FORTY-FIFTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

1936

PART VI

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FIFTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLV, PART VI, 1936

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by T. E. Bowman, Printer to the King's Most Excellent Majesty
1937

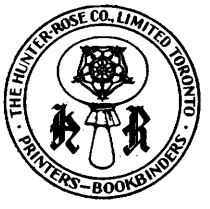

THE HUNTER-ROSE CO., LIMITED TORONTO
PRINTERS—BOOKBINDERS

TABLE OF CONTENTS

Vol. XLV, Part VI

ILLUSTRATIONS

SKETCH MAPS, SECTIONS, AND DIAGRAM

GEOLOGICAL MAPS

(In pocket at back of report)

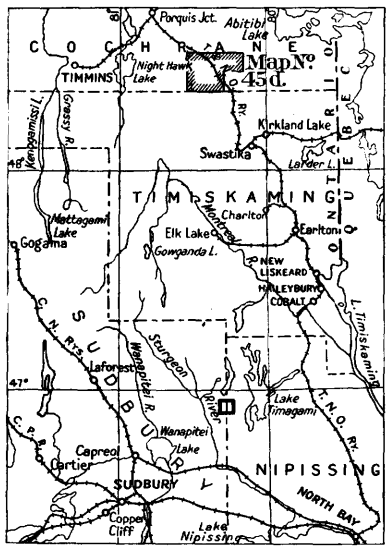
Map No. 45d—Ramore Area, District of Cochrane, Ontario. Scale, ¾ mile to the inch.
Map No. 45e—Burntbush River Area, District of Cochrane, Ontario. Scale, 2 miles to the inch.

Geology and Ore Deposits of the Ramore Area

By E. S. Moore

INTRODUCTION

The Ramore area, comprising the townships of Bowman, Hislop, Guibord, McCann, and Playfair, in the district of Cochrane, lies between north latitude 48° 21′ and 48° 33′ and west longitude 80° 8′ and 80° 33′. The village of Ramore is situated in Playfair township, on the Temiskaming and Northern Ontario railway, and serves as a centre for prospecting and mining activities



Key map showing the locations of the Ramore and Afton-Scholes areas. The latter is the small heavily outlined square near Lake Timagami. Scale, 60 miles to the inch.

for the greater part of the area. The Ferguson highway passes through the village, and since it is in a large farming community, roads lead out from it in nearly all directions. Many of these roads have been gravelled, but where this has not been done they are almost impassable in wet weather because the soil is mostly clay.

The situation of this area is of special interest to mining men because it lies between the two great gold camps, Porcupine and Kirkland Lake, about 30 miles northwest of Swastika. Gold is widely distributed, and consideration of the number of occurrences of this metal in connection with the relatively small number of rock exposures over large sections of the area leads to conjectures about the possibility of there being many more hidden deposits. It may be that the gold-bearing formations, on account of their quartz content, are more

resistant to erosion than others and therefore produce more outcrops. Nevertheless, it seems probable that many are concealed beneath the heavy mantle of drift and stratified clay, silt, and sand that covers the greater part of Hislop, Guibord, and Bowman townships and large sections of Playfair and McCann.

Gold was discovered in the Ramore area at a very early date in the history of gold mining in Northern Ontario, and much effort has been expended in attempts to develop producing mines on the large number of claims staked,

View of Ramore, which is situated on a plain of clay lake-beds. In the background is Lava Flow hill in Cook township.

but these efforts met with little success until quite recently. During 1935 the Ross mine of Hollinger Consolidated Gold Mines, Limited, in Hislop township, came into production, and the Vimy mine in the same township operated a mill for a short time. Hollinger has proved considerable ore reserves, and the development of this property has stimulated renewed interest in the whole area.

Acknowledgments

The writer is greatly indebted to many persons for favours received while in the field. Through the kindness of Mr. John Knox, general manager of Hollinger Consolidated Gold Mines, and Mr. John Caty, manager of the company's mine in Hislop township, accommodation was generously provided at the mine camp. They and other members of the staff of the company gave freely much information relating to their property. The staff of McIntyre-Porcupine Gold Mines, Limited, also furnished plans and information relating to properties in which the company is interested. The writer regrets that it is impossible to make individual acknowledgments to all of those from whom aid in some form was received.

The three assistants on the field party, B. T. Wilson, J. D. Bateman, and E. F. Hartwick, performed their share of the work in a very efficient manner. Special credit is given to Mr. Wilson for work done after the writer left Ramore to investigate the Afton-Scholes area. He was responsible for completing the mapping of parts of McCann and Guibord townships.

Previous Work

It is stated by Wright[1] that gold was discovered in Playfair township by land surveyors, in 1905, and that claims were staked the following year by a prospector named Frederick Mobbs and several others. This is believed to have been one of the earliest discoveries of gold in Northern Ontario. By 1908 discoveries had been made and claims staked in some of the other townships in this region.

The earliest geological work done in the Ramore area was probably that of Kay,[2] who descended the Watabeag river and passed through McCann township.

In 1920 Wright mapped the Black River area,[3] and in 1921 the townships of McCann and Playfair and others to the south.[4] His geological map,[5] covering McCann township in some detail and Playfair in a general way, and his reports on the geology of these and adjacent townships have been of great service in the present work.

As early as 1911 Burrows[6] mapped Munro and a small part of Guibord township. In 1915, Hopkins' map and report on "The Beatty-Munro Gold Area"[7] appeared. These maps and reports were a great aid in the geological work in those sections of the Ramore area contiguous to the Beatty-Munro area. The numerous gold discoveries made in the latter area and the great interest which they created among prospectors in the region surrounding Matheson has had much influence on prospecting in the Ramore area. This is particularly true of the discovery of the Croesus mine, the fabulously rich but small deposit in Munro township. Several properties in the southern part of Munro, on which considerable work has been done, contained veins that in some cases extended across the township boundary into Guibord. The Gold Pyramid Mining Company, for example, was operating a small mill in 1911 on a property in Guibord which adjoined that of Munro Mines on the north. The Detroit New Ontario property along the south boundary of Munro also produced some gold from a small stamp mill, which closed down in 1911.

Near the southeast corner of Hislop township, in a farming section, a small outcrop containing much quartz and pyrite had attracted the attention of prospectors on more than one occasion. No commercial ore, however, was found until a prospector, Frank Tremblay, sampled another section of the exposure and found good values. He staked the claims which were later known as the Brennan-David and are now called the Ross mine. The Hollinger took an option on the property and did much trenching and drilling in the autumn of 1933. In 1934 shaft-sinking was commenced.

Topography

When the Ramore area is viewed from the top of a high hill, it has the appearance of a large basin almost surrounded by ridges of hills. Considerable sections of the basin are almost perfectly flat because they are underlain by stratified clay and silt deposited in a bay of Lake Ojibway, a large glacial lake

[1]D. G. H. Wright, "Geology of the Watabeag Area," Ont. Dept. Mines, Vol. XXXI, pt. 7, 1922, p. 19.

[2]Geo. F. Kay, "The Abitibi Region," Ont. Bur. Mines, Vol. XIII, pt. 1, 1904, pp. 104-134.

[3]D. G. H. Wright, "The Black River Area," Ont. Dept. Mines, Vol. XXX, pt. 6, 1921, pp. 27-62.

[4]D. G. H. Wright, "Geology of the Watabeag Area," Ont. Dept. Mines, Vol. XXXI, pt. 7, 1922.

[5]No. 31d.

[6]A. G. Burrows, Ont. Bur. Mines, Map No. 21c, 1912.

[7]P. E. Hopkins, Ont. Bur. Mines, Vol. XXIV, pt. 1, 1915, pp. 171-184.

which lay between the height-of-land to the south and the ice front to the north and covered the area known as the "clay belt." The clay furnishes good farming land, and large sections of the area are tilled. The lake did not cover the higher hills, and distinct boulder and gravel beaches may be seen in lot 9, concession II, Bowman township. Here two beaches, one about 40 feet above the other, occur on the north flank of the large hill in the southwestern part of the township. The lower beach is estimated to lie from 70 to 75 feet above the lowlands.

The lowlands, before they are cleared, are swampy, and covered with an almost impenetrable growth of alders. Large sections of Guibord township are occupied by extensive swamps, and this township is particularly difficult to traverse, except in the rocky and sand plain sections. The northeastern part of the township is covered by sand, which represents the sediments deposited near the northeast shore of the bay of the old lake. The southwestern part of McCann township is also largely occupied by a sand plain, and there is another stretching south and east from Talbock lake in Playfair township.

Rising above the clay lands are ridges and hillocks of terminal moraine consisting of large boulders, gravel, and sand. These are particularly striking in Bowman township, south of Matheson. A little west of the Matheson cemetery there is a very deep, dry kettle in the moraine. In wet weather rivulets run into it, and the water readily drains out through the gravel at the bottom.

Hills and knolls of rock, large and small, protrude through the lake beds, and the larger hills stand as conspicuous monadnocks, rising to several hundred feet above the lowlands. The average altitude of the clay lands is about 950 feet. The altitude of Ramore is 944 feet, and of Matheson 861 feet. The highest point in the whole area is Kempis mountain, on the boundary between Playfair and Cook townships. This hill rises about 400 feet above the railroad at its base. The next highest points are two hills in lots 10 and 12, concession I, Bowman township. On the hill in lot 10, there is a Geodetic Survey record of 354 feet. Barometer readings indicate that the hill in lot 12 is approximately 350 feet above the valley north of it. On some maps the large hill in the central part of Guibord township has been given an elevation of 300 feet, but this is regarded as much too high, since barometer readings indicate that it is barely 200 feet above the large swamp at its base.

The drainage is all northward, and the largest river in the area is the Black, which is joined by the Watabeag below Matheson. The valley of the Black river is drowned as far up as Matheson by the dam at Iroquois Falls, as is the lower end of the Watabeag. The next largest river in the area is the Pike, which is a tributary of the Black river and drains practically all of the townships of Guibord and Michaud and a considerable part of Cook and Barnet. Wildgoose river, another tributary of the Black, is a stream of considerable size and drains most of the remainder of the Ramore area. The larger streams have cut deep valleys in the stratified lake beds and glacial drift, and where they have reached buried ridges of rock, falls and rapids occur. Where the road to the Ross mine crosses the Black river, the bottom of the valley is estimated to be more than 75 feet below the level of the clay plain on its east side. When the glacier that covered the Hudson Bay basin melted and Lake Ojibway drained out, lowering the water to the present level of James bay, the larger rivers in the area began their work of deeply dissecting many sections of the Ramore area. The Black river has long stretches with sluggish current above falls and rapids, where solid rock impedes rapid cutting of the valley, and below them for a considerable distance a canyon-like valley.

GENERAL GEOLOGY

Table of Formations

QUATERNARY	
RECENT:	Alluvium along streams.
PLEISTOCENE:	Glacial drift and stratified gravel, sand, silt, and clay lake beds.
	Great unconformity
PRE-CAMBRIAN	
KEWEENAWAN(?):	Quartz diabase dikes (may be Matachewan).
COBALT SERIES (Gowganda Formation):	Conglomerate, arkose, and greywacké (tillite).
	Unconformity
MATACHEWAN:	Quartz diabase, gabbro, and diorite dikes.
	Intrusive contact
ALGOMAN:	Lamprophyre dikes. Quartz porphyry and feldspar porphyry dikes. Diorite porphyry. Hornblende syenite. Hornblende granite.
	Intrusive contact
TIMISKAMING:	Conglomerate, banded arkose, greywacké, and slate.
	Disconformity
KEEWATIN:	Greenstone, andesite, basalt, diabase, epidiorite, dacite. Hornblende, chlorite, and sericite schists. Rhyolite, felsite, chert, greywacké, slate, tuff, and agglomerate.

Keewatin

The whole of the Ramore area is underlain by Keewatin formations, most of which are buried by drift and lake beds. The Keewatin series are intruded by Algoman and Matachewan rocks, and Timiskaming and Cobalt sediments cover them in a few places.

The Keewatin consists almost entirely of basic and intermediate rocks, there being little acid or sedimentary rock in the series. The basic rocks are of the types found in the Keewatin elsewhere. Andesite is a common type, and there is much basalt and diabase. Amygdaloidal and spherulitic lavas occur, and pillows may be seen in many places. Coarse phases of the basic flows have the appearance of diabase, and some parts of the flows are so coarsely porphyritic that the rock resembles the coarse porphyritic diabase of some of the Matachewan dikes. Such rocks are well exposed in lots 3, 4, and 5, concession III, Playfair township. The band of lavas seen here is a continuation of the one so splendidly exposed in the large hill, in Cook township to the east, on which the lookout tower is situated. Wright[1] has given a good description of the rocks in this hill, which he called "Lava Flow mountain," under the name of "leopard rock." The phenocrysts of altered anorthite have a maximum diameter of an inch or more, and chemical analyses quoted by Wright show that the porphyry approaches anorthosite in composition but is more basic. The phenocrysts are arranged in irregular zones, in some of which the crystals are crowded together, constituting a high percentage of the rock, while in others they are few and scattered. The tops of the flows, of which fourteen, with a total thickness of 7,300 feet, have been distinguished, show typical ropy, fragmental, amygdaloidal,

[1]D. G. H. Wright, Ont. Dept. Mines, Vol. XXX, pt. 6, 1921, pp. 35-42.

and pillow bands. Here, as elsewhere throughout the Ramore area where the tops of flows can be recognized, the formations dip steeply southward.

Associated with the lava flows are coarse-grained intrusions, which are now, for the most part, epidiorites, or secondary diorites derived from the alteration of gabbro or diabase. In these rocks amphiboles have taken the place of the pyroxenes, and the plagioclases are more sodic than the original feldspars. Such rocks may be seen in the southern part of Playfair township, concession I, lots 2, 3, and 4.

Porphyritic Keewatin lava flow, Lava Flow hill, Cook township. This is similar to the lava in Playfair township.

Dacite was observed in a few places. On the property of Hislop Gold Mines, in lot 1, concession IV, Hislop township, some of the veins in the trench at the western end of the outcrop occur in this rock. The rock appears in the field to be a little more acid than the typical greenstone, and in thin section it is found to be medium-grained, with plagioclase as the main constituent. It contains considerable chlorite and sericite, a little carbonate, and disseminated magnetite and pyrite. Another occurrence of similar rock was observed on the McIntyre property, claim L. 24,686, lot 2, concession IV, Hislop township.

In many places, the basic and intermediate lavas have been altered to schists. Chlorite schists are widely distributed in the area. Near the granite contact, in the southern part of Bowman township, there are large bodies of hornblende schist, which has apparently resulted from the contact effects of the granite intrusions, as it is practically confined to this section of the township. The schist is a hard, compact, barren, resistant rock, which forms large hills.

A few small areas of acid lava are found in the Ramore area. The most important are in Hislop township, at the Ross mine, lot 1, concession II, and on the McIntyre property, lots 1 and 2, concession IV. Outcrops were also found on Kempis mountain and in a few other places, but such lavas are comparatively

scarce. The lavas on the McIntyre property are fine grained and pink to red in colour. In thin section some specimens show flow structure, and they are full of microlites of feldspar, stained brown by iron oxide. Phenocrysts of feldspar also occur. The feldspars are orthoclase, albite, and oligoclase. Quartz forms a considerable proportion of the rock and is both primary and introduced. It has been impregnated with pyrite, and a little carbonate and epidote have also been introduced. It is on the rhyolite that most of the drilling and trenching has been done.

Of a number of bands of tuff in the Keewatin series, the most important are on the Hollinger and McIntyre properties in Hislop township. The tuff is mostly of an acid type, probably related to the rhyolite that occurs in its neighbourhood. It is mostly highly altered, sericitized, carbonated, and silicified. On the two properties mentioned it is also greatly impregnated with a green chrome mica, which seems to favour this rock. There is much of this green mica associated with the quartz in the spectacular outcrops in lot 9, concession IV, Guibord township. Here the rock is so schisted and otherwise altered that a definite determination of its original nature is impossible. A more detailed description of the tuff at the Ross mine will be found in a description of that property.

A few small patches of agglomerate occur with the greenstones in several places, but the quantity of this rock is small. In contrast to the tuff, the agglomerate is more commonly associated with the basic rocks of the Keewatin.

Scattered over this area are a few small outcrops of sedimentary rocks associated with the typical rocks of the Keewatin series. These consist of slate and greywacké. They may be later sediments infolded, or they may be local deposits of sediment laid down with the lavas, probably water-laid volcanic ash. An outcrop of dark slate may be seen on the banks of the Black river, near the south end of lot 4, concession I, Hislop township. Greywacké occurs on the same stream, at the rapids in lot 1, concession VI, Bowman township.

Timiskaming

Rocks of the Timiskaming series underlie a large area in the northern part of Guibord township, into which they extend from Munro township. In this area the only sediments are arkose, slate, and greywacké, which are in places distinctly banded like varved clays. In other places the only rock is a thick-bedded arkose, approaching quartzite in some sections, as at the Gold Pyramid mine. These rocks strike from N. 70° W. to N. 45° W. They have been considerably sheared along two lines, the most pronounced shearing being in a direction varying from N. 73° E. to N. 65° E., and the lesser east-west. They dip from 45° to 60° S.W. The contact of the sediments and greenstone is concealed in Guibord township, as a marked depression follows the contact. In Munro township, however, a short distance north of the township boundary, they are in contact, but the sediments dip southwestward, and a short distance from the contact the lava flows dip northeastward. This has given rise to much speculation regarding the age of these sediments. Some geologists have regarded them as Keewatin, or at least as older than the lava flows around the Croesus mine. There is strong evidence, however, that the contact in this place is along a fault and that the sediments are actually Timiskaming in age. There is no conglomerate in the sediments in this locality, but there is conglomerate in this same band of sediments elsewhere. The distinctly banded character of the rocks in places is similar to that of the Timiskaming in many other areas.

At the Talisman mine, lot 7, concession VI, Guibord township, there is a small outcrop of banded arkose, slate, and greywacké, which indicates the extension of the main body of Timiskaming sediments in that direction. They disappear under a great swamp to the southeast. The strike here is N. 80° W. and the dip 70° S. The quartz veins on this property cut the sediments at various angles and conform more or less to the strike of several dikes intruding the banded sediments.

On the north side of Guibord hill, in lot 8, concession IV, Guibord township, there are two small outcrops, one of conglomerate and the other of banded greywacké. The conglomerate contains a variety of angular to well-rounded pebbles and boulders up to 6 inches in diameter. It grades downward into agglomeratic rock, which overlies greenstone. The strike here is east-west, and the dip 68° N. Apparently this outcrop lies on the south limb of a large syncline, as the dip is nearly opposite in direction to that near the north boundary of the township. There is quite a distinct cleavage in the greywacké, which strikes N. 78° E. and dips 88° S.

A few small outcrops of conglomerate are found on the west side of the Pike river in lot 11, concession III, Guibord township. The rock contains a variety of pebbles and boulders, some as much as a foot in diameter. The fragments vary from angular to well-rounded forms. The strike is N. 65° W., and the dip indeterminable. As in the occurrence of this rock last described, it looks as if the conglomerate graded from an agglomerate to a conglomerate with well-rounded fragments; or the rock might have been formed in the sea near a steep shore, which was gradually levelled down. This gradation of coarse, angular fragments upward into conglomerate with rounded pebbles and boulders may also be seen in Playfair township, lot 1, concession VI. The writer has observed the same condition in the Timiskaming in several other areas in Ontario, for example in the Mississagi Forest Reserve, and on the Onaman river.

In Hislop township several outcrops of conglomerate are regarded as Timiskaming, although it must be admitted that it is difficult to be sure of the age of this rock, which is much like the Cobalt conglomerate in many ways. On the Vincent section of the McIntyre property, in lot 2, concession IV, a small wedge of conglomerate grades downward into what may be agglomerate and tuff. Many well-rounded boulders, are found, however, and since the relations here are similar to those in Guibord township this rock should be placed in the Timiskaming. On lot 2, concession I, Hislop township, and on lots 1 and 2, concession VI, Playfair, there are a number of outcrops of distinct conglomerate, which are considered as Timiskaming although in the field they were at first regarded as Cobalt in age. In some of these outcrops the rock is crowded with boulders, varying from angular to well-rounded shapes. There is a great variety of boulders of acid and basic rocks, and there are granite boulders up to 2 feet in diameter. Other parts of the series are almost entirely greywacké, which in places is not easily distinguished from the greenstone lying on the west side of the conglomerate, except where there is some banding in the sediments or where the greenstone contains pillows or spherulites. The strike of the formation varies from north-south to N. 35° W. The dip is indistinct. In some places the shearing planes are practically vertical, and at one point a thin band dips 25° S.W.

The matrix of the conglomerate is a blue greywacké-like material. In thin section it is found to contain particles of a great variety of rocks: greenstone with microlites of feldspar, a very basic rock with grains of olivine altered to serpentine, feldspar porphyry, arkose, etc. Some specimens contain a micrographic intergrowth of quartz and feldspar. When the matrix of this rock is compared

with that of the conglomerate in McCann township, which is regarded as undoubtedly Cobalt in age, it is found that on the whole it is much more indurated and altered, and it appears to be derived from a much older rock. Some of the feldspar porphyry fragments in both rocks are, however, remarkably fresh in appearance.

