# FORTY-FIRST ANNUAL REPORT

## OF THE

# ONTARIO DEPARTMENT OF MINES

## 1932

## PART II

ONTARIO

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. CHAS. MCCREA, *Minister of Mines* THOS. W. GIBSON, *Deputy Minister*

# FORTY-FIRST ANNUAL REPORT

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# ONTARIO DEPARTMENT OF MINES

BEING

## VOL. XLI, PART II, 1932



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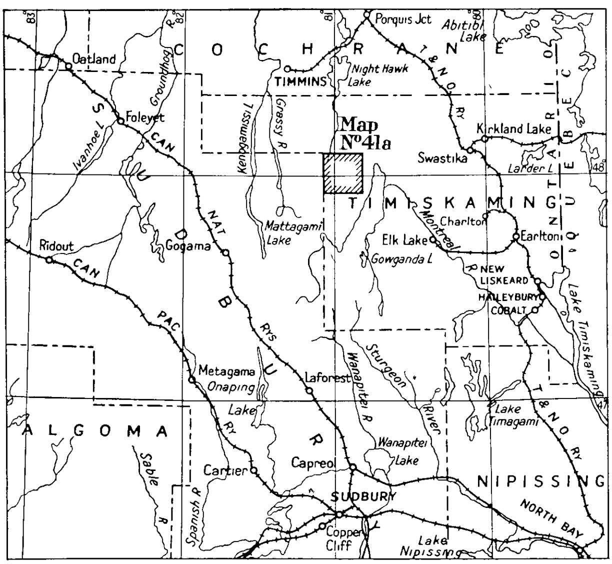
# Bannockburn Gold Area

By H. C. Rickaby

## INTRODUCTION

The Matachewan area lies west of the Montreal river, about 30 miles northwest of the town of Elk Lake, and is about 430 square miles in extent. Prospecting for gold in this area commenced about 1909, but nothing of importance was found until 1916, when discoveries were made by J. Davidson and S. Otisse in Powell township. During the next two years many claims were staked and considerable development work was done in the vicinity of the Davidson-Otisse property, without proving up ore bodies sufficiently large to be mined economically at that time. Interest in the area was revived in the




Key map, Bannockburn Area
Scale 60 miles = 1 inch

fall of 1930 by B. Ashley's discovery of a rich gold-bearing quartz vein in the northwest part of the township of Bannockburn, district of Timiskaming. Following this discovery a large number of claims were staked in the vicinity, and prospecting on these claims was carried on during the summer of 1931. This prospecting activity took place chiefly in the four townships of Argyle, Bannockburn, Hincks, and Montrose, which form a block in the west half of the Matachewan area and which, in this report, will be called the Bannockburn gold area.

### History of Exploration

The earliest geological work in the Bannockburn area was done in 1896 by E. M. Burwash,[1] who was attached as geologist to Alexander Niven's party

[1]E. M. Burwash, Ont. Bur. Mines, Vol. VI, 1896, pp. 167-184.

surveying the boundary line between the districts of Algoma and Nipissing. Burwash studied the geology along this line, which forms the western boundary of Montrose and Hincks townships, traversing D. Sinclair's exploration line for a distance of 5 miles eastward into Montrose. In 1911, J. G. McMillan[1] accompanied a party surveying the Temiskaming and Northern Ontario trial line as geologist, and mapped part of Montrose township. In 1917, A. G. Burrows[2] examined the four townships of Cairo, Powell, Alma and Baden, lying to the east of the Bannockburn area. In 1917-18, H. C. Cooke[3] examined the four townships included in the Bannockburn area as well as the adjoining halves of the townships on the north, east, and south. The townships of Zavitz and Hutt lying to the west of the area were covered by T. L. Gledhill[4] in 1925.

During the summer of 1931 as a result of the Ashley discovery and the prospecting activity which ensued, the writer was instructed by the Ontario Department of Mines to make a report on the Bannockburn area. The work consisted of a detailed examination of the properties under development as well as careful mapping of the rest of the area, particular attention being paid to the rocks and rock structures favourable for gold deposits. The method followed was to traverse the country systematically by pace and compass traverse, using the township boundary lines, surveyed waterways, and surveyed claim lines as bases.

## Acknowledgments

The writer wishes to express his thanks to W. H. Emens, C. F. Cockshutt, and other officials of the Mining Corporation for information in connection with the Ashley property and for assistance in many ways throughout the season. Thanks are also due to G. F. Summers and T. Code for copies of claims surveyed during the season, and to the prospectors working in the area for their assistance and co-operation. In the field, G. H. Charlewood, C. G. Clarke, and H. F. Zurbrigg, acted as assistants and rendered efficient service.

## Means of Access

The best canoe route into the area starts at Elk Lake, which is the terminus of a branch of the T. & N.O. railway, and follows the Montreal river westward. A motor launch is used for the 9-mile stretch up the river to Indian Chutes; from there a motor truck is taken for the 18 miles to Moyneur's landing on the west branch of the Montreal river. This branch is followed by canoe to Powell creek, from the head of which by a series of portages and lakes Whitefish river is reached. The route up one branch of the Whitefish leads southward on the western boundary of Bannockburn into Montrose; that up another branch leads westward across Hincks township and south to the western part of Montrose township. These upper reaches of the Whitefish entail considerable portaging and at low water are difficult to navigate.

Two other canoe routes, both from Nighthawk lake, lead to the area. One is by Nighthawk river and the other by Whitefish river. A canoe trip was made in the middle of August from Austen lake, going down the former and returning by the latter. The trip down the Nighthawk required 15 portages, the longest

[1]J. G. McMillan, "Geology of the Area along the Temiskaming and Northern Ontario Railway Trial Line between Gowganda and Porcupine," Toronto, 1912.

[2]A. G. Burrows, "The Matachewan Gold Area," Ont. Bur. Mines, Vol. XXVII, pt. 1, 1918, pp. 215-240.

[3]H. C. Cooke, "Geology of Matachewan District, Northern Ontario," Geol. Surv. Can., Mem. 115, 1919.

[4]T. L. Gledhill, "Grassy River Area, District of Sudbury," Ont. Dept. Mines, Vol. XXXV, pt. 6, 1926, pp. 57-76.

of which was 40 chains, and took 14 hours travelling to the head of the motor launch route. The portages were in good shape, but one section of the river in Cleaver township was full of log jams. Coming up the Whitefish from the end of the motor-launch route necessitated 10 portages, two of which were 40 chains long, and the trip required 13 hours travel to Argyle lake. Both of these routes would, of course, be better at high water.

A summer road suitable for motor trucks is under construction from Elk Lake to the Ashley mine. During the fall of 1931 it was improved from Elk lake westward as far as Moyneur's landing, a distance of 25 miles. From this point the projected route follows the old road, which runs west past the Davidson-Otisse property and then northwest, crosses the west branch of the Montreal river south of the mouth of Powell creek, and continues along the south side of Powell creek passing south of Beaudin lake and then approximately due west to the Ashley mine. This 17-mile section of the road is being graded and surfaced during the summer of 1932. Within the Bannockburn area

View of Ashley mine looking northeast.

a number of good trails have been cut leading to various claims; most of these trails are shown on the map.

Since the beginning of 1931, General Airways, Limited, has maintained airplane service between Elk Lake and Ashley lake and most of the supplies for the prospectors and operating companies have been taken in by this method, which has proved efficient and economical.

## Topography

A good description of the topography of the country is given in Cooke's report. The relief in general is low, and the hills seldom over 100 feet high, with the exception of those areas underlain by rocks of the Cobalt series where the maximum relief is about 500 feet. Of the Cobalt series, Cooke[1] states:—

> The rocks of this series have been gently folded along north-south axes; the erosional forces acting on the folded rocks have scooped out valleys along the anticlines, and the synclinal portions, less jointed and broken, and, therefore, more resistant to erosion, stand up as ridges. The areas underlain by Cobalt series are thus characterized by a predominance of valleys and ridges running north and south.

Cooke also observes that this structure of the Cobalt series has been superimposed on the areas underlain by older rocks, as shown by a marked

[1]H. C. Cooke, op. cit., pp. 3, 4.

north-south trend to the direction of the principal valleys and watercourses; whereas the structure of these rocks crosses this direction at various angles. Most of the other topographical features, such as irregular-shaped lakes and sand plains formed by outwash action, are the result of glaciation.

### Drainage

The height-of-land separating Hudson Bay waters from those of the St. Lawrence basin passes through the Bannockburn area from the northeast part of Argyle township southwesterly, crossing the northwest part of Bannockburn and the southeast part of Montrose townships. The north and central parts of the area drain northward via the Nighthawk and Whitefish rivers, and the western part of Montrose drains westward into the Grassy river. Most of the area is heavily drift-covered, and the streams passing through this drift area are sluggish and meandering.

### Forests

The Bannockburn area is well forested, chiefly with jackpine, spruce, and balsam. Occasional small stands of white and red pine were noted, but they do not cover a sufficiently large area to have any commercial importance. Brulé occupies a large part of Bannockburn township and some small areas in Montrose.

## GENERAL GEOLOGY

The table of formations may be summarized as follows, the arrangement being in the order of geological succession:—

| | |
|---|---|
| PLEISTOCENE: | Glacial sands and gravel. |
| KEWEENAWAN(?): | Olivine diabase. |
| | *Intrusive contact* |
| COBALT SERIES: | Conglomerate, greywacké, argillite. |
| | *Unconformity* |
| MATACHEWAN: | Quartz diabase. |
| | *Intrusive contact* |
| ALGOMAN: | Granite, syenite, porphyry, lamprophyre. |
| | *Intrusive contact* |
| HAILEYBURIAN(?): | Peridotite, pyroxenite, gabbro, diabase. |
| | *Intrusive contact* |
| TIMISKAMING SERIES: | Arkose, slate. |
| | *Unconformity* |
| KEEWATIN: | Iron formation.<br>Volcanics—rhyolite, basalt, andesite, and their tuffs and agglomerates. |

The oldest rocks in the area are Keewatin in age and consist of volcanic flows and tuffs of acid to basic character. Overlying these in the southwestern part of the area are steeply tilted sediments, which are thought to belong to the Timiskaming series. A series of basic to ultra-basic rocks intrusive into the Keewatin are considered to be Haileyburian in age. Algoman intrusives are represented by bosses of granite and syenite, and numerous dikes of porphyry and lamprophyre. Quartz diabase dikes of the Matachewan series cut all the above rocks. Flat-lying sediments of the Cobalt series form the latest sediments of the area. Olivine diabase dikes noted in two places may represent the Keweenawan.

## Keewatin

The Keewatin is represented by andesites, basalts, and rhyolites in the form of flows and pyroclastics. Rocks of the composition of andesite make up the largest part of the area including Argyle and Hincks townships, and the northern part of Bannockburn and Montrose. Rhyolite is prominent east and west of the boundary line between Montrose and Bannockburn. No sharp line, however, can be drawn between areas of the two main types. There is considerable interbedding between andesite and basalt and between andesite and rhyolite, and all three types are interbedded with their tuffs and agglomerates. On the map two main types are distinguished, one of which is largely andesite and basalt with thin rhyolite flows, and the other largely rhyolite with andesite interbedded. Throughout Hincks township, the southwestern part of Argyle and the northwestern part of Bannockburn the attitude of the flows and interbedded tuffs, as determined from flow tops, indicates a series of beds dipping at steep angles with the tops to the northeast. This would suggest that the position of the rhyolite was low down in the Keewatin series. However, the absence in this area of pillows or other structures favourable for the determination of dips and tops of flows makes it impossible to draw definite conclusions in this respect.

### Rhyolite

The largest area of rhyolitic rocks occurs in the western part of the township of Bannockburn and the eastern part of Montrose. The rocks are massive and fine-grained with phenocrysts of feldspar and quartz, though the latter forms but a small percentage as a rule, and the rocks are for the most part rather basic rhyolites. They have resisted alteration more than the andesites and basalts, the chief development being sericite and chlorite. Rhyolite occurs also in the southwestern part of Montrose township, where it forms part of a large mass extending to the south and west. Here it has been highly sheared and altered to a carbonate sericite schist.

### Andesite

The andesites form a thick series of flows, separate members of which have thicknesses up to 300 feet. The rock consists essentially of plagioclase and hornblende, grading on the one hand into rhyolites and dacites, with the addition of quartz, and on the other hand into basalts. A long east-west trench on claim No. 8173, north of claim No. 8204, of the Mining Corporation's property, exposed rock almost continuously for a distance of 1,400 feet, and at least six separate flows could be distinguished. The tops and bottoms of the flows are fine-grained with spherulitic and amygdaloidal textures, whereas the centres are frequently sufficiently coarse to be called diabases or diorites. Pillow lavas are very common in the basic greenstones and are sufficiently well developed in some outcrops to show the attitudes of the flows. The andesitic rocks are somewhat more altered than the rhyolites. The plagioclase has been sericitized and saussuritized, and the ferromagnesian constituents have been largely altered to chlorite. Epidote and leucoxene are also prominent as secondary constituents.

Tuffs and agglomerates underlie a large part of Argyle township and the northeastern part of Hincks. Agglomerates in the vicinity of Argyle lake have large fragments of andesite, up to one foot in diameter, in a finer andesitic matrix, which in places looks like conglomerate. Very fine ash beds, from a few inches to two or three feet in thickness, were seen interbedded with the tuffs.

### Iron Formation

A few small occurrences of iron formation were noted in Montrose township, two in the northwestern part and three in the northeastern part. In each case they appeared to be narrow and consisted of banded silica and iron oxides and carbonates, the oxides and carbonates having been partly replaced by pyrite. They appeared to be interbedded with the andesites and rhyolites.

### Folding

The Keewatin rocks of this area have been highly folded and dip at steep angles. The only criterion for the determination of their present attitude was

Coarse pillows in basalt showing spherules along the upper edge, Hincks township.

the occurrence of pillow structures in the lavas, or bedding in the tuffs. In the eastern part of Hincks township and the northern half of Bannockburn these structures occurred quite frequently. In the northern part of Hincks the strike of the bedding was north N. 15° W., while in the southern part and in Bannockburn the strike was N. 30° W. to N. 60° W. Throughout this area the tops of the flows or beds appeared to face northeast. In no other parts of the area were pillows or other structures well enough shown to determine attitudes. The folding, however, has not caused any marked degree of metamorphism of the rocks, most of the original textures, such as pillows, amygdules, and spherulites, being well preserved.

### Faulting

The course of the rivers and lakes in the Bannockburn area, particularly in the western half, suggests regional faulting in a north-south direction. Direct evidence of such faulting was noted on a small lake in Hincks township, about three-quarters of a mile east of Austen lake. In this case the fault appears to be connected with the Matachewan diabase intrusion. A prominent shear zone in the southwestern part of Montrose, which strikes northeast, indicates a fault of post-Timiskaming age, since it affects the Timiskaming sediments. This shear zone is wide and probably represents considerable displacement of the rocks affected. With this exception direct evidence of faulting on a large scale in the Bannockburn area was not seen.

## Timiskaming Series

Sediments of Timiskaming age were first mapped in this area by J. G. McMillan in 1911.[1] His map indicates a large area of these sediments in Midlothian township and they extend into the south part of Montrose. They include, according to McMillan, conglomerates, greywacké, and quartzite, composed chiefly of worn-down Keewatin materials, with steeply dipping beds. When Cooke mapped this area he gave these sediments a local name, the Kiask series, but describes along with the Midlothian area other rocks along the boundary line between Montrose and Bannockburn which he termed the Bannockburn area of the Kiask series. The latter is classed in this report with the Cobalt series for reasons that will be given later. The Montrose area of these sediments was not mapped in detail, and the boundaries shown are largely those of Cooke. The rock observed along the south boundary of Montrose appeared to be mostly arkose, slate, and tuff. It has been schisted and so altered to carbonates, sericites, kaolin, etc., that its original character is difficult to determine. At the west end of Midlothian lake, conglomerates, greywacké, arkose, and slate dip at steep angles to the north. The rocks are schistose and, to a great extent, composed of worn-down greenstones. The folding of these sediments is shown by Cooke to be synclinal, with the axis of the fold striking N. 60°-70° E. and plunging to the east. Cooke shows also that there is positive evidence of an erosional unconformity between the sediments and the underlying Keewatin, and there seems to be no reason why his Kiask series of the Midlothian areas is not equivalent in age to the Timiskaming series.

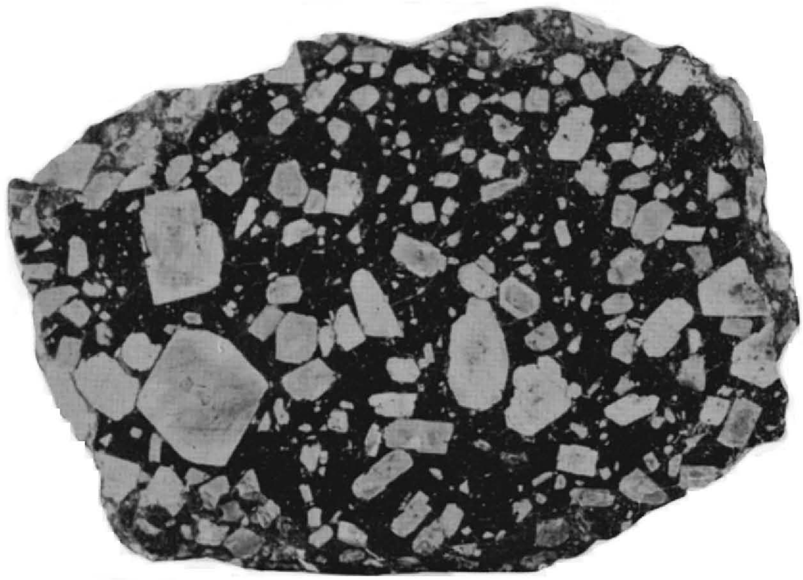
## Haileyburian(?)

The rocks included under this heading consist of a series of basic to ultra-basic varieties, including peridotite, pyroxenite, gabbro, and diabase. The first two of these were noted by Cooke, but were described as intrusive into the Keewatin. Because of their marked resemblance to basic intrusives of Haileyburian age described by C. W. Knight[2] and by later writers in other areas they are classed here with the Haileyburian, though it is not known definitely that they are later than the Timiskaming series. The best examples of these basic intrusives occur in the north half of Bannockburn township and the south half of Argyle. They appear to be in the form of small bosses or lenses, though some of the diabases were dikes. The peridotite and pyroxenites are black to greenish-black rocks, much altered on their weathered surfaces. Compasses were noticeably deflected in the vicinity of some of these rocks owing to a high content of magnetite.

A thin section of a peridotite from the north shore of Ashley lake showed it to consist chiefly of enstatite, olivine and serpentine. The olivine has been largely altered to serpentine containing considerable magnetite dust. A thin section from the large mass north of Deak lake in the southern part of Argyle township shows the rock to consist largely of fibrous hornblende and chlorite

[1]J. G. McMillan, op. cit.
[2]C. W. Knight, Ont. Dept. Mines, Vol. XXIX, pt. 1, 1920, p. 210.

with a little plagioclase and quartz. It is coarse grained, and since most of the mineral constituents are secondary it is probably an altered pyroxenite or gabbro. Another mass occurring at the south end of Zurbrigg lake in Bannockburn is a very coarse-grained rock consisting of lath-shaped crystals of plagioclase and hornblende up to half an inch in length, with a little quartz and ilmenite. The plagioclase is considerably altered to sericite and the ilmenite to leucoxene. It has a marked diabasic texture, which is more evident in the finer grained edge of the body. Rusty-weathering rocks with good diabasic texture were noted in several places and were mistakenly designated in the field as Matachewan diabase. In thin section, however, they are much older looking and more highly altered, and have been classed as Haileyburian. On Rahn lake in Bannockburn one of these peridotites has been faulted along a northwest-southeast direction. The rock is entirely altered to a serpentine, talc, and calcite, and small veinlets of asbestos have developed along fractures parallel to the fault plane.



Polished specimen (natural size) of feldspar porphyry, Bannockburn township.

## Algoman

Rocks of Algoman age in this area include granite, syenite, porphyry, and lamprophyre, with intermediate types. Two large granite bosses occur, one in the centre of Hincks township and the other on the east boundary of Bannockburn. There are also a number of smaller bosses or plugs, mainly in the southern half of Argyle. A great number of dikes of porphyry, porphyritic granite, and lamprophyre intrude the greenstones throughout the area. They are especially numerous in the area where the four townships meet and for three miles north. Their strike, which is in every direction, appears to bear no relation to the strike of the formations or to any other structural features.

