Forty-Third Annual Report

of the

Ontario Department of Mines

1934

Part III

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* THOS. W. GIBSON, *Deputy Minister*

FORTY-THIRD ANNUAL REPORT

OF THE

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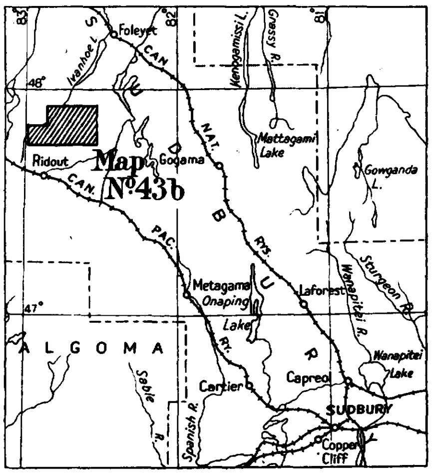
Geology of the Swayze Gold Area

By H. C. Rickaby

INTRODUCTION

The township of Swayze, from which the Swayze gold area derives its name, is in the district of Sudbury, approximately 150 miles northwest of Sudbury. This area is situated at the southwest corner of a triangle whose northeast and southeast corners lie at Porcupine and Shiningtree, respectively, and whose sides are between 70 and 90 miles in length. Belts of Keewatin greenstones and sediments form the sides of this triangle, and a large granite mass occupies the centre.

Prior to the summer of 1931, the Swayze corner of this triangle had probably been less carefully prospected than the other parts, and comparatively little was



Key map showing the location of the Swayze gold area. Scale, 60 miles to the inch.

known of it from the standpoint of gold-mining possibilities. The extensive belts of iron-formation to the south and east of the Swayze area received some attention about the year 1909; and during the years 1927 and 1928, some prospecting was done in the townships of Greenlaw and Cunningham, south of Swayze, chiefly for base metals—copper, zinc, and lead. In the summer of 1931, a promising discovery of gold-bearing quartz was made by J. G. and J. L. Kenty, working for the Brett-Trethewey Mines, Limited, in association with Northern Canada Mining Corporation and Northland Prospectors, Limited. This property, now known as the Kenty Gold Mines, Limited, has been actively developed with encouraging results. Following this discovery, in 1931 and during the years 1932 and 1933, considerable prospecting took place in the area, as a result of which a number of other discoveries of gold were made, chiefly to the west of the original find. They are distributed over a wide area, which includes the townships of Rollo, Raney, Swayze, Denyes, Halcrow, and Greenlaw.

Means of Access

The Swayze area lies between the main lines of the Canadian National and Canadian Pacific railways, and it may be reached by good canoe routes from either line. For Halcrow township and the western part of the area, the Kinogama river from mile 107 on the Canadian Pacific railway is probably the best water route. From the railway to the centre of Halcrow township there are five portages, the longest of which is less than 30 chains in length. For the central and eastern parts, the two best routes make use of the Wakami river and its tributaries, and the Groundhog river. The former route starts from Ridout on the C.P.R., follows the Ridout and Wakami rivers to Ridout lake, from the east end of which a chain of lakes connected by portages leads to Brett lake in the northeast part of Swayze township.

From the Canadian National railway there are two routes. One from Groundhog crossing ascends the Groundhog river to Horwood lake. The other

Snowmobile used for transportation from Sultan to the Kenty mine.

route starts from Foleyet, by a 6-mile wagon road to Ivanhoe lake and continues up the Ivanhoe river to Raney township in the northwestern part of the area. The portages on all these routes are in fair condition, and the routes are best shown on map No. 1933*a*, issued by the Ontario Department of Mines.

A good wagon road, suitable for light freighting, has been completed from Sultan on the C.P.R. to the Kenty mine. During the past two years an almost daily airplane service to Swayze has been maintained from Chapleau and other points.

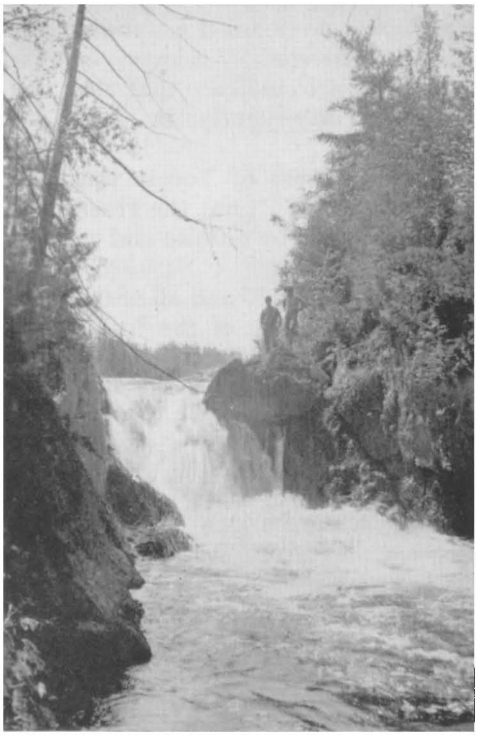
Topography and Drainage

The relief within the Swayze area is moderate and otherwise typical of the pre-Cambrian shield. Rocky hills and drift ridges, with elevations usually not exceeding 100 feet above the surrounding level, are characteristic throughout the area.

All of the Swayze area lies within the Hudson Bay watershed, the height of land being from 15 to 25 miles to the south. The rivers are all small with gentle gradients, lakes and stretches of river with sluggish current being interspersed with short stretches of rapids or waterfalls. The western part of the area is drained by the Ivanhoe river and its tributary, the Kinogama. The northeastern part drains northeast by the Swayze river to Horwood lake and the Groundhog river. The southeastern part drains eastward by the Wakami river, which is also part of the Groundhog river system. Within the area none of the waterfalls on these streams have sufficient flow for the development of any considerable quantity of water power. A waterfall on the Kinogama river in Halcrow township has a drop of approximately 20 feet, and a dam has been put in by the Halcrow Swayze Mines, Limited, with the idea of utilizing this power for the development of their property.

Natural Resources

All of the Swayze area is covered with forest made up of spruce, balsam, jackpine, poplar, birch, and cedar. Most of the trees, however, are small, 12



Falls on the Kinogama river, Halcrow township.

inches at the base being the maximum diameter. Much of the timber is suitable for pulpwood, but there are only small areas sufficiently large or otherwise suitable for mining purposes.

For a more detailed account of the topography, natural resources, etc., reference may be made to an earlier report by G. D. Furse.[1]

Previous Geological Work

The earliest reference to the geology of this area is contained in a report by W. A. Parks,[2] who made a reconnaisance survey along the Woman, Groundhog,

[1] G. D. Furse, Ont. Dept. Mines, Vol. XLI, pt. 3, 1932.
[2] "Niven's Base Line," 1899, Ont. Bur. Mines, Vol. IX, 1900.

and Ivanhoe (Pishkanogama) rivers in 1899. The Geological Survey of Canada conducted a survey of the Woman River and Ridout areas[1] from 1923 to 1927 and of the Rush Lake area[2] from 1928 to 1930, inclusive. In 1931, G. D. Furse[3] made a geological survey of the Swayze area, including the townships of Raney, Rollo, Coppell, Newton, Denyes, Swayze, Dore, and Heenan.

Scope of the Present Report

In 1932, the writer was instructed to make an examination of the area to the west of the Swayze area, with a view to locating and mapping a possible westward extension of the Swayze belt of greenstones. The first part of the season was spent in making a reconnaisance survey of a group of nine townships, McGee, Chewett, Sandy, Borden, Gamey, Crockett, McNaught, Lackner, and Halcrow. With the exception of Halcrow township, no large area underlain by greenstones or sediments was indicated, and no detailed examination of the other townships was made. Most of them are covered by a heavy overburden of sand or drift, but sufficient outcrops were seen to indicate that they are largely underlain by gneisses and granite and are consequently, in general, unfavourable for gold deposits.

Township 26, lying to the west of Tooms township, immediately south of the Swayze area, was also examined, but the greenstones of Tooms township were found to be cut off to the west by granite and gneiss, as shown on the map of the Kamiskotia-Ridout area.[4]

The remainder of the season of 1932 and all of the season of 1933 were spent in making a detailed geological survey of the townships of Halcrow, Denyes, Swayze, Raney, Rollo, and parts of the townships of Dore, Cunningham, Greenlaw, and Tooms, with special reference to the possibilities of gold deposits.

Acknowledgments

During the two seasons spent in the area the writer and his party had the co-operation of the officials of the various mining companies and prospectors working in the area. It is a pleasure to acknowledge the many ways in which these gentlemen assisted in the work. Thanks are due to F. L. Trethewey, E. T. Corkill, and Massey Williams, of the Kenty Gold Mines, Limited, for their hospitality and for the information and plans supplied in connection with the Kenty mine, and for similar assistance rendered by the following gentlemen in connection with the properties under their direction: Horace Strong and the officials of the Halcrow Swayze Mines, Limited; R. E. Hore, Swayze Gold Belt Exploration Company; W. H. Graves, Agaura Exploration Company; P. J. Scott, McIntyre-Porcupine Mines, Limited; W. Cliff, Dome Mines, Limited; J. J. Byrne, Lee Gold Mines, Limited; S. S. Saxton, Waite Company; P. A. Dyment, Dyment Mining and Investments, Limited; and D. C. McKechnie, Consolidated Mining and Smelting Company of Canada, Limited. Space does not permit mention of the names of the many prospectors and others who afforded assistance and hospitality in the field.

During the summer of 1932, the late Dr. A. G. Burrows, Provincial Geologist, spent a week with the party in the area. The writer had the benefit of his wide experience and also that of C. W. Knight, who paid several visits to the area

[1]R. C. Emmons and Ellis Thomson, Geol. Surv. Can., Mem. 157, 1929.

[2]H. M. Bannerman, Geol. Surv. Can., map No. 290A (report covering this area not yet available).

[3]Op. cit.

[4]Ont. Dept. Mines, Map No. 1933*a*.

during the course of the work. G. D. Furse gave access to his field notes covering much the same area as this present report.

G. F. Summers and J. W. Tyrrell supplied advance plans of surveys made during the progress of the work. Thanks are also due to the officials of the Ontario Forestry Branch at Chapleau for information and assistance rendered by them.

During the season of 1932 the writer had as assistants H. C. Laird, C. H. Knight, W. S. Savage, and H. F. Zurbrigg. Messrs. Savage and Zurbrigg continued during 1933 along with B. C. Coles. All of these men rendered able assistance throughout the whole course of the work.

GENERAL GEOLOGY

The basement rocks of the Swayze area consist of volcanic flows and tuffs typical of the Keewatin greenstones of other areas, with which are enfolded bands of rocks essentially sedimentary, but including a considerable amount of volcanics in the form of rather acid flows and pyroclastics. There are two main bands of these sediments, known as the Ridout and Swayze series, and several smaller subsidiary bands. The basement rocks have been highly folded into a series of anticlinal and synclinal folds with a general east-west strike. The greenstones and sediments are intruded by basic eruptive rocks, followed by granites, porphyries, etc., of Algoman age, and lastly by diabase dikes of Keweenawan age.

The stratigraphic relationship of the greenstones and sediments is rather obscure owing to the intense folding, which has obliterated much of the original textures. Field evidence given later in the report indicates, however, that the main sedimentary bands lie stratigraphically at the top of the greenstone-sedimentary complex. The evidence on which this complex can be definitely separated into a Keewatin series and a Timiskaming series is somewhat contradictory. In fact serious objection might be made to a Timiskaming age being assigned to the rocks included under the Swayze-Ridout series.

The geological history of the area starts with a period of intense volcanic activity, followed by a period of alternating vulcanism and local sedimentation, and later by a period during which considerable thicknesses of conglomerates, greywackés, and other sediments were laid down. Volcanic activity persisted to some extent even into the last period, and much of the sedimentary material consists of reworked volcanic debris. At or near the bottom of both the Ridout and Swayze series there are local occurrences of conglomerate that show pebbles of granite and other characteristics of Timiskaming conglomerate, suggesting an erosional unconformity. The contacts between the sediments and greenstones, however, as shown on the map, do not always suggest an unconformity.

The first period of intense volcanic activity resulted in the laying down of flows of considerable thickness, essentially of basic to intermediate composition. Toward the end of the period the flows tended to become more acid; but the general term greenstone is particularly applicable to these rocks, and a Keewatin age has been assigned to them. The second period is more or less a transitional one. The volcanic activity continued but was largely explosive and resulted in the deposition of a thick series of rather acid pyroclastic rocks, including trachyte and rhyolite tuffs, agglomerates, and flow breccias. Rocks of this period are more local in their distribution than those of the other two periods. They are well represented, for instance, in the area north of Cree lake in Swayze township, but are almost entirely absent along the south contact of the Ridout series near the boundary line between Tooms and Greenlaw townships, and along the south contact of the Swayze series in Halcrow township. The rocks of the third period consist essentially of water-sorted material forming conglomerates, quartzites, greywacké, slate, etc. The rocks of the last two periods, with the exception of some interbedded dark-coloured tuffs and slates, are prevailingly light-coloured, grey to greenish-grey rocks, as opposed to the dark-green colour of the Keewatin greenstones.

In most of the area it is possible to draw a line showing the contact between the rocks of the first and second, or first and third periods, but only in a very general way is it possible to map separately the rocks of the last two periods. There is no positive indication of a structural discordance separating any of the periods, but there is undoubted evidence of an erosional unconformity separating the greenstones and sediments. Moreover, the light-coloured rocks in general are somewhat less metamorphosed than the greenstones, and since they have much the same structural implications as the Timiskaming rocks of other areas they have been grouped with the Timiskaming series.

Table of Formations

QUATERNARY	
Pleistocene:	Sand, gravel.
PRE-CAMBRIAN	
Keweenawan:	Quartz diabase,[1] olivine diabase.
	Intrusive contact
Algoman:	Quartz and feldspar porphyry, aplite, lamprophyre, granite, granodiorite, gneiss.
	Intrusive contact
Pre-Algoman: (Haileyburian?)	Diorite, diabase, gabbro, peridotite, lamprophyre.
	Intrusive contact
Timiskaming(?): (Ridout-Swayze series)	Complex series consisting of sediments, including conglomerate, greywacké, quartzite, slate; trachytic to rhyolitic tuffs and agglomerates; hornblende and chlorite schists; iron formation.
Keewatin:	Acid to basic lavas, including basalt, andesite, gabbro, diabase; rhyolite, dacite; tuffs and agglomerates; hornblende and chlorite schists; iron formation.

Keewatin

The Keewatin rocks, as previously stated, are dark-greenish in colour and consist of basic to intermediate and acid volcanics, interbedded to a certain extent but with the more basic types at the bottom and becoming more acid toward the top. They show a wide variety of textures, including fine-grained and coarse-grained types. Pillow lavas are widespread throughout the area, though in many cases the rocks have been so much disturbed that original textures such as these have been partially or completely destroyed, and only rarely were the pillows suitable for the determination of the attitude of the flows. Where the flows are comparatively thick, the centres consist of diabase, gabbro, and diorite, in which cases it is difficult to distinguish them from later intrusive rocks. This condition is especially true in the Dore township section of the map area, south of Crossley lake. Around Cree lake the greenstones are almost entirely tuffaceous or agglomeratic.

The Keewatin rocks are highly altered, the chief secondary minerals being chlorite, uralite, sericite, and carbonates. This alteration is most intense along

[1]Possibly Matachewan series in part.

flow contacts and in the tuffaceous greenstones. Along the contact with the granites to the west the greenstones are represented chiefly by hornblende schist and gneiss.

Basic Volcanics

The basic volcanics consist essentially of basalts, with gabbroid and diabasic phases, and andesite. They are highly altered to secondary minerals, including chlorite, serpentine, uralite, carbonates, epidote, and leucoxene. The feldspars have been saussuritized. Very little original pyroxene remains except in the thicker flows which have resisted dynamic metamorphism.

Acid Volcanics

The acid volcanics consist largely of rhyolites, dacite, and their pyroclastic equivalents, tuff and agglomerate. Rhyolites are of rather local occurrence and were noted most frequently at the upper horizon of the Keewatin rocks. Along the north shore of Denyes lake in Raney township there is a band of rhyolite consisting of a fine-grained greenish-grey lava with phenocrysts of quartz. A dark-green rock showing much quartz is quite common among the more acid greenstones. In places it is coarse-grained, and might be called a quartz diorite or diabase, but in other places it has a flow structure and is thought to be a dacite.

The alteration of the acid volcanics consists in the development of such secondary minerals as sericite, chlorite, carbonates, and epidote, and results in the formation of sericite and chlorite schists.

Timiskaming(?)

Ridout Series

The Ridout series was originally described by R. C. Emmons and Ellis Thomson[1] in the Woman River and Ridout areas to the south and east of the Swayze area. This series forms an almost continuous band now known to extend from the northwestern part of Halcrow township in an easterly direction to the east side of Churchill township, in the West Shiningtree area, a total length of about 85 miles. The west end of the Ridout series lies along the southern part of the Swayze map area. Beginning in the northwestern part of Halcrow township, the band strikes southeast across Halcrow and the northeast corner of Tooms township into Greenlaw. It passes across the north end of Greenlaw to the east side, where it is faulted northward. From this fault it continues across the southern part of Swayze township to the east side, where it is again faulted north, crossing into Dore township and thence southeastward toward Opeepeesway lake. It ranges in width from a maximum of 2 miles in Halcrow township to less than half a mile at the east end of the area. It consists for the most part of greywacké and argillite with local occurrences of conglomerate, quartzite, slate, arkose, and tuffs.

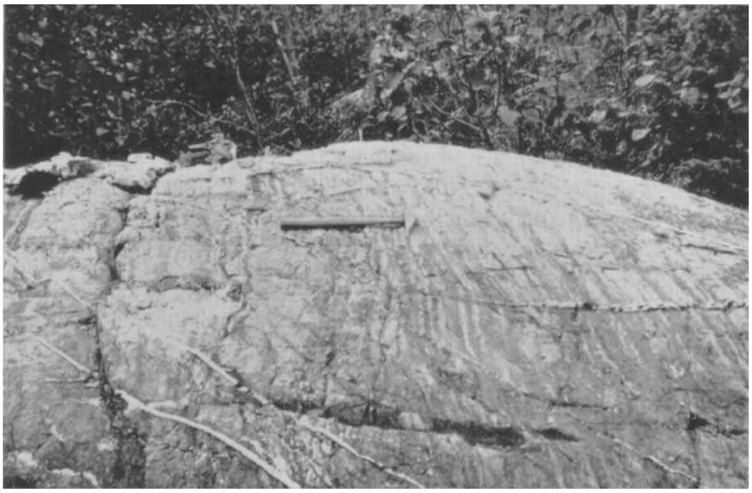
Conglomerate occurs at various horizons in the Ridout series of the Swayze area. The most important band lies along the south contact in the northeastern part of Tooms township. This band was traced for at least 2½ miles with an indicated maximum width of 600 feet. It is described by Emmons and Thomson[2] as follows:—

> North of Betty lake in Tooms township, the conglomerate consists of large boulders in an argillite matrix showing narrow, frequently crenulated bands. The boulders are exceptionally large and the bands remarkably distinct, especially on the weathered surface. The matrix is

[1]Op. cit.
[2]Op. cit., p. 10.

quite fine grained, but holds slightly larger, easily distinguishable grains of feldspar and quartz. The broader bands are only 2 or 3 inches wide, and many of these are finely sub-banded. Bands of one-quarter to one-half inch are very numerous; bands of smaller size are less noticeable. Each band varies considerably in width; the variation in part being related to the deformation. Deformation is intense in this locality, the matrix strongly chloritized, and the granite boulders and pebbles are markedly elongated. The planes of schistosity bend sharply about the boulders. Toward the southeast the banding of the matrix becomes progressively less prominent, is much narrower, but remains quite noticeable.

The fragments vary in size, the largest being 8 inches in diameter, and consist of greenstone, chert, quartz, and a porphyritic rock with quartz and feldspar, which appears to be a rhyolite. A few good granite pebbles were noted. With reference to the nature of the boulders and pebbles of the Ridout conglomerates, Emmons and Thomson[1] state that they are predominantly granite. Of the Tooms township conglomerate described above this would not appear to be true, unless the rhyolitic boulders may be included with the granites.



Bedded arkose on the south side of Kenty lake,
Swayze township.

Another band of conglomerate not over 100 feet wide lies on the north side of the Ridout series almost opposite the conglomerate in Tooms. It appears to extend from the southwestern part of Denyes township southeastward across Lee lake in Greenlaw township. The boulders consist largely of trachyte, or rhyolite, with a few greenstone and chert pebbles much elongated by schisting. At the south end of the 16-chain portage on the Kinogama river above Halcrow lake there is an outcrop of conglomerate with large boulders of granite, etc., up to 2 feet in diameter. One mile northwest of this outcrop there is a highly schisted conglomerate in which the boulders have been squeezed out into ribbons but are still recognizable.

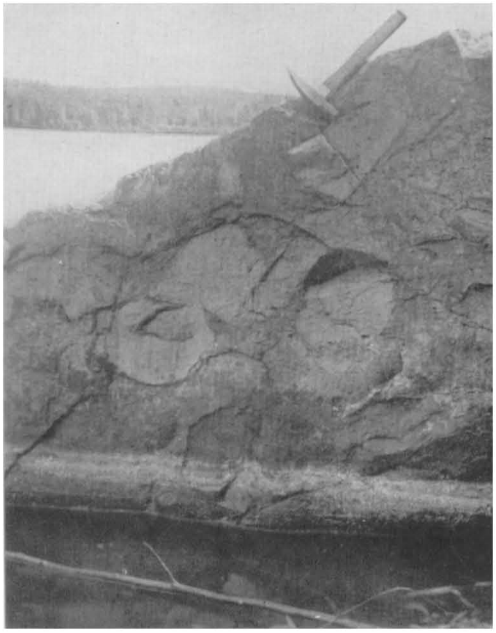
The remainder of the Ridout series consists of greywacké, quartzite, argillite, arkose, and tuffs. The margins of the Ridout sediments in Halcrow township are fairly sharp, but in the sections in Greenlaw, Cunningham, and Swayze townships the sediments and volcanics are intercalated and bands of dark slaty tuffs as well as thin flows alternate with the sediments near the margins. The tuffaceous bands persist right up through the Ridout series. In the section lying

[1]Op. cit., p. 9.

to the east of the fault in the eastern part of Swayze township there is a band of cherty rhyolitic rocks and acid pyroclastics separating the greenstones from the sediments, which here are narrow.

Swayze Series

Some narrow bands of sediments occurring near the north boundary of the townships of Denyes, Swayze, and Dore were provisionally designated the Swayze series by G. D. Furse. Adjacent to these sediments on the south side is a wide band of acid lavas and pyroclastic rocks, with which the sediments are closely associated and which, for reasons given previously, are included with the Swayze



Agglomeratic rock of the Swayze series, south shore of Ackerman lake, Swayze township.

series. The main band of this series with an average width of 2 miles extends from the western part of Halcrow township eastward across the northern parts of the townships of Halcrow, Denyes, Swayze, and Dore. The sediments of the Swayze series consist of conglomerate, arkose, quartzite, greywacké, and slate.

The most important band of conglomerate lies along the southern part of the series in Halcrow township, extending westward from the Kinogama river almost to the Ivanhoe river. The outcrop is cut off at the east end by a prominent north-south fault; the band was not seen east of the fault, as there is very little rock outcrop for some distance along the contact. West of the fault it appears to have a thickness of almost 2,000 feet, but it is possible that its apparent thickness may be due to strike faults, of which, however, there is no definite evidence. The boulders, varying in size up to 15 inches in diameter, have been considerably elongated by schisting. They consist of greenstone, rhyolite, trachyte, chert, and granite in a greywacké or argillitic matrix. As with most of the conglomerates of the area, the largest proportion of the pebbles and boulders are trachytic or rhyolitic in composition, but some of the larger ones are of grey and pink granite.

Narrow beds of conglomerate are of frequent occurrence throughout the Swayze series and occur at various horizons in it. These conglomerates grade from types having a greywacké or arkosic matrix with pebbles and boulders of various sorts to agglomeratic types in which the matrix and the included fragments or boulders consist of the same material, usually a porphyritic rock with the composition of a trachyte or rather basic rhyolite. Many of these agglomerates show bedding and have been subjected to some degree of sorting. The south shores of Dyment lake in Denyes township show good examples of this agglomeratic type.

Interbedded slate and greywacké, north shore of Raney lake, Raney township.

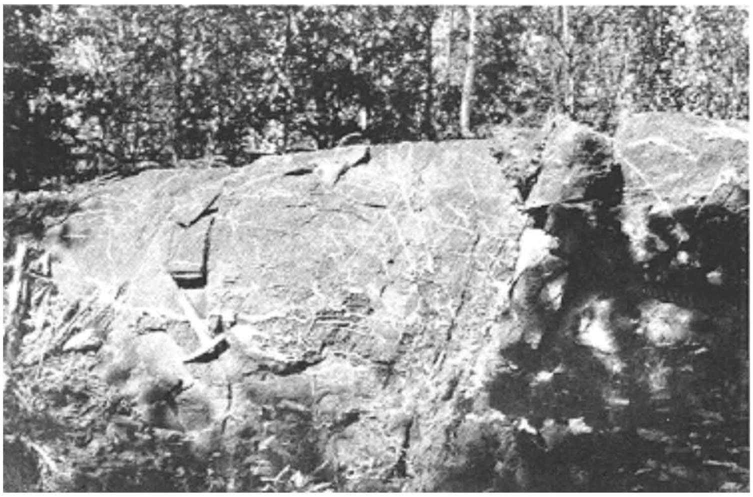
The other sedimentary rocks of the Swayze series consist of greywacké, quartzite, arkose, and slate, usually in narrow bands more or less interbedded. The best cross-section where these various types may be seen is along the Kinogama river below the falls in Halcrow township. The sediments here show good bedding, standing on edge or dipping at steep angles, usually to the north.

West of the south arm of Brett lake in Swayze township there is a large area of grey to greenish-grey moderately acid rocks, largely of pyroclastic origin, consisting of tuffs, agglomerates, and flow breccias. Many of these rocks are markedly porphyritic in appearance and are difficult to distinguish from later porphyry intrusives.

As with the Ridout series there is considerable interbedding of basic or acid flows with the Swayze series, particularly near the borders. This relationship is seen north of Freymond lake in Swayze township. Again on claim S. 21,144 in Denyes township, approximately a mile east of the 4-mile post on the west boundary, an outcrop consists of an agglomeratic rock with fragments of porphyry and greenstone overlain by an andesite showing good pillows. A narrow band of pillow lavas was also noted in an outcrop on the trail connecting Dyment and Denyes lakes.

Besides the main band of the Swayze series there are three smaller bands, one in Denyes township east of Sylvanite lake, another in Raney township at the north end of Raney lake, and a third small one in Rollo township west of Rollo lake. The rocks of these bands consist of conglomerate, greywacké, and argillite, as in the main band. Their bedding relationships suggest that they are infolded with the greenstones as closely folded synclines.

On the Rush Lake sheet, H. M. Bannerman[1] shows lens-like bands of pyroclastic rocks, including some clastic sediments. This area is the eastward extension



Brecciated carbonate iron formation, south of Cree lake, Swayze township.

of the Swayze area, and it is probable, in view of the relationship of these bands to the underlying basic lavas, as indicated on this map, that some of them may be correlated with the Swayze series to the west.

