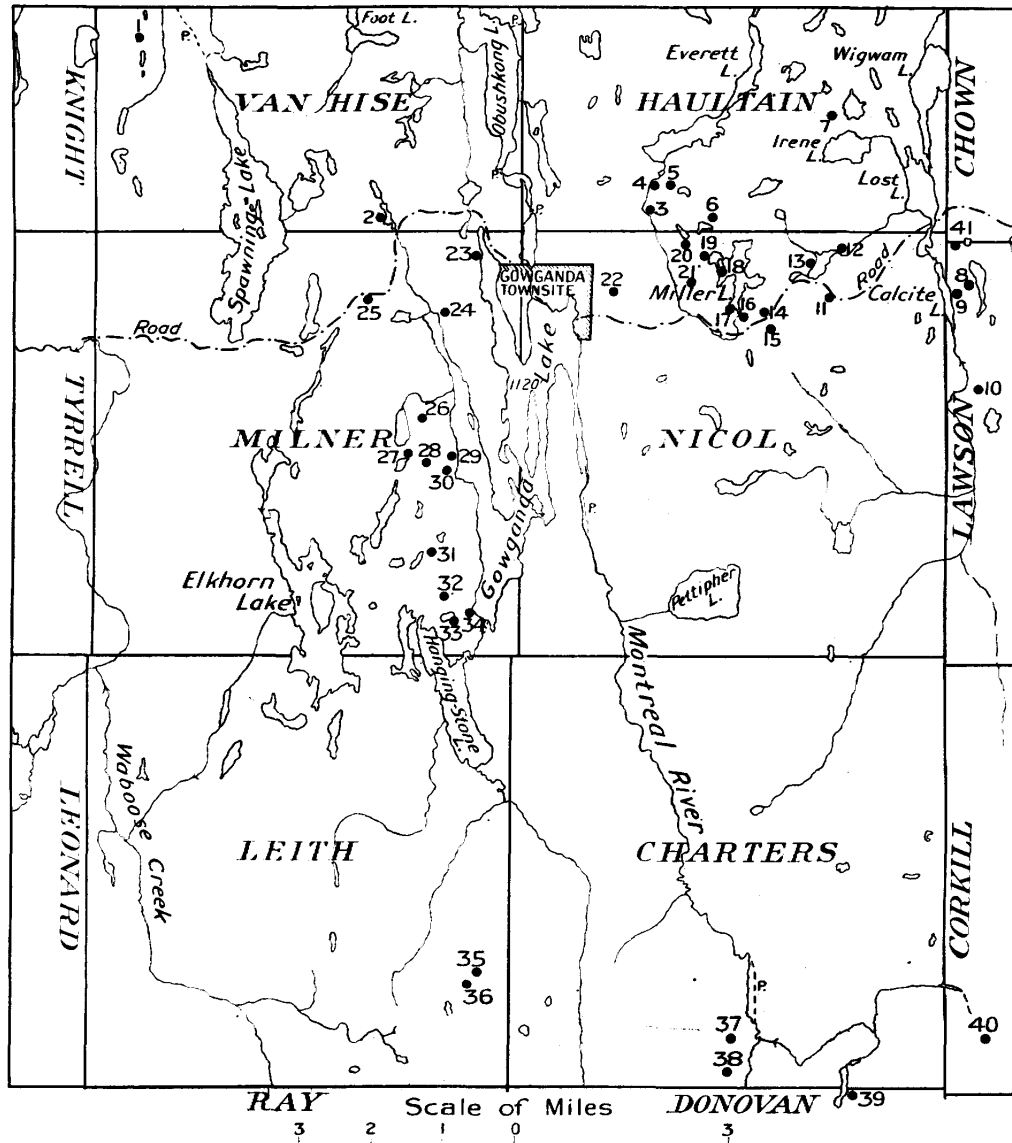
The veins vary greatly in width, and it would be difficult to state an average. The productive veins are usually from a fraction of an inch to 12 inches in width. Veins, however, occur that are as wide as two or three feet, but these are exceptional, and generally the wide calcite veins have not shown much value. One very strong vein, as wide as three feet in place, was found southeast of Miller lake. This vein, known as the Morrison, was traced for 2,000 feet across several claims. On claim T. C. 315 is showed some high-grade ore consisting of silver, smaltite, niccolite and native bismuth, over a length of about 8 feet along the surface.

A wide calcite vein, with east and west strike, occurs on the Miller Lake O'Brien property. This vein cuts a north and south silver-bearing vein.

Vein No. 7 at this property for a portion of its length showed a width of two feet of high-grade ore. The high-grade ore of No. 3 vein, Mann mines, varied from 1 inch to 5½ inches in width.

Several narrow veins with approximately the same strike sometimes unite to form one vein for some distance. Deposits of this character occur on the Miller Lake O'Brien and Castle properties. Where veins are parallel, one vein may carry ore, and an adjacent one may have little or no ore; while farther along in the workings these conditions may be reversed. Where several silver-bearing veins occur over a stopping width, the intervening wall-rock usually carries native silver in the form of thin scales or sheets in minute cracks which are generally roughly parallel with the veins. Even along a single narrow vein, there is generally a little leaf-silver in the rock adjacent to the vein.

A narrow calcite vein an inch or so in width may show segregations over a few feet in length of silver and smaltite entirely filling the vein, while the rest of the vein is calcite with dissemination of copper pyrites.



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|---|------------------------|-------------------|
| Map of Gowganda Silver Area, indicating the location of the principal Mines and Prospects | | |
| VAN HISE | 13 Collins | 29 Milne |
| 1 Alpine | 14 Northern | 30 Silvers Ltd. |
| 2 Hedlund | 15 Canadian Gowganda | 31 Reeve-Dobie |
| HAULTAIN | 16 Johnston | 32 Crews-McFarlan |
| 3 Bonsall | 17 Hart | 33 O'Brien |
| 4 Everett | 18 Walsh | 34 South Bay |
| 5 Castle | 19 Castle | LEITH |
| 6 Symmes-Young | 20 Miller Lake O'Brien | 35 Silverado |
| 7 Barbara | 21 T. C. | 36 Hudson |
| LAWSON | 22 Big Four | CHARTERS |
| 8 Caleta | MILNER | 37 Garvey |
| 9 Bishop | 23 Gowganda Lake | 38 Haines |
| 10 Powerful | 24 Northcliff | DONOVAN |
| 41 Sanderson | 25 Bishop | 39 Willans |
| NICOL | 26 Hewitt | CORKILL |
| 11 Lafayette | 27 Boyd-Gordon | 40 Kell |
| 12 Silver Bullion | 28 Mann | |

Ore Shoots

As at Cobalt, it has been found at Gowganda that the high-grade silver ore occurs in shoots in the veins. A vein may be several hundred feet in length and show 50 feet, 100 feet or over of an ore shoot, or one only a few feet in length. A number of veins have shown a little native silver in places along them, but with no determinable ore shoots. The ore shoots vary greatly in size. The largest of these so far discovered were in the area northwest of Miller lake. An ore shoot in the conglomerate at the old Millerett property (now Miller Lake O'Brien) was about 150 feet long, averaging about two inches in width of high-grade ore, together with mill rock for about two feet on either side of the high-grade. Some ore shoots in the diabase at the Miller Lake O'Brien mine were several hundred feet in length. Ore shoots 75 to 80 feet in length are worked at the Castle mine. In No. 3 vein, Mann mine, several ore shoots were discovered and developed, varying from 35 ft. to 65 ft. in length. Extremely rich but short ore shoots were mined at the Reeve-Dobie.

These measurements refer to the length of shoots on the surface or in drifts. The pitch length of a shoot may be greater or less than the drift length. Near Miller lake the shoots are generally found to be longer on the pitch than along the drift.

Description of Mines and Prospects

While the geological examination was being made in 1920 there were only a few properties on which mining operations were being carried on. However, since a large number of properties have been worked in various years from 1908, it was thought advisable to give some description, where possible, of the work that had been done in former years.

Haultain and Nicol Townships

Bonsall.—The Bonsall property was among the earliest operated at Gowganda. It includes eight claims: R. S. C 82 to 89 inclusive, situated northwest of Miller lake. The first work was done on claims 82 and 83, on veins carrying native silver discovered by Percy Bonsall in 1908. Most of the silver and smaltite showed in a narrow vein averaging about one inch with strike N. 34 deg. E., which was traced for 100 feet by trenching. The surface of the vein was much oxidized, showing crystallized silver in black, cobalt and nickel, decomposition products. A shaft was sunk on the vein to a depth of 25 feet and a drift run northward.

A main shaft was later sunk on a cross vein that strikes nearly east and west, and varies from about one inch to four inches in width. This vein intersects the previously described vein 30 feet east of the shaft. A drift at the 25-foot level was made along the vein for 60 feet and on the narrower vein for 40 feet. High-grade ore of the character shown near the surface was not encountered. The rich ore was found to occur near the junction of the two veins. About 30 sacks of ore were taken out in 1909. The main shaft was continued to a depth of 125 feet with a north-south drift of 60 feet in a faulted zone on the 75-foot level and 186 feet of drifting and crosscutting on the 120-foot level.

The property was re-opened several years later by the Miller Lake O'Brien interests, who did considerable work at the lower level. A strong north-south fault, dipping 45 deg. E., and showing about 12 feet in width of fractured diabase, was encountered 45 feet east of the shaft. This fault

was also crossed at 60 feet in the shaft and would reach the surface in the bed of Miller creek. To the east of the fault the east and west vein was drifted on for 130 feet. The vein carries calcite with some quartz containing copper pyrites, galena and a little native silver. A second vein, 175 feet southeast of this vein, was drifted on for 26 feet. It showed low assay values in silver.

From March to July, 1920, the property was worked under the management of George Glendinning. The workings at the various shafts were de-watered, and the veins sampled at the several levels. At the main shaft, No. I., the work at the 120-foot level consisted in extending the drift on the main vein for 71 feet, and on the south vein for 108 feet with 23 feet of crosscutting. At the 75-foot level a crosscut was made eastward 33 feet to the vein, and 83 feet of drifting was done in a NE-SW direction. A raise was made at the intersection of the vein to the 25-foot level. This level was also connected with the open-cut. From these operations a quantity of silver ore was hand-sorted, bagged and shipped to Cobalt.

In addition to the operations at the main shaft some work has been done on the east side of the property, on claim R. S. C. 84. Two shafts were sunk by the early operators on silver-bearing calcite veins. The east shaft, 60 feet deep with some lateral workings, was found too wet for operating, and a second shaft was sunk to the 100-foot level on a narrow calcite vein, an inch or two in width, that showed a few segregations of silver and smaltite. The drift at the 100-foot level, 74 feet in length, showed the vein to carry a little silver and smaltite, similar to that on the surface. Several veins occur on the surface, but little work has been done. Owing to the favourable location of the veins in the diabase near the upper contact with the Keewatin, it would seem that this locality would warrant more extensive exploration.

The property is equipped with a plant at the western workings, consisting of two 50-h.p. boilers, a straight-line compressor and a hoist. A plant at the eastern workings was destroyed by a forest fire.

Miller Lake O'Brien.—The following is reproduced from the 29th Annual Report of the Ontario Department of Mines, 1920, Part III., pp. 81-84.