The granites are pink-weathering, fresh-looking, medium-grained rocks, consisting of orthoclase, albite, hornblende, and quartz, the last-named mineral making up usually not more than 5 per cent of the constituents. Considerable variation is noticeable in different parts of the same mass through changes in texture and in mineralogical composition giving rise in the former to porphyritic granite and in the latter with decrease of quartz to syenite and diorite. The only alteration evident is the kaolinization of the feldspars.

The dikes are mostly porphyritic, the phenocrysts being mainly of feldspar, with or without hornblende or quartz, and occasionally biotite. A very striking porphyry occurs in Bannockburn township half a mile northeast of Rahn lake. This dike, which is about 20 feet wide and at least 200 feet long, strikes north and south. It contains well-formed phenocrysts of feldspar up to three-quarters of an inch in length along with smaller ones of hornblende in a fine-grained matrix. Some of the feldspars show marked zonary banding characteristic of plagioclase, but chemical analysis indicates that it is mostly a potash soda feldspar. In thin section the crystals show a combination of albite and pericline twinning, and it is probably anorthoclase. All the feldspar is much altered to kaolin.

Most of the lamprophyre dikes are less than 5 feet wide and generally occur in association with other porphyries. The phenocrysts are usually hornblende and plagioclase, with biotite prominent in a few cases. In a thin section from a small outcrop of lamprophyre near the Ashley shaft, biotite is the most prominent material of the phenocrysts with a little augite and hornblende.

From the foregoing descriptions of the Algoman intrusives it will be noted that they grade into one another with no definite line between the various types. In only one instance was there conclusive evidence of one type cutting another. On the west side of claim 8287 a dike of quartz-feldspar porphyry cutting the hornblende granite was noted, but even in this case the contact was not very distinct, and the dike is probably only slightly later than the granite. The conclusion is that all these intrusives are the result of one period of igneous activity.

## Matachewan

Diabase dikes of the Matachewan series are well represented in this area and appear most persistent and numerous in the vicinity of the Algoman intrusives, which they also intrude. They are normal quartz diabases consisting of augite, plagioclase, and quartz, with magnetite and ilmenite. As in other areas they have a pronounced north-south strike seldom varying by more than 15 degrees east or west of due north. Burrows[1] describes very similar diabases in Powell township to the east, and he shows that they are post-Algoman and pre-Cobalt in age.

## Cobalt Series

Sediments of the Cobalt series occupy the southern half of Bannockburn township and the southeastern part of Montrose. In Bannockburn an arm about half a mile wide runs north from the main body into Argyle, and in Montrose a band with an average width of 1½ miles runs slightly west of north across the township of Hincks into Cleaver. It consists of conglomerate, argillite, greywacké, and arkose, more or less interbedded, and has a total thickness of about 1,500 feet. It is a comparatively flat-lying series of rocks with an average dip of about 10 degrees.

The basal conglomerate of the Cobalt series was observed at a number of points, viz., near a small lake 1½ miles south of Ashley lake in Bannockburn township, at the north end of the arm projecting into Argyle and at several points along the west side of this arm, and at the northwest corner of Bannockburn lake in Montrose township. A remnant of the conglomerate was also seen on

[1]A. G. Burrows, op. cit., p. 229.

claim No. 8705 in Bannockburn. In every case examined it consisted largely of boulders of red granite with a few of greenstone in a matrix of granite or greenstone material. In none of these places was there evidence of a thickness greater than 50 feet and it appeared to be lying flat or with low dips on the greenstones. The best exposure is the one at the north end of the arm extending into Argyle; it shows a granite conglomerate with a thickness of 25 feet overlain by 20 feet of argillite, succeeded by another 30 feet of red granite conglomerate, which forms the top of the ridge. Another remnant of conglomerate lies on the southwest shore of Rahn lake, but here the boulders are of white granite and rhyolite and its classification is doubtful.

The argillite is a dense, fine-grained rock, often showing very fine bedding along which it splits readily. It might be called a siliceous shale. In the area to the east of Charlewood lake there is a similar rock with occasional pebbles or boulders. Greywacké and arkose make up most of the rest of the Cobalt series. The former is usually fine grained and massive without evidence of bedding, but its general appearance suggests a flat-lying structure. Reddish arkosic layers were noted, frequently interbedded with the argillites and greywacké. The presence of these red beds is characteristic of the Cobalt series in this area, and it was largely on the basis of their absence that Cooke classified the rocks in his Bannockburn area with the Kiask series. A good exposure in a hill on the east side of Zurbrigg lake shows several of these reddish beds alternating with the greywacké. In view of this fact, as well as the character of the basal conglomerate and the non-schistose character of the argillite and greywacké as compared with the Timiskaming series of the Midlothian area, the writer considers that this area is probably also a part of the Cobalt series. It is possible, of course, that inliers of the older sediments may exist in the Bannockburn area since, owing to its comparatively flat-lying structure, the Cobalt series here is probably quite shallow in depth, but no inliers were seen in the course of the work.

#### Folding

With respect to the folding of the Cobalt series, Cooke states:[1] "The Cobalt series in Matachewan district has been gently folded, and the strata thrown into open folds with dips rarely exceeding 20 degrees. The main axes of folding strike N. 15° W. in the western part of the district to nearly north in the eastern part." The area along the boundary between Montrose and Bannockburn appears to be synclinal, the axis of the syncline plunging at a low angle to the south.

#### Faulting

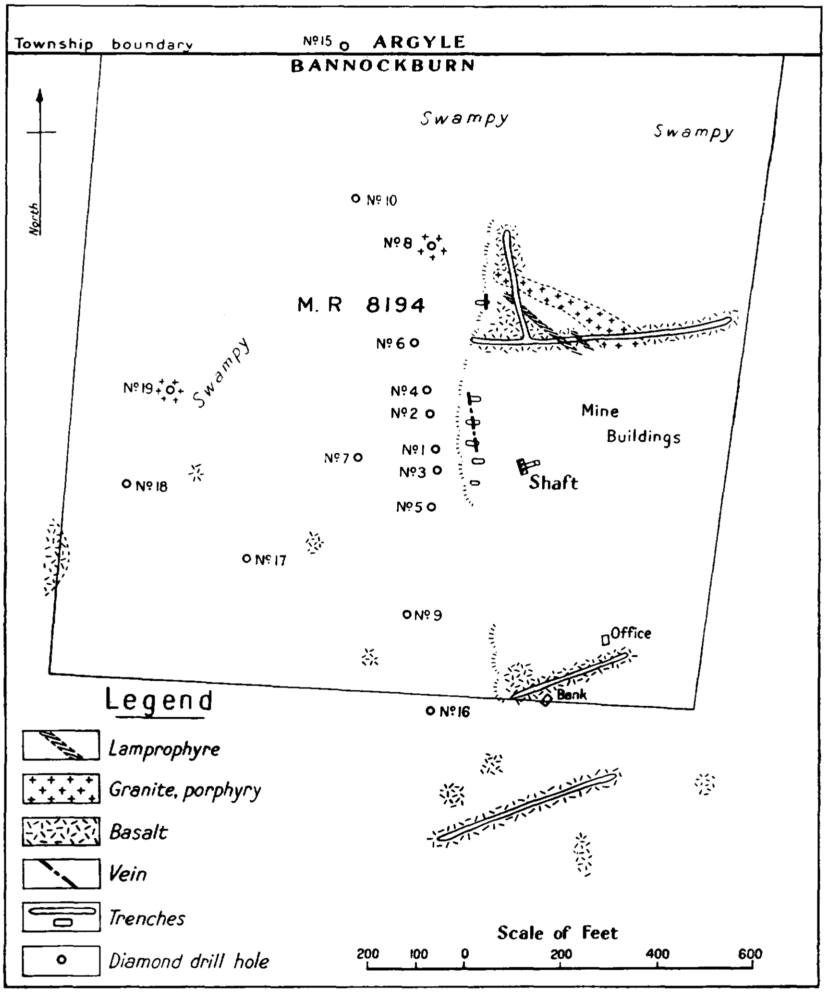
Direct evidence of faulting of the Cobalt series was noted only in one place. At the east side of the south bay of Sinclair lake a fault striking northwest was indicated by a small scarp on the east side of a draw with a coarse arkose on one side and a finer greywacké on the other. It did not, however, appear to be a fault of great displacement. Cooke has indicated north-south faults along the contact of the Cobalt series with older rocks. The rather steep dips of the younger sediments at the contacts in some instances possibly favour this conclusion, but for lack of more direct evidence these faults are not shown on the map accompanying this report.

### Keweenawan(?)

The only rock of possible Keweenawan age seen in the area was an olivine diabase, very similar in appearance to the late olivine diabases of other areas.

[1]H. C. Cooke, op. cit., p. 34.

It was a fresh-looking diabase consisting of augite, labradorite, olivine, and magnetite. The olivine was quite fresh and abundant and, since it was not seen in any of the dikes of the Matachewan series, it is thought that these dikes may be Keweenawan in age though they were not seen cutting the Cobalt series. One of these dikes striking northwest-southeast occurs in Montrose township about three-quarters of a mile east of the north end of Dara lake. The other




Sketch map showing geology and surface workings in vicinity of the Ashley mine.

was a single outcrop in the northwestern part of Hincks township without any indication of strike.

## ECONOMIC GEOLOGY

Previous to the discovery of the Ashley vein comparatively little intensive prospecting had been done in the Bannockburn area. The only evidence of previous development work noted was in connection with some asbestos showings on Rahn lake and on a pyrite body associated with iron formation in the south-western part of Montrose township. Following the discovery of the Ashley vein many claims were staked in the area, and during the summer of 1931 a number of the groups were prospected for gold.

## Asbestos

The asbestos deposits of Rahn lake are fully described by Cooke, and apparently very little additional work has been done since his report. Regarding the Rahn Lake deposits he states:[1]—

> The asbestos seen by the writer is in a lenticular body of peridotite on the south shore of the lake, which strikes north 40 degrees west and dips steeply to the southwest. The body was traced for a distance of about 1,700 feet northwest, where it passes under a covering of swamp and drift. At the southeast end it appears to pinch out. A shallow pit has been dug at the southeast end of the peridotite body, at its contact with the rhyolite, which forms the country rock. The peridotite, here highly serpentinized, is filled with veinlets of asbestos up to one-quarter inch in width, over a width of 5 or 6 feet. The formation of the asbestos seems to be genetically connected with a small boundary fault, which has sheared the serpentinized peridotite, obliterating the remains of all original textures and forming a featureless serpentine highly slickensided. At a distance from the fault plane the serpentinized peridotite retains its original granular texture, and asbestos veinlets are not present in it. . . .
>
> At the extreme northwest end of the peridotite mass, on the portage out of Rahn lake, a little further stripping has been done along the southern contact with the rhyolite, and there essentially the same conditions are observable as have been described, except for the lack of the supposed fault breccia. The veinlets of asbestos are somewhat wider, and specimens were obtained showing fibre an inch in length. The major part is, of course, less than this.

In 1922, since Cooke's visit, a small 45-foot inclined shaft was sunk on this showing on the Rahn Lake portage by the Empire Asbestos Company, Limited. This shaft was full of water at the time of the writer's visit.

## Gold Depoists

A large number of quartz veins, some of which carry gold values, were uncovered, chiefly in the northwestern part of Bannockburn, the southwestern part of Argyle, and the east half of Hincks townships. It will be noted that this area shows the greatest concentration of the porphyry dikes and the small masses of granite and syenite, and a genetic connection between these acid intrusives and the veins is evident.

### General Characteristics of the Veins

The veins discovered so far are narrow for the most part and of the fissure type, occupying fractures or faults of only slight displacement. Consequently they are frequently irregular in dip and strike and widths, and gold values are erratic. Most of the veins occur in the greenstones, but they also cut granite and porphyry without any marked difference in appearance. Alteration of the wall rock does not usually extend for more than a few inches from the joints formed by fracturing. It consists chiefly of carbonatization, silicification, and pyritization. Ankerite is very common amongst the carbonates replacing the wall rocks. Within the vein, orthoclase and specularite are almost invariably present, but no high-temperature minerals other than specularite were noted. The orthoclase is reddish in colour, and a chemical analysis of some of this material from the Ashley vein showed it to be an almost pure potash feldspar. Pyrite is abundant and shows two generations, a fine-grained variety characteristic of the wall rock, and a coarse variety occurring along fractures in the quartz. Galena and a little sphalerite and chalcopyrite are usually present. Gold is present in the native state, and in the richer veins altaite (lead telluride) is common.

[1]H. C. Cooke, op. cit., p. 40.

### Genesis of the Veins

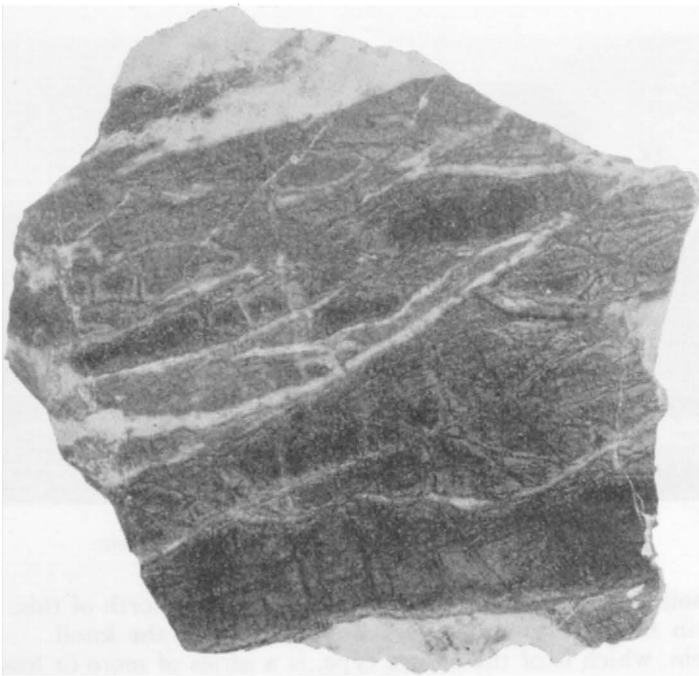
Fractures and minor faults cut the greenstones, granite, and porphyry, and provided the openings along which solutions deposited the vein-forming minerals. The source of these solutions was probably the granitic magma from which the granite, porphyry and lamprophyre crystallized, and the formation of the veins is probably the last phase of Algoman activity.

## Description of the Gold Properties

### MINING CORPORATION OF CANADA

#### Historical Summary

The claims of the Mining Corporation were staked in the fall of 1930 by B. Ashley and William Garvey, who were associated with Horace Strong of



Polished specimen (natural size) showing fracturing and alteration of the basaltic wall rock, McGill Gold Mines, Hincks township.

Haileybury, and were prospecting in the interests of the above-mentioned company. The property includes a group of 23 surveyed claims lying near the west end of the boundary between Bannockburn and Argyle townships, eleven of the claims being in Bannockburn and twelve in Argyle. The Mining Corporation also had under option nine claims lying to the north of this group, staked by A. Mosher, of Haileybury. Two veins were uncovered in the early stages of prospecting and were known as the Ashley vein and the Garvey vein. Trenching carried on during the summer of 1931 disclosed a number of smaller veins, but none of these appear to be of importance. During the winter of 1930-31 the two main veins were diamond-drilled, and as a result of the drilling an inclined shaft was sunk on the Ashley vein and drifting done on four levels at 125-foot intervals down to 500 feet. The amount of drifting on the levels is as follows: 125-foot level, 367 feet; 250-foot level, 362 feet; 375-foot level, 222 feet; 500-foot level, 182 feet. Ore pockets have been constructed below the 500-foot level, and raises have been put up to handle the ore. A mill is in process of construction. It is to have an initial daily capacity of 75 tons, but with slight additions will be capable of doubling this tonnage. A transmission line has been built by the Northern Ontario Power Company that will supply electric power to replace the steam plant which has been used up to the present.

#### Description of the Ashley Ore Body

The Ashley vein occurs on claim No. 8194 the north boundary of which is the boundary line between Argyle and Bannockburn townships. Very little rock outcrops on the claim, and consequently what is known of the geology of the immediate vicinity has been obtained from the trenching and diamond-drilling. The vein outcrops for a length of approximately 100 feet on the west

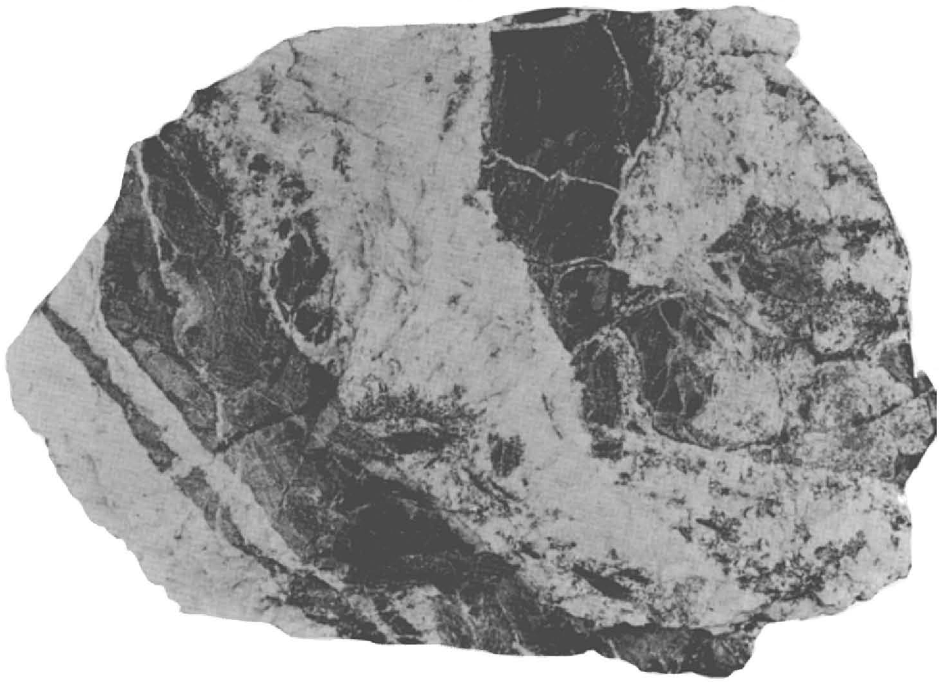
Pillow lavas in the footwall rock of the Ashley vein.

side of a knoll, and is visible again in a trench 200 feet north of this. Its actual outcrop is in the low ground along the west side of the knoll.

The vein, which is of the fissure type, is a series of more or less connected lenses of quartz cutting Keewatin greenstones. The greenstones consist of basalt flows showing good pillow structures, the flows standing on end and striking approximately northeast-southwest. Near the south end of the claim and on the strike of the vein, a thick member of the flows is a coarse-grained rock with the appearance of a gabbro or diorite, but its chemical composition as determined by an analysis is almost identical with that of the fine-grained material, which is undoubtedly part of a flow. Four hundred feet north of the shaft a dike of porphyritic granite and two small dikes of lamprophyre cut the greenstone. The granite dike is about 30 feet wide and strikes N. 70° W. It outcrops entirely in the footwall of the vein, but a diamond-drill hole to the west in the hanging wall started in granite, which is probably the westward extension of the dike. Seven hundred feet west and 150 feet north of the shaft a diamond-drill hole sunk to a depth of over 600 feet was in porphyry throughout its length, and another hole 200 feet south of this one showed several narrow porphyry dikes, evidently in the footwall of the vein. Associated with the granite dike outcropping north of the shaft is a dioritic rock, which is thought to be a border phase of the granite. The lamprophyre dikes occur just to the south of the granite, the larger one being 5 feet wide and striking N.50° W. It appears to cut the diorite rock and is probably slightly later than the granite. It is a mica lamprophyre, biotite being most prominent among the minerals of the phenocrysts, with some augite.

The strike of the main vein is N. 10° W., and its dip is approximately 50° W. Diamond-drilling has indicated that there is more than one fracture containing quartz with gold values, and shows a length of 1,200 feet of vein material in a north-south direction with possible extension in both directions.