Iron Formation

Typical banded iron formation occurs quite extensively in association with the Ridout series of the Swayze map area. Most of the occurrences are similar to those described by Emmons and Thomson,[2] who state that two iron formation horizons were recognized: one south of the Ridout series, i.e. in the greenstones, and the other at or close to the north edge of the sedimentary band. In the area covered by this report no typical banded iron formation was seen within the greenstones, and only one or two cases of conditions approaching iron formation within the band of rocks known as the Swayze series.

[1]Op. cit.
[2]Op. cit., pp. 20-28.

The occurrence of the iron formation at or near the north side of the Ridout series, however, is particularly marked. The most prominent band lies south of the east end of Cree lake in Swayze township and appears to be continuous for at least 1½ miles. Two good outcrops may be observed a few chains east and west of the Sultan-Kenty road. The occurrence consists of well-banded chert and jasper containing considerable amounts of quartz and sulphides. In places it is 300 feet wide and has been exposed by a series of old pits and trenches; further trenching has been done recently to search for gold in association with

Banded iron formation south of Halcrow lake, Halcrow township.

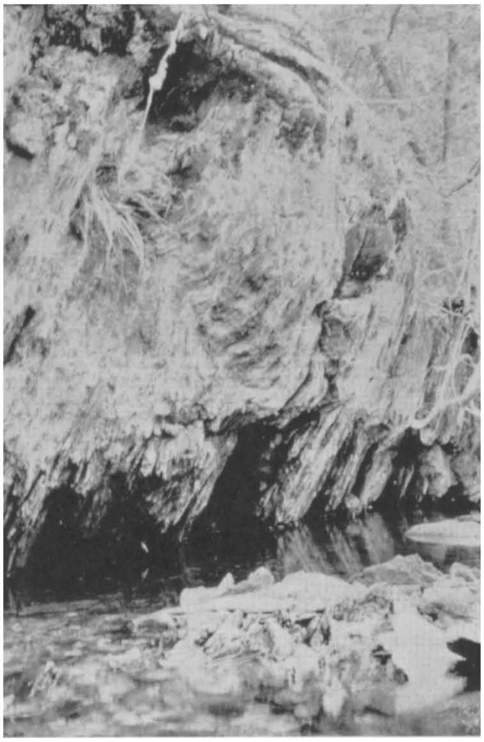
the sulphides. Parallelling the cherty banded material in a number of places is a prominent hogsback of breccia with a carbonate matrix.

Many other bands of iron formation were noted in the Ridout series from the east end of the map area right through to Halcrow township, and while they appear to be prominent along the north contact they are not by any means confined to it, but occur at various horizons within the series. Several bodies of iron formation occur in Greenlaw township, west of the portage connecting Hotstone (Edith) lake and Ridout lake. They are described by Emmons and Thomson[1] as follows:—

In Greenlaw township, at the west end of Ridout lake, iron formation occurs at the top of the sedimentary series. It strikes almost due east and dips 20 degrees to 70 degrees north, but in most

[1]Op. cit., p. 24.

places nearly 70 degrees. It forms a series of separate lenses, which occur at intervals for about one mile west of the portage from Edith lake to Ridout lake. Half a mile east of the portage, a rock, which becomes a small island at low water, is banded chert striking parallel to the rocks of the district and is a part of the same horizon. The lenses are 1,000 to 1,500 feet long in the case of the larger ones, and as much as 400 feet wide. Smaller lenses occur between and to one side or other of the larger ones. The grey and red chert of the more southerly bodies grades outwardly into dark, highly chloritized, finely banded argillite. The chert of the northern masses becomes dark-grey at the edges and is bounded by basaltic flows or by argillite or in places by diabase, which may be merely a diabasic flow. Sericite schists occur on the south sides of some of the lenses and in places in narrow zones within them. Near the portage where stripping has been done, bands rich in hematite and limonite, mostly less than one-half inch thick, are irregularly distributed through the chert and possibly compose a maximum of 15 to 20 per cent. of the rock. Locally the chert is brecciated, and in these brecciated zones there is considerable vein siderite.



Sericite schist with small drag fold,
Swayze township.

Structural Features of the Greenstones and Sediments

The conclusions as to the general structure of the Swayze area are based on the study of the attitude of the Ridout-Swayze series of sediments and the flows of the Keewatin greenstones. Careful attention was paid to the determination of dips and strikes or the attitude of any rocks showing bedding. Much of the evidence is somewhat contradictory, owing to the intensity of the folding, but enough information was obtained to afford reasonably safe conclusions on the broader structural features.

The main band of the Swayze series forms a syncline with its axial plane striking approximately east and west and dipping steeply to the north. Along the north contact of the sediments with the greenstones in Swayze township east of the northwest arm of Brett lake there is strong evidence that the tops of the sedimentary beds face south. On a small lake north of Brett lake, half a mile west of the outlet, there are several good outcrops of well-bedded greywacké standing on edge, with the beds showing coarse-grained material on the north side grading to fine material on the south. Some minor drag folds on the Kenty property near the east boundary of Swayze indicate a similar relationship. G. D. Furse[1] observed similar evidence in a fine-grained arkose at the west end of Brett lake. The north contact of the Swayze series with the greenstones in Denyes and Halcrow townships to the west is mostly covered by drift, and very little satisfactory evidence, such as outlined above, was observed.

Along the south contact of the Swayze series the use of the same criteria indicate that the tops of the beds face north. On the north shore of Freymond lake there is a good outcrop of well-bedded argillite, with the bedding dipping at 50° N. and with a well-developed cleavage parallel to the strike of the bedding

Courtesy Massey Williams

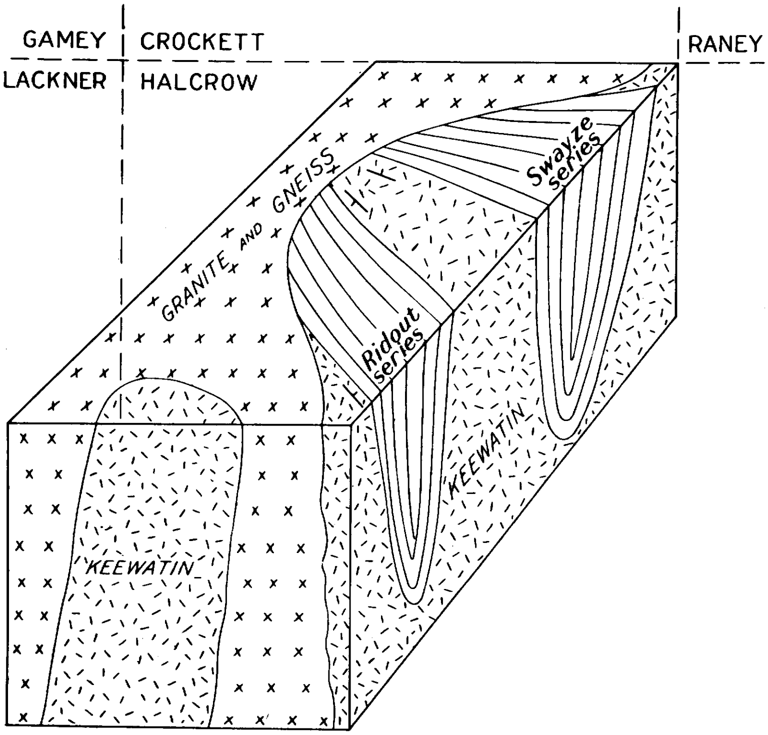
Drag fold in sediments of the Swayze series, Kenty mine.

but dipping at 75° N. In the southeast corner of claim S. 22,049, south of Dyment lake in Denyes township, H. F. Zurbrigg observed a basalt flow approximately 60 feet thick dipping steeply to the north. It shows a remarkable gradation in grains, with the coarse-grained material near the south side grading into fine-grained material to the north, clearly indicating that the tops face north.

In that part of the Ridout series included in the Swayze map area no conclusive evidence in the way of grain determinations of bedding, flow tops, etc., was obtained. Emmons and Thomson[2] concluded from their studies that the Ridout series was monoclinal in structure, i.e. that it was underlain by Keewatin volcanics on the south side and overlain by a similar series of volcanics on the north side. They based their conclusions on evidence obtained from grain determinations and cross-bedding relationships, largely in the vicinity of Opeepeesway lake. Farther east along the same belt H. C. Laird[3] concluded for various reasons that the Ridout series was synclinal in structure and overlay the greenstones to the north and south.

[1]Op. cit., p. 42.
[2]Op. cit., pp. 18, 19.
[3]"Geology of the Three Duck Lakes Area," Vol. XLI, pt. 3, 1932.

The only clues to the structure of the Ridout series observed in the Swayze map area lie in the apparent relationship of the Ridout and Swayze series at the extreme west limit of the greenstone sedimentary belt. In the northwestern part of Halcrow township there is a marked convergence of the two series, the north side of the former and the south side of the latter almost meeting, being cut off by the granite and gneiss. They are separated by greenstones, but the dips and strikes of the sediments along the contact strongly suggest that those parts of the two sedimentary series adjacent to the greenstone form the limbs of an anticline plunging steeply to the northwest. The determination of strikes and dips is



Idealized block diagram showing the relationship of the Ridout-Swayze series and the Keewatin series in Halcrow township.

complicated because of the fact that the rocks have been highly metamorphosed by the granite to the west, and it is difficult to be sure in places whether the foliation of the rocks is due to bedding or schisting. The latter possibility, however, seems hardly worthy of consideration, since the condition is apparently local. This major structural feature, combined with the fact that the main band of the Swayze series is synclinal and the dip of the sediments on the south side of the Ridout series is to the north, leads to the deduction that the two series are of the same age and are in the form of closely folded synclines converging to the west where they are cut off by the granite.

In the northern part of Swayze township there is a band of greenstones surrounded by sediments and acid volcanics of the Swayze series. This band is probably also in the form of a syncline plunging to the east in Dore township and to the west in Denyes township.

Pre-Algoman (Haileyburian?)

Among the rocks provisionally designated as Haileyburian in age are a number of varieties ranging in composition from ultrabasic to intermediate and including diorite, gabbro, diabase, peridotite, and lamprophyre. Their main distinguishing feature is their intrusive relationship to the sediments and greenstones. Where these intrusives occur within the Ridout or Swayze series the determination of their age relationship is reasonably certain, but there are many occurrences of similar rocks in the greenstones where it is difficult to classify them from an age standpoint.

A number of bosses and dike-like bodies of these intrusives occur in the vicinity of Lee lake in the northwestern part of Greenlaw township. They are usually massive green rocks with the textural appearance of diorite or diabase. In thin sections they are seen to consist essentially of fibrous hornblende, chlorite, and plagioclase, with a small amount of quartz. The plagioclase is usually saussuritized, and secondary minerals such as carbonates and leucoxene are present. An outcrop on the east shore of Lee lake is seen to consist chiefly of chlorite and serpentine with a little biotite. It is probably an altered peridotite or pyroxenite.

A number of small bosses or dikes of basic rock intrusive into the greenstones were noted, including peridotite, anorthosite, etc. About half a mile east of the south bay of Freymond lake an outcrop of coarse-grained rock consists essentially of a basic plagioclase, much altered to saussurite, with a little chlorite and epidote. It probably corresponds to anorthosite.

On the property of the Kenty Gold Mines there are a number of lens-like bodies or dikes of basic rocks, with lamprophyric, gabbroic, or dioritic phases, occurring in the sediments and in the greenstones. They have an east-west strike and are quite numerous in the vicinity of the two shafts. They vary considerably in appearance and composition in the same mass, owing probably in part to alterations caused by the porphyry intrusions and mineralizers associated with the formation of the veins. In many cases they contain a large number of inclusions of greenstone and sediments, giving them the appearance on a weathered surface of a conglomerate. One outcrop occurring southeast of No. 2 shaft has the appearance of diorite, varying from a dark-green to a lighter-coloured rock. In thin section the dark rock has a marked porphyritic texture with phenocrysts of augite and olivine in a fine-grained matrix of plagioclase partly altered to saussurite and carbonates. The olivine is almost entirely altered to serpentine containing nests of fine magnetite dust. The light-coloured rock contains much the same constituents with the addition of a little biotite. The augite has been partly altered to hornblende and chlorite, and the other constituents have been similarly altered with some carbonate replacement. These intrusives have been variously identified in hand specimens as gabbro, diorite, and lamprophyre, but they are probably phases of the same rock, which might be called a basic lamprophyre.

In Dore township south of Crossley lake there are a number of large bodies of basic rocks that look like diabase or gabbro. These rocks are massive and fresh-looking in contrast to the older appearance of most of the greenstones. In several instances, however, these coarse-grained rocks could be traced into fine-grained phases showing pillows with no sign of a contact. The coarse-grained phases form the centres of thick flows, and since the fresh appearances of these rocks is the only mark of distinction from the other greenstones they have not been included with the later intrusives. H. M. Bannerman[1] suggests the possi-

[1]Personal communication.

bility of a lava equivalent of some of the later intrusive rocks, and the suggestion seems worthy of consideration. The separation of such rocks from the other greenstones would, however, require considerable detailed study.

There are probably many other occurrences of rocks that are intrusive into the Keewatin, but from lack of definite evidence of their age relationship they have not been differentiated on the map. They are apparently all pre-Algoman and would not appear to have any economic significance as distinct from the older greenstones from the standpoint of gold deposition.

Algoman

The Algoman rocks consist essentially of granite, granodiorite, quartz porphyry, syenite porphyry, and lamprophyre. Along the west side of the Swayze area there are considerable areas of pink gneissoid rocks, many of which

Porphyry dikes cutting greenstones, Raney township.

are probably highly metamorphosed lavas or sediments. They have not been differentiated from the granites of Algoman age. It is also quite possible that there is more than one age of granites represented in the Swayze area.

Granite and Granodiorite

The granite along the western part of the map area varies in colour from pink to greyish and in texture from fine- to coarse-grained, and exhibits varying degrees of foliation. It is essentially a biotite-bearing type, occasionally showing some muscovite or hornblende. The granite bosses in Rollo and Raney townships are rather coarse grained with granodiorite phases. A prominent dike of granodiorite or quartz diorite occurs on the property of the Halcrow Swayze Mines, Limited, in Halcrow township, a few feet north of the shaft. The dike is from 100 to 200 feet wide and has been traced for over half a mile, striking S. 60° E. About 60 chains to the southeast near the Kinogama river the dike outcrops again with the same strike. In thin section it shows a medium coarse grained granitoid rock consisting of plagioclase, orthoclase, quartz, and biotite.

Porphyry

Small bosses and dikes of porphyry are of widespread occurrence in the greenstones and sediments throughout the area, but are most frequently found along the main band of the Swayze series from its western to its eastern limit. These porphyry bodies vary from narrow dikes a few inches wide to lens-shaped bosses as much as half a mile in width, usually with an east-west strike. The largest body of porphyry occurs at the east end of Brett lake, where it is three miles long with a maximum width of three-quarters of a mile. Included in this width, however, are a number of narrow parallel bands of sediments. In fact the south half of this porphyry appears to consist of sills or dikes of porphyry alternating with sediments. This condition is illustrated in cores from a series of diamond-drill holes put down by the Consolidated Mining and Smelting Company on the McNeely claims at the east end of Brett lake. One section near the north side of the porphyry showed a continuous width of over 1,000 feet of good porphyry. The porphyry is a typical pinkish quartz porphyry showing good phenocrysts of quartz, albite, and orthoclase in a groundmass of similar material. There is always some chlorite present; occasionally a little biotite or hornblende and apatite. The feldspars are much altered to kaolin and sericite, and carbonates are always prominent as secondary constituents.

The following is an analysis of a specimen of the quartz porphyry from the east end of Brett lake:—

	Per cent.
SiO_2	66.40
Al_2O_3	16.49
Fe_2O_3	1.05
FeO	1.56
CaO	2.97
MgO	1.28
Na_2O	4.82
K_2O	1.85
TiO_2	.37
P_2O_5	.28
H_2O	1.48
CO_2	1.44
S	trace
	99.99

Specific gravity, 2.69.

The porphyries throughout the area vary from reddish to grey in colour, and from types in which quartz is prominent to others in which it is practically absent. In the northwestern part of Halcrow township there are several bodies of typical syenite porphyry consisting essentially of orthoclase, albite, and biotite, without quartz.

Where these porphyries are intrusive into lavas they have sharp, well-defined boundaries, but where they intrude the sediments, coarse tuffs, or agglomerates, the contact is frequently indefinite. Apparently the porous fragmental rocks have been more or less soaked by solutions from the porphyry, giving them a marked porphyritic appearance and forming a hybrid type of rock. This condition is common along the main band of the Swayze series and makes it difficult to distinguish the true porphyries from the hybrid rocks. The process may be observed in the large bay at the west end of Brett lake, where coarse fragmental rocks can be seen grading into pinkish porphyritic rocks in which the outlines of the original fragments are only faintly visible.

Lamprophyre

Lamprophyre dikes of Algoman age are of frequent occurrence throughout the Swayze area. They are usually associated with the porphyry or other acid dike rocks and are almost invariably to be found in the vicinity of the more promising-looking gold-bearing quartz veins. They are narrow, not usually over 5 or 6 feet in width. Where they were seen in contact with the porphyry they appear to be the later intrusive. The largest lamprophyre dike of this type occurs just west of the boundary line between Swayze and Denyes townships, 10 chains south of the 5-mile post. This dike is at least 75 feet wide and strikes approximately east and west. It is a dark-grey to black rock showing considerable biotite. In thin section it is porphyritic, consisting of orthoclase, plagioclase, biotite, and a little augite, with hornblende and chlorite as secondary minerals. It is a mica lamprophyre corresponding to minette.

Most of the lamprophyres of Algoman age are of this type, but other varieties were noted. In Halcrow township just west of Shunsby lake on the south side of a small creek flowing into the lake near the narrows, there is a dike of olivine-biotite lamprophyre in which the phenocrysts consist of olivine largely altered to serpentine and biotite in a groundmass of carbonates, probably replacing feldspar. A few lamprophyre dikes in which hornblende or augite and feldspar make up the phenocrysts were noted, and these rocks grade into the feldspar porphyries.

Keweenawan

Dikes of olivine diabase and quartz diabase are the latest intrusive rocks in the Swayze area. They vary in width, the maximum being 200 feet or more, and are otherwise similar to diabase dikes of other areas. They have been classed as Keweenawan in age, but it is quite possible that many of the quartz diabase dikes belong to the Matachewan series, as they have a strike within a few degrees of north and south, which is characteristic of that series.

Structure

Folding

Much of the information as to the nature of the folding in the Swayze area has been given previously in the report. The Keewatin-Timiskaming rocks have been closely folded along east-west axes. The strike of the axes varies from approximately E. 10° N. in the northwestern part of the area to E. 10° S. in the southern part. There are local indications of some cross-folding, i.e. in the vicinity of Denyes lake, where some of the sediments on the west side of the lake have a north-south strike and rather gentle dips to the west. The main bands of sediments represent synclines with intervening anticlines, from which the sediments have been eroded away. The main period of folding appears to have occurred during and subsequent to the deposition of the greenstones and sediments and prior to the intrusion of the Algoman rocks.

As a result of the high degree of folding, regional schistosity is marked in the area, but the shearing action is most pronounced along contacts of sediments and greenstones or in the tuffaceous bands. This shearing has resulted in a pronounced development of sericite, chlorite, and carbonate schists. The strike of the schistosity is almost always parallel to the strike of the bedding or flows. Fracturing and minor faulting have been for the most part confined to the vicinity of the Algoman intrusives.

Major Faulting

There are three major faults, all with a north-south strike, in the area. One fault crosses the townships of Swayze and Rollo in a direction slightly west of north. In the southern part of Swayze township a displacement of over a mile in length is indicated, and it is well marked by valleys or escarpments. North of Brett lake it appears to be broken up: One part continues on to Ridley lake, where it is marked by a brecciated zone; the other may follow up the west side of Rollo lake. Another parallel fault crosses the central part of Denyes township; and a third one with a north-south strike lies in the eastern part of Halcrow township and is well marked where it crosses the Kinogama river. All of these faults affect all the rocks up to and probably including the Algoman, and they are, therefore, probably post-Algoman in age. It is difficult to establish the presence of faulting along an east-west direction owing to the prevailing strike of the formations. A fault with a northwest strike, however, is indicated in the west arm of Crossley lake.

Courtesy Massey Williams

No. 1 shaft, Kenty mine.

ECONOMIC GEOLOGY

Evidence of mineralization has been found in many parts of the Swayze area, but no evidence of any mineral, other than gold, of sufficient quantity to be of economic importance was noted. The various occurrences of iron formation described appear to have no economic significance under present conditions.

Gold Deposits

The gold-bearing veins of the Swayze area all occur within the greenstones or sediments in the vicinity of intrusive porphyries or small granite bodies. The intrusion of these Algoman rocks has resulted in considerable fracturing and shearing within the surrounding rocks, and within the openings thus formed the gold-bearing solutions have deposited their mineral content. Occurring as they do over a wide area, the deposits show considerable variation, including lode deposits, fissure veins, and shear-zones. In nearly all the veins the most prominent gangue minerals are quartz, ankerite, and pyrite. Other minerals occurring in varying amounts are chalcopyrite, galena, sphalerite, specularite, calcite, and tourmaline. The gold is present for the most part in the free state. No tellurides have been identified as yet in any of the deposits. Although the work up to date has failed to prove up large deposits of commercial grade, yet conditions favourable for gold deposition exist over a wide area, all of which is well worthy of further prospecting effort.

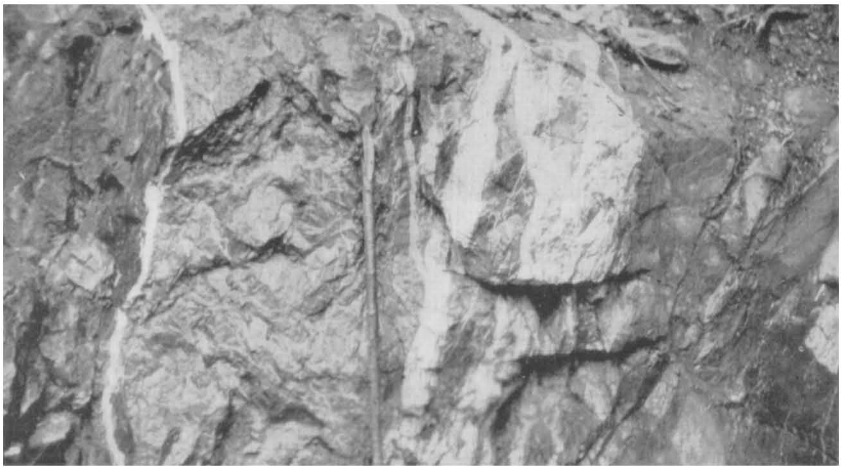
Description of Properties

SWAYZE TOWNSHIP

Kenty Gold Mines, Limited

The discovery of the gold-bearing quartz veins on the Kenty property in 1931 drew attention to the Swayze area as a favourable field for prospecting.

Courtesy Massey Williams



No. 3 vein, Kenty mine.

Following the discovery, in 1931 and during the season of 1932, the management carried out a programme of surface prospecting, as a result of which a large number of veins were uncovered and considerable information as to the surface geology was obtained. Early in 1933 shaft-sinking operations were undertaken, two vertical shafts being put down to a depth of 500 feet, and lateral work on levels spaced at intervals of 125 feet has been carried on. The development work is under the direction of E. T. Corkill, assisted by Massey Williams, who is the resident engineer and geologist.

An east-west belt of Keewatin andesitic and basaltic lavas is bounded on the north and south by sediments consisting of quartzite, slate, and greywacké. The sediments immediately adjoining the lavas contain considerable volcanic debris and on the south side of the basalts form the north side of the main band of the Swayze series. The contact between the greenstones and sediments in the vicinity of No. 1 shaft is almost perpendicular. East of the property the greenstones pinch out and probably represent an anticlinal fold plunging to the east. The greenstones and sediments are intruded by basic rocks, probably lamprophyres with dioritic or gabbroic phases, previously described in the report under the heading of pre-Algoman. These lamprophyres, indicated on the accompanying geological sketch as wide lens-shaped masses, are shown by underground work to be in the form of dikes or sill-like bodies, with an east-west strike, closely spaced over a width of 600 feet or more. Their actual attitude with respect to the enclosing rocks has not yet been determined. Along the south side of the property the sediments and greenstones are intruded by quartz-feldspar porphyry,

Courtesy Massey Williams

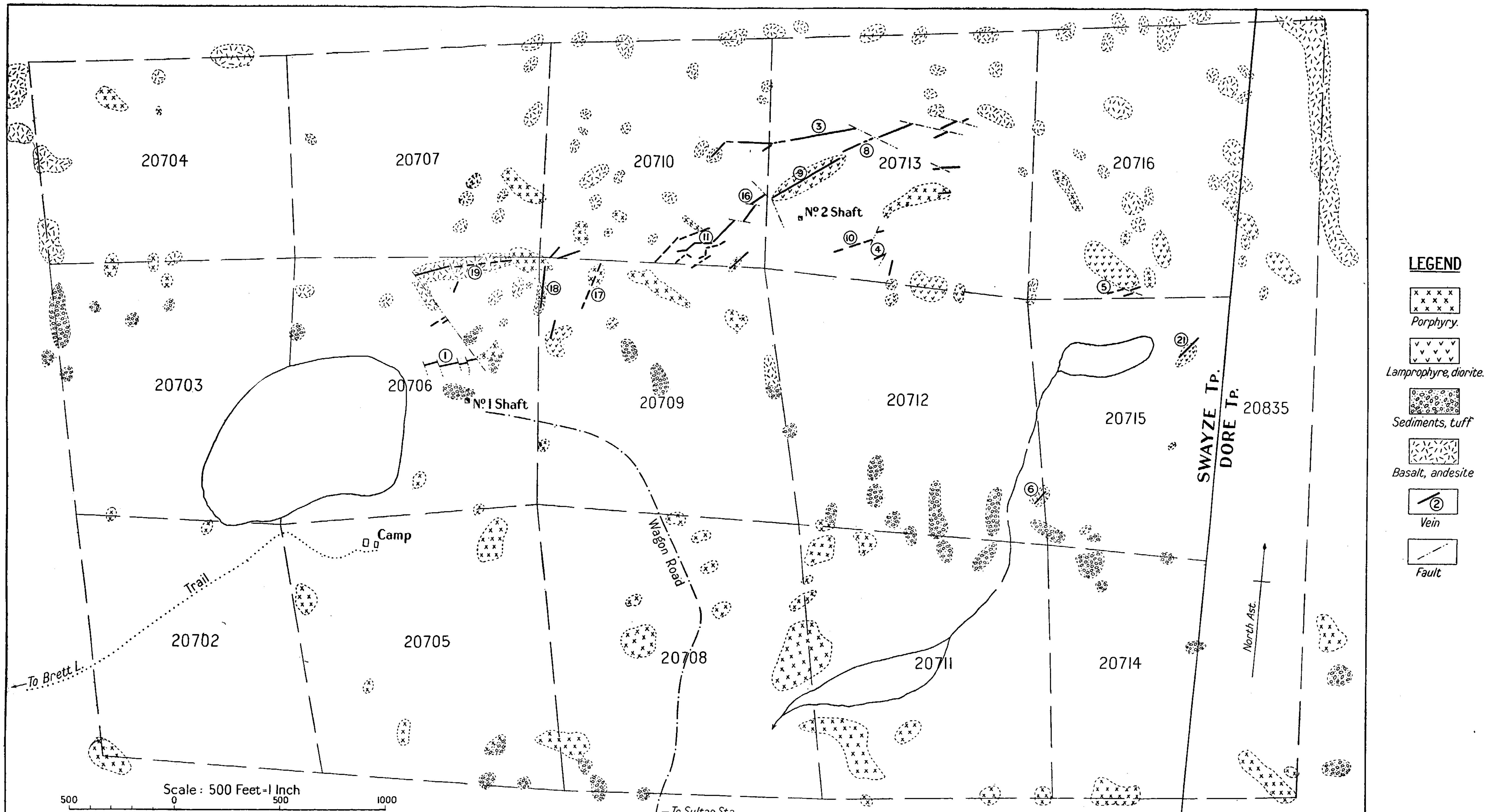
No. 5 vein, Kenty mine.

which here forms an eastern arm of the Brett lake porphyry body. Dikes of similar porphyry occurring to the north of the main body represent offshoots from the larger body. Small dikes of mica lamprophyre intrude all the above rocks.

