

THIRTIETH ANNUAL REPORT
OF THE
ONTARIO DEPARTMENT OF MINES
1921
PART VI



PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. H. MILLS, MINISTER OF MINES

THOS. W. GIBSON, DEPUTY MINISTER

THIRTIETH ANNUAL REPORT
OF THE
ONTARIO DEPARTMENT OF MINES
BEING
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1921

Boston-Skead Gold Area

By A. G. Burrows and P. E. Hopkins

and

Black River Area

By D. G. H. Wright

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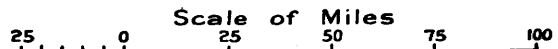
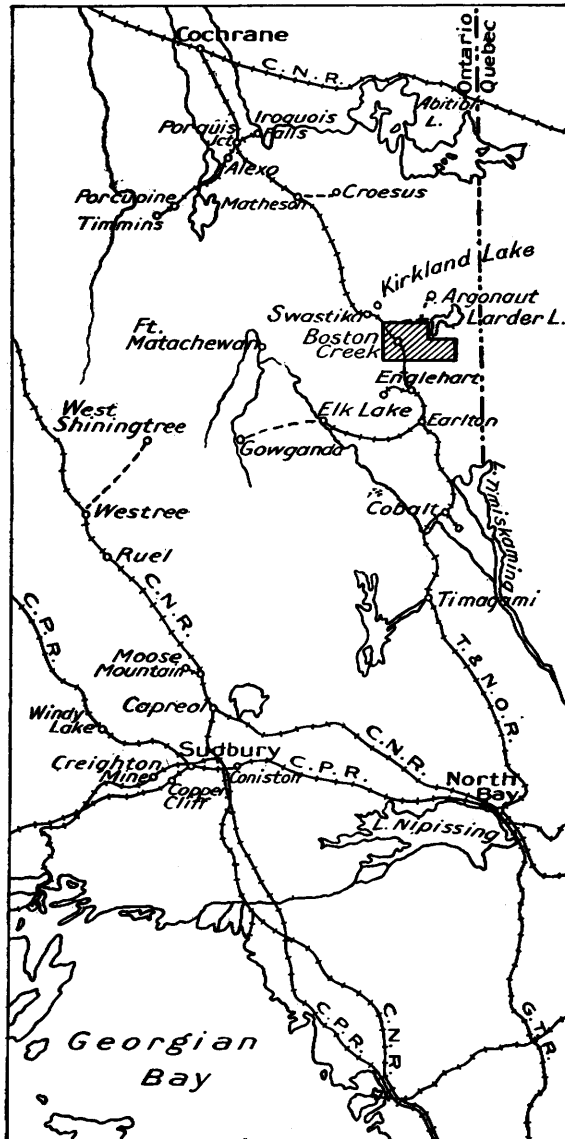
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Key map showing the Boston-Skead Area (hatched) as related to other mineral areas in Northern Ontario.

BOSTON—SKEAD GOLD AREA

(Second Report)

By A. G. Burrows and P. E. Hopkins.

A report and map No. 25 d. were issued on the Boston Creek Gold Area in 1916. The area included the township of Pacaud and portions of the townships of Boston, McElroy and Catharine, in the vicinity of Boston Creek. The map accompanying the second report has been enlarged to cover in addition Catharine and Skead townships, where for several years there has been considerable prospecting activity with the discovery of gold on several properties. Further field work was done near Boston Creek in June, 1919, while the township of Skead was examined in May, 1921. The writers were ably assisted by A. W. Carlyle and K. B. Heisey in 1919, and by A. R. Clarke and D. E. Kearney in 1921. The writers wish to express their thanks to the mine officials and prospectors for their many courtesies.

The region is situated in the district of Timiskaming about 45 miles north-westerly from Cobalt and is traversed by the Temiskaming and Northern Ontario Railway. Boston Creek station, mileage 153, is approximately in latitude



A section of the Boston Creek-Skead road, west of the Blanche river.

45° N and longitude 80° W. By rail Boston Creek station is 382 miles north of Toronto. A wagon road, first constructed to the Miller-Independence mine, has been extended across Catharine into Skead township. The easterly part of the area is also reached by a good wagon road from Englehart.

Claims were staked for gold in this area in 1906 and 1907, during the days of the Larder lake gold rush. Again, in 1913, during the activity at Kirkland lake, 12 miles to the northwest, many claims were restaked and some work was done on them. Since May, 1915, following operations on the R. A. P. and Boston Creek gold mines in Boston township, there has been considerable activity from year to year. A small amount of bullion has been produced at the Patricia and Miller-Independence mines, but up to this time no steady gold producers have been developed.

Early Exploration of the Area

The first exploration was by Walter McQuat¹ who, in 1872, made a reconnaissance survey of the Blanche river from Lake Timiskaming to Round lake.

W. G. Miller², Provincial Geologist, in 1900 described a portion of the area. In his report the geology along the Blanche river in McElroy and Catharine townships is described. He also mentions prospecting for gold on a 4-foot quartz vein in the hill west of the lower end of a portage which is now shown in lot 9, concession III, Catharine township.

In 1904, after the discovery of Cobalt, W. A. Parks,³ of the University of Toronto, made a geological survey of this portion of the country. Parks remarks that the high hills along the Blanche, in the township of Catharine, are well worth prospecting for gold.

In 1908 and 1909, M. E. Wilson examined the Larder Lake gold area, which is located to the northeast of Boston Creek. The geological map accompanying his report⁴ takes in Skead township which is also shown on the Boston-Skead sheet.



Scene on St. Anthony lake, Skead township.

Topography

The area in general has an elevation varying from 700 to 1,050 feet above sea level. Boston Creek station has an elevation of 920 feet. While the difference in elevation is seldom more than 200 feet, the country is somewhat rugged and broken, particularly in the vicinity of Boston Creek station and along the north branch of the Blanche river in McElroy and Catharine townships.

The country is situated south of the continental divide, and is drained by three branches of the Blanche river and their tributaries which flow southward into Lake Timiskaming.

The magnetic declination is about 8 to 9 degrees west of north.

¹Report on an examination of the Country between Lakes Timiskaming and Abitibi, Report of Progress, Geol. Sur. Can., 1872-73, pp. 112-135.

²Lake Timiskaming to the Height of Land, 11th Report Ont. Bur. Mines. 1902, pp. 214-230.

³The Geology of a District from Lake Timiskaming Northward. Summary Report. Geol. Sur. Can., 1904, pp. 103-225.

⁴Geology and Economic Resources of Larder Lake District, Memoir No. 17E., Geol. Sur. Canada, 1912.

General Geology

The rocks of the area covered by the accompanying geological map are of pre-Cambrian age. The dominant formations are members of the Keewatin, while formations of later age occur in relatively minor quantity, with the exception of a batholith of Algoman granite which covers the greater part of Pacaud township, and areas of conglomerate and greywacké of the Cobalt series in the east and south parts of Skead township.

The intrusive rocks, including granite and porphyry, which are believed to be associated with the gold mineralization, occur in small masses or narrow dikes through the older rocks.

LEGEND

PLEISTOCENE.	
GLACIAL AND RECENT—	Boulder clay, sand and gravel.
PRE-CAMBRIAN.	
KEWEENAWAN—	Quartz diabase, olivine diabase.
	<i>Intrusive Contact.</i>
ANIMIKEAN— (Cobalt Series)	Conglomerate, greywacké, quartzite.
	<i>Unconformity.</i>
ALGOMAN—	Hornblende and biotite granite, syenite, feldspar-porphyry, quartz-porphyry, lamprophyre.
	<i>Intrusive Contact.</i>
HAILEYBURIAN—	Serpentine.
	<i>Intrusive Contact.</i>
TIMISKAMIAN(?)—	Schistose conglomerate, greywacké, slate.
	<i>Unconformity.</i>
KEEWATIN—	Grey schist (volcanic fragments), ellipsoidal, amygdaloidal and spherulitic lavas, diabase (in part altered to hornblende and chloritic schist); felsite, andesite, dacite, iron formation; rusty weathering carbonate.

Keewatin

The Keewatin rocks, which have such a wide distribution, occur in bands with a general northwest and southeast strike. In the southwesterly part of the area the Keewatin consists of volcanic fragmental material, for the most part fine-grained and irregularly banded. These rocks are about one-half a mile in width in the vicinity of Boston Creek station and extend for about seven miles, following the periphery of a batholith of granite in Boston, Pacaud and Catharine townships. Following across this band to the northeast there is a width of nearly two miles of lava flows, the principal rocks of which are basic lavas, altered basalt, and non-pillow lavas with diabasic texture. With these flows there are some light-colored volcanics, probably rhyolite, together with narrow bands, a few feet in width, of much crumpled iron formation, slate-like rocks, and rusty weathering carbonate. These rocks occur in the vicinity of the Miller-Independence, Allied, Boston-McRae, Authier, Patricia, Roger-Barnett and other properties along a

northwest-southeast strike. A third band of Keewatin runs across the southwest part of McElroy township, through Catharine to Skead and Bayly townships. These rocks are usually light-greenish in color, consisting of felsite, or andesite, and dacite, together with agglomerate. The agglomerate occurs in large volume in McElroy and Catharine townships, whereas the andesite is more prominent in the southwest part of Skead township.

The light-colored rocks are followed to the north-east by more basic lavas, iron formation and rusty weathering carbonate, prominently shown near the Blanche river in McElroy township and in the central part of Skead township.

The Keewatin rocks throughout the area are frequently altered to schist, being designed by such terms as sericite, hornblende and chlorite schist. Generally, the altered rocks contain considerable carbonate of lime, magnesia and iron, which, when present in quantity, gives a grey color to freshly broken surfaces, but is rusty brown at the outcrop.

Volcanic Fragmental.—A belt of banded, greyish-green schist, resembling an altered sediment has been differentiated on the map. These rocks, which occur on the periphery of a granite and syenite mass, are about one mile in width and 7 miles in length, passing in a semi-circular shape from Lot 12, Concession II, Catharine, through Boston Creek station to Round lake. The rocks may be best seen in the vicinity of Boston Creek station, where deep railway cuts have been made. The schist approaches a vertical altitude, with a strike parallel to the periphery of the granite. A great portion of the series consists of narrow alternating bands of rusty carbonate (including some magnetite and pyrite bands) and slate. Ash rocks, with bomb-like inclusions, are common. Some thin sections represent greywacké and quartzite, while one is clearly an altered porphyry. The whole series is greatly metamorphosed by the large granite mass, and is cut by narrow porphyry, lamprophyre and other dikes. In the vicinity of Round lake, much altered diabase and green chloritic dikes are intruded into the banded schist. At mileage 153 on the Temiskaming and Northern Ontario railway three bands of pyrite occur in the grey schist. The series was probably laid down conformably with the Keewatin pillow lavas.

Basalt, etc.—The greenstones are fine-grained, and consist of altered basic volcanics which are sometimes schistose, but more often massive. They commonly show the amygdaloidal and ellipsoidal structure, and more rarely the spherulitic, indicating their volcanic origin. The spherulitic structure, which is rare in basic rocks, has not been noted before in this section of Ontario. What may be the spherulitic structure in greenstone was reported on the north shore of Doig lake, in the northwest corner of Lebel township¹. A similar structure was also seen under the microscope in an acid rock, a rhyolite, from lot 6, concession III, Beatty township². In this area, spherulitic greenstones are beautifully developed on a bare hill on claim L 1878, Boston township. The varioles, which are rounded and white-weathering, vary in size from minute pea-like form to those about two inches in diameter, and constitute a large part of the rock. Under the microscope the varioles consist of coarse radiating flakes of chlorite, feldspar, epidote and probably quartz in a fine groundmass of the same material, and actinolite.

¹Kirkland Lake and Swastika Gold Areas, Report Ont. Bur. Mines, Vol. 23, Pt 2, 1914, p. 4.

²Beatty-Munro Gold Area, Report Ont. Bur. Mines, Vol. 24, Part 1, 1915, p. 176.

Throughout the whole rock are pyrrhotite grains and numerous black ferruginous specks. The rock is probably an altered basalt. A similar spherulitic basalt occurs on the Roger-Barnett property in Catharine township.

The pillow lava flows constitute the main portion of the greenstone. They are interbedded in a northwest-southeast direction with much non-pillow greenstones, which have a diabasic texture at times, and some tuff, agglomerate and slate which point to a subaqueous origin. The nearly complete alteration of the greenstones, with the retention of their original ellipsoidal structure, is, according to Leith and Van Hise, due to the metasomatic rather than a dynamic change. Under the microscope the original minerals in the greenstones are hornblende, quartz, magnetite and plagioclase, the altered plagioclase laths suggesting a basaltic or diabasic texture. The secondary minerals are calcite, hornblende, chlorite, sericite and quartz. The altered greenstone in places may be spoken of as hornblende or chlorite schist.

Andesite, Dacite and Agglomerate.—A belt of light greenish-colored rock lying between two bands of basic lavas runs diagonally across the townships of McElroy, Catharine and Skead. There are several types of rocks in this group, the most prominent of which is andesite. It occurs in large volume in the vicinity of St. Anthony lake, extending southerly into Bayly township. The rock is usually fine-grained, resembling felsite, but phenocrysts of plagioclase are frequently recognized. Under the microscope the feldspar phenocrysts are set in a groundmass of feldspar, chlorite, epidote and calcite. Occasional irregular masses of chlorite suggest an alteration from a ferro-magnesian mineral. The following analyses (1) and (2) show the composition of the rock.

TABLE I.—ROCK ANALYSES.

	(1)	(2)	(3)
Silica	60.46	63.78	68.56
Alumina	16.85	15.86	15.16
Ferrous oxide	4.19	2.66	0.99
Ferric oxide	1.70	0.96	3.23
Lime	4.70	5.01	2.26
Magnesia	1.36	2.58	1.51
Potash	0.52	0.25	1.04
Soda	4.82	4.96	6.10
Carbon dioxide	3.98	2.67	0.22
Water	0.90	1.42	1.22
Total	99.48	100.15	100.29

(1) N.½ lot 7, con II, Skead township. (2) South boundary of Skead township in lot 4. (3) East side St. Anthony lake. Analysis—W. K. McNeill and T. E. Rothwell, Provincial Assay Office.

Intruding the andesite in the form of irregular dikes and stocks, there is a coarse-grained porphyritic rock of light greenish color, which is probably a dacite or quartz-diorite-porphry. The prominent minerals are quartz and plagioclase, and occasional ferromagnesian mineral, altered to chlorite, in a groundmass of feldspar, chlorite and epidote. The rock has likely been derived from the same magma as the andesite. It occurs prominently to the east of St. Anthony lake. A specimen of the rock has the composition shown in column (3) above.

With the andesite type of rock, particularly in McElroy and Catharine townships, there is a fragmental rock of volcanic origin. It contains numerous fragments of light-colored volcanic rocks together with some fine-grained, stratified,

ash-like material. It is well exposed along the boundry between McElroy and Catharine, in lots 10, 11 and 12.

Iron Formation.—Iron formation, consisting of interbanded silica, black slate and magnetite, occurs with greenstone on a number of claims among the Dane-Larder Lake road in Boston township. This range has been described in detail by W. G. Miller¹ and other writers².

There are a number of narrow bands of the formation in McElroy township to the west of the Blanche river. Some of these carry considerable iron pyrites, and on claim 4410 a small quantity of iron pyrites has been separated from the silicious iron formation during the sinking of a shaft.

Similar narrow bands occur on the Fidelity claims north of St. Anthony lake. The formation has been fractured and contains veinlets of quartz carrying pyrites. Gold has been obtained in material from prospect pits on several outcrops of iron formation.

Carbonate Rock.—Bands of rusty-weathering carbonate of lime, magnesia and iron occur in parts of the area. These have the prevailing strike of the district namely, northwest and southeast. Generally they are cut by irregular veinlets of quartz and sometimes by masses of porphyry. Several of the outcrops have been partially prospected for gold. These include the Cook property in the northwest part of Skead and the adjoining part of Hearst township, and the Lincoln-Nipissing claim, C.E. 3, Skead township.

Timiskamian

A few small, isolated patches of schistose conglomerate, slate and greywacké, standing in a vertical attitude, occur along the Larder Lake road in Boston and McElroy townships. The rocks are similar to the sediments classed as Timiskamian on the map of the Kirkland Lake and Swastika gold areas. The pebbles of the conglomerate, which are elliptical in outline, consist largely of greenstone and felsite and some iron formation. A grey magnesian limestone occurs both as pebbles and matrix in the conglomerate in McElroy township about a mile east of the three-mile post on the west boundary.

There is an area of schistose sedimentary rocks in the north and northeast parts of Skead township. The series is represented by slate, quartzite and conglomerate, which, in places, are greatly altered and difficult to determine.

The conglomerate in the northeast corner of lot 6, concession VI, Skead township, contains many pebbles 2 inches in diameter, some of which are quartz-porphyry, granite and greenstone. In the southeast corner of the same lot the bedding of the conglomerate and greywacké is north and south, while the schistosity is northeast-southwest. The usual strike and dip of the beds in the sediments is much the same as the Keewatin lavas, namely, northwest-southeast and nearly vertical dips.

Pre-Algoman (Halleyburian?)

Serpentine.—There are isolated exposures of serpentine in various parts of the area.

¹Boston Township Iron Ranges, Vol. XIV, Ont. Bur. Mines.

²Kirkland Lake and Swastika Gold Areas, Vol. XXIII, Part II, Ont. Bur. Mines.