“The Miller Lake O'Brien mine comprises a group of claims to the northwest of Miller lake. They were formerly the Gates claims, on which discoveries of native silver and smaltite were made in 1908. Later the Millerett mine was purchased by the Miller Lake O'Brien Company. The first development was done on veins with a general north and south strike, lying near the line between claims R. S. C 90 (654) and R. S. C. 91 (653). Of these the most important were known as No. 2 vein system, which produced most of the ore in the early years of the mine. Development showed the veins of this system to dip steeply to the west, with the pitch of the ore-shoots to the south. Of this system, the footwall veins have been the most productive. The ore-shoot in the hanging-wall veins did not extend to the 140-foot level, whereas the footwall ore body continued nearly to the 350-foot level. Each of these series carried two or more veins, which were sufficiently close together, where the ore-shoots occurred, to allow mining in one stope. The veins were generally from two to five inches wide, and in the ore-shoots individual veins were not always productive, but where one was barren, a parallel vein would carry high-grade ore. Very little ore was taken from this system above the

60-foot level. The greater proportion of the silver values was confined to the veins themselves, there being only a small impregnation of the wall rock. Strong east and west faults dipping 30 deg. north were encountered in the workings on No. 2 system. In developing this vein system a series of cross-veins was encountered south of the shaft, on the 250-foot level, having an east and west strike. This series of veins is known as the cross-system, and dips to the south at a high angle. An ore-shoot was found on the 250-foot level, and was stoped a short distance above the 140-foot level. It was followed down below the 400-foot level with decreasing length along the drifts.

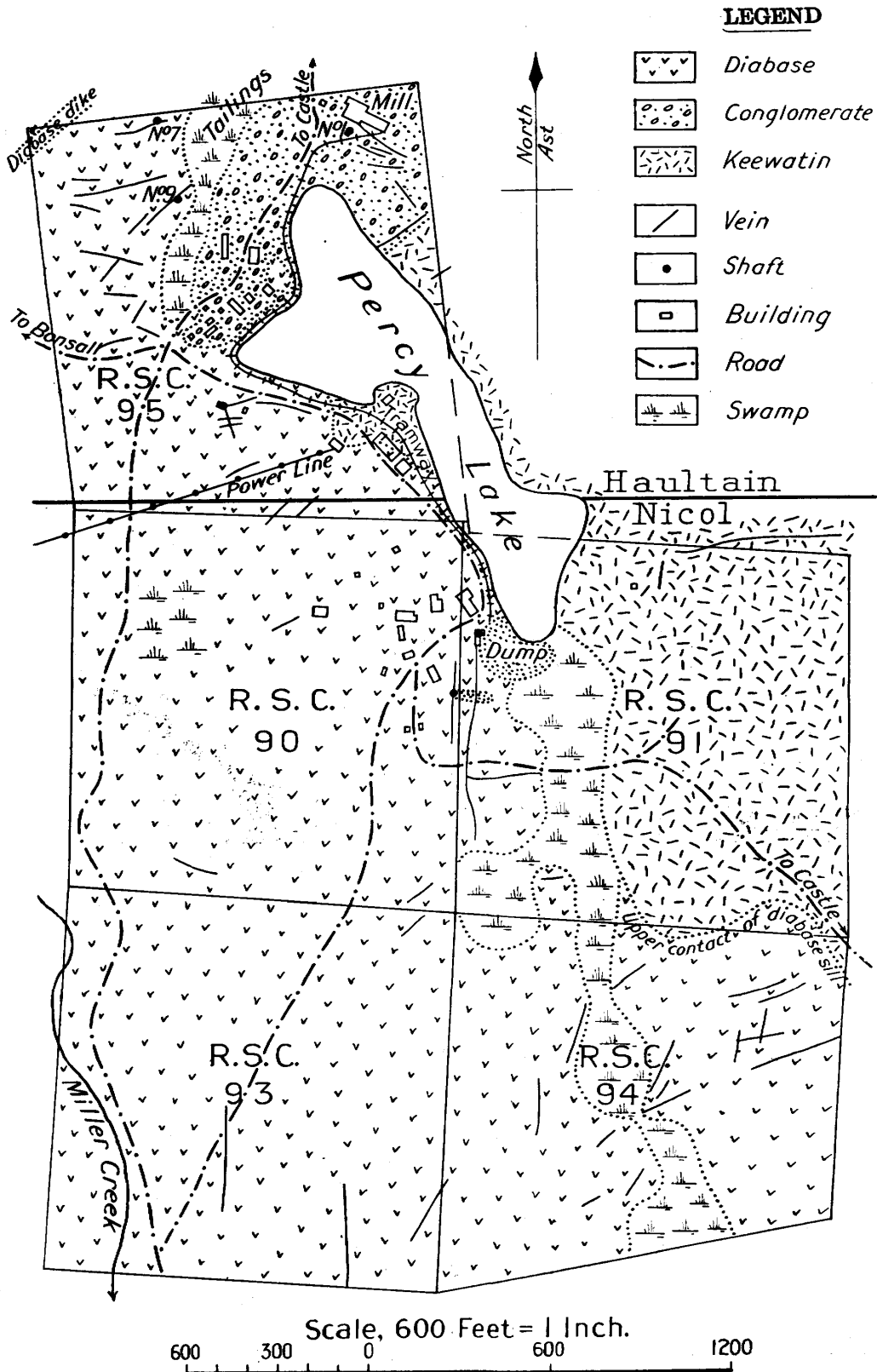
"The latest discovered ore system is known as the 'Flynn.' The first ore was encountered on the 350-foot level. A long east and west drift had crossed a very pronounced north and south fault, (c) dipping 50 deg. east, and a northerly cross-cut had intersected No. 6 vein, which was followed by a second fault, striking east and west and dipping 30 to 40 deg. to the north. Ore was found in No. 6 vein above this fault. From this discovery the development was extended to a number of veins, the principal of which are No. 6, No. 7 N., No. 7 N.W., etc. On stoping No. 6



Miller Lake O'Brien mine.

above the 350-foot level it was found to join No. 7 N., producing the greatest width of high-grade ore found in the mine, where one portion of the vein was three feet wide, of high-grade silver, smaltite and calcite. Later, in drifting on No. 7 vein on the 350-foot level, portions of it were of high-grade ore two feet wide. In this rich section of the 'Flynn' system, the stope was 14 feet in width, in places of high-grade veins and mill rock. Development in this part of the mine threw light on the ore relationships. The workings show that the high-grade values did not extend into the Keewatin, while in that formation the veins themselves became more indefinite, branching into stringers carrying galena, copper pyrites and other common minerals. The contact as determined at a few points in different parts of the mine dips from 20 deg. to 30 deg. (with the sill diabase below the Keewatin greenstone) gradually flattening.

"Development has proven the aforementioned east and west fault to be generally the lower boundary of the ore. The veins carrying the ore are said to have been only slightly displaced by the fault. One vein, No. 7 N.W., was observed to have been faulted about three feet. In this vein the east and west fault is not the lower boundary of the ore, since ore was being stoped from it on the 400-foot level below the fault. The ore occurs



Surface plan of Miller Lake O'Brien mine. Claim R. S. C. 95 was formerly the Millerett mine.

in the diabase below the Keewatin greenstone, while the main ore-shoots pitch to the north, being controlled by the Keewatin-diabase contact and the east and west fault, the ore not necessarily coming close to the contact. In developing vein No. 7 N., which carries the principal ore body, an inclined winze (87 deg. W.) has been carried from the 350-foot level to the 525-foot level, and the ore from this and other veins is developed from the several levels.

“Development at this mine on R. S. C. 90 and 91 has shown all the ore so far to be in the diabase. The early workings at No. 2 vein system were in the diabase, which outcropped at the surface, where only a small portion of the sill had been eroded. Later work being in the diabase below the Keewatin, it has been determined that silver ore occurs at greater depth from the present surface, depending roughly on the Keewatin-diabase contact. The silver ore occurs in the upper portion of the diabase sill in proximity to the contact.

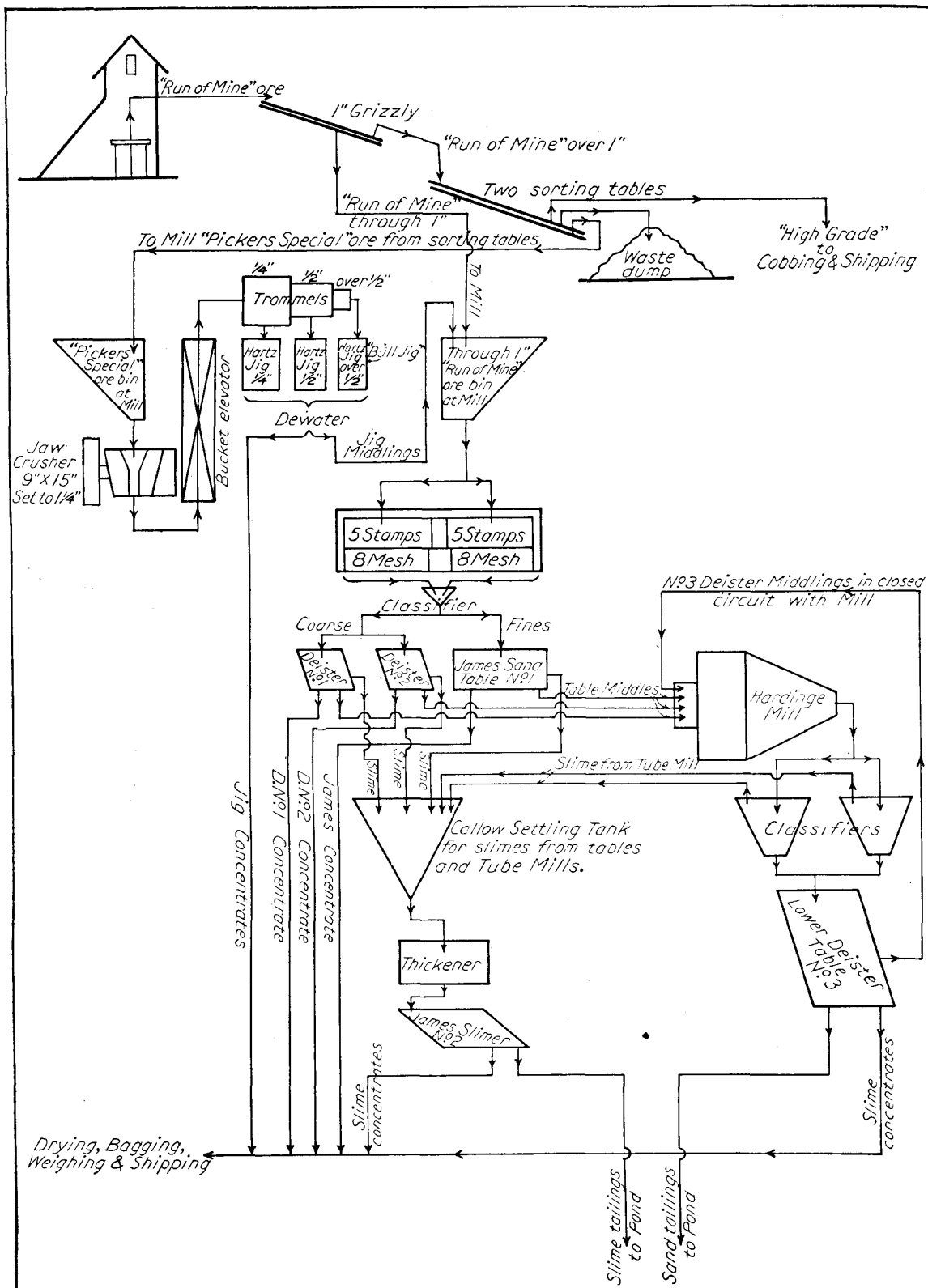


Part of Miller O'Brien mine, showing mill.

“The treatment of the ore is shown by the flow sheet diagram, page 28. The ore, after passing through the high-grade and water-sorting treatment at the main shaft, is hauled in trains of 2-ton cars to the incline at the mill by a gasoline motor. The cars are drawn up the incline singly by a hoist to the mill ore bin. About 35 tons of ore are treated daily in the mill. The mill was operated originally by the Millerett Mining Company, and is situated about a quarter of a mile north of the main shaft.

“Power for the mine and mill is supplied by a hydro-electric development at the foot of Gowganda lake. The natural fall is 27 feet, but by a dam is raised to 30 feet and the installation is capable of developing 500 horse power. The transmission line is $2\frac{1}{4}$ miles in length and the voltage 4,000. About 300 horse power is required for the mine and mill; in dry seasons, owing to the lack of storage, this requirement is not always met.”