Courtesy Massey Williams

No. 1 vein, Kenty mine, showing drag at the main fault.

Vein Characteristics.—The Kenty veins belong to the lode type of deposits, consisting of a series of parallel veins, each having a main quartz leader with subsidiary parallel veinlets and altered country rock intervening. They may occur in the lavas, sediments, or intrusive rocks. The average strike of the veins

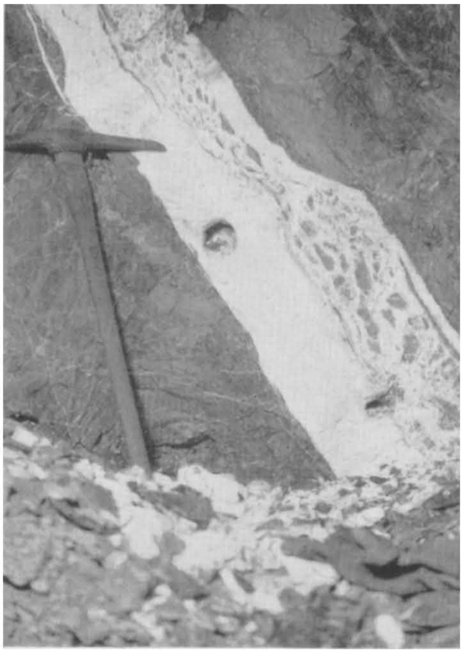


GEOLOGICAL SKETCH MAP OF THE PROPERTY OF THE KENTY GOLD MINES, LIMITED

The map is based on a preliminary sketch of the claims before they were surveyed, and additional information was obtained largely from the officials of the company.

is approximately N. 60° E., and they dip to the southeast at angles varying from 40 to 80 degrees. The veins occur in fractures in the country rock with practically no schisting. The average width of vein material is from 4 to 5 feet, with a maximum of 10 feet. The wall rocks show considerable replacement by carbonates, chiefly ankerite, and pyrite. The quartz contains some pyrite and tourmaline; other gangue minerals noted are calcite, galena, specularite, graphite, chalcopyrite, and a little feldspar. Coarse native gold is visible in fractures in the main quartz or in the narrow quartz veinlets. Almost every vein shows some visible gold, and in places on the surface it is present in spectacular amount, the most notable veins being Nos. 1, 3, 11, 16, and 21. Veins Nos. 9, 11, and 16 are probably

Courtesy Massey Williams



No. 3 vein, 290-foot level east, No. 2 shaft, Kenty mine.

faulted portions of the same vein; and in No. 16 over a length of 90 feet between two faults, coarse native gold is to be seen in fractures in the quartz for the full length.

Faulting.—A series of post-mineral faults intersect the veins, causing displacements from a few feet up to 350 feet or more. Vein No. 1, for example, in a length of 200 feet has three parallel faults striking N. 10° W., with a maximum displacement of 30 feet. At the east end of the surface showing it has been faulted to the northwest and has been recently picked up by crosscutting, proving a displacement of 360 feet. This condition of faulting adds somewhat to the problem of following the veins underground, but much information has already been obtained to assist in connecting various sections of the veins.

Underground Development.—Shafts Nos. 1 and 2 have been sunk to depths of 500 feet and 525 feet, respectively. Up to the end of April, 1934, approximately 5,000 feet of lateral work, including 3,000 feet of drifting, had been done.

Since the beginning of 1934 a campaign of diamond-drilling has been carried on to obtain further information on the geology, faulting, and vein structures. Up to the present the underground work has been concentrated on veins Nos. 1, 3, and 9, but there are many other veins indicated on the surface, in the drilling, and underground with possibilities worthy of investigation. In the vicinity of the two shafts and eastward the greenstones and sediments are intruded by the

Courtesy Massey Williams

No. 9 vein, Kenty mine, showing minor fault structures, 290-foot level east, No. 2 shaft.

lamprophyric rocks, and the veins lying to the north and dipping southward pass into these lamprophyres.

No. 1 Shaft.—Shaft No. 1, which was sunk on No. 1 vein, has been drifted on at three levels, 250, 375, and 500 feet. The vein, which is in basalt on the surface, dips about 58° S. and passes into the sediments above the 500-foot level. The vein is strong and has good widths with good mineralization down to and including the 375-foot level, but is narrow on the 500-foot level. On this level, however, another vein was encountered just north of the shaft and approximately 100 feet north of No. 1. One hundred and fifty feet east of the shaft both these veins are faulted to the north, and a crosscut run out to the north on the 375-foot level has picked up the eastward extension of No. 1 vein, showing a displacement of 360 feet to the north. The fault strikes approximately N. 10° W., and it would appear that the vein encountered on the 500-foot level north of the shaft is the westward extension of what is known on the surface as No. 19 vein.

No. 2 Shaft.—At No. 2 shaft, which lies approximately 1,800 feet east of No. 1 and was put down to examine veins No. 9 and No. 3, drifting has been done at two levels, 290 and 525 feet. The veins have the usual complications due to minor faulting, but the fractures are strong and have good widths of quartz. Much of the wall rock of these two veins in this section of the underground work consists of the lamprophyric dikes, alternating with basalts, with the former type predominating. The west drift on the No. 9 vein at the 290-foot level and the intersection of this vein at the 525-foot level show considerable porphyry. A drill-hole to the south from the end of the south crosscut at the 525-foot level passed through more than 300 feet of basalt showing two strong-looking veins that are not represented on the surface. This band of basalt would appear from surface work to widen out toward the east.

Gold Values in the Veins.—Surface and underground work so far indicate that the best ore values are present where the veins occur in the greenstones as opposed to the lamprophyres or sediments. The only difference noted in the appearance of the veins in the different types of rocks lies in the amount of mineralization of the altered wall rock, particularly with regard to the amount of pyrite present. The fractures may be just as strong and the quartz may have just as good widths in the lamprophyres as in the greenstones, but the pyritization is more marked in the latter, and better values occur in general where the pyritization is strongest. The veins show low or erratic values in the lamprophyre, and, as a result, the development of ore shoots up to date has been only moderately encouraging, owing possibly to the extent of these lamprophyres in the vicinity of the underground work. Considerable further exploration is now being carried out, particularly in the area to the south of No. 2 shaft, where a large body of greenstone is indicated and into which the veins outcropping on the surface north of the shaft would appear to dip below the 500-foot level.

Equipment.—Two Diesel engines supplying 165 horse-power operate the two hoists, the drills, pumps, etc. A good camp has been built, and approximately 40 men are employed on the property. A fair wagon road has been constructed from Sultan on the Canadian Pacific railway, a distance of 21 miles from the mine, to bring in freight and supplies.[1]

McNeely-McCullough

A group of 14 claims staked by Geo. McNeely and John McCullough, of Sudbury, lies at the east end of Brett lake, adjoining the claims of the Kenty Gold Mines, Limited, to the east and northeast. Considerable trenching and stripping has been done on this group of claims in an effort to locate possible extensions of the Kenty vein systems. A number of showings have been uncovered, chiefly near the north edge of the main porphyry body. They consist mainly of narrow quartz veins or fractured zones with quartz stringers carrying considerable pyrite and carbonates. Some of these showings were reported to give moderately low values over narrow widths.

[1]Since this report was written operations at the Kenty mine have been suspended. An extensive campaign of underground work and diamond-drilling was completed in July, 1934. The results of the work appeared to indicate that values were too irregular to warrant the expectation of ore bodies of sufficient size or grade to justify the erection of a mill at present, and future plans of the company are indefinite.

During the summer of 1933 this property was under option to Consolidated Mining and Smelting Company, Limited, who completed 5,000 feet of drilling on the property. A series of holes dipping about 30° N. was put down, covering the ground from the south side of claim S. 20,813 to the north boundary of claim S. 20,812. The south half of claim S. 20,813 appeared to be largely altered sediments intruded by numerous dikes of quartz porphyry. On the north half of this claim and the south half of S. 20,812, a continuous body of quartz porphyry with a width of over 1,000 feet is followed by a narrow band approximately 100 feet wide of well-bedded slates, which is in turn followed by greywacké to the contact with the greenstone. A number of mineralized zones with pyrite and narrow quartz stringers was encountered, but gold values were low.

Miner Kenty

A group of 13 claims staked by Miner Kenty in the fall of 1931 adjoins the Kenty Gold Mines property to the south and west, 10 of the claims being in Dore township. In 1932, they were under option to the Cyril Knight Prospecting Company, Limited. Eight veins had been uncovered by trenching and stripping, mostly in the greenstone. The veins are all small, not over 100 feet long, with maximum widths of 2 feet. Approximately 1,000 feet of diamond-drilling was done on the property in the winter of 1931-32. Gold values in the veins were reported to be low.

Montgomery-Ackerman

A group of 17 claims was staked by Tom Montgomery in the fall of 1931. Five of the claims lie along the south boundary of the Kenty Gold Mines property, and the remainder extend eastward into Dore township along the south boundary of the Miner Kenty group. A considerable amount of surface trenching and stripping has been done, and a number of veins and mineralized shear-zones have been disclosed showing quaitz, pyrite, carbonates, and other minerals, typical of the gold-bearing veins of the area. The veins discovered up to the end of 1933 were small, but some low values in gold were reported. A crew of men is at present engaged in further prospecting of the ground.

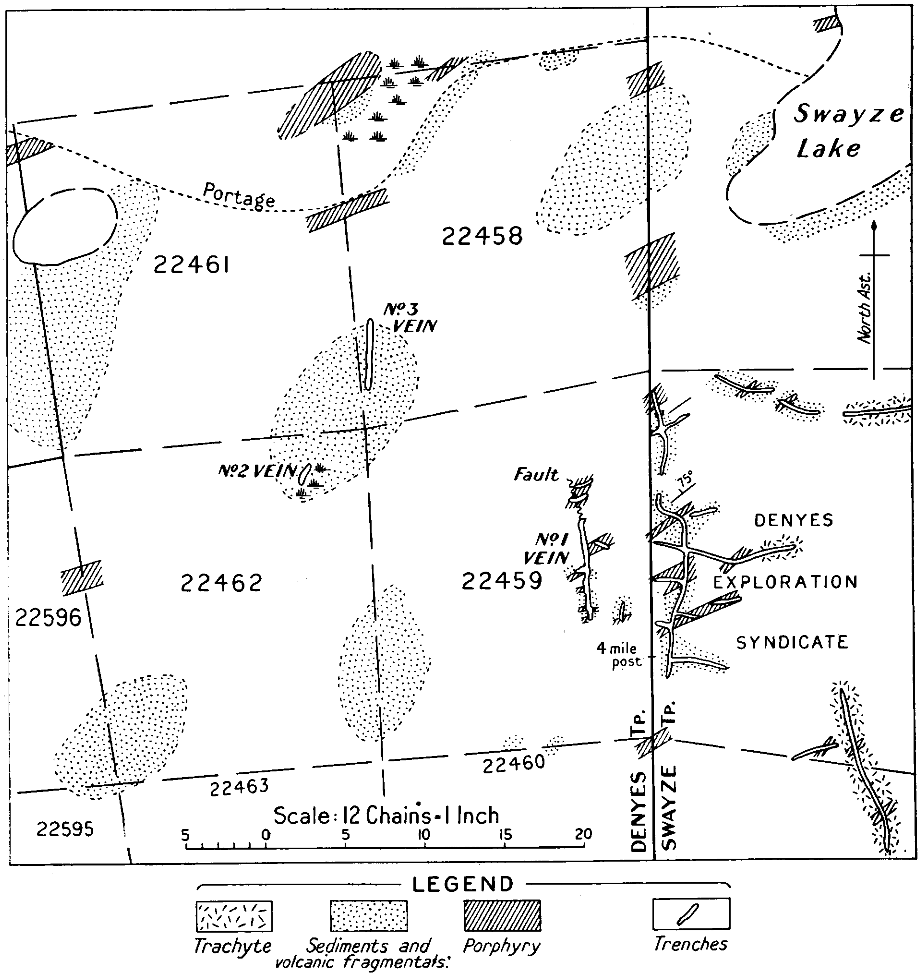
Buffalo-Canadian Gold Mines, Limited

The Buffalo-Canadian Gold Mines, Limited, controls a group of 12 claims in Swayze township lying north of the east end of Cree lake. The country rock consists essentially of greenstone intruded by porphyry dikes. In the vicinity of claim S. 21,389 a number of veins or mineralized zones have been uncovered. The property was visited during the winter of 1934, but only three of the showings were in condition to be examined. They appear to be in the nature of shear-zones, which have been silicified and carbonated and show considerable pyrite. Some visible gold was noted in what is known as No. 10 vein. No. 2 vein, which lies near the south boundary of claim S. 21,389, has been stripped for 500 feet. Two grab samples of the mineralized quartz from this vein gave 0.02 ounces per ton in gold. A grab sample from vein No. 2A, which is a branch from No. 2 vein, gave 0.08 ounces per ton in gold. The work consists of trenching and stripping and is under the supervision of A. C. Hahn, J. H. Collins is directing field operations. The officials in charge are reported to be contemplating some diamond-drilling of the showings in the near future.

DENYES TOWNSHIP

J. E. Derraugh

The property, staked by J. E. Derraugh, of Haileybury, in the fall of 1932, comprises a group of 8 claims adjoining the east boundary of Denyes township near the 4-mile post. The country rock consists of arkose, greywacké, trachyte tuffs and flows cut by dikes of quartz porphyry. The discovery vein, which lies



Geological sketch map of the Derraugh property.

in the eastern part of claim S. 22,459, has been trenched for 400 feet, of which 220 feet shows an almost continuous vein of quartz with small quartz veinlets in the footwall. The quartz is in the form of lenses with widths up to 6 feet. The main vein lies along a fault striking almost due north and south and dipping about 75° E. A much altered lamprophyre dike lies along the fault and has been brecciated by the movement.

Apparently the intrusion of the quartz porphyry dikes into the sediments was followed by a north-south fault accompanied by the intrusion of the lamprophyre dike. Further movement along the fault has brecciated the dike, and quartz has come up along the fault, replacing the wall rocks. The fault can be seen distinctly along the main quartz vein, continuing north and south to the end of the stripping. The footwall rocks are much cut up by tension cracks, which contain small quartz stringers.

The quartz is mineralized with pyrite, chalcopyrite, a little galena, and carbonates. Lenses of vein material with considerable chalcopyrite carry high values in gold, though no native gold was seen. A chip sample taken continuously

No. 1 vein, Derraugh property, showing well-defined hanging wall and fault.

from west to east across a wide part of the best-looking section of the vein and assayed in sections showed the following values in gold:—

	Ounces per ton
(a) 8 inches, quartz with heavy sulphides	2.22
(b) 24 inches, chiefly quartz	.15
(c) 36 inches, altered wall rock	.03
(d) 56 inches, quartz	.24
(e) 24 inches, quartz	.32

No. 2 showing lies in the northwest corner of claim S. 22,462 and consists of a rusty silicified arkose containing stringers of quartz with pyrite. It is exposed in two stiippings about 125 feet apart, with widths up to 20 feet, and strikes approximately N. 20° E. It is reported to show low values in gold.

No. 3 vein was discovered in the fall of 1933 and lies near the west boundary of claim S. 22,458. This vein, which strikes north and south and has a maximum width of 15 feet, has been stripped for over 400 feet. It is possibly the continuation of No. 2 vein. Heavy mineralization in the form of pyrite, chalcopyrite, carbonates, and galena occurs in narrow streaks along the vein. Channel-sampling of this vein is reported to have shown low values in gold.

During the winter of 1932-33 this property was under option to the Kirkland Hudson Bay Gold Mines, Limited, who put down a series of short diamond-drill holes, with an aggregate of 2,000 feet of drilling. Eleven holes were put down on No. 1 vein, and 2 holes on No. 2. As a result of this drilling the option was dropped. The more recent work on No. 3 vein was done under the direction of J. E. Derraugh.

Denyes Exploration Company

The claims of the Denyes Exploration Company, staked by T. R. Buchanan, adjoin the Derraugh group on the west and north, and part of the ground lying

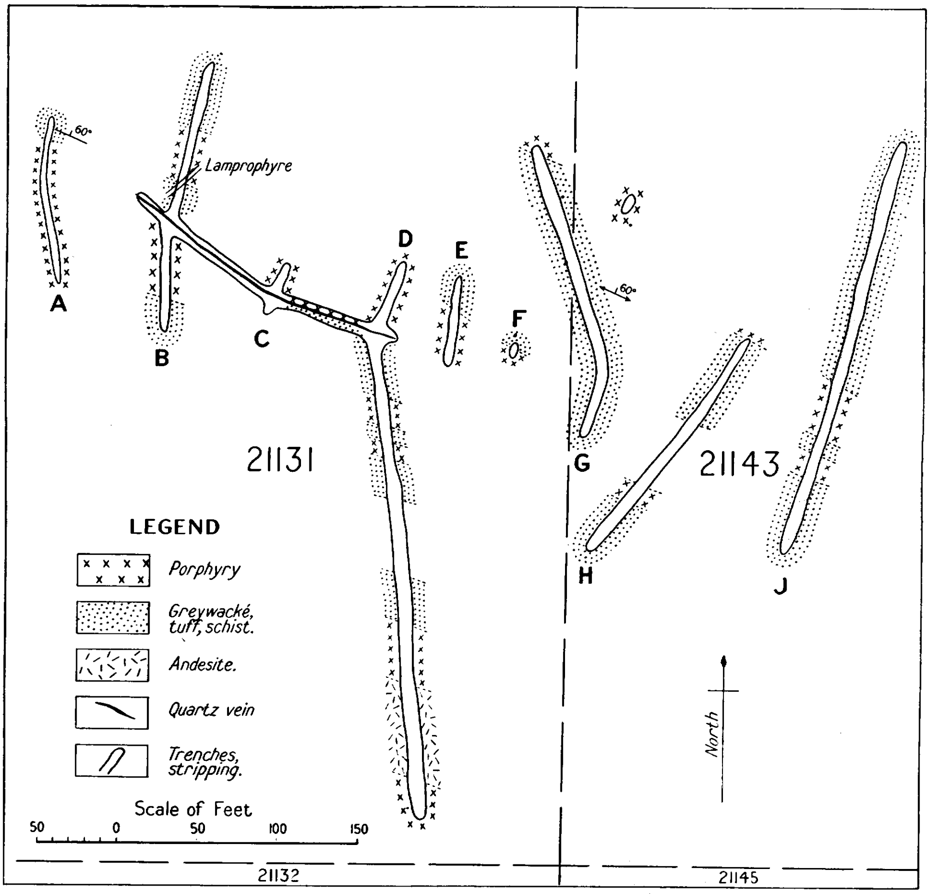
Main pit on the Dyment property, showing three quartz veins.

on the Swayze township side of the boundary is shown on the sketch of the Derraugh group. In 1932, the property was under option to the Dome Mines, Limited, who did considerable trenching and stripping, chiefly on claim S. 22,211 lying to the east of the discovery vein of the Derraugh. Some small quartz veins carrying values in gold were uncovered, but the option was dropped. The work was under the direction of W. Cliff.

Dyment Mining and Investments, Limited

In the summer of 1932 a group of 31 claims lying along the south side of Dyment lake in Denyes township was staked by Joseph Beaumont in the interests of the Dyment Mining and Investments, Limited. The claims cover an area about two and a quarter miles long in an east-west direction by three-quarters of a mile wide and lie along the contact between the Swayze series of sediments and volcanics to the north and the Keewatin greenstones to the south. A large number of dikes and small bosses of porphyry intrude the greenstones and sediments.

On the southwest shore of Dyment lake along the north end of claim S. 21,984 there is a band of schisted porphyry and tuff, with a maximum width of 300 feet, striking S. 80° E. A series of quartz lenses occur in this schist forming an almost continuous vein for 150 feet and striking S. 60° E., i.e. cutting the schist at a small angle. The maximum width of the quartz is not over 2 feet, but one trench shows two parallel lenses of quartz, each about 2 feet wide, separated by 10 feet of schist heavily mineralized with pyrite and carbonates. The main pit shows three parallel quartz veins making up a total width of 5 feet of quartz over a width of 9 feet. The quartz is milky-white in colour and well fractured, showing fine native gold along the fractures. Galena, specularite, and a little



Geological sketch map of the Sylvanite vein.

chalcopyrite were also noted in the vein. Samples of the quartz from this pit carry high values in gold, but the work up to date seems to indicate that these values are confined to a short distance (not over 15 or 20 feet) to the east and west of the main pit. The rest of the quartz and the heavily mineralized schist alongside the quartz show erratic or very low values.

Seventy feet east of the main pit the vein appears to be faulted to the north approximately 90 feet, and the continuation was picked up in a trench to the east of the fault. To the west the main vein pinches out, but narrow lenses and stringers of quartz have been uncovered for 600 feet along the strike. A narrow dike of diabase parallels the vein and quartz lenses to the west, cutting across it in places. Several large masses of porphyıy intrude the tuffs immediately south of the vein.

During the winter of 1933-34 a small amount of diamond-drilling was done on this showing. The drilling consisted of a series of short holes with an aggregate of 1,000 feet, put down along the strike of the vein near the main showing. The results were not encouraging, and work was discontinued. Considerable surface trenching has been done on the property, the earlier work being done under the direction of C. H. E. Stewart and Joseph Beaumont, and the drilling under C. F. Cockshutt.

Sylvanite Claims

A group of 18 claims controlled by Sylvanite Gold Mines, Limited, lies in the western part of the township of Denyes, approximately one mile west of Dyment lake. During the summers of 1932 and 1933 a small crew of men were engaged in prospecting the claims under the direction of Duncan Campbell, of Haileybury.

In the southeastern part of claim S. 21,131 of the group, trenching has uncovered a series of parallel porphyry dikes striking S. 60° E. and intruding schistose greywacké and tuffs. The porphyry and schist have been fractured and the fractures filled with quartz heavily mineralized with pyrite and carbonates. The main features of the geology are indicated on the accompanying sketch showing the trenches. The quartz vein with an indicated length of 200 feet lies along the contact between bedded tuffs and porphyry extending from trench B to trench D. The vein dips about 60° N. and in trench C shows its maximum width of 4 feet. No native gold is visible, but channel-sampling over 3-foot widths over a length of 160 feet of this vein are reported to give values up to 0.40 ounces per ton in gold. Grab samples of the quartz carrying considerable pyrite gave values up to 0.36 ounces per ton in gold. A number of narrow zones with quartz stringers were noted in trenches to the east and west of the main vein. Quartz stringers occur in the fractured zones in the tuffs and porphyry, but the best gold values appear to be associated with the stringers in the tuff.

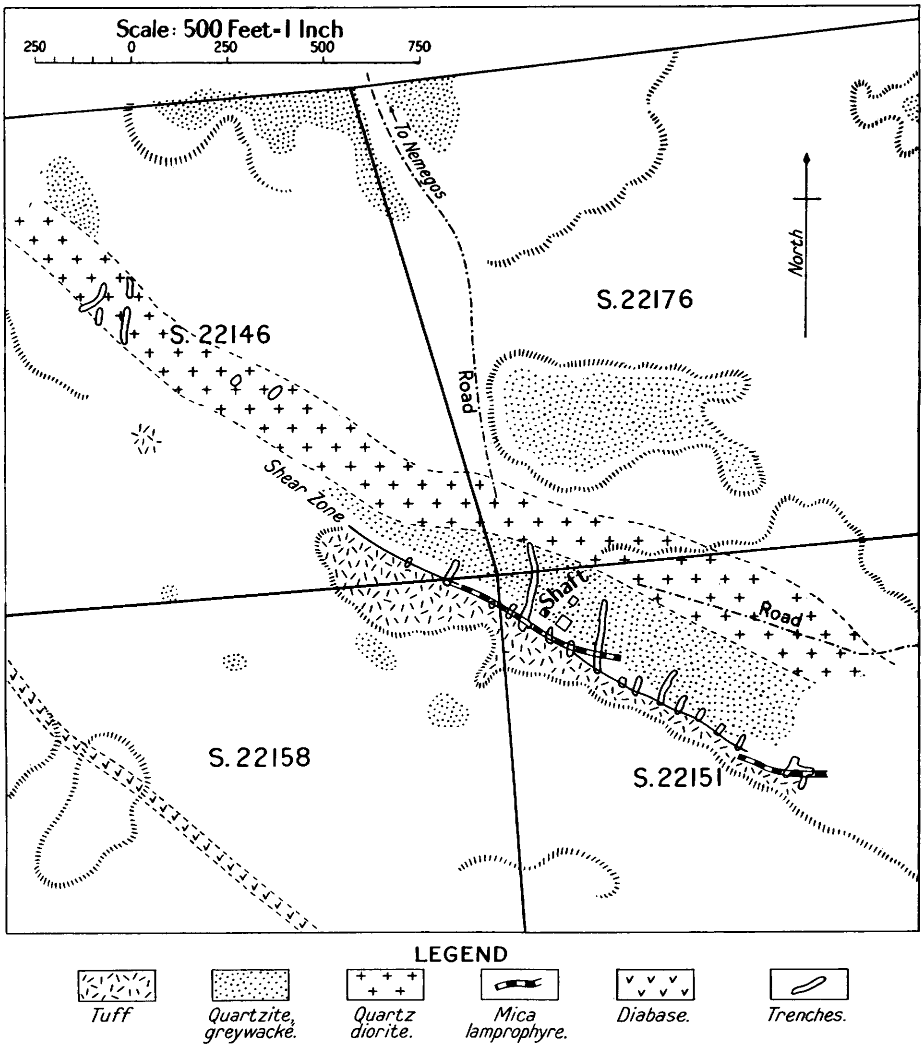
HALCROW TOWNSHIP

Halcrow Swayze Mines, Limited

The property of the Halcrow Swayze Mines, Limited, comprises a group of 35 claims lying in the central part of Halcrow township, staked by J. and D. Hughes and M. Shunsby in association with Horace Strong, of Haileybury. The claims lie along the contact between greenstones to the north and sediments of the Ridout series to the south. The principal showing occurs on claims S. 22,151, 22,158, and 22,146, and consists of a shear zone in an impure quartzite or greywacké, striking S. 60° E. and dipping 80° N.E. The south limit of the shearing is represented by a fault with greenstone tuffs on the footwall side. The north limit is represented by a dike of quartz diorite 100 feet or more in width, which parallels the shear zone and has been traced for half a mile. The width of the zone between the diorite dike and the fault varies, with a maximum of 200 feet, and the shearing varies in intensity across this width. In the zones of more pronounced shearing the quartzite and diorite have been mineralized, chiefly with pyrite and carbonates, and the gold values are associated with this mineralization. Definite quartz veins do not occur except in cross-fractures in the main zone.