The vein shows up well in the drifting on all four levels with a width of rarely over two feet of quartz. It splits in places into two or more parallel veins



Specimen (one-third natural size) of high-grade gold ore, 250-foot level, Ashley vein, showing quartz containing inclusions of basalt.
The small white specks are pyrite.

and narrows in others to a few inches, but for the most part is fairly persistent along strike. The dip varies from 45 to 55 degrees with an average of 51°W., except at the south end when it flattens considerably, with dips as low as 30 degrees. At the south end on the 125- and 250-foot levels, it is represented by a number of narrow, flat-lying lenses or stringers, which do not make ore. On the 375-foot level the dip changes from 50 degrees at the crosscut to 35 degrees at the south face, and on the 500-foot level the dip is from 30 to 35 degrees from the crosscut south, but the vein is strong and high-grade. This flattened condition of the vein at the south end of the present workings is probably due to a roll in the fault plane and is also probably a local condition, since a drill-hole 350 feet south of the present workings showed a good intersection of the vein.

There is considerable alteration of the wall rock with a rather marked contrast between that of the hanging wall and footwall on the two upper levels.

The footwall alteration consists mainly of silicification, carbonatization, and pyritization. Narrow stringers of quartz occupy fractures in the footwall in directions parallel to the main vein, and dipping at low angles into it. The greenstones bordering the main vein and along the small quartz stringers have been replaced by ankerite and fine pyrite. They carry low values in gold, but only rarely are they sufficiently high-grade to make ore. Extreme brecciation and carbonatization is characteristic of the hanging-wall rocks.

The minerals of the main vein include pyrite, galena, sphalerite, chalcopyrite, altaite, native gold, and specularite, which occur along fractures in the quartz.

View of Ashley vein, 125-foot level, north drift, showing main quartz vein, narrow stringers in the footwall, and mud seam in the hanging wall.

The pyrite is coarse-grained and its presence generally indicates high-grade ore. Fine-grained galena and altaite, and occasional coarse crystals of sphalerite, make up the rest of the minerals of the quartz vein. Native gold, usually in fine particles, is associated with the pyrite and altaite. A narrow high-grade stringer in the footwall showed a small quantity of a gold telluride, and Professor Ellis Thomson, of the University of Toronto, who is making a mineralographic study of the Ashley vein has identified krennerite, (Au.Ag.) $Te_2$, occurring very sparingly in association with altaite.

Movement subsequent to the formation of the main vein is represented by a mud seam on the hanging-wall side of the vein, which shows prominently on the two upper levels. On the 125-foot level it parallels the main vein throughout the length of the drift. At the north face this slip and the vein are together, whereas at the crosscut the former is 6 feet to the west in the hanging wall. Well-marked striations on the slickensided face of the slip indicate that the movement is in the form of an oblique slip fault with a low horizontal component. The actual displacement, however, does not appear to be great. On the 250-foot level, the slip and the vein are together at the north face, but at the crosscut the former curves sharply into the hanging wall. This later movement is characterized by the deposition of quartz and calcite, and small quartz calcite stringers were frequently noted cutting the earlier veins.

*Paragenesis.*—The genesis of the gold veins at the Ashley mine would appear to be as follows: Following the intrusion and consolidation of the porphyries and porphyritic granite, shearing stresses caused the development of fractures

View of a section of the Garvey vein.

in a north-south direction. Hydrothermal solutions from an underlying granitic magma penetrated these fractures, depositing quartz and replacing the wall rocks by carbonates, chiefly ankerite, and pyrite. Later the fracture was reopened and further deposition of quartz took place along the main vein accompanied by pyrite, galena, sphalerite, altaite, and native gold. Still later movement gave rise to the mud seam and minor slips attended by the deposition of quartz and calcite.

### Garvey Vein

The Garvey vein occurs on claim No. 8205, about 150 feet north of the centre of the south boundary. The vein dips at a low angle, approximately 20° N., and its strike is about east and west, the exact bearing being difficult to determine owing to the low dip and rough topography. A small creek in a draw separates the vein exposed by trenching into two parts. The west part has a length of 110 feet of quartz with a maximum width of 18 inches. East of the draw there is exposed another 200 feet of vein with a width of about 12 inches. The country rock is fine-grained basalt, which has been fractured and silicified and replaced by ankerite and pyrite. At the east end the rock has been more highly altered and shows felsitic phases. The minerals of the vein are pyrite, galena, native gold, and specularite, which occur along fractures in the quartz. At the west end the quartz appears to pinch out, though some narrow stringers of quartz have been exposed by trenching to the southwest of the main vein for a distance of about 400 feet, and these may be connected with the same fracturing.

Four shallow diamond-drill holes were put down to intersect the vein, none of which showed values of ore grade over sufficient width.

A number of other smaller veins have been uncovered by trenching on the claims of the Mining Corporation and on the adjoining Mosher group, but they are all small and apparently unimportant.

## OTHER CLAIMS IN BANNOCKBURN TOWNSHIP

### Aldermac

The Aldermac property comprises a group of 14 claims lying to the southwest of the south bay of Ashley lake. The country rock is andesite, which has been intruded by a lens-shaped boss of granite one mile long, lying along the west side of the south bay of Ashley lake. Approximately 20 chains south of the south end of the bay on claim No. 8374 a quartz vein occurs in the andesites. The vein, which strikes N. 50° E., was uncovered for a distance of 125 feet, with widths up to 2 feet. The quartz was heavily mineralized with pyrite. A grab sample from the showing assayed 20 cents per ton in gold.

### Galer Claims

This group consists of 9 claims staked by R. B. Galer, of Elk Lake, about 1½ miles south of the north boundary and 1 mile west of the east boundary of Bannockburn. In the northwest corner of claim No. 8485 a number of quartz veins, striking N. 10° W., were uncovered by trenching over a distance of 300 feet. They consisted of narrow lenticular veins in a zone 30 feet wide. The quartz and schist are heavily mineralized with pyrite, with a small amount of chalcopyrite and galena occurring in pockets in the quartz. A grab sample of quartz and sulphides gave only a trace of gold.

## ARGYLE TOWNSHIP

### Thompson Claims

This property consists of a group of 5 claims, controlled by E. J. Thompson, of Elk Lake, lying in Argyle near the 3½-mile post of the east boundary. The showing consists of a quartz vein occurring in a sheared zone in a medium coarse grained hornblende granite. The vein, which has been uncovered for a length of 30 feet, strikes N. 30° W. and stands perpendicularly. A pit shows a width of 30 inches of quartz mineralized with pyrite, chalcopyrite, and molybdenite. A channel sample across 3 feet at the bottom of the pit is reported to have assayed $4.80 per ton in gold. A grab sample taken from the pit assayed $2.80 per ton in gold. The country in the vicinity of the vein is heavily drift covered and neither the extension of the vein nor the limits of the granite are known.

### Fox Claims

Two claims, Nos. 7487 and 8325, lying almost a mile northwest of Tomfox lake were staked by Tom Fox of Matachewan. The country rock in the vicinity of the claims is andesite and andesite tuffs somewhat sheared and altered to a carbonate schist. Some pits near the south end of claim No. 7487 showed rusty carbonate schist abundantly mineralized with pyrite and containing small stringers of calcite and quartz. A grab sample of the quartz and pyrite assayed 40 cents per ton in gold.

## HINCKS TOWNSHIP

### McGill Gold Mines, Limited

This property comprises a group of 19 surveyed claims in the southeastern part of Hincks township. It includes a group of 10 claims staked by J. A. Davidson, of Toronto, and 9 others staked by H. Speers, of Gowganda. In the spring of 1931 near the south boundary of claim No. 8272 a large block of float quartz was uncovered showing heavy mineralization with pyrite, and carrying gold. Further prospecting led to the discovery of several more large chunks of similar vein matter spread out along a general east-west direction for a distance of approximately 1,000 feet. Trenching in one place showed a number of these large blocks weighing several tons each lying along a northeast-southwest direction for a length of 75 feet and occurring on the surface and at various depths down to seven or eight feet. These blocks consist chiefly of vein matter with stringers of quartz cutting basalt, which is heavily mineralized with pyrite and ankerite, with some native gold, galena, and a little altaite. It was evident from the size and shapes of the blocks that they could not be far removed from their original position, but owing to the heavy drift cover and extreme weathering of the surface bed rock, trenching to locate the vein was found to be difficult.

The Mining Corporation of Canada arranged with the company in control to prospect the claims in return for stock in the company. The prospecting took the form of deep trenching and diamond-drilling. This work was just under way at the close of the field season, but the officials of the Mining Corporation have furnished the information obtained from their operations.

Eight diamond-drill holes were sunk, and a large number of trenches were dug along an east-west direction near the north limit of the float quartz showings, as a result of which two veins have been located, one at each end of the explored ground, which may possibly be connected to form one vein. The dips of the veins as indicated by trenching and drill-holes is low, not over 30 degrees to the south or southwest. A trench at the east end showed a mineralized zone 4½ feet wide striking N. 60° W. and dipping 30° S.W. The zone consists of quartz stringers in basalt showing the characteristic reddish alteration and containing disseminated pyrite and ankerite. Native gold and altaite were noted in place in the vein at this point. This vein was followed for a distance of 200 feet along the same strike.

Eight hundred feet west, another vein, striking N. 60° W., was located and traced by trenching and drilling for 300 feet. The mineralization is similar to that of the east vein with widths up to 8 feet of fractured basalt containing quartz stringers with considerable pyrite. If the two showings are part of the same vein it would have an east-west strike. No float was discovered to the north of the line joining the two veins, and the conclusion of the officials in charge is that the veins were wide higher up on the dip and probably quite flat-lying, which would account for the large quantity of float located to the south.

Some narrow stringers were found on claims Nos. 8268, 8269, 8318, and 8319, one of which showed a little fine gold. They all strike north of west and dip to the southwest at angles of from 10 to 25 degrees.

The country rock in which the veins occur is basalt, which has been intruded by a number of dikes of porphyry and lamprophyre. Assays of sections from the drill-cores and surface showings were all low with the exception of the vein at the east end, where native gold was visible.

Two other small veins were located on claim No. 8273 near the township boundary. The larger of these veins occurs in andesite and has a length of 125 feet with a maximum width of 8 inches at the west end, where it passes into low ground. It strikes east and west and dips 75° N. The quartz contains considerable pyrite, and native gold was noted in one place in the vein. The other vein, 150 feet to the north, is similar but somewhat smaller; it strikes N. 60° W.

### McCollum Gold Mines, Limited

This property comprises a group of eighteen surveyed claims near the east boundary of Hincks township, lying north of the McGill group. The country rock is basalt and andesite, intruded by dikes of porphyry and granite. A lens-shaped body of granite half a mile long and as much as 10 chains in width occurs on the northern part of the group. Two veins had been discovered at the end of the field season, but very little work had been done on them. One vein occurs near the west side of claim No. 8167 in the granite. The quartz was 12 inches wide striking approximately north and south and dipping 35° W. It was mineralized with coarse pyrite and a little specularite. Two grab samples from this vein assayed $25.00 and $8.20 per ton in gold. The vein could be traced for a distance of 50 feet at the time of the writer's visit to the property, and it has since been reported that it has been uncovered by trenching for a distance of 600 feet into the greenstones to the south.

Another vein occurs on the boundary line between claims Nos. 8163 and 8164. The quartz has a width up to 18 inches, and is traceable for 150 feet. It strikes N. 35° W. and dips 45° S.W. It appeared to be associated with a porphyry dike with the same strike. A grab sample of the quartz containing some pyrite showed a trace of gold on assay.

### Oliver-Tough Claims

A large group of approximately 30 claims controlled by Sherman Oliver and George Tough are located near the centre of Hincks township, south of the west branch of the Whitefish river. During the summer of 1931 a gang of from 6 to 12 men was engaged in prospecting these claims. The country rock is andesite and basalt with granite along the northwest side of the group. On claims Nos. 8940 and 8937 a number of large masses of float showing altered basalt containing quartz stringers and mineralized with pyrite and ankerite were discovered, and considerable trenching and stripping was done to locate the source of the float, which was similar to that on the McGill property to the east. A number of small porphyry dikes and some narrow quartz stringers were located, but no veins showing widths corresponding to the widths indicated by the float were found up to the end of the field season.

## MONTROSE TOWNSHIP

### Montrose Syndicate Claims

J. H. McKinlay and George Welsh, of Elk Lake, control this group of 18 claims lying along the boundary line between Hincks and Montrose townships, about one mile west of the east boundary line of the townships, eight of the claims being in Hincks and ten in Montrose township. In 1931 the property was under option to Montreal interests, who did considerable surface prospecting under the direction of C. W. Greenland. The country rock is largely andesite with narrow rhyolite bands and some iron formation interbedded. Numerous small porphyry dikes intrude the volcanics. There are two showings on which considerable work has been done, one on claim No. 8457, approximately 500 feet southeast of the 1½-mile post on the north boundary line of Montrose and the other near the centre of claim No. 8242, about 900 feet southwest of the 1½-mile post. In the former a trench 100 feet long shows a highly sheared andesite with iron formation in the form of banded cherty rocks containing carbonates. The strike of the schistosity is N. 80° W. and that of the bedding is N. 65° W. A small porphyry dike and stringers and lenses of quartz cut the greenstones parallel to the schistosity. One band of rock, about 4 feet wide and of a bright greenish colour, stands out prominently in the schist. It consists of a ferruginous dolomite streaked with pea-green mica, probably mariposite, and with narrow stringers of quartz. Pyrite is abundant in the schist, quartz, and carbonates. Channel samples across the heavily pyritized material are reported to have given low values in gold on assay.

The other showing is very similar in general appearance to the above. It consists of a highly sheared andesite, which has been carbonatized, chloritized, and heavily mineralized with pyrite, and contains quartz stringers. Stripping in a number of other places in the vicinity of these two showings disclosed other narrow bands of pyritized schist, but no appreciable values in gold were obtained.

### Leliever Claims

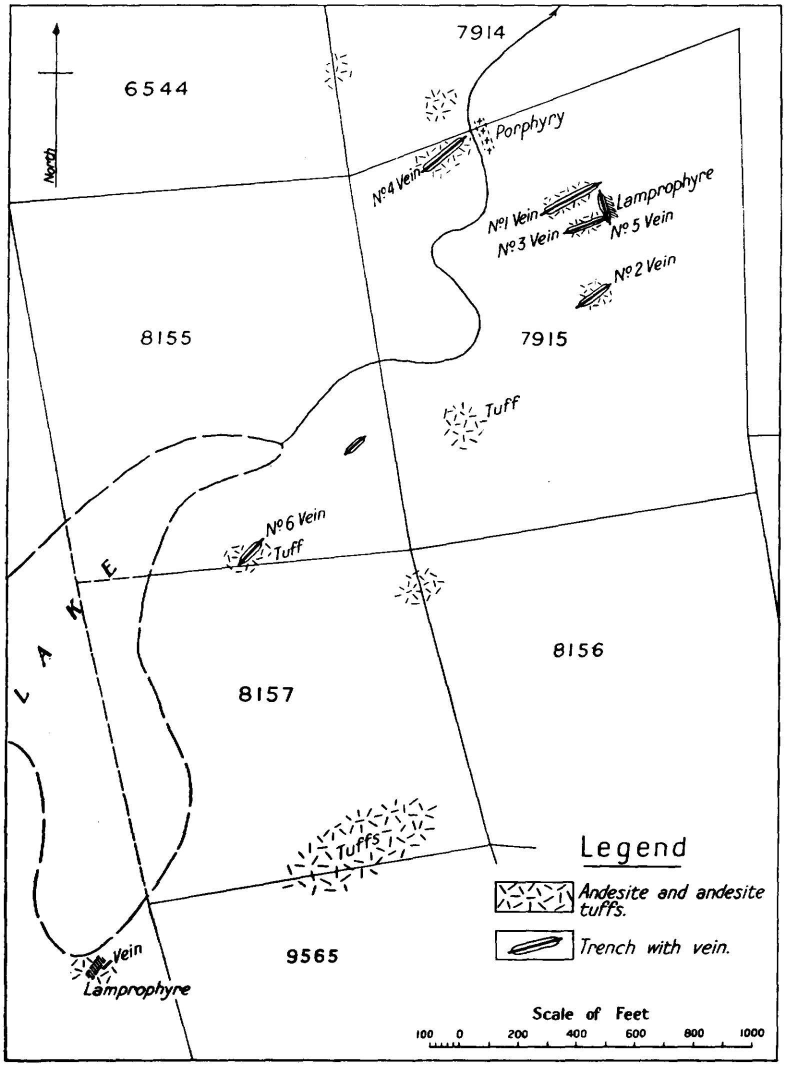
This group of nine claims, Nos. 9170 to 9178, inclusive, lying east of Dara lake, is controlled by J. Leliever, of Kirkland Lake. Some work has been done under the direction of Sandy McIntyre. The showings are connected with a pyrite body occurring in the rhyolite on claim No. 9178. The pyrite is associated with a massive cherty quartz, which appears to be in the form of a very acid intrusive in the rhyolite. In places the quartz was glassy and dark-coloured, and contained large fragments of jasper. The quartzose bodies were in the form of lenses or plum-shaped bodies with widths up to 100 feet, and striking N. 30° E. The rhyolite has been sheared and both rhyolite and quartz are heavily mineralized with massive fine-grained pyrite. Low values in gold were reported, but two grab samples of the pyritized quartz gave no gold on assay.

### Claims G.G. 5911-9

This group of 9 claims owned by T. Wright, J. Young, and J. R. Todd, of Schumacher, lie in the southwestern part of Montrose at the northeast end of Hutt lake. The property was under option to the Tump Line Syndicate, which did some work on a sulphide deposit associated with iron formation. The showing occurs at the north end of claim G.G. 5915, about 400 feet northeast of Hutt lake. According to local reports, some work had been done a number of years ago on this showing by a company known as the Ogiltree Mining Syndicate. A band of rusty schist up to 30 feet in width strikes N. 10° W. and has been traced for a distance of 600 feet. It contains a series of disconnected lenses of quartz up to 5 feet in width, heavily mineralized with pyrite and a little chalcopyrite. Some of the quartz is banded and cherty, which is typical of iron formation, and the schist is much altered to carbonates and sericite. At one place there is a lens-shaped body of an acid igneous intrusive, also considerably altered. Two grab samples of the quartz containing pyrite and chalcopyrite gave no gold on assay.

## BADEN TOWNSHIP

No geological mapping was done in Baden township, but short examinations were made of two properties on which some development work was done during the summer of 1931.




Sketch map showing geology in vicinity of veins on Baden Syndicate claims, Baden township.

### Baden Syndicate

The property of the Baden Syndicate consists of a group of 10 claims lying in the northwestern part of Baden township, approximately half a mile west of the north end of Matachewan lake, from which a good trail leads to the property. The showings occur on claims M.R. 7915 and M.R. 8155, and considerable trenching and sinking of test pits has been done on them under the direction of Harry Crawford, of Elk Lake.

The country rock is largely andesite and andesite tuffs which have been somewhat sheared and carbonatized in places. A 25-foot dike of feldspar porphyry striking N. 25° W. occurs on the north boundary of claim M.R. 7915. This has also been sheared and carbonatized, and contains narrow quartz stringers. A small lamprophyre dike appears on the footwall of No. 5 vein. Six veins have been uncovered, five of which have a northeast-southwest strike. The veins and surface geology are shown in the attached diagram.

In No. 4 vein, the quartz has widths up to 6 inches in a schisted zone 4 feet wide, which strikes N. 50° E. and dips steeply to the southeast. It contains coarse pyrite and some chalcopyrite and sphalerite. The vein has been uncovered for 150 feet and a pit sunk to a depth of 15 feet. A channel sample across 4 feet at the bottom of this pit was reported to assay $4.80 in gold. A grab sample of the quartz from this vein assayed $6.80.

No. 1 vein, which strikes N. 65° E. and dips 75° S.E., consists of 3 feet of schist containing parallel stringers of quartz up to 3 inches wide striking N. 65° E. and dipping 75° S.E. This vein has been uncovered for a distance of 250 feet, and a pit 15 feet deep sunk on it. Coarse pyrite is the chief mineral present. A chip sample across 4 feet at the bottom of this pit was reported to assay $1.60 in gold. A grab sample from the dump assayed $1.00.