The correct interpretation of the age relations of this conglomerate is of some importance because of its value in finding the key to the major structural features of the Ramore area. From observations in the field the formation is not cut by the Algoman intrusives in Hislop or Playfair townships, as are the Timiskaming sediments near the north boundary of Guibord. At the north end of lot 1, concession V, Playfair township, the conglomerate is cut by a diabase dike, but owing to the lack of evidence to determine whether this dike is Matachewan or Keweenawan, little help is given in determining whether the conglomerate is Timiskaming.

Algoman Intrusives

The Algoman intrusives in this area, as around Kirkland lake, comprise a considerable variety of rocks. They range in composition from very acid to nearly basic, and it is believed that they have all been derived from a common magma, which must have underlain the whole of the Ramore area in Algoman time. It is impossible to determine the age relations of all the members of the series because they have not been found in contact with one another, except in the case of the syenite and lamprophyre. The latter cuts the former and is, therefore, apparently the youngest of the series of intrusions.

The question may be raised as to whether the Matachewan diabase does not also belong in this series. The occurrence of diabase earlier than the ore and later than the other Algoman intrusives at Kirkland Lake, and the petrographic relations of Haileyburian, Algoman, and Matachewan intrusives, as worked out by Derby[1] in the area lying southwest of Kirkland Lake, seem to point to the possibility of the Algoman having closed with diabase intrusions. The diabases found in the Ramore area, and mapped as Matachewan, so distinctly cut the Algoman acid and intermediate intrusives in many places, that there is no doubt concerning the relative age of these two groups of rocks. The Matachewan diabase also cuts some of the quartz veins, and it is believed that whatever the relation of the diabase to the magma from which the Algoman rocks came, the diabase is later than the period of ore deposition. The diabase, because of its great volume and wide distribution, must have been drawn from a magma reservoir of great dimensions and not from subsidiary magmas produced by local differentiation, such as those that supplied the small basic lamprophyre dikes.

Probably the first of the Algoman series to erupt was the granite. Large bodies of granite occur in Egan township, west of McCann, and in Michaud and Garrison townships, east of the Ramore area. Smaller masses outcrop in McCann, Bowman, and Guibord townships, and a few outcrops were found in the southwestern part of Hislop. It is probable that a hidden connecting link joins the two main bodies under the southern part of Hislop and the northern part of Playfair townships.

Granite and Granodiorite

The granite is on the whole massive and little sheared. It is mostly the hornblende variety and is pink to reddish in colour. Some of the smaller

[1]A. W. Derby, unpublished thesis, University of Toronto, 1934.

intrusions are quite acid in composition and fine grained, approaching aplite; others are comparatively basic and are more nearly granodiorite or quartz monzonite. Several outcrops in Guibord township show the monzonitic phases. In lot 9, concession IV, the rock is slightly porphyritic, and while it contains a considerable amount of quartz this mineral is in smaller proportions than in typical granite. Orthoclase dominates, but plagioclase is abundant. There is little evidence of the presence of ferromagnesian minerals, and if any were originally present they have been replaced by carbonate and sericite. The rock contains a little pyrite. In another outcrop, in the same lot, the rock is a quartz monzonite porphyry, in which plagioclase is the dominant feldspar in quantity, but the larger crystals are orthoclase. There was originally more ferromagnesian mineral in this rock than in the one just described, and it has changed to chlorite. The rock is impregnated with fine-grained pyrite and stained by hematite along the contacts of quartz and feldspar grains.

In lot 3, on the line between concessions II and III, Guibord township, a porphyritic granite occurs. It is more typical of granite in composition than the specimens described and forms larger outcrops. This rock in thin section consists chiefly of microcline, orthoclase, and quartz, and many of the feldspars are well zoned. The ferromagnesian mineral is hornblende. Distinct wedge-shaped crystals of titanite, small, clear crystals of zircon, and a few grains of magnetite are present. The feldspars are partly kaolinized and in most cases are a dirty-grey in colour.

A more sodic phase of the granite was observed in lot 10, concession I, Hislop township. There is a considerable quantity of quartz in the rock, but the feldspars are entirely of the sodic variety. Some of the amphibole is the ordinary green type of hornblende, but there is also blue amphibole with pleochroism resembling that of arfvedsonite—deep-blue to greenish-blue to lavender-blue to greenish-yellow. The extinction angle is too high for arfvedsonite and is closer to that of ordinary hornblende. The blue colour is in many crystals unevenly distributed, being in blotches and zones in the green hornblende. The rock contains also well-formed crystals of titanite and zircon and a few grains of apatite.

It is evident from the descriptions given above that the smaller intrusions of granite in this area vary considerably in composition from the main masses of granite.

Syenite

Hornblende syenite is widely distributed in this area, but it is always in relatively small bodies, such as dikes and plugs. The rock is very commonly porphyritic, and there is no very sharp line in composition between the syenite and feldspar porphyries, which also occur throughout this area in small dikes. Gold occurs in many places with both the syenite and feldspar porphyries.

On the McIntyre property, lot 1, concession IV, Hislop township, a syenite porphyry dike 20 feet wide runs along the contact between carbonated tuff and rhyolite. In thin section the rock is seen to be made up chiefly of orthoclase and albite with a little ankerite. It is impregnated with pyrite and cut by veinlets of this mineral. Visible gold occurs along one side of the dike. A number of irregular dikelets cutting the rhyolite near the dike described consist of rather coarse-grained syenite, which is composed chiefly of orthoclase and microcline with some microperthite. The feldspar is largely microcline. As in many of the other syenite dikes there is practically no ferromagnesian mineral. Carbonate and quartz have been introduced.

A coarse-grained syenite porphyry on lot 8, concession IV, McCann township, consists of orthoclase and microcline feldspars; almost fresh, deep-green hornblende; a considerable amount of titanite; and a little hematite and pyrrhotite. The syenite on the property of Ramore Gold Mines, lot 8, concession III, Playfair township, is a medium-coarse, red, granular syenite highly impregnated with pyrite, which is said to carry values in gold.

Diorite Porphyry

Diorite porphyry was observed in several places in small intrusions resembling plugs. As a rule, it does not form distinct dikes. The rock is grey or greenish-grey in colour and spotted with white to greyish plagioclase phenocrysts, which are considerably kaolinized and sericitized, although in the hand specimen they appear nearly fresh. There are in most specimens a few phenocrysts of orthoclase. The ferromagnesian minerals, when seen in thin section, are now mostly uralite, chlorite, and serpentine. Certain specimens show original hornblende. Some of the intrusions might more properly be described as granodiorites than diorites. Quartz occurs in the matrix of all the specimens, but much of it may have been introduced by hot solutions.

Feldspar Porphyry

There is nothing unusual about the feldspar porphyry dikes, which occur in many parts of the area. They contain orthoclase and plagioclase phenocrysts with very little ferromagnesian material. They appear to have much the same composition as the syenite, but the process of cooling and crystallization has been different. A few of these dikes contain an occasional phenocryst of quartz.

Lamprophyres

A number of dikes occur in this area which in the field are commonly spoken of as lamprophyre, although few of them are really typical of this rock. These dikes are the youngest rocks in the Algoman series. They vary greatly in composition and are dark-grey to brownish in colour and more or less porphyritic in texture. They have an abundance of ferromagnesian constituents and occur only in small irregular dikes, usually near ore deposits. Some of them are highly altered, in which case few of the original minerals remain.

The most typical examples are found on the Bush claims, McIntyre property, lot 1, concession IV, Hislop township. In one of the trenches a dark dike, 6 feet wide, is well exposed for a few yards along its strike. This rock, following Iddings,[1] might be classified as a diabasic lamprophyre, as the lime-soda feldspars are lath-shaped. It has been considerably carbonated, and the long phenocrysts of biotite have lost most of their pleochroism, being greenish and dull and almost altered to chlorite. There are many outlines of what appear to have been hornblende crystals, which have been replaced by carbonate and a little chlorite. Some fairly fresh hornblende crystals remain. A little quartz, which appears to have been introduced into the rock, and many grains of magnetite and very small crystals of bluish apatite are present.

Another dike in the same locality is 5 inches wide and intrudes the syenite. It is porphyritic, and there are a number of outlines of previously existing crystals shaped like those of olivine, but these grains have been replaced by carbonate and sericite, as the rock is almost completely carbonated. A few flakes of

[1]J. P. Iddings, "Igneous Rocks," John Wiley & Sons.

bleached biotite are present. The rock reminds the writer of the picrite lamprophyre in the Michipicoten area.[1]

A specimen of another dike of highly carbonated lamprophyre on the property of Hislop Gold Mines, lot 1, concession IV, Hislop township, was examined in thin section. The greater part of the original constituents has been replaced by quartz and carbonate, but a considerable amount of bleached biotite remains.

In the outcrop at the Talisman mine, lot 7, concession VI, Guibord township, several small, irregular dikes cut the banded sediments. These range in width from a few inches to 8 feet. The dike at the shaft increases from 2 to 8 feet in width within a distance of 10 feet. The dikes cut the sediments in various directions and have no definite trend. The rock is light- to dark-grey in colour and weathers brown, appearing to be more basic than it really is. It is medium- to fine-grained and somewhat porphyritic. In thin sections the rock is found to consist of feldspar, quartz, and much biotite. The groundmass consists of columnar feldspar, chiefly orthoclase, and biotite. The biotite, which constitutes a considerable proportion of the rock, occurs in small flakes of nearly uniform size, which are so bleached that many of them retain very little of their green colour. There is considerable sericite present as a result of alteration.

These dikes are not typical lamprophyre, although several geologists have regarded them as such in the field. They might be regarded as syenitic lamprophyre.

Matachewan

Diabase or gabbro dikes, ranging in width from a few feet to 150 feet, are conspicuous in the Ramore area. They have a marked north-south trend, few of them departing from this direction by as much as 45 degrees. The rock constituting these dikes is usually a coarse, brown-weathering diabase or gabbro. In a few cases it approaches a diorite. In many places it is coarsely porphyritic, with a spotted appearance due to phenocrysts of plagioclase, which reach an inch and more in diameter. The feldspar is rarely fresh and it has taken on a greenish tinge, due to alteration and replacement by fibrous amphibole and other minerals.

The porphyritic diabase resembles some of the coarsely porphyritic lava flows in Playfair and Cook townships, but in most places the two rocks may be distinguished in the field without much difficulty. The diabase dikes strike approximately north-south, whereas the lava flows strike nearly east-west. The course phases of the flows grade upward into finer-grained rock in which ropy structure, breccia, pillows, or amygdules may be found. Some of the dikes in the area are more nearly dark-grey in colour than the majority of the Matachewan dikes. These may be Keweenawan quartz diabase, but there was no means available in the field of distinguishing them with certainty from the Matachewan, since they were not found cutting the Cobalt conglomerate.

Several thin sections of the dike rocks were studied, and it was found that some of them show distinct ophitic texture, while others have little or no such texture and should be regarded as gabbro. Some are highly altered; others quite fresh. The feldspars are sericitized or partly replaced by fibrous amphibole, and chlorite occurs along cleavage lines and cracks. Some of the labradorite has changed to secondary albite. The diopside may be fresh or uralitized, and the ilmenite may or may not be changed to leucoxene. Quartz is present in most

[1]E. S. Moore, Ont. Dept. Mines, Vol. XL, pt. 4, 1931, p. 12.

sections, sometimes in the form of individual grains, but more commonly in micropegmatitic intergrowths.

Rarely is any mineralization associated with these diabases. Small bodies of pyrrhotite may owe their origin to the diabase magma, such as that on the south side of Guibord hill.

Cobalt Series

Gowganda Formation

The few exposures of the Gowganda formation of the Cobalt series occur in the southeastern part of McCann township. The formation consists of conglomerate, arkose, and greywacké. The conglomerate contains a great variety of pebbles and boulders, of which granite boulders, up to 3 feet in diameter, are very conspicuous. In thin sections of the matrix are also many varieties of rock, mostly in very angular fragments, with little evidence of sorting among those of quite different size. Many of the particles of feldspar are quite fresh. A little chlorite and epidote occur in places, but the formation has been but little deformed and on the whole appears younger in many features than the conglomerate mapped as Timiskaming.

Pleistocene

The Pleistocene deposits in this area are of considerable importance. The surface was thoroughly glaciated, and in many places a thick mantle of drift was deposited. The ice during its retreat must have halted for a considerable time in the area because there is much terminal moraine. There are numerous kames, consisting of roughly stratified gravel and sand, mixed with boulders. In the terminal moraine there are a number of kettles, some dry and others occupied by small lakes. These deposits were probably made in the deeper part of a bay of Lake Ojibway. This great lake occupied a large area, now known as the "clay belt," which lay in front of the ice and north of the height-of-land. As the ice melted and retreated northward, the lake grew in front of the glacier, which filled the Hudson Bay basin, and prevented drainage to the Atlantic by way of Hudson strait. Near the shore of the bay stratified gravel and sand were deposited, and a little farther out in deeper water the clay set free by the melting ice and washed in by streams was laid down in varved beds. The large sand plains of the area and the valuable clay-farming lands thus owe their origin to this lake. When the ice finally disappeared and Lake Ojibway drained away through Hudson strait, the moraine was left rising above the low flat lands, and streams began to dissect the whole area.

The drift, and especially the lake beds, conceals large areas of the bed rock, thus making prospecting difficult. The drift and overlying stratified lake beds form a layer that must be over a hundred feet thick in some places. In drilling a short distance from the outcrop at the Ross mine, in Hislop township, the overburden was found to be 45 to 50 feet thick, and a similar thickness was found on part of the McIntyre property to the north of the Ross mine.

There is evidence of at least two glaciers having passed over this area. Striations were found running S. 10° E. and others, more distinct, running S. 25°-30° E. The direction varies a few degrees in different places. A prospector searching for the source of float rock should, therefore, look for it in a direction about N. 30° W. of where the float was found.

STRUCTURAL GEOLOGY

Folding

Wherever it has been possible to distinguish the top from the bottom of a lava flow in the Ramore area, the top is toward the south. The lava flows must have originally overlapped one another from north to south, and whatever folding has occurred since has not changed this condition on a large scale, although local deflections of the flows have occurred, and in some places the strike has changed from almost directly east-west to northwest-southeast or northeast-southwest. In those localities where more intense disturbances have occurred the greenstones are sheared, and it is difficult to distinguish the individual lava flows.

The Timiskaming sediments are a great aid in outlining some of the major structural features that have been developed since they were deposited. In the northwestern part of Guibord township the beds strike N. 65° W. and dip 60° to 70° S.W. On the north side of Guibord hill, some distance farther south, the dip is reversed, indicating that a large syncline underlies the northwest corner of Guibord township and extends N. 65° W. into Beatty and Munro townships. The nose of this syncline apparently swings a little more northward as it extends to the east, because at the Talisman mine the strike is N. 80° W. The Timiskaming rocks probably underlie a large section of the covered area in the northwestern part of Guibord township.

The Timiskaming rocks in lot 11, concession III, Guibord township, in lot 2, concession I, Hislop, and in lots 1 and 2, concession VI, Playfair, indicate that another syncline runs down through this area. The dip southwestward of the pillow lavas in the large greenstone hill in lot 6, concession VI, Hislop, also indicates that this syncline runs across Hislop township in the general direction of a line connecting lot 2, concession I, with lot 7, concession VI. This syncline must be comparatively shallow, however, as greenstone makes its appearance on either side within a short distance from this line. It is probably a subsidiary of the larger syncline in the northwest part of Guibord township. This major folding could not have been very intense because the western syncline is not deep, and the folds are not closely compressed.

In that part of the Ramore area where the Timiskaming rocks do not occur, there are two rather distinct trends to the formations. One is east-west to a little north of east, and the other is in a general northwest-southeast direction. There seems to have been thrusting from the northeast and southwest which gently squeezed up the lavas that originally dipped south into a series of apparent local folds that swing from an east-west to a northwest-southeast direction. In many cases this apparent folding is only indicated by a little schistosity, which is due to squeezing and not to actual twisting around of the lava flows.

The trend of the hidden granite ridge, which, as has been previously suggested in this report, may run under the southern part of Hislop township to connect the bodies of granite to the east and west, would have practically the same trend as the schistosity in the greenstone in the same area.

It is interesting to note that in the vicinity of the Ross mine, where the rocks are more disturbed than anywhere else in the Ramore area, the trend of the formations, which is mostly east-west to N. 70° E. in the southwestern part of Hislop township, changes to north-south and northwest-southeast. In the eastern part of the outcrop at the mine the strike is north-south, and in the western part northwest-southeast. A fault runs between these two sections and

may partly account for the sudden change in strike. A more detailed account of the conditions at the mine will be found under the description of this property.

In addition to the features already mentioned there is, in many places, a shearing running through the greenstones and the Timiskaming sediments at various angles to the strike of the beds. The direction of this shearing may be east-west or vary to N. 65° E. in places. Veins or stringers of quartz often occur in these narrow shear zones, good examples of which may be seen in the greenstone hill on lot 6, concession VI, Hislop township, and in the northwestern part of Guibord.

Faulting

A very distinct fault along the west side of the east ore body in the Ross mine is known as the hanging-wall fault. It strikes north-south and dips from almost vertical to as low as 72° W. It is apparently a normal fault, as the west side is the downthrow side, judging from the striations on the slickensided face. The amount of throw could not be determined, as there are no distinct horizon markers.

In lot 11, concession I, Hislop township, a small fault in a large outcrop of greenstone near the centre of the lot strikes N. 20° W. The horizontal displacement is 20 feet, and the west side has moved northward with respect to the east side. The displacement can be readily recognized from the difference in the lavas on opposite sides of the fracture. The lavas here strike N. 60 E. and dip southeast. Several quartz veins occur in this area, and like the fault they cut the lava flows nearly at right angles.

Several small faults in the south central part of Guibord township strike either a little east or west of north. The displacement is not large. The fault along the contact of the Timiskaming and Keewatin in Munro township strikes S. 65° E. and undoubtedly extends into lot 9, concession VI, Guibord township. This fault must have considerable displacement, but in Guibord township it is entirely concealed.

ECONOMIC GEOLOGY

Gold is the only metal that has been found in economic quantities in this area, where it was discovered in 1905, which was very early in the history of gold discoveries in this part of Ontario. Very small quantities of galena, chalcopyrite, and sphalerite have been found, but these are of little significance. The gold occurs as native gold, or associated with sulphide, which is mostly pyrite. It may occur in small quantities with chalcopyrite. A little tetrahedrite has been reported from the Talisman mine, but pyrite is the dominant sulphide throughout the area. Pyrrhotite occurs on the south side of Guibord hill, near the top, and in a few other places. This mineral is most commonly found in the vicinity of Matachewan diabase intrusions, and may owe its origin to them, but this question has not been satisfactorily settled.

There seems to be no doubt that the source of the gold was in the Algoman magma, as the deposits are closely related to intrusions of this age. Ore deposits have not been found in the Ramore area in close proximity to the larger intrusions of granite, but they occur in or close to syenite and porphyries of the intermediate type. The lamprophyres nearly all occur in the vicinity of gold deposits.

The occurrences of gold that have been attracting most attention lately lie in a zone running northeast across the southern and east-central part of Hislop township. In this zone, which lies between two large areas of granite, there are many intrusions of syenite and porphyry and a few small intrusions of granite.

In it there has also been considerable disturbance in some places, the evidence being well displayed in the outcrop at the Ross mine, where faulting, much fracturing, and a sudden change in strike of the formations may be observed. In Guibord township, lot 9, concession IV, near some small granite intrusions and within the zone mentioned, there is a remarkable display of quartz veins. Large and small veins, lacking continuity for any great distance along the strike, outcrop over an area of several acres. They occur in a green mica and carbonated schist, which is apparently a metamorphosed tuff. Unfortunately this spectacular showing of quartz carries scarcely any gold, although there is a little pyrite present. The quartz is white and barren in appearance and is apparently of the nature of pegmatitic quartz, lacking the other minerals commonly associated with quartz in pegmatites.

Part of a large quartz showing in lot 9, concession IV, Guibord township.
(Photograph by B. T. Wilson.)

On a number of properties on which gold occurs, the country rock contains a large proportion of a green chrome mica. This mineral is abundant in the Ross mine, on the McIntyre property, in the large quartz outcrop mentioned above, and in a number of other places. Much interest is attached to the occurrence of this mica here because of the frequent occurrence of mariposite in gold deposits in other areas. Its presence cannot be regarded as a definite evidence of commercial values in gold, but it owes its origin to hot solutions which came from the same magma as that supplying the gold. The formation of the mica occurred in an early stage of the formation of the gold deposits, because it is cut by stringers of quartz and ankerite and impregnated with auriferous pyrite. The mica often occurs in blotches and small angular bodies, suggesting that it has replaced angular fragments in tuff.