The mineralization of this deposit seems to be genetically connected with the quartz diorite dike. Besides the main dike a number of small offshoots from it may be seen in some of the pits. Several narrow mica lamprophyre dikes, usually not over a foot wide, occur along the shear zone. One of these dikes has been traced continuously for a distance of 500 feet, commencing east of the shaft and following westward along the footwall.

All the mineralized schist across the zone is reported to carry low values in gold, from 0.01 to 0.03 ounces per ton, and some zones show medium to moderately



Sketch map showing the surface geology of the property of the Halcrow Swayze Mines, Limited.

low values. One of these zones along the footwall side is reported from underground sampling to show over a width of 4 feet an average of 0.20 ounces of gold per ton for a length of 100 feet, or 0.15 ounces per ton for a length of 235 feet, and in addition at the west end of the drift an average of 0.20 ounces over 8 feet for a length of 50 feet. On the surface some quartz veins occurring in the cross-fractures with considerable pyrite and some chalcopyrite showed values considerably higher than this. One of these, known as No. 1 vein, is reported to have shown 0.70 ounces per ton across a width of 44 inches. Surface trenching and test-pitting have indicated a zone with a length of approximately 1,500 feet containing low gold values over considerable widths with possibilities of finding enrichments that might afford ore bodies of medium to low grade.

During 1932 and 1933 a great deal of surface trenching and test-pitting was done, followed by 2,000 feet of diamond-drilling. Following this a shaft was sunk to a depth of 200 feet, and approximately 1,200 feet of lateral work has been completed. The main drifting was done along the zone at the south side of the shearing with a crosscut run out to the northwest toward the quartz diorite dike. The management proposes to continue the drifting to the west and at the same time to carry on drilling from the 200-foot level to encounter the mineralized zone at a depth of 500 feet. During the winter a small pilot mill of 25 tons capacity with crusher, ball mill, Diesel engine, and cyanide equipment was taken into the property to be used in sampling the ore. John Hughes, one of the stakers, is directing operations in the shaft; H. Bischoff is the engineer and geologist in charge for Horace Strong. A good winter road was cut from Nemegos on the Canadian Pacific railway, a distance of approximately 16 miles.

Lyall-Beidelman

A group of 15 claims has been staked in the northwest part of Halcrow township by Knut Hammerland in the interests of J. C. Beidelman and associates, of Montreal. The principal showings occur in the northern part of claim S. 22,487, about one mile north of the north end of Shunsby lake. The country rock consists of sediments, including conglomerate of the Swayze series, which have been intruded by large dikes or bosses of reddish syenite porphyry, and later by narrow dikes of mica lamprophyre. The porphyry body in which the showings occur has a width of at least 800 feet from north to south; its length cannot be determined owing to overburden. A series of trenches over a length of 200 feet shows a fracture zone in the porphyry striking approximately east and west. The fractures have been filled with quartz in the form of narrow veinlets, and the porphyry has been replaced by moderate amounts of pyrite and arsenopyrite.

One hundred feet north another fracture zone with a northeast strike shows a similar condition but with more quartz and heavier mineralization over widths up to 3 feet or more. The linear extent of this fracture has not been determined.

The oxidized material from these two zones pans gold very freely, and some fine native gold was noted in one place. Selected grab samples from these showings are reported to give high values in gold. Two chip samples taken across 18 inches and 24 inches in the north pit gave 0.03 ounces per ton in gold. The owners plan further extensive surface work on this property in the near future.

GREENLAW TOWNSHIP

Lee Gold Mines, Limited

A group of 17 claims staked by Martin Shunsby and controlled by the Lee Gold Mines, Limited, headed by J. J. Byrne, lies in the northwestern part of Greenlaw township. The principal showings occur on claim S. 23,938 on the west side of Lee lake. The country rock consists of diorite, which intrudes the Keewatin greenstones and sediments of the Ridout series approximately along the contact. The diorite is cut by a dike of quartz porphyry from 10 to 20 feet wide, striking S. 60° E., which has been traced by trenching for 800 feet. The porphyry and the diorite for a width of 5 to 10 feet on either side of the porphyry have been sheared and replaced by quartz and carbonates heavily mineralized with pyrite and showing narrow streaks of chalcopyrite. This condition is seen in a series of seven deep trenches extending over a length of 300 feet. The mineralization is confined to the highly schisted rock, which dips about 80° N., and this mineralized schist is reported to show good values in gold. Four grab samples of this material gave a gold content up to 0.10 ounces per ton. A series of 11 shallow diamond-drill holes have been put down to intersect the mineralized zone over a length of 800 feet. Four of these holes are reported to have shown values in gold from 0.25 to 0.64 ounces per ton.

A shaft is being sunk for underground examination of the deposit. Good camps have been built, and an assay plant has been installed. The work is under the direction of Martin Shunsby.

Greenlaw Gold Mines, Limited

A group of 19 claims, controlled by J. J. Byrne, lies immediately southeast of the Lee Gold group. On claim S. 24,542 of the group a showing similar to

Camp of the Lee Gold Mines, Limited.

that of the Lee Gold Mines has been uncovered and consists of a porphyry dike cutting diorite with some pyrite and chalcopyrite mineralization. No definite information as to gold values is known.

Newbec Mines, Limited

A group of 10 claims was staked in 1932 by A. E. Dumond in the interest of the Newbec Mines, Limited, in Greenlaw township on the west side of Hotstone lake. The principal showings, which occur near the centre of claim S. 22,711, consist of a quartz vein with a maximum width of 2 feet, striking S. 80° E. and dipping 70° N. The vein, which has been stripped for 100 feet, occurs in a schistose greywacké of the Ridout series of sediments. The strike of the vein and smaller veins in the vicinity is the same as that of the schistosity. The quartz is glassy to whitish and contains a considerable amount of carbonates. Very little sulphide mineralization was noted and no native gold was seen, but three grab samples taken from different parts of the vein showed 0.29, 0.09, and 0.01 ounces per ton in gold. Smaller veins of similar quartz were noted 300 feet east and 60 feet west of this vein. The development work consists of trenching and stripping, and it is reported that further work has been planned by the controlling company.

ROLLO TOWNSHIP

Cyril Knight Prospecting Company, Limited

During the summer of 1932 a group of 15 claims was staked in Rollo township on the southeast side of Ridley lake by Miner Kenty working in the interest of the Cyril Knight Prospecting Company, Limited. In the northwest corner of claim S. 22,721 a gold-bearing quartz vein was discovered. The country rock consists of schisted andesitic lavas. The vein has an indicated length of approximately 800 feet, striking N. 65° E. and dipping 80° S.E. It is exposed in the main trench for 430 feet with a maximum width of 10 feet, pinching out sharply to the west and narrowing to a series of stringers to the east. The quartz, which is of the white glassy variety, is much fractured in a direction parallel to the strike of the vein. It carried a small amount of pyrite and a little native gold. Channel sampling of the vein is reported to have shown low values in gold.

Agaura Exploration Company, Limited

This group of 15 claims, staked by W. H. Graves on behalf of the Agaura Exploration Company, Limited, lies immediately south of the property of the Cyril Knight Prospecting Company and extends from the west boundary of Rollo township eastward to within a quarter of a mile of Rollo lake. The main showings occur on claim S. 22,632 and consist of two zones containing quartz veins mineralized with pyrite. The south zone has three short veins, striking N. 70° E., exposed in three trenches extending over a distance of 900 feet. The centre vein, which is the largest, has a maximum width of 13 inches and a length of approximately 70 feet. It is composed of quartz mineralized with pyrite, ankerite, and a little galena. Some native gold was noted, and a channel sample across 8 inches was reported to assay 0.70 ounces per ton in gold. The country rock of the veins in this zone is arkose.

Five hundred feet north in the greenstones is a strongly schisted zone with widths up to 12 feet. The schist is mineralized with coarse pyrite and lenses of quartz. This zone, which has been traced for 500 feet, strikes N. 80° E. Fifty feet south and parallel to the zone is a rusty carbonated quartz porphyry dike with a maximum width of 15 feet. Channel samples from this showing were reported to give low values in gold.

RANEY TOWNSHIP

Raney Lake Prospecting Syndicate

The Raney Lake Prospecting Syndicate controls a group of 35 claims in Raney township, extending northeast from the northeast bay of Raney lake. The claims were staked by G. A. Thorne and associates, of New York, in 1932. Two quartz veins have been discovered on claim S. 22,366. One vein with a width of 2 feet where exposed at the east end of the trenching has been traced for a distance of 100 feet, striking S. 80° E. and dipping steeply to the north. The country rock is arkose or impure quartzite. The quartz contains a little pyrite, some carbonates, and in one place a little native gold. Five hundred feet to the southwest another quartz vein, which has a maximum width of 6 inches and strikes N. 60° E., has been traced for a distance of 100 feet. It occurs in a feldspar porphyry and shows a little native gold in one place along with some pyrite, chalcopyrite, galena, and tourmaline.

DISCOVERIES OUTSIDE THE MAP AREA

Woman River Syndicate

The property of the Woman River Syndicate of New Liskeard lies in the northwestern part of Mallard township on the Woman river. The showing occurs on claim S. 20,506 at a falls on the river. It consists of narrow quartz veins and stringers in andesite, which is intruded by narrow dikes of porphyry. The largest of the quartz veins has a maximum width of 3 feet, and when the property was visited in May, 1933, this vein had been stripped for a length of 20 feet. The quartz is heavily mineralized with pyrite. No gold was visible. A channel sample across 3½ feet was reported to have assayed 0.25 ounces per ton in gold. A grab sample from this vein assayed 0.34 ounces per ton in gold. Across the river, approximately 400 feet west, a trench shows similar conditions, viz., a narrow porphyry dike cutting schisted greenstone with some quartz and pyrite. Since the property was visited, a considerable amount of work has been done, but the results are not known.

Mogridge Claims

This property, staked by Wm. Mogridge and associates, lies in the centre of Mallard township, on the Opeepeesway river. The showing, which lies near the northeast corner of claim S. 24,798, occurs in an area of schisted greenstone and tuffs. The strike of the schist is S. 45° E., and the dip vertical. The gold occurs in a silicified and carbonated zone in the schist, the zone being parallel to the strike of the schistosity. Very little vein quartz is present. The schist is heavily mineralized with pyrite and a little chalcopyrite. The mineralized zone has been traced for 500 feet and has widths as great as 30 feet. The showing has recently been diamond-drilled by N. A. Timmins Company. Five hundred feet of drilling in 4 short holes was done over a length of 520 feet. Grab samples of the pyritized schist from the surface gave values up to 0.45 ounces per ton in gold.

Hermiston Claims

Half a mile west of the Mogridge discovery a somewhat similar showing occurs on ground staked by P. A. Hermiston and Wm. Hammerstrom, working in the interests of Horace Strong, of Haileybury. Near the east side of claim S. 24,851 a mineralized zone is exposed in two trenches 80 feet apart. The strike of the schist is S. 45° E. The mineralization occurs over a width of 15 feet, with lenses of quartz and a considerable amount of pyrite. In the southeast trench a dike of felsite 10 feet wide cuts the greenstone parallel to the schistosity. Two grab samples of the pyritized schist from this find assayed 0.21 and 0.28 ounces per ton in gold.

Horwood Lake

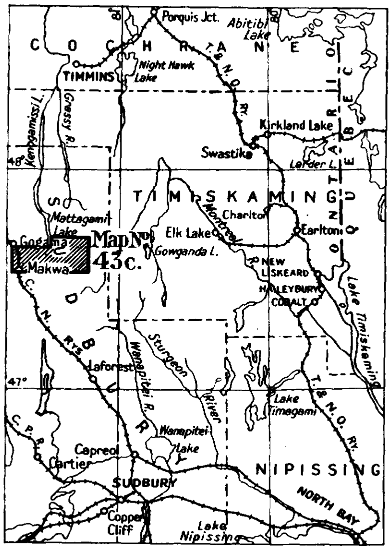
Several new finds have recently been reported from the area north of the townships of Newton and Dale and west of Horwood lake. A visit was paid to the claims of the Eclipse Airways at the end of the season. The group of claims lies on the Swayze river immediately north of the north boundary of Newton township. The country rock consists of greenstone with some coarse dioritic phases cut by porphyry dikes. A number of fractured zones containing narrow quartz veins and stringers have been exposed by trenching on these adjoining claims. The veins are mostly either flat-lying or dip at low angles and are mineralized with pyrite and a little chalcopyrite. One vein from 6 to 8 inches wide and exposed for 30 feet showed some native gold, and a number of these small veins are reported to show gold in panning.

Geology of the Makwa-Churchill Area

By H. C. Laird

INTRODUCTION

During the summer of 1933 a geological investigation was carried on in a section lying between Gogama on the Canadian National railway and the West Shiningtree gold camp. This section includes parts of the townships of Champagne, Groves, Brunswick, Connaught, Cabot, and Churchill, in the district of Sudbury, and is contiguous to the Three Duck Lakes area to the west. Previous work by the writer in 1931,[1] together with information supplied by reports of the Geological



Key map showing the location of the Makwa-Churchill area. Scale, 60 miles to the inch.

Survey of Canada, indicated the strong probability that a belt of sedimentary rocks known as the Ridout series traverses the townships discussed in this report. This feature has now been established, and it is known that the Ridout series extends in an almost unbroken belt from Halcrow township in the Swayze gold area to Churchill township in the Makwa-Churchill gold area, a distance of nearly 90 miles.

Generally speaking, a belt of sedimentary rocks of the magnitude of the Ridout series is of great significance to the prospector, who has learned to regard the sections in or near these belts as commonly being the loci of important gold deposits. The Makwa-Churchill area has been prospected with this point in mind. Several gold prospects have been located, but as yet none of them have received more than preliminary surface development.

[1]H. C. Laird, "Geology of the Three Duck Lakes Area," Ont. Dept. Mines, Vol. XLI, pt. 3, 1932.

The area is readily accessible from either Gogama or Westree, both of which are on the main line of the Canadian National railway less than 100 miles north of Sudbury. There is no accommodation at Makwa, but trains will stop on flag. Every part of the area is served by excellent canoe routes and good portages. Many old lumber roads in Groves and Champagne greatly facilitated the traversing of these townships. An excellent gravel road connects Shiningtree with Westree, a distance of 20 miles. Motor cars use this road in reaching the Churchill, Ribble, and Burvan properties in the Wasapika section of the West Shiningtree camp. In the fall of 1933 this road was being extended in a northeast direction toward Tyrrell township. Eventually it is planned to extend it to Gowganda.

During the latter part of the season the more important properties in the West Shiningtree and Three Duck Lakes camps were visited. The progress of development in these camps is discussed later in this report.

Acknowledgments

The writer wishes to tender sincere thanks to the citizens of Gogama and Shiningtree for their courtesies and general expressions of goodwill. Special thanks are due to Chief Rangers Wm. Piggott, of Gogama, and James Burns, of Mattagami Post, and to Deputy Chief A. C. Mitchell, of Shiningtree, for their cordial hospitality and sustained interest in the work and welfare of the party; also to Thos. Saville and Lloyd Foster, of Shiningtree, for maps and plans of Cabot and Connaught townships.

The writer was assisted until the middle of September by C. H. Knight, who performed his duties in a highly capable and satisfactory manner. D. A. Marshall took Mr. Knight's place for the remainder of the field season.

Previous Work

In 1880, when a location for the Canadian Pacific railway was being sought, a trial line surveyed by W. A. Austin traversed the area lying between Nabakwasi[1] lake and Mattagami[2] lake. In 1875, Robert Bell in the course of an extensive reconnaissance survey between Lake Huron and James bay, described the sediments at the south end of Mattagami lake, and crossed the portage to Wanatangua lake. In 1899, W. A. Parks traversed Mattagami lake to its southern extremity. His report is accompanied by a coloured geological map. In 1900, J. R. L. Parsons traversed parts of the area described in this report, which had been visited earlier by Bell and Parks. In 1900, A. P. Coleman reached Mattagami lake via Nabakwasi lake. In 1916, the Geological Survey of Canada published a preliminary map-sheet[3] to accompany a report by T. L. Tanton on reconnaissance traverses along the Canadian Northern Ontario railway (now the Canadian National railway) between Gogama and Oba. This map indicates a narrow belt of Keewatin schists extending from the southern extremity of Mattagami lake to Minisinakwa lake and beyond. These rocks are now mainly regarded as being sedimentary in origin and belonging to the Ridout series. In 1917, the Geological Survey of Canada published a memoir entitled "Onaping Map-Area," by W. H. Collins. This report gives a very detailed and admirable description of the general geology and petrographic nature of the rocks in the

[1]Originally Napawquazi.

[2]A contraction for Mattawagami or Mattawagamanque, meaning branch or fork lake.

[3]"Explored Routes in a Belt Traversed by the Canadian Northern Ontario Railway between Gogama and Missonga," Pub. No. 1697.

eastern part of the area. References to other geological work, no less important than that above, are included in a selected bibliography listed below.

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H. C. LAIRD, "Geology of the Three Duck Lakes Area," Ont. Dept. Mines, Vol. XLI, pt. 3, 1932.

Topography and Drainage System

The Makwa-Churchill area displays a monotonous repetition of topographical features characteristic of the central part of Northern Ontario. In general, it is a region of moderately low relief and consists largely of low hills interspersed with wet muskeg areas. Any trace of pre-glacial ruggedness has no doubt been further obliterated by the infilling or dumping of subsequent glacial deposits in the hollows, a process that gives the present surface a gently undulating appearance. Dome-shaped hills with gentle slopes occur in the central part of Brunswick township, where, in some cases, they attain an elevation of 200 feet or more above the level of the main watercourses. Relatively high hills of a more rugged nature occur in the southeastern part of Connaught township near Elephanthead lake. In other parts of the area hills seldom rise more than 100 feet above the general level of the surrounding country.

It may be observed from the accompanying map that the main watercourses occur along well-defined north-south fault lines, among the more conspicuous of which are the Minisinakwa lake fault, the Groves-Hanover lakes fault, the Nabakwasi river fault, and the Mattagami-Nabakwasi lakes fault. These "breaks" show up particularly well from the air, where they are seen to extend across the country in parallel lines for many miles beyond the limits of the area under discussion. Fault escarpments are not commonly observed, but one striking instance is that on the east side of the Nabakwasi river just south of the 15-chain portage. At this point a cliff of granite a quarter of a mile long rises almost vertically out of the water to a height of about 250 feet.

A gently undulating sand plain occupies much of the country between the Nabakwasi river and Elephanthead creek. It extends south toward Nabakwasi lake and north for several miles on either side of Mattagami lake. Within this area are many topographical features indicative of glacial phenomena, such as esker ridges and kettle lakes. A fine example of the latter is Wanatangua lake on the portage route between Mattagami lake and Waonga lake. This lake contains beautiful clear cold water and has no outlet. It lies in a steep-walled depression 150 feet or more below the level of the surrounding sand plain, and 100 feet below Waonga lake, which is located a few chains to the south.

Aerial view of Mattagami lake looking south. The outlet of Claw creek is seen in the left foreground. Waonga and Nabakwasi lakes are in the background.

The height-of-land between the St. Lawrence and Hudson bay watersheds passes through Connaught township. The main rivers to the west of this line are the Mollie, Noble, and Nabakwasi, which form a part of the Mattagami river system. These streams carry a considerable volume of water, since their drainage basins extend as far west as Yeo township and south to a point a few miles south of Ruel station on the C.N.R. Except for short stretches of rapids and waterfalls, the rivers mentioned above are readily navigable by canoe. A notable exception, however, is that part of the Mollie river between Makwa and the railway bridge at the south end of Minisinakwa lake, where rapids and waterfalls occur over practically the whole distance. Over most of its course the Nabakwasi river is a fairly wide stream, especially in its lower reaches; but in places it flows through narrow rock gorges, where, in the spring, the swirling waters, using boulders as tools, have cut deep pot-holes in the solid rock. At the 15-chain portage pot-holes 3 feet deep and 2 feet in diameter were observed.

In connection with the power development at Wawaitin Falls, Mattagami lake was converted into a supply reservoir, as a result of which the water level was raised about 12 feet. The lower part of the Nabakwasi river was flooded back to the 13-chain portage where the depth of the waterfall decreased accordingly. Below this point a waterfall completely disappeared. At the same time a lagoon at the south extremity of Mattagami lake was flooded and made navigable for another half mile or more.

Elephanthead creek flows north through the central part of Connaught township close to the height-of-land and empties into Claw creek[1] in the south central part of Cabot township. For the most part, it meanders through sandy country and low alder swale. It carries a considerable volume of water at all times and has a current estimated at about 1 mile per hour. This stream, which at present is not navigable on account of numerous log-jams, fallen trees, and brush, could readily be made a good canoe route through the centre of a township that otherwise is not easily accessible by canoe.

The waters in Churchill township flow into the west branch of the Montreal river, and belong to the St. Lawrence watershed. West Shiningtree[2] lake is characterized by a very irregular, rocky shoreline. It empties into Okawakenda[3] lake by way of West Shiningtree creek, a wide shallow stream broken only at its

Rapids at the 13-chain portage, Nabakwasi river, Brunswick township.

inception by a half mile of rapids and near its outlet by one short stretch of rapids, in which a channel has been cleared so as to make a portage unnecessary. Okawakenda lake empties into Michiwakenda[4] lake, the waters of which in turn reach the Montreal river by way of Wasapika lake.

Natural Resources

Timber

The eastern part of the Makwa-Churchill area lies within the Timagami Forest Reserve, the west boundary of which follows the portage route between Mattagami lake and Nabakwasi lake, as shown on the map accompanying this report.

Lumbering operations have been confined to Groves and Champagne townships, where numerous abandoned camps and logging roads attest the

[1]Called "Wabasistagenda" on old maps.
[2]Derived originally from the Ojibwayan name of a small lake on the route to the west branch of the Montreal river, meaning "bare white tree."
[3]A contraction of an Ojibwayan word meaning "big pickerel."
[4]A contraction of an Ojibwayan word, "Michigowganda," meaning "on the way to Gowganda."

magnitude of activity in previous years. These operations were carried on largely by jobbers, who delivered their product to the mills in Gogama. White pine appears to have been the principal type harvested. Other coniferous types, such as red or Norway pine, jackpine, and spruce, are still plentiful, particularly fine stands of red pine having been observed in the vicinity of Shuller lake. No lumbering has been carried on in Brunswick township, where fine stands of white pine, red pine, and jackpine remain to be harvested, if they are not already over-mature. In the central part of Brunswick township, just west of the Nabakwasi river, giant white pines belonging to the old forest tower majestically above the forest of more recent growth. Farther east, in the vicinity of Mattagami and Waonga lakes, approximately 75 per cent. of the coniferous trees are red pine. Officials of the Ontario Forestry Branch rate the standing timber in this area as largely mature coniferous and mixed, and, in part, semi-commercial.

As a result of the lumberman's axe many parts of Groves and Champagne townships are covered with heavy brush and slash, making a traverse difficult and creating a most dangerous fire hazard during the summer season. In recent years, however, the area has been fortunate in escaping any serious conflagration. Small brulé areas were encountered at Makwa (burned in 1921), at Hanover lake, at Okawakenda lake, at Mataris lake in the central part of Connaught township, and on the southwest side of Nabakwasi lake. The West Shiningtree fire in 1911 swept the country lying between West Shiningtree lake and the Montreal river. The old brulé is now being replaced by young poplar, birch, and jackpine, which, in places, form very dense thickets.

Nature itself has been a potent agent in the general destruction of the forest. This is particularly true in Brunswick township, where hurricanes of recent years have swept wide swaths through the bush laying low everything in their paths for many miles. Even more noticeable is the almost total annihilation of the Canada balsam as the result of the ravages of a larva said to be allied to the spruce budworm. Scarcely a living tree of this species was seen anywhere in the area.

Fish and Game

The lakes and rivers of this area abound in types of fish common to northern waters, namely pike, pickerel, sucker, whitefish, perch, and ling. Commercial fishing is done on a small scale in Mattagami lake. Okawakenda lake is noted for the large size of its pike and pickerel. In 1929, the Fish Culture Branch, Ontario Department of Game and Fisheries, planted 2,000 small-mouthed black bass fingerlings in Minisinakwa lake.[1] If this stock has not been entirely destroyed by other rapacious types, enthusiastic anglers may expect to hook them at least by next season.

Big game is rather scarce, only one moose and two red deer being seen by the party during the entire season. The black bear is very common. Although most of the common fur-bearing animals were observed, trappers state that they are really scarce and that trapping is an unprofitable venture.

Water Power

Possible sites for the development of small quantities of water power occur on the Mollie river, a quarter of a mile east of Makwa, and at the 15-, 18-, and 13-chain portages on the Nabakwasi river. It seems improbable, however, that it would ever be necessary to harness these sites for other than very local needs, since the Ontario Hydro-Electric Power Commission, whose transmission line

[1]Ont. Dept. Game and Fisheries, 23rd Ann. Rept., 1929, p. 34.

traverses the area, could supply cheaply almost any quantity of power required for mining purposes.

Agriculture

As yet the area is not adapted to broad agricultural pursuits. It should be stated, however, that when the necessity arises much of Brunswick and Connaught townships will be cleared and made to yield profitable crops. For the most part, the soil is a sandy loam well adapted to the growth of vegetables, particularly potatoes.

Mapping Methods

In the compilation of the accompanying map, township plans provided by the Ontario Department of Surveys were used as a base. The lakes in the south half of Groves township were surveyed by means of a Lugeol split-lens micrometer with prismatic compass control, the traverse being tied to known points on township lines. When time did not permit mapping by this method, rough sketches of the lakes and streams were made, these being indicated on the map by broken lines. In the eastern part of Connaught township a rough survey of the lakes was made a few years ago by Lloyd Foster of Shiningtree. This information, in part, was used in the compilation of this part of the sheet. Bush traverses, controlled by standard pace-and-compass methods, were made at suitable intervals, depending on the locality and the nature of the information desired. For 1933, the magnetic declination in this area was 9° 10′ west of true north.

GENERAL GEOLOGY

The consolidated rocks in this area are pre-Cambrian in age. The assemblage consists of a wide variety of extrusive, intrusive, and sedimentary rocks, the age relationships of which have been fairly well established.

Champagne township is underlain largely by granitic rocks. A few scattered outcrops in the southern part indicate that granite gneiss underlies this heavily drift-covered section. At Makwa, granodiorite containing many recrystallized basic inclusions is the common type. This granodiorite is a part of the Three Duck lakes batholith lying to the west. North of Makwa, as far as mileage 80 on the C.N.R., there is a rather striking assemblage of transition rocks consisting of granite, granodiorite, diorite, greenstone, and acid porphyry dikes. These types alternate in a most bewildering manner and must be regarded as a fine example of a broad contact zone between the Keewatin and Algoman rocks.