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

No. 2 vein has been trenched for a length of 100 feet, showing quartz up to 12 inches wide, mineralized with pyrite. A grab sample of the quartz gave no gold on assay.

No. 6 vein, on which work was being done at the time of the writer's visit, lies about 25 chains to the southwest of the other showings. This vein ranges in width from 3 to 16 inches at the west end, where it passes into low ground. It strikes N. 40° E. and dips 85° S.E., and has been stripped for 100 feet. It is mineralized with pyrite and a little chalcopyrite, and considerable fine native gold was seen in the vein at the west end. This property is being further prospected under Mr. Crawford's direction.

#### Hurd Property

This property comprises a group of four claims lying in the western part of Baden township, approximately 1 mile east of the 3-mile post on the west boundary. The country rock is andesite and andesite tuffs, somewhat schisted and frequently showing carbonate alteration. A dike of quartz-feldspar porphyry from 10 to 30 feet wide cuts the greenstones, striking N. 60° W. It has been traced by trenching and stripping for over 3,000 feet, and is reported to extend for some distance farther to the southeast. The dike itself has been sheared and mineralized with pyrite and carbonates, and contains in places small irregular quartz stringers. In one place where the shearing of the dikes is more marked, a pit has been sunk to a depth of 12 feet showing numerous fractures filled with quartz, and the quartz and porphyry are heavily mineralized with coarse pyrite. A 5½-foot channel sample across the bottom of this pit is reported to assay

$11.80 in gold. A grab sample of the mineralized quartz assayed $8.80 in gold. The walls of the dike do not show much mineralization.

This property was optioned by the Arno Mines, Limited, and was explored by diamond-drilling in the spring of 1931. Twelve holes, totalling 2,000 feet, were put down over a distance of 2,200 feet along the porphyry. Assays of sections from the porphyry nearly all gave values in gold, but they were low and no ore of commercial value was indicated.

#### Claims M.R. 7318, 7319

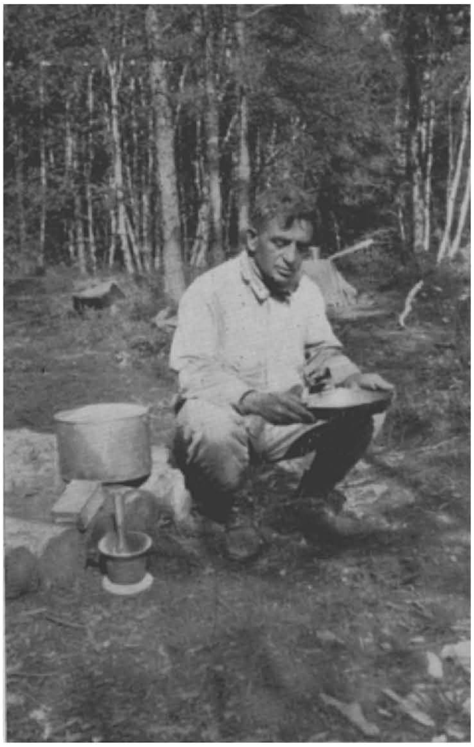
These two claims, staked by James Quilty, of Elk Lake, lie southwest of the Hurd group, approximately two miles north and one mile east of the southwest corner of Baden township. Near the west boundary of M.R. 7319, a narrow band of schist striking N. 70° W. contains a 2-foot vein of quartz heavily mineralized with pyrite. A grab sample of the quartz from a small pit assayed $11.40 per ton in gold. Sufficient trenching or stripping had not been done at the time of the writer's visit to indicate the length of the mineralized zone.

# Tyrrell-Knight Area

By A. R. Graham

## INTRODUCTION

Owing to a stringency in financing, the year 1930 witnessed a decline in prospecting for gold in the more remote areas in Northern Ontario and a revival of interest in several of the older established and easily accessible gold fields. The efforts of many prospectors were not without success, and a number of promising discoveries were made in areas that have been disregarded for years.

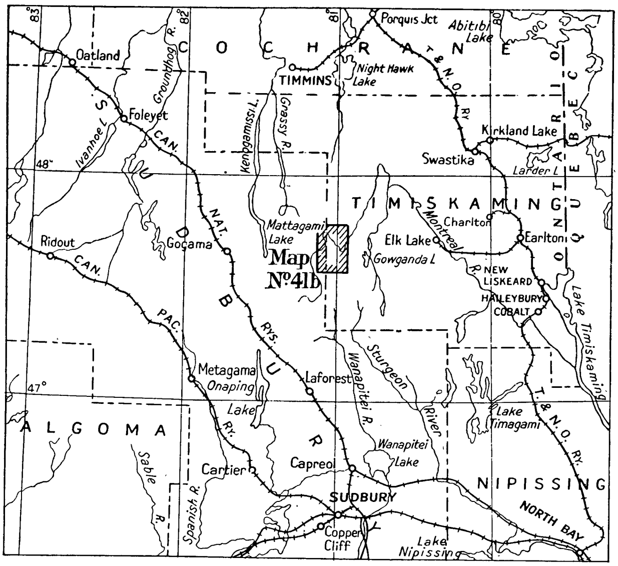


A prospector panning crushed rock for gold, a common sight in Northern Ontario during the summer months.

Although many were prophesying a paucity in the production of gold, it would appear that more intensive prospecting and a more practical consideration of the engineering problems of many gold deposits already located will result in the continuation of gold mining in Ontario for many years to come.

One of the most attractive finds of the year 1930 was made by Bert Ashley and B. Garvey in Bannockburn township, district of Timiskaming, in the Matachewan gold field. The publicity given to the Ashley-Garvey discovery was the incentive for a considerable rush into this area during the fall of 1930. A large number of prospectors, whose arrival was delayed until the most favourable ground was already occupied, turned to other areas of Keewatin greenstone in the immediate vicinity. This expansive movement reached as far south as the townships of Tyrrell and Knight, where the explorations of prospectors were rewarded before the winter set in. Late in October, gold was discovered by E. Holland near the boundary line between Knight and Tyrrell townships, about a mile and a half west of Duncan lake. Widespread interest was aroused following the announcement that the McIntyre-Porcupine Mines had acquired the Holland claims. During the spring of 1931, the greater part of the Keewatin area in the two townships was staked in claims. The exploration of this ground in the summer months resulted in numerous other gold discoveries in addition to the Holland deposit, and several of the most promising of these are now under development.

Since little geological information was available concerning the possible occurrence of gold in this area, the Ontario Department of Mines commissioned the writer to report on the recent activity and to prepare a detailed map of the



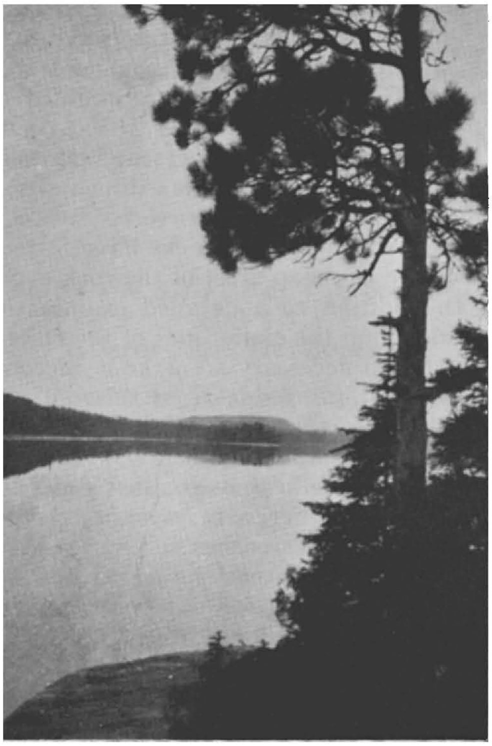

Key map showing location of the Tyrrell-Knight Area.
Scale, 60 miles = 1 inch.

geological formations. The examination during the summer of 1931 indicated that the gold deposits were genetically related to a small intrusion of granodiorite, with which are associated porphyritic dike rocks, the cause of considerable shearing and faulting in the intruded Keewatin volcanics. These geological conditions are similar to those of other gold fields in Ontario and may be regarded as favourable for the occurrence of auriferous veins of economic importance.

## Location and Access

The townships of Tyrrell and Knight are situated in the southwestern part of the district of Timiskaming. They lie about 75 miles due north of Sudbury and 60 miles northwest of Cobalt. The west side of the two townships forms the district boundary. As recent stakings have spread westward into the townships of Natal and Macmurchy, in the district of Sudbury, the eastern halves of these two townships were examined by the writer and included in the geological map.

Entrance to the area may be made either from Gowganda on the east or Shiningtree on the west, both of which towns are connected with railways by good motor roads. It is 27 miles from Gowganda to Elk Lake, the terminus of a branch railway line from Earlton Junction, which is on the main line of the Temiskaming and Northern Ontario railway, and a motor-bus service operates daily between Gowganda and Elk Lake. A 20-mile automobile road connects Shiningtree with Westree, on the main line of the Canadian National railway, and trucks or automobiles may be hired at Westree to transport equipment to Shiningtree. Supplies may be purchased at Gowganda and Shiningtree, both of which are connected by telephone lines with outside points.



View on Duncan lake looking north towards Mount Collins.

Canoe routes into the area from either Shiningtree or Gowganda are rather circuitous and require about a day's journey in each case. The route from Gowganda, going by way of Spawning lake and Wapus creek to Duncan lake in the centre of the area, necessitates several long portages. The total distance is approximately 15 miles. Coming into the area from the west, the motor road from Westree to Shiningtree extends six miles farther to the Westree mine on the West branch of the Montreal river, which flows northeastward through Duncan lake. There are fourteen short portages in the 20-mile canoe trip between the Westree mine and Duncan lake.

Travel from Gowganda is facilitated by a 9-mile road from the northwest arm of Gowganda lake to Wapus creek in Tyrrell township. Supplies can be taken over this road by wagon in the summer. This route, which is the one chiefly used, requires a half day. The road has been extended, for winter transportation only, into the camp of the McIntyre-Porcupine Mines on the Knight-Tyrrell boundary line. This company teamed in most of their equipment and supplies during the winter of 1931. A quick trip can be made to any of the larger lakes in the area by the General Airways plane, stationed at Elk Lake. Communication with outside points may also be quickly made, for a phone line connects the fire rangers' cabin on Duncan lake with the district headquarters of the Ontario Forestry Branch at Gowganda.

## Field Work and Acknowledgments

Field work, which was carried out during the summer of 1931, consisted of the preparation of geological map No. 41*b* and of the examination of the many gold prospects. Pace and compass traverses were run east and west at quarter-mile intervals, across all the region west of Duncan and Pigeon lakes. The greenstone area around Lafricain lake was also examined by the same method. From the information noted on these traverses, it has been possible to indicate on the map most of the rock outcrops. Since the bed rock east of Pigeon and Duncan lakes consists principally of the Cobalt sediments, which are unfavourable for the occurrence of gold, this region was traversed at half-mile intervals only. But, owing to the manner in which these rocks have formed long escarpments, it was possible to indicate on the map most of the rock exposures with a certain degree of accuracy. In addition to a detailed examination of the showings, pacing surveys were made along the claim lines of the chief prospects. Because of a discrepancy, it was found necessary to make a micrometer survey of some of the lakes in Tyrrell township. Aside from this, all geological information has been plotted on a base map, compiled from former surveys.

In conducting the field work, able assistance was rendered by G. A. Harcourt, H. F. Burnaby, and Bruce Russell. Credit must especially be given to Mr. Harcourt, the chief assistant on the party, who was responsible for much of the geological mapping. The writer wishes to express his appreciation to the mining officials and operators in the area for their hospitality and their interest in forwarding the field work required for this report. Many kindnesses were also received from the residents of Shiningtree and Gowganda.

## Previous Geological Work

The first geological work in the area was done many years ago and was of an exploratory character only. In 1875, Robert Bell traversed the Montreal river and described the rocks seen along the route. When the district boundary line was surveyed in 1896, E. M. Burwash accompanied the survey party as geologist and was the first to note the iron range through Tyrrell township. In 1901, this range was examined in more detail by A. P. Coleman, who also described the rocks of Shiningtree lake.

The first systematic geological examination of the area followed the Gowganda silver boom in 1908, and most of the subsequent reports were especially concerned with the geology of the silver-bearing formations. In 1910, W. H. Collins visited the area in preparing his excellent report on the Gowganda Mining Division. In a later report on the Onaping Map-Area, he reviewed the geology of the area and altered his conclusions on the age relationship of a sedimentary belt in Tyrrell and Leonard townships. This report can be regarded as the standard reference for information concerning the petrographic, structural, and historic geology of the region. In 1909, A. G. Burrows, reporting on the Gowganda silver area, examined the townships directly east of the area; and in 1912, R. B. Stewart, in his report on the Shiningtree Silver Area, examined Leonard township to the south. A re-examination of the Shiningtree area was made by George B. Langford in the summer of 1926. Natal township, part of which is included in this report, was mapped by F. L. Finley in 1925, but unfortunately, owing to his death in 1926, his report was not completed.

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## History and Development

Situated half way between the West Shiningtree gold area and the Gowganda silver area, the townships of Tyrrell and Knight have received the attention of prospectors for over twenty years. Since the area contained quartz diabase intrusions, with which the silver veins in Northern Ontario have a genetic relationship, the chief exploratory activity was formerly directed towards the discovery of silver. The Gowganda silver rush began in 1908, and prospectors exploring the neighbouring country in 1909 found native silver in Leonard township. The staking, following this discovery, extended into Tyrrell township and prospecting continued until 1912 without the discovery of an economic deposit.

Early residents in Gowganda reported to the writer that the presence of gold in Tyrrell township was noted at the time of the silver boom, but slight attention was given to its occurrence, probably owing to the fact that the gold does not occur in prominent quartz veins but in mineralized shear zones filled with narrow quartz stringers. These occurrences were disregarded again when the West Shiningtree gold area was active in the years 1912 and 1913. Since that time little prospecting was done through the area until the recent activity in Matachewan spread to outlying points. Tyrrell and Knight townships were explored once again, and on this occasion new discoveries of gold aroused the interest of many prospectors. Active staking began in February, 1931, and during this rush the greater part of the favourable ground in the two townships was staked out in claims. In the summer extensive surface work on certain prospects was done by several mining companies, and many groups of claims were systematically explored.

## General Character of the Area

Although the area is part of the pre-Cambrian peneplain, the fact that there is a general flatness in the relief is only perceptible when the sky-line is viewed from one of the higher summits. When considered in detail, the topography of the area is exceedingly hilly and irregular. Knob-shaped hills and long ridges, which frequently have abrupt escarpments on one side, rise to several hundred feet above the surrounding country. The lower levels are occupied by lakes, muskeg, and soil. Despite these rugged topographic details, the country slopes gently to the northeast. The small variation in the levels of the following lakes is a good indication of the gentleness of this slope:—

| | Feet above sea-level |
|---|---|
| Shiningtree lake | 1,125 |
| Indian lake | 1,196 |
| Hydro lake | 1,171 |
| Cripple lake | 1,165 |
| Breeze lake | 1,140 |
| Pigeon lake | 1,074 |
| Duncan lake | 1,065 |
| Sedge lake | 1,060 |

View on Wapus creek, illustrating typical topography.

Between Hydro lake and Sedge lake the mean northeastward slope is about 10 feet per mile. Rocks of massive composition have been more resistant to erosion and consequently form the higher elevations. The granodiorite in Knight township rises 200 feet above Pigeon lake, and Keewatin lavas form high ridges west of Duncan lake and Hydro creek. The structure and composition of the quartz diabase sills are also responsible for variations in the superficial relief. When the sills are flat, as is the case in the southeastern part of Tyrrell township, they form high irregular hills capping the underlying rocks. When the sills are tilted, like the Duncan lake sill, they form long low ridges, which are frequently bordered by deep marginal trenches eroded in the shattered sediments proximate to the sills. The depression in which Duncan lake lies follows the margin of a sill for many miles. The surface of the country over the flat-lying sediments, east of Pigeon lake, is gently undulating, but block-faulting has disturbed the low relief of the sediments east of Duncan lake and caused a succession of high north and south ridges with abrupt escarpments on the west and gentle slopes on the east. The intervening valleys are narrow and filled with muskeg or water. The Montreal river occupies a fault valley in the sediments for several miles north of Wapus creek and the south end of Pigeon lake also lies in a similar depression.

The harsh features of the topography were modified somewhat by glacial erosion, and the drainage of the area was altered by glacial drift deposits. The large rocky hills have a rounded profile, and many of the small exposures have that distinctly glacial-made form known as *roches moutonnées*. The rock surfaces are in many cases polished and striated. In addition to a thin mantle of glacial drift covering most of the bed rock, there are several large areas of drift that mask the underlying rocks and exhibit their own special glacial features. The flat relief of a glacial outwash plain of sand and gravel covering several square miles of country south of Arthur lake in Knight township is broken by an occasional drumlin or kettle lake. Sand plains cover a large section of the country north of Slim lake in Tyrrell township, and terminal moraines cover much of the bed rock between Porphyry lake and Indian lake in Tyrrell township and over the region east of the Montreal river in Knight township. The most striking topographic feature exhibited by the glacial deposits is a series of esker

Example of a *roche moutonné* with glacial fluting.

ridges, which run for many miles in a north-south direction. A high ridge resembling a railroad embankment begins at Brush lake in Knight township and can be traced for six miles south to Indian lake in Tyrrell township. Another ridge can be followed from Duncan lake in Raymond township eight miles south to Wapus creek in Tyrrell township. These eskers at certain points are eighty feet above the surrounding country.

The West branch of the Montreal river follows a very circuitous course and drains the entire area. This river enters the southwestern part of the area at Houston lake and forms an almost perfect letter V in the course of its flow down to Sedge lake in the northeast corner of the area. Consequently, many parts of Tyrrell and Knight townships are easily reached from this ideal waterway. All the drops on the river are abrupt, and the portages are short in length. Access to the eastern part of Macmurchy township is possible by means of Shiningtree creek, which is devoid of rapids from the Houston lake portage to Shiningtree lake in Leonard township. Many small lakes linked by several long portages form a canoe route from Duncan lake to Shiningtree lake through the southern part of Tyrrell township. Except for two short rapids, Wapus creek can be travelled to the south boundary of Tyrrell township without meeting any obstructions.

Although the country is well wooded, the trees are practically all second-growth birch and poplar, which are of little value for timber. Virgin white and red pine were noticed east of Pigeon lake in Knight township and west of Wapus creek in Tyrrell township. The region between Natal (Alexander) lake and Pigeon lake has been recently burnt bare, and the partial burning of the forests from Soot (Black) lake northeastward to Wapus creek has resulted in a thick slash of dead timber.

The area is situated approximately twenty miles east of the new Abitibi-Sudbury power line, which will serve any future mines in Tyrrell and Knight townships with an abundance of power. The right of way for a power line between Shiningtree and Gowganda crosses the southern part of Tyrrell township and could be used in building the transmission line from Shiningtree east to Tyrrell township.

## GENERAL GEOLOGY

The consolidated rocks abundantly exposed through a thin covering of glacial and recent soil are all pre-Cambrian in age and consist of metamorphosed igneous and sedimentary types in about equal proportions. These pre-Cambrian rocks are separated by a major unconformity into two divisions, which are quite distinct in age and degree of metamorphism.

The younger and least metamorphosed division includes the Cobalt sedimentary series, composed of conglomerate, greywacké, and quartzite, and the Nipissing diabase sills, which intrude the former series. These rocks are of economic importance, since the silver veins of Northern Ontario are genetically related to the diabase sills and occur both in the diabase and in the Cobalt sediments adjacent to the diabase. As this report is primarily concerned with the gold deposits and as these younger rocks have no significance in this respect, they are only briefly described in the following pages. Those wishing detailed descriptions of these rocks may refer to the excellent reports of A. G. Burrows and W. H. Collins.

The rocks of the younger division were deposited on those of the older division, which form a peneplanated basement consisting of two main parts: (1) a primary volcanic and sedimentary complex, and (2) plutonic and dike intrusions of Algoman age. The oldest rocks differentiated from this complex are the highly metamorphosed and steeply inclined Keewatin greenstones and iron formation. Enfolded with the Keewatin rocks, but separated by a minor unconformity, are the Timiskamian series consisting of rhyolite and trachyte flows, tuff, volcanic breccia, slate, arkose, and conglomerate. The succession in this series is commonly as follows: Initial beds of pyroclastics are overlain by volcanic flows, which in turn are followed by another bed of pryoclastics grading upwards into the sediments. The Algoman period is represented by intrusions of granodiorite, with which are associated dikes of lamprophyre and porphyry. The gold deposits in this area are located in rocks of Keewatin and Timiskamian age adjacent to the Algoman intrusions.