W. W. Moorhouse, of the University of Toronto, studied the mica from the Ross mine in some detail, and the writer is greatly indebted to him for the following information regarding its physical and chemical properties:—

ANALYSES OF MICA FROM THE ROSS MINE AND MARIPOSITE

	No. 1	No. 2
	per cent.	per cent.
SiO_2	56.00	55.35
Al_2O_3	23.52	25.62
Fe_2O_3	3.30	.63
FeO	.51	.92
TiO_2	not determined	.18
Cr_2O_3	.78	.18
MgO	2.12	3.25
CaO	.37	.07
K_2O	7.03	9.29
Na_2O	2.72	.12
H_2O	3.52	4.52
Total	99.87	100.13

Sample No. 1—Green mica from the Ross mine. Analysed by W. W. Moorhouse.
Sample No. 2—Mariposite (green). Analysis given by Hillebrand, Amer. Jour. Sci., Vol. 49, 1895, p. 377.

It is evident from these analyses and a comparison of sample No. 1 with a number of analyses of fuchsite, another green chrome mica, that the composition of the mica from the Ross mine is very much more like that of mariposite than fuchsite. The latter mica is 9 to 10 per cent. lower in silica, the alumina is much higher, and the chromium oxide is several times as high.

The physical properties of the mica from the Ross mine are as follows: biaxial, with a very small axial angle; optical sign, negative; polarization colours, brilliant; index of refraction, 1.624. These correspond fairly closely with the properties assigned to mariposite. They differ in that mariposite has been described as uniaxial and its mean index as 1.63. Since the micas vary so much in composition and it was difficult to obtain a perfect separation of the green mica from the pyrite, quartz, and carbonate with which it is intimately intergrown, it may be safely assumed that the mica is mariposite. Since the green mica found on other properties in this area is similar to that described it is believed that it is all mariposite.

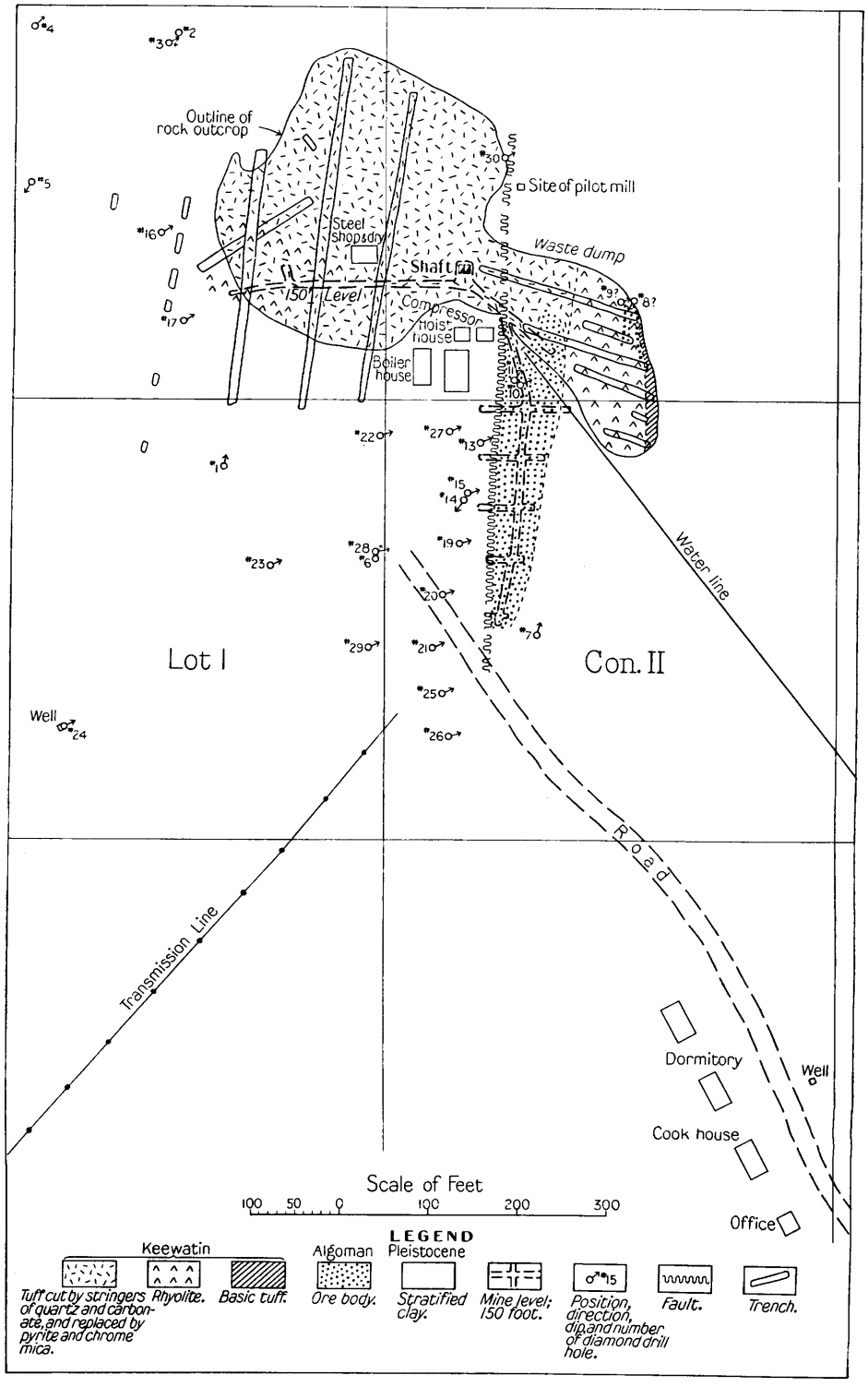
DESCRIPTION OF PROPERTIES

Hislop Township

ROSS MINE

The most important property in the Ramore area at present is the Ross mine, which is owned by Hollinger Consolidated Gold Mines, Limited, and is situated near the north end of lot 1, concession II, Hislop township. The property at the time the writer studied it comprised the north half of lot 1, concession II, and the south third of lot 1, concession III. It was previously known as the Brennan David property.

Prospectors had on several occasions examined the outcrop on the Ross farm, but no values of much interest were discovered until Frank Tremblay sampled it in 1933. Sufficient gold was found in assays to justify taking up the property. The Hollinger took an option from Tremblay and his associates in October of the same year and proceeded with development by trenching the outcrop. Diamond-drilling on a large scale followed; and in July, 1934, shaft-



Sketch map showing the surface geology, underground workings, and diamond-drill holes, Ross mine, Hislop township.

sinking commenced. When the shaft reached 150 feet, work on the 1st level was started, and about 1,000 feet of drifting and crosscutting was done to test the accuracy of the diamond-drill results. It was estimated that 115,000 tons of commercial ore had been proved above the 150-foot level in the east ore body. The 3-compartment shaft, which was completed to a depth of 480 feet late in the summer of 1935, provides for three levels, at intervals of 150 feet, and a sump 30 feet deep below the 3rd level.

In the autumn of 1935, a pilot mill with a capacity of about 80 tons per day was built, and it came into operation near the close of the year. This mill has proved to be capable of treating over 100 tons a day.

Shaft, boiler, and hoist houses, Ross mine.

The mine is situated on an outcrop 525 by 350 feet, rising about 15 feet above the surrounding flat clay land. No other rock is exposed within a radius of five-eighths of a mile to the north, 2 miles to the east, a mile to the south, and several miles directly west of the shaft. A short distance from the outcrop, the stratified clay and sand and the underlying drift have a thickness of 45 to 50 feet.

Geology of the Outcrop

The rocks have been so changed by shearing and replacement by mica, silica, carbonate, and pyrite that in many places it is exceedingly difficult to recognize the original rocks and to distinguish one rock from another. Two general types have been recognized, however, by studying a number of thin sections. The first are lava flows of intermediate composition and the second, basic, intermediate, and acid tuff. There is also a band of cherty rock in one section of the outcrop.

For convenience in describing the rocks on the surface they will be discussed in two parts, one east and the other west of the shaft. In the eastern part there is a band of rather basic tuff, with a maximum thickness of 20 feet, running along the east side of the outcrop. It consists chiefly of serpentine and carbonate, a little sericite and chlorite, scattered fragments of plagioclase, and grains of

pyrite. Some of the serpentine appears to have replaced pyroxene. On the west side of this tuff more than 100 feet of lava is found, containing distinct phenocrysts of orthoclase and plagioclase in a very fine grained groundmass. The composition of the rock is apparently close to latite, the extrusive rock corresponding to monzonite, since the feldspars consist of both plagioclase and orthoclase and there is little ferromagnesian mineral. This rock is cut by small veins of quartz and numerous stringers of quartz and carbonate, but any values found in it seem to be rather closely confined to the quartz veins.

West of the lava flow described, the rock is mostly concealed by buildings and the waste rock dump, and its character is difficult to determine, but it is believed to be an acid to intermediate tuff, similar to that in the western section of the outcrop. It is highly impregnated with silica, pyrite, and green mica.

In the western part of the outcrop, a careful study was made of a section along the longest trench, which crosses the outcrop from north to south. In hand specimens, the rock in this trench appears much the same from end to end, except for the relative amounts of quartz, carbonate, pyrite, and mica, and the extent of the shearing and fracturing. In thin sections there is also a marked similarity, except for one specimen taken about 200 feet south of the north end of the trench. Whereas all the other sections indicate that the rock is tuff, this one indicates a porphyritic lava similar to that east of the shaft. There is probably a thin lava flow in the tuff. The tuff is, for the most part, an indefinite rock containing in some places, angular fragments of feldspar and in others what appear to have been similar fragments replaced by silica, carbonate, pyrite, or mica. There are also a few fragments of acid lava or lava similar to that described, but these have in most cases been replaced by the minerals mentioned.

The irregular and patchy replacement lends force to the conclusion that the rock is a tuff.

Near the north end of the trench there is a considerable amount of chalcedony, a fibrous form of silica, in blotches and stringers. Fine-grained pyrite is particularly associated with this mineral. The tuff is cut by countless small stringers of quartz up to 6 inches in width, extending only a few feet along the strike. The larger ones follow the general trend of the schistosity and for the most part dip steeply southward, but the stringers run in all directions and some are nearly horizontal. Some of the tuff is 50 per cent. or more quartz, the remainder being carbonate and sericite. Pyrite impregnates the greater part of the rock, but most of it is in the stringers and associated with the quartz that replaces the tuff. It is mostly rather fine grained, but in a few places it occurs in medium-coarse, cubic crystals. Very small quantities of chalcopyrite, galena, and sphalerite were found. No evidence of the presence of Algoman intrusives was found on the surface.

Underground, on the 150-foot level, some additional information was obtained regarding the character of the formations, although many of the conditions found on the surface are repeated on the 1st level. A sample of rock taken at the west end of the long crosscut running west of the shaft is reddish in colour, resembling some of the rhyolite seen on the McIntyre property north of the mine. It shows in thin section numerous fragments of feldspar, indicating that the rock is either a crushed porphyritic lava flow or a tuff composed of similar material. The distribution of the fragments of feldspar suggest that the rock is a tuff. It contains disseminated pyrite and magnetite and considerable amounts of sericite and carbonate. Another specimen taken a short distance from the end of this crosscut is tuff, largely replaced by a brownish carbonate and silica. In thin

section there is a sort of augen structure, in which the sericite is wrapped around fragments which have been replaced by an indefinite mixture of minerals.

Where the short drift runs off the crosscut near its west end, there is a band, at least 10 feet wide, which consists largely of dark, dense, cherty rock. Similar rock was found in irregular bands in other sections of this crosscut.

The shaft has been sunk in tuff. A specimen taken at a depth of 420 feet is a sericitized rock containing numerous fragments of feldspar with a little quartz and pyrite.

In the crosscut running east from the shaft there is a slightly yellowish green, fine-grained rock resembling the tuff on the surface. It is tight and little fractured and does not contain ore. It is followed by what must have been rather coarse fragmental rock with angular pieces of green mica, which seems to have replaced previously existing fragments of another rock. This is followed by a fragmental rock resembling the basic tuff seen on the surface at the extreme east side of the outcrop.

Near the centre of the drift running south from the shaft, and on its east side, there are a number of quartz eyes in a dense, green, micaceous rock. Some of these eyes are whiter in the centre than around the border, giving them an apparent concentric structure.

Structural Features of the Outcrop

The most prominent structural feature in this outcrop is a fault striking north-south and dipping from 72° W. to nearly vertical. This is known as the hanging-wall fault because it runs along the boundary of the east ore body. It appears in all the west crosscuts from the south drift on the 150-foot level, except No. 5, which had apparently not reached it. It is very distinct in the workings, having in some sections a slickensided face and a little gouge and in most places it is marked by an oxidized zone and a considerable flow of water. On the 450-foot level many tons of oxidized quartz and mud literally flowed out into the drift along the fault, indicating that oxidation has occurred on a large scale to a depth greater than 450 feet. It is unusual to find oxidation occurring to such an extent and depth in the Canadian shield, although at the Keeley mine in South Lorrain, it extended to even greater depth. The extensive underground circulation responsible for the oxidation must have occurred before the glacial epoch, at a time when this area had a higher altitude than at present, because the rocks at 450 feet below the present surface are saturated with water. From the extent of the weathered zone, oxidation will probably be found for a considerable distance below the 450-foot level.

Judging from the striations on the slickensided face this is a normal fault, with the west the downthrow side. The movement of the block appears to have been nearly vertically downward. The rocks for at least 100 feet to the east and for several hundred feet to the west of the fault have been greatly shattered and broken into innumerable blocks of all sizes, and the whole mass is filled with a very complex network of quartz veins and veinlets. Brecciation is quite marked near the fault, and the largest bodies of quartz and carbonate in the mine are in the fault zone. Brecciation extended into both the hanging and foot walls.

There has been some post-ore movement along the fault and on many of the slips seen at the surface and underground. The relations of the larger veins of quartz with the fault underground, and the apparent close relations of the brecciation of the whole mass of rock in the vicinity of the workings with the faulting, indicates, however, that the main fault must have originated at about

the time the ore was deposited. In the workings there are numerous examples of small veins faulted, with a few inches to a foot or more displacement, and the fault fractures are filled with quartz.

Throughout the mine there are many open cracks from which water pours into the workings and which are red with iron oxide. Most of these are cracks that were filled with quartz, carbonate, and pyrite, which have been weathered out, but a few appear to have been formed after the deposition of quartz and carbonate had ceased. In diamond-drilling, water under considerable pressure is sometimes encountered in these openings. The flow for the mine is about 300 gallons per minute. When the bottom of the oxidized zone is passed in mining most of the cracks will be much tighter, and there should be much less water per cubic foot of mine openings.

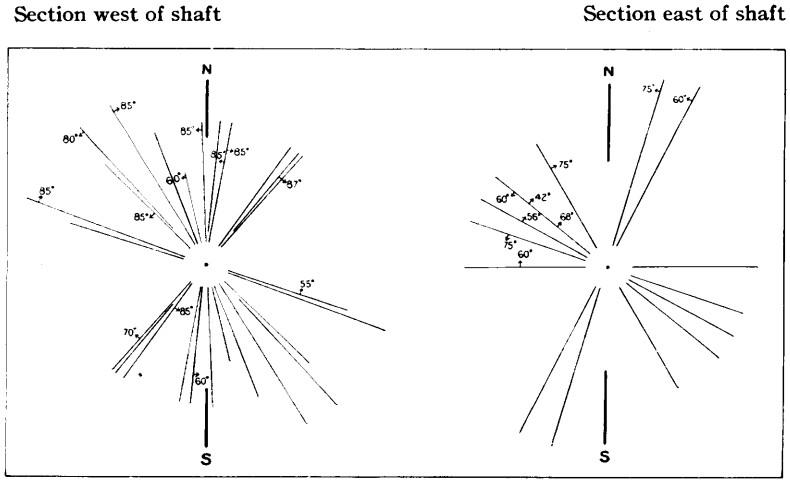


Diagram illustrating the strike and dip of a number of the most prominent joints and slips in the outcrop at the Ross mine, and their direction in relation to the strike of the schistosity and the small quartz veins and larger stringers of quartz and carbonate. The strike of the veins is indicated by the longest lines.

West of the shaft, the strike of the schistosity and the trend of the major quartz stringers are in a general northwest-southeast direction, with a variation in different places from N. 68° W. to N. 30° W. The dip is vertical to 80° N.E. in some cases and southwest in others. East of the shaft the strike is N. 15°-25° E., and the dip of the quartz veins that follow the strike is from 60° to 75° W., indicating a tendency of these to approach the ore body with depth.

As will be seen from the above diagram, there is considerable difference in the direction of the major joints in the two sections of the outcrop, and within each section, although one set in each section corresponds fairly well. The eastern section shows a rather definite tendency of the joints and slips to cut the strike of the formations in the same general direction and at high angles, whereas the western section shows two sets of joints about equally developed, one running in the general direction of the strike and the other cutting it at large angles. The joints show a tendency to lie in directions approaching 45 degrees to the direction of the main fault, and they are more closely related to the fault than to the shearing.

The major fault in this outcrop does not account for the difference in strike in the two sections, because the block has moved after the folding ceased. Apparently there was a twist in the formations in this locality at the time the folding and shearing occurred early in the period of Algoman igneous activity. The formations were disturbed by twisting and shearing without much horizontal displacement by actual faulting. The normal fault occurred later along the line where the formations were weakened by being bent from a direction east of north to one west of north. The presence of the more competent lava flow in the weaker tuff beds seems to have been a factor in the location of the fault, and it developed near the contact of the two formations. The fault no doubt resulted from activity in a magma at depth late in the Algoman period. There are no Algoman intrusions exposed in the outcrop, but typical red feldspar porphyry has been found in small irregular intrusions during the recent mining operations. A little of this rock was found in the west ore body on the 150-foot level and a larger body on the 450-foot level.

Ore Deposits

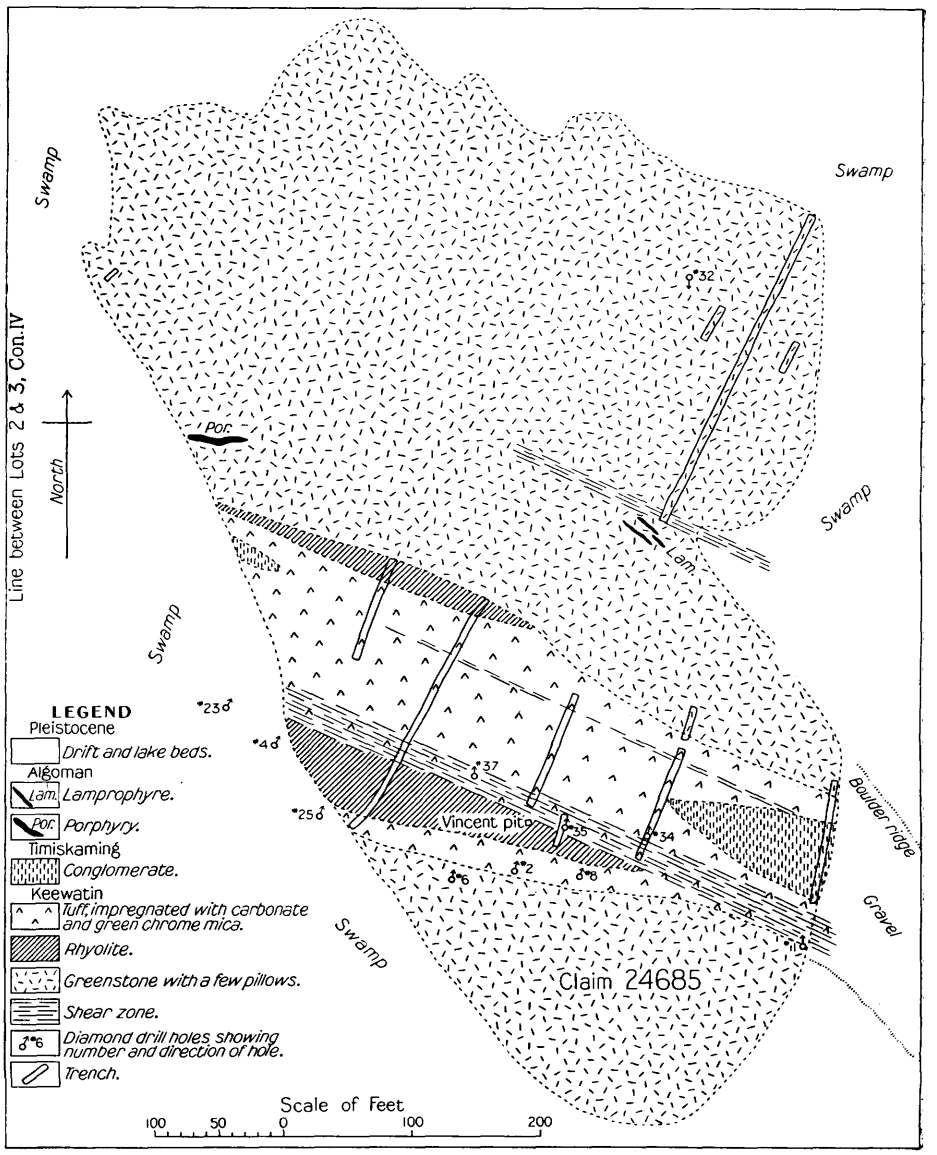
There are two ore bodies on the property, known as the East and West. The East ore body is a lens that has been stoped across a width of 50 feet and developed by drilling and underground workings for a width of 75 feet and a length of 400 feet. It is practically bounded on the west by the major fault described above, and it grades out into waste rock to the east. The ore consists of quartz and carbonate lenses, veins and stringers containing auriferous pyrite, and country rock impregnated with sulphide, and is of much higher grade than that in the West ore body. The carbonate, in some cases at least, is later in origin than the quartz, since stringers of it may be seen cutting veins of quartz. In other cases it seems to be contemporaneous with the quartz. Much of the carbonate is apparently ankerite. There is a considerable amount of pink calcite in the quartz veins near the fault on the 300-foot level. Quartz is the most favourable gangue mineral. On the surface in the eastern section of the outcrop three nearly parallel quartz stringers, 2, 3, and 18 inches wide, have shown some high values.