The townships of Groves and Brunswick are traversed by a belt of sediments known as the Ridout series, the average width of which is approximately 1¼ miles. These rocks are well exposed on the east shore of Minisinakwa lake toward the south end, along the railway between mileage 80 and 81, at the north end of Hanover lake, along the Nabakwasi river in the central part of Brunswick township, and on the east side of Mattagami lake near the extreme south end. For the most part the series is strongly sheared parallel to the bedding, and consists of boulder conglomerate, greywacké, sericite schist, arkose, quartzite, and iron formation. The strike varies between N. 80° E. and S. 60° E.; and although the dip is likewise variable, for the most part it is close to the vertical. The south boundary of the sediments is everywhere in contact with granite, whereas the north boundary is separated from the granite by narrow belts of either hornblende schist or tuffaceous greenstone.

In the eastern part of the area, i.e. Cabot, Connaught, and Churchill townships, sediments, pyroclastics, and greenstones have a wide distribution. Intrusive rocks, such as porphyry, lamprophyre, and diabase, likewise occur, but in less volume than the extrusive types.

The Ridout sedimentary series may be readily traced from the south end of Mattagami lake eastward to Elephanthead creek. Between this point and the east boundary of Connaught township the sediments are extremely altered and schisted, so much so, in fact, that their original nature and origin is in many cases very obscure. Moreover, if the general field relationships were not known, these rocks might readily be considered as highly altered and schisted acid lavas or even porphyries. The sediments cross the east boundary of Connaught township 26 chains south of the 5-mile post; at this point the belt is probably not more than 10 chains in width. They continue eastward across the north half of Churchill township as far as Michiwakenda lake, where they terminate abruptly owing to a well-defined fault.

In Connaught and Churchill townships the sediments are closely associated with a thick series of acid to intermediate flow rocks and pyroclastics, with which they are thought to be infolded in a syncline. The latter rocks occur in wide belts on either side of the sediments, structurally underlying them. Farther out, and structurally beneath the acid volcanics, are basic volcanics consisting largely of an undifferentiated complex of pillow lavas, andesite, and basic tuffs, all of which are typically Keewatin in age. Unfortunately there are few places where the actual contact between the sediments and volcanics may be observed. However, one exposure on the north shore of Okawakenda lake near the middle shows that there is no apparent structural unconformity, but rather that the contact is marked only by a gradual passing from volcanic to sedimentary types. More will be said, in another section of this report, of this relationship between what are here designated as Keewatin and Timiskaming rocks.

Lying within the area of volcanics and sediments and intrusive into them are dikes and stocks of late Algoman rocks, the distribution of which is more widespread in the eastern part of the area than in the western part. Porphyry dikes and lamprophyre dikes are commonly observed, but, as a rule, they are narrow and probably not important with regard to mineralization. More significant in this respect, however, are stocks of diorite, quartz-feldspar porphyry, and granite porphyry. The Saville gold quartz showing in the Claw lake section of Cabot township would appear to be associated genetically with a stock of diorite 1½ miles long and half a mile wide. Gold-bearing quartz veins in the West Shiningtree camp are thought to be related to small irregular intrusions of granite porphyry, quartz porphyry, and feldspar porphyry. About half a mile south of the 4-mile post on the north boundary of Connaught township there is a small stock of reddish quartz-feldspar porphyry, in the environs of which one might expect to encounter gold-bearing quartz veins; as yet none have been disclosed.

Toward the centre of Connaught township, just east of Elephanthead creek, there are isolated areas of a fresh-looking, flat-lying, reddish boulder conglomerate closely associated with beds of impure arkose or greywacké. The general appearance, attitude, and unmetamorphosed condition of these rocks suggest that they are outliers of the Cobalt series, the parent mass of which occurs in Natal township, 10 miles to the northeast.

Diabase dikes are very common. Both quartz and olivine varieties occur, the former being by far the most abundant. On the accompanying map no distinction is made between them, both types being considered as Matachewan in age. Certain olivine varieties, however, are definitely later than the quartz diabases, and may be of Keweenawan age.

Table of Formations

QUATERNARY	
RECENT:	Sand beaches, peat, diatomaceous marl.
PLEISTOCENE:	Glacio-fluvial deposits.
	Unconformity
PRE-CAMBRIAN	
KEWEENAWAN:	Diabase sills and sill remnants.
ANIMIKEAN: (Cobalt series)	Conglomerate, greywacké.
	Unconformity
MATACHEWAN:	Diabase dikes and sills.
	Intrusive contact
ALGOMAN:	Hornblende and mica lamprophyre. Quartz-feldspar porphyry, diorite. Porphyritic granite, pink and grey granite, gneiss, granodiorite, diorite.
	Intrusive contact
PRE-ALGOMAN: (Haileyburian?)	Diorite, serpentine-carbonate rock.
	Intrusive contact
TIMISKAMING: (Ridout series)	Schistose conglomerate, greywacké, arkose, quartzite, slate, sericite schist, banded iron formation.
	Unconformity
KEEWATIN:	Iron formation. Upper Group: Hornblende andesite and trachyte flows, tuff, and agglomerate. Lower Group: Andesite, pillow lava, hornblende schist, basic tuff.

Keewatin

Except for a narrow strip in Brunswick and Groves townships the Keewatin rocks are confined to that part of the area lying east of Mattagami and Waonga lakes. They form the south border of a broad area of Keewatin rocks extending north toward Porcupine and Abitibi lake. They consist mainly of volcanic types, including varieties of andesite, trachyte, rhyolite, and their associated tuffs and agglomerates. On the basis of wide differences in lithological character as well as stratigraphical arrangement, these rocks have been divided into what will hereafter be known as the Upper group and the Lower group, the stratigraphical succession of which is as follows: The infolded Ridout series of sediments is underlain on either side by broad subparallel belts of acid volcanic types, which are included in the Upper group. These, in turn, are underlain by another subparallel series of highly folded and strongly metamorphosed rocks, to which, in many cases, the term "greenstone" is especially applicable; this is the Lower group. Whether or not these groups are separated by an unconformity has not been established here, but it is noteworthy that evidence of such a relationship has been recorded by others who have studied a similar succession of rocks a few miles to the east in the Shiningtree Lake area[1] and in Tyrrell township.[2]

More information than is available at present would be necessary before the boundary between the Upper and Lower groups of volcanics could be mapped with any degree of accuracy. For this reason a notation rather than a colour is used on the map to mark the approximate location of these rocks.

[1]Geo. B. Langford, "Shiningtree Silver Area," Ont. Dept. Mines, Vol. XXXVI, pt. 2, 1927, pp. 88, 89.

[2]A. R. Graham, "Tyrrell-Knight Area," Ont. Dept. Mines, Vol. XLI, pt. 2, 1932, pp. 33, 36.

Lower Group

The rocks in this group occur widely in Connaught township, in the south half of Churchill township, and in the north half of Asquith township. They constitute a schist complex varying somewhat in general appearance and degree of metamorphism, but they are predominantly dark-green, highly altered basic lavas, close to andesite in composition. In places the lavas are massive, coarse-textured types having the appearance of diabase or diorite. In other places narrow east-west belts of chlorite schist are metamorphic expressions of the strong shearing movements to which these basic rocks have been subjected. In Cabot township, the flows have a general east-west strike and vertical dip, but eastward in Churchill township, where the rocks have been much disturbed by folding and faulting, they have a northwest-southeast strike, but still maintain their vertical attitude, or nearly so. Throughout the area it was observed that the strike of the schistosity in the volcanics was parallel to that of the flows, and that this in turn was approximately parallel not only to the Ridout series contact but to the bedding of the sediments themselves.

In the Mattagami-Claw lakes section there are many narrow bands of rather basic tuffs, agglomerates, and flow breccias interbedded with lava flows. No doubt this is true of other parts of the area, but it is less noticeable. As a rule, a flow grades upward into pyroclastic types with little or no line of demarcation between them. The contact with the overlying flow, however, is rather sharp. One of the few places where the latter feature was observed was on the south side of the narrows at Claw lake. Nowhere was there sufficient exposure to measure the actual thickness of any individual flow, but they are probably seldom more than 300 to 400 feet thick, the majority being much less.

Pillow or ellipsoidal lavas were encountered in various places throughout the Keewatin area. The area of greatest distribution is that in the environs of West Shiningtree lake, Churchill township. Smaller areas of the same rock were observed at Cryderman lake and on the east shore of Michiwakenda lake, 1½ miles from the south end. The rock is a rather basic type of andesite, varying in colour from greyish-green to dark-green, usually with a fine-grained texture. For the most part it has a somewhat fresh appearance, but thin sections under the microscope show that it is composed largely of highly altered feldspar and secondary hornblende. The outstanding feature, of course, is the development of excellent subellipsoidal structures ranging from a few inches to several feet in diameter. Adjacent ellipsoids are separated by a narrow zone half an inch to two inches wide of rusty-weathering epidotic interstitial material. These structures are particularly conspicuous along the rocky shores of West Shiningtree lake toward the north end. Commonly the ellipsoids are seen only in cross-section, but in several instances close to the water's edge wave action has exposed them almost in their entirety. As a rule, Keewatin lavas of this type are characterized by the presence of small amygdules or gas cavities near the periphery of an ellipsoid. Although they were eagerly looked for, since their distribution often gives a clue to structural relationships, none were observed here.

A more acid type of ellipsoidal andesite occurs along the north shore of Wire lake, Connaught township. The freshly broken rock is fine-grained and greyish-green in colour, whereas the weathered surface is characterized by a distinct reddish-brown colour.

In many places the greenstones of the Lower group are in contact with broad areas of granite intrusives, the contact metamorphic effects of which are very marked. Along the north contact, between Minisinakwa lake and the Nabakwasi river, a strip of greenstone ranging from 4 to 40 chains in width has been converted into hornblende-chlorite schist. This contact action has been particularly intense in the vicinity of Vendette lake. Along the south contact the occurrence of a broad zone of transition rocks is further evidence of the strong contact metamorphic action to which these rocks have been subjected. The general character of this zone will be described under the heading of granite.

In the vicinity of Speed and Gosselin lakes, in the south central part of Churchill township, and extending for three miles southeast toward Stewart lake, there are localized bands of rusty-weathering carbonate rock, unweathered portions of which are a pleasing malachite green. A chemical analysis[1] shows that this rock is an impure magnesium-iron-lime-carbonate type. It is closely associated with small intrusive masses of porphyry and is intersected by intricate stockworks of auriferous quartz veins. This relationship leads to the supposition that this carbonate rock is the result of strong hydrothermal alteration of the greenstone. The alteration was caused by the invasion of hot carbonated waters exuded from the intrusives. Carbonate rocks of this type are common in the Keewatin areas of Northern Ontario, notably at Porcupine, Night Hawk lake, Larder lake, and Abitibi lake.

As far as is known, no iron formation occurs within the volcanics of the Lower group, but in the east central part of Churchill township a band of this rock lies between the Lower and Upper groups. It has been traced from Perkins lake southeast across the Cochrane and Gold Corona properties, a distance of two miles. On the latter property it consists mainly of black aphanitic material strongly impregnated with pyrite and quartz, which occur in stringers. On weathering the pyrite gives rise to a dark-brown limonitic substance.

Upper Group

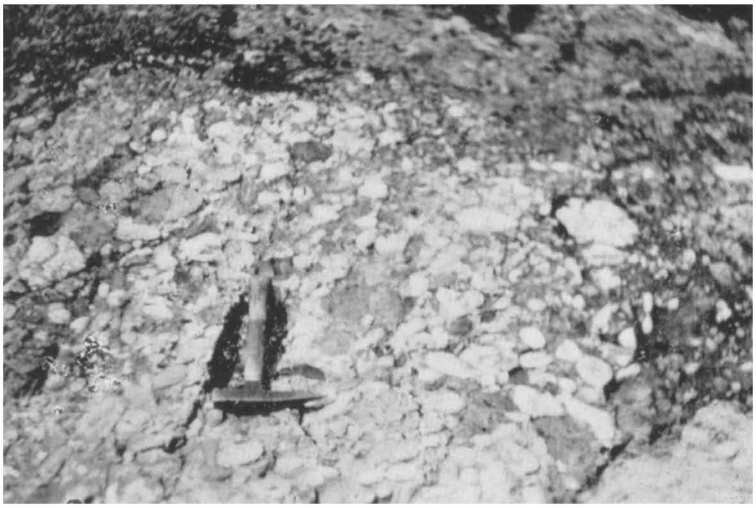
The rocks of the Upper group are confined largely to that part of the area lying between Elephanthead creek and Michiwakenda lake. Excellent exposures occur on Okawakenda lake and toward the north end of Michiwakenda lake. The rocks consist of hornblende andesite and trachyte flows, and their associated breccias, tuffs, and agglomerates. As compared with the rocks of the Lower group they have a distinct fresh appearance and are quite massive, being free from intense folding or shearing movements. Flow structures are not common, but in places rudely developed pillow structures were observed, viz. certain tuffaceous flows at the extreme north end of Michiwakenda lake.

The hornblende andesite is a fine-grained, dull greyish-green rock with varying amounts of black hornblende occurring as slender glistening prisms up to one-half inch in length. It is a more acid type of andesite than that in the Lower group. Other varieties, more acid in composition, are greyish in colour, contain fewer hornblende prisms, and show a marked development of light-coloured phenocrysts of feldspar. A thin section under the microscope shows phenocrysts of hornblende, plagioclase, and orthoclase set in a dense felsitic matrix of the same materials and their alteration products. The feldspars are quite turbid on account of alteration products, and much of the hornblende is altered to chlorite. The rock may be properly called a trachyte. Toward the west end of Okawakenda lake, the trachyte is pale-reddish in colour, and locally shows the development of porphyritic texture with phenocrysts of hornblende and feldspar. In hand specimens this rock bears a strong resemblance to certain reddish hornblende lamprophyre, with which it might readily be confused, but the latter may be distinguished by the fact that it always occurs in the form of

[1]P. E. Hopkins, "West Shiningtree Gold Area," Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, p. 33.

dikes. The reddish porphyritic variety, moreover, has frequently been mistaken for intrusive porphyry of the syenite type. As a rule, however, close examination will reveal delicate reddish to greenish mottled effects and a felsitic texture. In general, all gradations between hornblende andesite and hornblende trachyte occur, giving rise to a wide variety of rocks. So close indeed is their association that, in spite of their variable nature, they are believed to be phases of one and the same extruded magma.

Interbedded with the andesite and trachyte flows, but of more widespread distribution, are volcanic *ejectamenta* types, such as tuffs and agglomerates, the latter being merely a coarse phase of the former. The fragments vary in size from microscopic grains to boulders 8 inches in diameter. The larger ones are oval to subangular in shape and tend to become more angular with decrease in size. They are composed mainly of trachyte and andesite, materials similar in every respect to the flow rocks with which they are associated; the matrix is



Volcanic agglomerate, Okawakenda lake, Churchill township.

composed of the same materials. Black, cherty, vitreous fragments are not uncommon. Weathering tends to accentuate the fragmental character of these rocks, which on freshly broken surfaces is scarcely noticeable. The bedded character of the tuffs is not always clearly discernible, but a good example was observed on the most northerly point of the large island in Okawakenda lake near the west boundary of Churchill township. Here the beds strike at S. 65° E and have a vertical dip. The agglomerate has a marked tendency to occur in well-defined bands, which in many cases are so persistent as to constitute good horizon markers. A notable instance is the agglomerate band striking in an east-west direction across the islands and mainland at the west end of Okawakenda lake and outcropping again at the narrows toward the north end of Michiwakenda lake. This band is at least 4 miles long and a quarter of a mile in width.

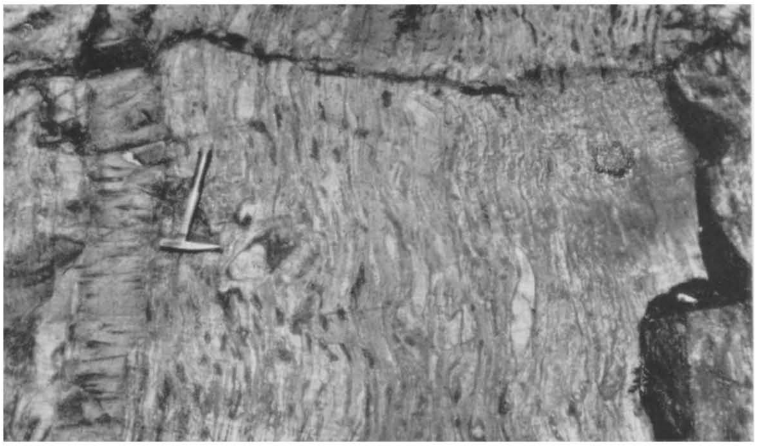
Timiskaming

Ridout Series

Although the occurrence of sedimentary rocks had been noted in the early explorations of parts of this area, the first detailed description was that given by

W. H. Collins[1] in his study of the Onaping map area. In this connection, however, his work was limited to those sediments in the region about Okawakenda lake, Churchill township. At a later date T. L. Tanton[2] traced these rocks from the south end of Mattagami lake westward to Schist lake, in the Three Duck Lakes area, but in his report and map he did not discriminate between the greenstone and the clastic sediments, apparently regarding them as a part of the pre-Huronian schist complex. Farther west, and at a still later date, R. C. Emmons and Ellis Thomson[3] mapped the sediments separately from the greenstones, and called them the Ridout series. As a result of subsequent mapping this series has been traced from the Swayze area to the West Shiningtree area, a distance of nearly 90 miles.

Although the belt would seem to terminate abruptly in Churchill township, it occurs again and has been mapped in the Tyrrell-Leonard area, 8 miles to the east. In this connection it should be noted that Duncan McDonnell, who has made a study of the geology in the northern half of Macmurchy township, states



Sheared conglomerate of the Ridout series, mileage 80½, Canadian National railway, Groves township. Note the narrow diabase dike.

that the Ridout series may be traced across the northern half of this township, and that there is no gap in the sedimentary belt between Churchill and Tyrrell townships. On one occasion Mr. McDonnell accompanied the writer to a point near the outlet of Big Four lake, Macmurchy township, where there is an outcrop of conglomerate undoubtedly belonging to the Ridout series.

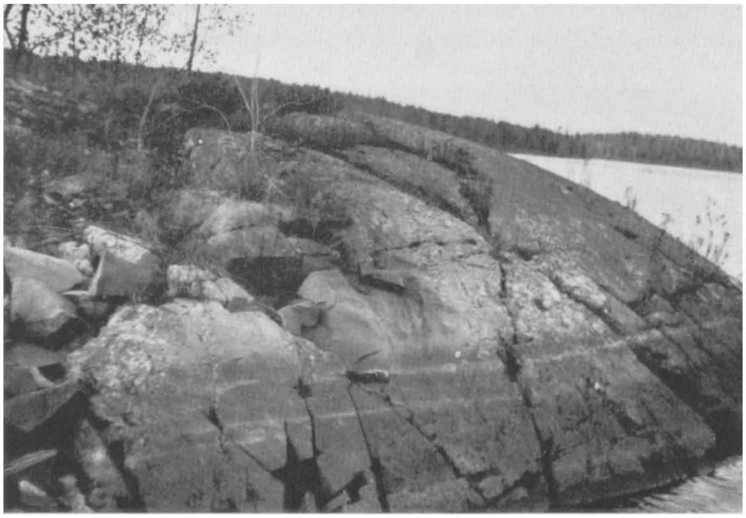
For the most part the Ridout series in this area possesses certain characteristic features that are common to the belt as a whole. So excellent and detailed has been the description of these features by officers of the Geological Survey, named above, that a further extended account would seem unnecessary. For the sake of completeness, however, a general description will be given.

The Ridout series is dominantly composed of greywacké, impure arkose and quartzite, conglomerate, and sericite schist, but slate and banded iron formation are prominent locally. Normally these rocks are strongly sheared in a general east-west direction, as is the case from Groves township to Connaught township;

[1]W. H. Collins, "Onaping Map-Area," Geol. Surv. Can., Mem. 95, 1917.
[2]T. L. Tanton, "Reconnaissance along Canadian Northern Railway between Gogama and Oba," Geol. Surv. Can., Sum. Rept., 1916, pp. 179-181.
[3]R. C. Emmons and Ellis Thomson, "Preliminary Report on Woman River and Ridout Map-Areas," Geol. Surv. Can., Mem. 157, 1929.

but toward the east end of Okawakenda lake, they are more massive in appearance, the shearing movements apparently having petered out. The dip of the beds, except in the Okawakenda lake section, is never far from the vertical, and in most cases the beds stand on edge. The more easily altered types, such as greywacké, conglomerate, and arkose, have undergone intense alteration to chloritic, sericitic, and carbonated materials.

Conglomerate occurs in the position of a basal conglomerate, i.e. at both margins of the sedimentary belt, as well as at various horizons within the belt. This recurrence of conglomerate bands may be ascribed to the complex folding to which the whole series has been subjected. As a rule, the narrow bands are elongated lens-shaped structures traceable for only short distances. The wider bands, however, are more persistent as to length; for example, the band extending

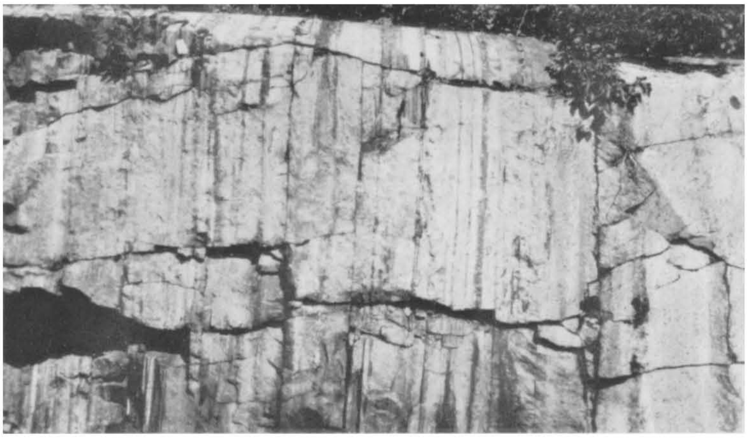


Narrow lenses of coarse conglomerate in massive greywacké of the Ridout series, small island at the east end of Okawakenda lake, Churchill township. Note the *roche moutonné* shape of the outcrop caused by glacial ice movement.

eastward from the south end of Mattagami lake to the central part of Connaught township has been traced for nearly two miles. An excellent vertical exposure on the east shore of the lake indicates that the conglomerate band is at least 1,500 feet wide, a figure singularly great if it represents the true thickness of the deposit. Since folding and faulting commonly cause the duplication of beds, a feature not always clearly discernible in outcrops of limited extent, the danger of assuming a thickness of this magnitude is readily apparent.

The conglomerate contains a wide variety of pebbles and boulders. In the western part of the area they are mainly granite, gneiss, red jasper, black chert, and greenstone, whereas in the eastern part of Churchill township they are largely volcanic types apparently derived from the underlying andesite, trachyte, and tuffs; granite, porphyry, and black chert are less common here than is usually the case elsewhere along the belt. Normally the pebbles and boulders have been greatly stretched in the direction of the schistosity, but in the region about Okawakenda and Michiwakenda lakes, where the beds have not been sheared, they are well rounded to subangular, and closely crowded together. The matrix is predominantly greywacké, but arkose and feldspathic quartzite types were also observed. In general, the conglomerate grades into other types, such as greywacké, arkose, or slate, the gradation being marked only by the disappearance of pebbles.

Greywacké and arkose have a wide distribution in this area, particularly in the western part. In the field, the distinction between these rocks is more or less an arbitrary one based largely on colour, the light-coloured varieties being referred to arkose. All gradations between greywacké and arkose were observed. Under the microscope the so-called arkose shows an abundance of impurities, so much so in some cases that the term "greywacké" might be more appropriate in order to be strictly within the limits of the definition as proposed by certain authorities in these matters. Where these rocks have not been strongly sheared they frequently display a distinct banded appearance, owing to the alternate arrangement of light- and dark-coloured materials, as in varved clays, which they strongly



Vertical section of banded greywacké of the Ridout series, rock cut on the Canadian National railway, 10 chains north of the 80-mile post, Groves township.

resemble. A particularly fine illustration of this feature occurs in a rock cut on the C.N.R., 10 chains north of the 80-mile post.

Light-coloured bands of feldspathic quartzite occur locally. Thin sections under the microscope show a predominance of clastic quartz grains, and minor amounts of feldspar and ferromagnesian minerals.

Slate is not of widespread distribution in this area, being confined almost entirely to the eastern part of Churchill township. Fine exposures occur along the east shore of Michiwakenda lake; on the large islands and mainland in the east half of Okawakenda lake; and in the deep bay of Okawakenda lake into which West Shiningtree creek flows. It is a fine-grained, dark-grey to muddy-green rock showing excellent bedding. In places the *laminae* display variegated colours to such an extent that the beds have a distinctly banded appearance. In every instance, the beds are strongly contorted and show excellent drag folds and fracture cleavage. In places, thin bands of slate up to 5 inches in width are intercalated with beds of greywacké.

On the large islands at the east end of Okawakenda lake, and on the east side of Michiwakenda lake just opposite the bay leading to Okawakenda lake, are exposures of well-banded iron formation, the thickness of which probably does not exceed 100 feet. It is distinctly a phase of the slaty formation, since the *laminae* consist of alternating layers of reddish iron oxide and greenish slate. The iron-rich layers are never more than half an inch in thickness and diminish almost to paper thinness in some cases. The iron occurs mainly in the form of hematite, but locally magnetite is present in quantities sufficient to seriously deflect a compass. The total iron content is small.

Iron formation, more typical than that noted above, occurs in a band close to the south shore of Pensyl lake, Groves township. This band has been traced for three-quarters of a mile and is probably not more than 50 feet in width. At one point near the east end of the lake the band consists of alternating layers of dark chert and magnetite, in the vicinity of which there is strong magnetic attraction. On the east shore of the lake, magnetite is absent and the band consists of light-coloured cherty quartz having a rudely laminated appearance. The strike of the iron formation conforms to that of the accompanying greywacké, with which it is interbedded.

Contorted beds of slate of the Ridout series, north shore of Okawakenda lake, Churchill township. Note the glacial striae.

Age and Relationships of the Ridout Series

Previous geological work[1] by officers of the Geological Survey of Canada led to the conclusion that the Ridout series is Keewatin in age. The writer, up to the present, has not been able to subscribe to this view, but rather holds that the Ridout series belongs to the Timiskaming period of sedimentation. In a report on the Three Duck Lakes area[2] evidence in support of this conclusion was presented, and evidence of a similar nature was observed in the area under consideration.

The Ridout series possesses certain lithological features that have long been regarded as typical of the Timiskaming series in other areas of Northern Ontario and Quebec; in other words, they look like the Timiskaming rocks. The materials composing the rock, the well-banded appearance, and the vertical attitude of the beds are all characteristic of the Timiskaming series.

[1]W. H. Collins, op. cit., p. 41.
R. C. Emmons and Ellis Thomson, op. cit., pp. 4, 18.
[2]H. C. Laird, Ont. Dept. Mines, Vol. XLI, pt. 3, 1932, p. 18.