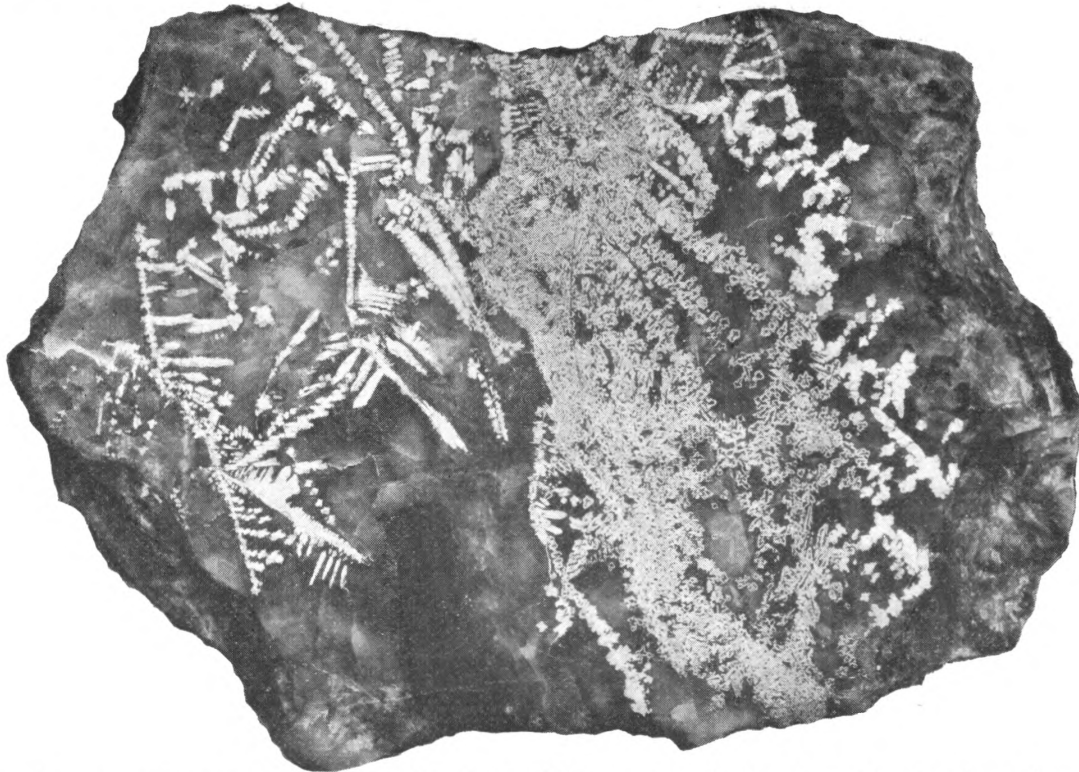
During 1920 operations were continued on the series of veins in the Flynn system. A new vein, No. 16, carrying native silver, which lies 25 feet west of the north part of the main vein, No. 7 N., was discovered and drifted on for 140 feet on the 460-foot level. This vein lies above the



Floor Sheet, Miller Lake O'Brien mine.

strong north-south fault C. which dips 50 deg. E., and the ore-shoot in this vein, as well as N. 7 N.W., was not located below the fault. Further work was done on vein No. 7 N.E., in which ore was found on the 525-foot level below the prominent east-west fault, called the ore fault, which in several veins terminated the downward extensions of ore shoots.

J. G. Dickenson of Cobalt is general manager, and H. G. Kennedy is resident superintendent.



Specimen of polished ore from Miller Lake O'Brien mine, showing fern-like structure of crystallized native silver and smaltite (white) and crystallized smaltite (light grey) in calcite gangue (dark grey.) Some of the silver occurs in minute veinlets in the calcite and smaltite.

Symmes-Young.—This property, H. S. 351, is located about a quarter of a mile north of Miller lake. The outcrops show conglomerate and greywacké of the Cobalt series overlying Keewatin greenstone. These formations overlie the diabase sill that outcrops nearly one-half a mile to the west, and has a gentle dip to the east. Two hundred feet west of No. 1 post there is a strong smaltite-niccolite vein that strikes approximately north and south. It crosses the line to claim H. S. 350, being traceable on both properties for about 700 feet, and is in the conglomerate-greywacké. A shallow shaft about 44 feet in depth has been sunk on claim H. S. 350, fifteen feet north of the line. The vein had a maximum width of a foot when the shaft was located, but diminished rapidly to the north and south and also in the shaft. In places there are several narrow veins running from an inch to three inches in width. At 30 feet in the shaft there are several veins in a width of 15 inches. The walls of the shaft are stained with pink and green arsenates. At the bottom of the shaft the rock is greywacke, the Keewatin not having been penetrated. The ore is smaltite-chloanthite and niccolite intimately intermixed. It carries less than one ounce of silver per ton. A sample of the grey smaltite-chloanthite examined by J. A. Reid contained 12.44 per cent. of cobalt and 13.31 per cent. of nickel. The depth of the diabase sill below

the Keewatin and Cobalt series is not known, but the vein contents in all probability have been derived from the diabase sill magma.

Haultain Township

Castle (R. S. C. 101)—Claim R. S. C. 101, which is one of a number of claims of the Castle group situated about half a mile south of the west end of Everett lake, has been operated continuously by the Trethewey Silver-Cobalt Mine, Limited, since the fall of 1919, when trenching near the west line of the claim revealed some narrow veins carrying high-grade silver ore. The veins are continuations of fractures that were worked several years previously on claim R. S. C. 102 by the Miller Lake and Everett Mines, Limited. They strike approximately N. 30 deg. W. and dip 85 deg. SSW. As shown near the surface, the ore deposit consisted of a series of closely spaced calcite and quartz veins over a width of 18 inches. In sinking the shaft the veins were found at times to unite into fewer and wider veins, a width of 5 inches of high-grade ore being occasionally encountered. The high-grade ore averaged about three inches in width. The chief vein-filling is calcite, but quartz is abundant. Native silver, smaltite, copper pyrites and specularite occur in parts of the veins. Where there are several narrow veins, one may carry ore and an adjacent one be practically barren at the same horizon; while the values may shift from one vein to another on further working. The diabase adjacent to the veins frequently carries leaf silver, sometimes in short heavy sheets. The ore shoot has been developed by means of a shaft to the 150-foot level. At the 100-foot level the shoot is about 80 feet in length, the shaft being located near the centre of the shoot, which pitches nearly vertically. Two stopes, 25 feet in length, were opened 10 feet from the shaft on the 100-foot level, and carried toward the surface. A third stope was opened southeast of the shaft at the 150-foot level. The broken ore and rock from the stopes is passed over picking tables, and the ore sorted from the waste and mill rock. With the high-grade from the veins and the higher-grade wall rock a product is obtained averaging approximately 1,000 ounces to the ton. The mill rock is accumulated on the dump for possible future treatment.

Exploratory work was also carried on at the 100-foot level, a series of veins having been drifted on for 350 feet southeast of the shaft. A northwesterly cross-cut intersected a wide calcite vein, but no exploratory work was done on this vein. Several strong veins outcrop on the southwest part of the claim, but underground work on the 100-foot level was not carried to their probable underground extension.

The ore shoot just described is probably located toward the centre of the sill, as indicated in the accompanying cross-section, in which respect it differs from the more recently discovered ore shoot on the east part of the property. This ore shoot occurs in Keewatin greenstone at and near the surface, and has been proven by exploration to pass into the underlying diabase sill, the contact of which with the Keewatin is exposed at the surface about 100 feet west of No. 2 shaft. This high-grade vein was discovered by Tom Garvey, a prospector, in the spring of 1920. The vein strikes nearly east and west magnetic, and dips 80 degs. to 85 degs. N. An open cut about 30 feet long was first made along the ore shoot from which some high-grade ore was extracted. Oxidation extended downward several feet and loose fragments of native silver up to 15 inches in length were taken from the black decomposed cobalt oxide. The fresh ore is smaltite and native silver in calcite. The bottom of the open

cut showed in places a width of three inches of high-grade ore. Several sacks of silver in loose pieces were shipped from the open cut.

To develop the ore shoot a vertical shaft has been sunk at its eastern end, the vein being intersected at several levels by cross-cutting. The contact between the Keewatin and the Nipissing diabase was encountered at a depth of between 25 and 30 feet. As the Keewatin rock is a fine-grained diabase, or basalt, the exact location of the contact is difficult to determine without microscopic examination of the rock. The Keewatin rock contains much hornblende and may be called a hornblende diabase.

As already stated, the high-grade ore shoot was found to continue from the Keewatin into the sill diabase, shown in the sub-drift at the 30-foot level. After entering the diabase, the vein was succeeded by a second overlapping vein 15 inches to the north, in which the high-grade ore continued downward. In the drift the vein shows in places two inches of high-grade ore with some leaf silver in the wall rock. The vein was also cut at the 70-foot level where the ore shoot was encountered a few feet north and west of the shaft. The drift at this level is reported to follow the ore shoot for 75 feet. When first encountered two veins were shown in the face, a narrow vein about $\frac{1}{4}$ -inch in width accompanying the main vein, which was one to two inches in width. Both veins were faulted four inches to the north by a horizontal fault carrying calcite. This flat calcite vein, near the intersection of the nearly vertical veins, carries some secondary ruby silver. By February, 1921, the shaft had reached the 160-foot level. In sinking from the 70-foot level a second vein was encountered in the shaft at 105 feet on the south wall, and followed 125 feet, where it left the shaft on the north wall. This vein averages one and one-half inches in width and is high-grade.

A cross vein, showing some high-grade silver ore near the junction with the main vein, was also encountered in the open cut at the east end of the ore shoot. It dips steeply to the west and also shows west of the shaft at the 30-foot level. Its junction appears to limit the ore shoot to the east.

The property is equipped with a power plant at No. 1 shaft, consisting of two locomotive boilers, a three-drill compressor and two hoists. A third boiler has been altered to an air receiver at No. 2 shaft to which air is piped from the power plant.

Murray Kennedy is manager and Neil Morrison superintendent of the property.

Miller Lake and Everett (R. S. C. 102).—This property, lying to the west of R. S. C. 101, was operated some years ago by the Miller Lake and Everett Mines, Ltd., and 8.35 tons of silver ore were shipped in 1910. The ore was taken from a long open cut on a series of silver-bearing veins striking north 35 degs. west. The ore was hand-sorted, and there are a few tons of mill rock on the dump at present, where fragments of diabase frequently show scales of native silver. Fissuring is pronounced on claims R. S. C. 101 and 102 in the vicinity of the north and south centre line.

Barbara.—During parts of 1915 and 1916 some exploratory work was done on the Barbara property, situated to the north of Lake Irene. Several veins of quartz and calcite show on the surface. A strong vein on claim S. W. 8, striking N. 15 degs. E., has been trenched for several hundred feet, and consists of calcite and quartz, from an inch to two inches in width, carrying copper pyrites and bornite. A little native silver

shows in seams in the very coarse, gabbro-like diabase. A shaft was sunk to the 100-foot level, and some crosscutting done on the level to intersect veins. The veins are located well within the diabase sill. The sedimentary rocks, one-quarter of a mile south around Lake Irene, lie on the sill.

Some smaltite and silver occur in veins on claim S. W. 18, south of Lake Irene.

Nicol Township

Big Four.—The Big Four consists of four mining claims, W. D. 961 to 964, situated one-half mile northeast of Gowganda lake. There is a great assemblage of rocks, consisting of Keewatin iron formation and green schist, quartz-porphry, older diabase dikes, Cobalt series conglomerate and later diabase dikes. The diabase sill is not exposed on the property.