The West ore body lies west of the main fault and is a stockwork of narrow veins and stringers, mostly in tuff. There are some sections in which quartz is much more abundant than in others, but there is no definite ratio between quartz and ore. The ore body dies out to the east in places where there is abundant quartz and the boundaries are only assay boundaries. On the west side the commercial ore generally ends in a dark, dense lava cut by small stringers of quartz. Small bodies of the same rock occur within the ore body, and these are said to carry values, but apparently they were small enough to be impregnated by the ore-bearing solutions. On the 300-foot level the ore body has been crosscut for nearly 100 feet. This deposit is characterized by considerable chalcopyrite, much more than in the East ore body, and it also carries a little galena. The grade is lower than that of the East ore body. West of the West ore body, several quartz veins, which run practically parallel to the main body, have been drifted on for short distances.

A striking feature of these deposits is the similarity of ore and waste rock. The ore bodies occur mostly in the tuff, which is highly impregnated with quartz, carbonate, mariposite, sericite, and pyrite, the mariposite giving a green shade to much of the rock. When exposed to the air a yellow shade develops by oxidation of the carbonate. Much of the rock taken from the shaft was so highly mineralized that it appeared to be ore, but it ran only a few cents of gold to the ton.

McINTYRE PROPERTY

McIntyre-Porcupine Mines, Limited, took an option on 28 claims lying north of the Hollinger property. Most of these are in Hislop township, but eight lie wholly or partly in the adjoining section of Guibord. There are two



Geological sketch map of part of the Vincent claims, McIntyre property, Hislop township.

properties in Hislop township: the Bush property in lot 1, concession IV, and the Vincent in lot 2, concession IV. There is an outcrop on each of these properties in which gold has been found and on which much drilling and trenching have been done. Thirty-eight diamond-drill holes were bored on or in the neigh-

bourhood of these outcrops, and some holes were later drilled to cover assessment work on adjoining claims in Hislop and Guibord townships, in which the overburden conceals all bed rock. The accompanying geological sketch maps show the drill-holes and trenches on these two outcrops.

In the Vincent outcrop the prevailing rock is greenstone of andesitic character, in places approaching dacite. A few pillows are exposed, but otherwise there is little in the rock to denote its true character. The greenstone has been sheared in several places, and one distinct shear zone runs through it in a direction N. 65° W. Two other shear zones, one quite a minor one, occur near the southwest side of the outcrop and lie parallel to the one mentioned. These are in a different type of rock, as two small wedges of conglomerate and a band of tuff, more acid than the greenstone, occur in this part of the outcrop. The conglomerate is regarded as Timiskaming, as it is similar to some of the outcrops of this formation in other parts of the Ramore area. Well-rounded boulders of different types grade into coarse angular fragments, and these bodies apparently have been infolded in the Keewatin. In the band of tuff a small body of rhyolite shows in the trenches near the southwest corner of the outcrop. In thin section this rock is found to be crowded with phenocrysts of orthoclase, plagioclase, and quartz. The rock is so altered that it is difficult to decide whether this is rhyolite of the Keewatin series or an Algoman intrusion. On the west side of the outcrop, however, a small Algoman porphyry dike appears to be much fresher than the rhyolite, indicating that the rhyolite is extrusive and not intrusive.

The band of tuff is sheared and highly carbonated, and in places it contains a large proportion of mariposite, as does some of the tuff at the Ross mine. Relatively little quartz is seen here, and there is little to suggest a vein or lode deposit except for the large amount of carbonate and pyrite in some zones. So far as can be seen the carbonate and quartz are contemporaneous in age. Three small lamprophyre dikes occur in the outcrop.

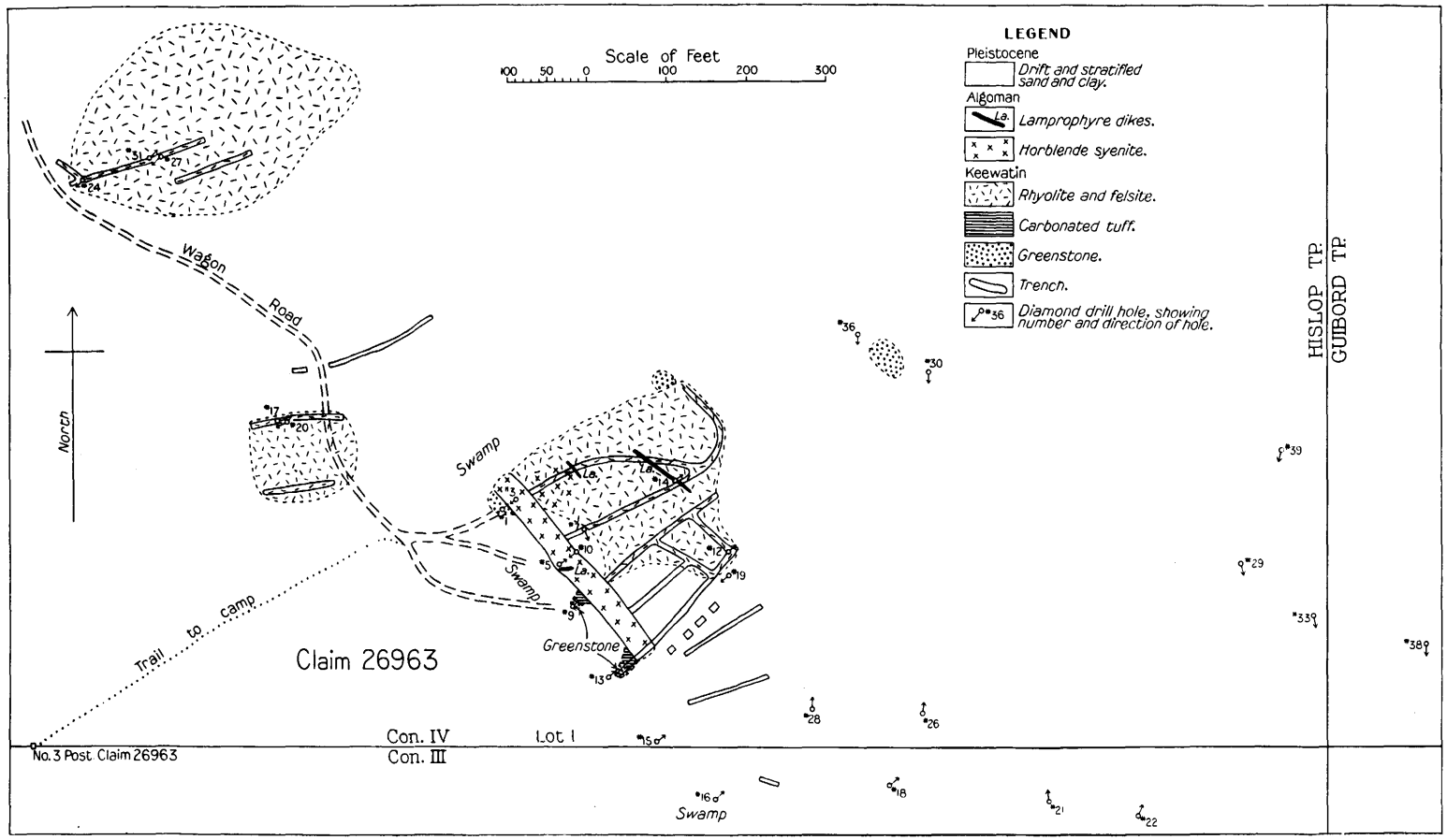
On the main Bush outcrop and on some of the smaller outcrops in its vicinity, the most common rock is reddish, fine-grained, and felsitic. It has the appearance of being highly silicified, and in one place a cherty zone shows injections of a rock consisting of silica with feldspathic streaks running through it.

This felsitic rock proves, from thin sections, to be a fine-grained rhyolite, in some places showing flow structure, as indicated by the arrangement of microlites of feldspar. Some specimens show distinct phenocrysts of feldspar, both orthoclase and oligoclase. The rock has been considerably carbonated by the introduction of ankerite, and large amounts of quartz and pyrite have been introduced.

Running through the main outcrop is a syenite dike about 20 feet wide, striking N. 40° W., at an angle to the schistosity of the rhyolite, which runs N. 70° W. The syenite is coarse-grained and pink to red in colour; it consists almost entirely of feldspar. In the vicinity of this dike, on its northeast side, there are a large number of small, irregular dikes and dikelets of syenite consisting chiefly of microcline. They are offshoots from the main dike and decrease in number away from it.

On the southwest side of the main dike, a narrow band of highly carbonated tuff contains fragments, which in most cases have been replaced by carbonate. This band of tuff lies between the syenite and the greenstone.

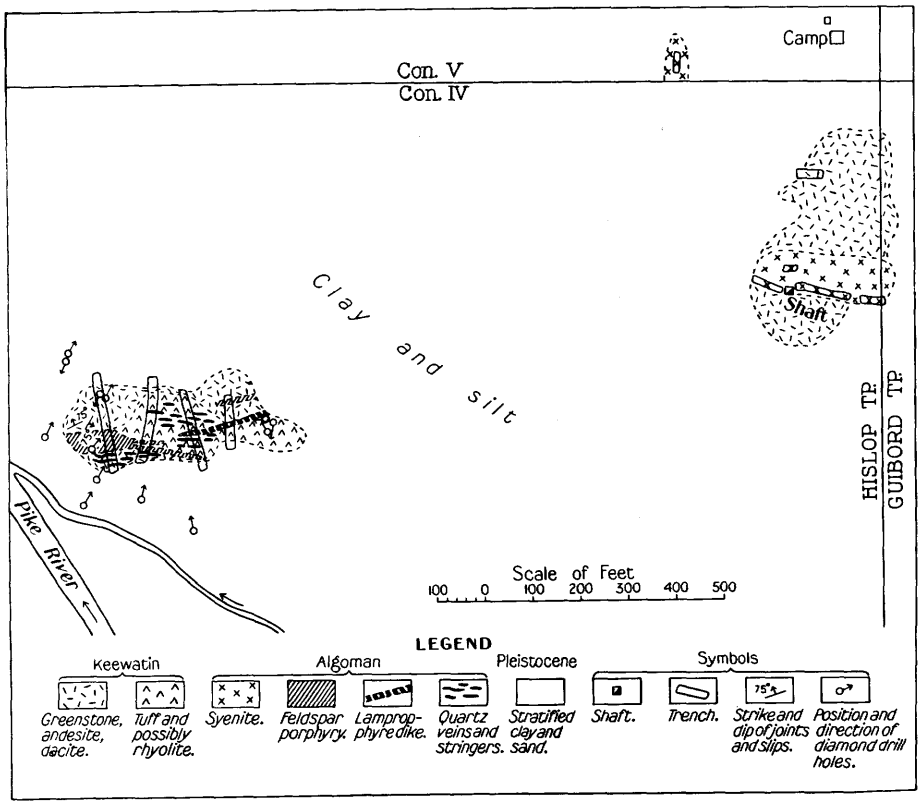
Cutting the rhyolite, and in one case the main syenite dike, are dikes of lamprophyre. One of these is well exposed in the trenches northeast of the syenite dike, where it reaches a width of 6 feet. It is dark-grey, micaceous rock, which from thin sections might be classified as a diabasic lamprophyre because



Geological sketch map of part of the Bush claims, McIntyre property, Hislop township.

of the lath-shaped feldspars. The rock contains phenocrysts of biotite, considerable amounts of hornblende, magnetite, and apatite, and a little quartz, which appears to have been introduced. Considerable alteration to chlorite and replacement by carbonate have occurred.

The lamprophyre dike cutting the syenite dike is 5 inches wide. It has been much altered by replacement by carbonate and sericite and is slightly porphyritic. In thin section it shows outlines of replaced crystals, like those of olivine. The biotite is dull and bleached.

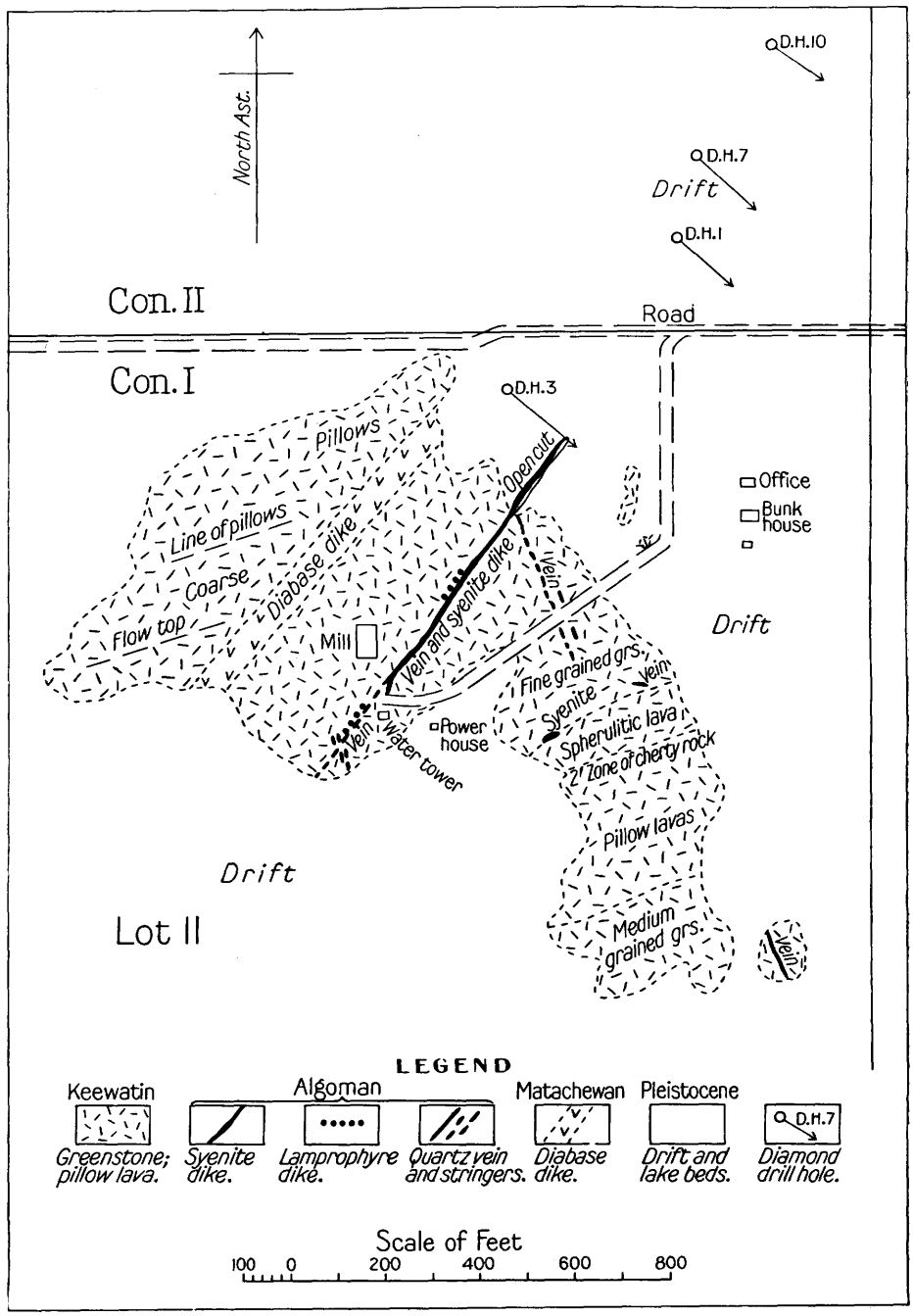


Geological sketch map of part of the property of Hislop Gold Mines, Limited.

The rhyolite in this outcrop is so impregnated with silica, carbonate, and pyrite that it gives the impression that it might be nearly all ore. Native gold was readily found along the contact of the syenite dike and the red rhyolite. Away from the dike the values appear to be spotty and uncertain. The writer has no information regarding what was found in the drill-holes at depth.

HISLOP GOLD MINES, LIMITED

Hislop Gold Mines, Limited, controls the south half of lot 1, concession V, the patented part of the north half of lot 1, concession IV, Hislop township, and two adjoining patented claims in Guibord township. The property lies north of the McIntyre, and the operations are all on the northeast side of the Pike river. Considerable work has been done on the two outcrops on the property.



Geological sketch map of the property of Vimy Gold Mines, Limited, Hislop township.

On the eastern outcrop there is a shaft on a quartz vein, which, judging from the quartz removed from a trench that is now full of water, is 2½ to 3 feet wide on the west side and 6 inches to 1 foot wide in the deep trench on the east side of the shaft. In some sections, the quartz is highly mineralized with chalcopyrite. This vein follows a distinct slip along the contact between syenite and greenstone on the west side of the shaft, but on the east side it swings a little to the northeast, and from there on lies within the syenite. This rock is a biotite syenite, differing from the hornblende variety common in other parts of the Ramore area, and is one of the Algoman intrusives.

According to V. B. Lyle, who kindly furnished information regarding this property, the 2-compartment shaft is about 65 feet deep. It was started on an incline and then changed to the vertical position. As success in finding satisfactory values in gold was not attained, the operations were suspended on this part of the property. The next work of consequence was done on the western outcrop, near the Pike river, where Ventures, Limited, and the Mining Corporation of Canada made a thorough test of the formations by diamond-drilling and trenching. It is said that in all 15 holes were drilled, of which the sites of 13 were found and located on the map. These holes are said to be comparatively shallow, few if any of them exceeding 300 feet in depth.

The geology of the western outcrop is quite complex. In a body of greenstone, some of which is as acid as dacite, quite conspicuous "quartz eyes" are developed. Within this formation is a zone of rock that is probably of tuffaceous origin. It is silicified and carbonated, and in some places is green in colour from an abundance of mariposite. These Keewatin formations are cut by Algoman feldspar porphyry and lamprophyre dikes. In places the formations are cut by narrow quartz veins and a network of quartz stringers. Visible gold was found with some of these stringers, and pyrite occurs with the stringers and impregnates the wall rocks. A series of joints and slips break up the greenstone with the quartz eyes into blocks. The more prominent of these have directions of N. 20° E., with a dip of 75° E., and N. 60° E., with a dip of 75° N.W.

A geophysical survey of the property was made during the summer of 1935 with the object of locating favourable bed rock beneath the heavy mantle of clay and sand that covers the greater part of the property.

VIMY GOLD MINES, LIMITED

The property controlled by Vimy Gold Mines, Limited, comprises the north half of lot 11, concession I, and the south half of lot 10, concession II, Hislop township. The mine is situated on a hummock of Keewatin pillow lavas, which has been intruded by a large Matachewan diabase dike, a biotite syenite dike, and a lamprophyre dike. The main vein lies along a fracture zone, which is followed for part of its length by the syenite and lamprophyre dikes. The lamprophyre dike lies next to the hanging wall. It is very narrow but appears in several sections of the lode. The syenite dike contains considerable quartz, making it appear to be a granite, but it was not studied under the microscope and the quartz may have been introduced. The dike joins the vein, near the road to the mill, from a direction S. 20° W. At this point it has a width of 5 feet. It pinches to a few inches and swells again to a width of 3 feet.

The vein strikes N. 47° E. and dips 74° N.W. It is uncovered by a trench, which runs practically across the greenstone outcrop, and there is a large pit at the northeast end from which some ore for the mill has been drawn.

At the southwest end, the lode, which here consists of quartz stringers in silicified greenstone, is about 2 feet wide at the surface. About 70 feet from this

point there is a zone about 4 feet wide of quartz stringers running south from the main vein. They dip 63° E. and extend a few feet into the hanging wall. They are unmineralized at the surface. Between this point and the open pit the vein ranges in width from a few inches to about 5 feet. In some sections it is represented by silicified greenstone and in others by a band of quartz stringers in the lamprophyre and syenite dikes; in certain sections a distinct quartz vein occurs. The main pit, spoken of as the open cut, at the northeast end of the trench, was nearly 200 feet long and in places up to 20 feet wide. In this pit a syenite dike, 2 to 3 feet wide, and dikelets of the same rock lie along the hanging-wall side of the lode. This rock and the greenstone are cut by quartz stringers and impregnated with pyrite. A band 8 feet wide is well mineralized with fine pyrite, and a zone 4 feet wide is said to run over $20.00 in gold per ton.[1] In part of the

View showing the open pit and tram to the mill, Vimy mine.

open pit, bed rock had not been reached owing to difficulty with quicksand. From the main vein at the open pit there is a narrow quartz vein running S. 20° E. for 350 feet. This vein dips 60° E. and ranges in width from 2 inches to 1 foot.