In other parts of Ontario and Quebec, where Timiskaming rocks have been mapped, an unconformable relationship with the Keewatin rocks has, in every case, been recognized, whether it be an erosional one, structural, or both. That an erosional unconformity exists between the Keewatin volcanics of the Upper group and the Ridout series is reasonably certain from the fact that conglomerate bands lying in the position of a basal conglomerate, i.e. at or close to the bottom of the sedimentary series, are composed largely of the debris of the subjacent volcanics. The north shore of Okawakenda lake affords one of the few places in this area where this relationship may be observed. Here, the volcanic tuffs grade upward into a well-bedded slate horizon, 100 feet or more in thickness, with no evidence of a structural unconformity; the slate in turn grades upward into a thick conglomerate band. The pebbles in the conglomerate are predominantly trachyte and andesite tuff and flow materials precisely like that of the underlying volcanics; pebbles of granite, diorite, chert, and slate occur less abundantly.

Reddish banded iron formation of the Ridout series, east side of the large island at the east end of Okawakenda lake, Churchill township.

The occurrence of an erosional unconformity signifies a time interval between the periods of deposition of the fragmental volcanics and the Ridout series. That this interval was of relatively short duration is suggested by two observations noted above: First, the volcanics and sediments are structurally conformable and grade into one another; second, the conglomerate shows a notable homogeneity of pebbles, on account of their having been derived from a rather localized area. Had the time interval been great, one might expect to find a wider variety of pebbles than is the case.

Farther west in Connaught township the Upper group of volcanics is absent, the Ridout series being in contact with the greenstones of the Lower group. Evidence of a discordant relationship was observed at Wire lake, where the contact is marked by a well-defined fault that strikes across the lake and follows the creek bed east from the Hydro camp. Within a few feet massive pillow lavas give place to highly contorted argillaceous schist of the Ridout series type. This schist grades upward into coarse arkose, which in turn grades into boulder conglomerate containing a wide variety of granite, chert, schist, and quartz pebbles. That the conglomerate in this instance is not a basal conglomerate does not militate strongly against the evidence of an unconformity, since there are many instances in the study of sedimentation where sediments have been deposited unconformably on older rocks without an intermediary conglomerate. This unconformity is believed to represent a reasonably long period of time, in which there was erosion rather than deposition.

So widely divergent are the relationships between the volcanic series and the sedimentary series in different parts of the area, that widely varying geological processes must have taken place. The chronology of events as based on observations noted in the preceding paragraphs is believed to have been as follows:—

In the eastern part of the area a brief interval of time followed the extrusion of the basic volcanics of the Lower group. This was followed by vulcanism of a more explosive type, with the result that great thicknesses of acid flows and tuffs were deposited. As this period came to a close there were weak intermittent explosions between brief periods of erosion and reworking of the volcanic materials under water. This would account for the gradational nature of the contact on Okawakenda lake. Farther west the tuffs appear to pinch out laterally on account of the increased distance from the volcanic vent or vents. In the western part of Connaught township, where they seem to fail entirely, their period of deposition is represented by a great hiatus or gap in the record, as expressed by a marked unconformity.

In connection with discordant relationships it should be stated that conditions similar to those noted above are known to obtain at the Keewatin-Timiskaming boundary in Porcupine, Kirkland Lake, and Quebec. In parts of these areas tuffs and agglomerates fill the gap between the Keewatin basic volcanics and the Timiskaming sediments, a feature that has frequently given rise to some apprehension as to where these rocks should be placed in the stratigraphical column. On lithological grounds the writer, in the area under consideration, has included them with the Keewatin, but there would seem to be no very serious objection to their being regarded as Timiskaming in age if the chronology of geological events as stated above be correct.

Pre-Algoman (Haileyburian?)

Among the basic plutonic rocks provisionally regarded as Haileyburian in age are two small masses of serpentine-carbonate rock close to the Churchill-Asquith boundary line, and a small mass of diorite on the portage route between Chris lake and Mataris lake, Connaught township. The outcrops of serpentine are found on the east side of Gosselin lake and on the south side of Chlorus lake. Hopkins[1] states that they are "probably altered peridotites which immediately preceded the acid rocks of the Algoman epoch." On Gosselin lake weathered surfaces show characteristic columnar structures hexagonal in outline and in juxtaposition. The diorite is a dark, coarse-textured, fresh-looking rock intruding the Ridout series.

Algoman

Various types of intrusive rocks believed to be of Algoman age occur in this area.

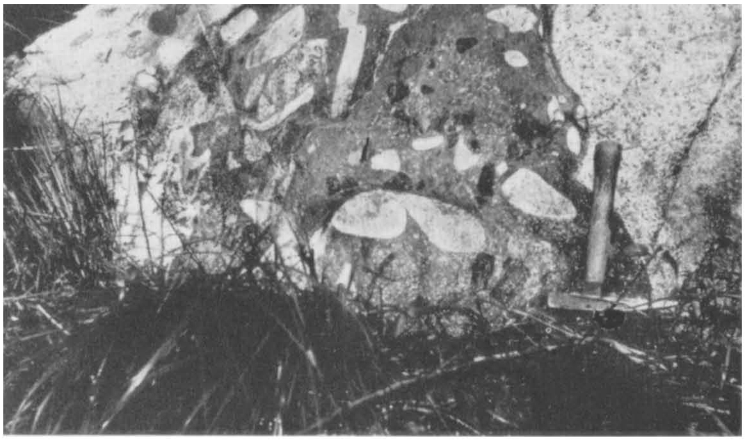
Granite, Gneiss, Granodiorite, Diorite

Granite, gneiss, granodiorite, and diorite have a widespread distribution on either side of the narrow belt of sediments and volcanics, but this report concerns only those in the immediate vicinity of the belt. The wide variation in their lithological character and composition suggests the intrusion of more than one magma, but this would be difficult to establish, since one type apparently grades

[1]Op. cit., p. 35.

into another. This observation is particularly well illustrated along the C.N.R. between mileages 74½ and 82. In one place greyish hornblende-biotite granite passes gradually into hornblende-biotite gneiss with no line of demarcation between them. South of Makwa grey biotite granite passes into granodiorite in a similar manner. Granodiorite, in turn, passes into diorite, the change being marked only by a gradual increase in the amount of dark mineral. Much of the rock that would ordinarily be called granite in the field is really a granodiorite, since plagioclase is the predominating feldspar. The granodiorite and diorite, moreover, are everywhere characterized by scattered eyes of blue quartz, the occurrence of which has not been observed in the typical granites. At the east end of the small lake on the portage route between Piggott lake and Shuller lake, there is an outcrop of reddish alkali granite consisting of little other than quartz and pink orthoclase.

Porphyritic varieties of all the above-mentioned rocks are commonly observed. Bordering the north boundary of the sedimentary belt between the



Algoman granite with a large inclusion of conglomerate of the Ridout series, Nabakwasi river, a quarter of a mile north of the 13-chain portage, Brunswick township.

Nabakwasi river and Mattagami lake there is an extensive area of coarse-grained, massive, red porphyritic granite of striking appearance and notably different from other porphyritic granites observed elsewhere in the area on account of the development of large phenocrysts of orthoclase feldspar and quartz. The feldspars are salmon-coloured and commonly attain a length of 4 inches and a diameter of 2 inches. On weathered surfaces quartz grains as much as half an inch in diameter stand out like grains of tapioca. In many respects this granite bears a strong resemblance to the Killarney granite along the north shore of Lake Huron, but of course the writer does not mean to imply contemporaneity.

The invasion of granite or granodiorite into the older belt of volcanics and sediments has produced noteworthy contact metamorphic effects resulting in broad zones of transition rocks. This condition obtains everywhere along the south margin of the belt and to a lesser extent along the north margin. Along the C.N.R. between mileages 78 and 79½ there is a bewildering alternation of greenstone and granodiorite bands, many of which are only a few feet in width. The disposition of these bands is such as to suggest that a rather flat-topped batholith invaded the overlying greenstone, roof pendants of which have been exposed by subsequent erosion. Farther out in the massive granodiorite, as in the vicinity of Makwa, there are great numbers of basic inclusions consisting largely of recrystallized greenstone. These inclusions vary widely in shape and size and show all stages of digestion from those retaining their original angular character, through those more or less rounded by assimilating processes, to those occurring only as dark vestiges of the original material. In Brunswick and Groves townships the granite is in contact with the Ridout series. The nature of this contact is well illustrated on the shores of a small lake 16 chains east of the north end of Piggott lake. The granite invaded the sediments parallel to the bedding, as a result of which there is a contact zone several hundred feet in width consisting of alternating bands of granite and schist, the latter being a metamorphic derivative of the sediments. Farther from the contact the granite contains fragments of the sediments in all stages of assimilation. In the vicinity of Elephanthead lake, Connaught township, the contact is in the nature of a brecciated zone. Apophyses of the granite penetrate the greenstone schist, and closely crowded angular blocks of the schist apparently floated out into the granite magma for short distances.

Porphyry and Lamprophyre

Quartz-feldspar porphyry is not common in the western part of this area. A few east-west trending dikes ranging from 1 to 15 feet in width were observed along the C.N.R. between mileages 79½ and 80½, and on the east and west shores of Minisinakwa lake. They are definitely younger than the granodiorite, since they intrude it. Other narrow porphyry dikes were observed at the north end of Piggott lake and at the north end of Hanover lake. Farther east, in Connaught township, porphyry intrusions would appear to be more common. Between Wire lake and Okawakenda lake there are two small stocks of reddish feldspar porphyry and numerous narrow dikes of the same rock. A thin section of the porphyry just west of Elephanthead creek shows phenocrysts of quartz, orthoclase, and plagioclase set in a dense fine-grained matrix of the same materials. The feldspars are turbid on account of strong alteration.

Acid intrusives in the form of dikes and stocks occur widely in the south half of Churchill township. The following description by P. E. Hopkins[1] can scarcely be improved upon.

> The light-coloured rocks in southeast Churchill township included with this group comprise quartz porphyry or rhyolite, granitic rocks, feldspar and granite porphyry, which grade at times into each other, thus making it difficult to separate them in mapping. They are quite massive and fresh-looking, and crosscut at times the green schist; nevertheless, some of the quartz porphyries may be connected with the rhyolites. . . . Certain gold-bearing deposits lie in the green schist not far from the north and east contacts of this group of rocks in southeast Churchill. The quartz porphyries are light-grey or pink. The numerous quartz and occasional feldspar phenocrysts stand out prominently in the dense fine-grained groundmass. The granitic rocks, which are at times in sharp contact with the quartz porphyries, are mauve in colour and have a fine and even grain. The microscope shows quartz, acid feldspars, biotite, apatite, chlorite, and magnetite. In places the granite becomes lamprophyric and porphyritic.

In the Claw lake section, Cabot township, a stock of granitic rock 1½ miles long and half a mile wide intrudes Keewatin tuffs. The mass shows all stages of differentiation from diorite along the south contact through granodiorite to typical red granite and acid porphyry along the north contact. The rock has a remarkably fresh appearance in hand specimens, but thin sections under the microscope show that it is strongly altered. The basic phase is a highly altered quartz diorite, thin sections of which show plagioclase, hornblende, and quartz. The feldspars have been altered to carbonate and sericite, and the hornblende to chlorite.

[1] Op. cit., p. 36.

On the shores of Claw lake, light-coloured dikes of quartz-feldspar porphyry are seen cutting the Keewatin volcanics. They range in width from a few feet up to 20 feet. Thin sections show large phenocrysts of plagioclase and quartz set in a fine-grained mosaic of quartz, sericite, epidote, and hornblende. These dikes are doubtless acid differentiates of the large granitic stock noted above. In this section the mineralization seems to be associated with dikes of this nature.

A few scattered dikes or sills of lamprophyre were observed, mainly in the eastern part of the area. The most notable example is the lamprophyre sill(?) on the Herrick property toward the south end of Michiwakenda lake. It is a dull reddish rock containing large phenocrysts of chloritized mica in book form, as well as large rounded fragments of what is apparently foreign material up to several inches in diameter. Its composition is such that it may be properly called a minette. A fine-grained dike rock, similar in outward appearance to that just mentioned, occurs on the east shore of Burns lake, Connaught township. A close examination of a thin section under the microscope shows that it is close to hornblende lamprophyre (camptonite) in composition. It is composed of phenocrysts of oligoclase feldspar slightly sericitized, chlorite pseudomorphs after hornblende, and apatite, set in a matrix of carbonated and sericitized feldspars, chlorite, magnetite, and a little quartz. The age of these lamprophyres has not been definitely established, but they are believed to be either very early or very late differentiates of the granite magma.

Matachewan

Diabase dikes cutting all the above-mentioned rock formations occur widely throughout this area, being particularly abundant in the eastern section. In Groves and Brunswick townships the strike of the dikes varies from east-west to north-south, but farther east they assume a very definite north-south alignment. They range in width from a few inches to 200 feet or more. Certain irregularly shaped masses of diabase in the eastern part of Churchill township are probably sill remnants. Both olivine and quartz varieties occur; the latter in many cases is porphyritic, having phenocrysts of highly altered yellowish-green feldspars (huronite) up to several inches in diameter. Magnetite is a common constituent of the olivine diabase, and in many instances occurs in such quantities as to cause strong magnetic attraction.

Since many of the dikes in this area exhibit lithological characteristics peculiar to diabase of Matachewan age, as established by intrusive relationships with the Cobalt series in the neighbouring areas of Gowganda and Matachewan, most of them have been assigned to the Matachewan period of diabase intrusion. To this group belong the quartz diabases, in particular those carrying phenocrysts of huronite. It should be added, however, that dikes and sills of the comparatively rare olivine-bearing diabase may be of Keweenawan age, and some of them have been so designated on the accompanying map. On the trail leading south from Burns lake, the Cobalt conglomerate has been intruded by a flat-lying sill of fine-grained diabase, which, on account of its intrusive relationship, may with certainty be assigned to the Keweenawan period of intrusion.

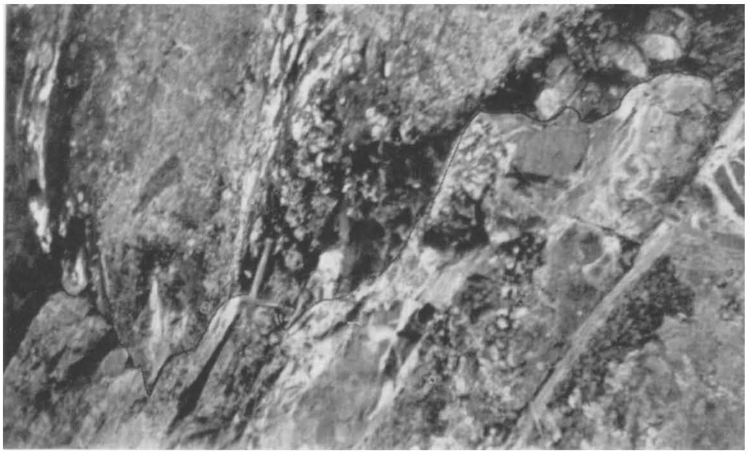
Animikean

Cobalt Series

Toward the centre of Connaught township, just east of Elephanthead creek, there are at least two isolated areas of a fresh-looking, flat-lying, reddish boulder conglomerate closely associated with arkose and greywacké. The general appearance, attitude, and unmetamorphosed condition of these rocks suggest that they are outliers of the Cobalt series (Gowganda formation), the parent mass of which occurs in Natal township, 10 miles to the northeast. In general, little difficulty would be experienced in distinguishing between this series and the older Ridout series.

Conglomerate of the Cobalt series, Connaught township.

The conglomerate is a very massive rock consisting of pebbles and boulders of widely varying shape, size, and composition, derived entirely from the pre-Cobalt basement. It grades imperceptibly into greywacké and arkose, which,



Cobalt conglomerate resting uncomformably on Keewatin hornblende andesite, Connaught lake.

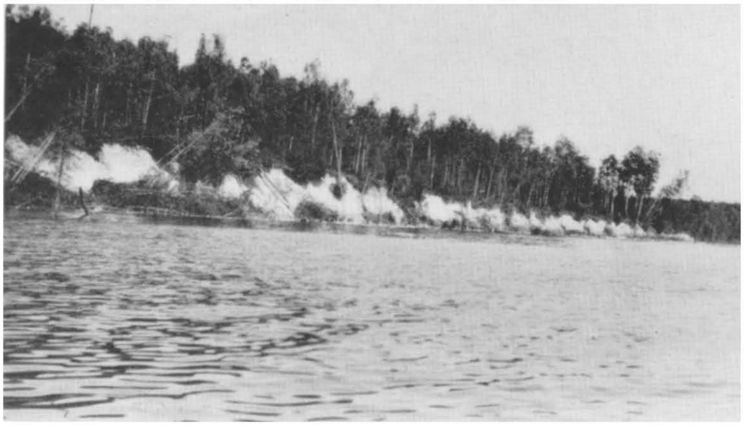
in some cases, have such a fresh appearance that the term "sandstone" would seem more applicable.

In a rocky cliff, near the narrows at the west end of Connaught lake, massive conglomerate beds may be seen resting discordantly on the older Keewatin hornblende andesite. The beds contain reddish granite boulders up to 4 feet in diameter and dip 30° S.W. The surface of the andesite is rough, and jagged pieces project up among the pebbles and boulders of the overlying conglomerate.

Pleistocene and Recent

Lying on the consolidated pre-Cambrian rocks, and separated from them by an unconformity representing a vast time interval, is a relatively thin mantle of unconsolidated materials consisting of sand, gravel, and clay. In Pleistocene time the advancing ice-sheet gouged and polished the underlying rock leaving characteristic features, such as glacial striae, flutings, *roches moutonnées*, and chatter marks. The direction of these surface markings indicate that the ice moved almost due south. The dumping of vast quantities of glacio-fluvial debris by succeeding recessions and advances of the ice-front greatly modified the earlier topography and resulted in characteristic glacial land forms, such as ground moraines, eskers, and pitted outwash plains.

Among the materials of glacial origin, unsorted sand and gravel predominate. Makwa marks the east limit of a gently rolling outwash sand plain extending far



Typical Pleistocene sand and clay deposits, west shore of Mattagami lake, Togo township.

to the south and west. Coarse gravel ridges of the esker type, having a north-south trend, occur in the vicinity of Shuller, Mattagami, and Nabakwasi lakes. A large part of Brunswick township is occupied by a gently undulating ground moraine, thick enough to conceal most of the underlying rock. Kettle lakes are common in the Mattagami-Nabakwasi section, Wanatangua lake being a notable example. In places, e.g. at Wanatangua lake, the drift attains a thickness close to 150 feet, but over the whole area the average thickness is probably not more than 20 feet. The north part of Miramichi township and most of Londonderry township are heavily drift-covered and display all the features of glacial topography mentioned above.

Since this area lies outside the clay belt regions of Northern Ontario, clay deposits are scarce and somewhat local in their distribution. Much of the ground moraine material contains boulder clay mixed with sand in such proportions as to constitute a loam.

Freshly exposed sections of stratified sand and clay may be observed at various points along the shores of Mattagami lake, where wave action has resulted in the caving of the steep-walled banks, which locally rise 25 feet or more above the new lake level. Cross-bedding is a feature commonly observed in both the coarse and fine sand deposits. On the west side of Mattagami lake, two chains south of the boundary line between Togo and Brunswick townships, there is an excellent exposure of interbedded sand and clay. Near the top of the section are three distinct dark-grey clay seams up to 2 inches in thickness alternating with light-coloured silty sand members up to one foot in thickness. Stratification planes within the individual members are clearly discernible. On the same side of the lake, and 16 chains farther north, a 12-foot section of varved clay is exposed at the water's edge. The varves are uniform neither in thickness nor composition. Dark-grey clay members up to 2 inches in thickness alternate with light-coloured silty clay members up to 16 inches in thickness. Toward the top of the section, the clay grades imperceptibly into well-stratified, fine, yellowish sand, a fact that indicates a change from quiescent to freshet conditions of deposition. Limonitic clay concretions occur abundantly in the lower part of the section. Most of them are rudely cigar-shaped structures up to 4 inches in

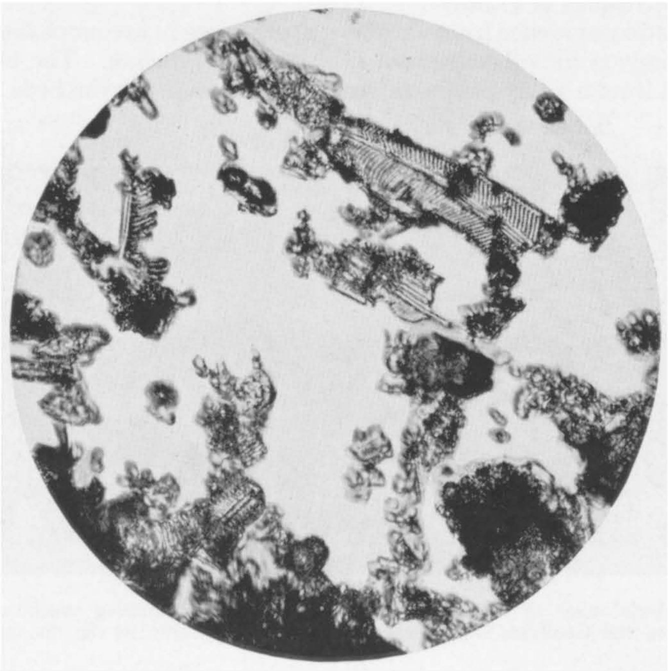
Varved clay and sand deposits, west shore of Mattagami lake, Brunswick township.

length and standing in a vertical position with respect to the enclosing beds; hollow, suboval forms were also observed.

Terraces of stratified sand, silt, and clay, many feet above the present water-levels in the Mattagami and Nabakwasi lake sections, would indicate deposition under fluvio-lacustrine conditions in a broad river valley with occasional lake-like expanses. That the waters of this supposed Pleistocene river flowed south rather than north, as at present, is indicated by the structure of the cross-bedding in the sand and gravel deposits. If this be true it may be inferred that late in the Pleistocene, the waters of this area drained toward Lake Algonquin (the present Lake Huron basin) by way of the Opikinimika-Vermilion river valley. Furthermore, there is reason to suppose that this river provided the main avenue of escape for the waters of Lake Ojibway, a glacial lake lying in front of the ice-sheet to the northeast.

Deposits of the Recent consist of sand beaches, ice ramparts, peaty swamp deposits, and lake deposits. Of extraordinary interest among the latter is a deposit of diatomite or diatomaceous marl reported by Thomas Saville, of Shiningtree, as underlying the whole of the west and north arms of Claw lake, Cabot township. This part of the lake is extremely shallow, being filled to the surface level by a black slimy ooze with an average depth of 4 to 5 feet; there is little or no open water except for narrow channels close to the shore. With the assistance of Mr. Saville, the writer obtained several representative samples of the diatomite from depths of 4 to 12 feet; the samples were taken by means of a long-handled auger operated over the gunwale of a canoe.

The diatomite is a siliceous deposit essentially composed of the siliceous skeletons of tiny aquatic plants called diatoms. When dry it is a dull, whitish, earthy material of very small density. Impurities in the form of grit, calcareous shells, and iron occur in such abundance as to seriously impair the economic value of the deposit. Examination of the calcined material under the microscope shows a wide variety of diatoms, the specific identification of which is not



Photomicrograph of calcined diatomite (×1,100), Claw lake, Cabot township. The feathered and seed-shaped structures are diatoms, the others being detrital material.

important in a report of this nature. It should be stated, however, that seed-like types are much more abundant than rod-shaped types, a feature that limits in no small degree the economic uses to which this material might be put, even though there were no impurities present. For a complete and exhaustive account of diatomite, its occurrence, preparation, and uses, the reader is referred to a report[1] by V. L. Eardley-Wilmot.

It is of scientific interest to note that the back slimy material overlying the diatomite is really a living diatomaceous ooze, since the microscopic examination of a calcined sample showed diatoms like those in the underlying deposit. It follows, therefore, that diatomite is being slowly deposited in Claw lake at the present time.

[1]V. L. Eardley-Wilmot, "Diatomite," Mines Branch, Dept. of Mines, Ottawa, Pub. No. 691, 1928.

Structural Features

The absence of a structural discordance between the Ridout series and the Keewatin series shows that little or no deformation of the volcanics took place prior to the deposition of the sediments. In post-Timiskaming time, however, both series were closely folded into a major syncline or synclinorium, whose axis follows the sedimentary belt across the area in an east-west direction. This folding is especially complex in the sediments, as a result of their being less resistant to strong compressional forces than the more massive lavas and tuffs. Subsequent to folding, the sediments were subjected to strong east-west shearing movements parallel to the strike of the beds. This latter deformation is definitely pre-Algoman in age and was caused by forces other than those attending the batholithic intrusions of granite.

Fragmentary evidence from various sources argue in favour of the supposition that the sediments have been folded into a major syncline. The best evidence was obtained from a study of the differential movements in the beds as expressed

Aerial view of the Groves-Hanover lakes fault, looking southwest. Note the Geoffrion-Shuller lakes fault showing dimly in the distance.

by the disposition of drag folds and fracture cleavage. Locally, even this evidence was of a contradictory nature, but this might be expected on account of the fact that small synclines and anticlines doubtless occur on the flanks of the major fold. In many instances, a right-hand drag fold has been directly superimposed on a left-hand drag fold, leaving considerable doubt as to which belongs to the major structure. Further evidence was obtained on Okawakenda lake, Churchill township, where the sediments are definitely younger than the volcanic tuffs since, in part at least, they are derived from the latter. It follows that the fold must necessarily be a synclinal one.

Strong regional faulting has divided this area into distinct segments, as is the case in the adjacent Three Duck Lakes area. No less than seven major fault lines cross the country in a direction a little east of south. They are represented by the linear basins of Minisinakwa lake, Shuller lake, Hanover lake, Nabakwasi river, Mattagami lake, Elephanthead creek, and Michiwakenda lake. These faults show up particularly well from the air, where they can be seen extending to the north and south far beyond the limits of the accompanying map-sheet. The displacement attending this faulting has been both horizontal and vertical.

as shown where fault lines intersect the east-west trending Ridout series. The greatest horizontal displacement is that on the Nabakwasi river, where the sediments have been shifted nearly 1¼ miles. In every case, the east segment has moved north with respect to the west segment. Strike faults occur along or close to the boundary between the Keewatin rocks and the Ridout series, a notable example of which is that just east of Wire lake, Connaught township. Other minor adjustment faults of local importance occur throughout the area.

The age of the major faulting is definitely post-Algoman, as shown by the fact that the "breaks" intersect the Keewatin-Timiskaming belt of rocks and extend far out into the Algoman granite areas. This point is particularly well illustrated in the case of the Nabakwasi river fault, a well-defined scarp of which may be observed in the granite just south of the 15-chain portage.

ECONOMIC GEOLOGY

Gold-bearing quartz veins were found near West Shiningtree lake in the summer of 1911. Subsequent discoveries in the Wasapika section of that camp led to a heavy influx of prospectors, who, finding no unstaked ground, soon spread westward along the favourable belt of rocks. Many old abandoned test pits and trenches in the central part of Groves township and in the northern half of Connaught attest the magnitude of development in those days. Not until 1930 were these efforts rewarded by notable discoveries of gold farther afield in the Three Duck Lakes area and in the Tyrrell-Knight area. As a result of the impetus given to prospecting effort by the present world-wide depression, this area, for reasons both economic and geologic, has been singled out as worthy of a more intensive search for gold, either in the form of new mines or in the rehabilitation of old ones. In 1933, gold was found at several places in this area, but at present development work has not yet reached the stage where a deposit of commercial ore is indicated on any of the showings. On three of the properties, however, results obtained by preliminary stripping, trenching, and test-pitting have been so encouraging that intensive development campaigns have been planned.