The trail on claim L. 4902, Boston township, passes over an exposure of serpentine. A thin section of the rock was examined microscopically and found to consist of about 60 per cent. serpentine and 40 per cent. calcite. Numerous magnetite grains and a little pyrite are scattered through the rock.

Serpentine occurs in small areas on and north of claims W.R. 97, to the west of the Blanche river, McElroy township, and in the northern part of Catharine township.

The largest exposures of serpentine are scattered across the northerly part of Skead township. The rock is readily recognized in the field by its light weathered surface and greasy feel in freshly broken fragments. No chromite, or asbestos, was recognized in specimens from the various serpentine outcrops.

Algoman

These rocks include batholith and stocks of granite and syenite, and dikes of feldspar-porphyry and lamprophyre. They are massive, fresh-looking, and are probably Algoman in age, since similar granite in Boston and Lebel townships to the north was found cutting the Timiskamian series.

Granite and Syenite.—A batholith of red, biotite granite occupies nearly all of Pacaud township, and extends to the south and west for miles beyond the township boundaries. The rock is massive, except near the contact with the Keewatin, where it occasionally takes on a gneissoid structure. Near the contact with the greenstone, just south of mileage 153, the granite is intruded by numerous parallel felsitic dikes which give the rock a banded structure. It is cut by quartz veins, and by pegmatite and other dikes representing various differentiation facies of the magma. The rock in the south part of lot 9, concession VI, Pacaud, is a light grey, medium-grained biotite granite. Under the microscope microcline is seen showing the gridiron structure, albite partly altered to sericite, biotite altered partly to hornblende and chlorite, quartz and calcite.

A reddish syenite outcrops in the west part of Boston township, being part of the large syenite boss-like mass occupying most of Otto township.

A small stock of reddish biotite and hornblende granite intrudes the greenstones in McElroy township. Gold and a telluride have been found in this granite in a pegmatitic quartz vein which is probably a part of the granite magma.

The gold-bearing quartz veins at the Wisconsin-Skead property in Skead township occur in a dike of red granite with which the gold is probably genetically connected.

Other small irregular, granite dikes cut the greenstones and felsitic rocks. Gold was seen in quartz veins in these small granite dikes on claim L 5165 and L 5133, Boston township.

Feldspar-Porphyry.—Numerous intrusions of massive red and grey feldspar-porphyry occur over the whole area. They appear as narrow dikes up to thirty feet or more in width, and probably represent apophyses from the granite masses. The phenocrysts usually consist of albite, often showing a zonal structure, an occasional rounded quartz grain, and blades of biotite in a microcrystalline ground-mass of quartz, feldspar, chlorite and calcite. Fine grains of magnetite and pyrites, and crystals of apatite are often present. A feldspar-porphyry on claim L 2000, Boston township, and in other parts of that vicinity, contains white feldspar phenocrysts up to one inch across, which show beautiful zonal structure in the

hand specimen. Some porphyry dikes in the southwest part of Boston township contain many prominent quartz phenocrysts, and thus resemble the quartz-porphyry at Porcupine. In other parts the rock may be called a felsite. The acid dikes are usually cut by minute veinlets of quartz, some of which carry gold. Small, irregular fragments of red feldspar-porphyry are also, at times, present in auriferous quartz veins.

Lamprophyre.—A few narrow lamprophyre dikes cut the greenstones and grey schist, but these are too small to map. They may be seen on the south part of lot 3, concession VI, Pacaud township, and at about mileage 154.3 along the railway. In the Kirkland area the lamprophyre cuts the Timiskaming sediments, but is older than the feldspar-porphyry. A lamprophyre dike that intrudes the Algonian granite can be observed in a rock-cut about half a mile north of Mindoka station.

Some red lamprophyre occurs in the northwest part of Skead township, and the adjacent part of Hearst township. It is associated with porphyry dikes very similar to the occurrence at Kirkland lake. It is also found on the Crawford claims in lot 9, concession V, of the same township.

Animikean

The youngest sedimentary rocks consist of greywacké, quartzite and conglomerate, which occur in prominent ridges in the east and southeast parts of Skead township. They represent erosion remnants of the sedimentary series which can be traced at intervals southerly to Cobalt. The rocks in the vicinity of Hough Lake are 200 or 300 feet in thickness. The sediments are nearly flat-lying, with dip generally up to 15°. On lot 12, concession V, Skead township, a portion of the rocks dip 60° easterly. No deposits of economic importance have been discovered in the late sedimentary rocks in this area. They were deposited subsequently to the deposition of the gold-bearing veins. A portion of the Flannigan gold-bearing vein, on lot 7, concession III, Skead township, is covered by a bed of conglomerate 10 feet in thickness.

Keweenawan

Quartz diabase dikes are rare in this area; however, they were noted cutting the greenstones and Timiskamian(?) sediments. These dikes are classed as Keweenawan, since they are fresh-looking and resemble the diabase at Cobalt. A thin section of a sample taken immediately south of M.R. 15, Boston township, shows labradorite laths, partly altered to saussurite and sericite, augite partly altered to hornblende and chlorite with a little quartz, biotite, magnetite and intergrowths of quartz and feldspar.

There are several outcrops of diabase in the north-east part of Skead township. These represent remnants of the Keweenawan diabase sill. A calcite vein carrying galena, which occurs in this rock, is referred to elsewhere in the report.

Glacial and Recent

The region has been heavily glaciated, the ice having moved in a general S. 20° E. direction, astronomic.

The area lies at the northern edge of a tract of farming land, which extends from Haileybury to Round Lake, and is covered in places with stratified clays, sand and gravels. At Boston Creek Station one can see the vertical section of

a morainic deposit which has been cut into by Boston creek. The central part of McElroy township, to the east of the Blanche river, is one vast area of sand and gravel, representing, probably large terminal moraines and outwash plains. The glacial drift extends southerly into Catharine township where it occupies the greater part of the easterly portion of the township. In lot 3, concession III, there are several remnants of old kettle lakes. In this same vicinity the sands are overlain by a thin clay deposit, suggesting damming during glacial times. The sand and gravel also extends easterly into the northwest portion of Skead township, and southerly into Marter township. The gravel ridges are the source of several fine springs, one of which is the headwaters of Spring Creek, in Catharine.

Origin of Gold Deposits

As pointed out by W. G. Miller and C. W. Knight in a paper entitled "Metallogenetic Epochs in the Pre-Cambrian of Ontario,"¹² most of the gold deposits of Ontario belong to the Algonian epoch. The gold deposits of Boston creek supply another example of gold being derived from acid intrusives of Algonian age. The granite, syenite and feldspar-porphyry exposed in this area by erosion are probably different facies of a plutonic rock which underlies the whole area. The gold generally occurs near these acid rocks. The presence of a number of gold-bearing veins along the contact of the intrusive porphyry and older rocks at Boston creek, as in many other parts of central Canada, and the frequent occurrence of auriferous quartz veinlets in the porphyry and granite, suggest the relationship between the intrusives and the veins. The relationship is more clearly shown in this area by the occurrence of gold in a pegmatitic vein in the granite on the Charest claim, McElroy township.

The deposits are in part due to the replacement of the country rock by mineral solution.

Only a few minerals which characterize deposits that are formed at high temperatures are found in the veins at Boston creek. Actinolite was noted in a thin section of material from the Kenzie vein, and specularite has been frequently observed in other veins. Tourmaline formed at high temperature has been noted in quartz veinlets at the Catharine gold property. It is probable that the deposits were formed at great depth, but not at extremely high temperature.

Economic

Gold.—Gold, the chief mineral sought for in the area at the present time, occurs, usually native, but occasionally combined with tellurium, in quartz veins and veinlets in the Keewatin greenstone and later intrusions of granite and porphyry. The veins, which have various strikes and dips, are well mineralized with varying quantities of pyrite and molybdenite, and sometimes with chalcopyrite, galena, specular hematite, cosalite, native bismuth, gold and tellurides. The gangue consists largely of quartz of several generations, with considerable calcite and chlorite. The gold is found along the dark streaks of chlorite and calcite.

There are many types of gold deposits, viz:

(a) Fissure quartz veins in the greenstone, granite and porphyry, with well-defined walls. Examples: No. 1 vein at Miller Independence, Boston-McCrae, Authier, Patricia and Wisconsin-Skead.

¹²Rep. Ont. Bur. Mines, Vol. XXIV, Part 1, 1915, pp. 243-248.

(b) Replacement veins. The country rock, including altered greenstone and porphyry, has been brecciated and partly replaced by vein-forming solutions of quartz of several generations, and by calcite and other carbonates. Examples: the calaverite vein on the Miller-Independence and the Kenzie vein on the R.A.P. property.

(c) A stockwork in granite and porphyry. Examples: Charest (L. 5305), Authier (L. 4737), and Papassimakes (L. 5133).

The chief deposits will be described later in the report when dealing with the gold claims.

Iron Pyrites.—In the first railway cut north of Boston creek station there are two narrow bands of pyrite, 10 to 20 inches wide, with some disseminated pyrite in the adjoining schist. The pyrite on assay showed the absence of gold; the exposed deposit is of no economic value. Two shallow pits have been put down on the eastward extension of the deposit and at present a little pyrite can be seen on the dumps.

On the Marsh claim, 4410, McElroy township, a shaft has been sunk 80 feet on an iron-formation band some 50 feet in width. Fairly solid pyrite extends over a width of six feet and eight or ten tons of massive pyrite have been separated on the dump.

A twenty-five foot pit has been sunk on a quartz deposit carrying some grains and nodules of pyrite on the Sharp claim, H.S. 914, Ratray township.

Magnetite.—The isolated exposures of iron formation along the Larder Lake road, in Boston township, represent the southern portion of the Boston township iron range. The formation consists of interbanded silica and magnetite, with some black slate. Numerous shallow test pits were sunk in 1902, but the iron proved to be too low in grade to be workable at that time. The iron formation is, in places, intruded by quartz veins, some of which carry gold.

Argentiferous Galena.—There are two occurrences of argentiferous galena in Skead township, one on the *Mageau-Authier* claim, W.D. 1001, in lot 12, concession V, the other on the De Villiers claim on the west central part of lot 12, concession VI. On the former location a 50-foot shaft has been sunk vertically on a quartz-calcite vein in a Keweenawan diabase sill remnant. The vein strikes 15° north of east, averages 6 inches in width, the calcite in places containing galena, zinc blende, cobalt bloom and pyrite.

On the *De Villiers* location is a calcite vein from a few inches to one foot in width, averaging about 6 inches, striking 15° north of east and dipping vertically. The vein, which has been uncovered for a distance of 450 feet, lies in Keewatin diabase and basalt, Timiskamian conglomerate and Algoman porphyry, and apparently passes under a Keweenawan gabbro remnant on the west. The vein contains zinc blende, cobalt bloom, pyrite, and, in places, large pieces of galena which, on analysis, showed 4 ounces of silver per ton and no gold.

Calcite veins carrying galena are reported to have been found on claims L. 66 and L. 67, on lots 11 and 12, concession IV, Skead township.

M. E. Wilson, in his report on the Larder Lake Area, refers to a silver-lead occurrence on claim B.G. 229, on the Hearst-McElroy boundary, 4 miles north of Skead township, owned by the *North Canadian Gold Mines, Limited*. "Several irregular veins of galena, blende, and chalcopryrite, up to 10 inches in width, occur

in Keewatin greenstone. They all pinch out quickly when followed along the strike.”¹

Building Stone.—The red and grey granite and syenite along portions of the railway in Pacaud township is serviceable for building purposes. The station at Matheson, which was burned in 1916, was constructed of stone taken along the railway immediately to the north and south of Mindoka station.

Timber and Agriculture.—In general the trees are small, and consist of spruce, jack pine, poplar, birch and cedar. A few white pine, three and one-half feet in diameter, to the southeast of Smith lake, have escaped an old fire which swept most of the area. Large charred stubs of pine in various parts of the area are relics of the same fire. Other parts have been recently burned.

Many farms have been located on the scattered clay areas of Pacaud township, while the greater part of the remaining area is unsuitable for agriculture by reason of rock, sand or swamp.

Power.—The Northern Ontario Light and Power Company's transmission line, from Cobalt to Kirkland Lake, passes through the area. The Miller Independence mine is operated by power furnished from this line. The transmission line from Charlton to Kirkland Lake runs along the west boundary of Pacaud and through the westerly part of Boston township. The Wisconsin-Skead Company expects to get power from Raven falls in McFadden township.

The branches of the Blanche river, which flow through the area, have several waterfalls which could be utilized for power. One of these is on the northwest branch in lot 12, concession IV, Pacaud. On August 12th, 1914, the discharge of the river at this point was 350 cubic feet per second. The 61-foot falls in expected to develop 405 horsepower. Immediately to the north, in concession V, is a 36-foot falls which could be utilized to develop additional 240 horsepower.

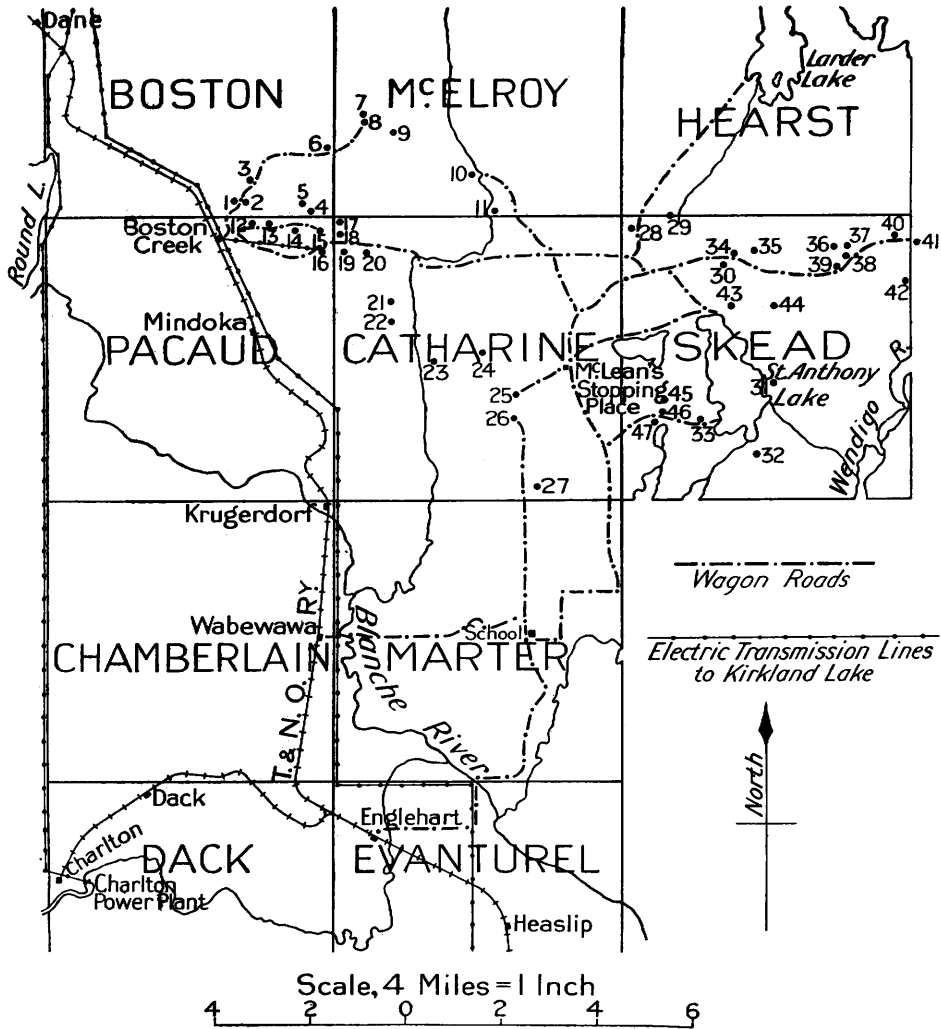
A larger possible waterpower is situated at High Falls on the north branch in lot 11, concession IV, Marter township, where a total operating head of 138 feet is available. The discharge of the river on May 6th, 1915, was 352 cubic feet per second. Messrs. M. Hotchkin and G. Grover, who surveyed the waterpower at that time determined a minimum of 2,000 horsepower available.

Description of the Gold Prospects by Townships

Boston Township

R.A.P.—The first discovery of gold in Boston Creek was made in 1914 in the “Kenzie” vein, which extends from claim No. L. 3665 to claim No. L. 5163 in the south central part of Boston township. During that year some work was done on the vein by La Rose Mines, Limited. During 1916, the R.A.P. Syndicate, controlled by E. M. Richardson, W. B. Albright and J. K. Papassimakes, continued development on the Kenzie vein on L. 5163. The inclined shaft was sunk to the 200-foot level and drifting done as follows: On the 100-foot level, east drift, 250 feet; west drift, 175 feet; 200-foot level, east drift, 90 feet; west drift, 190 feet. Development has shown the ore to occur in small shoots in the vein. The vein strikes 30° north of east, and dips 65° S. in massive pillow lava. The vein varies from several inches up to 5 feet in width with good breaking walls on either side. The vein material consists of quartz of several generations, silicified rock,

¹Memoir No. 17 E., Geol. Sur. Canada.



OUTLINE MAP OF BOSTON-SKEAD AREA SHOWING THE RELATIVE LOCATIONS OF THE MINERAL PROSPECTS MENTIONED IN THIS REPORT.