A 50-ton mill was completed in July, 1935, and it was intended to supply it with ore from the open pit. Meanwhile a shaft was started near the mill. Difficulty was experienced in finding an adequate water supply for the mill, and a pipe line was laid to a pond in lot 12, concession VI, Playfair township, a mile and a quarter away. Unfortunately, during dry weather this source was sufficient for only two or three days' operation, and the mill was closed down. It was suggested that water might be obtained from a small lake five-eighths of a mile to the southwest in lot 11, concession VI, Playfair township. The gold is in fine-grained pyrite, and in milling the sulphide is floated, necessitating water of suitable type for this purpose. Visible gold is rare in this deposit.

[1]At $35.00 an ounce.

Electric power is available at the mine from the transmission line along the Ferguson highway near Ramore, and electrical equipment has been installed.

About 5,000 feet of diamond-drilling is said to have been done on the Vimy property before plans to operate were completed. In the winter of 1936, Hollinger Consolidated Gold Mines, Limited, drilled three holes on their claims on the Dowson property, in the southeast corner of lot 11, concession II, Hislop township. At the same time they put down a hole near the end of the open pit on the Vimy property. The writer is indebted to Mr. W. C. H. Dowson for information regarding the geological data obtained from the holes on the Dowson property. No. 1 hole was drilled to 250 feet at an angle of 50 degrees. The overburden was 46 feet thick, and the rest of the core was greenstone with dikes and irregular bands of porphyry or syenite and patches and stringers of quartz. In No. 7 hole, which started with a dip of 50 degrees and ended at 322 feet with a dip of

View of the Vimy mine, showing the mill in the background.

45 degrees, there was 65 feet of casing. The solid rock was almost entirely greenstone with a little porphyry and quartz. There was some evidence of breccia with the quartz, and this rock was mineralized with pyrite. No. 10 hole had a depth of 498 feet and a dip of 50 degrees. The casing was 82 feet. Evidence of brecciation, mineralization, and alteration of the greenstone was found, especially between 177 and 181 feet in the hole. Apparently the syenite exposed on the Vimy property occurs in irregular intrusions under the overburden to the northeast, but there is no definite vein in that area.

LOT 10, CONCESSION I

On the Birch farm, north half of lot 10, concession I, Hislop township, Sylvanite Gold Mines, Limited, made a test of the formations by stripping and trenching several outcrops. The bed rock on the property is mainly coarse Keewatin greenstone, which has been intruded in many places by dikes and irregular injections of Algoman feldspar porphyry. A few dikes of granite occur near the south end. Two north-south dikes of Matachewan diabase also cut the outcrops.

In the southern of the two main outcrops a quartz vein 3 to 7 feet wide is crossed by the power line. This vein runs north-south through a feldspar porphyry dike and has been trenched for 4 chains. Unfortunately, it is poorly mineralized, although it contains a little pyrite, galena, and chalcopyrite. To the northwest of this vein, 360 feet along the power line, there is a large trench 12 feet wide and about 200 feet long, with a maximum depth of 6 feet. It runs north-south on a zone of small quartz veins, dikelets of porphyry, and somewhat mineralized greenstone, which is exposed for nearly 500 feet and ends in a mass of rock that is mostly feldspar porphyry cut by stringers of quartz. A series of white quartz veins run north-south through the western part of the outcrop. Much quartz occurs on this property, but it is not well mineralized.

SOUTH HALF, LOT 11, CONCESSION I

On the J. Weir property, south half of lot 11, concession I, Hislop township, there are several quartz veins in granite and greenstone near small intrusions of granite. One vein has a width of from 3 to 10 feet. In places where the vein is narrow, parallel quartz stringers make up a zone about 6 feet in width, which is composed mostly of quartz. At the widest points the quartz is white and very barren in appearance, but a band of dark quartz 2 feet wide occurs near the centre of the 10-foot vein. This quartz is mineralized with pyrite, which is abundant in some places. The greenstone walls are altered a little and contain pyrite in some parts. The vein strikes N. 20° W., dips 70° E., and was traced for a distance of more than 400 feet. The strike of the lava flows is N. 60° E., and they dip southeast. There is some shearing in the direction of the main quartz veins, and a fault with a horizontal displacement of 20 feet runs in the same direction.

In another outcrop to the west, several other quartz veins strike N. 20° W. and have widths up to 3 feet. The quartz is white and little mineralized.

It is interesting to note that the veins on the south half of the lot trend almost at right angles to the main vein on the Vimy property in the north half of the same lot.

GOLDEN ARROW

The Golden Arrow property comprises claims in the south half of lot 12 and in lot 13, concession I, Hislop township. Much work has been done on the two main outcrops. One of these lies across the line dividing lots 12 and 13, and the other a little south and east of the centre of lot 12. The geology of these outcrops is quite complex. The oldest rock is Keewatin pillow lava, which strikes nearly east-west. The lavas have been intruded by dikes of Matachewan diabase and numerous small bodies of syenite and granite. They have been sheared, and in a number of sections the shear zones are followed by quartz stringers.

A large trench runs east-west across the outcrop that crosses the lot line. East of the line a number of quartz stringers mineralized with pyrite are exposed in the trench. The zone here is 10 feet wide. Another trench follows an oxidized zone in the lavas. West of the line a quartz vein about 1½ feet wide runs N. 80° E. from the west side of the greenstone outcrop and dips 65° N. Associated with this quartz vein are stringers of quartz, making a zone which is 8 to 10 feet wide in places. The quartz carries some pyrite. Near the west edge of the outcrop, quartz stringers are scattered through a zone about 100 feet wide, in which the greenstone has been silicified, carbonated, and slightly sheared. In this zone, sampling has been done on a band 30 feet wide. Very thorough sampling of the Golden Arrow property was done by Hollinger Consolidated

Gold Mines, Limited, in the summer of 1935. Four diamond-drill holes had been drilled near the western edge of the outcrop to test the quartz-bearing zone described above.

The other main outcrop on the property consists largely of coarse- and fine-grained lava flows, cut by small bodies and numerous dikelets of syenite. The eastern part consists of rather massive greenstone, and the western part of the finer-grained rock, which is sheared in a number of zones. A considerable amount of hornblende schist occurs in this section, and the schist has been so twisted that the strike lies in various directions. The syenite and the greenstone near it have been silicified and well mineralized in many places. There is also a considerable amount of chalcopyrite in this outcrop.

Shaft and dump at the Talisman mine, Guibord township.

The showings have been extensively trenched and thoroughly sampled. One trench is from 10 to 14 feet wide and 165 feet long. It is difficult to distinguish any definite ore zone, as the mineralized bands are irregular and in places wide. In one place a channel sample had been taken across a width of 25 feet.

OTHER PROPERTIES

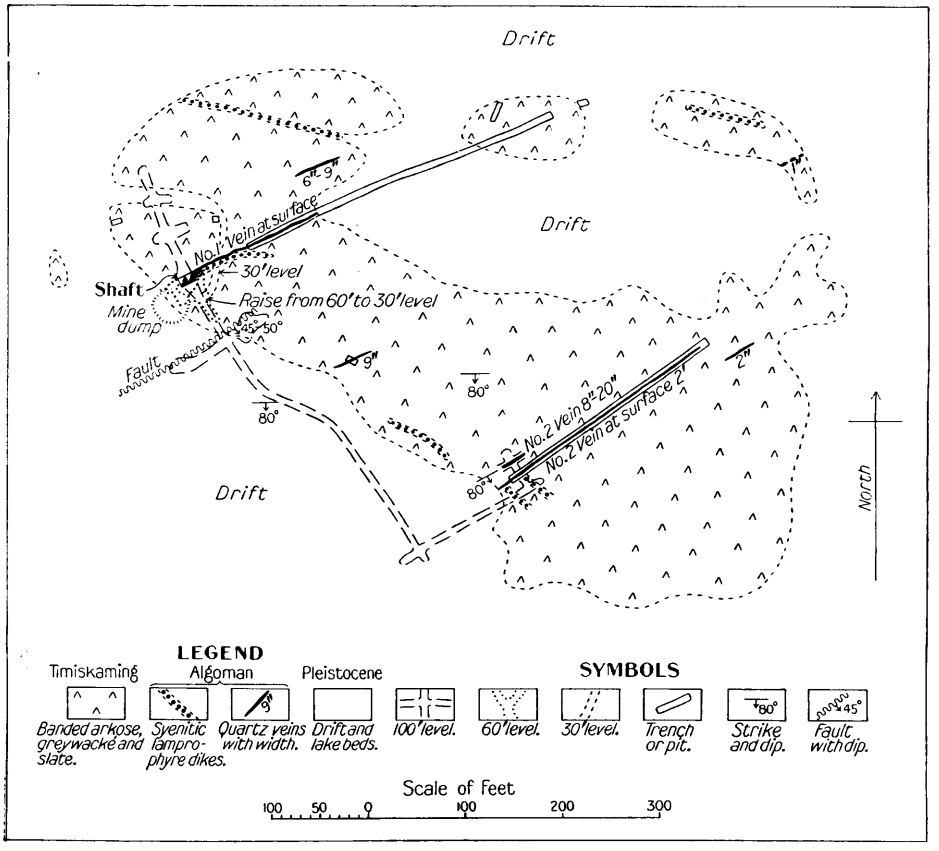
Considerable work has been done on a number of other properties in Hislop township. There is an old shaft in lot 13, concession III, and a shallow new one in lot 9, concession VI. Trenching has been done on a considerable scale in lots 10, 11, and 12, concession II, but there was nothing, at the time the mapping was done, to require a detailed description of these properties.

Guibord Township

TALISMAN MINE

The Talisman property in the south half of lot 7, concession VI, Guibord township, can be readily reached by an automobile road running east from

Matheson. No work was being done on the property in 1935, but during the previous year underground work was carried on from a shaft sunk ten years earlier. M. E. Hurst, of the Ontario Department of Mines, visited the property while it was in operation in 1934, and the writer is indebted to him for the following description of the conditions underground and the plan of the underground workings embodied in the accompanying map of this property.



Sketch map of the surface geology and underground workings, Talisman mine, Guibord township.

During 1923 and 1924, a shaft was sunk near the west end of the No. 1 vein to a depth of 115 feet, and about 500 feet of lateral work was done at the 100-foot level. In 1934 the property was reopened and additional exploratory work was carried out at the 30-foot, 60-foot, and 100-foot levels. The extent of the underground workings in June, 1934, is shown on the accompanying plan.

In the shaft, the No. 1 vein splits into two stringers, one of which pinches out at a depth of 18 feet and the other at a depth of 30 feet. At the 100-foot level crosscuts were driven to the northwest and southeast without encountering the downward extension of the No. 1 vein. A fault, which dips about 45° S., was intersected at a point 75 feet southeast of the shaft. Lateral exploration in the vicinity of the shaft at the 30-foot and 60-foot levels also failed to find the continuation of the No. 1 vein but encountered the fault exposed on the 100-foot level. Later, the southeast crosscut at the 100-foot level was extended to intersect the downward extension of the No. 2 vein. At a point about 370 feet southeast of the shaft a drift was run to the northeast to get beneath the surface exposure of the vein. After drifting 120 feet, a crosscut driven to the northwest intersected the vein at a distance of 37 feet. At this point the vein strikes N. 54° E., dips 80° S., and ranges from 8 to 20 inches in width. It consists of white quartz containing wall-rock inclusions and small amounts of tetrahedrite and chalcopyrite. The walls

are somewhat sheared and contain disseminated pyrite and chalcopyrite. Some drifting is said to have been done on the vein since the property was examined by the writer.

Most of the surface exposure consists of banded arkose, greywacké, and slate of Timiskaming age. The formation strikes east-west, dips from 70° to 80° S., and is cut by several small dikes running in different directions and of no great length. The dikes, which vary greatly in width from point to point, are from 2 to 8 feet wide and have been regarded in the field as lamprophyre, as they are rather dark in colour and rich in biotite. They are slightly porphyritic and weather to a reddish-brown colour on the surface. Thin sections show that they consist largely of orthoclase, biotite, and a little plagioclase. The biotite occurs in blades, which are often bleached from their original green colour. The rock approaches a fine-grained syenite in composition, except for the large amount of biotite present. It might be considered a syenitic lamprophyre.

There are several quartz veins exposed on the surface ranging in width from 1 inch to 2 feet. The veins are roughly parallel to one another and to a small fault found on the 100-foot level, and they cut the banded sediments at a low angle. No. 1 vein near the shaft follows one of the lamprophyre dikes for a short distance at the surface.

OTHER PROPERTIES

Near the top of Guibord hill on the south side there are a number of pits, trenches, and diamond-drill holes on several small bodies of pyrrhotite and pyrite in the greenstone. A quartz vein with a maximum width of 15 inches, strikes N. 20° W., dips 70° N., and runs southward from a pit in which pyrite is exposed. It maintains its strike and dip for 180 feet along a trench. The main sulphide body is somewhat dome-shaped and lies between layers of greenstone. It is about 4 feet thick near the top of the dome, where the body dips 45° S. Much gossan is found at the surface. Part of the pyrite is quite coarse grained. A number of patches of gossan are found on Guibord hill, and pits have been sunk on several of these.

A considerable amount of work has been done on quartz showings along the foot of Guibord hill on the west side, where a number of porphyry and syenite intrusions occur in the greenstone. Work has also been done on and in the vicinity of the big quartz exposure in lot 9, concession IV. This remarkable display of quartz has attracted much attention, but gold values in it are very low. A number of small granite intrusions occur in its neighbourhood.

Work has been done on several other lots in this township, where quartz is found in association with granite, syenite, and porphyry intrusions of Algoman age, such as those in lots 8 and 9, concessions I and II; lots 1 and 6, concession IV; and a number of others.

Apparently no work has been done recently on the Big Pete or the Gold Pyramid near the northwest corner of the township. The latter property is reported to have produced a considerable quantity of gold from shafts and open cuts previous to 1912 but nothing since. The plant has been destroyed by fire. The ore here occurred in quartz veins cutting the Timiskaming sediments.

Playfair Township

Although what is claimed to have been the earliest discovery of gold in this part of Northern Ontario was made in Playfair in 1905, no producing mine has been developed in the township. The first claims in the Ramore area are said to have been staked by a prospector named Frederick Mobbs, after whom the

lake in lot 9, concession III, is named. A number of claims have been tested in this part of the township, and a large amount of work has been done by Ramore Gold Mines and other companies.

RAMORE GOLD MINES, LIMITED

Ramore Gold Mines, Limited, controls claims in lot 8, concession III, on which shafts, drill-holes, and large trenches have been sunk. The concession line at the north end of the lot crosses a large outcrop of coarse greenstone, which in some sections is sheared in zones running east-west; in such zones the greenstone has been altered to hornblendite. The main mass of the rock appears to have been a gabbro, now largely altered to epidiorite. At the southeast corner of the outcrop there is an intrusion of hornblende syenite, and a dike of this rock runs off to the northeast in the greenstone. The syenite is a reddish, medium-grained rock, which has been brecciated and cut by veinlets of quartz. A considerable part of the intrusion is impregnated with pyrite, which is said to contain gold, although the writer has no assays of it. A pit about 20 by 15 feet and 15 feet deep has been sunk in the syenite, and apparently it was intended that this should be timbered and used as a shaft, since timbers were on the ground. The pit was full of water at the time of the writer's visit, as no work was then in progress.

A trench has been cut across the syenite and a diamond-drill hole bored in the swamp just south of the pit. The impregnation of so much of this intrusion by pyrite is interesting, because on no other property in the Ramore area is there a body similar to this. The syenite intrusion contains a horse of greenstone, and both the greenstone and the small syenite dikes are cut by a large dike of porphyritic Matachewan diabase.

About a quarter of a mile south of the workings described, and beyond a swamp, there is a 2-compartment, timbered shaft. It was full of water, but is reported to be about 70 feet deep. The shaft was sunk on an outcrop of greenstone, about 50 feet in diameter, which is cut by dikelets of a very fresh-appearing hornblende syenite. In fractures in the syenite a considerable amount of epidote is found, but there is relatively little quartz or sulphide mineralization. Another diamond-drill hole has been put down near this shaft.

Nearly 600 feet south of the shaft a large outcrop of greenstone, 15 chains long, is cut along the east side by a large Matachewan diabase dike, which runs a little west of north. On the west side it is cut by a dike of syenite, which widens out at the south end so that it is cut by the diabase dike. A swamp lies along the west side of the outcrop.

Deep trenches and pits have been sunk on this exposure, especially along the syenite-greenstone contact, where there are quartz stringers and variable degrees of pyrite mineralization.

LOT 13, CONCESSION IV

What is commonly called the Noranda property, because that company did the work on it, is situated in lot 13, concession IV, Playfair township. Much trenching was done, and a number of diamond-drill holes, from which the casing has been pulled, were sunk on an irregular quartz zone lying along the east side of a large hill of porphyritic Keewatin lavas. The trenches extend along the hill for a distance of about 400 feet. There is no definite vein, but numerous stringers of quartz make up a zone that in one section has been channel-sampled across a width of 15 feet. The dip of the zone seems to vary from nearly vertical to quite flat, and the strike changes rapidly. In some places the zone is well

mineralized, and in others it is practically barren of sulphide. Irregular dikelets of syenite are associated with the quartz.

OTHER PROPERTIES

Work has been done on a number of properties in this township, in addition to those mentioned. Quartz or carbonate veins and impregnations of sulphide near intrusions of porphyry or syenite in greenstone have attracted the attention of many prospectors. The sulphide is usually pyrite, but small quantities of chalcopyrite occur in some of these deposits. A considerable amount of work has been done in lots 7 and 8, concession II, and at several other places.

McCann Township

A large number of claims have been staked in McCann township. Trenching and some shallow diamond-drilling have been done, but no definite ore deposits have been revealed.

Bowman Township

Gold has been reported on a number of properties in Bowman township, and work has been done in several localities, but none of these require a special detailed description.

Geology of the Afton-Scholes Area

By E. S. Moore

INTRODUCTION

Afton and Scholes townships are situated in the southwestern part of the Timagami Forest Reserve, district of Sudbury. Late in the last century, attention was attracted to Afton township by a discovery of gold on Emerald lake, prospectors have from time to time staked claims in the township, but little development work was done until 1915. Recently this area has again aroused interest. The New Golden Rose (Afton) mine is now being developed by the Consolidated Mining and Smelting Company of Canada, Limited, and most of the Afton-Scholes area has been restaked.

The area is not readily accessible, except by air, and airplanes are commonly used for transporting men and materials. The route in summer is by way of Lake Timagami. A boat trip of about 30 miles from Timagami, on the Timiskaming and Northern Ontario railway, brings one to Obabika portage, which is about a mile in length and on which a wagon road has been built. There is a 9-mile trip south on Obabika lake to the Emerald lake portage, which is 1¼ miles long and is also crossed by a wagon road. The New Golden Rose mine is situated on the east shore of Emerald lake about three-quarters of a mile from the portage. Last summer heavy machinery, including a 75 h.p. Diesel engine and compressor, and supplies of all sorts were brought in over this route.

The area can also be reached by canoe by another route from Lake Timagami, via Gull and Eagle Rock lakes, as well as by the Obabika lake route. In taking the latter a small lake and two shorter portages between Obabika and Emerald lakes are used instead of the long portage. A winter road runs from the mine to Chudleigh on the Canadian National railway, near Sudbury.

The writer is greatly indebted, for information and generous hospitality, to the Consolidated Mining and Smelting Company of Canada, especially to W. E. Aitchison, manager of the New Golden Rose mine, and D. C. McKechnie, district mining engineer, and to David Ferguson, of the Taylor-Caswell property. E. Hartwick performed the duties of assistant in a very efficient manner.

Previous Work

Barlow[1] mapped the region around Lake Timagami and covered at least part of this area, but no mention of gold discoveries on Emerald lake was made in his report. Gold had been discovered before 1900, however, being mentioned briefly in other reports of that date,[2] and Miller[3] discussed the discovery in a report made the following year:—

> A few years ago Emerald lake attracted considerable attention from prospectors on account of the reported occurrence of gold on its shores. The gold was said to have been found in the loose state in grains of considerable size, mixed with sand, in a small cave, or so-called "vug," near the water's edge. . . . Rock had been blasted out here at different points, but we saw no signs of the precious metal in the quartz in which the openings had been made. Considerable pyrite, some of which is in well defined cubes, occurs in these openings.

[1] A. E. Barlow, "Report on the Geology and Natural Resources of the Area Included by the Nipissing and Temiscaming Map-sheets," Geol. Surv. Can., Vol. X, 1897, pp. 271-279 I.

[2] "Report of the Survey and Exploration of Northern Ontario, 1900," Ont. Bur. Mines, 1901, pp. 88, 112.

[3] W. G. Miller, "Iron Ores of Nipissing District," Ont. Bur. Mines, Vol. X, 1901, p. 175.

Miller[1] also mentions the occurrence of conglomerate and dolomite on the north side of the southeast bay of Emerald lake and speaks of the dolomite having a striking appearance.