The general geology is summarized in the following table, in which the rocks are classified according to their relative ages, the oldest being at the bottom.

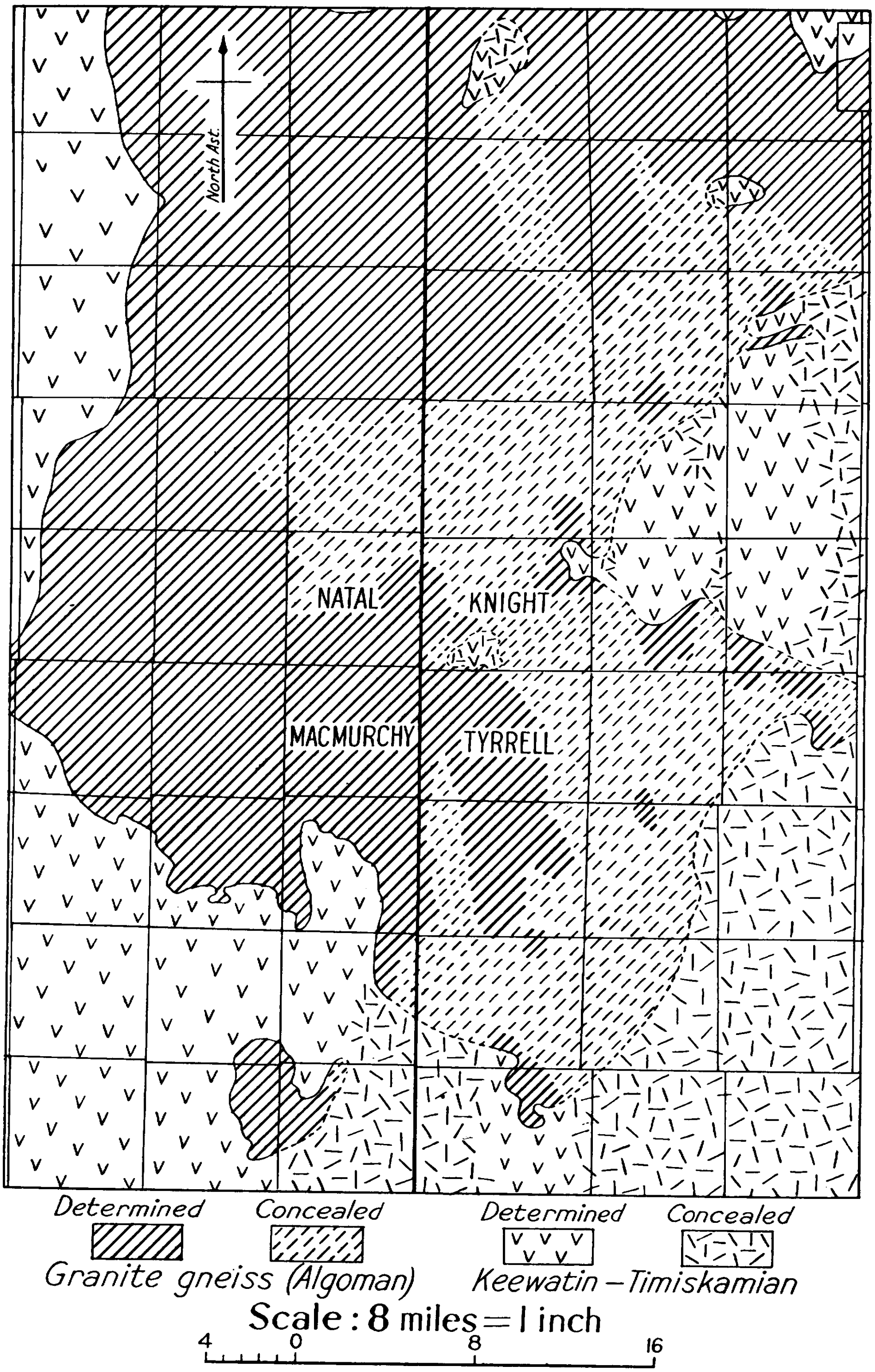
### Table of Formations

| | | |
|---|---|---|
| QUATERNARY | | |
| PLEISTOCENE AND RECENT: | | Sand, gravel, swamp and boulder clay. |
| | *Great unconformity* | |
| PRE-CAMBRIAN | | |
| KEWEENAWAN (Post-Nipissing): | | Olivine and quartz diabase dikes. |
| | *Intrusive contact* | |
| | | Quartz diabase sills. |
| | *Intrusive contact* | |
| ANIMIKEAN (Cobalt Series): | | Quartzite.<br>Greywacké, slate, arkose, and conglomerate. |
| | *Great unconformity* | |
| MATACHEWAN: | | Diabase dikes. |
| | *Intrusive contact* | |
| ALGOMAN: | | Mica lamprophyre dikes.<br>Quartz and feldspar porphyry dikes.<br>Lamprophyre dikes.<br>Granodiorite and granite. |
| | *Intrusive contact* | |
| HAILEYBURIAN: | | Serpentine (peridotite). |
| | *Intrusive contact* | |
| TIMISKAMIAN(?): | | Slate, greywacké, arkose, conglomerate.<br>Tuff, volcanic breccia, rhyolite and trachyte flows. |
| | *Unconformity* | |
| KEEWATIN: | | Andesite, ellipsoidal and variolitic pillow lavas, diabase, dacite, chlorite schists, banded iron formations, agglomerate. |

All the formations lying unconformably beneath the younger Cobalt sediments are included in the basement rocks. They are separated into three main divisions: the Keewatin volcanics, the Timiskamian volcanics and sediments, and the Algoman intrusives. These formations, underlying the Cobalt sediments throughout the area, are exposed in three separate localities, covering about half of the area. The basement rocks are almost continuously exposed in the region west of Pigeon and Duncan lakes; a large patch is revealed through the Cobalt sedimentary mantle in the vicinity of Lafricain lake, and a small area outcrops west of Wapus creek in Milner township.

The oldest rocks in the basement belong to the Keewatin period of prolonged vulcanism, during which time a thick series of basic and acid flows was deposited upon an unknown primordial floor. There followed a period of mountain-building and possibly granitic intrusion when this thick series of Keewatin rocks was upturned into folds. After a period of erosion the Timiskaming volcanics and sediments were laid down unconformably upon the Keewatin floor. During the Algoman period of mountain-building and plutonic intrusion, further folding took place, which in all cases did not coincide with the general direction of folding of the Keewatin rocks. In the long period of erosion following the Algoman only the synclinal parts of the folds were left uneroded within broad areas of granite.

The Keewatin rocks form part of a broad synclinorium, which begins thirteen miles south of Tyrrell township and extends many miles to the north. The general direction of folding in the Keewatin volcanics, indicated by the strike of the banded iron formation, is N. 20° to 30° W., which is rather exceptional, since a southwest-northeast direction of folding is usually regarded




Inferred distribution of basement rocks in the region adjacent to the Tyrrell-Knight area.

as a constant characteristic of the Keewatin rocks in the Canadian pre-Cambrian. In a small lobe of Keewatin rocks extending eastward from Knight and Tyrrell townships into the Gowganda area the axis of folding changes to an east and west direction. This change in the folding can be detected in the Lafricain lake area, where the strike of Keewatin volcanics follows the curving contact of the granite batholith. The Timiskaming rocks remain uneroded in several small synclines within the larger Keewatin synclinorium. The direction of folding in these Timiskaming areas does not always correspond to the direction of folding in the Keewatin volcanics. In the area of Timiskaming volcanics extending from Tyrrell township into Natal township the axis of folding trends northwest-southeast, whereas in the areas of Timiskaming rock northwest of Shiningtree lake in Macmurchy township, the strike of the bedding is N. 70° W. In the main area of Timiskaming volcanics and sediments in Tyrrell and Leonard townships the direction of folding coincides with that of the Keewatin rocks, but there is a marked unconformity between the dips of the two formations.

## Keewatin

The Keewatin rocks are mainly exposed in the area of basement rocks west of Pigeon and Duncan lakes. A central belt of Timiskaming volcanics exposed through Tyrrell and Natal townships separates the Keewatin rocks in this region, but the rock types are similar on either side of this belt. On the northeast side of this belt the Keewatin rocks extend northwestward from Breeze lake creek to the northeast corner of Natal township. Southwest of this belt they extend westward from Pear lake into Macmurchy township. Two areas of Keewatin rocks project through the mantle of Cobalt sediments overlying the eastern part of the map-area. One area centres around Lafricain lake in Knight and Raymond townships, and the other is found to the west of Wapus creek in Milner township.

The Keewatin rocks consist essentially of andesite and basaltic lavas, which were folded so that they now occupy vertical or nearly vertical positions. In the main areas exposed to the west of Pigeon and Duncan lakes, these rocks are extremely massive and do not exhibit the fissile types so common to other Keewatin areas in Northern Ontario. The ellipsoidal, vesicular, and variolitic structures that indicate their volcanic nature are excellently preserved. This lack of intense metamorphism may be due to their central position within the broad Keewatin synclinorium and also to the fact that the dynamic forces causing metamorphism may not have been so great in the rather exceptional northwest-southeast direction of folding of this area. In the Lafricain lake and Wapus creek areas, the Keewatin rocks form the contact zones of large granite batholiths and consequently are composed of fissile schists. The structure of the Keewatin is complicated owing to the presence of several belts of Timiskaming rocks within the main area, and it is probable that they are a number of minor folds. Owing to the massive nature of the flows it was impossible to decipher the structure. The general structural trend, as expressed by the banded iron formation, is N. 20° to 30° W.

The massive andesites and basalts, which are commonly referred to in the field as greenstones, are usually fine-grained, but in a few localities they become coarse-grained and dioritic or diabasic in texture. Basalts outcropping to the east of Pigeon lake on the Hurst property have a fine ophitic texture, and a coarse-grained diorite outcrops on the west shore of Cripple lake. The common types of these rocks are well exposed between Hydro and Shiningtree creeks and also west of the Montreal river in Natal township. Frequently, the andesites have developed an ellipsoidal structure. One band of these ellipsoidal lavas is of rather striking appearance, owing to the presence of white varioles around the margins of the pillows. This rock outcrops southwest of Pear lake and also along the west boundary of Knight township. The only exposure of volcanic fragmental material noted in the Keewatin rocks occurs to the southwest of Brush lake. A thin flow of light-green dacite was noticed at several points west of Hydro creek. Several areas of carbonate rock were seen, usually near intrusions of serpentinized peridotite. The rock is greatly fractured and filled with a network of narrow calcite veinlets. Small isolated areas of rhyolite, indicated on the map as Timiskaming, may belong to the Keewatin. The Keewatin rocks exposed around Lafricain lake are dark-coloured chlorite and hornblende schists.

A band of iron formation crosses through the southwest corner of Tyrrell township and is exposed at several points in a length of two miles. At the power-line right-of-way in Tyrrell township the width is about 60 feet, but it narrows to 20 feet where it crosses the west boundary of Tyrrell. The margins of the iron formation are composed of a dark-grey siliceous rock, and the central

Specimen (half natural size) of carbonate rock outcropping on the east shore of Pigeon lake.

part consists of alternating bands of brilliant red and black rock. The strike of the formation ranges from N. 20° to 30° W., and the dip is 80° E. The iron formation is too low grade to be of commercial importance.

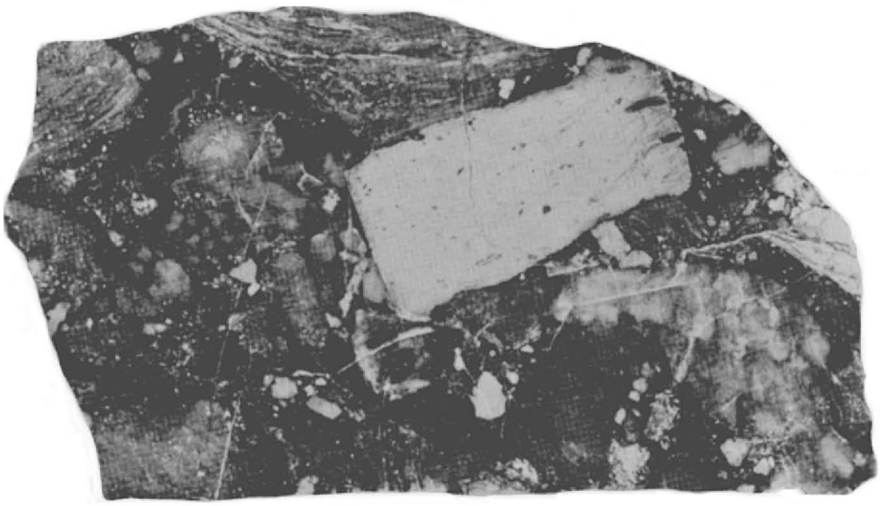
## Timiskamian(?)

The Timiskaming rocks, consisting of rhyolite and trachyte flows, tuff, volcanic breccia, arkose, slate, and conglomerate, were placed in the Keewatin by former geologists. These rocks, however, are not metamorphosed or folded as greatly as the older Keewatin. The presence of granite, grey porphyry, and jasper pebbles in the conglomerate indicates that the time interval between these two formations is great. The members of this series resemble the Timiskaming rocks in the West Shiningtree and Midlothian areas. Thus, owing to the similarity of this series to the Timiskaming rocks of other areas and with such a marked unconformity in evidence between the Keewatin volcanics and this series, the writer has classed them as Timiskamian in age.

The Timiskaming rocks are exposed in three separate areas, each of which, no doubt, represents a small fold within the Keewatin rocks. A thick series composed of both the volcanic and sedimentary members extends into the southern part of Tyrrell township between Spider and Slim lakes. The axis of folding in this series strikes N. 20° W., and the beds dip at angles of 30° to 80° W. A central area extending from Duncan lake northwest into Natal township consists principally of the volcanic members. Rhyolite types, exposed in the eastern part of the area, grade westward into trachytic types, exposed throughout Natal township. The axis of folding trends northwest-southeast, and the dips are commonly steep. A third area of Timiskaming rocks is irregularly exposed in the southeast corner of Macmurchy township and consists mainly of pyroclastic sediments. The strike of the beds is N. 70° W., and the dips are vertical.

### Volcanic Rocks

The volcanic rocks consist of interbedded flows and pyroclastic sediments. They are found beneath the sedimentary rocks, although in the central



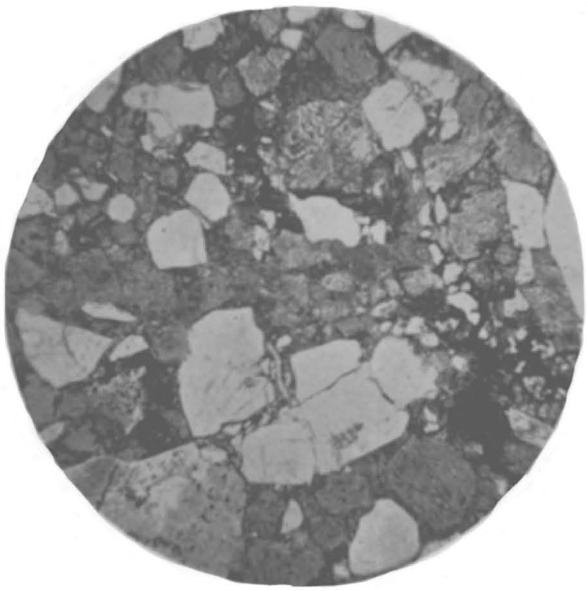
Specimen (natural scale) of volcanic breccia from the shore of Scot lake. Angular fragment of rhyolite occurs in a glassy matrix.

Timiskaming area thin beds of conglomerate occur near the base of the volcanic rocks. In the southern part of Tyrrell the succession is as follows: Initial beds of volcanic breccia and tuff are overlain by rhyolite flows, which in turn are followed by another series of breccia and tuff grading upwards into the sediments.

The rhyolite is massive pale-grey rock. Amygdules and flow structures are sometimes noticed in the tops of the flows. The rock ranges in texture from a fine glass to a coarse porphyry. The porphyritic variety consists of white phenocrysts of feldspar and quartz in a grey groundmass, and in its coarser phases it resembles the feldspar porphyries of the Algoman. Under the microscope the porphyritic variety is seen to consist of tabular albite and rounded quartz phenocrysts in a holocrystalline groundmass of quartz, feldspar, and chlorite. Large grains of pyrite are frequently present. The trachyte is pale-red in colour. In its coarse phases it exhibits a porphyritic texture, and the phenocrysts are pink feldspar and green hornblende. It resembles the hornblende lamprophyre of the Algoman, for which it might be easily mistaken. In thin section it is seen to consist of phenocrysts of tabular orthoclase and some oligoclase, smaller crystals of green hornblende, and a groundmass of slender plagioclase crystals and some chlorite. The tuffs and breccias, when associated with rhyolite, are composed mainly of rhyolite fragments; when associated with trachyte they are composed mainly of trachytic fragments. When trachytic, the matrix of the breccia is usually coarse-grained; when rhyolitic the matrix is frequently a dark ropy glass. The fragments are angular and range in size up to 6 inches. In an outcrop on the west shore of Soot lake the stratified character of the tuff is exhibited by thin alternating beds of light-grey and dark-grey material.

**Sediments**

The sediments are chiefly exposed north and east of Soot lake. The tuff exposed on the west shore of Soot lake grades conformably upwards into an arkose or feldspathic quartzite. Owing to the weathering of considerable



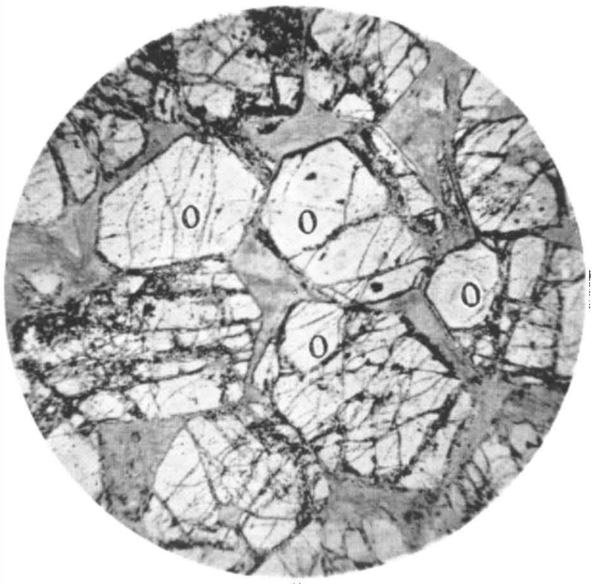
Photomicrograph of arkose found south of Indian lake.
The white grains are quartz. (One nicol, ×20.)

disseminated pyrite, the arkose is usually a rusty-brown colour on weathered surfaces, but when freshly broken it is quite white. Small angular fragments of red jasper can frequently be seen in this rock. Under the microscope, it is seen to consist of angular or slightly rounded grains of quartz, feldspar, rhyolite, jasper, and pyrite, with the interstices between these grains filled with green, chloritic material.

A narrow band of slate, in which small drag folds occur, is interbedded with the arkose on the south shore of Soot lake. A thick series of conglomerate, which was formerly mapped as Cobalt, is exposed northeast of Soot lake. It consists mainly of well-rounded boulders of volcanic material, up to 8 inches in diameter, with an occasional boulder of granite and grey porphyry. Angular fragments of jasper are also common. The matrix is similar to the arkose that underlies this conglomerate. The series is tilted into an almost vertical position, and its thickness is much greater than the thickness of any of the basal conglomerates of Cobalt age.