BOSTON			13 Patricia or Barry-Hollinger	SKEAD
1	Boston Creek	14	Boston McCrea	28 Zenith Gold
2	R. A. P.	15	Allied Gold	29 Cook
3	Currie	16	Miller Independence	30-33 Flanagan
4	Authier	CATHARINE		34 Lincoln-Nipissing
5	Ivanhoe-Boston	17	Campbell	35 Manley-O'Reilly
6	Gold Leaf	18	Cotter	36 Martin
McELROY			19	Connell-McDonough
7	Hughes-McElroy	20	Kennedy-Boston	37 Sampson
8	Peerless or Mondoux	21	Burnand-Gzowski	38 Wisconsin-Skead
9	Charest	22	Catharine Gold	39 Crawford-Skead
10	Marsh	23	Ostrum	40-41 DeVilliers
11	Irish	24	Daley	42 Mageau-Authier
PACAUD			25	Walsh-Taylor
12	O'Donald	26	Roger-Barnett	43 Fidelity
		27	Hounslow	44 Barry Webster
				45 Nigger
				46 Skead Gold
				47 Telluride Syndicate

reddish calcite, and brecciated and partly replaced masses of reddish feldspar-porphry. The occurrence of feldspar-porphry in various parts of the workings suggests that originally the greenstone was intruded by a narrow feldspar-porphry dike, that at a later period was greatly brecciated and impregnated with vein-forming solutions which carried the gold and other minerals. The gold occurs with a very fine-grained greenish quartz, which has the character of a replacement deposit, while the green colour is due to minute inclusions of chlorite. Iron pyrites is finely disseminated in the vein, and copper pyrites, molybdenite and galena occur in minor quantity.

Thin sections of the ore show the gold to be closely associated with the sulphides in chlorite and calcite seams near the footwall part of the vein, where there is a narrow band of fine-grained greenish quartz. Certain sections of the vein run as high as \$25 or \$30 in gold to the ton, across five feet.

On the east side of claim L. 2631, which lies immediately northeast of that on which the main shaft is sunk, there is an irregular band of mineralized schist with quartz, about one foot wide, which contains visible gold. The showing occurs where the greenstone is intruded by a dike of feldspar-porphry, and near the contact.

The plant includes one 60-h.p. Jenckes locomotive-type boiler, and one 5 by 7 Jenckes hoist. Work was discontinued by the syndicate on September 17th, 1916, and the shaft and hoisting equipment rented to the Boston Creek Mining Company. In July, 1917, preparations were under way to take over the shaft and resume work.

Boston Creek.—The Boston Creek Mining Company, Limited, did considerable development work on claim L. 3665 in Boston township during the year 1916. Work was carried on through the R.A.P. shaft, which was rented with hoisting equipment from the R.A.P. Syndicate.

The drifts on the 100 and 200-foot levels of the R.A.P. were extended into the Boston Creek ground and a raise carried to the surface from the 200-foot level. A winze has been sunk 200 feet from the 200-foot level, and stations cut at the 300 and 400-foot levels. Development is as follows: 100-foot level, 325 feet of drifting and cross-cutting; 200-foot level, 300 feet of drifting and cross-cutting; 300-foot level, 50 feet of drifting and cross-cutting; 400-foot level, 300 feet of drifting and cross-cutting.

The vein is a continuation of the "Kenzie" vein from the R.A.P., and similar in appearance. Spectacular gold showings were obtained in the upper 30 feet of the shaft and a few very small shoots were obtained in the deeper levels.

In February and March, 1917, new buildings were erected, including office, sleeping camps, dining-room and store-house. Operations were suspended in July, 1917, to permit of exploration by diamond-drilling. Air is supplied by two Chicago Pneumatic Tool Company fuel-oil compressors.

Ivanhoe-Boston.—On claim No. L. 5079 is a quartz vein of a few inches to 4 or 5 feet in width which strikes northeast-southwest and dips approximately 65° to the southeast with numerous quartz veinlets running nearly at right angles on either side. Some cosalite carrying high values in gold and silver occurs in one portion of the vein. The wall rocks are massive Keewatin diabase and pillow lava which are extremely altered for a few inches next the veins.

Currie (L. 5037) —In the northwest part of the claim are rusty schist bands heavily mineralized with iron pyrites and cut by quartz stringers. No visible gold could be seen in place, but gold colours can be panned from the sulphides. A grab sample showing cubes of pyrite gave \$2.40 in gold to the ton, while samples across two feet and three feet seven inches gave \$1.60 and 60 cents respectively in gold to the ton.

Authier.— Visible gold has been found on a number of veins on the Authier claims, Nos. L. 4734 and L. 5025, which are situated in the southeast part of Boston township. The veins are from a few inches to three feet in width and occur in greenstone, iron-formation, granite and porphyry. The deposits strike a little north of east and dip from 20° to 45° to the north, although some veins dip to the south. There are often cross veins forming a stockwork. The veins contain much disseminated iron pyrites and small quantities of chalcopyrite, specular hematite, molybdenite, bismuthinite, magnetite and tetradymite, but on the whole sampling has shown the gold content to be low.

Gold Leaf (L. 5757).—A shaft has been sunk on a quartz vein together with numerous stringers of quartz which intersect a reddish, medium-grained hornblende granite. The main quartz vein strikes N. 60° E., and dips 60° north-westerly. This vein is from two to four feet wide and is accompanied by quartz stringers over a width of ten feet. Fifty feet northeast of the shaft the deposit has been faulted to the west with a horizontal throw of thirty feet. The quartz has a somewhat banded character and carries iron pyrites, copper pyrites, pyrrhotite and molybdenite in film-like structures. The property was not in operation at the time of visit.

About a mile west of the Gold Leaf, on claim No. L. 5165, is a similar granite cut by narrow white quartz veins, some of which carry molybdenite and a few specks of native gold.

Pacaud Township

O'Donald.—The O'Donald claim, the N.E.¼ of the N.½ of lot 4, in the sixth concession of Pacaud township, has four nearly parallel E.-W. veins, which dip from 60° to 70° to the south. The south vein, which is considered the most promising, consist of schist, quartz and pyrite, across a width of eight or ten feet. A nineteen-foot shaft was sunk on this vein and later the vein was cut underneath the shaft at a vertical depth of 200 feet by a diamond drill. Neither the Crown Reserve nor the Allied Gold Mines exercised its option. The rocks are Keewatin, diabase and pillow lava cut by aplite, feldspar-porphyry and hornblende-mica syenite.

Patricia.—The Patricia (Barry-Hollinger) consists of two claims in the north half of lot 3, in the sixth concession of Pacaud township. A mining and milling plant was placed on the property and the mine was operated for a short time in 1917 and 1918 by the late C. A. O'Connell. A forest fire in July, 1919, burned the mine buildings and mill, the mine not being in operation at the time. A description of mining and milling operations is given on page 101, Part 1, Vol. 27, Report Bureau of Mines. Twelve veins were found on the property, but underground operations were chiefly confined to vein No. 7, with a small amount of work on a parallel vein to the north. An inclined shaft was sunk 215 feet on No. 7 vein, that dips 74° S, with orepockets at the 100 and 200-foot

levels and drifts along the vein on these levels. Two stopes, 25 feet and 130 feet in length, were opened up on the 100-foot level in the west drift, and one stope 80 feet long on the 200-foot level. The stopes were carried up about thirty feet before milling operations were suspended.

The ore is banded quartz of rather fine grain and carries a small percentage of iron pyrites, and some copper pyrites and zinc blende; it frequently shows native gold in hand specimens. The quartz varies in width from about twelve to thirty inches. In the west drifts on the two levels, bands or lenses of calcite were encountered with a narrowing of the quartz. The values are contained in the quartz vein with little mineralization of the enclosing basic rock. The ore raised from the mine was of good grade, approximately \$18 per ton.

Boston-McRae.—The Boston-McRae Gold Mines comprises four claims in the north half of lot 2, in the sixth concession of Pacaud township. The rocks are pillow lava and associated volcanic flows with narrow bands of iron formation, the general strike of the formations being N.W. and S.E. The volcanic rocks are partly altered to carbonate. A number of mineralized zones have been found, generally containing irregular veinlets and masses of quartz. A well defined quartz vein, with N. and S. strike and dip 45° E., occurs in the northeast part of the property. An inclined shaft was sunk in 1916 by former operators. The vein averaged about twelve inches in width and visible gold was observed in the hanging-wall at a number of points. This vein is cut by a diabase dike to the south of the shaft. Further work was done near the north line to the west and a shaft started on a series of lenticular quartz veins dipping gently to the east. The shaft was down fifteen feet showing a series of quartz veinlets on the east wall for eight feet from the surface. Native gold and tellurides with iron pyrites have been recognized in the ore. Some faulting was observed in the shaft. The surface where the quartz stringers occur is highly oxidized, this condition being traced to the Authier claim on the north. The rock below the surface shows the characteristic grey colour of basalt altered by carbonate with quartz and sulphide.

On the south central part of the property a shaft has been sunk on a wide schist zone carrying quartz stringers, iron pyrites and copper pyrites and some value in gold. To the east of the shaft there is a serpentine dike and a coarse hornblendite.

Allied Property.—The Allied Mining Co. operated the Renaud-Cullen group, consisting of the north half of lot 1 in the sixth concession of Pacaud township, during parts of the years 1918 and 1919. Much trenching was done on the south central part of the property, where the basalt carries irregular stringers of quartz in a general N.W.-S.E. direction. One trench shows mineralization over a width of sixty feet across narrow bands of quartz in the basalt, the rock being altered along the quartz veinlets to a grey color and containing grains of iron pyrites. A little copper pyrites and calcite occur in the veins. Some low gold assays were obtained in the fractured zone, but no commercial ore was found. Work was also done on the southeast part of the property where the basalt and other Keewatin rocks are intruded by a small irregular body and narrow dikes of granite. A number of narrow quartz veins, from an inch to a few inches in width, were discovered in the granite or basalt near the contact, and some visible gold with a black telluride found in some veins. Needle-like crystals of bismuthinite were observed in one quartz veinlet. Gold was also found in irregular veinlets of quartz

in a red porphyry dike eight feet in width. A shaft was sunk 100 feet on a fracture along an E.-W. basic dike, cutting the Keewatin.

Diamond drilling was done in the vicinity of the south line near the Miller Independence. Three shafts were sunk to moderate depths at an earlier time by former operators.

Miller Independence.—This property, which is one of two in the area which has produced some gold, is situated on the south half of lot 1, in the sixth concession of Pacaud township. Gold was first discovered on the lot in No. 1 vein by Joseph McDonough in July, 1915. Three years later W. Adams, then mine captain, discovered the "Independence Vein," which contains a small shoot of ore carrying a precious telluride, calaverite. All the recent work has been done in connection with this vein.

The geology is comprised dominantly of alternating flows of Keewatin pillow lava (meta-basalt), altered diabase or dacite, with which are associated subordinate amounts of rhyolitic schists, agglomerate, iron-formation and tuffs, all of which have a N.W.-S.E. trend. These rocks are cut by small granite stocks and feldspar-porphyry dikes. In the vicinity of the veins the rocks contain abundant calcium magnesium and iron carbonates.

The original No. 1 vein has been traced on the property for about 600 feet in an east and west direction and for several hundred feet easterly into Catharine township. It is narrow, averaging about a foot in width, and has a low dip to the north, usually about 20° or less, at one place being almost horizontal. The vein material is milky white quartz, and the mineralization is more or less concentrated toward the footwall side of the vein. Tellurides, copper pyrites, pyrite, specular iron ore and galena are observed in the quartz. Native gold occurs frequently with the telluride in a net-like arrangement in the quartz along the footwall. A bismuth telluride, brilliant grey in color, and containing some selenium, occurs abundantly with the gold. A darker-coloured telluride (petzite?) is also present in smaller amounts. The vein has been prospected by means of a number of trenches, pits and shafts from which some high-grade ore was bagged and a small production recorded. Along parts of both walls of the vein there is a narrow dike of grey feldspar-porphyry. The porphyry contains much calcite and other carbonates, as well as disseminated iron pyrites and is cut by veinlets of quartz.

The Independence vein, containing the small shoot of exceptionally high-grade ore, strikes No. 22° E., and dips 55° southeasterly. The rich ore was found between the depths 30 feet and 160 feet in the inclined shaft, but could not be traced for any great distance on the 100-foot level. The hanging wall of the shaft is a strong fault plane. Below this is a second fault plane nearly parallel to the upper one, the planes varying from a foot to three feet apart. Below the lower fault plane is a series of irregular quartz veinlets from a fraction of an inch to one inch in width and roughly parallel to the fault plane. A few veins are terminated sharply at the fault plane, indicating that some of the faulting is later than the mineralization. About ten feet above the 100-foot level the veinlets occur over a width of four feet. These veinlets can be followed down to 160 feet in the shaft below which the rock is less altered. Where the veinlets occur, the dark basalt has been altered for a few inches to a light grey rock carrying abundant iron pyrites. The quartz carries in places iron pyrites and copper pyrites together with gold telluride, calaverite. The telluride occurs chiefly in minute veinlets and small masses in and with the copper pyrites and is sometimes accom-

panied by native gold. Faulted sections of flat-lying quartz veins were observed between the main fault planes about fifty feet below the 100-foot level.

Shaft No. A has been sunk vertically to a depth of 500 feet and extensive exploration carried on at this level. The strong faults on which the inclined shaft "D" was sunk to the 200-foot level were encountered in the cross-cut on the 500-foot level, 190 feet north of "A" shaft; drifting along these faults did not reveal any ore of similar character to the rich telluride ore which was found in "D" shaft. Seven diamond-drill holes were made from the 500-foot level. The mine is run by electricity supplied by the Northern Ontario Light and Power Company. W. S. Simpson is manager of the mine.

McElroy Township

Peerless.—The Peerless property comprises a group of claims formerly the Mondoux, located in the west part of McElroy township. The rocks are principally of Keewatin age and are intruded by small masses and dikes of granite. Work has been largely confined to claim 5266, where a strong quartz vein crosses the claim in a N.E.-S.W. direction. The vein would average about six inches in width, but is lenticular in structure. At a point where the vein intersects a N.W.-S.E. granite dike, a shaft has been sunk to a depth of 250 feet. The dike dips steeply to the west and below the 75-foot level is to the west of the shaft. Exploration has shown a small lens of ore in the vein lying to the west of the granite dike. This ore was opened up by a stope from the 75-foot level to the 50-foot level, and a few tons of ore taken from the workings. Exploration at 125 and 250-foot levels did not reveal ore of a similar character. The ore is of a peculiar type, being brecciated and containing fragments of greenstone and much calcite with the quartz. The ore minerals are native gold, native bismuth, copper pyrites, iron pyrites, galena, zinc blende, pyrrhotite, and a rare mineral containing lead, bismuth and sulphur, which was determined at the Department of Mineralogy, Toronto University, to be cosalite.¹

Charest.—The Charest claim, L. 5305, is situated in the south-west quarter of McElroy township. As shown on the map the claim is on a small stock of massive, coarse-grained, flesh-coloured hornblende and biotite granite. A quartz vein, averaging about one inch in width and three hundred feet long, strikes 30° north of west across the granite. Considerable fine gold, pyrite, chalcopyrite, and a grey telluride were noticed in different parts of the vein. Other veins on the property contain molybdenite and specular hematite. Some of the veins contain coarse feldspar and are pegmatitic in character, while many of the narrow veins represent the filling of joint cracks. The occurrence of gold in the pegmatitic vein strongly points to the formation of the gold-bearing quartz veins following the pegmatitic veins and representing part of the granite intrusion.

Marsh.—Near the centre of claim No. 4410, McElroy township is an iron formation band striking N.W.-S.E. on which a shaft has been sunk to a depth of eighty feet. Much gossan occurs on the surface, below which are interbanded pyrite and sugary quartz over a width of fifty feet. Across a width of six feet the pyrite is fairly massive. About 100 cubic feet of massive iron pyrites are on the dump.

¹ Cosalite from Ontario by T. L. Walker, University of Toronto Studies, Geological Series No. 12, 1921.

Irish.—On the central part of claim L. 2581 a 440-foot tunnel has been driven on a white calcite vein which varies from 4 to 8 feet in width. The vein strikes N.E.-S.W. and dips 75° to the south east. A winze has been sunk at a point near the centre of the tunnel.

Near the northern part of the same claim a 35-foot tunnel has also been made on a quartz vein about one foot wide and containing iron pyrites.

Catharine Township

Ten chains east of the northwest corner of lot 9, con. VI, Catharine, there is a quartz vein in volcanic fragmental rocks. The vein strikes N. 75° E. and dips 80° S, showing in places 8 inches in width together with lenses of calcite a foot in width. The quartz carries copper pyrites and has been traced by trenching 50 feet. The same vein has been located four chains to the north-east in McElroy township where some trenching has also been done.

Campbell.—The Campbell property consists of two claims in the north part of lot 12 in the sixth concession of Catharine township. A well defined narrow fracture has been traced by means of trenches from near the northwest corner of the property in a southeasterly direction across the claims. Along the strike several pits have been sunk, revealing narrow, sometimes parallel veins of quartz, averaging one or two inches in width, with the basalt along the veins showing alteration with iron pyrites a few inches from the wall. A small amount of copper pyrites occurs in the veins. Native gold was found in several pits by D. Campbell while samples over a width of four inches, taken by the writers, showed values in gold. The strike of the fracture is roughly that of the volcanic flows of the area.