A vein, carrying calcite, cobaltite, iron pyrites and galena, was found on claim W. D. 962. It strikes N. 14 degs. E. and dips 30 degs. E. An open-cut about 20 feet in length was made along the vein, disclosing a width of 5 to 6 inches of material carrying much bloom and cobaltite. This showing is cut off by a diabase dike to the south. To the south of the dike, which is 50 feet wide, there are also some small showings of bloom. The vein or lens carrying the cobaltite occurs in iron formation, here represented by a silicious rock resembling chert, which for four feet above the vein is much stained with iron rust. A sample from the vein carries no gold and 8 ounces of silver per ton. A shaft sunk at a point 50 feet east of the outcrop of the vein intersected the low dipping vein which showed the same mineralization.

Some prospecting was also done on rusty silicious iron formation three chains northeast of the shaft. This work indicated a mass of solid iron pyrites in the iron formation lying between two north-south diabase dikes 9 feet apart and having a footwall of quartz-porphry dipping 60 degs. N. Toward the north the iron pyrites, about 6 feet wide, becomes leaner, grading into silicious iron formation. The area immediately beyond the two dikes of diabase is drift-covered, and may conceal the extension of the sulphide band. A sample of the iron pyrites carries 41.35 per cent of sulphur. The silicious iron formation, carrying disseminated iron pyrites, contains no gold.

Castle, R. S. C. 106 and R. S. C. 92 (652).—Considerable exploratory work has been done on these claims by the Trethewey Silver-Cobalt Mine, Limited, with a view to prospecting the diabase formation which occurs beneath the Keewatin. These claims are situated just northwest of Miller lake.

A shaft was started in Keewatin on claim R. S. C. 106 and sunk to the 300-foot level. The diabase was first encountered at 90 feet, and from this depth to 130 feet the shaft was partly on both formations, showing a nearly vertical contact for this distance. Below this the shaft was entirely in the diabase, and a cross-cut 400 feet in length to the north of east was run to the contact, indicating a general dip of contact of 20 degs. from 130 feet in the shaft. The contact was further ascertained, in a long drift extending 500 feet to the north of the cross-cut, to be 15 N.E. Consequently at this horizon the diabase dips gently under the Keewatin. A calcite vein, striking north and south and dipping steeply to the west, was discovered 130 feet from the shaft, and drifting on the

vein for about 230 feet has been done on the 300-foot level, and also on the 360-foot level, which is connected with the upper level by a steeply inclined winze on the vein. This vein carries in places some native silver together with smaltite, niccolite, native bismuth, copper pyrites and pyrite, and some quartz. Several strong faults dipping 30 degs. N.E. were encountered in the workings. One of these displaced the vein 20 feet on the 300-foot level. Several other calcite veins were also discovered. One of these showed a width of six inches in a cross-cut west from the main vein, while another was encountered 400 feet from the shaft in the long cross-cut, near the Keewatin contact. This vein of calcite up to four inches wide carries some smaltite.

Chapelle Claim H. R. 715 (195).—This property lies to the east of Leroy lake, including part of the lake. The rock exposed on the surface is nearly all sill diabase, with a small amount of Keewatin near the northeast corner post. In October, 1919, C. L. Campbell and W. H. Fairburn, who had optioned the property, began work on it by continuing the sinking of a shaft that had been begun some years before. This shaft is on a strong aplite dike and calcite vein. Some high-grade silver ore was encountered by the former operators at 48 feet, and again in the drift at the 85-foot level. Small amounts of silver had been found frequently while sinking the shaft and running the drift. Exploration showed that the vein, which strikes south 20 degs. west when drifted on to the south, was faulted 55 feet to the southeast. This fault which dips 60 degs. northeast contains drag vein material and also that of an aplite dike. In the face of the drift beyond the fault, there is a 4-inch vein of calcite and two mineralized aplite dikes of 1½ and 4 inches respectively. Specimens on the dump show calcite and aplite with copper pyrites, bornite, iron pyrites, and some smaltite and niccolite.

A number of veins were located on the surface by means of trenching in previous years, but most of these are now concealed by sand filling in the trenches. These veins occur in the diabase, which rises as a sill from the northwest, having the same relation to the Keewatin area northwest of Leroy lake as the diabase to the northwest of Miller lake, that is, it dips under the Keewatin. Owing to trouble over the option, work was discontinued on this claim in November, 1919.

Collins Claim (T. C. 220).—This claim, on the west side of Leroy lake, shows exposures of Keewatin tuffs and greenstone intruded by dikes of diabase. The Keewatin rocks, where banded, strike N. 60 degs. E. A vertical shaft, started on the east contact of a diabase dike with banded tuff, where there is a vein of calcite with quartz, copper pyrites, iron pyrites, and some smaltite and niccolite, has been sunk to the 300-foot level. A station was cut on the 180-foot level, also at the 300-foot level, where exploration will be carried on.

The vein on the surface is somewhat lens-like, and is four inches in width 100 feet south of the shaft, being located in places along the contact with the diabase. It was found to dip from the shaft at 50 feet; below 80 feet the shaft is entirely in the diabase dike. At 165 feet a second vein was encountered, averaging four inches in width and dipping from the shaft at 180 feet. Some native silver is reported to have been found in this vein. Distant 375 feet north of the main shaft, there is another shaft 20 feet in depth on the west contact of the diabase dike, where a vein about three inches wide contains minerals similar to those previously mentioned; native silver is found occasionally in this vein. The area of Keewatin overlies the diabase sill that outcrops on the east side

of Leroy lake and to the south along the road. The bottom of the 300-foot shaft should be near the contact with the diabase sill provided the dip is approximately 30 degs. W., as indicated at the surface. F. H. Collins is manager.

Hart Claims.—The Hart claims, R. S. C. 135 and 136, were under option for a part of the year 1920. This property is favourably located along the hanging-wall contact of the sill diabase with the Keewatin, the sill outcropping on the southerly claim and the southwest part of the northerly claim. A shaft was sunk to the 100-foot level on a strong calcite vein. The vein strikes N. 23 degs. E., is nearly vertical and averages about four to six inches in width. Masses of vein material from the drift show abundant copper pyrite, bornite and pyrite. A little silver is reported from the vein. When visited in September, 1920, the drifts had reached 80 feet and 25 feet, north and south of the shaft respectively. A number of calcite veins are exposed on the surface.

Silver Bullion.—The Silver Bullion property is situated at the north-east end of Leroy lake. It includes two claims on each of which a shaft has been sunk. The easterly claim, W. J. 1, formerly called the Dodds, contains outcropping of schistose Keewatin greenstone. Near the south line of the claim a vein, carrying native silver, smaltite and native bismuth, with strike nearly east and west, was discovered. An open-cut was made on the vein by former operators, the cut being carried to a flat slip beyond which no work was done. A few bags of silver ore were taken from the open-cut. Further work by the Silver Bullion Company showed the lower extension of the vein to be faulted four feet to the north. A shaft was put down on the vein to a depth of approximately 50 feet by means of hand steel. The work showed a succession of faults and slips, the vein being displaced a few feet north or south, with the greater movement to the north. The greatest throw is at the bottom of the shaft where the lower part of the vein is displaced six feet to the north. At 30 feet in the shaft the vein is six inches in width. Segregations of silver, smaltite, niccolite and bismuth were encountered in the calcite vein. A plant, consisting of a 100-h.p. boiler, a 6-drill compressor and a 6 x 8-inch hoist, was installed in the fall of 1920. The property was closed down shortly after, but it is expected operations will be resumed early in 1921.

The shaft on the westerly claim is located on a small island where there is an outcropping of Keewatin. It was sunk 100 feet, and the area under the lake was prospected by a cross-cut to the south. A two-inch vein of calcite was encountered 90 feet to the south of the shaft. This vein showed a little smaltite. The shaft was abandoned for the new shaft on the Dodds vein. R. C. Gamble is manager of the property.

Walsh.—The Walsh claim (R. S. C. 98) includes a small portion of the shore of Miller lake and takes in some land under the lake itself. During parts of the years 1917 and 1918 the property was under option to the Crown Reserve Mining Company. A shaft previously sunk 60 feet deep was continued to 200 feet. It is located on the south part of the claim, near the shore of the lake. From the shaft drifts were run northward on the 100- and 180-foot levels. A little silver ore was indicated on the 100-foot level. The calcite vein is said to be strong on both levels.

During the first part of 1920 the Walsh Mines, Limited, reopened the mine and continued prospecting, chiefly on the 180-foot level, but the result was not very encouraging. The drift was extended to the contact, where the Keewatin was found to overlie the sill diabase at an angle of

calcite, but lenses of the mineral occur with an aplite dike along which the open cut was made. The aplite and diabase wall rock are much fractured in places, and contain sheets and scales of native silver. Some of the vein material carries considerable copper pyrites.

The high-grade ore consisted of smaltite with native silver and argentite. Some of the diabase and aplite carrying abundant leaf silver is of good milling grade. Most of the ore shipped from the property came from the open cut.

No. 2 shaft, located in the southwest part of the property, was sunk 100 feet and drifting and cross-cutting amounting to 360 feet done. The work did not indicate commercial ore. A narrow vein, about one-quarter of an inch in width, carrying massive smaltite and silver, was encountered in the workings.

Directly west of the shaft there is an aplite dike which showed a lens of calcite with smaltite and silver over a few feet. A shallow open cut was made along the lens of ore by the early operators and a few bags of high-grade material obtained.

The most recent work was done on claim H. F. 224 in the southeast part of the property where several veins were located by trenching. One of these, having a width of one inch, contained a shoot of high-grade ore along which an open cut was made and a quantity of high-grade ore obtained. A shaft, No. 3, situated 40 feet to the north of the open cut and near a second vein, was sunk to a depth of 75 feet and at 50 feet a cross-cut made southwestward to the silver-bearing vein on which some exploratory work was done and also on the vein located near the shaft.

Some silver ore was encountered on this level, but the outlook was not sufficiently encouraging to continue operations under the high cost of operation.

The ore obtained from the open cut was of peculiar appearance in so far that most of the calcite vein matter is very dark, almost black in colour. This dark colour is evidently due to very fine particles of magnetite disseminated in the calcite. Some of the high-grade vein shows massive native silver with argentite in calcite, the silver occurring in veinlets and masses generally near the contact with the diabase. Other samples show massive smaltite with the silver minerals.

Four chains southeast of the shaft there is a 2-inch aplite dike, showing calcite with niccolite and smaltite, on which a shallow pit was sunk.

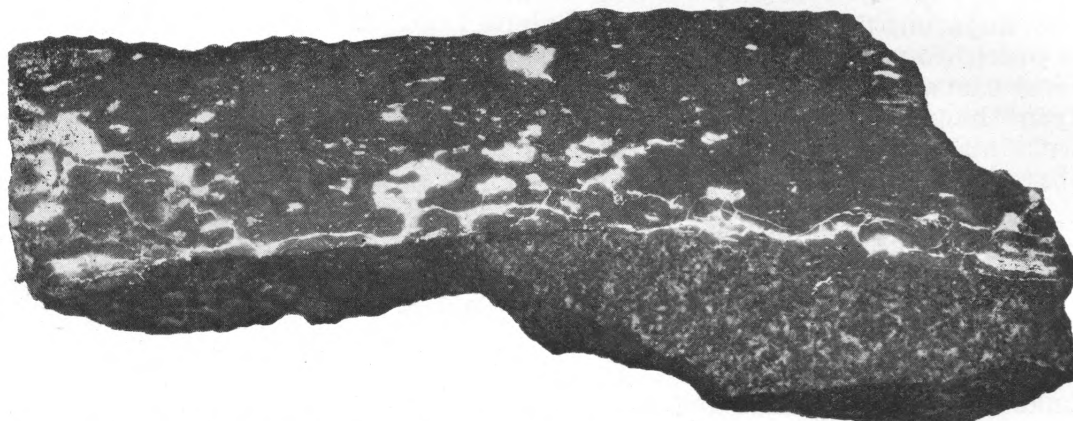
Hewitt.—For some years previous to 1920, the Hewitt Lake Mining Company operated a group of claims lying west of Gowganda lake and one-half a mile north of the Mann mines. When visited in 1920 no work was being done, and the workings were filled with water. One shaft is reported to have been sunk to a depth of 300 feet with some lateral work, but no information is obtainable as to the silver bearing character of the veins. The Nipissing diabase is exposed at the surface, erosion having removed the overlying sediments from a part of it. Some small patches of sediment still show on the diabase sill, consequently the workings are in the upper part of the diabase where fractures would be looked for.