Apart from gold, there are no other minerals in this area occurring in possible economic quantities. An extensive deposit of diatomite in the Claw lake section has economic possibilities in the future if the demand for this material continues to increase.

Description of Prospects

CHAMPAGNE TOWNSHIP

North Bay Group

In the summer of 1922, gold was discovered half a mile east of the railway bridge at Makwa on what is known as the North Bay group, which consists of 7 unsurveyed claims. A little work, done some years ago, is indicated near the main showing on claim S. 5,385. As far as the writer is aware, no one was on the property during the past season. A sparsely mineralized quartz vein, ranging from 2 to 4 feet in width, has been traced for 300 feet; it strikes N. 81° E. and dips steeply to the south. The country rock is granite or granodiorite. A 5-foot test pit a few feet to the east on the strike of the vein shows a heavy gossan in a strongly jointed and fractured zone having a width of from 6 to 10 feet. The zone is heavily mineralized with fine sulphides, consisting of pyrrhotite, chalcopyrite, and pyrite. Samples of the auriferous gossan from this showing are reported to have yielded high values in gold, and particles of native gold as large as wheat grains were obtained. Since the quartz itself contains only minute quantities of gold, the spectacular amounts in the gossan can only be attributed to weathering and concentration processes.

T. L. Tanton,[1] who examined this property shortly after the original discovery was made, describes other showings as follows:—

On the next claim north [S. 5,382] . . . an irregular quartz vein with maximum width of 10 inches trends south 30 degrees west up the side of a low cliff which lies at the margin of the sand-covered lowland through which Mollie river flows. The country rock is an inclusion of calc-chlorite schist in the granodiorite. The vein pinches and swells for its exposed length of 15 feet. It consists of white quartz mineralized with chalcopyrite, which is so abundant in some places as to make up 5 per cent. of the vein by volume. There are a number of small chlorite schist inclusions in the vein. Gold can be panned from the roasted and pulverized vein material.

Fifteen chains northeast from the above occurrence several large lenticular quartz veins occur as a stockwork permeating an inclusion of chlorite schist in the granodiorite. The vein material is restricted to the inclusion, which is 20 feet wide. The trend of the veins and the schist is north 40 degrees east. There are no metallic minerals to be seen in the veins, though a rusty stain occurs in the quartz locally. . . .

All the above quartz veins . . . trend in various directions, but they are all of the same age and origin. A consideration of the field evidence collected at the time of the visit leads to the conclusion that the quartz veins are genetically related to the granite intrusion. . . . The surface examination indicates that no commercial deposit of gold ore has yet been encountered on the claims.

Makwa-Champagne Gold Mines, Limited

In May, 1933, Wesley Claus found visible gold about 10 claims north of the dam on the Mollie river, near the northwest corner of what is now claim S. 24,527. This discovery led to a small rush, in which nearly 100 claims were staked and recorded across the north half of the township. In October of the same year, Makwa-Champagne Gold Mines, Limited, took over 9 unsurveyed claims previously known as the Butterfield-Devanney-Rivers group, consisting of claims S. 24,523 to 24,531, inclusive. At the time of the writer's visit early in July, the main showing was the discovery vein near the northwest corner of claim S. 24,567. It consists of two parallel quartz lenses separated by a horse of granodiorite, the strike being about N. 35° E., and the dip slightly west. The east lens is 2 feet wide, and the west one 3 feet wide; the total exposed length is about 30 feet. At the west end of the exposure the lenses meet and pinch out, and at the east end they are apparently terminated by a fault. The quartz is a rather white glassy variety containing pyrite, chalcopyrite, and visible specks of very pale yellow gold.

Near the southwest corner of claim S. 24,527, a flat-lying quartz vein was stripped for a few feet. It strikes N. 70° E. and dips north at approximately 30 degrees. The quartz is only sparsely mineralized, and no gold was observed. Other slightly mineralized gash veins had been uncovered at the time of the writer's visit, but none of them seemed promising.

The company is reported to be actively engaged in surface exploration, the results of which are said to have been encouraging.

Champagne Mining Syndicate, Limited

Champagne Mining Syndicate, Limited, has title to 12 mining claims located immediately southwest of Makwa siding. No special examination of this section was made, as the claims were not staked until after the writer's visit to this part of the township. Officials state that several auriferous quartz veins have been uncovered. Plans are being made to continue surface exploration and to institute a programme of diamond-drilling.

[1]T. L. Tanton, "Gold Occurrence at Makwa," Geol. Surv. Can., Sum. Rept., 1922, pt. D, pp. 11, 12.

John C. Dunn

The John C. Dunn group consists of 7 claims (S. 24,576-78, 24,621, 24,622, 24,579, and 24,580) lying immediately to the east of the property of the Makwa Champagne Gold Mines. Early in July, John C. Dunn uncovered a large irregular lens of quartz in the northwest corner of claim S. 24,580. Stripping exposed it for a length of 45 feet and a width of 10 feet. The lens, which strikes N. 61° E. and has a vertical dip, occurs at the contact of a large inclusion of Keewatin schist on the north and granite or granodiorite on the south. The quartz is sparsely mineralized, but is said to yield fine gold when panned.

Three narrow quartz stringers were uncovered on the south side of a high hill, 5 chains east of the northwest corner of claim S. 24,622. The veins, which strike N. 66° E. and dip steeply north, were exposed for a length of 25 feet. They occur in an inclusion of Keewatin schist at the contact between granodiorite to the north and a diabase dike to the south. Except for a small amount of specular hematite, very little mineralization was observed.

Tyrrell McMurchy Syndicate

The Tyrrell McMurchy Syndicate, under the management of George Bruce, holds 6 claims lying immediately east of the Dunn group. No discoveries have been reported.

GROVES TOWNSHIP

A total of 50 claims were staked and recorded in Groves township, but many of these were allowed to lapse. As yet no discoveries of economic importance have been made.

Tasmijopen Syndicate

The Tasmijopen syndicate, representing Pennsylvania interests, holds a group of 12 claims centred about Pensyl lake. During the past summer an energetic programme of surface exploration was carried on under the direction of J. Earl Jones, H. S. Pensyl, and O. H. Smith. Certain showings were probed to shallow depths by a light diamond-drill of the type assembled by Boyles Brothers; this drill was owned by the syndicate. The main showings occur at the east end of Pensyl lake in the northwest corner of claim S. 24,319. On the lake shore stripping has exposed a rudely banded sugary or cherty quartz vein for a length of 25 feet and a width of 9 feet. It strikes N. 86° E. and is in contact with greywacké on the north. Locally the quartz is strongly impregnated with very fine sulphides. A picked sample of the drill-core material from a depth of 20 feet is reported to have assayed 0.15 ounces gold and 0.15 ounces silver per ton.

Eight chains east of the above showing, a 6-foot test pit has been sunk in a band of cherty iron formation associated with highly contorted beds of greywacké. The iron formation strikes N. 85° E. and dips steeply to the north. The band has been exposed for a length of 30 feet, and heavy gossan occurs over a width of 25 feet or more. The mineralized portion of the band is about 5 feet in width and consists of narrow layers of dark cherty material alternating with layers of sulphides. The sulphides consist of pyrite, pyrrhotite, chalcopyrite, mispickel, and sphalerite in about the same order of decreasing abundance. Some of the magnetite present has been replaced by pyrrhotite, and this in turn has been partly replaced by chalcopyrite. Grab samples of the mispickel, which occurs rather sparingly in the bottom of the test pit, are reported by O. H. Smith to have yielded from 0.25 to 0.50 ounces gold per ton and notable quantities of silver. About 100 feet north of this point is a mineralized quartz vein in greywacké. It is one foot wide, strikes S. 81° E. and dips 80° N. It has been opened up for a length of 40 feet, along parts of which there is a heavy ankerite and pyrite gossan. A grab sample taken by O. H. Smith is reported to have yielded 0.50 ounces gold and 2.5 ounces silver per ton.

The band of iron formation has been picked up at two points on the south side of Pensyl lake. Although it carries notable quantities of sulphides, there are no gold values.

Flintoba Mines, Limited

Early in 1934, Flintoba Mines, Limited, took over a group of 12 claims lying south and west of the narrows on Shuller lake. This group was staked late in 1931 by W. J. McMurchy in the interests of the Empire Holding Syndicate, Toronto. Very little work has been done on this property beyond the sinking of a few shallow test pits in rusty shear zones in the sediments along the tote road west of the lake. An official of the company states that preparations are being made to carry on a campaign of surface exploration.

Arthur La Rose

The Arthur La Rose group consists of 6 claims located between Groves and Duckbreast lakes. No less than 12 showings were visited, on which considerable assessment work has been performed in the last few years. The country rock consists of a wide variety of granitic types, such as porphyritic gneiss, porphyritic diorite, granite porphyry, massive red granite, and feldspar porphyry dikes. The quartz veins, which occur both in the granitic types and in inclusions of chlorite schist, show little or no mineralization. One vein, 15 claims west of the north end of Groves lake, consists almost entirely of granular epidote and pyrite, but contains no gold values. Veinlets of specular hematite up to a quarter of an inch in width are common in the granitic types. On the small lake just north of Groves lake, what appears to be a large inclusion of greenstone or sediments in the granite carries an abundance of large reddish-brown garnets.

W. Claus

The W. Claus group consists of 12 claims lying between the south end of Shuller lake and Piggott lake. On the portage 10 chains west of Shuller lake shallow test pits have been sunk on a narrow, irregular, east-west fractured zone in light-coloured granite. The zone appears to be silicified and sericitized, and is strongly impregnated with very fine iron pyrites. Grab samples showed no values in gold.

At the east end of the small lake on the same portage, considerable work was done on a stockwork of narrow quartz stringers in a salmon-pink granite. The zone is 7 feet in width, strikes S. 35° E., and dips steeply southwest. Over this width it is moderately mineralized with pyrite and specular hematite. No gold values were obtained.

J. W. Young

The J. W. Young group consists of 8 claims, S. 24,461-68, inclusive, in the southwest corner of the township. In addition, there are 6 claims in St. Louis township, S. 24,469-74, inclusive, and 4 claims in Benneweiss township, S. 24,475-78, inclusive. During the past summer the group was thoroughly prospected by Charles Young, who reports that results were disappointing. In general, the claims are located along the south contact of the granite and the Ridout series.

BRUNSWICK TOWNSHIP

Brunswick township has not been prospected to any great extent. At present there are no mining claims in good standing.

CONNAUGHT TOWNSHIP

No recent discoveries have been made in Connaught township. However, as a result of the Mataris discovery several years ago, 115 mining claims were staked across the northern half of the township, but they have all long since been allowed to lapse.

John Mataris

Twenty years ago, John Mataris discovered copper mineralization about three-quarters of a mile southwest of the extreme west end of Okawakenda lake, on what is now mining claim T.R.S. 3,556. In 1916, several deep test pits were sunk, and some of the mineralized material was sent to Sudbury. In 1927, Noah Timmins took an option on the property and drilled one 200-foot hole. The property, which has since reverted to the original owners, consists of 6 claims held under lease from the Crown. There is no evidence of any recent development work having been done.

The deposit occurs in a rather unusual type of dark-coloured, aphanitic, brecciated or fragmental type of rock, exposures of which are confined almost entirely to the immediate vicinity of the showings. In places, vesicular structures have been developed, which in many cases have been filled with quartz or pyrite. A thin section of this rock under the microscope shows that it consists mainly of quartz, a pale-greenish chloritic material, and glass; tiny flow structures are very much in evidence. It is probably a flow breccia of pyroclastic origin and closely related to the volcanic tuffs that occur near by. The mineralized zone attains a width of 100 feet and has been traced for several hundred feet. Among the minerals observed on the rock dump were pyrite, chalcopyrite, azurite, malachite, bornite, and covellite. Generally speaking, the mineralization is rather disseminated and has a strong tendency to occur in tiny fractures and little pockets in the otherwise massive rock. Interesting gold values are said to have been obtained from this deposit, but grab samples of the best-looking material taken by the writer failed to show even traces of gold.

Lloyd Foster

In 1927, Lloyd Foster did considerable surface work on two parallel bands of iron formation occurring on a trail leading northwest from the north end of Burns lake. The bands are highly disturbed, strike approximately east-west, and consist of sugary quartz, limonitic material, and massive pyrite. The claims have been allowed to lapse.

J. C. Mahon

In November, 1933, J. C. Mahon staked a group of 12 claims lying between Wire lake and Elephanthead creek. The group is centred about a small boss of feldspar porphyry. Although no discovery has been reported as yet, it should be stated that the geological conditions here are such as to warrant an intensive search for gold-bearing veins.

CABOT TOWNSHIP

Interest in Cabot township is largely confined to the region about Claw lake, where gold was discovered a few years ago. The north half of the township is covered by an extensive sand plain.

Thomas Saville

Thomas Saville, of Shiningtree, holds a group of 9 claims, T.R.S. 5,550-54, 5,607, 6,253-55, on which several promising discoveries have been made. During the past season these showings commanded considerable attention on the part of various mining scouts.

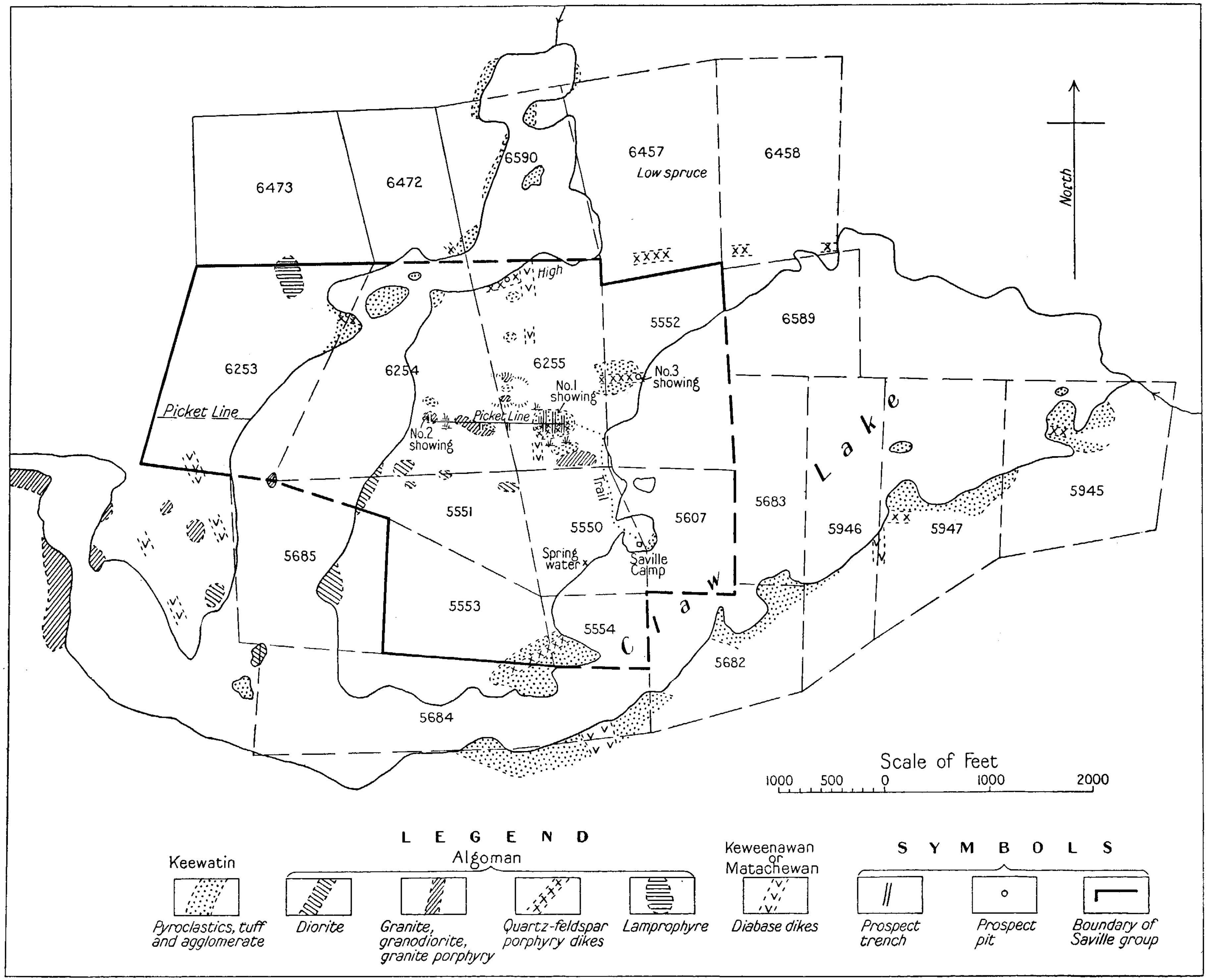
Considerable surface development has been carried on at the main showing, known as No. 1, in the southeast corner of claim T.R.S. 6,255, 10 chains from the east arm of Claw lake. It occurs close to the north margin of a stock of diorite, to which reference has already been made in a previous section. At this point the diorite has been differentiated into a reddish porphyry. The showing itself consists of an intricate stockwork of quartz stringers ranging in width from a fraction of an inch to several inches and cutting what appears to be a strongly granitized and sheared Keewatin tuff. A series of 4 north-south trenches, located at suitable intervals across the strike, has exposed the showing for a length of nearly 500 feet, and for widths as great as 250 feet. The country rock has a reddish to greenish mottled or bleached appearance, such as is commonly observed in wall rock immediately adjacent to quartz veins. This appearance may be attributed to the effects of a hydrothermal alteration process involving carbonatization, sericitization, silicification, and pyritization. The larger quartz veins commonly exhibit vein breccia structure due to wall-rock fragmentation. A series of three parallel quartz-feldspar porphyry dikes ranging from 2 to 15 feet in width cut across the showing in an east-west direction. The close association of the quartz stockwork with these dikes strongly suggests that there is a genetic relationship between them. The altered tuff is strongly impregnated with very fine iron pyrites, and locally the quartz carries notable quantities of molybdenite, specular hematite, and galena. The gold values over suitable mining widths are reported to be low, but the possibility of developing a large low-grade deposit should not be overlooked.

No. 2 showing, which occurs on claim T.R.S. 6,254, on an east-west picket line, 1,900 feet west of No. 1, is exposed in a north-south cribbed trench 30 feet in length. It consists of two parallel quartz veins striking east-west and dipping steeply south. The north vein is 16 inches wide, and the south one 10 inches wide. They occur in a fresh-looking reddish granite, which is probably an acid differentiate of the diorite stock mentioned in the preceding paragraph. The quartz is fairly well mineralized with pyrite, galena, molybdenite, and chalcopyrite, in about the same order of decreasing abundance. Fair gold values are reported, but a grab sample of the well-mineralized material yielded low values.

No. 3 showing is located a few chains northeast of No. 1. A 10-foot test pit has been sunk on two parallel vertical quartz veins, each about 20 inches in width, which strike N. 70° E. They occur in a highly schisted quartz-feldspar porphyry. The south vein contains an unusually heavy concentration of molybdenite and its yellow oxide, molybdite. The former occurs both in the massive state and as thin films in tiny fractures in the quartz. An analysis[1] of this material gave 0.74 per cent. molybdenum. Coarse pyrite occurs rather sparingly, and there is only a trace of gold.

A narrow quartz vein associated with a heavy rusty gossan has been uncovered near the north line of claim T.R.S. 6,255 on the shore of the north arm of Claw lake. The vein strikes east-west and occurs in a quartz-feldspar porphyry dike. A sample of the quartz yielded no gold values.

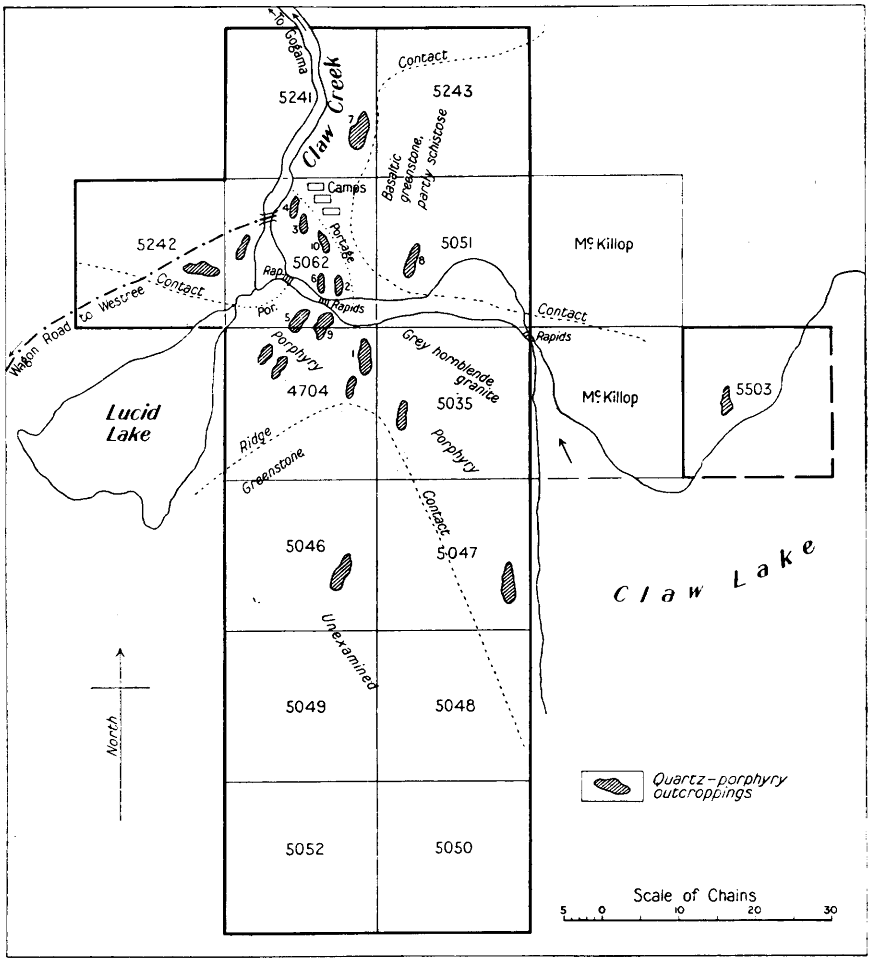
[1]By W. K. McNeill, Provincial Assayer.



Sketch Map Showing the General Geology in the Vicinity of the Saville Group, Claw Lake, Cabot Township.

Porcupine-Kirkland Gold Mines, Limited

Porcupine-Kirkland Gold Mines, Limited, has 13 claims in the vicinity of Lucid lake, one of which, T.R.S. 4,704, is now held under lease. A few years ago considerable surface work was done on a spectacular showing of quartz veins located on the north slope of a hill immediately opposite the south end of the 16-chain portage on Claw creek. This work included some diamond-drilling. On the whole, the results are said to have been rather disappointing, but scattered



Geological plan of the claims of the Porcupine-Kirkland Gold Mines, Limited, Cabot township. (Information from a plan furnished by company officials in 1926.)

gold values were obtained. For the most part the quartz is a glassy, barren variety, but in places it contains small quantities of sulphides. The property has been idle for some time.

Tasmijopen Syndicate

During the summer of 1933, the Tasmijopen syndicate uncovered a quartz vein near the southwest corner of claim T.R.S. 6,727. A good trail leads west from the north arm of Claw lake to the showing, a distance of 35 chains. The vein is 4 feet wide, strikes N. 10° W., and stands vertically. It occurs in a whitish-weathering, highly altered porphyry phase of the granite, with which is associated a stockwork of narrow quartz veinlets. The quartz contains an abundance of carbonate material and sparse quantities of pyrite. No gold values were obtained here.

Alexander Irving

Alexander Irving holds under lease a group of 4 claims, T.R.S. 3,207, 3,208, 3,210, 3,211. These claims are located on either side of the Hydro-Electric Power Commission transmission line, midway between Claw creek and the south boundary of the township. No showings are known to the writer, nor is there any record of development work having been done on this group.

Progress Report on Gold Camps

The latter part of the season was spent in making a cursory examination of the various gold properties in the Three Duck Lakes area and the West Shiningtree camp. This was done not with the idea of making a re-examination, but rather with the idea of recording the progress of development in these camps since they were last reported on.

WEST SHININGTREE CAMP

The first serious effort to develop the West Shiningtree area began in 1912. Since that time its career has been a hectic one from the point of view of mining development. In the early days of the camp the discovery of much spectacular high-grade gold ore, particularly in the Wasapika section, led to a period of extravagant financing and fanciful development. The inevitable result of this over-expansion was chaos, litigation, and a general loss of public confidence, a blow from which this camp has not yet fully recovered. At present attempts are being made to correct this condition by what is believed to be a sincere mining effort on the part of certain interests, particularly those holding properties in the Wasapika section.

For a more detailed description of the various properties in this area, reference should be made to previous reports[1] of the Department of Mines.

Churchill Mining and Milling Company, Limited

Churchill Mining and Milling Company, Limited, owns 4 claims, T.R.S. 3,741, 3,773, 3,774, and 4,044, located at the southern extremity of Michiwakenda lake, Churchill township. The main showings, which occur close to the road in the north half of claim T.R.S. 3,774, have been described by P. E. Hopkins[2] as follows:—

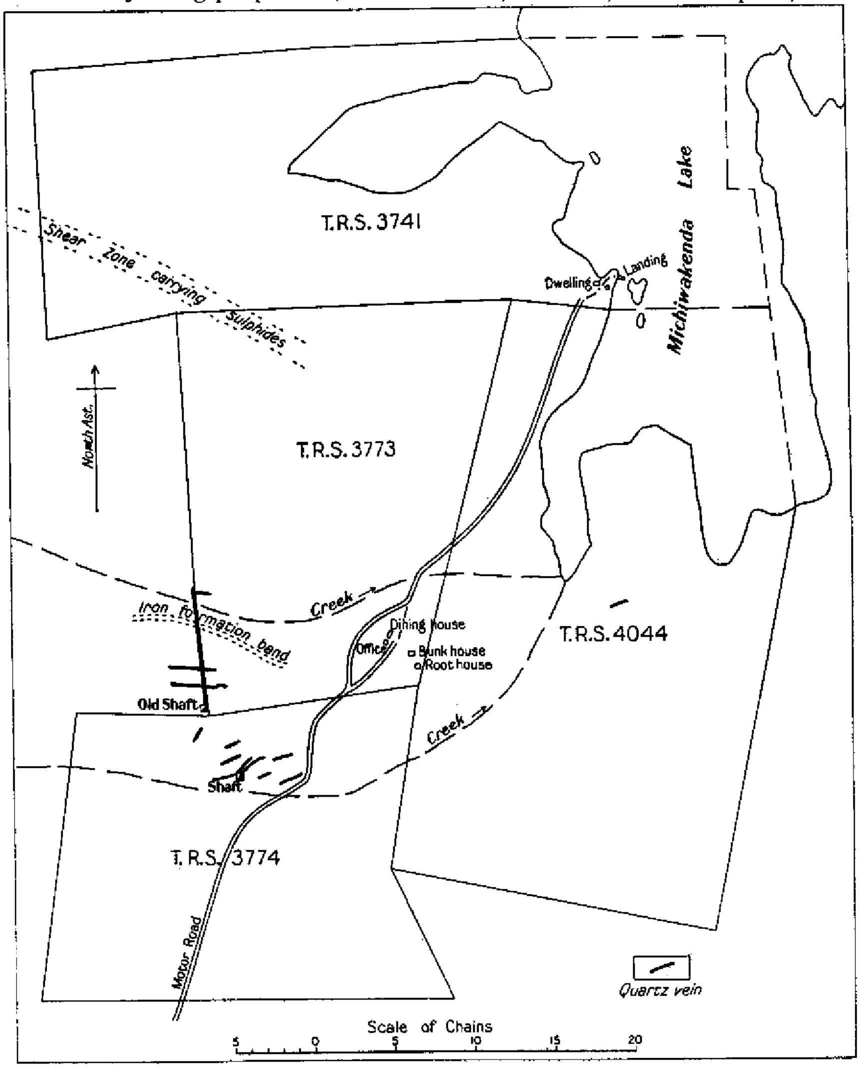
> Two veins from 2 to 3 feet wide occur in the rusty pillow lava schist. They have been traced for 200 feet or more in a direction slightly north of east, the dip being 75° to the south. Towards the west the veins come together and pass into a porphyritic rock. Towards the east they have been faulted, the easterly portions being thrown 20 feet to the south. A 40-foot shaft has been sunk on the north vein which was reported by Mr. Knox to average in the shaft 38 inches in width. Gold could be seen in various parts of the veins, usually occurring in fractures, with pyrite and other dark minerals.