Cotter.—The property consists of the two south claims in the north half of lot 12, in the sixth concession of Catharine. Trenching has been done on several quartz veins in the west part of the westerly claim and some diamond drilling has been done from the south boundary. The northerly vein, 9 chains north of the south boundary has been trenched for 11 chains. It strikes east and west, dips 60° N. and varies from 2 inches to 2 feet in width. The quartz is narrow, but the wall rock is altered to carbonate and contains iron pyrites and stringers of quartz. A similar but wider vein occurs in the southwest part of the claim, the quartz varying in width from 2 inches to one foot, while the wall rock is altered over a width of 3 feet. No underground work has been done on these veins.

Connell-McDonough (S. ½. lot 12, Concession VI, Catharine township).—The nearly flat vein on the Miller-Independence extends easterly to the Connell-McDonough where there has been considerable trenching along the strike of the vein. Native gold can be observed at several places along the footwall of the vein.

Kennedy-Boston.—The Kennedy-Boston Gold Mines includes the south half of lot 11, con. VI, Catharine township. The rocks are pillow and coarse-grained basic lavas together with narrow bands of felsitic and porphyritic acid rocks with a general N.W.-S.E. strike. A fracture has been traced 1,200 feet on the surface from near the northwest corner to the southeast. It is along the contact of a basic lava, with a light-coloured felsitic or porphyritic rock which lies to the southwest. A shaft, 600 feet from the west line, has been sunk on the fracture, the northeast wall of the shaft being on the contact which is nearly vertical. The mineralization occurs chiefly near the contact. At a depth of 50 feet in the shaft (Sept., 1919),

there is reddish greyish silicified vein material carrying pyrite and copper pyrites in fine grains with occasional showings of finely disseminated gold. Two faults, $3\frac{1}{2}$ feet apart, were observed in the shaft to the south of the silicified zone, together with a narrow vein of reddish quartz carrying pyrites. The shaft was later sunk to the 150-foot level and 130 feet of drifting was done northwest and 80 feet southeast of the shaft. A strong fault was encountered 80 feet west of the shaft that displaced the vein to the south.

Catharine Gold.—This property, which is controlled by Geo. and J. Tough, is situated in the north half of lot 10, concession IV, Catharine township. On the north boundary a 12-foot pit is sunk on an altered grey feldspar-porphry dike about 13 feet wide and striking N.E.-S.W. The porphyry contains a network of quartz stringers some of which carry quite coarse gold showings. Iron pyrites and tourmaline occur in the narrow quartz stringers. The Keewatin pillow lavas adjoining the porphyry are impregnated with carbonate.

Burnand-Gzowski.—The porphyry dike and probably the gold-bearing quartz veinlets which the Catharine Gold is working extend to the adjoining property, the Burnand-Gzowski, which comprises the south half of lot 10 in the fifth concession of Catharine township.

Ostrum (N.W. $\frac{1}{4}$, N. $\frac{1}{2}$, lot 8, concession III, Catharine township).—Gold to the value of \$1 and \$2 per ton can be obtained on assay from quartz veins carrying pyrites and calcite in a light-coloured greenstone cut by a narrow quartz-porphry dike.

Daley.—The claim comprises the S.W. $\frac{1}{4}$ S. $\frac{1}{2}$, lot 6, concession IV, Catharine township. Work has been done on a mineralized zone 250 feet southeasterly from No. 4 post. The rock is rusty weathering carbonate cut by numerous reticulated quartz stringers. The general strike is N. 40° W. and dip 80° N.E. A pit has been sunk to a depth of 12 feet and a long cut made in the mineralized deposit. Iron pyrites occurs abundantly together with some specularite in the deposit.

Walsh-Taylor (N.E. $\frac{1}{4}$, S. $\frac{1}{2}$, lot 5, concession III, Catharine township).—An inclined shaft has been sunk to a depth of 30 feet on rusty carbonate containing quartz veins. The deposit, which contains considerable iron pyrites and brown and green iron carbonates, strikes 30° south of east and dips about 45° to the northeast. A sample of selected material from the dump yielded \$4.80 in gold per ton. During 1921, a rich showing of gold was reported to have been made on the southern part of the claim.

Roger-Barnett.—W. G. Roger and F. Barnett are prospecting a group of claims consisting of the N. $\frac{1}{2}$ lot 5 and the west part of the N. $\frac{1}{2}$ lot 4 in the second concession of Catharine township. The country rock is basalt and diabase with a few narrow feldspar-porphry dikes. The basalt shows pillow structure and, at times, is spherulitic. In places the basalt and diabase have been replaced by carbonate, a grey rock which is rusty weathering on the surface. Through the altered rock there are a number of quartz veins on most of which work has been done.

Hounslow.—On the Hounslow location, S. $\frac{1}{2}$, lot 4, concession I, Catharine township, is a deposit quite similar in appearance to the Roger-Barnett. Coarse gold occurs in four quartz stringers. Between each two stringers is about a foot of basalt altering to a grey rusty weathering carbonate. The veins strike north and south and dip 60° E. About 20 feet east is a parallel vein system in which is a quartz vein 100 feet long and 6 inches in width.

Skead Township

Skead Gold.—Since the spring of 1920, the Skead Gold Mines, Limited has had about 20 men, under the direction of M. L. Bouzan, prospecting 55 mining claims in various parts of Skead township. Encouraging results are being obtained to the west of St. Anthony lake on claims L.S. 29 and L.S. 30 in lot 20 of the second concession. On L.S. 29 three shafts have been sunk to depths of 50, 14 and 50 feet on three parallel quartz veins which strike N. 10° E. and dip 60° to 85° easterly. The veins occur in a light grey-coloured andesitic rock which is intruded by an occasional dike of feldspar-porphry. Some visible gold was found in the central vein near the surface while sinking the shaft. The



Narrow quartz vein with stringers of quartz in hanging-wall, Skead Gold property.

quartz contains much iron pyrites and, in places, thin seams of molybdenite. Some selected material from the dump at the central vein gave on assay \$4.00 in gold per ton.

In 1921, a number of narrow veins, quite unlike those just described, were discovered on claim L.S. 30 which corners on L.S. 29 to the north-west and extending easterly on claim L7970. These veins, which are roughly parallel in an east-west direction, vary from one inch to twelve inches in width and have been traced 600 feet or more. They carry iron pyrites, copper pyrites and specularite with little or no quartz. From these narrow veins high assays have been obtained varying from \$9.00 to \$75.00 in gold per ton. The veins, however, are not closely spaced, eight having been found in a width of 250 feet at the time of inspection in October, 1921. The andesite and porphyry adjacent to these narrow

The main workings are in the westerly part of the property on lot 5, where a mineralized zone has been trenched in a direction of N. 25° E. for 500 feet. In this zone, which averages 10 feet in width there are numerous stringers of quartz from half an inch to a foot in width running diagonally in a direction N. 18° W. across the altered basalt, now rusty carbonate. The cross stringers of quartz in many places show visible gold, while iron pyrites are present in the quartz and altered rock near the veins. The veinlets are not sufficiently close together in most of the deposit to be mined in one large mass. In one part of the deposit there are



Irregular stringers of quartz in rusty weathering altered basalt, Roger-Barnett claim, Catharine township.

irregular quartz veins which are roughly parallel with the general strike, and from these there are narrow quartz veinlets running toward the walls. Some coarse gold was observed in the quartz veinlets. Several pits and cross-cuts have been made on the deposit which generally resembles a stockwork.

A strong quartz vein from 3 to 10 feet wide strikes N.E. and S.W. across the line between 4 and 5. It occurs in the spherulitic lava and, as far as explained, has shown only low gold content.

In the vicinity of this vein some spherulitic lava contains stringers of quartz, while the lava contains spots of iron pyrites. A sample of the mineralized lava showed some gold on assay.

sulphide seams have been fractured in places over a width of 8 or 10 inches and the cracks filled with specularite and sulphides. Additional work may reveal wider veins.

A number of pits have been sunk on the veins and a few tons of iron and copper pyrite and specular hematite obtained which were shipped to the provincially owned Timiskaming Testing Laboratory at Cobalt for experimental work. It was found that oil flotation would successfully concentrate the copper after which the gold could be recovered by cyanidation. The higher values appear to come from those specimens which contain considerable pyrite. The company is installing a plant, consisting of boiler, hoist and 4-drill compressor, and intends sinking a shaft and exploring the veins at depth.

On the west side of L.S. 30 a number of pits have been sunk on a quartz vein with strike N.E. and S.W. The quartz is banded and contains iron pyrites, molybdenite, and shows some gold on assay.

The company has also done exploration work on several claims east of St. Anthony lake. On claim 313 an open cut was made on light-coloured felsite carrying irregular stringers of quartz with calcite and a little iron pyrites. On claim 6722, a pit was sunk on stringers of quartz carrying calcite, epidote, red feldspar and iron pyrites. The irregular quartz stringers have a general strike of north and south and occur in diabase.

Telluride Syndicate.—This syndicate has several claims in the south-west part of Skead township. On claim 8846, in lot 2, concession III, a vein with chalcopyrite, iron pyrites and specular hematite, similar to the veins on the Skead-Gold, has been uncovered for a length of 200 feet. The vein strikes N. 60° E., and is from one to three inches in width and shows the presence of considerable gold on analysis.

Nigger (M.R.3.).—This 80 acre claim was surveyed prior to the subdivision of the township of Skead in 1908. The rocks are largely Keewatin dacite and andesite. A few pits have been sunk on narrow N.E.-S.W. bands of iron pyrites containing a little copper pyrites and specular hematite. One such sample gave on assay: silver, none; nickel, none; platinum, none; and gold, \$15.60 per ton.

Flanagan.—P. Flanagan has done some development work on several claims in the south part of lot 7, concession III, Skead township, to the east of St. Anthony lake; the principal claims are 4927 and 6593. A quartz vein having an east-west strike has been found in a white weathering coarse-grained quartz-diorite porphyry. A shallow pit on claim 4927 exposes a quartz vein 13 inches wide and dipping 80° S. The quartz is somewhat banded and carries fine-grained iron pyrites. A picked sample showed \$3.20 gold per ton. The vein, faulted 75 feet to the south, has been followed easterly to claim 6593. At one point it is four feet in width. At the extreme easterly exposure of the vein it is 3 inches wide and carries iron pyrites, copper pyrites, a little galena and a telluride. The vein and quartz-diorite-porphry are concealed for several chains by a bed of conglomerate of the Cobalt series, 10 feet in thickness. The conglomerate was deposited on the eroded surface of the older rock which carried the vein.

Work has been done by Mr. Flanagan on claim 7675 in lot 4, concession II, Skead township, to the west of St. Anthony lake. A pit was sunk on a quartz vein carrying abundant iron pyrites which occurs along or near the contact of a quartz-porphry and light-coloured felsitic rock.

On the road west of St. Anthony lake, on claim 8937, in lot 4, concession II, the Flanagan Bros. have uncovered a quartz vein for a length of 150 or more feet in Keewatin felsite. The vein strikes 20° west of north, dips 60° west and varies in width from 2 to 4 feet. Gold can be obtained on panning. One channel sample across 3 feet yielded on assay 60 cents in gold per ton. The quartz is much fractured and contains iron and copper pyrites.

On the Smith-Flanagan claims, L.S. 364 and 365, in lot 6, concessions I and II, Skead township, is a quartz vein from one foot to 6 inches in width and carrying much chalcopyrite. The vein occurs in Keewatin felsite and an intrusive feldspar-porphry. One sample, on analysis, yielded \$5.20 gold per ton.

On claim 7861, immediately south of C.E. 4, in lot 5, concession VI, Skead township, small amounts of gold were reported to have been obtained on analysis from a stockwork of quartz in a red porphyritic hornblende syenite. Small amounts of pyrite, chalcopyrite, galena and green talc were observed.

Fidelity.—The Fidelity property is situated directly northeast of St. Anthony lake in concession IV and V. The north part consists of basic lavas and serpentine with narrow bands of iron formation and dikes of lamprophyre and porphyry.

On claim 238 a shaft has been sunk to a depth of 28 feet on a band of black chert carrying some stringers of quartz with iron pyrites and copper pyrites. Some visible gold was obtained in sinking the shaft. Just north of the shaft the chert band, which strikes N. 10° W., is two feet wide. Cutting the basic lavas and running into the shaft are two lamprophyre dikes 6 inches and one foot in width.

Exploratory work, consisting of stripping and shallow pits, has been done on several bands of iron formation, which consist of contorted layers of silica and magnetite with some hematite. These bands are cut by irregular cross veinlets of quartz in which there is iron pyrites while massive iron pyrites occurs in the iron formation. One band, with strike N. 15° W., from 8 to 20 feet wide crosses the concession line on claims L.S. 11 and 6590. Assays have shown the presence of low gold values from several pits. In one pit on claim 463 a lenticular mass of iron pyrites in the iron formation has a width of one foot.

On claim L.S. 11 there is also a mass of light-coloured volcanic rock that is intersected by quartz veinlets. The rock and veinlets carry a little iron pyrites from which assays of two or three dollars have been obtained. Three shallow pits have been made on this mineralized rock.

Barry Webster.—The Webster property is situated in the south half of lot 7, concession V, Skead township. No work was being done at the time of the visit, but some work was found on a narrow band of chert with strike N. 60° W. in the basalt. The chert in places carries streaks of iron pyrites and pyrrhotite on which a shallow pit was sunk. A sample of the mineralized chert showed no gold and a trace of nickel. The owners report that on another part of the property some gold-bearing material was found.

Zenith.—The Zenith Gold property is situated in the northwest corner of Skead township on claim 6202. A shaft was sunk to a depth of 20 feet on a quartz vein, varying from 3 inches to a foot in width, which strikes east and west. The vein occurs in green schist near the contact with a narrow band of porphyry. A. Johnson, in charge, stated that a little visible gold was obtained in the shaft. A pit was sunk on a series of porphyry and lamprophyre dikes striking N. 66° W. on claim 7115. Two porphyry dikes, 2 feet and 3 feet wide, are well mineralized with iron pyrites, but a sample from there showed no gold.

Cook.—The Cook claims, Nos. 3943, 4041, 6743 and 6741, are situated along the boundary between the townships of Hearst and Skead. The rocks consist of bands of rusty weathered carbonate, green schist and sediments intruded by porphyry of which the general strike is N. 35° W. Most work has been done in Hearst township near the boundary line on claim 3943. Here the white weathering porphyry and the rusty carbonate are traversed by numerous stringers of quartz striking N. 38° E. and varying from an inch to a foot in width. The cross stringers are in places connected by other stringers, affording a stockwork structure. The quartz carries in places iron and copper pyrites and the carbonate carries some pyrite near the quartz veinlets. One pit has been sunk eight feet in carbonate. A sample from the pit, across a number of stringers of quartz and carbonate over a width of 4½ feet, was found to carry \$6.80 in gold per ton. A selected sample of quartz with sulphides from one vein 4 inches wide showed \$14.80 in gold per ton. Several shallow pits have been made along the strike of the carbonate and porphyry for a distance of 100 feet.

Lincoln-Nipissing (C.E. 3.—C.E. 4)—The deposits are stockworks, namely: ferruginous dolomite and porphyry containing considerable pyrite and irregularly cut by quartz veinlets. "Some work has been done on claim C.E.3, consisting of a few cuts, and a shaft, the depth of which was not ascertained owing to the water which it contained when visited" in 1909 by M. E. Wilson.¹ No additional work has been done since 1909.

Manley-O'Reilly.—A specular visible gold showing was made in the autumn of 1919 by Walter Manley on the Manley-O'Reilly claim L.S. 128, lot 6, concession VI, Skead township. Considerable gold in very fine particles occurs on a slickensided contact between quartz-porphyry and a narrow band of greenish carbonate carrying numerous cubes of iron pyrites and some serpentine and quartz particles. Some gold also occurs in seams in the green carbonate distant a few inches from the gold-bearing contact. Two similar carbonate bands, 6 inches in width, lie a few feet northeast of the gold-bearing carbonate. The 12-foot quartz-feldspar-porphyry dike and ferruginous dolomite adjoining the gold showing are intersected by numerous quartz veinlets which carry some iron pyrites and a little galena. A similar assemblage of porphyry, quartz and green carbonate bands occur along the same strike across a clay flat 200 yards to the southeast. A diamond-drilling programme is outlined for 1922.