Mann.—The Mann mine is situated on a diabase ridge one-half mile west of the northwest arm of Gowganda lake. It includes a group of claims: H. R. 249-252, inclusive, staked by the Mann-Ryan interests in 1908, following a discovery of native silver by Robt. Mann. This discov-

Milner Townships

Bishop.—The Bishop Mining Company operated a group of claims lying northwest of the northwest arm of Gowganda lake. A shaft on claim T. C. 136 was sunk 130 feet with drifting of 20 feet. The surface of the diabase exposed here is near the top of the sill. A small remnant of the overlying sediment, partly altered to adinole, occurs along the road north of the shaft. The diabase is well fractured and some silver occurs in veins at the surface, but underground operations were discontinued before sufficient lateral work was done to determine the possibilities of the veins underground. The veins have an approximate N.E.-S.W. strike and are nearly vertical. Some of the vein material on the dump shows bloom and flakes of native silver.

Crews-McFarlan.—The Crews-McFarlan mine was not in operation during 1920. It includes four claims, H. F. 221-224, situated near the south end of the southwest bay of Gowganda lake. The property has been worked intermittently since the fall of 1908, following the spectacu-



Specimen of polished ore from the Crews-McFarlan (Bartlett) mine showing calcite vein, one inch in width, with adhering diabase wall. Native silver is shown in the light parts in the form of veinlets and patches in the calcite and along the contact. A little argentite and copper pyrite occur with the silver.

lar discoveries of native silver by two prospectors, F. McIntosh and S. McLaughlin. Under the name of the Bartlett mine, it was first operated by the Bartlett Mines Company, later by the Scottish Nigeria Mining Company, and finally by the Crews-McFarlan Mining Company.

The property is equipped with a plant consisting of two 80-h.p. return tubular boilers, a 12-drill compressor, two hoists and a machine shop.

Shafts Nos. 1 and 2 were sunk by the original company and later operators have increased the underground workings.

No. 1 shaft, at which the most extensive work has been done, is on claim H. F. 222. It is in the lower part of the diabase sill about 500 feet west of the outcrop of the underlying quartzite which dips about 45 degs. westward. The shaft is 300 feet deep with workings on three levels, totalling over 1,000 feet. It was started on a high-grade ore-shoot that extended downward only 25 feet. The ore was massive smaltite and native silver in calcite from two to three inches in width. A series of open cuts were made southwestward from the shaft on a number of lenses of ore over a distance of 350 feet. The chief gangue material with the ore is

calcite, but lenses of the mineral occur with an aplite dike along which the open cut was made. The aplite and diabase wall rock are much fractured in places, and contain sheets and scales of native silver. Some of the vein material carries considerable copper pyrites.

The high-grade ore consisted of smaltite with native silver and argentite. Some of the diabase and aplite carrying abundant leaf silver is of good milling grade. Most of the ore shipped from the property came from the open cut.

No. 2 shaft, located in the southwest part of the property, was sunk 100 feet and drifting and cross-cutting amounting to 360 feet done. The work did not indicate commercial ore. A narrow vein, about one-quarter of an inch in width, carrying massive smaltite and silver, was encountered in the workings.

Directly west of the shaft there is an aplite dike which showed a lens of calcite with smaltite and silver over a few feet. A shallow open cut was made along the lens of ore by the early operators and a few bags of high-grade material obtained.

The most recent work was done on claim H. F. 224 in the southeast part of the property where several veins were located by trenching. One of these, having a width of one inch, contained a shoot of high-grade ore along which an open cut was made and a quantity of high-grade ore obtained. A shaft, No. 3, situated 40 feet to the north of the open cut and near a second vein, was sunk to a depth of 75 feet and at 50 feet a cross-cut made southwestward to the silver-bearing vein on which some exploratory work was done and also on the vein located near the shaft.

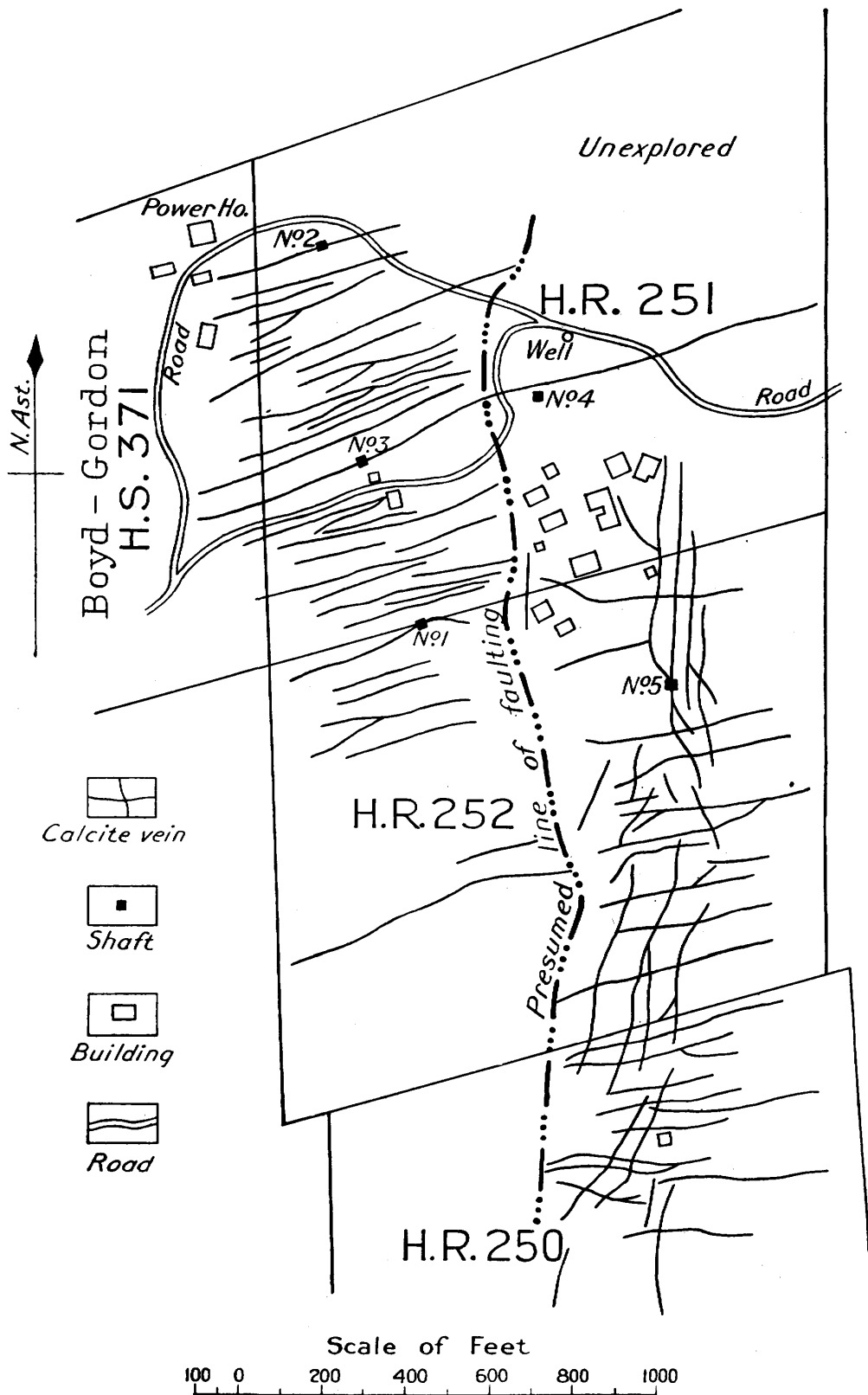
Some silver ore was encountered on this level, but the outlook was not sufficiently encouraging to continue operations under the high cost of operation.

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Four chains southeast of the shaft there is a 2-inch aplite dike, showing calcite with niccolite and smaltite, on which a shallow pit was sunk.

Hewitt.—For some years previous to 1920, the Hewitt Lake Mining Company operated a group of claims lying west of Gowganda lake and one-half a mile north of the Mann mines. When visited in 1920 no work was being done, and the workings were filled with water. One shaft is reported to have been sunk to a depth of 300 feet with some lateral work, but no information is obtainable as to the silver bearing character of the veins. The Nipissing diabase is exposed at the surface, erosion having removed the overlying sediments from a part of it. Some small patches of sediment still show on the diabase sill, consequently the workings are in the upper part of the diabase where fractures would be looked for.

Mann.—The Mann mine is situated on a diabase ridge one-half mile west of the northwest arm of Gowganda lake. It includes a group of claims: H. R. 249-252, inclusive, staked by the Mann-Ryan interests in 1908, following a discovery of native silver by Robt. Mann. This discov-



Plan showing vein system at Mann Mines, reproduced from sketch furnished by Geo. R. Rogers.
 The vein in which most work has been done, and from which most of the ore was produced, is No. 3.

ery of silver was made on a bluff of diabase, where a decomposed calcite smaltite vein, about 3 inches wide, showed a rib of native silver protruding from the vein. The vein, known as the discovery or No. 1 vein, was traced several hundred feet by trenching to the west, with several showings of native silver along the surface.

The principal vein is No. 3, which has produced almost all the ore shipped from the mine. The vein has been traced 1,300 feet by trenching, while open-cuts and underground operations indicated several ore-shoots. No. 3 shaft has been sunk to a depth of 200 feet with levels at 80 feet, 120 feet, and 200 feet, while No. 4 shaft, located 350 feet to the east, was sunk to the 80-foot level and connected on this level with No. 3 shaft. Most of the underground work was done on the 80-foot level, where three stopes were opened up to the west of No. 3 shaft and one stope 100 feet west of No. 4 shaft. The easterly stope connects with an open-cut which was made just west of No. 4 shaft. This cut is 30 feet long, and about 14 tons of high-grade ore were taken from it. The ore-shoot pitches westerly at 45 degs., and did not extend below the level. An ore-shoot near No. 3 shaft also shows a pitch to the west, while on the 80-foot level it was 50 feet in length. The ore-shoot was stoped from about 15 feet below the level to near the surface. A third stope was made on the vein 130 feet west of No. 3 shaft, and was also carried from 15 feet below the level to near the surface. The shoot was about 60 feet long on the level. A fourth small shoot about 15 feet in length was found near the end of the west drift on the 80-foot level. High-grade ore was also encountered on the 120-foot level, 200 feet west of No. 3 shaft; 450 feet of drifting along the vein was also done on the 200-foot level of No. 3 shaft.

The vein is about one inch to 5½ inches in width. The ore was hand-sorted at the surface and bagged for shipment. Twenty tons of low-grade ore were treated at the Millerett mill in 1912, and from this 715 ounces of fine silver were produced.

The high-grade ore is chiefly native silver with smaltite in calcite. Forty-eight tons of high-grade silver ore, from which were recovered 99,076 oz. silver, were shipped from the property.

One shipment averaging 2,000 ounces per ton silver contained \$2.00 per ton in gold.

On the Mann property there are two pronounced north and south ridges. On the westerly ridge all of the veins have a strike of a few degrees north of east, whereas on the easterly ridge there are a number of veins which strike nearly north and south, in addition to a number which strike easterly and westerly. This has suggested the possibility of faulting. The underground work proved a strong north-south fault dipping 45 degs. W., with a crushed zone about four feet in width. The westerly part of No. 3 vein was displaced 15 feet to the south by this fault.

The Boyd-Gordon mine, H. S. 371, was taken over by the Mann mine in 1912.

George Rogers was in charge of the Mann property during most of the development of No. 3 vein from which the shipments were made.

The property was closed down in 1914.