The south vein, known as No. 1, and that part of No. 3 vein east of the fault occur in a light-coloured rhyolite or quartz porphyry, which is somewhat sheared at S. 80° E. This porphyry, which is probably a differentiated portion of the large granitic mass lying to the south, occurs as a narrow tongue pinching out a few hundred feet to the north of the showing. Locally it is intersected by irregular

[1] P. E. Hopkins, "West Shiningtree Gold Area," Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, pp. 37-52; "Ontario Gold Deposits," Ont. Dept. Mines, Vol. XXX, pt. 2, 1921, pp. 36-38.
F. L. Finley, "Wasapika Section, West Shiningtree Gold Area," Ont. Dept. Mines, Vol. XXXV, pt. 6, 1926, pp. 92-96.

[2] P. E. Hopkins, Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, p. 41.

stockworks of narrow quartz stringers, which are reported to carry low values in gold. The veins are of the fissure type and are definitely later than the porphyry, since they cut it. The north-south faults displacing the veins belong to a late system of north-south fracturing characteristic of the whole region. In the case of the adjoining properties, Gold Corona, Herrick, and Wasapika, the north-

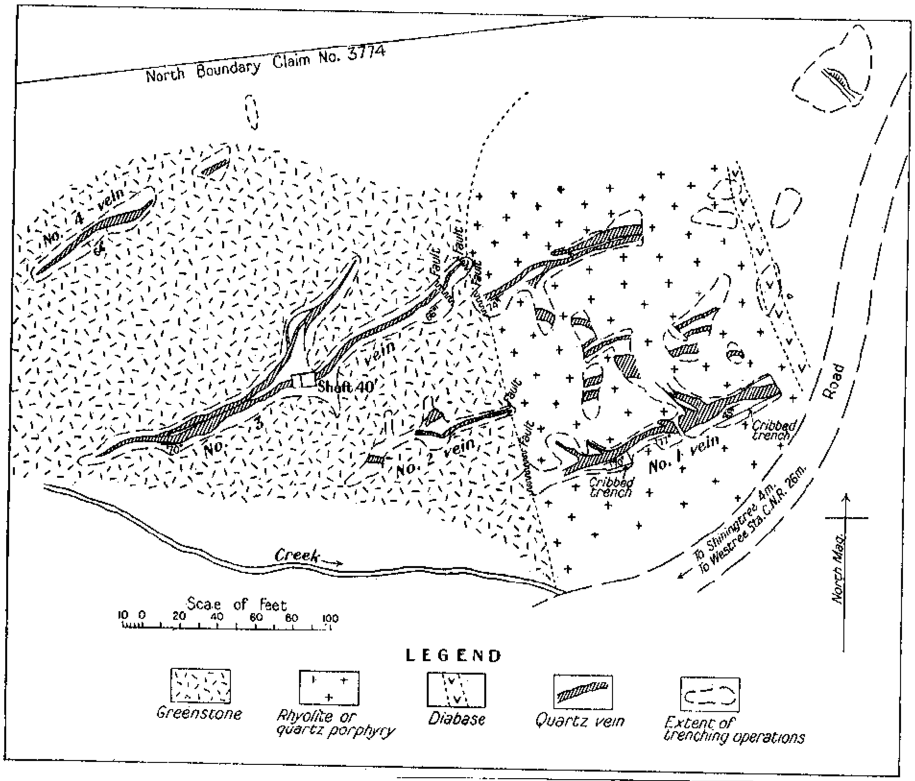


Plan showing the location of quartz veins on the claims of the Churchill Mining and Milling Company, Limited, Churchill township.

south fractures carry the gold-bearing quartz veins, but on the Churchill property the east-west fractures are in this respect the important ones.

In February, 1933, a small crew of men was engaged to open up further the main showing and prepare it for systematic sampling. When the writer visited the property in October, 1933, No. 1 vein had been exposed for a length of over 100 feet, with native gold showing at many places. No. 3 vein had been exposed for a length of 300 feet, with native gold showing toward the west end. As a rule the quartz carries a little pyrite and carbonate, but no other minerals were observed. The following table is a compilation of assay results taken from the company's assay plan, which was provided through the courtesy of John A. Knox, resident manager.

Vein	No. of channel samples	Average width of sample	Average gold value
		feet	ounces per ton
No. 1..................	5	4	0.858
No. 3..................	18	4	.801



Detailed surface plan of the geology and vein system on claim T.R.S. 3,774, Churchill Mining and Milling Company, Limited, Churchill township.

Late in the season a new vein was discovered near the middle of claim T.R.S. 4,044, 14 chains east of the camp. It is 4 to 6 inches wide, strikes N. 80° E., and dips 75° N. It lies directly on the strike of the veins at the main showing and, although of no importance itself, shows the possibility of a strong vein system being picked up in the intervening low ground.

The results of surface development to date have so encouraged the management that a 10-ton test mill is being installed. The property is equipped with an excellent set of camps and may now be reached by motor car.

Consolidated Ontario Gold Mines, Limited

Consolidated Ontario Gold Mines, Limited, was incorporated in January, 1933, for the purpose of merging certain of the larger properties in this area and consolidating a number of scattered mining claims. The properties reported to be involved in this merger are Herrick Gold Mines, Limited; Miller-Adair Mines, Limited; Algonquin Mines, Limited; and Shining Tree Consolidated Mines, Limited. The mining claims included in the consolidation are 2 held by Orion Gold Mines (formerly owned by Gosselin Gold Mines, Limited); 4 claims formerly held by Wakenda Mines, Limited, Nos. 6,369, 6,370, 6,371, and 6,372; claim W.D. 1,408, now No. 2,796; and other scattered groups, making a total of 32 claims.

The immediate plans are to carry on further underground development at the Herrick property, where a two-compartment shaft is already at a depth of 308 feet and where several hundred feet of lateral work and diamond-drilling has been done. It is the intention to sink the shaft to a depth of 770 feet and start drifting toward a point where a diamond-drill is reported to have cut 22 feet of vein matter.

White Rock Mining Company, Limited

White Rock Mining Company, Limited, hold 2 claims, Nos. 2,535 and 2,536 (formerly known as the Saville-McVittie group), in Macmurchy township, Wasapika section. Two shafts have been sunk, one 375 feet and the other 210 feet, and several hundred feet of drifting has been done. In September, 1932, the company resumed underground operations, being equipped with a new mining plant. On surface, further trenching was done along the vein just east of the shaft. Development continued until May, 1933, when the plant was closed down, dismantled, and sold. It is reported that the rich ore that warranted this development has now been exhausted and that the future of the property depends on further underground exploration.

Other Properties

In the summer of 1933, 12 tons of gold ore were shipped from the *Atlas* property. This ore came from the vein several feet above the tunnel entrance and is said to have yielded 0.70 ounces gold per ton. Late in the season, the *Bennett* vein was sampled for Toronto interests. The *Burvan Gold Mines, Limited*, was incorporated in December, 1932, to acquire the assets of the Canadian Champion Reef Mining Company, Limited, originally known as the Westree Mines, Limited. The underground development consists of a 500-foot shaft, with levels established at 90, 240, and 500 feet, and 200 feet of drifting. The property is equipped with a mining plant and good camp buildings, but it has been idle for some time.

Watchmen are being maintained at the *Kingston*, *White Rock*, *Burvan*, *Ribble* (formerly Wasapika), *Gold Corona*, and *Wood* properties.

The southern part of the camp, known as the West Shiningtree section, is not being developed to any extent at this time. This section includes such properties as the *Gosselin*, *Holding*, and *Buckingham*. Lying half a mile south of the Buckingham shaft is the *Kubeik* group, on which an active programme of surface development is being pursued by the joint owners, M. Graiboski and N. Kubeik. Visible gold has been found in several of the test pits.

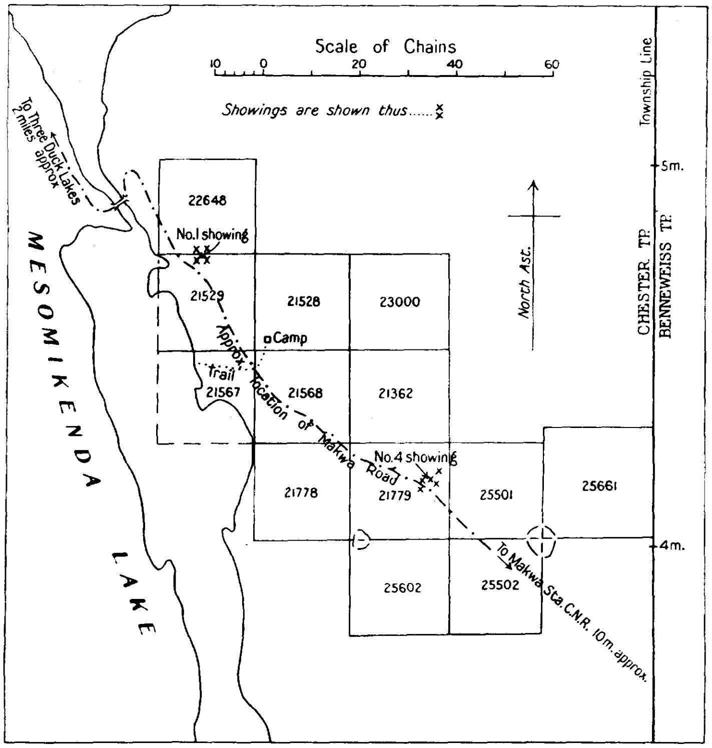
THREE DUCK LAKES AREA

Considerable interest is attached to development work in the Three Duck Lakes area on account of the fact that several discoveries have been made since the area was examined and mapped by the writer in 1931.[1] The following is a brief description of the more important of these new finds.

[1] H. C. Laird, "Geology of the Three Duck Lakes Area," Ont. Dept. Mines, Vol. XLI, pt. 3, 1932.

Beaver-Bethnal Gold Mines, Limited

In August, 1933, Beaver-Bethnal Gold Mines, Limited, resumed active surface exploration on their group of 34 claims lying between Mesomikenda lake and Three Duck lakes. Much of the recent work has been done on a showing just south of the small lake on the winter road between Mesomikenda lake and Bagsverd lake. The showing, which consists of a strongly schisted zone in highly carbonated and sericitized greywacké, strikes S. 65° E. and has been traced eastward by means of a picket line for several hundred feet. Test pits have been sunk at suitable intervals. The zone is strongly impregnated with fine iron



Key map showing the position of the claims of the Eccles-Holmes group, Chester township.

pyrites and silicified over a total width of 6½ feet. The results of channel assays are not known to the writer, but grab samples of the well-mineralized material yielded gold up to 0.40 ounces per ton.

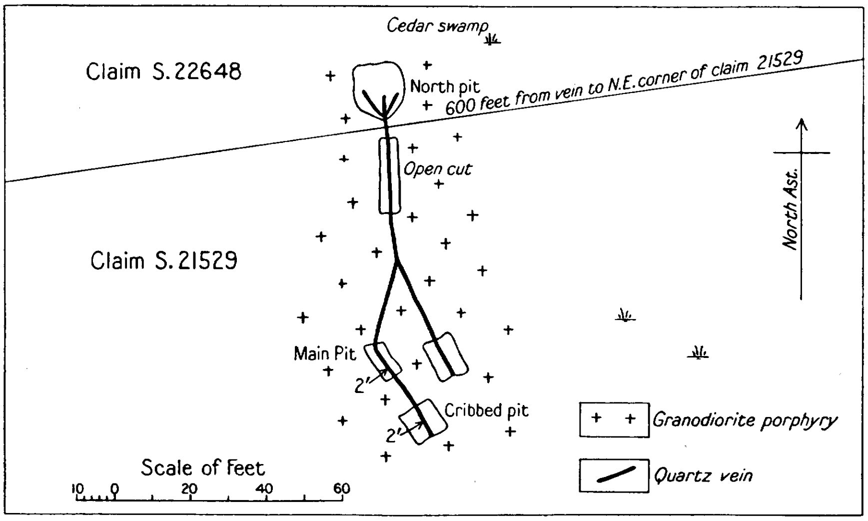
The property is now equipped with an excellent set of camps, and it is planned to continue surface exploration.

Chester Gold Mines, Limited

Chester Gold Mines, Limited, which is controlled by Porcupine Crown Mines, Limited, holds 14 claims, S. 21,575-80, 21,587-99, 23,640-42, lying between Chester lake and Clam lake. A new discovery was being opened at the southwest corner of S. 21,576 at the time of the writer's visit late in October, 1933. Quartz veinlets impregnate a well-fractured zone in a strongly epidotized rock, which is probably a porphyry phase of the granite. The zone has a width of 5 feet or more, strikes N. 73° E., and dips 30° S. A shaft has been sunk to a depth of 35 feet. Massive pyrite is common, and native gold is occasionally observed. A grab sample yielded 0.10 ounces gold per ton, but higher values are reported by officials. To date, 9 men have been engaged in stripping, trenching, and deep test-pitting, with the result that 4 mineralized quartz veins have been discovered. Further surface exploration may be expected to disclose other gold-bearing quartz veins.

J. F. Eccles-Holmes

The Eccles-Holmes group consists of 13 claims, S. 21,362, 21,528, 21,529, 21,567, 21,568, 21,778-79, 22,648, 23,000, 25,501, 25,502, 25,602, 25,661, located on the east side of Mesomikenda lake just south of the road bridge. A narrow quartz vein, known as No. 1, has been uncovered at the north boundary of S. 21,529 in a coarse phase of the granodiorite porphyry. It strikes north-south,

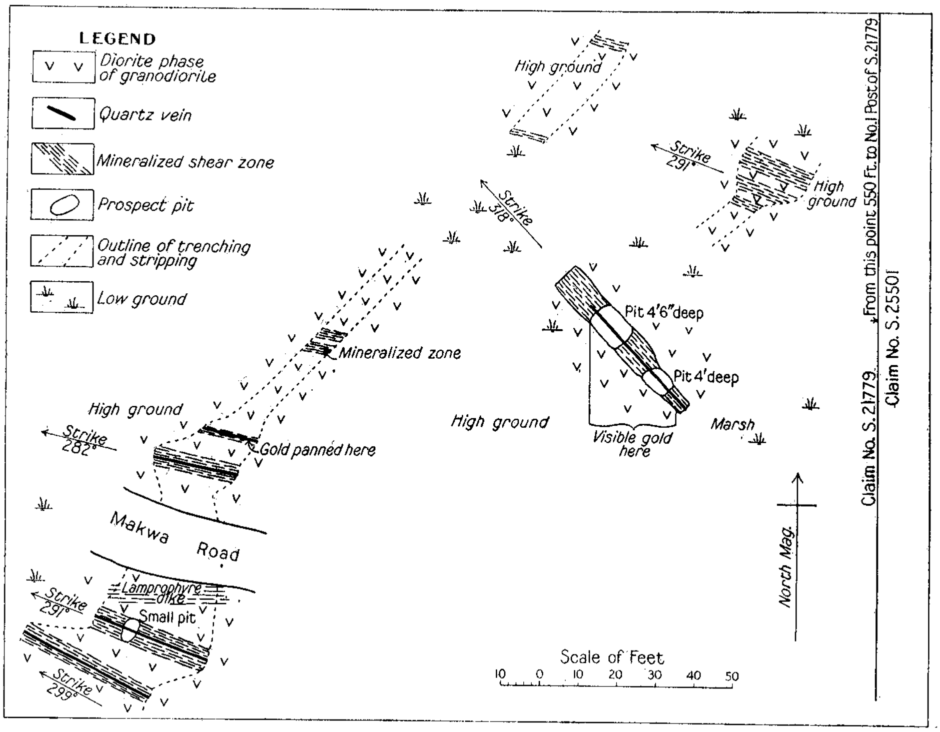


Surface plan of No. 1 showing, Eccles-Holmes property, Chester township.

has an average width of 1 foot, and has been traced for 100 feet. The wall rock is silicified and fairly well mineralized with pyrite for several inches on either side of the vein. The common minerals are pyrite, chalcopyrite, and molybdenite in minute quantities. Midway toward the south of the exposure, the vein splits into two parts. Two test pits have been sunk, disclosing heavy mineralization over a width of 3 feet. From the bottom of the main pit, which is cribbed and has a depth of 14 feet, a channel sample taken by J. F. Eccles-Holmes over a width of 3 feet 3 inches is reported to have yielded 0.50 ounces of gold per ton, and a grab sample of the quartz yielded 1.00 ounces of gold per ton. A grab sample of only moderately mineralized quartz taken by the writer from the same pit yielded 0.70 ounces gold per ton and 1.70 ounces silver. Another grab sample of fresh or silicified vein matter taken by the writer from an open cut at the north end of the vein yielded 0.31 ounces gold per ton.

About 200 feet southwest of No. 1 vein there is a strongly fractured zone, which in places shows 6 inches of quartz carrying an abundance of pyrite and chalcopyrite. The total width of the "break" is about 3 feet. The wall rock immediately adjacent is silicified and epidotized and is essentially the granodiorite type. A grab sample of the mineralized vein matter from the bottom of a shallow test pit yielded negligible gold values.

Another vein, known as No. 4, has been uncovered on claim S. 21,779, a few feet northeast of the Makwa road. It occurs in a sheared zone in a rather basic or dioritic phase of the granodiorite. The zone itself varies from 3 to 5 feet in width, strikes northwest, and apparently widens in the same direction. The main quartz leader is 6 inches wide and is accompanied by narrow quartz stringers on either side. The mineralization consists of pyrite, chalcopyrite, and a little visible gold; actinolite is abundantly developed at one point. The quartz is characterized by the presence of minute quantities of a silvery-grey metallic



Surface plan of No. 4 showing, Eccles-Holmes property, Chester township.

mineral occurring in nest-like forms. Microchemical tests on this material indicate that there are probably two minerals, bismuthinite (bismuth sulphide, Bi_2S_3) and tetradymite (bismuth telluride, Bi_2Te_3). Two 4-foot test pits have been sunk on the vein. A 27-inch channel sample taken by Captain Eccles-Holmes from the south pit yielded 1.39 ounces gold per ton. A grab sample taken by the writer from the same pit yielded 2.58 ounces gold per ton. Thirty feet north of the road, stripping has disclosed another quartz vein, one foot in width, from which gold may be panned freely.

A. Labbé

In 1931, a well-mineralized break was uncovered in the northwest corner of S. 19,991, Chester township. Further surface exploration during the past season has resulted in the tracing of this break several hundred feet to the east, as well as the picking up of a parallel break 40 feet to the north of it. The new showings, which occur in the northwest corner of S. 20,011, consist of sheared zones, 2 to 9 feet wide, in a silicified granite porphyry. Small quartz lenses, up to 4 inches in width, occur at intervals along these zones. The mineralization consists of pyrite, chalcopyrite, and a little visible gold.

A new showing near the north boundary of the group on claim S. 19,992 was being stripped when the writer visited the property. The vein appears to trend N. 80° E., and consists of a sort of stockwork of quartz veins in a dark-coloured quartz porphyry, the total width being about 25 feet. Both the porphyry and quartz are strongly impregnated with very fine pyrite and chalcopyrite as well as coarse light-coloured pyrite. The type of mineralization in this vein suggested that fair gold values might be expected, but the results of assays of three representative grab samples were disappointing.

Prospect pits along a strongly fractured zone containing gold-bearing quartz lenses, Chester Shannon claims, west shore of Clam lake, Chester township.

It is reported that this group, consisting of 9 claims, has been optioned by Porcupine Crown Mines, Limited. Camps have been erected, and a small crew of men have been maintained to complete the necessary assessment work.

Chester Shannon Syndicate

Late in 1931, the main showing on the claims of Chester Shannon Syndicate, on the point at the northeast corner of Clam lake, was diamond-drilled, holes being put down to intersect the vein at various horizons down to 500 feet. The deepest hole showed continuity of vein width and gold values, but on the whole the results are said to have been inconclusive.

In 1933, work on the property was resumed, and a programme of surface exploration was energetically carried on under the direction of J. A. Shannon and M. S. Beal. A most unusual occurrence of gold was discovered on the west shore of Clam lake, almost directly opposite the showing on the east shore that created so much interest in 1931. The showing consists of irregular quartz lenses in a strongly sheared zone ranging in width from 6 to 10 feet, striking S. 78° E., and dipping 54° N. It occurs at the contact of quartz porphyry and a fine-grained micaceous schist or lamprophyre. The break has been exposed for a length of 440 feet, and 5 deep test pits have been sunk at intervals along the strike. The mineralization is heavy and consists of an intimate intergrowth of siderite or ankerite, quartz, books of biotite, pyrite, chalcopyrite, and visible gold. In places the siderite is very massive, and books of biotite an inch in diameter are commonly observed. In some instances the gold is intimately associated with the biotite. The biotite, which occurs in rather unusually large volume, is a product of wall-rock alteration and owes its presence to the reaction of mineralizing solutions on a type of country rock high in ferromagnesian minerals, which in this case is lamprophyre or hornblende-mica schist.

Another new showing has been uncovered in the southwest corner of claim S. 9,289, Yeo township. It consists of a series of irregular quartz lenses up to 16 inches in width in a strongly fractured zone in porphyritic granodiorite. The "break" has been exposed by stripping for a length of over 100 feet; it strikes in an east-west direction. The wall rock on either side is strongly mineralized with pyrite, chalcopyrite, bornite, and covellite, and a heavy gossan occurs over a total width of about 25 feet. The centre of the showing is traversed by two narrow lamprophyre dikes only a few feet apart, which strike S. 42° E.

The syndicate now holds 14 claims which have been brought to patent.

R. S. Sheppard

During the past summer the West McWatters Syndicate had an option on the R. S. Sheppard group of claims, in the central part of Chester township. They carried on a programme of surface development, mainly on showings in the north half of claim S. 20,655. Two parallel veins, about 50 feet apart, have been opened for about 200 feet along the east-west strike. Channel assays over a width of 90 inches are reported to have yielded values up to 0.84 ounces gold per ton.

A newly discovered vein, known as No. 5, occurs near the east boundary of claim S. 20,657. It consists of a sheared zone in quartz diorite porphyry exposed for a length of 125 feet and, in places, attaining a width of 3 feet. The quartz occurs as small lenses up to 8 inches in width. It is heavily mineralized with pyrite, chalcopyrite, and visible gold.

Other narrow quartz veins have been uncovered on claims S. 20,661 and 20,662, but they appear to be of little importance at the present stage of development.

The property is equipped with an excellent camp, and further surface exploration is contemplated.

Martin Syndicate

Robert Martin, of Sudbury, maintains a majority interest in the Gosselin group of claims formerly held by the Three Ducks Syndicate. In 1932, a diamond-drilling campaign was carried on in what is known as the Coté lake section of the property. The results of this work are not known to the writer, but an engineer's report is said to have been highly favourable. Since that time the claims have been further prospected without important results. A caretaker is being kept at the property to look after an excellent set of camp buildings.

Ironstone Syndicate

P. S. Ironstone and associates, of Gogama, hold a group of 21 claims, lying east of the Sheppard and Labbé groups, on which considerable surface exploration was carried on during the summer of 1933. A quartz vein was uncovered near the northwest corner of claim S. 21,616. A grab sample of the quartz is reported to have yielded 1.25 ounces gold per ton, and a channel assay over a width of 4½ feet yielded 0.19 ounces gold per ton.

M. S. Beal

The M. S. Beal group of claims, formerly known as the Coté property, consists of 6 claims lying between Clam lake and Coté lake. A small quartz lens, striking at S. 80° W. and dipping 40° W., has been uncovered near the west line of S. 14,598, a few chains north of Clam creek. The lens, which occurs in a well-defined fracture in the granodiorite, ranges from 6 to 12 inches in width and has been traced for 25 feet. The quartz is heavily mineralized with pyrite and chalcopyrite and contains visible gold.

Corbett-McCambly

The Corbett-McCambly group consists of 11 claims in Chester township, located just south of Schist creek. Leslie Corbett reports an 8-foot quartz vein at the contact of a feldspar porphyry dike and arkose on claim S. 24,803. It strikes east-west and dips slightly south. A channel assay from a prospect pit over a width of 8 feet yielded 0.09 ounces gold per ton. A 6-foot quartz vein in sheared arkose is exposed in another prospect pit on claim S. 24,936. It strikes east-west and dips steeply south. A channel assay over a width of 7 feet yielded 0.05 ounces gold per ton; a grab sample of the same material gave 0.32 ounces gold per ton.

Young-Shannon Gold Mines, Limited

Young-Shannon Gold Mines, Limited, was incorporated in 1932 to take a working option on a group of 14 claims, held by the Chester Shannon Syndicate, in the vicinity of Clam lake. Sufficient work was completed to bring this group to patent, and the company now holds a 15 per cent. interest in the Chester Shannon Syndicate. In addition, the company holds a group of 8 claims, S. 20,641-47, 20,653, lying between Owl (Chester) creek and Clam lake.

In October, 1933, a small gang of men, under the direction of C. T. Young, were engaged in completing the necessary assessment work on the company's claims, named above. During the progress of this work a quartz vein was discovered on a small island toward the south end of Clam lake, only a few feet north of the south boundary of claim S. 16,304. This claim, which at that time was held by the Chester Shannon Syndicate, has since been purchased outright by the Young-Shannon company. The vein, the discovery of which was made while the writer was visiting the Clam lake section, is exposed only at the water's edge and consists of about 3 feet of dark smoky quartz, which is heavily mineralized with mispickel, pyrite, and chalcopyrite. Assays of two grab samples yielded 0.49 and 0.02 ounces of gold per ton. Mr. Young reports that this vein, or possibly another one that is parallel to it, has been picked up on the mainland a few hundred feet to the west and that interesting mineralization is being encountered, as well as consistently high gold values.

A 26-foot test pit has already been sunk near the original discovery. The results obtained have been so encouraging to the management that plans are being made to establish a level at a depth of 125 feet, at which point the vein will be drifted on for 600 feet. If the results are still encouraging a more extensive programme of underground development will be initiated by sinking a vertical shaft on the mainland. For this purpose the property is being equipped with a complete mining plant and excellent camps. In this connection it is interesting to note that this company is the first in the Three Duck Lakes area to undertake a programme of underground development.

INDEX, PART III

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