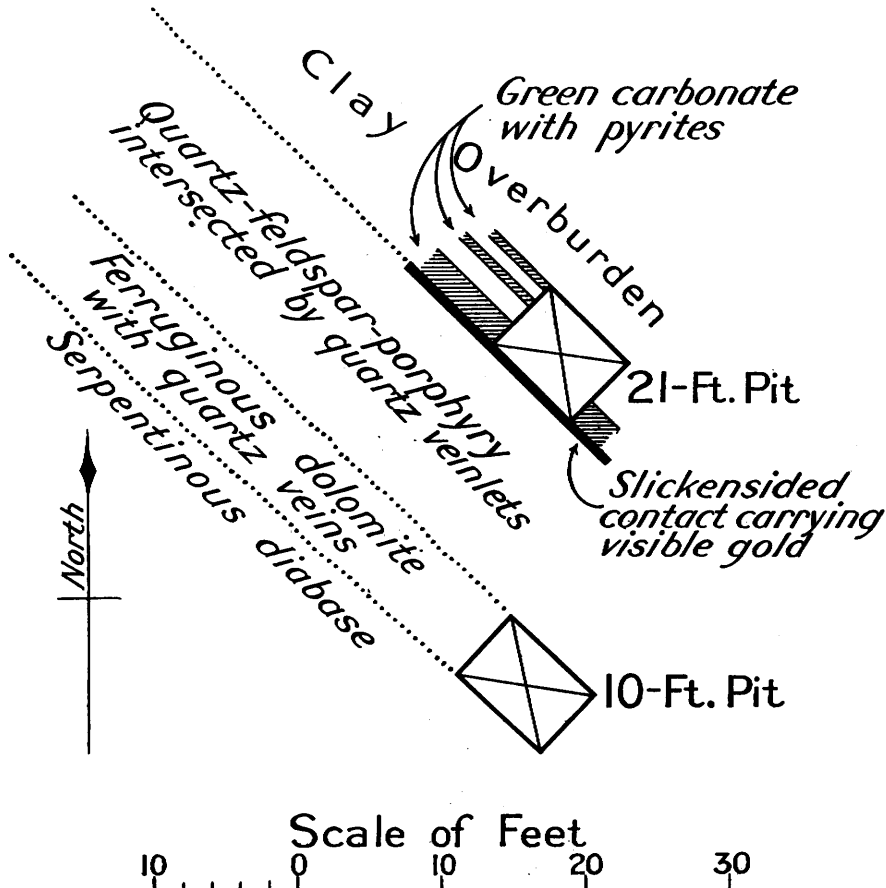
Martin.—In the southwest corner of the Martin claim, No. 6263 on lot 9, concession VI, Skead township, is a cylindrical mass of porphyry about 100 feet in diameter and apparently surrounded by Keewatin pillow lava. The porphyry contains a network of quartz veinlets and lenses of quartz up to several feet in width carrying much pyrite and some galena. Visible gold was reported to have been found. A chipped sample across 20 feet yielded 40 cents in gold to the ton. The work comprised a shaft and some open cuts.

Crawford-Skead.—The Crawford-Skead property consists of two claims in the north parts of lots 9 and 10, concession V, Skead. A shaft has been sunk to a depth of 22 feet on the contact of red porphyry and lamprophyre. Along the contact there is a silicified zone which carries abundant fine-grained iron pyrites for a width of 26 inches at the east end of the shaft. Some molybdenite occurs along slickensided fractures in the quartz. The porphyry near the contact also carries abundant iron pyrites. A sample 26 inches wide of silicified

¹ Geol. Sur. Canada, Memoir 17 E., p. 55.

material, with pyrite lying between porphyry and lamprophyre, gave 40 cents in gold per ton. The general country rock is an altered sediment.

Wisconsin-Skead (Claims Nos. 4352, 4353, 4354, and 4406 on lot 10, concessions V. and VI., Skead township)—Crossing these claims in a northwest-southeast direction is a massive pink biotite granite, porphyritic in places and about 400 feet in width with Keewatin greenstone and Timiskamian sediments on the sides. Crossing the granite dike at right angles to its longer dimension on claim 4353, where practically all development work has been done, are numerous parallel quartz veins which all dip about 40° south. These veins are usually an inch or so in width, although veins Nos. 6 and 11 are approximately 3 and 6 feet wide respectively, and contain some visible gold and a telluride. No vein was

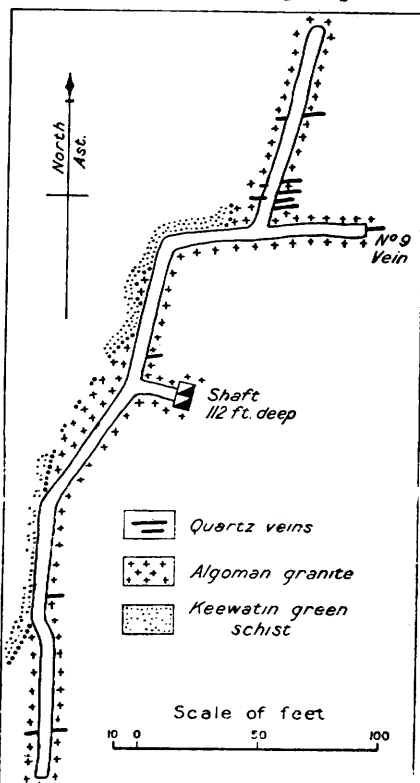


Sketch showing the geology in the vicinity of the Manley-O'Reilly gold discovery.

seen extending from the granite into the adjoining wall rocks. A shaft has been sunk vertically in the granite to a depth of 112 feet exposing numerous quartz veinlets dipping about 40° south. On the 110-foot level about 1,000 feet of lateral work has been done. No. 6 vein occurs along a fault which contains quartz, calcite, pink barite, pyrite, molybdenite, gold and a telluride. The No. 11 vein had not been reached in the cross-cut when the workings were examined in March, 1920. In May, 1921, the shaft was full of water. Much diamond-drilling has also been done. The porphyry has been cleared of the forest; a steam compressor and gold

buildings have been erected. The company intends obtaining hydro-electric power from the Raven Falls power plant, for further development.

Sampson (Claims Nos. 4363 and 4364 on lot 10, concession VI, Skead township).—These claims lie directly north of the Wisconsin-Skead. Work consists of trenching and test-pitting. Gold has been found in a stockwork of porphyry and quartz up to 100 feet in width. The quartz veins vary in width from 3 feet to a fraction of an inch in thickness and carry pyrite, molybdenite, telluride and gold. A grab sample, from a seam 4 inches wide and containing much pyrite, molybdenite and molybdate, assayed \$14.80 in gold per ton.



Plan of 100-foot level. Wisconsin-Skead property, March, 1920.
Most of the veins dip from 30° to 45° south.

De Villiers-McBurke.—Gold was reported to have been found on May 17th, 1921, on the northwest corner of Rattray township on the unsurveyed claim No. 9168. The vein was examined two days later, but the owners had no gold that could be seen in place. The vein is composed of glassy quartz, occasionally smoky in character and containing a little pyrite and galena. In places considerable rusty carbonate is interbanded with the quartz. The vein had been uncovered, at intervals, for 1,700 feet in a north and south direction. The vein is 10 feet wide in places and apparently dips 85° to the west. The enclosing rocks are Timiskamian greywacké schists impregnated with pyrite, and quartz-porphry.

Gold is reported to have been found on various other locations in Skead township. They are as follows: Mutton (claim No 6711 in lot 4, concession III); Kearney (L.S. 214); Gorman (6830) and Boughmam (5004), the last three claims being the north parts of lots 7 and 8, concession V.

THE BLACK RIVER AREA

By D. G. H. Wright

Introduction

The following report, based on information obtained during a survey in the field season of 1920, deals with the geology and economic possibilities of an area in the District of Timiskaming, north of and contiguous to the Kirkland Lake¹ area and west of the Ben Nevis area². The character and age of the rocks in the area were known in a general way to be similar to those in the adjoining townships already geologically surveyed. Little detailed information, as to character of the country, geology, economic possibilities or travel routes, had been collected.

With such limited time available for the work—nine townships, approximately 325 square miles being covered in the season—detailed examination was neither attempted nor possible. For this reason the report must be considered as presenting only the geological generalities, supplemented by more detailed work in parts where considerable staking had been done or rock formations warranted it.

The mapping of the lakes and rivers was done by means of a split-objective lens micrometer and prismatic compass, using the various township boundaries as control. Closed traverses were made wherever possible. The inland traverses were made by pacing and compass methods and small lakes intercepted on these traverses were sketched by taking compass bearings on prominent points and estimating the distances.

Acknowledgments

The writer was efficiently assisted in the field by E. Howell, D. E. Kerr-Lawson and R. Presgrave.

The photomicrographs were kindly prepared by C. W. Knight, to whom thanks are also due for many suggestions as to the geological mapping of the area and assistance in the compilation of this report.

The preparation of the geological maps and inserts accompanying this report was done by P. A. Jackson under the supervision of W. R. Rogers, topographer of the Ontario Department of Mines.

The chemical analyses and assays were made by W. K. McNeill and T. E. Rothwell of the Provincial Assay Office.

Thanks are due to many prospectors who tendered much information which aided materially in the field work. It is particularly desired to thank V. Woollings of Thos. S. Woollings Co., Ltd., for many courtesies shown the party while in Black township and vicinity.

Thanks are also due H. George Ginn, Mining Recorder, Swastika, for blue prints and information provided.

Maps

The report is accompanied by a geological map, No. 30c, scale one mile to the inch. In the general arrangement of the map, the plan, initiated by C. W. Knight in his map of the Ben Nevis area,³ has been followed, the dotted lines showing the

¹ Kirkland Lake Gold Area, Ont. Dept. Mines Report, Vol. 29, Part IV, 1920; also Vol. 23, Part II.

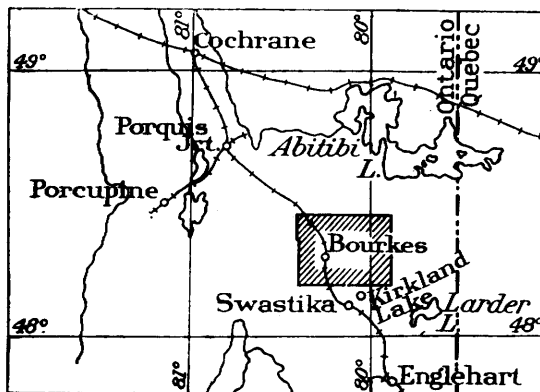
² Ont. Dept. Mines, Vol. 29, 1920, Part III, Ben Nevis Gold Area.

³ Map No. 29c, accompanying Ont. Dept. Mines Report, Vol. 29, 1920., Part III.

country traversed in the section work. As most of the lakes and rivers of the area had not been surveyed previously, much of the time spent in the field was occupied in topographical work.

The following maps have been utilized in the preparation of the map of the Black River Area:

- (1) The eastern boundary of Bisley and Morrisette township taken from map No. 29 e, Ben Nevis gold area, by C. W. Knight, Ontario Dept. of Mines Report, 1920, Vol. 29, Part III.
- (2) The Goodfish Lake Area taken from map No. 25 f. by A. G. Burrows and P. E. Hopkins, Ontario Bureau of Mines Report, 1916, Vol. 25, part I.
- (3) The southern boundary of Bernhardt and Morrisette from map of Kirkland Lake and Swastika Gold Areas by A. G. Burrows and P. E. Hopkins, Ontario Bureau of Mines Report, 1913, Vol. 23, part II.
- (4) The township of Maisonville extracted *in toto* from map No. 23b, by A. G. Burrows and P. E. Hopkins, Ontario Bureau of Mines Report, 1914, Vol. 23, part II.
- (5) The northern boundary of Barnet and Thackeray townships from map No. 28b, accompanying Ontario Bureau of Mines Report 1919, Vol. 28, part II.
- (6) Topographical features of Lee township were largely supplied by S. Woolings, who has timber cruised this township.



Scale, 50 Miles to 1 Inch.

Index map showing location of the Black River Area (hatched) in relation to Porcupine and Kirkland Lake.

Location

The area described comprises the following townships; Cook, Barnet, Thackeray, Bisley, Melba, Benoit, Black, Lee, Bernhardt and Morrisette. Since all of this area with the exception of the southern portion of Bernhardt and Morrisette is drained by the Black river and its tributaries, it has been named for the purposes of this report "The Black River Area." The position of the area with respect to adjacent localities is indicated in the accompanying index map. Black river is a tributary of the Abitibi, and joins the latter in the township of Walker at a point about six miles east of Porquis Junction on the T. and N.O. railway.

Accessibility

The western portion is traversed by the Temiskaming and Northern Ontario Railroad. The southeastern part is best reached by way of Swastika from thence by stage to Kirkland lake; by canoe route from Kirkland lake, Bernhardt and the southwest portion of Morrissette township is accessible.

White Clay and Woollings creeks, which empty into Meyers lake, make the interior of Lee and Black townships, accessible by canoe. White Clay creek is not navigable in low water, and even in high water navigation is made difficult by the swamp alders which overhang the banks. Canoe travel on Woollings creek was possible even during the dry season experienced in the summer of 1920. A canoe route, free from portages, leads to Meyers lake from Bourkes on the T. and N.O. railway. From Bourkes the route follows the White Clay river, traverses Lower Twin and Swan lakes and then follows White Clay creek northward into Meyers lake.

The balance of the area is accessible from Scotties Springs,¹ a flag station on the Temiskaming and Northern Ontario railroad, at a point where the Black river parallels the railroad about five miles north of Bourkes. The Black river is navigable with little difficulty into Morrissette township. More will appear under the various townships regarding their respective accessibility.

Early Prospecting and Historic Notes

Shortly after the discovery of the silver bearing veins at Cobalt in 1903 this area was prospected for silver, and old workings were met with in various places, but particularly in Benoit, Black and Barnet townships.

In 1912 gold discoveries were made in the vicinity of Goodfish Lake. In 1916 discoveries of gold promising to be of economic importance, were made in the vicinity of Bourkes by A. Skjonsbye, Oscar Anderson, A. Wickstead, and others. These two localities are still promising and contain many prospects which require more development before any pronouncements can be made as to their economic value.

Thackeray township also boasts of its gold rush, and considerable prospecting was done by the Howey brothers, D. Willans, W. Cochenour and others, but no spectacular finds were made. As a result nothing further has been done in this locality.

The finding of a flint arrowhead on the north shore of Splashwater Lake, in Bernhardt township, caused the writer to inquire into the early Indian occupation of this area, as it was not thought that the Indians penetrated so far inland from recognized travel routes in arrowhead days. Dr. R. B. Orr,² when questioned relative to the early Indian occupation, volunteered the information that this area was occupied by Algonquin tribes, chiefly by the Abitibi, as early as the 17th century. Historical records tell of an expedition of the Iroquois sometime in the 17th century as far as Iroquois Falls, where they met and defeated the Abitibi. Shortly after the French occupation the Abitibi discontinued the manufacture of flint artifacts, as they readily accustomed themselves to new conditions. The finding of the arrowhead, above referred to, points to Indians penetrating even this remote part of our Province prior to the French occupation.

Previous Geological Work

The only previous geological work accomplished in the area, other than along some of the township boundaries done in conjunction with the work in adjacent areas, was that of A. G. Burrows³ in the vicinity of Bourkes, and that of A. G. Burrows and P. E. Hopkins, in the Goodfish Lake Gold Area.⁴

¹ Since called Yorkston station, Scotties Springs P.O.

² Director Provincial Museum, Normal School Bldg., Toronto.

³ Gold Bearing Veins of Benoit Township, Ont. Bur. Mines Report, Vol. 26, 1917, pp. 248-251.

⁴ Goodfish Lake Gold Area, Ont. Bur. Mines Report, Vol. 25, pp. 260-263.

Topography and Physiography

The Black River area saddles the divide between the Hudson Bay slope and the drainage basin of the St. Lawrence river. The greater portion lies to the north of this height of land. The area has an average elevation of 1000 ft. above sea level with hills and ridges rising here and there to elevations seldom in excess of 350 feet above the surrounding country. A bench mark about one quarter of a mile north of Bourkes on the Temiskaming and Northern Ontario railroad records an elevation of 1011.92 feet. Goodfish lake is approximately 1025 feet above sea level.

The principal points of high elevation in the area consist of volcanics of the Keewatin series. Practically the only exceptions are ridges of the Cobalt series, which may be seen in the southwest of Benoit township and also in Black township. The high, hump-shaped, northern outlier of the Cobalt series—Defiance Peak—west of Butler lake is a typical example. The highest hill in the area is possibly the one rising to a height of 350 feet above the surrounding country situated one mile north of the southwest corner of Cook township. Lava Flow mountain, in lots nine and ten in the fifth concession of Cook township, is approximately 175 feet in height. It has the outline of an old volcanic cone. From Blue mountain which rises 200



Looking north at "Lava Flow" mountain, Cook township.

feet in the northwest of Bernhardt, and also from the east to west ridge rising 150 feet with a precipitous face northward situated immediately south of the northwest corner of Melba township, commanding views of the surrounding country may be had. A wonderful view of the country stretching to the north, west and east for fifteen to twenty miles may be obtained from the last mentioned mountain. There are many other localities possessing prominent peaks, for example the central portion of Morrissette, the area southwest of Columbus lake in the same township and along the line between Bisley and Melba townships northward from the Black river which consists of a series of peaks from which one may view for miles the landscape typical of the Laurentian plateau region, spruce covered for the most part, but here and there dotted with patches of poplar and birch.

The area in common with all of the Laurentian plateau country has many lakes. These occur chiefly in the rocky, hilly country, particularly in Bernhardt and Black townships.

Amikougami lake is remarkable for its irregular shape, high rocky shores, numerous arms and islands, and the extent of its shore line. The series of lakes lying

north of Goodfish lake, east of the western boundary of Morrissette, being in sandy country are all remarkably clear and largely spring fed. Butler, Malloch and Verona lakes are sand bottomed and crystal clear. The first two named vary in depth from 20 to 40 feet. Soundings of 150 feet were obtained in Verona lake. The only other lake of outstanding features is Lauramay, situated in the southwest corner of Bisley township. Next to Amikougami it is the largest lake in the area, being about one and a half miles long from east to west and one half mile wide. It is dotted with rocky islands and surrounded on all sides by high hilly country, all of which make quite a picturesque setting. The other lakes of the area are for the most part shallow, weedy-edged bodies of murky water containing a considerable amount of organic matter in suspension.



High falls, Melba township, a series of cascades with a total drop of upwards of one hundred feet. The picture was taken from hilltop at foot of falls.