Northcliff—The Northcliff prospect is situated at the north end of the northwest arm of Gowganda lake. The property consists of about 160 acres, the principal claim of which is J. S. 282. The veins are in the Nipissing diabase, which occurs as a high ridge along the northeasterly shore of the lake. The ridge rises abruptly from the water's edge to an

elevation of 125 feet. The relationship to the conglomerate is seen along the north line of J. S. 282, where the diabase underlies the conglomerate at 60 degs. W.

The property was operated from the fall of 1919 for about one year. Some surface work was done on a series of veins on the top of the ridge. An open cut 25 feet long was made on a calcite vein with strike N. 20 degs. E., which averages from about an inch to three inches in width. Some specimens showing crystallized smaltite and silver were taken from the open cut. The vein is faulted at the south end of the cut, ten feet westward. Shallow cuts and trenches were also made on some other fractures near the open cut. Most attention was, however, given to driving a tunnel eastward into the hill from near the water's edge. This work was stopped before it was certain that the underground extension of the surface vein carrying silver had been intersected. Several calcite veins, from an inch to three inches in width, and a stringer of quartz showing some silver, were cut in the tunnel, but no drifting was done on them.

The tunnel is about 285 feet in length. The work was accomplished by using steam drills, but this was not found satisfactory, and it is expected when conditions improve that a compressor plant will be installed. Norman Dye is manager of the property.

Reeve-Dobie.—The Reeve-Dobie mine, which has been operated intermittently since 1908, was closed down in the fall of 1920. It has been worked by various interests. The original discoveries were among the most spectacular in the camp, and from open-cuts along short ore-shoots some very rich silver ore was shipped. The early work consisted in prospecting for high-grade ore which was found to occur in a number of short shoots along a mineralized zone about 700 feet in length. Most of the high-grade ore was taken from a number of open-cuts. Later a mill was erected which ran for a short time treating diabase carrying minute veinlets containing native silver. The mill was reopened in 1919, a flotation plant added and ore from an open-cut or glory hole to the south of the shaft was treated. The ore was dropped to the 50-foot level and trammed to the shaft. The mill rock was said to carry from 30 to 35 ounces of silver per ton. Underground operations were carried to the 200-foot level and considerable drifting and crosscutting was done. A number of strong faults were encountered in the workings.

Very little work has been done on the westerly side of the property where there is much fracturing.

South Bay.—The South Bay Mining Company did exploratory work several years ago on claims H. S. 723 and H. S. 724. They also sank a shaft to a depth of 100 feet on the O'Brien claim H. S. 602, lying to the west. There is a series of five calcite-quartz veins near the shaft, with a general strike of NW.-SE., running from H.S. 602 to H.S. 723. In addition to the shaft, several large open-cuts were made on veins. A description of the property is given in a report on the Gowganda Silver Area: (1)

Active development was in progress at that part of the property which adjoins the southeast claim of the Bartlett mine when visited in October, 1912. A great amount of surface trenching had been accomplished, and open cuts had been made on some of the veins. Smaltite, niccolite and silver were found at different points. At one place 90 feet south of the shaft some high-grade ore has been taken from a cut about 20 feet in length. The shaft was down 100 feet, and a cross-cut was being run to the south to intersect three N.W. and S.E. veins which showed on the surface. A north cross-cut

(1) The Cobalt-Nickel Arsenides and Silver Deposits of Temiskaming, Ont. Bur. Mines, Vol. XIX, 1913, PART II, p. 186.

was also being run towards a vein with strike N. 60 degs. W. which crosses from the Bartlett property. A 50-foot shaft had also been sunk just south of the north boundary line, on a vein parallel to the one just mentioned. The material on the dump consists of diabase, with aplite and calcite. Native silver and argentite occur in some of the vein material. Part of the vein about one inch in width consists of crystallized epidote and quartz carrying silver and argentite.

Columnar structure is quite pronounced in the diabase, and along the joints veins have been formed, suggesting the filling of cooling cracks. Some of the country rock is quite reddish and coarse-grained, and traceable into the dark grey diabase. Much of the reddish rock adjoining the veins is greatly stained with cobalt and nickel bloom.

Van Hise Township

Alpine (Gamey-Thompson). —The property of the Alpine Silver Mines is situated in the west part of Van Hise township to the northwest of Spawning lake. Here there is a north-south ridge of diabase about 2½ miles in length, reaching an elevation of 200 feet above the surrounding plain which consists of sediments of the Cobalt series overlain in part by sand and gravel.

A series of aplitic veins was discovered on the diabase ridge, along which a great amount of trenching accompanied by the sinking of shallow pits and two shafts to moderate depths, has been done. Associated with the aplite dikes are lenses and veinlets of calcite which occur in different parts of the dikes, as shown along the surface. Most of the work has been done on claim H. R. 458. The aplite dikes vary from about 6 inches to one foot in width.

A northerly trench is along an aplite dike for 140 feet, showing veinlets of calcite, and aplite impregnated with calcite, with frequent occurrences of native silver. Along one streak the calcite is two inches in width on the north wall of the dike, which strikes N. 83 degs. W.

A second aplite dike has been followed for 450 feet by means of trenches. It has a strike of N. 20 degs. E. for 120 feet at the northerly end, and a strike of N. 60 degs. E. for the southerly portion, while the dip is 80 degs. W. The best surface showings occur north of the 30-foot shaft. Some rich nuggety silver ore was taken from an open-cut just north of this shaft. The matrix is also aplite, with lenticular calcite structures. A third dike occurs at the southwest end of the second dike, and has been followed for 300 feet. Just south of the intersection of the dikes there is some high-grade ore.

A tunnel 575 feet in length has been driven from the base of the hill westward to intersect the first dike at a depth of about 170 feet. The aplite dike was drifted on underground for 80 feet before work was discontinued.

A shaft was sunk on another aplite dike with NW-SE strike to a depth of 29 feet.

The diabase sill has been fractured with the formation of intersecting aplite dikes, along which segregations of calcite carrying native silver have been formed at several points on the dikes.

The columnar jointing planes exposed in the long tunnel would suggest that the diabase is in the form of a sill rising from the east.

A power plant consisting of a 60-h.p. boiler and 3-drill compressor was installed recently and exploration will be carried on in 1921.

E. J. Thompson is superintendent.

Hedlund.—During 1920, L. O. Hedlund was prospecting T. C. 141 and an adjacent claim to the east, situated a mile and a half north of the northwest arm of Gowganda lake. These claims are around what was formerly known as McLaughlin lake, but which has been drained by the blasting of a rock ledge at its lower end in aid of the waterpower supply of Gowganda lake, the lake now being represented by a marsh. Considerable work was done on the west side of the marsh in the sill diabase, and also on the easterly side, in a dike of diabase which intrudes the conglomerate. The best results were obtained west of the marsh, where there are quartz veins showing some native silver. A shaft has been sunk to a depth of ten feet at the junction of a quartz vein two to three inches in width with strike NE.-SW., and narrow transverse stringers of aplite. The quartz vein with offsets has been traced southwesterly several hundred feet. It has a banded structure showing scales of native silver in the white quartz, together with copper pyrites, galena and a little niccolite at the shaft. A little cobalt bloom was also seen in the narrow veins near the shaft. The transverse veins at the shaft also show a little native silver in the aplite.

The sill diabase outcrops at a few places in the marsh, but was not observed in contact with the older rocks that occur to the east of the marsh. On the west side of claim, T. C. 141, the diabase underlies the conglomerate at a high angle.

Charters Townships

Garvey.—The Garvey claim, E. D. 1231½, situated west of the Montreal river, in the south part of Charters township, was being prospected during the summer of 1920 by the Garvey Bros. A number of veins were discovered on a knoll of diabase near the west line of the property.

The veins vary greatly in strike, and are more or less connected as revealed by the trenching. The vein in which most silver was noted is about an inch to two inches in width, strikes N 60 degs. E and was traced for 125 feet. In part of the distance there is an open fissure, but toward the easterly end of the trench, for a distance of 30 feet, there are showings of high-grade ore, consisting of silver and smaltite, some of the silver being in the black decomposition products of cobalt and nickel minerals. A second vein, 13 feet northwest, strikes N 48 degs. E and contains aplite six inches wide together with calcite. Fragments of the aplite show scales of native silver. Cobalt bloom can be seen along the walls of several other veins, represented by open fissures for six inches or more. The discoveries having been so recently made, practically no work has been done beyond trenching, so that more time will be required to prove their economic value. The greatly fractured diabase knoll affords a promising location for considerable exploratory work.

Haines.—The Haines claim, H. R. 439, is in Charters township, one-half a mile south of the Garvey claim and near the south boundary of the township. Some work was being done in a shaft on a vein which strikes N 45 degs. E. The shaft was down 11 feet, and for six feet from the surface showed a lens of calcite carrying some silver and smaltite, while at the bottom of the shaft there is a thin seam of calcite,

Work was also done by the same interests on claim G. G. 2606 in Donovan township, where a shallow shaft has been sunk on a calcite vein from an inch to two and a half inches in width with a strike N 62 degs. E. The vein carries disseminated smaltite, niccolite, chloanthite and some

native silver. The rock is a coarse-grained diabase showing some reddish granophyric interstices of quartz and feldspar.

Leith Township

Hudson Bay.—This property is in the southeast part of Leith township, and includes mining claims H. S. 695, 696, and 716. It was operated from 1910 to 1913, but has since been idle. Two shafts were sunk on silver-bearing veins on claim H. S. 716 and one shaft on claim H. S. 696. When visited in 1920 some of the veins could be seen at the shafts near the surface, while some heavy smaltite silver-bearing ore was picked up on the dump. It is reported that about six tons of silver ore were taken from the workings, chiefly from shaft No. 2.

At No. 1 shaft, which was sunk 94 feet with a drift of 128 feet, there is a strong calcite vein 7 inches in width in addition to some narrow stringers. Some massive smaltite, 20 inches in width, is reported from the open-cut.

No. 2 shaft was sunk 110 feet with drifting of 274 feet. The vein showed near the collar of the shaft a width of two inches with a dip of 80 degs. NW.

No. 3 shaft was sunk 214 feet with drifting amounting to 362 feet on the 76-foot level, and 359 feet of drifting and cross-cutting on the second level. The vein in shaft No. 3 is reported to be from one inch to four inches wide, and in places to carry high values in silver. Four veins were met with in drifting, two of them showing native silver.

It is expected that this property will be reopened when conditions of mining and transportation are improved.

Silverado.—The Silverado Mining Company is operating a group of 14 claims located in the southeast part of Leith township and the southwest part of Charters township, most of the claims being in Leith. The property is adjacent to the Hudson Bay mine. Most of the exploratory work has been done on claim H. S. 693, where several veins have been located. Nos. 1, 2 and 3 veins have a general N-S strike. Some trenching and shallow pits have been made on these veins, indicating the occurrence of smaltite, niccolite, copper pyrites, aplite and calcite. Native silver was found in No. 1 vein, and also in No. 4 vein, which strikes more nearly east and west. Some very high-grade silver ore an inch in width was obtained from a pit on No. 4 vein.

A shaft has been sunk on No. 3 vein to a depth of 100 feet, and a drift to the north and a cross-cut to the southwest were begun to intersect veins that outcrop at the surface.

The veins are in the Nipissing diabase, with which conglomerate and quartzite of the Cobalt series form the contact. On claim G. G. 4149 the sedimentary rock adjacent to the diabase has been altered to adinole, showing rounded spots. The top of the sill is exposed in the locality.

The plant consists of an 125-h.p. return tubular boiler, a 7-drill compressor, hoist and pumps. A saw-mill has also been erected to prepare lumber for the mine buildings.