In 1909, the Golden Rose Mining Company was incorporated, with head office at Sudbury and a capital stock of $500,000.[2] Apparently little work was done on the property until 1915, when about eight men were employed during the open season. Trenching, open-cutting, and test-pitting were done, and a 6-foot Hardinge mill and amalgamation plates were installed for the extraction of the gold. Edward J. Townsend was president and manager of the Golden Rose Mining Company at that time.[3] In the following summer some work was done; and in addition to trenching, a shaft was sunk to a depth of 30 feet.[4] The remains of the old mill and a large vault for storing the gold recovered may still be seen on the shore of Emerald lake.

The next record of work done on the property was in 1927. In June of that year, Afton Mines, Limited, was incorporated at Toronto, with a capital stock of $2,000,000. During the summer about 30 men were engaged in deepening the shaft to 100 feet and in crosscutting and drifting. Some diamond-drilling was also done on the hill in the vicinity of the mine.

In the summer of 1934, New Golden Rose Mines, Limited, was organized. The Consolidated Mining and Smelting Company of Canada, Limited, controls 2,000,000 shares of the stock of this company and has undertaken the development of the property. Further drilling was done on the surface to check the former records, and in March, 1935, a start was made in deepening the old shaft to 450 feet. Up to the present time, at least 12 diamond-drill holes have been sunk from the surface, a considerable amount of drilling has been done from the underground workings, and about 1,500 feet of drifting and crosscutting has been completed on the second and third levels.

Topography

This area, like so much of the Timagami region, is very rugged. The relief is due chiefly to remnants of a great diabase sill that at one time covered the whole area. It has been partly removed by erosion, leaving in some places unscalable cliffs, scores of feet high, and large rugged hills that rise several hundred feet above the larger lakes. South of Emerald lake the hills stand nearly 300 feet above the lake.

Where the diabase has been eroded away, exposing the older rocks, the relief is low and there are numerous lakes, the larger ones, like Emerald and Eagle Rock lying in basins that are mostly in the Timiskaming sediments. There are a few small lakes among the diabase hills. The area of older rocks is in many places deeply covered with glacial drift and around the larger lakes with alluvium. The whole area is covered with pine. The red species predominates, but there is a sprinkling of the white variety.

GENERAL GEOLOGY

The Afton-Scholes area may be considered as a low dome, on the surface of which erosion has cut windows through a great sill of Nipissing diabase, exposing rocks of Keewatin, Timiskaming, Algoman, and Cobalt ages. The section of

[1]W. G. Miller, op. cit., p. 176.
[2]Ont. Bur. Mines, Vol. XIX, pt. 1, 1910, p. 48.
[3]Ibid, Vol. XXV, pt. 1, 1916, p. 103.
[4]Ibid, Vol. XXVI, 1917, p. 90.

special interest to prospectors is almost surrounded by diabase, and two large ridges of this rock traverse the area from north to south. Streams have cut gaps through the sill at the north and south ends of the area, exposing the older rocks.

Table of Formations

QUATERNARY	
PLEISTOCENE:	Glacial drift.
PRE-CAMBRIAN	
KEWEENAWAN:	Nipissing diabase sill.
COBALT:	Conglomerate and arkose.
ALGOMAN:	Red and grey feldspar porphyries.
TIMISKAMING:	Conglomerate, quartzite, arkose, greywacké, and a little limestone.
KEEWATIN:	Greenstone and schist, iron formation, and possibly some rhyolite.

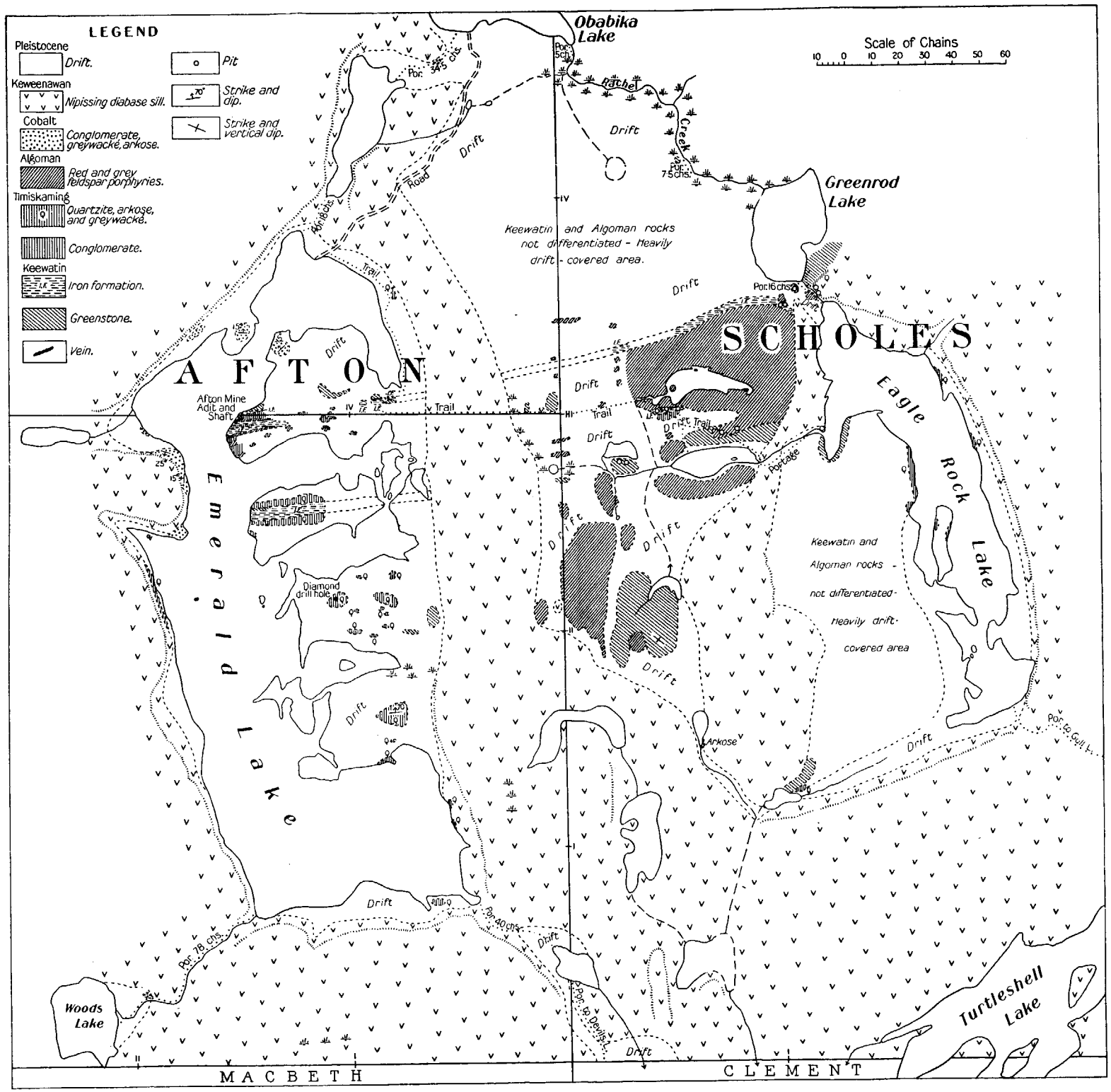
Keewatin

The oldest rocks in the area are greenstones, and schists resulting from dynamic metamorphism of basic rocks. These rocks occur in scattered outcrops, separated by drift and Algoman porphyries. Associated with the greenstone is an acid rock, rhyolite or feldspar porphyry, that on the whole appears to be older and more altered than most of the Algoman porphyries. This may be Keewatin, but the heavy mantle of drift that hides the rocks in so many places covers the contacts and prevents a satisfactory determination of the relations between the greenstone and the more acid rocks. Further, some of the Algoman porphyries are so altered that it is difficult to distinguish them from older rocks of similar composition except where they are found cutting rocks younger than the Keewatin.

The Keewatin iron formation is important in this area because most of the gold deposits so far found are located in it. The rock is a typical banded type, in most places consisting of red to nearly black jaspilite. In places hematite and magnetite are almost sufficiently abundant to make a low-grade iron ore. In part of the formation the rock consists almost entirely of laminated chert. The formation is, for the most part, very hard, dense, and impermeable, but there are bands of quite porous granular silica, which on account of its more permeable character permitted the circulation of ore-bearing solutions.

The iron formation is strongly magnetic, and compass work is difficult over the formation in place and over drift containing boulders of this rock. It is impossible to run lines by compass in the vicinity of the outcrops with any degree of accuracy, and there are few surveyed lines in this area that can now be recognized. Many of the claim lines run by compass are far from their proper positions.

There are two main bands of iron formation exposed on the east side of Emerald lake. The New Golden Rose mine is located on one of these, and the other occurs on the large island south of the mine. It is believed that these two bands indicate the limbs of a large syncline with Timiskaming sediments in the centre. The northern band is more or less continuous from Emerald lake eastward to Eagle Rock lake, a distance of 2½ miles. For about half of this distance it is covered by a remnant of the diabase sill and drift. The dip needle indicates its presence beneath the drift in some places, but it may be cut out by Algoman intrusions in others. The formation is in a single band for the greater part of its length, but in the vicinity of the mine there are three bands, the result of duplication by folding.



GEOLOGICAL SKETCH MAP OF A PART OF AFTON AND SCHOLES TOWNSHIPS.

The south band is well exposed at the west end of the large island in Emerald lake, but 30 chains east from the shore it disappears beneath drift, and a little farther east a remnant of the diabase sill overlies its extension in that direction. On the east side of the ridge of diabase a large mass of Algoman porphyry is exposed, and it has caught up some of the iron formation on the south side of a lake lying between Emerald and Eagle Rock lakes. This exposure of iron formation is regarded as a part of the south band, which was apparently continuous along the south side of the syncline before the injection of the Algoman porphyries. The remnants of the iron formation surrounded by porphyry are greatly distorted and have very complicated structures.

Timiskaming Series

A series of sediments in this area consists of conglomerate, arkose, quartzite, and greywacké. These formations are regarded as Timiskaming for several reasons. The basal formation is a conglomerate that strongly resembles the Timiskaming conglomerate in other areas; it contains large granite boulders, some being as much as 2 feet in diameter, and there is no granite in place in the neighbourhood that could have furnished these boulders; it also contains pebbles and angular fragments of the iron formation, which it is believed to overlie (a shallow syncline of conglomerate lies in the iron formation at the mine). The conglomerate and iron formation are both cut by the Algoman porphyries, and these are overlain by Cobalt sediments, which in turn are intruded by the Nipissing diabase sill.

The distribution of pebbles and boulders in the conglomerate is quite irregular, as the rock gives place within a short distance to greywacké with only scattered pebbles, or none at all. This irregularity in the distribution of the pebbles and boulders makes it more difficult to determine the structure south of the mine than if there were not these rather rapid changes from conglomerate to greywacké in sections of the area where there are only scattered outcrops.

The conglomerate is well exposed near the mine, and a few outcrops may be seen on the south side of the iron formation just east of the mine. A small patch of it occurs on the south side of the iron formation south of a lake between Emerald and Eagle Rock lakes. Outcrops also occur on the south side of the iron formation on the large island, on the north shore of the southeast bay of Emerald lake, and on the west side of Eagle Rock lake. It grades into greywacké and arkose and these rocks may be seen at the south end of Emerald lake and at the south end of a small lake lying about half way between the southern sections of Eagle Rock and Emerald lakes.

The Timiskaming quartzite is an impure type grading into arkose and greywacké. Some of it is rather friable and highly impregnated with pyrite in places, as on the large peninsula jutting out from the east side into the southern part of Emerald lake. In some sections it is a hard, pink rock, as on the east and west shores of Eagle Rock lake, where there are several outcrops. The quartzite is also exposed beneath the edge of the diabase sill on the west side of Emerald lake southwest of the large island.

The small occurrence of limestone, associated with conglomerate, on the north side of the southeast bay of Emerald lake is unusual, as it is entirely crystalline and practically a marble. It is similar to some of the Grenville limestone in southeastern Ontario.

The Timiskaming formations on the whole weather readily and form the basins of the larger lakes in this area.

Algoman Porphyries

In this area are two types of porphyry that are regarded as Algoman. They are both feldspar porphyries, less acid than typical granite in composition but slightly more acid than typical syenite. The phenocrysts are almost entirely feldspars: orthoclase and plagioclase of a composition near oligoclase and albite.

The porphyries occur in dikes, small stocks, and bosses. The largest mass is found around the lake near the trail between the mine and Eagle Rock lake. It is a comparatively fresh pink feldspar porphyry. There are many smaller bodies in the form of dikes and small stocks scattered throughout the area, some of which are pink to reddish and others grey in colour. On the whole the grey porphyry is a little more altered than the red, and some of it appears older. As the two porphyries were never found in contact with one another, their age relations could not be definitely determined, but it is believed that they are of approximately the same age. The grey porphyry probably represents border phases of the reddish type and intrusions that have been influenced by the rocks intruded and by hot solutions where these intrusions are in the vicinity of mineralized formations.

The porphyries are quite similar in composition and other features, except for a slightly larger proportion of sericite, chlorite, epidote, and other secondary minerals in some of the dikes. One intrusion on the point south of the mine, on the north side of the bay separating the large island from the peninsula on which the mine is located, has an unusual structure. In thin section it shows a perlitic or onion-like structure in the matrix. This was not observed in any of the other intrusions.

Cobalt Series

Conglomerate and banded arkose and greywacké of the Cobalt series, which lie immediately beneath the diabase, outcrop in a number of places around the northern part of Emerald lake. These rocks have a dip westward of 15 to 20 degrees, except on the west side of the lake opposite the mine, where they have been disturbed by the intrusion of the diabase. Where the sill has pushed up over some of the sedimentary rock it has so disturbed it that at first glance one is led to believe that the sediments must be part of the Timiskaming. Further study shows, however, that these disturbed rocks are confined to a small area close to the sill.

A small outcrop of Cobalt quartzite was seen along the trail between Emerald and Woods lakes and another on the portage between Obabika and the small lake south of it. Farther north, around Obabika lake, the Cobalt rocks underlie the drift over larger areas.

Nipissing Diabase

The Nipissing diabase outcrops in large sections of the Timagami Forest Reserve, where remnants of a great sill remain. The Afton-Scholes area is practically surrounded by this rock, and ridges of it extend from north to south across the area. The rock here is very similar to that in other areas, which has been described in detail. No estimate of the original thickness of the sill is possible in this area because much of the upper part has been removed by erosion. Between 300 and 400 feet remain.

STRUCTURAL GEOLOGY

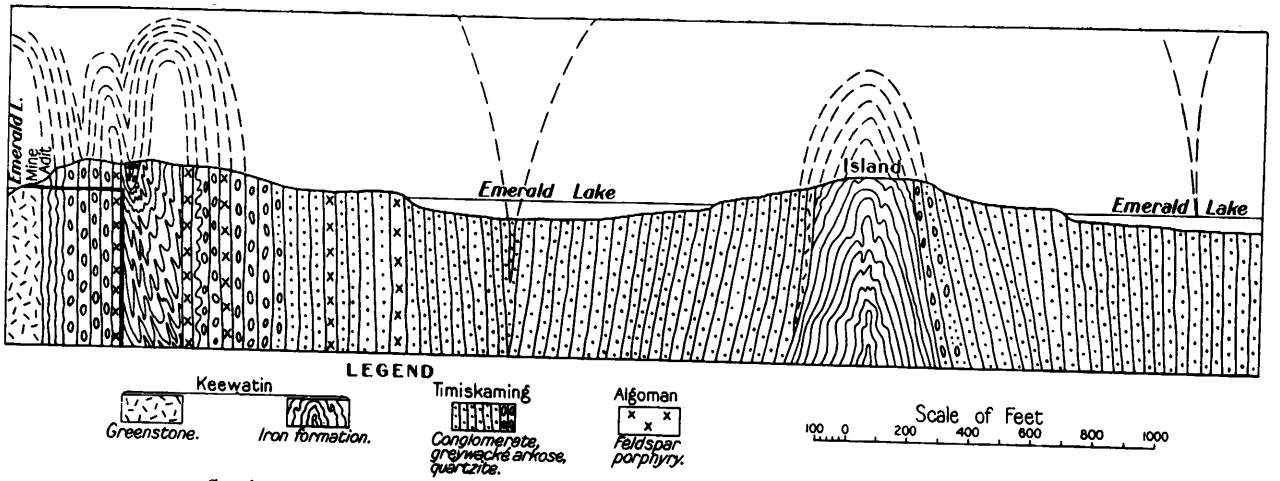
It is evident that this area was greatly folded at the close of the Timiskaming, and probably the major disturbance accompanied the intrusion of the Algoman rocks. This diastrophism was so great that there is no way of determining whether there was extensive folding after the Keewatin rocks were formed and before the erosion that resulted in the deposition of the Timiskaming. It is probable, however, that there was a period of folding and erosion preceding the deposition of the Timiskaming sediments.

An unconformity is indicated by the Timiskaming rocks lying directly on the greenstone in some places and on the iron formation in others. On the north side of the creek flowing out of Eagle Rock lake the Timiskaming arkose and quartzite are in contact with greenstone. In other places, as near the eastern shore of Emerald lake, these formations appear to be in contact without iron

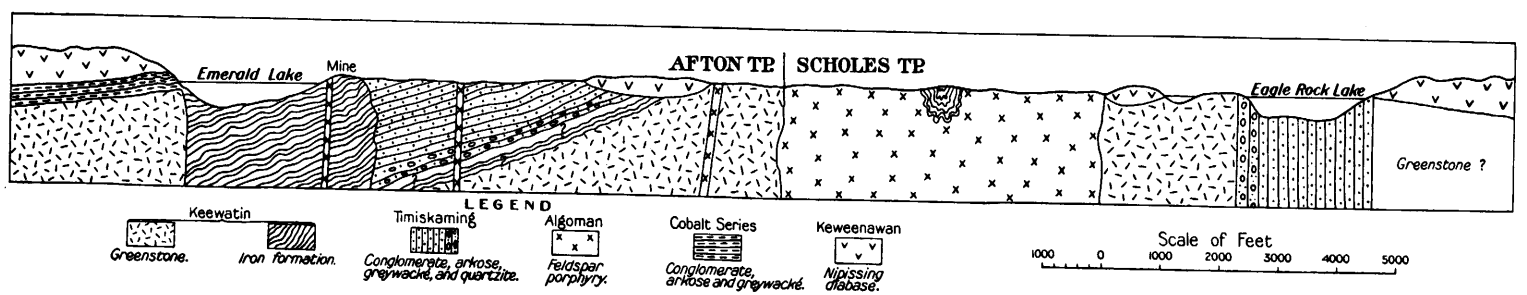
Diabase sill on the west side of Emerald lake. Timiskaming sediments underlie it towards the left-hand and Cobalt sediments near the right-hand end of the photograph.

formation intervening. It must be borne in mind, however, that the iron formation, judging from other regions, tends to occur in isolated bodies and in many cases is not continuous over large areas, as many other sedimentary formations are. Further, in the Afton-Scholes area there is greenstone overlying, as well as underlying, the iron formation, although that overlying is not very thick. The assumption that the Keewatin formations were folded and eroded before the Timiskaming sediments were deposited seems to explain the structural conditions better than any other theory. The iron formation is very hard and resistant, and during the pre-Timiskaming erosion it would be left in anticlinal ridges, which would again be exposed in anticlines after the Timiskaming was folded and eroded. If this assumption is correct the iron formation should be found beneath the syncline between the mine and the large island in Emerald lake.

On the shore of Emerald lake, near the mine, a minor syncline with conglomerate folded down into the iron formation may be distinctly seen. It is



Section running south-southeast from the New Golden Rose mine, showing suggested interpretation of structure.



Generalized east-west section across parts of Afton and Scholes townships.

quite shallow, since the mine workings pass under it, and it pitches westward. This indicates a deepening and widening of the major synclinal structure toward the west and probably improves the possibility of finding ore bodies in that direction.

The occurrence of the two bands of iron formation in this area, and the tendency of these, although they are not continuous, to converge toward the east, near Eagle Rock lake, further suggests that these bands represent the limbs of a large syncline having its axis between the mine and the large island and pitching to the west.

The outcrops of Timiskaming sediments around Eagle Rock lake, between the southern part of this lake and Emerald lake, and around the south end of the latter indicate that another large synclinal structure runs through Eagle Rock lake. This syncline swings around the south end of the greenstone area under the diabase sill to Emerald lake. Along Eagle Rock lake the strike of the formations is roughly north-south, and around the south end of Emerald lake it is north of west. The structure near the north end of this lake is complicated, and there are indications of a fault running through the bed of the lake and roughly parallel to it.

The dip of the Timiskaming sediments is everywhere quite steep, 70 degrees to vertical. The Cobalt sediments, on the other hand, are very little disturbed. It is evident that the folding of the Timiskaming, the intrusion of the Algoman porphyries, and the deposition of gold were all closely associated activities.