The Black river is the only stream of importance. Its source is south of the centre of Morrissette township, and it follows a sinuous course through swamp-land northward into Bisley township where its banks become higher as it flows through the clay land; then in a general westerly direction it meanders across Melba township into Benoit and Cook, where it broadens into a stream two to three chains wide with a depth of ten to fifteen feet, after its two main tributaries, the White Clay and the Little Black, have augmented its flow. The other streams and creeks of the area are neither wide nor deep and the largest of them are only navigable in the early summer or during a wet season.

Waterfalls

The area possesses several waterfalls, the principal one being High falls, situated on the Black river about the centre of Melba township. The total drop including the rapids at the foot of the falls approaches 100 feet and is made up of a series of cascades from eight to twenty five feet each. In June the volume of water passing over was not large, but a storage dam might make the falls worth harnessing for power purposes. Three other waterfalls of from 20 to 30 feet exist, one on the White Clay river in Benoit township about 30 chains east of mileage 185.5 on the Temiskaming and Northern Ontario railroad, another on the Little Black river in the northwest corner of Bernhardt and the other in the centre of Lee township on the creek which drains into the southwest of Meyers lake.

Glaciation

The effects of glaciation are noted everywhere throughout the region. Huge boulders have been left on the summit of the highest peaks. The processes of denudation and deposition resultant from the Labradorian ice sheet have created a youthful drainage system on a surface of low relief, producing the peculiar glacial physiography so typical of the pre-Cambrian Shield. The sand ridges of the region do not follow any general direction. For instance along the southern boundary of Thackeray the ridges run from north to south; in Cook township several prominent ridges have a northeast to southwest trend, and in the northwest corner of Black township, the alignment is from east to west.

A rather striking feature was noted in Cook township. On the slopes of Lava Flow mountain are terraces suggestive of ancient beaches. The boulders and pebbles are in step-like formation and there is an indication of sorting.

Fish and Game

Generally speaking fish are not plentiful throughout the area. The lakes of Bernhardt township are the most productive. Pickerel, pike, and whitefish are the most plentiful species. There are also a great number of suckers and white trout which are of little commercial value. The large amount of suspended material, both clay and organic matter, in nearly all of the lakes and streams make them an unsuitable environment for either trout or bass, but even in the lakes already referred to as having clear water these two species, which might be expected, are absent. The only fish in Butler lake, for example, were perch, and these rarely of edible size.

Moose were plentiful in the district particularly along the Black river in Melba township. A few red deer and caribou are reported to frequent Black and Lee townships. The intense trapping of the beaver during the recent open season has nearly exterminated this species. Only a few fresh beaver cuttings were seen by the party. The mink, the fox, the fisher, the lynx, the muskrat, the rabbit and the black bear are all inhabitants of this area, but are not numerous.

Ducks were not plentiful; each lake, however, had a few. Partridge were especially abundant.

Forests and Forest Fires

The forests are nearly all green, practically the only large belt of brulé being in Cook and Barnett townships which were swept by the Matheson fire in 1916. The northwest corner of Black township is all old brulé. The only fire of any size in 1920 swept along the Woollings camp road to the south of Malloch lake and crossed into Benoit township. No timber of merchantable size was lost in the fire.

The forest growth varies locally, the character of the country being the determining factor. Poplar, birch and balsam of gilead border streams and lakes and timber the slopes or other areas where the drainage is good. The sand covered areas are timbered with jack (Banksian) pine. The low, poorly drained, clayey soil

produces a black spruce forest which if very wet has a fair percentage of tamarack. In rocky areas, a mixed forest growth of red, white and jack pine with considerable birch, poplar and black spruce exists. The low muskeg areas are covered with scrub spruce and tamarack. Cedar has not an extensive distribution in the area, only two localities of importance were noted, one in the northwest quarter of Black township and the other in Cook township.

Economically, the only trees of importance are the black spruce and poplar and these species are the most plentiful in the region. Spruce and poplar for pulpwood was being cut in Black, Lee, Benoit and Cook townships in 1920. The balance of the area possesses large reserves of these woods, which, as they become more accessible will provide a supply for the ever growing pulpwood industry. The jack pine in some localities grows straight and tall with a diameter of twelve to eighteen inches. In the vicinity of Malloch lake one jack pine having a girth of seventy odd inches, was cut for exhibition purposes. The year rings numbered 167 approximately. Doubtless much of the jack pine will some day be of commercial value for rough lumber, lathes or railway ties.

General Geology

The Black River area geologically is pre-Cambrian, the dominant rocks being basic lavas of Keewatin age.

Below is given the classification of the rocks and unconsolidated material referred to in the report and on the accompanying map, according to their relative ages. The oldest rocks are at the bottom of the table.

PLEISTOCENE.

GLACIAL AND RECENT:

Boulder clay, stratified clay, sand gravel, peat.

Unconformity

PRE-CAMBRIAN

KEWEENAWAN:

Diabase and gabbro.

Intrusive Contact

COBALT SERIES:

Conglomerate, arkose, greywacké, slate-like greywacké.

Unconformity

ALGOMAN:

Granite, syenite, grano-diorite, red and grey feldspar-porphyry, quartz-porphyry.

Intrusive Contact

PRE-ALGOMAN (HAILEYBURIAN):

Diabase and lamprophyre dikes and boss-like masses which intrude the Keewatin but the relationship to the Timiskaming series is unknown.

Intrusive Contact

TIMISKAMING SERIES:

Conglomerate, quartzite, greywacké and schistose derivatives, some of which may be Keewatin.

Unconformity

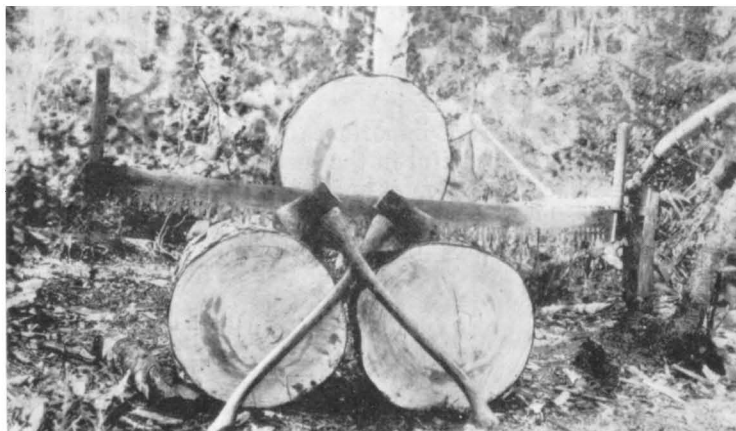
KEEWATIN:

Basic to acid rocks including basalt, diabase, andesite; grey, pillow and amygdaloidal lavas; tuffs and volcanic fragmental rocks.

Keewatin

Prior to the spring of 1918 geological investigation had not revealed the structure of the Keewatin series of Ontario. The Keewatin was regarded as a complex of igneous rocks of volcanic origin, devoid of regular geological sequence. In 1918 members of the staff of the Ontario Department of Mines¹ discovered and worked out an orderly succession of lava flows in Holloway township, comprising 14 distinct flows with a combined thickness of 4,400 feet. These flows have aided materially in giving a true conception of the Keewatin series.

¹ Abitibi-Night Hawk Gold Area, Ont. Bur. Mines, Vol. 28, Part II.



Jack pine cut for exhibition purposes from Malloch lake, Black township. The girth is seventy odd inches and the year rings, roughly counted, numbered 167.

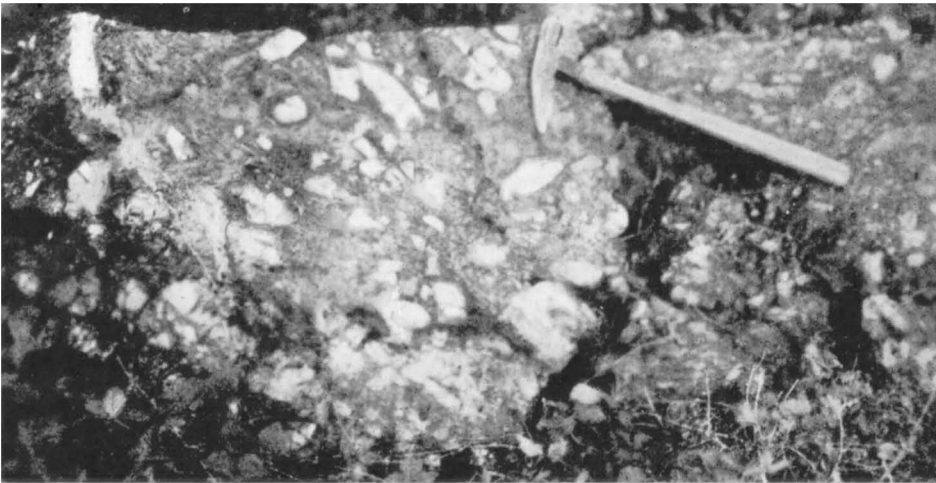


View showing the sharp dividing line between two lava flows, Cook township. The pick in foreground, and figure in distance are on the bottom of lava flow where it is frozen against the ropy fragmental surface of the preceding flow.

That the Holloway township lava flows are not merely a local structure in the Keewatin is substantiated by the fact that a similar succession of lava flows were found in Cook township about twenty-two miles west of Holloway, during our work in the summer of 1920. As the Cook township flows are considered typical of the Keewatin series of the Black River area, no unnecessary details of petrographic description will be given here. Suffice it to say that the rocks of the Keewatin series in this region are similar to those of like series in northern Ontario and Quebec already fully described by W. G. Miller, C. W. Knight, A. G. Burrows, W. H. Collins, M. E. Wilson and others.

Keewatin Lava Flows, Cook Township

The Cook township flows are located in the north half of lots eight, nine, and ten in the fourth concession, and lots seven, eight, nine, ten and eleven in the fifth concession of Cook township. The north to south section traversing these flows was run from the north half of lot ten in the fifth concession to the north half lot ten in the fourth concession, along a line a few chains east of the lot line.



Fragmental top of lava flow, Cook township.

The locality is accessible by canoe from Scotties Springs. The Black river is followed down stream for about two miles to the mouth of the creek outlet of Bolton lake. This creek is followed to Bolton lake; then the lake crossed to the northeast extremity where a small creek has its inlet. This creek is followed a short distance to the line between concessions three and four which is travelled to the southwest corner of lot ten in the fourth concession. The lot line is then taken northward for forty-six chains. To the north and east of this point are the lava flows.

A brief resumé of the principal lava flows of the world ranging in age from Pre-Cambrian to geologically recent, was given by C. W. Knight,¹ in connection with his description of the Holloway township flows and the reader's attention is directed to this report for a better understanding of the following detailed discussion of the Cook township lava flows.

The belief of the most eminent geologists is that fissure eruptions (both the Holloway and Cook townships flows are classed in this type) played a more important role in the formation of lava flows than did the volcanoes. The absence of

¹ Ont. Bur. Mines Report, Vol. 28, 1919, Part II, pp. 17-19.

volcanic necks in areas where vast and ponderous sheets of lava appear furnishes a basis for the theory of fissure origin.

The Cook township lava flows as worked out, have a total thickness of 7,300 feet and comprise at least fourteen distinct flows, or the same number as in the township of Holloway. More detailed work may reveal the presence of even more, for it was noted that the ropy fragmental tops of the flows disintegrated more readily under weathering processes and hence it may be surmised that the drift covered areas are more likely to conceal a flow top, than a flow centre. It is not desired to give the impression that these flows are local, for throughout the Black River area there is a widespread distribution of pillow lavas, amygdaloidal basalts, and other rocks possessing the specific characteristics of lava flows. For this reason it is thought that the Keewatin formation in the entire Black River area represents a succession of lava flows, the structure of which is at present obscure, owing to the overburden. The locality of the Cook township lava flows has been burned over, and thus the rocks are laid bare revealing the structure in a remarkable manner. The flows have been tilted up from a horizontal position to one approaching the vertical. The upturned edges of the flows have an average strike of north 83° east astronomic, and a dip to the north of 80°.¹

An interesting fact about the strike of these flows is that a continuation of their line of strike would approximately join the Holloway lava flows.

The lateral (east to west) extent of the flows was not worked out owing to the limited time at our disposal. A section near the southern limit of the exposure was run eastward from the line between lots ten and eleven for one and a quarter miles along the dividing line between the top of one flow and the bottom of the succeeding flow. The dividing line was continuous and well marked throughout, except, of course, where it was concealed by drift. Along the foregoing section several dikes were observed to cut the lava flows. The location of three of these dikes is given below:

- (a) 600 feet east of the lot line a diabase dike 40 feet wide, striking N. 40 E. magnetic.
- (b) 2950 feet east of the lot line diorite porphyry dike 10 feet wide striking N.W. approximately.
- (c) 5500 feet east of the lot line numerous gabbro dikes cut the flows for 100 feet of their lateral extent.

Before proceeding with a description of these flows it is deemed advisable to explain the scope of some of the various terms used. The term basalt includes the dense basic igneous rocks of a green color. The term "grey lava"² refers to those grey coloured, fine-grained lavas which may have an intermediate composition between rhyolites on the one hand and basalts on the other.

It is highly probable that other rocks are included in these two classes such as trachytes, dacites, quartz-porphyrines and andesites, but for the purpose of this discussion the foregoing broad classification will suffice.

In the brief summary of the flows which is given below the oldest is No. 1, and occurs at the northern extremity of the outcrop; proceeding south younger and still younger flows are met with.

Flow No. 1.—This flow is the most northerly worked out, although indications of distinct flow structures were observed north of this point on the west boundary of the township. The flow has an exposed thickness of 350 feet. The bottom is not discernible because at the northern exposed limit, the basalt, which is the characteristic rock of the bottom and central portions of the flows, disappears in a spruce

¹ The Holloway township flows dip to the south 80 deg. and strike a few degrees south of west, astronomic.—Ont. Bur. Mines Report, Vol. 28, Part II, p. 10.

² C. W. Knight, Ont. Bur. of Mines Report, Vol. 29, Part III, p. 20.

swamp. The top has a thickness of 30 feet comprising ropy, slaggy, fragmental material in which incipient pillow structure is developed.

Flow No. 2.—This flow has a depth of 875 feet, and may possibly include more than one flow, as part of it is drift covered. The ropy fragmental top is but 10 feet thick which tends to confirm this conjecture. Two shear zones which have been infiltrated with quartz and calcite exist near its base and test pits have been sunk on these but apparently they failed to reveal minerals of economic importance. This flow has a porphyritic development running in bands, almost dike like, one 20 feet and another 160 feet from the surface. The porphyritic bands are each 20 feet wide.

Flow No. 3.—This is a thin flow of 60 feet having a 25 foot top of ropy, volcanic, fragmental material. At the base the flow has a porphyritic texture, but the phenocrysts are not as plentiful as in the preceding flow.

Flow No. 4.—This flow has an apparent total thickness of 635 feet, a 30 foot ropy, fragmental top, and below this a development of pillow structure for about 300 feet. Another belt of pillow lava is developed to 100 feet from the bottom. A porphyritic texture is assumed ten feet from the bottom. The plagioclase feldspar phenocrysts are sparsely scattered through a basaltic ground mass.

Flow No. 5.—The depth of flow No. 5. is 500 feet of which 35 feet constitutes a top of volcanic fragmental material possessing a ropy and incipient pillow lava structure. Below the top for two hundred feet pillow lava structure is developed, and then basalt, assuming towards the centre a granitoid to diabasic texture.

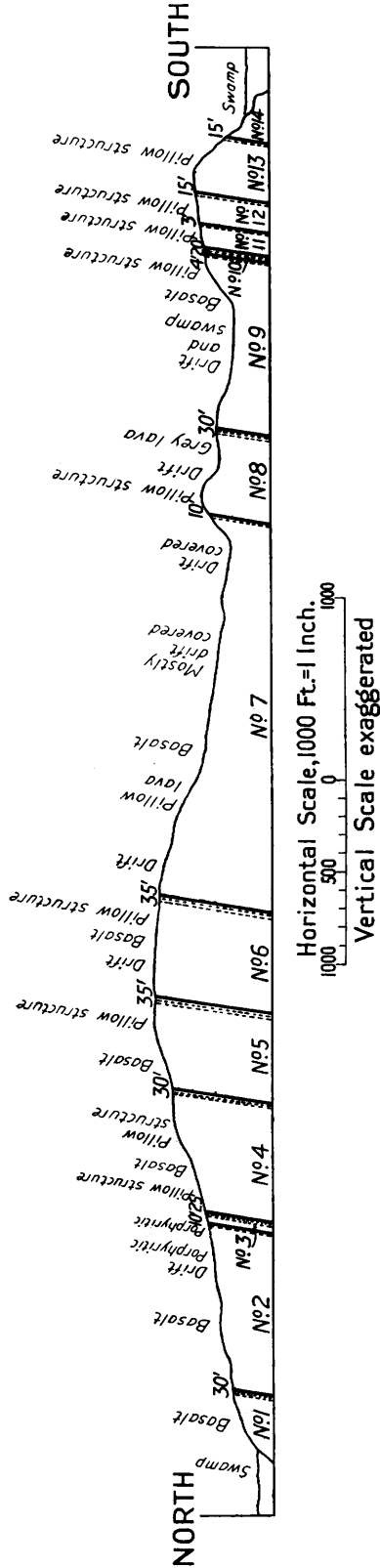
Flow No. 6.—This flow has a 40 foot top of ropy, fragmental material and a total thickness of 540 feet. As 150 feet of this is drift covered, there is a possibility that this may comprise more than one flow. Below the ropy surface to a depth of 200 feet there is a wonderful development of pillow structure. Many of the pillows show a concentric structure of alternate bands of spherulites and basalt. Where it is frozen against the top of flow No. 5 there is a 10-foot belt of pillow lava.