Donovan Township

Duggan.—Some work was done on claims H. R. 720, and T. C. 418 during part of 1920 by Howard Duggan. These claims are along the east branch of the Montreal river in Donovan township. Veins were discovered by earlier stakers in 1909, and in succeeding years considerable

prospecting was carried on by means of trenches and open-cuts. On claim H. R. 720 there is a calcite vein three inches in width with strike N. 71 degs. W., that has been traced for about 400 feet on the claim and on adjacent claim to the northwest for 200 feet. A little native silver, smaltite and niccolite were found in places in the calcite. A pit 10 feet deep was sunk on the vein 150 feet east of No. 4 post. Just west of the pit is another vein, three inches in width, showing calcite with a little smaltite, crossing the longer vein.

Two veins of calcite carrying bloom and copper pyrites occur in the northwest part of claim T. C. 418.

Wilder.—Claims G. G. 3541 and 3542, located in Donovan township, a quarter of a mile east of Collins lake, were explored by Frank Wilder during part of 1920. An open-cut 28 feet long and nearly five feet deep was made along a calcite vein varying in width from half an inch to two inches, and in strike from N. 65 degs. E. to N. 45 degs. E. A few segregations of native silver and smaltite together with some niccolite in one place occur in the calcite vein. Two branch veins, one two inches wide and the other from one inch and a half to four inches wide, are shown near the southwest end of the open-cut. Two of the showings of silver are near the intersections with the main vein. Seven feet north of the east end of the cut on the main vein a second vein, varying in width up to two inches, has been followed northeasterly for 175 feet. The wall rock of the veins is Nipissing diabase.

Morel Township

Bishop.—During part of 1920 Wm. Shields carried on exploratory work on claim L. O. 305 lying to the northwest of Bloom lake. A vein with east-west strike and varying in width up to six inches, was trenched for several hundred feet. The vein filling is calcite which carries in places smaltite, together with some massive bornite and native silver. The wall rock is Nipissing diabase. The shaft was sunk to a depth of 50 feet.

Corkill Township

The township of Corkill came into prominence after the discovery of native silver on the Kell claims, G. G. 3786, 3449, about 12 miles south-eastward from Gowganda. The locality is reached by a wagon road which leaves the main Elk Lake-Gowganda road about one-half a mile west of Long Point lake. From Gowganda a canoe route up the east branch of the Montreal river to the lower end of the third portage can be used. From here there is a trail eastward by way of Steele lake and partly following the south boundary of Charters township to Corkill township.

Corkill is largely covered with sand and gravel deposits of glacial origin, occurring in plains and gently rolling ridges. The township contains a number of spring lakes, the largest of which is Lady Isabel, locally called Beauty lake. This lake has beautifully clear water, has no surface outlet, and abounds in lake trout. Brook trout are found in several spring creeks in the area south of Long Point lake.

Geology

Several ridges of Nipissing diabase and Animikie quartzite outcrop through the drift. Of these the ridges of diabase form the chief topographical features, reaching in places 250 feet above the plain.

Diabase.—The diabase ridge in the southwest corner of the township was examined closely. Its structure is that of a highly inclined sill rather than a dike. The normal quartz diabase is dark grey, but in a few places was found to contain dark red spots which are chiefly acid plagioclase (albite) showing some differentiation not recognized in dikes. Microscopically, the rock has an ophitic texture, the laths of feldspar being partly altered to saussurite, and the augite partly to chlorite. Micrographic intergrowths of quartz and red plagioclase occur abundantly in the interstices of the specimen examined. The diabase resembles that of Gowganda, Elk lake and elsewhere, and is clearly in the form of a sill. An excellent contact of the overlying diabase and the quartzite occurs on the line between claims G. G. 4247 and 4326. The contact is well up the east side of a steep ridge that overlooks Shack lake and dips westerly at 55 degs.

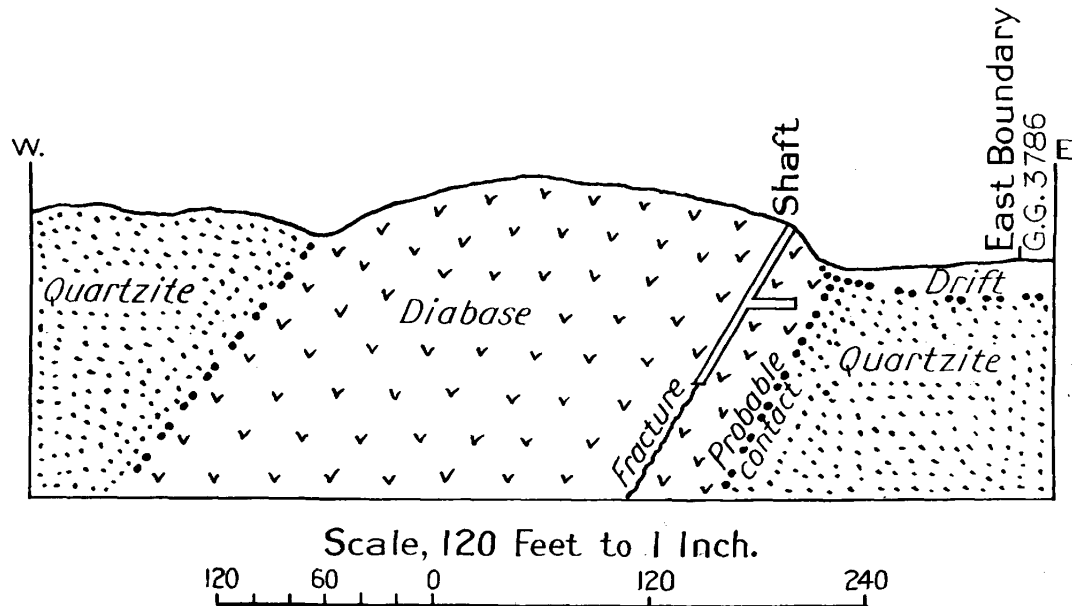
Quartzite.—Quartzite of varied grain and colour is the only sedimentary rock found in the area near the silver discoveries. In this respect this area resembles Cane and Auld townships and the silver area near Maple Mountain.

Discovery of Silver.—Claims were staked as early as 1909, but little work was done until several years later. The discovery made by Hugh Kell and associates was of native silver in veins on a narrow diabase ridge on G. G. 3786 in the southwest part of the township. The first find was made in a number of loose fragments of diabase carrying sections of a calcite vein. Further exploration resulted in the finding of native silver in place at points along the easterly side of the ridge. Here there is a main fracture that roughly parallels the contact with the quartzite, dipping 55 degs. to 60 degs. westward. What appears to be the same fracture zone has been located by means of trenches and pits at intervals over several claims. The main fracture varies up to 18 inches in width. The principal constituents are calcite and quartz, carrying angular fragments of diabase and showing cobalt bloom in places along the surface. There are also roughly parallel veinlets of quartz and calcite, mostly on the footwall side of the main fracture, as well as subsidiary veins that run diagonally from the main fracture. In some of these latter high-grade silver ore was discovered.

Exploration of Kell Claims.—The property was optioned during 1919-20 to J. G. Smith, ex-Governor of Vermont. Well-constructed camp buildings and a steam power-plant were built on claims lying to the east of those carrying the silver-bearing veins. The steam plant consists of an 80-h.p. boiler, a 4-drill Ingersoll-Rand compressor and a 6 by 8-inch Jenckes hoisting engine. An inclined shaft, 58 degs., was sunk on the main fracture to a depth of 104 feet, and 275 feet of drifting on the 54-foot level and about 50 feet on the 100-foot level accomplished. A raise was also made from the 54-foot level to an outcrop of high-grade ore 25 feet south of the shaft. The diabase along the footwall in the shaft showed some native silver to the 100-foot level, and a little silver was encountered in the drift on the 54-foot level to the south of the shaft.

A small shipment of ore, 1,584 lbs., containing 1,620.9 oz. of silver, was made from an open-cut south of the shaft, together with a few bags from an open cut 700 feet north of the shaft. A number of prospecting pits have been sunk along the main fracture. From one of these, 200 feet south of the shaft, good specimens of the rare nickel sulphide, millerite, were obtained. An assemblage of minerals, including argentite, smaltite, niccolite, millerite, together with small quantities of magnetite, specu-

larite and pyrrhotite, have been obtained from the calcite-quartz veins. The presence of the last three minerals indicates a high temperature of formation of the veins. Most of the ore shipped consisted of white calcite with native silver in scales, together with some argentite. Some heavy smaltite with native silver was obtained from an open cut north of the shaft. Work had been discontinued for two months when the property was visited in July, 1920, so that only the surface conditions could be studied. From information obtained and an examination of the surface, it was judged that the narrow subsidiary calcite veins on the foot-wall side of the main fracture afford the most promise for high-grade silver ore.



Cross section at Kell property, Corkill township, showing highly inclined attitude of diabase sill and shaft on fracture near footwall:

Kell (G. G. 4124 and 4125).—Mining claims G. G. 4124 and 4125, along the west shore of Lady Isabel lake, belong to Hugh Kell. The rock here is diabase, occurring as a N.W. and S. E. ridge outcropping through the drift. Unlike the fracture on the Kell claims previously described, the veins are transverse to the long axis of the diabase outcrop. They are largely of quartz with a ribboned structure. Calcite lenses occur with the quartz veins. Small particles of galena and copper pyrites are frequently seen. A little native silver occurs in the quartz and as scales in the diabase. A series of veins averaging one to three inches in width occur along the easterly base of the diabase ridge running back over the hill. At one place there are three in a width of 15 inches. A few shallow pits have been sunk on several veins, but many of the veins are unprospected.

South Bay Power Company

A hydro-electric power plant has been installed by the South Bay Power Company at the outlet of Hangingstone lake, where it discharges into Gowganda lake. The natural head is 58 feet, but by means of a dam this has been raised to 69 feet, 4 inches. The flume is 450 feet in length, most of the fall being near Gowganda lake. The drainage area of Hangingstone lake is approximately 39 square miles, and the present plant is a 250-horsepower installation.

II.—AULD AND CANE TOWNSHIPS

By A. G. Burrows

Location

The townships of Auld and Cane are in the district of Timiskaming about 20 miles northwest of Cobalt. The Montreal river flows diagonally across Auld, so that about half the township is in the Timagami Forest Reserve. Cane lies directly north of Auld, and the Elk Lake Branch of the Temiskaming and Northern Ontario railway traverses the northerly part of the township.

Means of Access

The mineral area is connected by a wagon road, about six miles in length, with Kenabeek station, situated in Henwood township. The southerly part of the area is readily reached from Latchford by gasoline launch to Indian lake, from which there is a mile portage to Lepha lake. From Lepha lake there is a good trail to the Triangle silver mines.

Topography

The prominent feature of the area is the winding diabase ridge that, in places, is 150 feet higher than the plain. The easterly part of Auld and a part of the south portion of Cane are quite rugged and rocky. Most of Cane has been taken up as farm land, the greater part of the township being suitable for agriculture. The country, except where cleared, burned or lumbered over, is well timbered with spruce, jack pine and other soft woods. Large quantities of spruce have been shipped as pulpwood.