## Haileyburian

Numerous masses of peridotite, in most cases completely altered to serpentine, occur throughout the Keewatin and Timiskaming rocks in the area. The form in which these ultra-basic intrusions invaded the volcanics and sediments is now indefinite. The surface outline is roughly lenticular, and the longer axes of the lenses conform to the structural direction of the Keewatin volcanics, in certain horizons of which they appear. Several occur along a northwest-southeast zone from Pear lake to Pigeon lake, a direction that corresponds to the strike of the volcanics. These masses are probably small bosses of plutonic origin. One of the bosses intrudes the Timiskaming volcanics




Photomicrograph of serpentine from a drill-core from the Hedlund property. Magnetite grains outline original olivine crystals (O). (One nicol, X20.)

east of Porphyry lake, and a porphyry dike of Algoman age intersects a small boss on the west shore of Pigeon lake. As these ultra-basic rocks are post-Timiskaming and pre-Algoman in age, they have been assigned to the Haileyburian period.

The rusty surface of these soft rocks is traversed by a network of veinlets of light-green asbestos. On freshly broken surfaces the decomposed peridotite is dark-green or black in colour. Under the microscope they are seen to have altered principally to fibrous serpentine with minute quantities of brightly polarizing talc and many disseminated grains of magnetite. Although badly decomposed, the original composition can still be determined by means of the outlines of the original mineral grains. Magnetite has segregated around the original olivine crystals.

Apparently the peridotite originally consisted of idiomorphic crystals of olivine contained in poikilitic fashion in large irregular grains of a rhombic pyroxene and could be classified as the harzburgite variety of peridotite.

Typical samples from a boss, which does not outcrop on the surface, were found in drill-cores at the Hedlund property. Dark crystals of altered olivine give the freshly broken rock a coarse-grained appearance.

Another mass of serpentine occurs on the west shore and on two of the islands in the central part of Pigeon lake. A zone of well-fractured Keewatin diabase filled with carbonate veinlets surrounds the boss. Similar zones of carbonatized Keewatin rocks occur around the contact of two small lenses in Natal township and of a small mass near the Tyrrell-Knight line west of McIntyre lake. Possibly the carbonatization of the contact rocks took place during the serpentinization of the peridotite, which is usually attributed to the Algoman granite intrusions.

No mineralization of economic importance seems to have accompanied the intrusion of these ultra-basic rocks.

Specimen of granodiorite (natural scale) from Knight township.

## Algoman

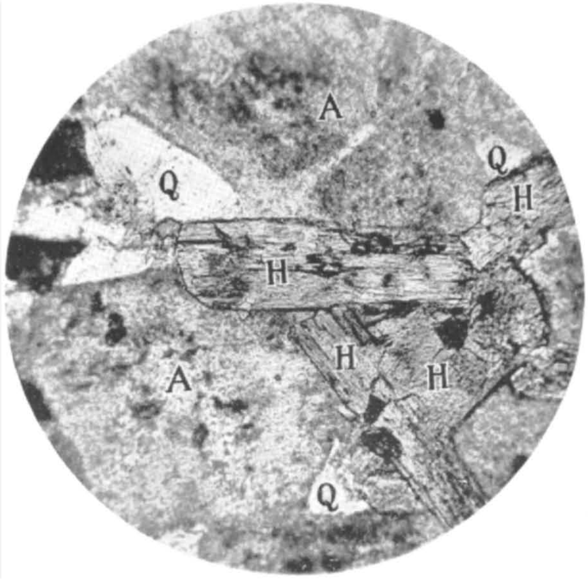
Algoman intrusives of various types occur throughout the area. They range in size from small dikes to batholiths and in composition from soda-rich granite to mica lamprophyre. A small boss of granodiorite was intruded into the Keewatin volcanics southwest of Pigeon lake. Numerous lamprophyre and feldspar porphyry dikes occur within a radius of six miles of this granodiorite and seem to be facies of this intrusion. Since these dikes intrude the Timiskaming volcanics and sediments in Tyrrell township, it is possible to class definitely all these intrusives as Algoman. The margin of a large granite batholith is found in the area east of Lafricain lake. Marginal phases of this batholith resemble the Pigeon lake granodiorite very closely in appearance and composition, and the small boss is probably related to the large batholith.

### Pigeon Lake Granodiorite

The exposed area of the irregular boss of granodiorite outcropping southwest of Pigeon lake and extending to the south boundary of Knight township is about four square miles, and the east and west margins are overlain by Cobalt sediments. It would be expected that the boss would be elongated in the general direction of the axis of folding of the Keewatin volcanics, but the direction of greatest width is almost at 90 degrees to the folding. Owing to the large number of porphyry dikes to the south of the granodiorite, it seems probable that the boss pitches in a southward direction and drops off abruptly on the north side.

The intrusion has caused very little metamorphism or distortion upon the adjacent Keewatin rocks. The greenstones along the contact and even large blocks in the granodiorite retain their original character, but smaller fragments of greenstone enclosed in the granodiorite show the effects of assimilation and are surrounded by an aureole of dark-coloured hybrid rock.

The common type of rock forming the Pigeon lake boss is a massive medium-grained granodiorite that is given a speckled appearance by dark-green hornblende crystals scattered through grey feldspar and quartz. Owing to a




Photomicrograph of granodiorite from the Pigeon lake boss, showing hornblende (H), andesite (A), quartzite (Q), and magnetite (the dark grains). (One nicol, ×50.)

change in the colour of this feldspar, the granodiorite near the margin of the boss has a dull red appearance. At certain points along the south contact, marginal porphyritic phases have developed, which show tabular pink crystals of feldspar embedded in a dark-red groundmass. No gneissic structure or banding was observed in this boss, and the rock is fresh-looking.

In thin section, the normal type of granodiorite is seen to consist of idiomorphic crystals of green hornblende, irregular grains of andesine, subordinate amounts of orthoclase, and a few grains of quartz; the accessory minerals are apatite, zircon, and magnetite. The andesine forms the most abundant constituent, being greatly in excess of the orthoclase.

The hybrid type of rock around the Keewatin fragments consists of a great deal of green hornblende, some altered to chlorite, epidote, and interstitial quartz. The porphyritic phases are composed of large tabular crystals of andesine and smaller prisms of green hornblende in a holocrystalline groundmass of feldspar, quartz, and hornblende.

A sample of the normal granodiorite from the centre of the Pigeon lake boss, analysed at the Provincial Assay Office, had the following chemical composition:—

| Chemical composition | | Theoretical mineral composition | |
|---|---|---|---|
| | per cent. | | per cent. |
| $SiO_2$ | 58.47 | Quartz | 10.32 |
| $Al_2O_3$ | 17.45 | Orthoclase | 8.34 |
| $Fe_2O_3$ | 2.36 | Albite | 36.16 |
| $FeO$ | 4.09 | Anorthite | 20.29 |
| $MgO$ | 4.32 | Hornblende | 17.19 |
| $CaO$ | 4.91 | Magnetite | 3.48 |
| $Na_2O$ | 4.30 | Apatite | .78 |
| $K_2O$ | 1.43 | Ilmenite | 1.54 |
| $TiO_2$ | .83 | Calcite | .70 |
| $P_2O_5$ | .29 | Water | 1.43 |
| $CO_2$ | .25 | | |
| $H_2O$ | 1.43 | | |
| S | trace | | |
| Total | 100.13 | Total | 100.23 |

Specific gravity, 2.808.

The theoretical composition, calculated from the chemical analysis, indicates that the orthoclase and plagioclase are in the ratio of 1 to 7.

### Lamprophyre Dikes

Dikes of hornblende lamprophyre appear to be one of the earliest formed facies of the Pigeon lake granodiorite. They are all located within a narrow radius of the granodiorite and appear to be contact differentiates. The dikes are lenticular and range in width up to 150 feet. The longer axes of most of these intrusions lie roughly parallel to the strike of the volcanics. Frequently numerous small partially assimilated fragments of greenstone are contained in the dikes, and it is possible that the basic nature of the dikes is due to the admixture of the granodiorite with this basic material.

The common type is dark-grey in colour with a tendency towards a porphyritic structure, due to dark-green hornblende crystals, which are well defined in a fine dark-grey matrix. At certain points the hornblende crystals are absent, and in these cases the rock might be more appropriately termed a syenite. The syenite phases are composed almost completely of a finely granular feldspar, which weathers to a dull-red colour. A reddish coloration also develops in the lamprophyre along contacts with the younger feldspar porphyry. Under the microscope the lamprophyre is seen to consist of idiomorphic crystals of hornblende contained in a finely granular matrix, which has suffered partial decomposition and in which are seen shreds of chlorite and sericite, magnetite grains, apatite crystals, and scattered carbonates.

Lamprophyre dikes are exposed at several places on the Hedlund property, and they have also been found in the drill-cores. Many wide dikes are exposed in the McIntyre's trenches south of McIntyre lake. A small dike was noticed in the drill-core from the Gordon property. Along with the feldspar porphyry, this type of rock seems to be constantly associated with the gold deposits.

### Feldspar Porphyry

Dikes of feldspar porphyry, up to 70 feet in width, are widely distributed through the Keewatin and Timiskaming rocks in Tyrrell and Knight townships.

Some strike N. 20° W., or roughly parallel to the folding of the volcanics; others strike N. 80° E., or nearly at right angles to the first set of dikes.

The rock varies from grey to deep red in colour. Tabular phenocrysts of white or pink feldspar form a considerable portion of the rock and reach a maximum length of one-eighth of an inch. These rocks resemble the marginal porphyritic phases of the Pigeon lake granodiorite and no doubt are related to this intrusion. Under the microscope it is seen that the phenocrysts of feldspar are mainly of the albite variety, though zoning is a common feature. In the matrix, chlorite, apatite, magnetite, carbonates, and quartz may be identified.

#### Mica Lamprophyre

A flat-lying dike of mica lamprophyre, which cuts the granodiorite north of McIntyre lake, is about five feet wide and can be traced for 1,000 feet. Black


Photomicrograph of lamprophyre from the Hedlund property, showing crystals of hornblende (H). One nicol, ×20.)

plates of biotite are quite prominent in a dark-red matrix. One exposure of a similar rock was noticed south of McIntyre lake; it appeared to be intrusive into the feldspar porphyry. Apparently these basic rocks represent the final phase of igneous activity in the intrusion of the granodiorite boss.

#### Lafricain Lake Granite

The margin of a huge batholith, which extends many miles eastward, is found in the mapped area in the vicinity of Lafricain lake. The common type of rock is a dark-red hornblende granite, but basic phases, which resemble the Pigeon lake granodiorite, occur along the margins. The Keewatin greenstones along the contacts with the batholith have been altered into chlorite and hornblende schists. The folding of the volcanics and older sediments may be attributed to this batholith and others that occur beyond the limits of the area. The strike of the schists roughly follows the contact of the granite.

Several dikes of quartz porphyry were noticed in the vicinity of House (Beaverhouse) lake, and these, no doubt, are facies of the granite.

## Matachewan

The quartz diabase dikes of Matachewan age intrude the Keewatin, Timiskaming, and Algoman formations, but are older than the Cobalt sedimentary series. The dikes are vertical, range in width from a few feet to several chains, and have a remarkably consistent north strike. On freshly broken surfaces the diabase is black in colour, whereas the dikes are rusty-weathering. Round phenocrysts of light-green feldspar are frequently present along the borders of the larger dikes. Under the microscope, the diabase consists principally of labradorite and augite, with accessory magnetite and some interstitial quartz.


Flat-lying dike of mica lamprophyre above granodiorite outcropping to the north of the McIntyre property.

Many dikes of Matachewan age occur in the Keewatin and Timiskaming areas in Tyrrell and Knight townships. They have penetrated most profusely into the Timiskaming sediments and volcanics north of Soot lake. When the power-line through Tyrrell township was surveyed, it was noticed that several of the larger Matachewan dikes had a pronounced magnetic alteration.

## Animikean (Cobalt Series)

The Animikean rocks that overlie the older basement complex in the area consist of the Cobalt sedimentary series, which is separated by a slight unconformity into two parts. The lower Cobalt is composed of conglomerate, laminated greywacké, slate, and arkose; and the upper Cobalt formation consists entirely of quartzite. The whole series is little metamorphosed and only gently folded. Consequently, the unconformity between these flat-lying sediments and the older steeply inclined basement rocks is very pronounced. In most cases, it is not difficult to distinguish between the younger sediments and the older Timiskaming series.

The Cobalt series is widely distributed over the eastern parts of Knight and Tyrrell townships, forming the western margin of an almost continuous mantle of these rocks which extends 60 miles eastward to Lake Timiskaming. The Cobalt sediments were deposited on a surface that resembles very closely the present one, being of the same peneplanated type. The lower part of the series is believed to be terrestrial deposits of glacial origin. The strata now dip at low

Basal conglomerate of Lower Cobalt age
outcropping west of Pigeon lake.

angles, usually towards the east. The most intense folding has occurred near the Duncan lake diabase sill where the strata reach a maximum inclination of 30° E. The thickness of the lower series is possibly not greater than 500 feet; the upper series, of which there is only one small area, is very thin.

Conglomerate is a constant member at the base of the lower Cobalt series, and its thickness, which varies greatly throughout the area, never exceeds 100 feet. It consists of angular, subangular, and rounded boulders of granite, granodiorite, gneiss, quartzite, rhyolite, trachyte, greenstone, and iron formation, and is entirely derived from the older basement rocks. The fragments range in size from small pebbles to huge boulders 5 feet in diameter. The matrix usually consists of a fine gravel or sand, but, in a few cases, it is composed of a slaty material.

The contact of the conglomerate with the basement rocks was noticed at numerous points in the area. Frequently the conglomerate abuts directly against the base of high hills of Keewatin or Algoman rocks. In the case of two contacts of the conglomerate resting on the Pigeon lake granodiorite, the surface of the granodiorite was rough and jagged, and the conglomerate was composed almost completely of granodiorite boulders and pebbles, indicating that it was formed *in situ*. One of these contacts was found on the Hurst property near the main vein on the shore of Pigeon lake. At another contact on Wapus creek, also noted by W. H. Collins,[1] the surface of the Keewatin rock underlying the conglomerate was very smooth, suggesting glaciation.

The greater part of the sedimentary series consists of a laminated greywacké composed of thin alternating bands of light-grey and dark-grey or brown rock. Occasionally, small pebbles are found, and it frequently grades into slaty members. Dark-grey slates are well exposed along the Montreal river in the narrow channel about three miles north of the south boundary of Knight township. At the south end of Cyril (Shallow) lake a dull-red slate was noticed. Towards the upper part of the greywacké formation, narrow bands of reddish arkose are interbedded with the greywacké. Arkose bands are also prominent in the greywacké exposed on the east shore of Duncan lake in Knight township.

Isolated remnants of conglomerate and greywacké are found over the western part of the area; frequently these areas have been protected from erosion by the overlying diabase sill. Owing to post-Nipissing faults throughout the eastern part of the area, many escarpments are found where the bedding is well exposed.

## Keweenawan

This period is represented in the district of Timiskaming by basic intrusions of great areal extent, which are termed the Nipissing quartz diabase sills. The diabase has a special economic importance, since the silver-cobalt veins of Gowganda and Cobalt are associated with this formation. Remnants of a quartz diabase sill are exposed in Tyrrell and Knight townships, and at several points silver veins have been discovered in this sill.

The Nipissing diabase sills were intruded along the bedding planes of the Cobalt sediments or immediately beneath the sediments along the surface of the older basement rocks. Their intrusion resulted in little disturbance or contact metamorphism to the enclosing rocks. The sills reach thicknesses of 500 feet or more and extend over many square miles. The common type of rock forming the sills is a medium to coarse grained quartz diabase, dark-grey in colour and of fresh appearance. There are minor phases of the sills which are more acid in composition and have a reddish colour. Small dikes of light-weathering aplite are occasionally found in the sills. In thin section the normal diabase is seen to consist of labradorite and augite intergrown in the customary ophitic manner of the diabases; while quartz, alone or in a micrographic intergrowth with feldspar, fills the interstices. The minor constituents are biotite and titaniferous magnetite.

There are three isolated sections of quartz diabase within the area, and it is probable that they may be remnants of one continuous sill that originally extended over the entire region. For descriptive purposes these sections will be mentioned as belonging to three individual sills: Duncan lake, Wapus creek, and Shiningtree lake.

[1]Geol. Surv. Can., Mem. 33, 1913, p. 51.

#### Duncan Lake Sill

The Duncan Lake sill is interbedded with Cobalt sediments, which dip at 30° E. The sill, tilted to a corresponding angle, is exposed at the surface in the form of a long continuous ribbon which parallels Duncan lake through Tyrrell and Knight townships and extends beyond the borders of the area. The sill has a maximum thickness of 400 feet and probably underlies the greater portion of the Cobalt sediments east of Duncan lake. Numerous quartz and calcite veins carrying chalcopyrite occur in the sill and in the sediments adjacent to it, but no silver minerals have been discovered in the veins.

#### Wapus Creek Sill

Two irregular areas of quartz diabase outcrop to the north and south of Wapus creek in Tyrrell township. These sill remnants dip slightly to the west beneath the Cobalt sediments and probably connect with the Duncan lake sill. A series of north and south faults upthrowing the rock formations east of the Duncan lake sill were responsible for the re-exposure of the diabase at the surface. The area to the north of Wapus creek is interbedded with the Cobalt sediments, and the small area south of Wapus creek exposed along the east boundary of Tyrrell township lies beneath the sediment on the surface of the basement rocks. Calcite veins containing silver and cobalt are found in the Wapus creek sill.

#### Shiningtree Lake Sill

Remnants of a diabase sill at one time overlying the region to the north and east of Shiningtree lake, form isolated areas of irregular outline. The northern extremity of an elongated area of diabase extending into Tyrrell township between Spider and Bobtail lakes dips at angles of 15° to 30° E. In Tyrrell township its maximum thickness is about 500 feet; to the south in Leonard township it broadens out considerably. Between Bobtail lake and Sulphide creek the sill had a horizontal position on the surface of the basement rocks and was eroded into irregular patches capping the higher hills. Small remnants are found as far north as mile 64 on the district boundary line, and the presence of calcite veins northeast of Houston lake in Macmurchy township indicates that the sill also extended over this region. Native silver was found in small calcite veins in the sill near Spud lake in Leonard township.

#### Olivine and Quartz Diabase Dikes

The youngest rock formations consist of olivine and quartz diabase dikes, which intrude all other rock formations, including the Cobalt sediments and Nipissing diabase sills. In addition to their age relationship, other characteristics which aid in their distinction are a northeast-southwest or a northwest-southeast strike, in contrast to the usually due northerly strike of the Matachewan dikes, and the sharp angular boundaries of feldspar phenocrysts, in contrast to the rounded phenocrysts of the Matachewan dikes. The widths of the younger dikes seldom exceed two chains, yet the lengths are exceptionally great. A quartz diabase dike can be traced for 3 miles across the Cobalt sediments exposed over the eastern part of Knight township. As a rule the rusty surface of the dikes serves to distinguish them from the fresh quartz diabase of the Nipissing sills.

### Pleistocene and Recent

If any formations were deposited over this area following the close of the pre-Cambrian, they were removed in the following period of erosion, which has apparently been of extremely long duration. The variations in the climatic conditions of this period of erosion can only be traced back to the Pleistocene, when glaciers rode over a rock surface which was probably covered by deep soil. During the advance of the ice-sheet, this weathered material was removed from the rocks and their surfaces were rounded and polished. During the retreat of the ice-sheet, a mantle of glacial debris was deposited on the denuded rock surface. This mantle, composed of unstratified sand and gravel, is of irregular thickness and over a considerable part of the area is extremely thin; at only a few points have the accumulations attained the thickness necessary for the development of typical glacial topographic forms. Several long eskers form the most striking feature of the glacial deposits; in addition there are several small outwash plains of sand and terminal moraines of gravel. The distribution of these glacial deposits has already been mentioned in describing the general character of the area.

No important geological changes have taken place since the retreat of the Pleistocene ice-sheet. In Recent time, vegetable remains have accumulated in the deeper valleys and formed muskegs and swamp. Poor drainage over the flat-lying Cobalt sediments has been responsible for extensive spruce-covered swamps in Knight township. The organic soil has also attained a considerable depth over the higher ground that has escaped forest fires. Consequently, the outcrops of consolidated rocks form isolated areas in a great mantle of unconsolidated glacial and Recent organic soil.

## ECONOMIC GEOLOGY

### Gold

The gold deposits in the region are genetically related to the small boss of Algoman granodiorite intruding the Keewatin rocks to the southwest of Pigeon lake in Knight township. The boss pitches southward causing considerable shearing and dike intrusions of lamprophyre and feldspar porphyry in the overlying Keewatin and Timiskaming rocks in Tyrrell township. It is adjacent to the boss and dike rocks that the gold discoveries have been made. The deposits were hydrothermally injected into the shear zones in the Keewatin and Timiskaming rocks and represent the final phase of differentiation of the granodiorite magma.