Flow No. 7.—Drift, sand, and swamp cover this flow in various places and consequently it is possible that more than one flow is included. The apparent thickness is 2120 feet. The thickness of the possible top is only 10 feet, a fact which would point to a thin rather than a thick flow. About the centre of this flow there exists a shear zone 10 feet wide. Here the basalt has become quite schistose and much altered. In places the flow becomes less basic, resembling a grey lava with flow lines.

Flow No. 8.—The total thickness of this flow is 490 feet. The surface extends to a depth of 30 feet and consists of volcanic fragmental material having slag-like inclusions and showing the usual ropy, incipient pillow lava structure. Below the surface is a belt 125 feet thick of grey lava. Surfacing the ropy top of this flow is a 15 inch band of light green chert-like rock which shows distinct bedding. This is probably a silicified tuff, as under the microscope a thin section shows it to be an aggregate of fine angular particles. This tuff may have settled through the condensation of water vapors which in all probability would be quite dense during an outpouring of lava such as this, or it may denote a sub-aqueous deposition. The narrow belt of silicified tuff is not continuous and caps the flow for only a little over a hundred feet.

Flow No. 9.—This flow has an apparent thickness of 930 feet but as 700 feet of this is covered with sand and swamp it is impossible to state definitely that this thickness comprises but one outpouring of lava. There is only 4 feet of ropy fragmental top indicative of a thinner flow.

Flow No. 10.—This flow was only considered as a possible one owing to the fact that there was a depth of but ten feet of amygdaloidal basalt topped with



VERTICAL SECTION THROUGH COOK TOWNSHIP LAVA FLOWS, SHOWING 14 BASALTIC LAVA FLOWS.

Heavy lines denote contact between lava flows. The flows are numbered 1 to 14, commencing at the north end. The numbers 30, 10, 25, etc., denote the thickness of the fragmental top. The oldest flows are at the north, successively younger flows occurring to the south.

a thickness of fifteen feet of ropy, volcanic fragmental material. No pillow lava structure was observed.

Flow No. 11.—This flow has a total thickness of 120 feet and a ropy surface to a depth of 3 feet. No pillow lava structure was observed.

Flow No. 12.—This flow has a total thickness of 165 feet and a 15 foot top of ropy, fragmental material. No pillow structure was seen, other than the incipient pillow structure characteristic of the tops of all the flows observed. The bottom of the flow, like its predecessors, is basalt grading to a gabbro near the centre of the flow.

Flow No. 13.—This flow has a thickness of 310 feet, 15 feet of which constitutes the volcanic fragmental top. The flow has a considerable thickness of pillow lava. The pillows show a concentric structure of basalt alternating with spherulites. Eighty feet from the surface of the flow is a layer of porphyritic lava containing phenocrysts ranging in size up to three quarters of an inch in diameter. The phenocrysts weather white, producing a leopard-like appearance.

Flow No. 14.—Only 20 feet of the basaltic bottom of this flow is exposed before the outcrop disappears in a swamp.

Description of Bottom of Flows

The immediate bottom of the flows is a basalt, fresh and fine-grained resembling a devitrified glass where it is frozen against the top of the underlying flow. As the centre is approached the texture becomes coarser, until a coarse granitoid texture is reached. Just below the ropy fragmental top, the basalt, gabbro or diabase becomes quite amygdaloidal. In nearly every flow the amygdaloidal facies was observed below the fragmental surface.

The flows show little effects of dynamic metamorphism although they have been tilted into a nearly vertical position. In consequence they retain their massive character and are rarely altered to schists.

A thin section was made from a specimen taken from the centre of flow No. 4, which, under the microscope, revealed a remarkably fresh rock possessing ophitic or diabasic texture. The usual decomposition products such as chlorite were present. No primary quartz¹ was observed.

Description of Top of Flows

The surface of the flows is made up of angular, stony to sub-vitreous fragments of lava varying from a few inches to a fraction of an inch in width. Fragments of a peculiar, quite porous, bluish-black slag-like material, may be observed in the surface of these flows. This material is rarely angular in shape. Other fragments are of amygdaloidal basalt.

An analysis of the peculiar bluish black, slag-like material was made. It will be observed from the results tabulated below that chemically it corresponds with the average basalt:

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	K ₂ O	Na ₂ O	CO ₂	H ₂ O	XyO
A.	48.64	14.81	6.02	9.78	7.28	4.56	4.10	1.72	0.88	2.18	....
B.	51.9	15.3	3.1	3.6	7.4	8.7	2.5	3.3	....	2.5	1.7
C.	48.76	15.89	6.04	4.56	8.15	5.98	2.93	3.43	....	1.88	2.61

A.—Bluish black slag-like material from Cook township Lava Flows.

B.—Basalt—Pirsson; Rocks and Rock Minerals, page 225.

C.—Basalt—Reis & Watson; Engineering Geology, page 89.

¹ Ont. Bur. Mines Report, Vol. 28, Part II, p. 15, C. W. Knight.

The volcanic fragmental tops of the flows seem to have had a dual origin. Primarily they are autoclastic rocks formed by the inclusion of the partly solidified and broken-up crust of the magma in the still liquid magma below the crust, the whole then solidifying. Secondly, doubtless a goodly percentage of it is pyroclastic and has its origin in material thrown out during the effusion by the explosive action due to the release of vapors, principally water. No bedding was noticed in the various zones of this variety of fragmental materials.

An incipient pillow lava structure was almost invariably seen in the fragmental surface.

The contacts between the surface and the basaltic bottom of the succeeding flow were continuous and well defined.



View showing sharp dividing line between two lava flows in Cook township. The hand rests on fragmental top, and the finger points to exact line of contact.

The upper zones of all these flows bore the ear marks of effusive volcanic igneous rocks in that they had a marked development of the amygdaloidal, vesicular, scoriaeous, fragmental, spherulitic and ropy structures. Lithophysæ, whose origin according to Pirsson¹ is ascribed to repeated shells of crystallization and a subsequent expansion of the cavities through the influence of the aqueous vapor liberated at high temperatures, were also noted in several instances.

Chalcedony-like inclusions occurred in several of the clastic tops. These appear to be epigenetic, i.e., formed subsequent to the solidification of the rock. The mineral shows concentric structure and frequently forms a geode. This chalcedony-like material was probably formed in a similar manner to the precious opal which fills seams and cavities in certain igneous rocks, more particularly, trachytes. The

¹ Pirsson—Rock and Rock Minerals, p. 265.

opal, it is thought, was formed by the action of hot magmatic waters upon the silicates, the silica liberated, being deposited in the hydrous form.

Pillow Lava

The pillow lava structure was well developed in nearly all the flows. Generally it forms near the top of the flow although in several places it was observed near, or at the bottom, as is the case in Flow No. 6.

A close observation for corroboratory evidence of the criterion that "the flattening of the ellipsoids of the pillow lavas on their under side due to gravity can also be used to ascertain not only the attitude of the volcanics, but the upper and lower side of the flows" referred to by M. E. Wilson¹, was made. In no one instance could this be verified. It was found that an approximately even division existed between the number of flattened and rounded pillows, and there were as many pillows with the upward surface flattened, as with the lower.

A peculiar structure was observed in the pillows of flows Nos. 6 and 13. Concentric layers of basalt are interbanded with layers of spherulites which weather white. A thin section from the spherulitic band was made and it appears under the microscope as an aggregate of round figures built up of fibres radiating from a common centre. These fibres appear to vary in composition slightly at uniform distances from the common centre giving the spherulites the appearance of having been built up of successive concentric shells. Individual spherulites under polarized light show a dark figure resembling a maltese cross. The figure remained constant when the section was rotated.

A thin section of spherulites from Corriegillis, Island of Arran, Scotland, which from the description given, the writer takes to be much the same, has been described as follows²: "Part of the fibrous radiating structure becomes altered to a pale green substance which under the revolution of a single nicol changes from lighter to darker hues of greens, and under fully polarized light gives greys and steel blues of the first order which point to chlorite."

From a microscopic examination the writer does not care to hazard giving the composition of these spherulites, but Dana³ states that spherulites in the volcanic rocks of Obsidian Cliff, Yellowstone Park, are believed to consist essentially of orthoclase needles with quartz.

Spherulites are indicative of sudden cooling and rapid crystallization and their presence may give additional evidence of the now generally accepted subaqueous origin of pillow lavas.⁴

Volcanic Tuff

The greenish colored, banded, rock which formed a bed on the surface of flow No. 8 is taken to be a silicified tuff. Examined under the microscope in a thin section its fragmental nature is easily discernible. The tuff is comprised of angular pieces, principally feldspar and quartz with fragments of other minerals or rocks. The rock weathers white. Other bands of this volcanic tuff were observed but in no one instance were they over two feet wide. In one case the tuff was observed to lie between the pillow lava and the ropy fragmental top. The tuffs appear to be made up of thin laminae which on weathered surfaces show bedding and cross bedding lines. In connection with the presence of this silicified tuff in flow No. 8 it is interesting to note that this flow has a grey lava composition to a depth of 150 feet below the fragmental surface. It is therefore thought that the formation of the tuff in this instance was due to the high silica content of the grey lava, for lavas

¹ Memoir No. 39, Geological Survey of Canada, pp. 51 and 53.

² 20th century Atlas Microscopical Petrography, Part 5, p. 33.

³ Dana, Textbook of Mineralogy, p. 372.

⁴ Geikie, Ancient Volcanoes of Great Britain, p. 184. Daly, American Geology, Vol. 32, p. 78, 1902. Wilson, Canadian Geological Survey, Mem. 39, p. 54.

of this type are very viscous at temperatures which would render basic magmas relatively fluid¹. The vapors, principally water, which have been contained in the magma under pressure prior to extrusion, escape with explosive violence while in basic magmas they pass off with facility. Consequently in the case of magmas of acid composition we might expect as is the case in this instance the formation of fine fragmental material.

Porphyritic Lavas

The porphyritic lavas, probably andesite porphyrites, referred to in the various flows, have been termed "leopard rock" on account of their spotted appearance. The white weathering phenocrysts or "globs" are sometimes one inch in diameter and show up in marked contrast against the darker colored, fine grained, ground mass. Some of the "globs" show evidence of crystal form but for the most part they are irregular in outline and may possibly, in part, represent a differentiation product rather than true phenocrysts. Under the microscope they show much fracturing due to dynamic metamorphism, and evidently were originally a plagioclase feldspar but are now so altered that only faint suggestion of the original polysynthetic twinning is revealed by the microscope. Concentration of the phenocrysts or "globs" is, as might be expected, greater near the centre of the porphyritic belt and lessens as the border is approached, decreasing in concentration until only sparsely scattered throughout the flanking basalt which shows, in some cases, an amygdaloidal structure. This fact identifies the porphyritic rock as part of the flow rather than an intrusive dike paralleling the strike of the flows.

A rock analysis of a sample taken from the porphyritic belt was made and the results are given below together with two other analyses for comparison. The high percentage composition of Al_2O_3 and CaO would point to the feldspar being the plagioclase variety, anorthite.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	K ₂ O	Na ₂ O	H ₂ O	CO ₂	XyO	Total
A.	40.30	28.94	4.70	1.53	16.2	1.23	0.92	2.71	2.99	0.64	....	100.16
B.	45.78	30.39	1.33	1.22	16.66	2.14	0.10	1.66	0.51	....	.....	99.79
C.	46.24	29.85	1.30	2.12	16.24	2.41	0.18	1.98	....	....	1.03	101.35

A.—"Leopard rock" from the porphyritic belt, Cook township Lava Flows.

B.—Anorthosite, Monhegan island, Maine, U.S.A., U.S.G.S. Bull 695, page 457.

C.—Anorthosite, mouth of Seine river, Rainy Lake, Ont.—Reis & Watson, Engineering Geology, page 80.

Alteration

The principal alteration products are epidote and chlorite. The alteration of the lime, iron and alumina silicates to epidote has in places been quite general: sometimes so extensively as to form masses which consist almost entirely of this mineral.

No mineral of the zeolite group was identified although a keen lookout was kept for these minerals which so frequently occur as secondary minerals in lavas, particularly basaltic ones lining cavities and coating jointing planes or composing the filling of the amygdules. Minerals of the zeolite group are quite common in the lava flows on Keweenaw Point, Michigan, U S.A.

¹ Engineering Geology, Reis and Watson, p. 92.

Timiskaming Series?

East of Nettie lake, in Morrissette township, is a small area of clastic rocks and schistose derivatives. The writer has tentatively classed these rocks with the Timiskaming series owing to their similarity to certain rocks of the Kirkland area classified as Timiskaming, and the fact that they are intruded by a granite porphyry of the Algonian series. On the Martin claim, No. 8501, about 30 chains east of Nettie lake, is an outcrop of one of the upper horizons of these sediments which is a hard conglomerate comprised of water worn pebbles of greenstone, banded chert, an occasional granite and fragments of a bright red jasper, all of which readily separate from the matrix. The photograph, page 61, shows a specimen taken from this locality. The outcrop is poorly exposed and the structural relationship could not be ascertained. The lower horizons which outcrop on the east shore of Nettie lake and extend inland for 20 to 30 chains, are so impregnated with carbonate and schistified to such a degree that scarcely anything save the original clastic nature is discernible. Red jasper pebbles were seen in this rusty carbonate schist. At a point about 30 chains north along the east shore a faint suggestion of bedding was observed. The strike of the schistosity is N. 40° E., which is similar to that of like series noted in other areas¹. A bright green talcose like mineral is abundant in the conglomerate of the upper horizon. This mineral was identified by W. K. McNeill, Provincial Assayer, as fuchsite.

Near the southern limit of Martin claim, No. 8501, a test pit has been sunk and considerable trenching done in the proximity of the contact of the granite porphyry and the rusty carbonate schist, classed as Timiskaming series. The border facies of the porphyry is a light green colored felsite mineralized with pyrite. Cracks in this felsite are filled with carbonate and are rusty. The mineral fuchsite was present in the felsite near the contact with the rusty carbonate schist.

A sample of the carbonated schistified clastic, similar to the rock comprising the outcrop at the water's edge along the eastern shore of Nettie lake, taken from an outcrop on Martin claim No. 8311, south east of Nettie lake, gave the following result on analysis:

Silica.....	56.20	per cent.	Magnesia.....	2.32	per cent.
Alumina.....	14.19	"	Potash.....M..	2.84	"
Ferrous oxide...	2.27	"	Soda.....	2.33	"
Ferric oxide....	1.54	"	Carbon dioxide.	7.10	"
Sulphide of iron			Water (com-		
(pyrite).....	4.05	"	bined).....	2.34	"
Lime.....	5.08	"			
			Total....	100.26	per cent.

The Nettie lake fragmental rocks comprise the only occurrence of the Timiskaming series in the region.

Pre-Algonian Intrusives

In many localities the Keewatin series has been intruded by dikes and boss-like masses of diabase and lamprophyre dikes. The relationship of these to the Timiskaming series is unknown. Typical of these diabase intrusives is the one on the property of the Bourkes mine, forming the wall rock of the main ore body; and the diabase intrusion at the falls a few chains southeast of the office building. The diabase dike on the road allowance between the north half of lots eight and nine in the second concession, Benoit township, is also of this type.

Dikes of lamprophyre are common in the Keewatin. The dikes are usually quite narrow, the majority seen being under two feet in width. A schistose structure is frequently developed. A mica-lamprophyre dike 20 feet wide may be seen

¹ Geological Notes, Map No. 23a. (Kirkland Lake and Swastika Gold Areas), Ont. Bur. Mines, Vol. 23, Part II.

along the western boundary of Benoit township about 18 chains north of the southwest corner of the township. On the Mosher claim, No. 5834, Bernhardt township, a 12-inch mica-lamprophyre dike cuts the contorted schistose greenstone, striking N. 15° W. magnetic. This dike has been so impregnated with carbonate solution that it is altered largely to ankerite.

In several localities¹ contemporaneous with the lamprophyre dikes, are the complementary types. There is, for instance, a hornblende-lamprophyre dike 50 feet wide on the southern boundary of Melba township about one and three-quarter miles east of the southwest corner, and here an aplite dike striking north 2° west magnetic cuts in between the lamprophyre and the basalt. Other instances of complementary dikes will be cited later.

Algoman

The granite, syenite, grano-diorite (monzonite) batholiths and bosses, also the feldspar-porphry and the quartz-porphry dikes occurring throughout the area are thought to belong to the Algoman series. There is a possibility that minor occurrences mapped as Algoman on the accompanying map may be acid phases of the Nipissing diabase.

As has already been pointed out, the Timiskaming (?) series in the vicinity of Nettie lake was observed to have been intruded by a granite porphyry. This porphyry is typical of the area, variations being largely resultant from conditions of intrusion and solidification. Analysis of the granite-porphry showed a silica content of 72.86 per cent. The eastern extension of the Winnie lake-Maisonville township batholith of hornblende-granite occupies the southwest quarter of Bernhardt township. This batholith varies quite locally from a hornblende-granite to a pink syenite or to a quartz-diorite. The two latter seem to be border facies of the granite, for this occurrence was particularly noted near the border of the batholith. The granite passes gradually into a syenite or grano-diorite without material change in texture, and this is indicative of some process of differentiation subsequent to the entry of a single body of the parent magma into its chamber rather than successive intrusions of different magmas. This feature was notably observed on the high ridge southwest of Bourzk lake. The pink syenite passes gradually to a granodiorite in which the hornblende predominates, and in which pink feldspar (orthoclase) and quartz comprise as low as 25 per cent. of the rock. A similar transition was seen northwest of Webash lake. The granite and syenite are always of a deep rose color.