ECONOMIC GEOLOGY

Gold Deposits

The gold deposits in this area are mostly confined to the banded iron formation where it is intruded by Algoman porphyries. A discovery in the southern part of the area has been reported since the writer left the field, but information on the nature of the rocks in which the gold occurs is not available. This occurrence is apparently not in the iron formation. A well-mineralized band of arkose and impure quartzite in the Timiskaming series has recently been uncovered on the east side of the outlet of Eagle Rock lake. The band is at least 8 feet wide and is mineralized with pyrite, which carries some gold.

This area is of special interest, since it adds another example to the rapidly increasing number of gold deposits occurring in a formation that was formerly regarded by prospectors as unpromising for the occurrence of gold. Much of the formation is too impervious to permit the ready injection of ore-bearing solutions, but there are zones of more porous silica that have permitted the penetration of solutions, and the brittleness of the rock has aided brecciation during folding, thus favouring deposition of ore. The iron formation is tremendously contorted and greatly brecciated in some places in the vicinity of Algoman intrusions. In these localities solutions that have risen later from the magma that produced the porphyries have formed the ore deposits. On the Afton property the ore deposits are all in the iron formation near dikes of porphyry. On the large island in Emerald lake neither porphyry intrusions nor ore deposits were found.

The ore deposits have the form of lenses and veins in the iron formation, often lying alongside of porphyry dikes. These lenses consist in some cases of quartz and a little ankerite, which have replaced the iron formation, and in others of iron formation impregnated with quartz and pyrite. Some fairly

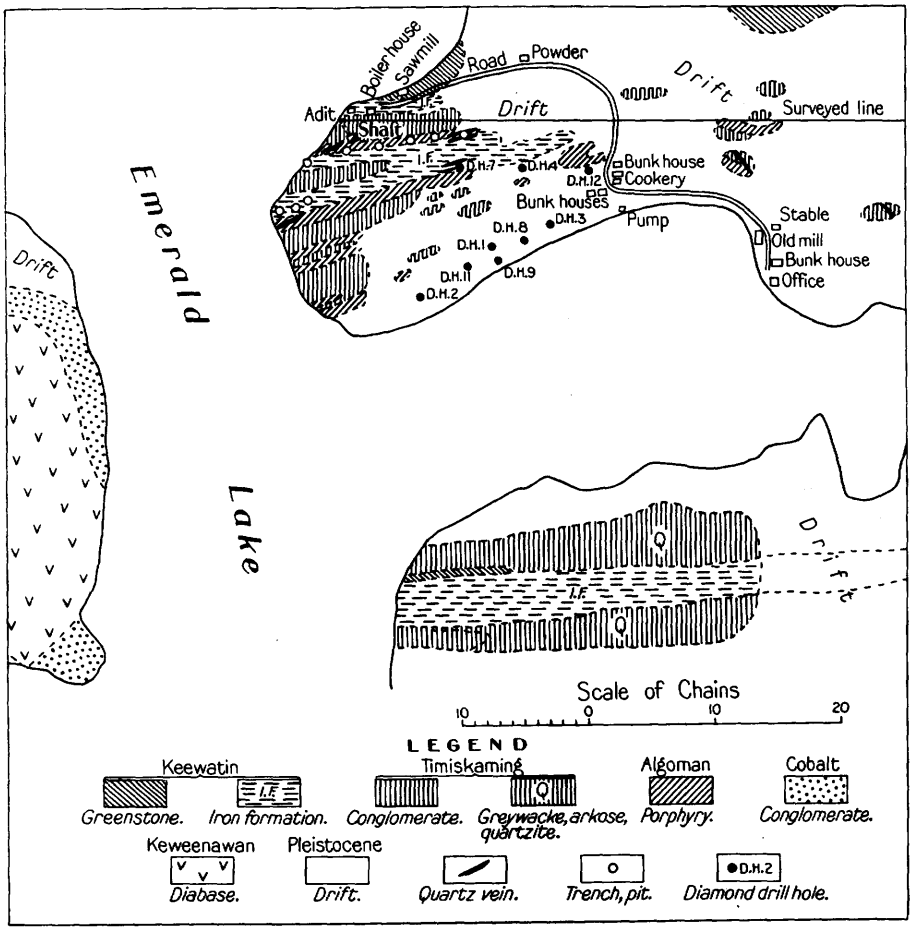
distinct quartz veins have been found, besides large lenses of massive sulphide. Stringers of quartz in some cases serve as a guide from one lens to another. In the heavy sulphide bodies a striking feature is the coarseness of the pyrite. Crystals of pyrite an inch or more in diameter have particles of native gold distributed among them, a feature that is unusual because, as a rule, such coarse pyrite is not as favourable for gold as the finer-grained type. The metallic gangue is practically all pyrite, but a little chalcopyrite occurs. Tellurides occur sparingly. In a sample from the workings of the New Golden Rose mine, a speck of a dark mineral grown on a crystal of gold has been identified by J. E. Thomson, of the University of Toronto, as a telluride, apparently of a bismuth type, and he has also identified altaite in gold specimens from the southern part of the area. The ore can be easily treated, as over 80 per cent. of the gold is said to amalgamate with mercury.

Boiler-house and machine shop at the New Golden Rose mine. The adit entrance is near the lower right-hand corner. The hill is iron formation.

New Golden Rose Mine

The New Golden Rose (Afton) mine is situated on a peninsula jutting out into the northern part of Emerald lake on the east side. It was near the present mine that the first discovery of gold in this area was made toward the close of the last century. The gold was found at the water's edge in a small cavity in rather porous and friable silica of the iron formation. In 1915-16, considerable surface work was done by the Golden Rose Mining Company, and some gold was extracted in the small amalgamation mill from the ore taken from the pits and trenches. In 1927, work was resumed when Afton Mines, Limited, took over the property and sank a shaft. An adit, 240 feet long, runs from near the water's edge into a hill of iron formation and conglomerate, and the shaft descends from it, the collar being about 85 feet below the top of the hill. The shaft is small, and if the mine should develop into one of large production a new shaft would be necessary to handle the ore. The Consolidated Mining and Smelting Company completed the present shaft during the summer of 1935 to a depth of 450 feet, with three levels. In 1936 a raise was driven through to the surface and a 200-ton mill was under construction.

A porphyry dike ranging in width from 6 inches to 20 feet runs along the contact of the conglomerate and iron formation, and the ore lenses lie in the iron formation near this dike. The jaspilite is very hard to drill, and on this account in some places the drift has been run in the porphyry or the conglomerate. The lenses of ore, consisting of quartz and pyrite, occur scattered along the strike of the formations, and diamond-drilling from underground has located mineralized zones at various places across the strike of the iron formation There are



Sketch map showing the geology in the vicinity of the New Golden Rose mine.

some nearly flat veins that appear to cut across the iron formation between the porphyry dikes, and the attitude of these seems to have been controlled to some extent by the folds in the formation. Three bands of the iron formation are found near the mine, owing to duplication by folding, and in the bottoms of synclines and on the tops of anticlines the beds will have low dips. The jaspilite has been greatly contorted and fractured during folding, which made conditions more favourable for the deposition of ore. The synclines of conglomerate pitch westward under the lake, and in the writer's opinion the duplication of the beds, with consequent greater width of the iron formation to the west, as compared to the narrow single band to the east, should increase the possibilities of ore

occurrences beneath the lake. Twelve diamond-drill holes have been sunk on the hill, mostly east of the shaft, and these indicate the occurrence of mineralized zones in close association with porphyry dikes in the iron formation. Four of these holes have been drilled by the company now operating the property.

The values in the mineralized zones are not uniform and vary from a small fraction of an ounce to over an ounce in gold.

The company was employing about 70 men, including wood-cutters, in their development work during the summer of 1935. Toward the end of the summer, a 75 h.p. Diesel engine and compressor were installed to supplement the steam and gasoline compressors and to cut down on the consumption of wood fuel. A relatively high consumption of air is necessary for drilling the hard iron formation.

The Consolidated Mining and Smelting Company controls 45 claims in this area and holds an option on others.

Taylor-Caswell Property

A block of claims known as the Taylor-Caswell property is situated to the east of the New Golden Rose property and runs west from the northern part of Eagle Rock lake. A large amount of work has been done on these claims under the direction of David Ferguson, to whom the writer is indebted for information regarding the results accomplished. In two localities much trenching and test-pitting on the iron formation has exposed mineralized zones. One of these localities is on the south side of the lake lying along the trail running from the New Golden Rose mine to Eagle Rock lake. Here a number of large pits and trenches expose bodies of highly disturbed cherty iron formation caught up in the Algoman porphyry. The iron formation is cut by quartz stringers and impregnated with quartz and pyrite. Apparently only low values in gold have been found.

A short distance west of the portage between Eagle Rock and Greenrod lake, a large trench, nearly a chain in length, has been dug in the iron formation along an intrusion of porphyry. In the trench an irregular quartz vein and jaspilite impregnated with quartz are well mineralized with pyrite carrying some gold. A short distance away another quartz vein carrying some chalcopyrite was seen. These occurrences indicate the close relationship of mineralization and porphyry intrusions in the iron formation.

Other Parts of the Area

The whole Afton-Scholes area has been staked and some work has been done in a number of places, but in most cases little of interest has been found, except in the recent discovery, previously mentioned, near the south boundary of the area. Here in the winter of 1934-35, two diamond-drill holes were sunk in the Timiskaming quartzite and greywacké on the peninsula on the east side of Emerald lake south of the large island. The formations in this locality are highly impregnated with pyrite over considerable areas, but no information has been disclosed regarding gold values found.

It is quite possible that some of the Timiskaming sediments, where intruded by porphyry, may contain ore deposits, and they are worthy of consideration by the prospector. The schisted greenstones should also be favourable prospecting ground, although the exposures of these rocks are not large and so far nothing of special interest has been found in them.

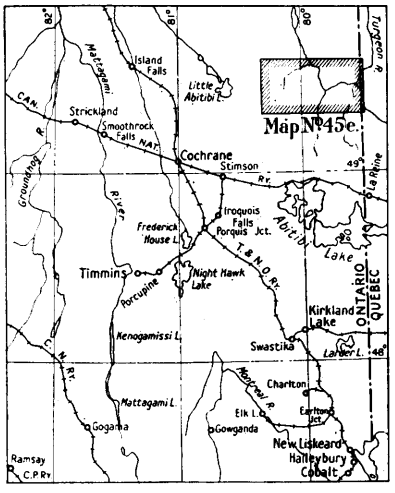
Geology of the Burntbush River Area

By Robert Thomson

INTRODUCTION

The Burntbush River area lies about thirty-five miles north of Lake Abitibi in the district of Cochrane. It extends from the Ontario-Quebec boundary some thirty miles west to the townships of Bragg and Tweed, and from the townships of Seguin, Kenning, Singer, and Clive north to Speight's line.

The writer's work in the Burntbush River area, covering a period of about three months in 1934, was primarily to determine if prospecting might be carried on in the area with some likelihood of success. The work accomplished included the survey and mapping of most of the topographical features and a reconnaissance geological survey. A small amount of prospecting had been carried out in preceding years.



Key map showing the location of the Burntbush River area. Scale, 70 miles to the inch.

Previous Work

Hopkins[1] in 1917 made a reconnaissance along the Patten river. Tanton[2] reported on the northwestern part of Quebec. The western part of his map includes the lower part of the Burntbush river and the Patten river.

Means of Access and Travel Routes

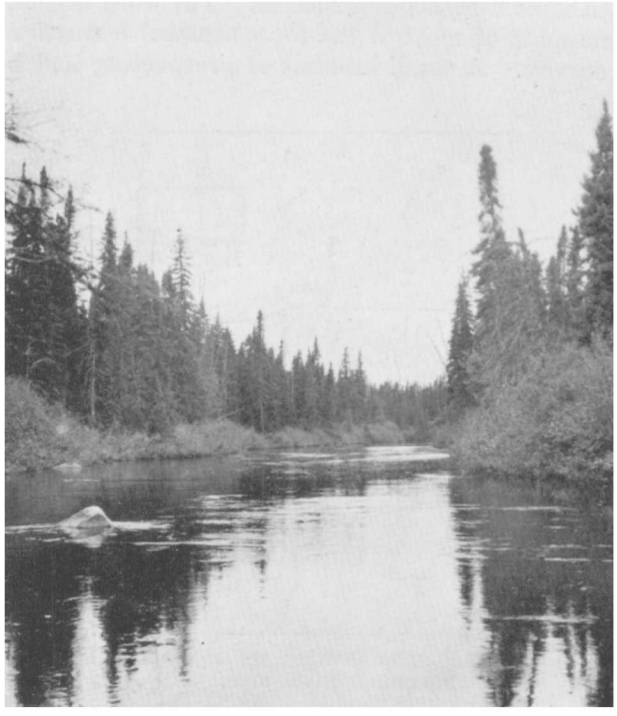
The Canadian National Railways furnish the only available railway transportation close to the area, by the line running from Cochrane eastward into Quebec. The easiest route into the area, and the one available at all times of the year, begins at La Sarre, Quebec. From La Sarre a road leads north 16 miles to a fire-ranger's camp on the Turgeon river. This road is suitable for

[1]P. E. Hopkins, "Notes on Lake Abitibi Area," Ont. Bur. Mines, Vol. XXVII, pt. 1, 1918, pp. 200-214.

[2]T. L. Tanton, "The Harricanaw-Turgeon Basin, Northern Quebec," Geol. Surv. Can., Mem. 109, 1919.

wagon and to some extent for motor traffic. Vehicles can be hired at La Sarre. The Turgeon river is navigable by canoe to the mouth of the Burntbush river. Ten portages (kept in good repair by fire rangers and none more than a quarter of a mile long) are encountered along the route; an outboard motor, nevertheless, can be used to advantage over this stretch. The trip from La Sarre to the mouth of the Burntbush river generally takes from two to three days.

Other routes into the area are by way of La Reine (Okikodosik) and the Patten river and by way of the Kabika (Mud) river. The Kabika River route goes from Mace on the C.N.R., by way of Lake Abitibi to Forks creek, and about 1½ miles up Forks creek. From here the portage over to the Kabika river is



View up the Mikwam river from the third portage above the mouth.

4½ miles. Kabika river as far down as the forks shown on the Burntbush River map (No. 45e) is likely to be "bad going," owing to shallowness and log jams. The use of this route is thus restricted to periods of high water; at any time it is very poor and uncertain compared with the Turgeon river route.

The La Reine–Patten Rivers route is not used at present. The water is shallow, and the portages are long; the one at the head of Patten river is 6 miles in length. This route is not recommended.

Most parts of the Burntbush River area can be reached from canoe routes. The amount of water in the river makes a material difference in the ease with which travelling can be done. High water is assured in the early spring and fall of the year. Some of the portages marked on the accompanying map may be avoided by poling, lining, or wading up the rapids. The portages were in good condition in the summer of 1934, but there is no permanent agency to keep them cut out. Numerous boulders in the rivers are hard on canoes.

The Burntbush river, from the Turgeon river to Speight's line is suitable for canoe travel at all seasons of the year, but from the Turgeon river to the Kabika river, rocks obstruct the passage in low water. The Kabika river, from its mouth up to the forks, is easily navigated by canoe at all seasons. The Mikwam river is navigable at all seasons all the way to Bateman lake. The route from Bateman lake to the Kabika river through Payntouk lake is unsuitable for canoes at all seasons.

A trail runs north from Payntouk lake to the Mikwam river near the second rapid above its mouth, and continues on the other side of the river to a small lake about 2 miles north. The trail, originally well cut, is impaired by a subsequent burn and much deadfall but is still useful (1934).

From Springer lake a portage leads to Wasicho lake, and from there Two Peak lake is easily reached. Although the divide between the Burntbush River system and the Abitibi River system has been crossed, the creek draining Wasicho

View of the hills west of Two Peak lake from the outlet of the lake.

lake is too small and choked with logs to permit canoe travel farther down the latter system.

During the field season of 1934, the writer unsuccessfully sought routes through to the Abitibi River system. Two routes were reported later by local Indians. It was stated that a portage about a mile long, which starts at the tiny lake about a mile from the mouth of the creek running into the Mikwam river between Mikwam lake and Kanitama lake, lies on the route to Little Abitibi lake. Another route to Little Abitibi lake through the Burntbush River area was said to start from the west branch of the Kabika river and to run by way of Lowbush river. It is stated to be a poor route in low water.

A canoe route to James bay by way of the Turgeon and Detour rivers is shown on map No. 25A, Ontario Department of Surveys. Local Indians told the writer of another route up the Burntbush river.

Topography and Drainage

The usually gentle undulating surface of the area is broken by three rock hills, which rise several hundred feet above the surrounding country. West of Two Peak lake a hill of basic volcanic rock (see photograph above) rises about

View over Two Peak lake from the hills to the west of it. (Photograph by J. C. Sproule.)

400 feet above the general surface and affords an excellent view (see photograph opposite) of the surrounding country. Apart from such hills the only noteworthy topographic elevations are ridges of unconsolidated glacial material, which sometimes rise 35 feet, e.g. the eskers in the vicinity of Magiskan lake. In places, as along the Burntbush river from Kabika river north for several miles and along the Kabika river from its mouth to where it crosses the township line, the banks are steep and rise about 20 feet above water level. A jackpine-covered sand plain, with an east-west width of some 3 miles, lies in the east central part of Bragg township.

As shown on the accompanying map, outcrops are scarce and usually very small. Most of the ground is covered with moss, except on sandy ridges. The moss-covered surface in places grades into muskeg with small trees or no trees, although this type is not extensive. Occasional undrained ponds are found away from the drainage system.

In the eastern part of the area lakes are few and small; in the western part, however, they are rather abundant, although for the most part shallow. The lakes and rivers are rimmed with unconsolidated glacial material; rarely are there any rock outcrops among them. The Burntbush river above the Kabika river has the dark-coloured water so characteristic of muskeg areas in Northern Ontario. The light-coloured muddy water of the Kabika river contrasts sharply with the dark muskeg water of the Burntbush river at their junction.

The water level in the rivers is subject to considerable changes during the seasons. When the ice goes out in spring there is an abrupt rise. Ice scars on the trees along the river bank up to heights of 15 feet attest to the seasonal high level of the water.

The area drains into James bay, for the most part by way of the Turgeon and Harricanaw rivers, but the western part is drained by the Abitibi river.

The lakes owe their origin to slight original depression in the unconsolidated glacial deposits, to dams of glacial material across depressed parts of the surface, and to the southward tilting of the general surface following the recession of the ice.

The rivers have cut their courses to bed rock only at a few rapids; most of the rapids are caused by accumulations of boulders.

Climate

The dates of the opening up and of freezing up of the rivers are of importance to anyone travelling in the area. Jos. Berube, independent trader at the mouth of the Burntbush river, kindly supplied the following information:—

	First open water	Freeze-up
1930	May 4	November 6
1931	April 25	December 2
1932	May 6	November 13
1933	May 2	October 28
1934	May 5	.....

Tanton[1] has described the climate in the Harricanaw-Turgeon Rivers basin, of which the Burntbush River area is a part. As stated there, the climate is unfavourable to agriculture. During 1934, frost was experienced in June and September but not in July or August. Mr. Berube has been able to grow potatoes, beets, carrots, and some other vegetables at his trading station.

[1]T. L. Tanton, op. cit., p. 4.

Natural Resources

Timber

Johnston and Sharpe[1] have reported on the timber resources of this part of the province. As they show, a considerable part of the Burntbush River area is "burn." From the west boundary a belt of burn runs southeastward, between Magiskan lake and Bateman lake, to a point beyond the Kabika river. Small areas of unburned timber are found in it.

Spruce is the most abundant tree, although locally other kinds may be plentiful. Trees seen in the area include spruce, balsam, balsam poplar, aspen poplar, birch, jackpine, tamarac, and cedar.

Agriculture

The rigorous climate, combined with the distance from markets and lack of transportation facilities, make the area unfavourable for agriculture, although in most places the soil is quite suitable and there is little rock outcropping.

Game, Fur-bearing Animals, Fish

Moose are the most plentiful large animals in the area. Deer are rare. Black bear are fairly common. A half a dozen beaver colonies were seen by the writer's party. Muskrat and fox were also seen. Other animals reported to occur in the area are: otter, mink, marten, weasel, wolf, skunk. Rabbits and squirrels are common.

Pike and pickerel may be caught at many of the rapids in the rivers.

An independent fur trader, Jos. Berube, maintains (1934) a trading post at the mouth of the Burntbush river, but usually carries only a limited amount of supplies.

With the exception of itinerant trappers the area is uninhabited. Trapping, the only industry carried on at present, furnishes a precarious livelihood for a few people, including some Indians.

Acknowledgments

The writer is indebted to a number of persons who furnished information on the area. C. W. Knight very kindly allowed the use of maps and reports of the Cyril Knight Prospecting Company, prepared by C. F. Rice and J. D. Bateman from prospecting work done during 1931, 1932, and 1933. J. R. Brayley, Toronto, and A. V. Dukes, Mace, contributed helpful information on the area. A small-scale map of the area sketched from an airplane by Karl Springer was of material assistance.

During the field season the writer was ably assisted by J. C. Sproule, M. F. Teskey, and J. D. Bateman.