There are two somewhat different types of deposits. In most cases, the gold is found in mineralized shear zones filled with small quartz stringers. Frequently, the rock in these zones is brecciated, and irregular masses of quartz fill the openings through the crushed rock. These mineralized shear zones have no definite boundaries separating them from the massive, unmineralized country rock. The introduction of secondary minerals into the shear zones caused the alteration of the rock, which is sometimes silicified, sometimes carbonated. Pyrite in the form of small cubes and grains is commonly distributed through the quartz and altered rock.

The main system of shear zones strikes N. 20° to 30° W., parallel to the lines of weakness in the Keewatin rocks. The deposits are generally lenticular in form and attain widths of 60 feet. The mineralization continues along some shear zones for great lengths. Gold is found both native and combined with sulphides, especially pyrite. Although visible native gold has been discovered in many deposits, it is not concentrated spectacularly and is contained principally in the sulphides. The metallic minerals are pyrite, pyrrhotite, chalcopyrite, and arsenopyrite. Graphite occurs in several shear zones. This type of mineralized shear zones forms large deposits of low-grade material.

In the other type, gold is found in distinct quartz veins, only a few of which have been found in the area. They range in width up to 6 feet, but do not continue over great distances. The veins strike in two directions: one set strikes roughly north and the other set strikes east and west. Fine native gold occurs in small fractures in the quartz. Tellurides have been reported in samples of one vein. The metallic minerals are pyrite, chalcopyrite, and molybdenite.

### Silver

The area was actively explored for silver from 1909 till 1911. The silver veins are genetically related to the Nipissing diabase sills and occur chiefly in the diabase near the upper contact of the sill. The veins of this period may be recognized by their filling of coarsely crystalline white and pink calcite and comb quartz. The mineralization consists of native silver, niccolite, smaltite, chalcopyrite, bismuth, and specular hematite.

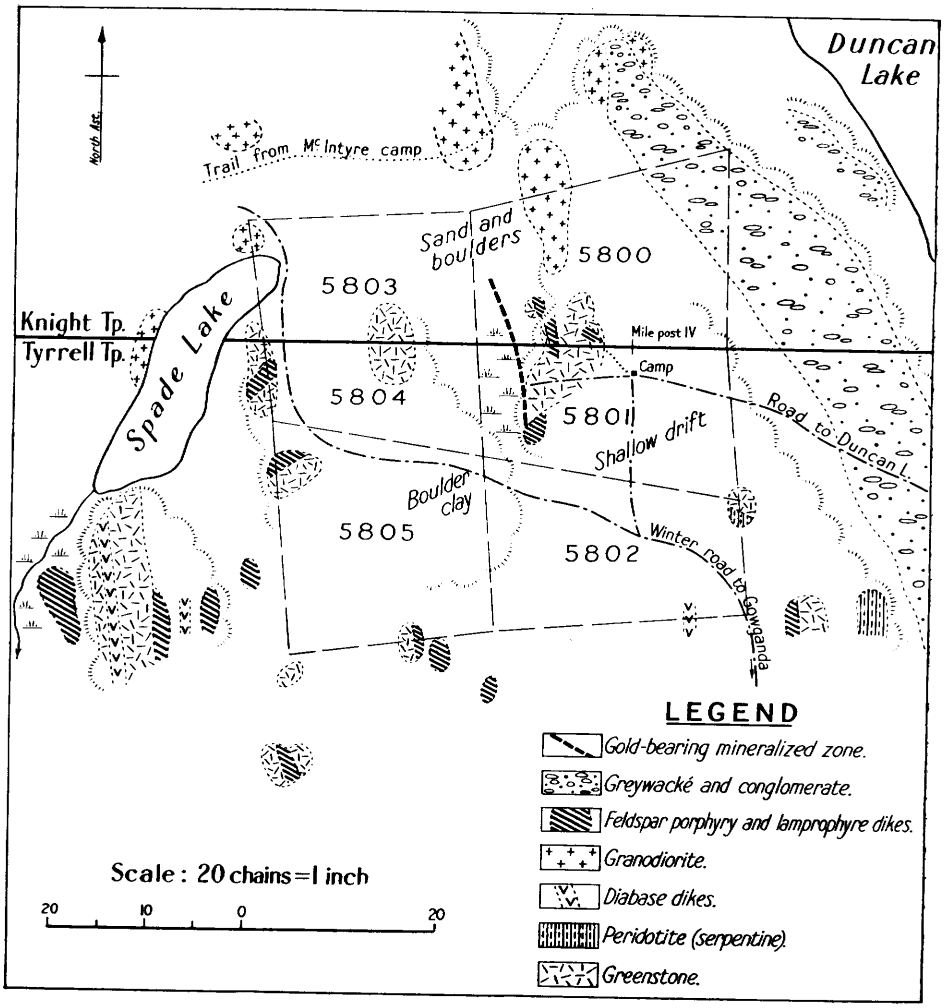
Native silver was discovered in narrow calcite veins near Spud lake in Leonard township. The sill with which these veins are associated continues north into Tyrrell township, and small mineralized calcite veins were also found in this township. The Wapus creek sill also contains calcite veins of the silver-bearing type. Although numerous quartz and calcite veins are associated with the Duncan lake sill, they apparently contain no metallic minerals other than chalcopyrite and specular hematite. No silver deposits of economic importance have been discovered in the area.

## Description of Properties

#### Hedlund Property

During the summer of 1931 the chief interest in the area was centred on the development of the Hedlund property, which held the most promising indications of any in the area at that date. The property lies across the boundary of Tyrrell and Knight townships, one mile west of Duncan lake, with which it is connected by a rough wagon road. The group of six claims (G.G. 5800-5805) were staked by L. O. Hedlund in the fall of 1930, and in June, 1931, were optioned by J. C. Waite before much surface work had been completed by the owner. The Waite syndicate was encouraged to option the property when a channel sample across a wide mineralized fracture zone showed medium values in gold. Following considerable trenching and 2,200 feet of diamond-drilling, in which work Ventures, Limited, and Nipissing Mines co-operated with the Waite syndicate, their option was allowed to expire on September 17. A short while later, M. J. O'Brien, Limited, took up the option and in December, 1931, were forming plans for further development of the property.

As illustrated in the accompanying geological sketch, a shallow mantle of sand and gravel conceals the greater part of the bed rock on the property, necessitating the assumption of many geological boundaries. The contact of the greenstone and granodiorite strikes in a general east and west direction about 10 chains north of the township line. Numerous lamprophyre and feldspar porphyry dikes intersect the greenstone to the south of the granodiorite boss. The greenstones are principally altered andesite lavas, which are folded in an almost vertical position, the direction of bedding being N. 20° to 30° W. Several intrusions of peridotite, now altered to serpentine, intrude the greenstone, causing carbonatization and silicification along the contacts. Because of the overburden, the form and extent of the intrusions are not definitely known, but it is probable that they are lenticular in surface outline with the longer axes conforming in direction to that of the bedding of the greenstones. During the drilling, one of the peridotite bodies was discovered to lie along the west side of the main mineralized zone. Apparently the contact zone of this particular intrusion

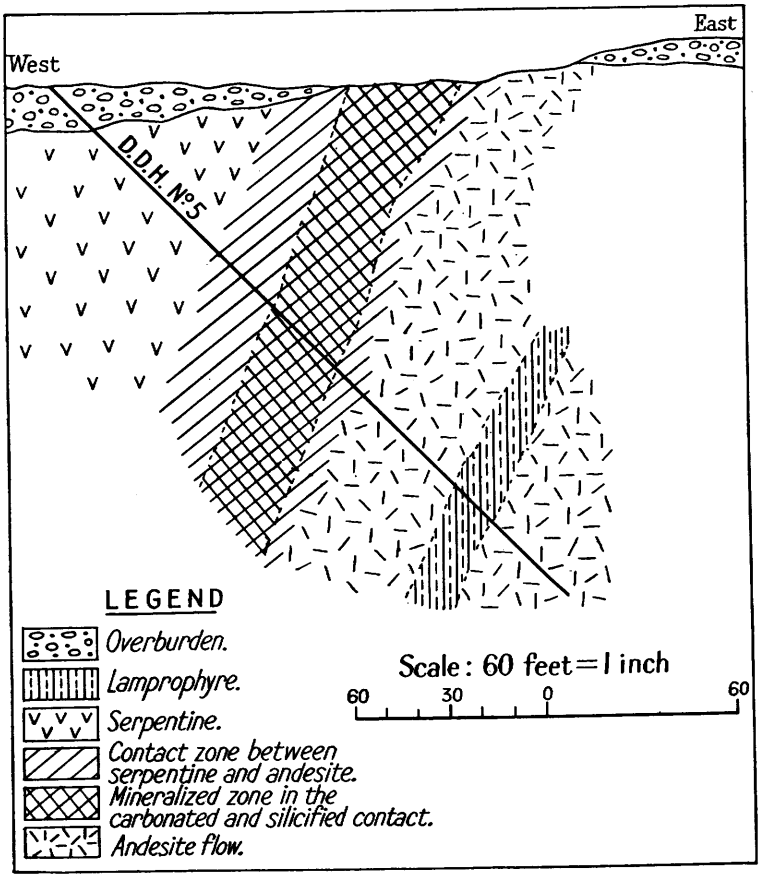



Geological plan of Hedlund property.

formed a favourable site for the fracturing and mineralization that accompanied the Algoman granodiorite and porphyry dikes.

The deposit is located in claims G.G. 5800 and 5801, which lie to the north and south of the township line. Trending roughly N. 20° W., the fracture zone in which the deposit occurs has a slight curvature to the west, which becomes more pronounced as the granodiorite is approached on the north. The mineralization was traced by trenching to a point 400 feet north of the township line, where heavy overburden prevented further exploration, and to a point 550 feet south of the township line, where the fracture zone in which it occurs penetrates an intrusion of lamprophyre and porphyry. Thus, the known length of the mineralized zone of fracturing is 950 feet. For 600 feet along this distance, it intersects the carbonatized and silicified contact of a peridotite intrusion and an andesite flow. The serpentinized peridotite underlies the low swamp-covered ground to the west of the deposit, and the massive andesite flows form a high ridge to the east. It is along this part of the deposit that the most favourable values were obtained.

An accompanying structure section shows the relationship of the mineralized fracture zone and the rock formations, as indicated by the diamond-drilling.




Vertical section across mineralized zone, Hedlund vein.

The mineralized fracture zone and the enclosing contact zone dip at an angle of 70° W. It is probable that they conform to the dip of the bedding of the andesite flows. Besides the contact alteration due to the peridotite intrusion, the introduction of the gold-bearing solutions intensified the silicification throughout the fracture zone. Consequently, the rock in the deposit is very siliceous and might be mistaken for an acid flow. In addition, quartz and carbonate veinlets filled the innumerable small fractures through the rock. These veinlets and the rock approximate to them are impregnated with pyrite in irregular particles and in cubic crystals. The gold values are contained chiefly in this sulphide·

and, since there are no definite walls, the widths are generally dependent upon the quantity of this mineral.

The surface workings, which were done in July, 1931, consist of trenches and rock cuts, which are illustrated in the accompanying plan of the deposit. The widths of the deposit, although not determined definitely in some trenches where the overburden was too deep, averages approximately 30 feet. The surface assays indicated a large low-grade deposit with a few small parts of higher grade. During August and September, 1931, nine diamond-drill holes were put down along the central part of the deposit where surface indications were most favourable. Six drill-holes intersecting the fracture zone at approximately 70 feet vertical depth showed that the values found on surface were maintained across similar widths. In addition, a core showing coarse gold from one of these drill-holes yielded a high assay over a length of four feet. Three drill-holes cutting the fracture zone at approximately 150 feet vertical depth indicated that the pyritization continued across similar widths, but yielded very small values in gold.

### Spears Claims

During the period that Ventures, Limited, were interested in the Hedlund property, they also optioned this group of claims, which are favourably located around the Hedlund. No mineralization was uncovered before Ventures took their option, and no further examination was made at that time. In the fall of 1931 the Spears brothers reported to the writer that they had discovered a rusty sulphide zone in andesite lavas on claims to the southeast of the Hedlund. No assay values of this showing were available at that time.

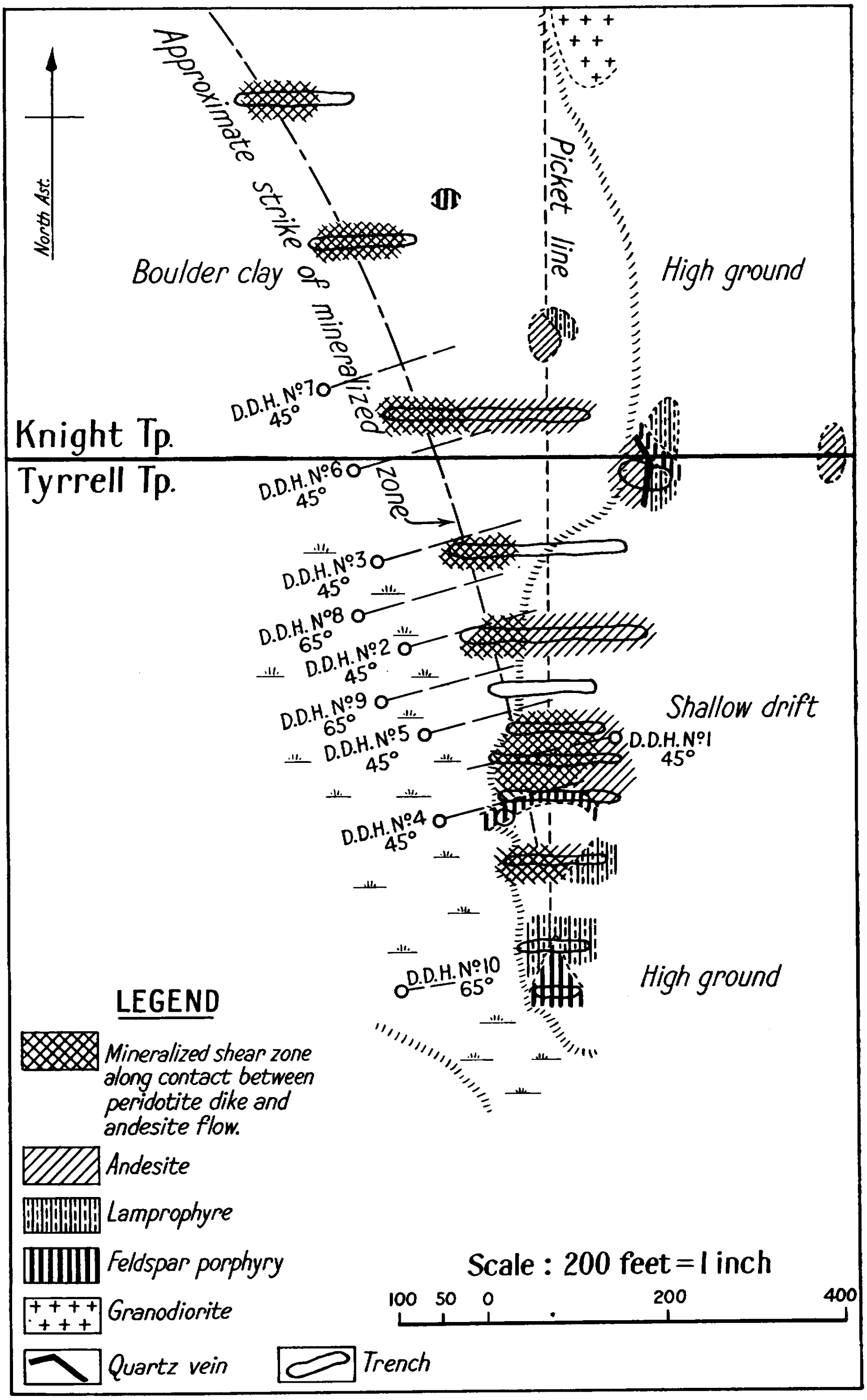
The bed rock on the claims to the north and east of the Hedlund consists principally of Cobalt sediments, which overlie the gold-bearing formations and hinder exploration. The claims to the southeast and west of the Hedlund are underlain by Keewatin lavas intruded by porphyry and consequently have possibilities for surface discoveries of gold.

### Gordon Syndicate

This syndicate has under option a group of ten claims (G.G. 5839-42, 5909-10, 5951, 5952, 6023-4) situated about a mile south of the Hedlund property and reached from Duncan lake by way of the Breeze lake portage and the winter road.

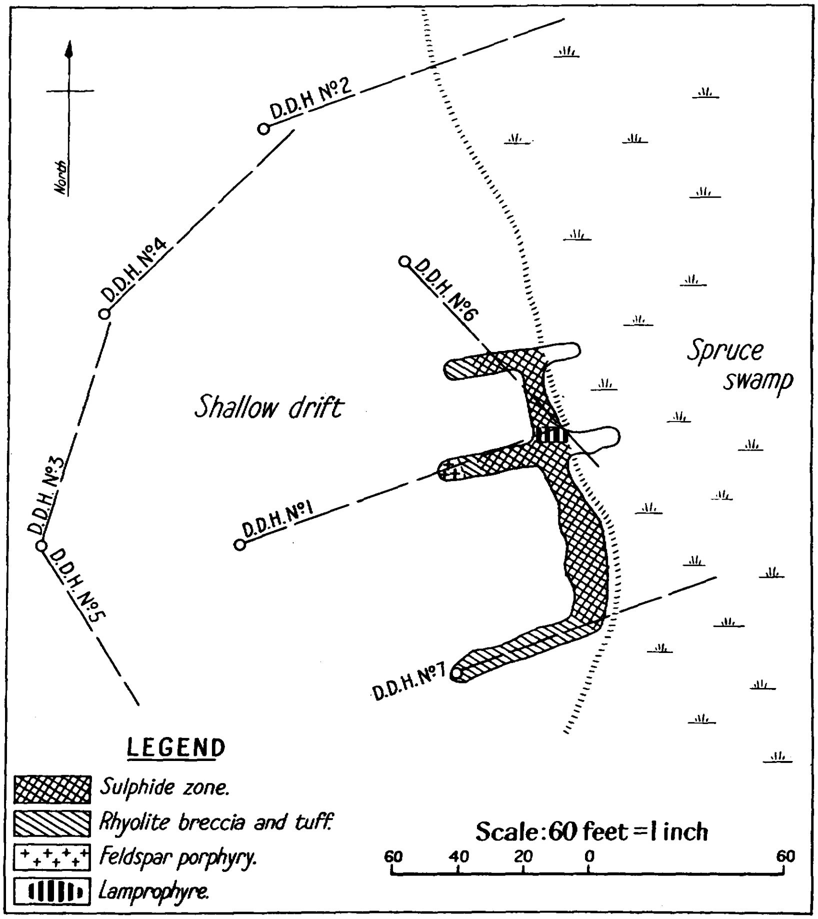
Mineralization has been found at several points on the property. The most important showing, and the one on which development work has been concentrated, is a brecciated sulphide zone exposed over a small area on claim G.G. 5841. During April and May, 1931, this deposit was explored by trenching and 1,000 feet of diamond-drilling. Further work was curtailed until September, at which time several men were placed on the property to continue the surface examination.

The formations on these claims consist of basic and acid lava flows, tuff, and volcanic breccia, which are intruded by dikes of lamprophyre and feldspar porphyry. The main deposit is exposed for 60 feet on a small outcrop of interbedded rhyolite, volcanic breccia, and tuff. The width of the mineralization is approximately 20 feet. The rock forming the centre of the deposit was brecciated minutely, possibly due to the intrusion of a nearby porphyry dike. Subsequently, quartz, carbonates, and pyrite filled the openings and partially replaced the crushed rock. Although the pyritization extends beyond the brecciated zone, it is in this area that the best gold values were obtained. Several channel samples across the deposit averaged $3 in gold per ton.




Surface workings and diamond-drill holes at the Hedlund deposit.