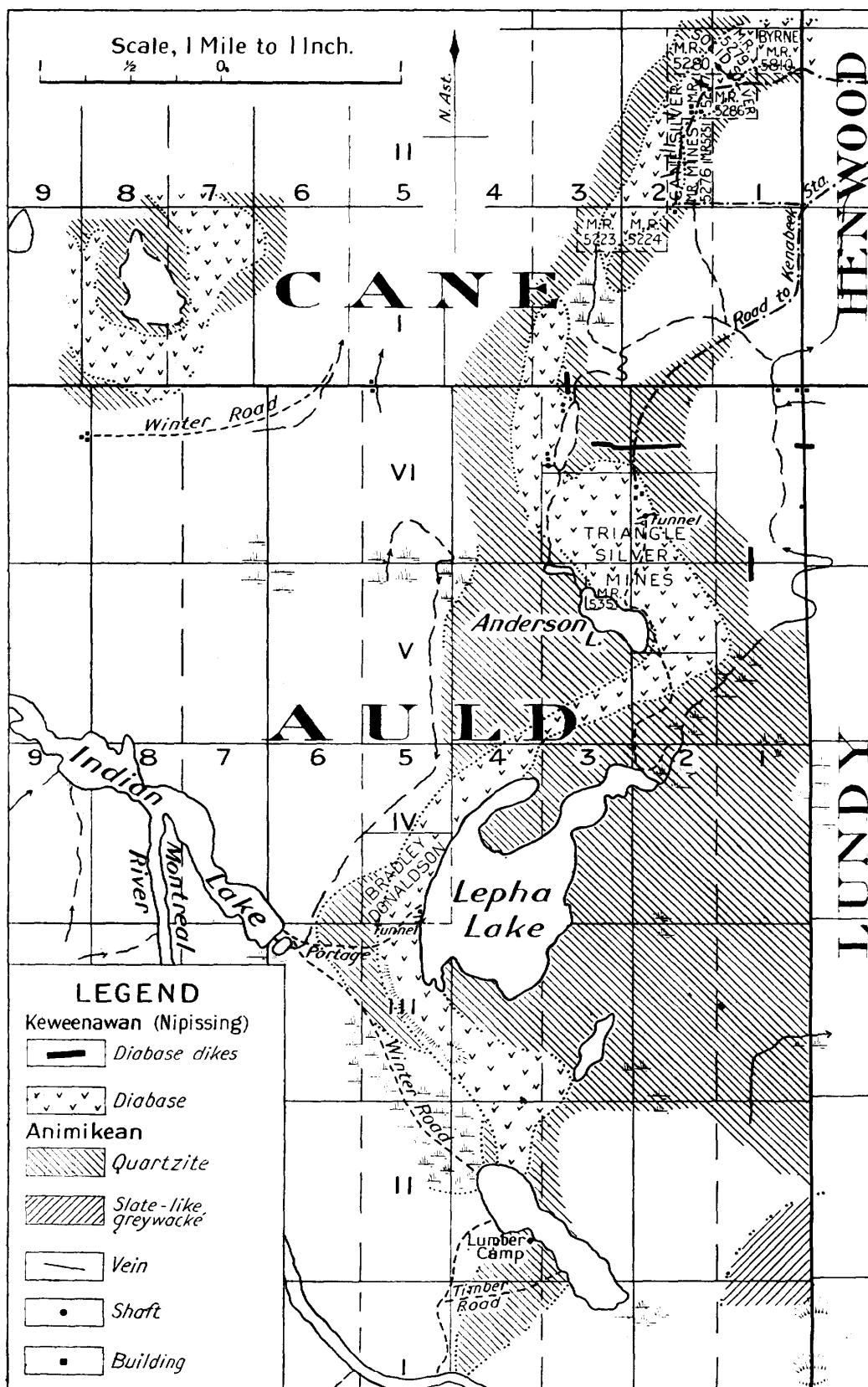
Geology

Two geological series are found in the area, namely, quartzite together with some slate-like greywacké of the Animikie age, and quartz-d diabase of Nipissing (Keweenawan) age.

Animikie—The Animikie consists chiefly of quartzite, which is found so abundantly in the Montreal river district. It resembles the quartzite known as the Lorrain quartzite near lake Timiskaming, at Maple mountain and elsewhere. These rocks occur in thick beds usually with low dip. They are of greyish, greenish and reddish colour, and sometimes show some rounded quartz pebbles.

A small quantity of slate-like greywacké occurs in the southeast part of Auld, near the Montreal river.

Nipissing Diabase.—The quartzite is intruded by sill diabase which for the greater part occurs as a long, narrow ridge with a general north and south strike. Several contacts were observed in the field, which indicated that the diabase rises toward the west and dips under the quartzite toward the east. Several contacts were observed on the northeast quarter of the north half of lot 3 in the first concession of Cane, showing the upper contact of the sill, and with dip varying from horizontal to 45



Geological sketch map of parts of the townships of Cane and Auld.

degs. S.E. Other hanging-wall contacts were found to the southeast of the small lake in the north half of lot 3 in the sixth concession of Auld. Footwall contacts, showing the bottom of the sill resting on quartzite, are exposed just southeast of Anderson lake, and a quarter of a mile north of the northwest bay of Lepha lake.

An irregular area of diabase also occurs in the first concession, lot 8, of Cane, the relationship of which to the quartzite was not observed.

The diabase is mostly of the dark-grey variety, but shows in places some red phases. Occasionally some red spots of intergrown acid plagioclase and quartz are conspicuous in the dark-grey normal diabase.

Numerous dikes of red aplite, up to about two feet in width, are found here and there throughout the diabase. These dikes are frequently associated with the cobalt, nickel and silver ores. A few unimportant diabase dikes intrude the quartzite.

Veins

There are a number of veins of calcite and dikes of aplite that are silver-bearing. They occur toward the hanging-wall side, or upper part, of the diabase sill. The main outcrop of diabase is a long narrow section of a sill extending in a general north and south direction. The veins of calcite and dikes of aplite are approximately at right angles to the contact of the sill with the overlying quartzite, consequently the strike approaches east and west. A number of properties have been located on the diabase ridge, and the exploration of those along the easterly side has shown silver-bearing veins of promise.

Generally where an aplite dike is mineralized, it is accompanied by calcite and quartz veinlets, either irregularly in the dike or parallel to it. Veins in which aplite, quartz and calcite occur are more numerous than the ordinary silver-bearing calcite veins. The silver-bearing aplite dikes vary in width from an inch to 18 inches. The aplite is a differentiation from the diabase magma, sometimes occurring in dikes with well-defined walls. Again, the aplite may grade into the normal dark diabase and still have a dike-like structure, suggesting a segregation from the diabase magma in the process of cooling with consequent shrinkage, the more acid portion of the aplite being near the centre of the dike.

The quartz in the veins is later than the aplite, and the calcite the latest gangue mineral. Frequently there is a narrow band of quartz between the diabase, or aplite, and the calcite.

The smaltite usually accompanies the calcite, and native silver may occur as masses in the smaltite and calcite, or as sheets and scales in the quartz, aplite and diabase. Where veins of calcite occur in diabase or aplite, one portion may be replaced over its width with massive smaltite and silver, and thus show bunches or small shoots of high-grade along the vein, with adjacent parts containing little or no smaltite or silver.

Properties

Cane.—The Cane Silver Mines comprise three mining claims, M. R. 5277, 5251, 5276, in lot 2 in the second concession of Cane township. They are situated along the narrow ridge of diabase that extends from Auld to Cane.

A number of silver-bearing veins occur along the easterly side of the diabase ridge in proximity to the overlying quartzite, consequently they

are in the upper part of the diabase sill. They are approximately at right angles to the contact, varying in strike from N. 70 degs. E. to S. 70 degs. E. Eight veins have been located and work was being done on three of them in the fall of 1920. Open cuts were made on veins Nos. 1, 2 and 8, and ore has been bagged from each of these. No. 1 was traced for 175 feet, with strike N. 70 degs. E. and dip 80 degs. N., extending westward across the boundary to the next claim. This vein is aplitic in character, showing lenses of calcite, smaltite, niccolite and silver and some bismuth, varying in width up to four inches. There are also branching veins, in one place three in a width of four feet. There is also some leaf silver in the diabase along the veins. One lens of high-grade ore that was mined was about three feet long, carrying massive smaltite studded with native silver. A sample of high-grade ore has the following partial composition: Co.—19.29; Ni.—3.67; As.—46.44 per cent.

An open-cut was made on No. 2 vein which contains two leads about two feet apart. Aplite is also the chief gangue of these veins, one showing a width of two to three inches, with streaks of high-grade silver ore about $\frac{1}{4}$ -inch to $\frac{1}{2}$ -inch thick, and forming a rib-like structure in the aplite. At times the high-grade ore runs diagonally across aplite. These high-grade streaks carry silver, smaltite and calcite. Some leaf silver is also found in the diabase near the veins.

No. 8 vein, on the northerly claim of the group, is also of aplitic dike character with an average width, where exposed by trenching, of 14 inches. One section of the dike for 20 feet shows an abundance of cobalt bloom on the surface. An open cut was made along this section, revealing lenses and impregnations of smaltite carrying native silver. The silver-bearing smaltite occurs irregularly, sometimes along the walls of the dike, sometimes running diagonally across the dike, and again as rounded nodular-like masses in the aplite. The aplite where it contains smaltite and silver is impregnated with calcite. A shaft was sunk on this vein, using hand steel, to a depth of 40 feet, the vein maintaining its width with ore similar to that found at the surface. Work was stopped in December. It is expected that a compressor plant will be installed at a later date, when mining will be resumed.

Previous to October 1, 1920, 100 sacks of ore weighing $3\frac{1}{2}$ tons and assaying 402 ounces of silver per ton, were shipped from open-cuts to the Cobalt Reduction Company. One hundred sacks in addition were taken from the open-cuts and shaft before work ceased for the winter.

J. J. Byrne is manager of the property.

Triangle—The Triangle Silver Mines, situated in Auld township, consists of 1,000 acres, being part of lots 2 and 3 in the fifth and sixth concessions. Silver was discovered on the group in 1912, and this discovery is described by C. W. Knight (1) as follows:

“On the Hitchcock location, south half of lot 3, Con. VI, there are a number of narrow east and west veins, in some of which native silver with some smaltite and bloom have been found. The wall rock of the veins is usually aplitic. On the westerly side of the easterly diabase ridge native silver occurs in fairly coarse dendritic form. At the northerly exposure there is coarse-grained reddish aplite which is heavily stained with bloom. The aplite has more the character of a differentiation of the diabase than a clearly defined dike. At the other exposure where silver was seen, there is a grey aplite along one perpendicular surface of which there is native silver in dendritic form.

(1) Ont. Bur. Mines, Vol. XIX, 1913, Part 2, p. 163.

Veins were later discovered on lot 2 lying to the east and near the contact with the quartzite. The group of claims was operated first as the Kenabeek Silver Mines and later re-organized as the Triangle Silver Mines. On lot 2 a tunnel has been driven westward on a fracture on the east side of a high diabase ridge. The principal work, however, has been on a series of veins, the principal one of which strikes N. 66 degs. E. and dips 80 degs. S. A shaft has been sunk to the 132-foot level, on the dip of the vein, and to the 182-foot level at a flatter angle. Drifting and cross-cutting have been done on the two levels, most of the work being on the upper level. A faulted zone, 10 feet to 12 feet in width and dipping flatly southward, was encountered at the first level.

The calcite veins on which underground work was done carry segregations of native silver, smaltite and niccolite. The veins vary from an inch to six inches in width, while some heavy sheet silver is occasionally encountered in the wall rock. A small quantity of ore has been raised from the mine but no shipments have been made.

W. R. Hitchcock is managing director and W. H. Jeffrey is mine manager.

Shepp.—The two principal claims of the group are M. R. 5279 and M. R. 5286, lying just northeast of the Cane Silver Mines. An aplite dike 8 inches wide and dipping 80 degs. N.E. crosses the line between the two claims; two shafts have been sunk to moderate depths and some trenching done. The southerly shaft was sunk at the junction of two aplite dikes 6 inches and 8 inches in width. The material on the dump shows some massive smaltite, partly altered to cobalt bloom, together with a little native silver. The exposure here somewhat resembles that at No. 8 vein at the Cane mine. The property had not been worked recently, and the shafts were filled with water.

Bradley-Donaldson.—The Bradley-Donaldson property includes the south half of lot 5, con. IV., Auld. It is situated on the west side of Lepha lake, along the westerly shore of which is a high diabase ridge sloping steeply to the lake. No work has been done in several years, and the camp buildings are dismantled. A tunnel was run westward into the ridge on a calcite vein near the south boundary of the property, and it is stated that some native silver was obtained from the workings now filled with water. Fragments from the dump show a banded structure in the vein, which is composed chiefly of grey calcite with narrow ribbons of quartz. The structure indicates a replacement type of vein along a fracture in the diabase. In this locality the diabase dips steeply beneath the quartzite and the workings are near the upper contact.

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