GENERAL GEOLOGY

Table of Formations

QUATERNARY	
RECENT:	Muskeg, alluvium.
PLEISTOCENE:	Glacial deposits.

[1]R. N. Johnston and J. F. Sharpe, "Report of the James Bay Forest Survey-Moose River Lower Basin," Department of Lands and Forests, Ontario, 1922.

PRE-CAMBRIAN

KEWEENAWAN or PRE-COBALT:	Diabase dikes.
ALGOMAN(?):	Batholithic granite intrusives.
TIMISKAMING(?)	Chlorite schist, greywacké, arkose. Conglomerate.
KEEWATIN:	Andesite, including some minor basic intrusives and some intimately related sediments. Rhyolite, feldspar porphyry, quartz porphyry. Flow breccia. Biotite schist, feldspar gneiss. Hornblende schist and amphibolite.

Keewatin

The name Keewatin is applied to the predominantly volcanic group, the oldest rocks known in the area. The contacts are difficult to trace, owing to the large amount of drift covering the area. From the few scattered outcrops tentative contacts have been drawn on the accompanying map. The Keewatin in the Burntbush River area is a tongue extending westward from a much more extensive area in Quebec. A smaller body is exposed at the south edge of the area along the Kabika river. The rocks dip at high angles and in places are altered to schists.

Rock types include basic lavas, such as andesite or greenstone; acid lavas, such as rhyolite; quartz porphyry and feldspar porphyry; volcanic sediments, such as tuffs, jaspilite, and schists, whose original nature is uncertain, biotite schists with garnet or staurolite, hornblende and chlorite schists.

Acid Volcanics

Acid volcanics outcrop in many places along the lower part of the Burntbush river (below the Kabika river). Tanton[1] has mentioned the occurrence of quartz porphyry and agglomerate here. The outcrops appear to be restricted to the river bank; farther inland is muskeg.

On the lapsed claims on the east side of the Burntbush river, acid lavas are exposed. With the fine-grained rhyolites containing small quartz eyes are green- and white-weathering tuffs. Quartz, feldspar, and quartz-feldspar porphyries appear to have intrusive contacts with the other volcanics. These dikes are probably nearly contemporaneous with the lavas and in places appear to grade into them. Rhyolite outcrops about 2 miles north of Wasicho lake and feldspar porphyry about half a mile north of the rhyolite.

Thin sections of the acid lavas show phenocrysts of quartz and albite occurring singly or together in a microcrystalline groundmass. Biotite is the usual dark mineral. Carbonate is a common alteration product in the rock and is abundant in places. White mica is also a common secondary mineral. The original biotite is often altered to chlorite. In places shearing has tended to destroy the phenocrysts.

Basic Lavas

Andesitic lava forms extensive outcrops west of Two Peak lake and west of the Patten river. It also occurs along the Kabika river and near Rube lake. The greenish rock is fine- to medium-grained. Pillow structure is common, and amygdules can be made out in a few places. The flows have a nearly vertical attitude, as shown by the occasional sediment lying between them. In thin section secondary hornblende is the most abundant mineral. The plagioclase ranges in composition from andesine to albite.

[1]T. L. Tanton, op. cit., pp. 24, 28.

Hornblende schists occurring east of the second rapid on the Mikwam river are believed to be altered basic lavas. The greenstone along the Kabika river (near the south boundary of the area) contains abundant carbonate.

Sedimentary Rocks Associated with the Volcanics

Associated with the volcanic rocks, in places clearly between successive flows, are minor amounts of cherty rock, bearing magnetite. These rocks are banded, and the banding is often brecciated and closely folded. Red jaspilite containing small amounts of magnetite and pyrite occurs on the portage between the Burntbush river and Rube lake.

Banded magnetite and quartz-feldspar gneiss, associated with biotite schist, are found on the south side of the second rapid in Mikwam river. The total width is less than a yard; the width of the contorted banding is from a quarter of an inch to paper thin.

Interbanded chert, garnetiferous chlorite schist, and biotite schist up to a width of 15 feet lie between andesite flows on the west side of the hills near Two Peak lake.

Schists

Biotite schist outcrops near the second rapid on the Mikwam river and along the Burntbush river up to 4 miles below the Mikwam river. In them quartz-feldspar dikelets and quartz veins are of common occurrence. The biotite flakes are less than a millimetre in diameter. In places hornblende is abundant.

The origin of the rock is uncertain; in places the banding suggests a sedimentary origin. The metamorphism is probably due to the proximity of the schists to the large granite mass to the north. T. L. Tanton[1] has described biotite schists in adjoining parts of Quebec and concluded that they were altered tuffs. Schists which he describes on the Turgeon river about 4 miles below Corset island[2] are similar to those seen by the present writer.

A highly metamorphosed dull-grey mica schist occurs about a quarter of a mile north of mile-post IV, east line, Bragg township, and about half a mile east of this. The mica is in very fine flakes. Garnet and staurolite crystals up to one-third of an inch in diameter are developed in places. Finely banded, contorted chert beds up to a width of 2 feet are associated with the schists.

Timiskaming(?) Sediments

Sedimentary rocks other than those clearly interbedded with lava flows are exposed in five places in the area. Of these, four are sufficiently in line to suggest that they may form a more or less continuous band. The localities are described as follows:—

East Side of the Burntbush River at the Lapsed Claims

About 100 yards from the north end of the portage on the east side of the Burntbush river at the lapsed claims is a puzzling exposure which may be a metamorphosed conglomerate or a volcanic breccia. In a matrix, which if occurring alone would be called feldspar porphyry, are fragments of acid volcanic rock similar to that occurring in the claims to the north. The fragments have a maximum length of 5 inches and vary in shape from rounded to irregular, with re-entrant angles. They are of rhyolite, quartz porphyry, and feldspar porphyry (resembling the matrix). Under the microscope the matrix shows well-shaped

[1]T. L. Tanton, op. cit., pp. 26, 27.
[2]Ibid., p. 27.

feldspar crystals (for the most part albite) in a microcrystalline groundmass. The feldspar crystals are not clastic grains; in places they have been broken by shearing.

This rock, which is dark-grey and fine-grained, is in sharp contact with altered sediments, now chloritic schist, which show fine banding. Exposures continue south for a hundred yards along the river bank. Irregular discontinuous quartz veins and lenses occur in the schist. In places shearing has broken these veins into irregular fragments.

Feldspar porphyry lies south of the chlorite schist in a band 100 yards wide, with the south contact sharp against chlorite schist, whose outcrop extends some 4 yards farther. These exposures are seen during low water only. The feldspar porphyry is believed to be a dike or sill.

Light-coloured quartz porphyry in sharp contact with green contorted schists on abandoned claims east of the Burntbush river.

West Side of the Burntbush River

Sediments altered to a contorted chlorite schist are exposed on the west side of the Burntbush river, and about three-quarters of a mile from it. The schist is exposed over a width of 40 yards and contains small irregular quartz veins. Some pyrite occurs in the schist. A small amount of stripping has been done. About 150 yards south are two or three low outcrops in which lenticular, rounded, or irregular fragments, for the most part less than 6 inches long, occur in a greenish sheared chloritic matrix. The fragments are of rhyolite, quartz porphyry, feldspar porphyry, chert, and andesite. A few appear to be of acid plutonic rock. The angular shape of the fragments is shown in the photograph above.

Near Porphyry Lake

On the south side of the lake immediately north of Porphyry lake, well-bedded greywacké containing a few fragments occurs. A sub-rounded granite boulder, 5 inches long, in a fine-grained, dark greywacké matrix, is one of the few instances of fragments of plutonic igneous rock found in the sediments.

Schisted greywacké containing angular to sub-rounded fragments occurs in several outcrops in the area south to Porphyry lake. Feldspar crystals have developed in the greywacké in places, giving the rock a resemblance to feldspar porphyry. An outcrop of sheared feldspar porphyry occurs at the west end of Porphyry lake.

North of Wasicho Lake

About 2 miles north of Wasicho lake is a rock hill about 20 feet high and 150 yards square. Sub-rounded to irregular fragments, for the most part under 6 inches, occur in varied amount in a dark greywacké matrix.

Bragg Township

Nearly vertical greywacké and arkose, exposed over a width of 40 feet, outcrops in Bragg township. The strike is about S. 50° E. Poor cross-bedding

Conglomerate, about three-quarters of a mile west of the Burntbush river opposite the abandoned claims.

indicates that the top of the beds is toward the west. Since no other outcrops, except intrusive diabase, were found within 2 miles, the relations of these sediments to others in the Burntbush River area is unknown.

Summary

The origin and significance of these sediments is not clear to the writer. Two hypotheses may be presented: (1) that they represent a period of sedimentation during Keewatin time, or (2) that they were laid down after the conclusion of most of the volcanic activity and after some considerable erosion of the Keewatin had taken place, i.e. that they are Timiskaming in age.

The sediments in general are highly metamorphosed. Originally they were not well sorted, and in them secondary minerals are commonly developed. Thus in places the abundant secondary feldspar gives them the appearance of igneous rocks. The irregular to angular shape, with re-entrant angles, of many fragments suggests that the coarser fragmental rocks may be agglomerates, somewhat water-worn. The chloritic schists are altered tuffs of water-laid volcanic

ash. In view of the occurrence in places of a few pebbles of plutonic igneous rock, the writer has mapped them as conglomerate and considers that they are probably of Timiskaming age.

Batholithic Intrusives

As shown on accompanying map a large part of the Burntbush River area is underlain by plutonic igneous rocks of acid composition. Only approximate contacts could be drawn, owing to the scarcity of outcrops. The granites lie north and south of the main belt of volcanics. With the exception of a large outcrop hill southwest of Payntouk lake, only small scattered outcrops of granite were found. Small granitic dikes were found cutting through the volcanic group in places as, for example, near Two Peak lake. It seems reasonable to believe that they are offshoots from the underlying batholith.

Along the Mikwam river are several outcrops of granite. It is fresh, coarse-grained, usually non-gneissic and often porphyritic, with microcline crystals up to three-quarters of an inch in length. The phenocrysts usually make up about 5 per cent. of the rock but are locally much more abundant. The granite in the vicinity of Two Peak lake is quite similar. The pink granite of the large hill southwest of Payntouk lake is non-porphyritic and often gneissic; otherwise it is similar to those mentioned above. The average mineral composition, estimated from five thin sections, is as follows: oligoclase, 47 per cent.; microcline, 35 per cent.; quartz, 13 per cent.; and biotite (with minor amounts of hornblende), 5 per cent. Myrmekite is of rather common occurrence. The thin sections show the rock to be granodiorite, but in view of the limited exposures from which specimens were collected the writer prefers to describe it under the more general name "granite," which is probably more descriptive of the whole body.

A grey biotite granite exposed along the Kabika river is of varied composition, particularly as to dark materials. A thin section of a light-coloured phase has the following composition: oligoclase, 55 per cent.; microcline, 25 per cent.; quartz, 18 per cent.; biotite, 2 per cent.

Some feldspar porphyry dikes in the Timiskaming(?) sediments may be closely related to the batholithic intrusives. The porphyry on the Burntbush river near the lapsed claims has been mentioned in connection wih the sediments there. The intrusive relation seems definite. Lithologically similar porphyry is exposed at the west end of Porphyry lake in a small outcrop. An unaltered dike of grey feldspar porphyry cuts the conglomerate about 2 miles north of Wasicho lake. The dike here is 5 feet wide but pinches out.

The porphyry is of varied colour, from reddish to grey, and shows abundant feldspar crystals (for the most part albite) in a fine-grained matrix.

The Patten River Intrusives

Along the Patten river from the first portage to the mile portage, several outcrops of plutonic igneous rocks are exposed. Hopkins[1] mentions the altered quartz gabbro occurring at the first falls above the river mouth. The rock is cut by small, fine-grained acidic dikes and a few quartz veins; it contains inclusions of andesite, sometimes showing pillow structure. Similar andesites outcrop abundantly a short distance to the west. The gabbro varies in composition and texture over short distances. A common type is made up of white

[1]P. E. Hopkins, op. cit., p. 209.

feldspar crystals, up to a quarter of an inch in length, and dark-green hornblende in about equal amounts. In places where quartz occurs abundantly, the rock is somewhat coarser in grain and has well-shaped hornblende crystals. Over small areas feldspar crystals, up to half an inch in diameter, are accompanied by quartz, and the two are present in larger amount than the dark minerals. The inclusions seem to furnish a partial explanation of the variation in rock types. In places the edges of the inclusions are sharp; in others they are gradational. In some of them are developed patches of feldspar, giving a rock similar in appearance to the matrix of the inclusions and suggesting that they represent an incomplete stage in the eventual disappearance of the inclusions.

Farther south along the Patten river quartz-poor biotite granite is exposed. The quartz gabbro appears to be a phase of the granite.

Age and Contact Effects

Wherever granite was found in contact with rocks of the volcanic group it was clearly intrusive. No evidence of more than one period of granitic intrusion was found.

Coarse amphibolite, presumably developed from basic igneous rocks, such as andesite, are found in a few places at and near the contacts of the large granite masses, e.g. at the south end of Mikwam lake. A wide contact zone between granite and amphibolite rock is exposed along the north boundary of Clive township. This type of contact is probably prevalent throughout the area, but owing to the drift covering was not observed elsewhere. In places granite is enriched with hornblende, the enrichment being often shown in parts of a hand specimen. It is probably due to the assimilation of parts of the basic igneous rock by the granite.

The emplacement of the granite masses is intimately related to the structural disturbance of the volcanic group. It seems reasonable to suppose that the general alteration of the volcanic group is related to the changed conditions of heat, pressure, and circulating fluids brought about during the consolidation of the batholithic masses.

Diabase Dikes

The youngest consolidated rock in the area is diabase. In all 9 dikes were found within the area. The largest of these is 185 feet wide. One crossing the hills west of Two Peak lake is exposed at short intervals over a length of 4½ miles. A north-south trend appears to be characteristic. Most of them strike within 10 degrees of true north, and none vary over 25 degrees from it. No appreciable differential movement of the dike walls was found. The dikes have a slightly greater tendency to outcrop than the other rocks of the area. They appear to be of no economic significance.

In the hand specimen the diabase is an unaltered, fine- to medium-grained, dark rock. A thin section showed it to be nearly fresh quartz diabase. Plagioclase phenocrysts occur in 3 of the 9 dikes, but are abundant in one only. The dike about half a mile north of Magiskan lake is cut by small aplite stringers. In places, as on Snare lake, the diabase contains enough magnetite or other magnetic mineral to affect the compass needle in the immediate vicinity.

Two groups of petrographically similar diabase (or gabbro) dikes are spread widely throughout Northern Ontario and adjacent parts of Quebec. The older is pre-Cobalt in age; the younger, Keweenawan. Cooke, James, and Mawdsley[1]

[1]H. C. Cooke, W. F. James, and J. B. Mawdsley, "Geology and Ore Deposits of Rouyn-Harricanaw Region, Quebec," Geol. Surv. Can., Mem. 166, 1931, p. 143.

state that the post-Cobalt diabase intrusions appear to diminish north of latitude 47° 54′. As the Burntbush River area is considerably north of this, the dikes there would, in keeping with this idea, be pre-Cobalt in age.

PLEISTOCENE GEOLOGY AND PHYSIOGRAPHY

Bed Rock Surface

From pre-Cambrian to Pleistocene times, processes of erosion are the only activities which have left a record in the area. The three rock hills previously mentioned appear to be erosion remnants. From the top of the hill west of Two Peak lake a view of the other two hills in the area and other more distant hills may be had. These appear to have somewhat similar summit levels, which suggest that they are remnants of an old erosion surface. This erosion surface had been cut into prior to glaciation to give the present bed rock surface, though possibly it was modified slightly by subsequent glaciation.

Glaciation

In Pleistocene time the area was completely covered by continental glaciers. No evidence of more than one period of glaciation was found. The direction of ice advance as shown by glacial striae was about S. 15° E. A further indication of the direction of ice movement is the presence of fossiliferous Paleozoic limestone pebbles and boulders in the drift. Such Paleozoic limestones outcrop southwest of James bay. Only a few boulders of such limestone are found on the lower part of the Burntbush river, but they are quite common along the lake shores in the western part of the area.

Glacial Deposits

Practically the entire region is covered by a mantle of boulder clay, through which few and scattered outcrops of bed rock project. The clay commonly contains only a few small pebbles,but there are occasional moraines with numerous large boulders; indeed, most of the rapids in the rivers are caused by such accumulations. Examples are the irregular ridges southwest of Two Peak lake and the low piles of large boulders a mile and a half west of Magiskan lake.

Kames and eskers, occasionally as high as 35 feet, are abundant in the western part of the area. Two eskers which partly cross Magiskan lake give it a peculiar outline. Small sandy plains are found throughout the area. They are easily distinguished by the growth of jackpine on them. One fairly extensive sand plain with frequent boulders occurs in the east central part of Bragg township, as shown on the accompanying map.

Varved clay was found in only one place, on the Kabika river, 1½ miles above its mouth. Here, about 3 feet of silty varved clay overlies boulder clay, which, as usual, contains a few small boulders. In the course of the work the writer looked for varved clay exposures, as carefully as the muskeg covering would permit, in an attempt to find the northern limit of the great post-glacial lake in which the stratified clays of the clay belt have been deposited. Since no extensive stratified clays and no beaches around any of the hills were found, the writer concludes that the post-glacial lake (Lake Barlow-Ojibway) had been drained before the ice front had receded as far north as the Burntbush River area.

Drainage System

On the complete withdrawal of the ice from Northern Ontario, the surface had a much more pronounced tilt to the north than at present; a discussion of this phase of glacial recession is given by Cooke, James, and Mawdsley.[1] On this northerly sloping surface the new drainage system originated. The direction of flow of individual rivers would be influenced by minor irregularities in the surface. No evidences of pre-glacial erosion channels were found by the writer in the Burntbush River area. As the new rivers were developing, the northerly gradient was reduced by a rising of the northern part. The smaller streams were backed up and finally diverted laterally into those larger rivers that had the ability to cut through the rising barricade. This and the usual development of rivers appear to have modified to some extent the drainage system in the area. A series of changes in keeping with this explanation may possibly have taken place as follows. Three rivers originally flowed northward through the area: (1) the Turgeon, with its tributary the Patten; (2) a river made up of the present Kabika river and the Burntbush above its junction with the Kabika; (3) a river now represented by the chain of shallow lakes and creeks in the western part of the area. The most westerly river was diverted into the next one to the east, and this into the Turgeon river.

The glacier left behind a wide, more or less flat, poorly drained area, lined with a mantle of impervious boulder clay, overlain locally by sand, gravel, and boulders. Such conditions were ideal for the development of the extensive muskeg flats that now cover the region.

ECONOMIC GEOLOGY

Any area of volcanic rock in Northern Ontario that has been sheared and intruded by granite may be considered to have some merit as a field for prospecting. To this extent the Burntbush River area is worth attention, and access is not difficult. The important adverse factor, however, is the small area of exposed rock, which makes a difficult and expensive task of establishing either the presence or absence of workable mineral deposits. Gold is the valuable mineral most likely to be found, but up to the present it has not been discovered in encouraging quantities.

Some claims were staked by the Cyril Knight Prospecting Company on the east side of the Burntbush river, at the second long rapid about 4 miles above the Kabika river. A small amount of trenching and stripping was done during parts of 1931, 1932, and 1933, but the claims have since been allowed to lapse. Much of the area staked is drift-covered. Exposed rock consists largely of acid lava. Possibly some of the acid porphyritic rocks are intrusive and related to the granite, but if so they are lithologically very similar to others known to be flow rocks.

In places the rocks have been changed to schists and contain contorted quartz veins, which in places have been bent, broken, and pulled apart. These veins appear to be barren of gold, as shown by panning and assays. Trenching and stripping have been done principally on shear zones containing quartz-carbonate veinlets in altered acid rock, both containing pyrite. The trend is about E. 10° S. The shear zones stand out more markedly where they intersect light-coloured massive rock than in the darker-coloured, more highly schisted

[1]Op. cit., pp. 150-157.

rock. At the place where most of the work was done, a 6-foot zone, as described above, is bordered by fine-grained, massive rhyolite with disseminated fine-grained pyrite. The highest assay result obtained by C. F. Rice and J. D. Bateman (for the Cyril Knight Prospecting Company) was $2.00 per ton in gold.[1] A grab sample collected by the writer yielded no gold.

Quartz veins intersect the volcanics west of Two Peak lake but appear quite barren. About 2½ miles north of Wasicho lake, a 1½-foot quartz vein with abundant coarse pyrite cuts andesite, also containing pyrite. A grab sample yielded no gold. About 2 miles north of the same lake an outcrop of conglomerate contains a few small quartz veins and some slight impregnation of fine-grained pyrite. A grab sample of the pyritized rock yielded a trace of gold.

Hopkins[2] states that gold has been reported along the Patten river in narrow quartz veins. At the second rapid, just below the fall on the Patten river, a small amount of trenching has been done in recent years on a small rusty-weathering shear zone with some quartz. It does not appear to be of economic importance.

[1]At $35 an ounce.
[2]P. E. Hopkins, op. cit., p. 209.

INDEX, PART VI