A heavy mantle of boulder clay surrounding the showing prevented an extensive surface examination, and the diamond-drill was used for further exploration. A plan of the diamond-drilling included in this report indicates the general direction of the seven drill-holes put down at an angle of 45 degrees from horizontal on three sides of the deposit. These holes failed to establish the continuity of the mineralization beyond the surface showing. Drill-hole No. 6, put down beneath the outcrop intersected, at a vertical depth of




Plan of diamond-drilling, Gordon property.

approximately 60 feet, 30 feet of mineralized breccia, which assayed $4 in gold per ton.

### Garvey Claims

This group of six claims* (G.G. 5498-5501, 6038, 6039), situated east of Breeze lake, were staked in 1927, following the discovery of a narrow quartz-ankerite stringer in sheared rhyolite, which yielded an assay of $16 in gold per ton. The stringer and wall rock are mineralized with pyrite and chalcopyrite. No further discovery has been made on this group.

### Johnston-Gardner Claims

The holdings of Johnston and Gardner consist of three groups of claims, which were staked in the spring of 1931. One group is situated on the west side of Pigeon lake, the second lies across Hydro creek, and the third is located south of Pear lake. Trenching and blasting were done on several small showings during the summer. The owners reported a good assay from a mineralized shear zone in rhyolite on the group south of Pear lake.

### Shahen Claims

The Shahen group of nine claims surround and include Breeze lake, which is reached by a 70-chain portage from Duncan lake. The owner had several men trenching and stripping rock on the property during the summer of 1931, and a cabin was erected on the north shore of Breeze lake.

Mineralization has been found at several places on the claims. On claim G.G. 5903 north of the lake two parallel shear zones in rhyolite contain low values, in gold. The south zone, traced for 100 feet in a northwest-southeast direction, has a maximum width of 2 feet. A narrow quartz vein in this zone contains visible gold. In the north shear zone the silicified rock, which encloses many quartz lenses, is well mineralized with pyrite and chalcopyrite; it was trenched in 1910 during the silver boom. The length of this zone, uncovered at the time of the writer's visit to the property, was approximately 60 feet, and the width about 4 feet. Samples of the mineralized quartz have yielded $3 in gold per ton.

South of Breeze lake, on claim G.G. 5907, a quartz vein 8 inches wide is exposed for 50 feet along the wall of a feldspar porphyry dike intruding rhyolite. The vein and the wall rock are mineralized with pyrite and chalcopyrite. A sample of the quartz assayed $1.80 in gold per ton. Considerable trenching has been done across the porphyry dike, and several narrow fracture zones have been exposed.

### Burroughs Claims

Several groups of claims were prospected by Charles Burroughs. One group is situated south of Indian lake, another group covers the west shore of Cripple lake, and a third group lies across the portage from Breeze to Duncan lake. On the west shore of Cripple lake a small quartz vein, which follows a fracture in massive andesite and dips flatly into swamp on the east, contained visible gold. The greatest width is 5 inches and the determined length approximately 60 feet. The mineralization has extended into the walls, which are altered to a carbonate rock. Cross-trenching did not disclose any further mineralization.

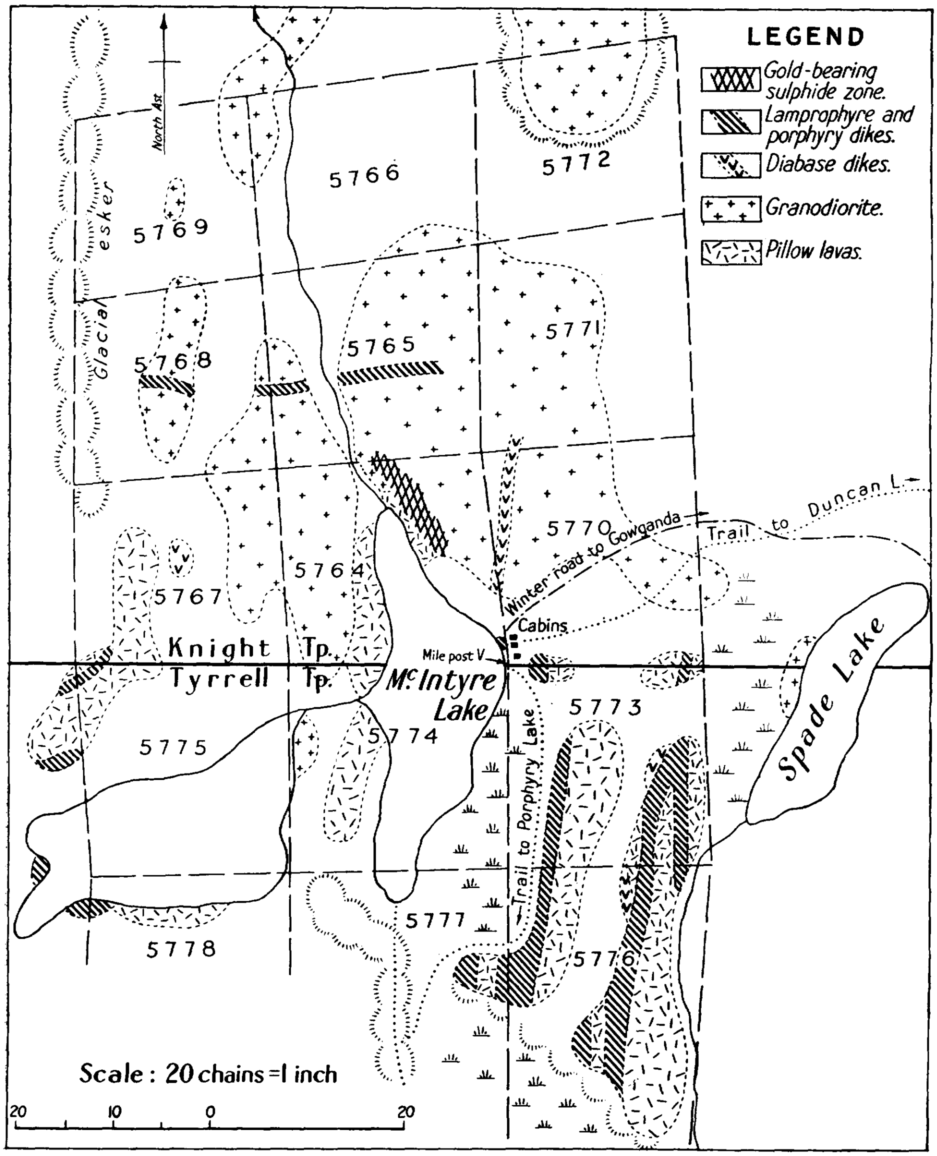
Late in the fall of 1931, another find was reported on the claims between Breeze and Duncan lakes. Thomas Saville shares an interest in this group. No definite information has been obtained concerning the importance of the showing.

### Sorbel and Lafrance Claims

These two groups of claims lie to the east of Indian lake. Both owners did the assessment work, but no mineralization of importance was discovered.

### Cryderman Claims

Six claims (G.G. 6040-45), staked by J. Cryderman, are now the property of the John Agnew Estate. The claims are situated north of Indian lake and are heavily overburdened with glacial sand and gravel. A few outcrops of quartzite on claim G.G. 6044 were trenched by a gang of 8 men, who did the assessment work in July. It was reported that gold could be panned from a small mineralized fracture in one outcrop. Disseminated pyrite is common throughout the quartzite, but, in most cases, it does not carry gold.




Geological plan of McIntyre property (north half).

**Coniagas Mines, Limited**

This company did the assessment work on a group of nine claims south of Indian lake. The bed rock on this group is chiefly quartzite intruded by several large diabase dikes. No finds were made in the summer.

### McIntyre Porcupine Mines

This company was the instigator of the present activity in this area. A block of 27 claims (G.G. 5764-90) were staked by Ed. Holland for the company in the fall of 1930. The claims start at Porphyry lake in Tyrrell township and continue two miles north into Knight township. In February, 1931, a winter road was made to the property from Wapus creek and supplies were transported from Gowganda. A camp was constructed on the east shore of a small lake at mile-post V on the township line. Seventeen men were employed during May and June in the exploration of a mineralized fracture zone occurring at the contact of the granodiorite and greenstone. This deposit is located in claim G.G. 5764 in Knight township. Besides 1,000 feet of trenching and rock-cutting on this deposit, the company completed a systematic exploration of the 27 claims. East and west survey lines were cut at 500-foot intervals from the township line south to Porphyry lake. All rock outcrops along these lines were stripped or trenched. No further mineralization was discovered, and work was stopped at the end of June.

The bed rock on the nine claims in Knight township, which is well exposed because the timber has been removed by fire, consists almost entirely of granodiorite. The contact of the granodiorite and greenstone runs irregularly back and forth across the township line. One narrow belt of pillow lavas forms an indentation north to the foot of McIntyre lake. The main deposit occurs at the apex of this indentation. Glacial sand and gravel cover a great deal of the bed rock on the 18 claims in Tyrrell township. A glacial esker causes a pronounced ridge from McIntyre to Porphyry lake. The rock formations consist of andesitic pillow lavas, rhyolite, and tuff, which are intruded by numerous lamprophyre and porphyry dikes. The intrusion of the granodiorite and these dike rocks has effected no pronounced alteration or movement in the volcanic rocks. Details are shown in the accompanying geological plan.

The main deposit was formed in local fracturing at the contact of the granodiorite. There are two directions in which the fracturing is most decided. These are N. 40° and 15° W. Mineralization occurred over an area approximately 300 feet long and 60 feet wide. The fractured granodiorite and greenstone were replaced partially by quartz and pyrite. Quartz carbonate veinlets, containing small amounts of pyrite, chalcopyrite, and arsenopyrite, occupy many of the fractures. Visible gold was detected in veinlets intersecting the granodiorite, and samples of this material yielded the best assay values. The channel sampling of the mineralized zone indicated a low-grade deposit.

### Mining Corporation of Canada, Limited

A group of nine claims south of Porphyry lake was examined by this company. Outcrops of rhyolite and tuff are found around Porphyry and Hare lakes, but the bed rock on other parts of this group is concealed by a mantle of glacial sand and gravel. On the south shore of Hare lake a narrow sulphide body, traced for 100 feet along the contact of an andesite and a rhyolite flow, failed to yield gold values. The sulphides, pyrite and pyrrhotite, are quite massive, and the mineralization may not belong to the gold-bearing period.

### Martel Claims

This group of 9 claims (G.G. 5996-6004) are located west of Cripple lake. The assessment work was completed in July, but no mineralization of worth was discovered. A heavy mantle of sand and gravel covers practically all the bed rock.

### Tough-Regan-Summerville Claims

These parties acquired approximately 1,600 acres of ground in the northwest section of Tyrrell township. Originally, 9 claims were staked east of Hydro creek in the fall of 1930. Following the discovery of mineralization along a pronounced north and south shear zone, further claims were staked to the north and northwest, until in August, 1931, about 40 claims were under their control. These included the Burke group of 8 claims, which were optioned in July. The surface work, carried out during the summer, resulted in several interesting finds. In the fall of 1931, some of the claims were purchased by the Hilltop Mines, Limited, and the remaining ones were taken over by several syndicates formed by the owners, including the Golden Regan Syndicate and the Iona Matachewan Syndicate.

Although most of the ground covered by the claims east of Hydro creek is muskeg, a low narrow ridge of rock parallels the east bank of the creek across four claims. The rock, consisting principally of acid volcanics, contains a few thin sedimentary beds of conglomerate and quartzite. At the north end of the ridge, in claim G.G. 5962, the contact of the former series with the older basic volcanics forms the site of the most important find. A mineralized shear zone, occupied by numerous parallel and intersecting veinlets of quartz, has been exposed over a length of 300 feet, with widths up to 5 feet. The strike of this zone is N. 20° W., and the dip is vertical. The greenstone in the shear zone was altered into a chlorite-graphite schist, which was partially replaced by disseminated grains and cubes of pyrite. Visible gold has been found in the quartz stringers at several points along the shear zone. Two other parallel shear zones and a narrow lamprophyre dike were uncovered in a long cross-trench to the east of the main break.

At several points along the ridge, in the claims to the south, similar shear zones are exposed in line with the strike of the main break. It is reported that gold may be panned in samples from these zones. Whether they are an extension of the main break has not been proved, for they have been uncovered only in cross-trenches. However, the persistent occurrence of the shear zones for a mile along the ridge provides promising ground for further exploration.

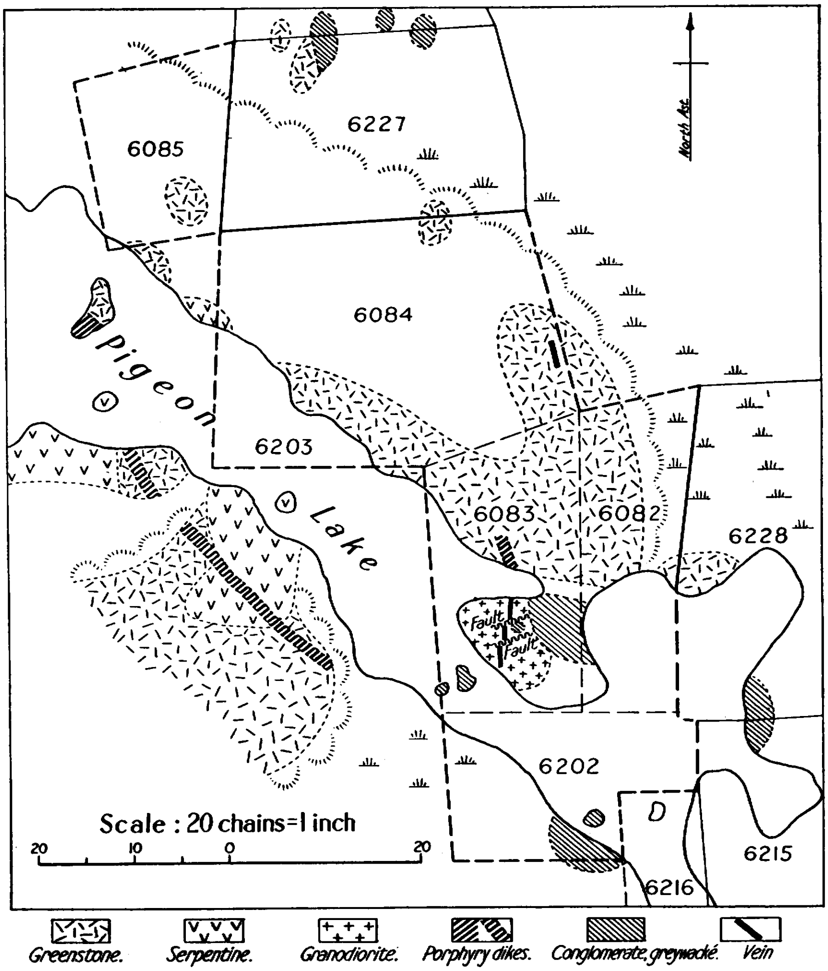
The claims to the west of Hydro creek are underlain by massive andesite flows, which are well exposed in several high ridges. No mineralization was uncovered on this side of the property.

### McNeely Matachewan Syndicate

When the mining rights on a group of claims originally held by the Tump Line Syndicate were allowed to expire in July, 1931, Wm. J. McNeely restaked four claims directly south of the Tough-Regan-Summerville group. The bed rock on these claims is similar to the rock outcropping on the former group and consists principally of acid volcanics. A large quartz vein, striking east and west across the rock formations, has been exposed over a length of 200 feet. A pyritized shear zone, which crosscuts this vein N. 20° W., contains graphite and resembles the main zone in the T.R.S. group to the north. Sulphides are not abundant in the quartz vein, but the wall rock for many feet on either side is altered into carbonate rock, containing pyrite and chalcopyrite. When visited, the showing was only in the initial stages of development. Late in the fall, the owners reported good values from the vein, including an assay of $18.40 in gold per ton from a channel sample across 67 inches.

### Hurst Property

The Hurst deposit is situated on the north contact of the granodiorite boss in Knight township and is the only gold occurrence located on that side of the intrusion. The property consists of six unpatented claims (G.G. 6082-5, 6202, 6203), which were staked by Charles Hurst in February, 1931. The quartz vein that forms the main showing was discovered in June of the same year on a small point on the east shore of Pigeon lake about a mile above the portage to Duncan lake. In the summer, access to the property was only




Geological plan of the Hurst property.

possible by means of the canoe route from Duncan lake. In August the property was optioned to R. E. Hore, who placed five men on it during September to carry on surface exploration.

It will be seen by reference to the accompanying sketch map that, although numerous rock exposures reveal much of the geological relationships of the property, Pigeon lake conceals important geological and economic features. It was surmised from evidence further south on the lake that a post-Keweenawan fault coincides with the main channel of the lake. As is customary with this system of faulting, the upthrust was on the east side of the fault. The small hill of granodiorite on the point of land in claim G.G. 6083 is probably the northern extremity of the granodiorite boss in Knight township. The granodiorite on the east slope of this hill is overlain by greywacké of the Cobalt series, which dips slightly to the east. A small remnant of basal conglomerate resting on the crest of the hill is composed almost entirely of granodiorite boulders. The Keewatin rocks exposed on the north shore of the small bay in claim G.G. 6083 are basic flows with a fine diabasic texture. They show no indication of contact alteration due to the granodiorite to the south.

Two quartz veins have been found on this group of claims. The more important, which is situated on the small point in claim G.G. 6083, lies in a fracture zone in granodiorite, strikes N. 6° E., and dips 80° W. The walls of the vein are irregular and contorted, indicating that there was considerable movement along the fracture zone subsequent to the intrusion of the vein. It is faulted at two points, with a horizontal displacement of about 10 feet in both cases. Surface trenching has shown the vein to continue for 150 feet across the point of land, with the width rangining from 3 inches to 2½ feet. The owner reported that one channel sample across 8 inches of the vein assayed $16.20 in gold per ton, and that two other samples, taken across 4 feet of the fracture zone, with approximately 2 feet of the quartz vein represented in the samples, assayed 20 cents and $4. Visible gold was found at two points. The vein is mineralized with pyrite, chalcopyrite, and considerable molybdenite.

The other quartz vein was discovered on the east side of claim G.G. 6084 and trenched for approximately 20 feet, showing a maximum width of 2 feet along this exposed length. Though much chalcopyrite is associated with the quartz, the gold values were found to be low.

### Nipissing Mining Company, Limited

In addition to the development of the Hedlund property already mentioned, this company did the assessment work on several groups of claims, staked in their own interest, and also examined two groups under option. C. Train was in charge of this work, which was largely concentrated on a group of six claims (G.G. 5806-11), located south of Brush lake in Knight township and containing a portion of the west contact of the granodiorite boss. Some 2,500 feet of cross-trenching along a ridge of Keewatin pillow lavas, outcropping for 10 chains in a northeast-southwest direction in claim G.G. 5810, exposed several narrow rusty mineralized fractures lacking in gold values.

In examination of the Ferguson group of three claims (G.G. 5812-4) in Tyrrell township and a group of six claims (T.R.S. 6421-6) in Macmurchy township, no mineralization of commercial importance was discovered. Agents of the company staked six claims around the Hearst property in Knight township in June, 1931. Since sediments of the Cobalt series cover favourable geological formations on these claims, their worth will depend upon future developments at the Hurst property.

### Netherton Claims

This group of 13 claims is situated in Macmurchy township between Shiningtree creek and the east boundary of the township. A trail leading from a camp on a small lake in the centre of the property 2½ miles east to Porphyry lake was used to reach the claims during the summer of 1931. The bed rock is chiefly massive andesite lavas, which are well exposed on the southern claims where they are intruded by feldspar porphyry and diabase dikes. Prospecting during the summer did not disclose any mineralization, but information has been received that late in the fall of 1931 the owner discovered a quartz vein 2 feet wide, which was traced over a length of 40 feet and showed considerable fine gold. Tellurides were also identified in samples of quartz from the vein. Following this interesting find the claims were optioned by George Tough.

### Pariseau Claim

Claim T.R.S. 5423, which is situated in Macmurchy township, was staked a number of years ago by J. Pariseau. It lies east of the Montreal river and directly south of the Macmurchy-Natal line. The bed rock consists of massive andesite flows. A large quartz vein, outcropping a short distance from the river, has been exposed over a length of 100 feet. The width ranges up to 10 feet, the strike is 120 degrees, and the dip is vertical. A large diabase dike parallels the vein a short distance to the north. The vein filling consists principally of quartz, with small amounts of pyrite and chalcopyrite. The owner reports low values in gold.

# Index, Part II