The only other noticeable occurrences of granite are near Butler lake along the Benoit-Black boundary in the southwest corner of Black township, and in Thackeray township south of No. 3 post of claim No. T.T. 7. The first two occurrences have biotite and other femic minerals whereas that last noted is a binary granite.

In the monzonite, or grano-diorite, referred to on the accompanying map No. 30 c, the femic minerals predominate but quartz, pink orthoclase, and some plagioclase feldspar are plainly visible. Thin sections of this type of rock from three different localities under the microscope showed a wonderful development of a micropegmatitic texture, being an intergrowth of quartz and feldspar, one mineral containing particles of the other. The arrangements present a more or less regular pattern which, from its fancied resemblance to certain ancient inscriptions, has been also termed "graphic texture."

Many dikes of red and grey feldspar-porphry cutting the Keewatin were seen. Under the microscope the rock shows phenocrysts of acid plagioclase, and occasional quartz and hornblende, imbedded in a fine grained groundmass consisting of feldspar, quartz and other minerals.

¹ See page 46.

A rather singular porphyry may be seen on James claim, No. 8201, in Morrisette township. The porphyry contains pink phenocrysts three quarters of an inch in diameter of orthoclase feldspar displaying a distinct zonal structure, and smaller (not greater than one quarter of an inch) phenocrysts of plagioclase feldspar with an occasional quartz, imbedded in a grey groundmass. The dike is 30 feet wide and strikes approximately northeast and southwest. The porphyry weathers a faint pink color. Many of the porphyry dikes seen in Bernhardt and Benoit townships have a general east and west strike. On Bergstrand claim, No. 6850, Benoit township, there are several dikes of feldspar-porphyry ranging in width from four to thirty feet, all of which have an east and west strike. These dikes closely resemble those in the southwest corner of Bernhardt township in that they have considerable hornblende and some larger blood-red feldspar phenocrysts.

The occurrence of quartz-porphyrines is particularly confined to the Goodfish lake area and the vicinity of Jack Post camp, a few chains north of the third mile post on the southern boundary of Morrisette township. This porphyry has already been fully described by A. G. Burrows and P. E. Hopkins¹.

Cobalt Series

The Cobalt series represents the latest sediments of the area overlying the older complex. The series consist of conglomerate, greywacké, argillite, arkose and quartzite. Individual members of the series are not abruptly defined. In a general way there is an orderly succession from a basal conglomerate through slate-like greywacké and argillite to greywacké, or more rarely in this area to an impure quartzite or an arkose which in turn is overlain by an upper conglomerate. The bedding planes, in all the outcrops seen, are horizontal or nearly so. The beds appear undisturbed.

The occurrence of the Cobalt series in the Black River area is confined to the townships of Black, Benoit and Lee.

In Benoit a hill 100 feet high in lot two in the first concession comprises the largest area. Small outcrops extend northward to the fifth concession; all outcrops are west of the lot ten and eleven line.

In Black township the distribution is more widespread, outcrops being seen in almost every section of the township. The 150-foot hill in this township west of Butler lake is a landmark for miles around. Here the lowest horizon is a conglomerate, largely composed of red granite boulders imbedded in a greywacké matrix. The uppermost horizon is a red greywacké, extremely resistant to weathering. The intermediate beds of argillite and slate-like greywacké being less resistant, have been more disintegrated forming a talus which spreads for several chains around the cliff's base on the north and west. The weathering of these intermediate beds leaves the upper ones overhanging, giving the hill a top-heavy appearance.

An outstanding feature of the larger outcrops is the precipitous faces. In Black township, for example, there are several east to west ridges and all have precipitous faces toward the north. Possibly these steep faces are due to faults.

As the individual members of this series have already been fully described², a repetition will not be made here.

The relationship of the Cobalt series to the underlying basement was only seen at a few points. In the southwest quarter of the south half of lot eleven in the second concession of Benoit township, a conglomerate underlying a bed of slate-like greywacké lies unconformably upon the eroded surface of Keewatin greenstone. The outcrop of conglomerate is only exposed by trenching for a few square yards.

¹ Ont. Bur. of Mines, Vol. 25, 1916, Part I., p. 260.

² W. G. Miller, Ont. Bur. of Mines, Vol. 19, Part II, 4th edition, 1913.
M. E. Wilson, Canadian Geological Survey, Mem. 39.

In Black township at a point two and a quarter miles north of Woollings' camp an east to west ridge of conglomerate has a sheer drop on the north side of 20 feet. About 100 feet north there is a low outcrop of basalt, mineralized with pyrite, which appears to directly underly unconformably, the conglomerate although the actual point of contact was obscured.

A glacial erratic of conglomerate 20 to 25 feet in diameter was observed just north of Woollings' camp and Scotties Springs road and about 20 chains east of the camp. Numerous other erratics are scattered throughout Black township.

Keweenaw Diabase

The youngest rocks of the pre-Cambrian in the Black River area are dikes and small intrusive masses of diabase, trap and gabbro. They may correspond in age to the Nipissing diabase, or the later olivine diabase dikes. They vary in texture from aphanitic to coarse in grain. A microscopic examination of them shows that they are augite-diabase irrespective of the texture. They show a texture which is identical with that of other well known Keweenaw rocks of Northern Ontario, i.e., a beautiful ophitic texture, the lath-like crystals of basic plagioclase cutting into and penetrating the crystals of augite. The percentage composition (megascopically examined) of the femic minerals varies and from the one outcrop specimens differing greatly in appearance may be obtained. The color and texture are variable according to solidification conditions. Small dikes and marginal masses are black, elsewhere the general color is greyish green to dark green and the texture medium. In some only a very minor amount of pyroxene is present. There are two types of diabase, one with olivine, the other olivine free the latter being by far the more common type.

The relationship with the older underlying rocks, other than the Keewatin, was seen only in a few instances. These will be cited later.

As much of the diabase mapped has been correlated only on petrographic evidence, it is possible that some may represent older intrusives. In this connection it is noted that P. E. Hopkins¹ states that in the area to the north there are diabases which microscopically are identical with the Nipissing diabase at Cobalt, but which appear older than the latter.

In both Bisley and Black townships, narrow complementary dikes were seen cutting the diabase. About 3 miles north of Woollings' camp, in Black township, there is an outcrop several chains in diameter of this fresh diabase. At the southern limit of the outcrop the diabase can be seen to intrude and overlie the Cobalt series. The visible member of the Cobalt series was an argillite. Complementary dikes occurred also at this point.

On the Bergstrand claim, No. 6850, being the southeast quarter of lot eleven in the fourth concession of Benoit township, one of the feldspar-porphry dikes, already referred to in connection with the Algoman series, is paralleled on the south by a dike two feet wide of fresh diabase. The texture of the diabase is aphanitic at the contact, gradually becoming coarser until a fairly coarse texture is assumed. The diabase does not actually cut the Algoman porphyry; the gradation of texture, however, would point to the porphyry having been in place prior to the intrusion of the diabase. A similar relationship was also noted in the north half of lot eleven in the third concession of Benoit township.

In no one instance were the exomorphic effects of the diabase important. The intruded rock was apparently unaltered three or four inches from the contact.

¹ Marginal geological notes, Map No. 24a, Beatty-Munro Gold Area.

Glacial and Recent

It is roughly considered that at least 75 per cent. of the Black River area is overlaid with a mantel of boulders, gravel, sand and boulder clay. The clay, sand and gravel is frequently stratified or rudely so.

Much of the clay area of Benoit township is already settled and doubtless in time other level tracts of clayey soil throughout the area will be cleared for agricultural purposes.

No attempt was made to differentiate the areas of clay, sand or gravel, and a geological history of the glacial period does not fall within the scope of this work.

Economic Geology

The Black River area comprises 325 square miles of the great pre-Cambrian region, which in Ontario has produced such important mining centres as Porcupine, Kirkland Lake, Cobalt and Sudbury.

There is but one property in the area upon which a mining plant has been installed, and few localities where anything more than the most superficial prospecting has been done. Therefore, the fact that the area has not a producing mine, has little or no bearing on its future possibilities; but the fact that the formations are akin to those of neighbouring camps already proven, combined with the fact that there exists a widespread distribution of Algonian granite, syenite and porphyry intrusives, with which the deposition of gold is said to be associated, augurs well for the future of the area.

In proximity to these acid intrusives gold should be carefully prospected for, particularly where the greenstones have been rendered schistose. In these localities, as has already been pointed out¹, prospectors should be on the look-out for tin.

Veins are comparatively plentiful in the area and in some localities they appear well mineralized. The principal types being:—

(1) Fissure veins containing chiefly calcite, and minor quantities of quartz as gangue, with sphalerite, galena and other sulphides in subordinate amounts. These deposits are rarely auriferous in economic amounts.

(2) Quartz veins occupying fissures. These frequently contain pyrite, in crystals, and are often auriferous.

(3) Torsion cracks, which have been subsequently filled by solutions depositing quartz, comprise another class. These usually take the form of short lenticular splashes of quartz which, unless very numerous, could not constitute an ore body even though mineralized.

(4) Joint planes which have been filled with quartz. This type is almost invariably narrow and frequently carries free gold. The horizontal veins, occurring in the vicinity of Bourkes, have been classed with this type.

(5) Sheer zones have been infiltrated with quartz and calcite. The quartz and calcite lenses vary from a fraction of an inch to several inches, or a foot in width. The rock infiltrated by the quartz and calcite bearing solutions is usually impregnated with iron pyrites. The main vein of the Bourkes Mines Limited, is considered as one of this class.

(6) Pyrrhotite and sulphide bodies occupying channels similar to the foregoing. The sulphide bodies are believed to have the same origin as the auriferous quartz deposits, that is to say, to be genetically connected with the Algonian intrusives². Granite or porphyry intrusions were observed in close proximity to these deposits, and in the deposit on the Post claim—No. LL. 4868, Morrissette township

¹ Cyril W. Knight, Marginal geological notes, Ben Nevis Gold Area, Map No. 29c.

² Miller and Knight, Metallogenetic Epochs in the Pre-Cambrian of Ontario, Trans. Royal Society, 1915, Vol. 9.

—the deposit on the footwall had a felsitic border facies 5 feet wide. The sulphide ores in northern Manitoba are believed to have had a similar origin.¹

(7) Parallel slip planes coated with quartz and a thin film of molybdenite² as in the Goodfish Lake area.

Veins of the fissures and sheer zone types frequently contain brecciations of the wall rock, the edges of which have either been altered to secondary minerals or partially replaced by sulphides. Secondary minerals such as chlorite and epidote are common.

No general strike is common to the veins in the area; there is, however, more fissuring in an east and west direction, and at right angles thereto, than in any other. The channels, through which the vein-forming solutions passed, appear to have had a dual origin. From the close association of some of the gold-bearing veins (1) with the pre-Algoman diabases it is inferred that some of the fracturing,

Notably:—

1.—Main vein on Bourkes Mines Ltd. property.

2.—Auriferous veins on Webb claims, lot 7, con. I and II, Benoit township.

3.—Auriferous veins on Skjonsbye claim, lot 2, con. I, Benoit.

directly or indirectly, was caused by these intrusives. Again, numerous veins cut or parallel the Algoman intrusives and the fracturing forming this class may be attributed to these intrusives, which would mean that these deposits were formed immediately following the acid intrusions. The close connection between the gold quartz veins and the Algoman intrusives is shown by the occurrence of blotches or stringers, in practically all the veins, of a deep pink, feldspathic mineral, identified mainly as orthoclase feldspar. This is considered to be a seepage from the granite intrusives. Some of the narrow granite-porphry dikes are reported to carry small gold values.

Gold occurs chiefly in the native state in narrow veins in a quartz-calcite gangue. Tellurides of gold are reported in several localities and have been identified³ in the main vein on the Bourkes Mines Limited property. This latter occurrence—as the telluride—while unique has not to date proved to be of economic importance in Ontario. Gold is frequently associated with the minerals molybdenite and pyrite.

The cessation of work by the Bourkes Mines, Limited, has been a great setback to the further development of prospects in the vicinity of Bourkes; and while gold has been found on many properties, capital is lacking to prove or disprove their economic value.

To sum up, the greater part of the area has been but slightly prospected. Gold has already been found in many localities and the economic importance of these discoveries is still problematical. The vicinity of acid intrusions should be carefully prospected for gold and tin. The latter mineral may occur in quartz veins on the borders of granite knobs and in granite, or as grains disseminated through the rock adjacent to the granite. Quartz, topaz, tourmaline and fluorite are commonly found with tin deposits, as are also wolframite and scheelite, and other contact minerals.

The galena-sphalerite deposits should be carefully examined for silver and gold, which if present in sufficient amounts, would make these deposits workable. These deposits do not, however, appear to carry more than traces of gold, whereas silver values up to 57 ounces per ton have been obtained.

Description of Black River Area according to Townships

A more detailed account of the topography and economic possibilities of the nine townships of the Black River area is given in the following paragraphs, together with brief notes on some of the mining claims.

¹ E. L. Bruce, Mem. 105, Can. Geol. Sur. 1908, p. 61.

² Ont. Bur. Mines, Vol. 25, Part 1, 1916, p. 262.

³ Ont. Bur. Mines Report, Vol. 26, p. 250.

Cook

Cook township consists largely of low country covered with an exceptionally fine growth of black spruce. Considerable wood for both pulp and lumber purposes has already been cut and timbering operations are still active. Practically none of the township is under cultivation. Only one settler's clearing was seen.

There are three important hills all comprised of Keewatin rocks, two along the boundary in the southwest corner, and one named Lava Flow mountain in the northwest part of the township.

The predominant rocks are Keewatin which in many localities are well exposed. The rocks are generally massive, and little fissuring was observed. Shear zones wherever seen had an east and west strike. Few veins were seen, and no extensive mineralization noted.

The Pike river and the creek which flows along the north portion of the third concession are not at present navigable owing to numerous log jams.

Barnet

Barnet township is west of Thackeray, and, like its neighbour, is not easily accessible. The shortest route is by the western boundary of Melba from where the Black river flows a few chains west of the line. This route was followed by our party, but the line especially along the western boundary of Barnet is poorly cut out, extremely difficult to follow, and not practicable for packing. It is therefore recommended that from the southwest corner of the township some alternative route be chosen to enter the township. The majority of the lot and concession lines are well cut out and offer good travel routes, particularly the line between the third and fourth concessions, which has been used as a trail.

It has been estimated that 15 per cent. of the township is rock and a like amount muskeg. There are few outstanding hills or ridges, the principal one being in lots one in the third and fourth concessions, and at the south of Fitter lake. From the last named point a splendid view of the township may be had. The balance of the township is characterized by the evenness of its landscape and the numerous creeks.

Patches of spruce and poplar suitable for pulp wood purposes are frequently met with. In the north of the township areas of sandy country exist, many of which have been burnt over. There are areas of clayey soil, well drained and suitable for agricultural purposes.

The Pike river is a good stream 50 to 60 feet wide, four to six feet deep with high banks, and a fair current. This stream, were it not for the numerous log jams, would be quite navigable, so far as we could judge from various views obtained during our exploration work, and if so it should be cleared out in order to give freer access, not only to Barnet, but to the northern part of Cook township as well.

The dominant rocks, are the same monotonous types of Keewatin Lavas so characteristic of this and adjoining areas. In small areas there are dikes and boss-like masses of granite, grano-diorite and porphyry. In no instance had the vicinity of these intrusives been exploited.

Thackeray

Thackeray township is accessible by a trail which follows the eastern boundary of Melba township northward from the crossing of the Black river. This trail was well travelled when the first stakings were made in the township and is still in good condition.

The general character of the whole township is that of a gently undulating tract of land. The north and northwest parts are largely jackpine, sand plain country. The rock outcroppings are not prominent, being confined to the southwest quarter of the township.

The prevailing rocks belong to the Keewatin series and the only outstanding geological feature is the many intrusive dikes of feldspar porphyry, and granite; a few of these have been shown on the accompanying map. A very beautiful syenite-porphry containing rectangular, elongated phenocrysts of feldspar sometimes three quarters of an inch long and only one sixteenth to one eighth of an inch wide was seen *in situ*, in several places. This porphyry was noticed only in Thackeray township. The mineralized veins seem to be closely associated with the acid intrusions of porphyry or granite. Assays of gold were obtained but the writer is informed these were not high. The prospecting in Thackeray township appears to have been of an extremely superficial type which accompanies a "rush," and in reality does more harm than good to an area. From the numerous small dikes of the Algoman series and the amount of mineralization seen in places it would seem that this area should be more carefully prospected.

Grab samples from a test pit along the trail running north of the Howey camp site, and from workings thought to be on Andrews claim¹ did not give any gold values.

No free gold was seen on any of the claims although finds have been reported in this locality.



Base of "Defiance Peak," Black township. Note the almost horizontal strata of the Cobalt series.

Black

Black township is accessible either by the Woollings' camp road from Scotties Springs, or by the water route from Bourkes already mentioned.

The topography consists mainly of rolling well drained country with unimportant hills. The north of the township is more rugged. From the prominent peak of the hill west of Butler lake a commanding view of the township

¹ The writing on the claim posts is no longer legible and the claim lines are so irregular and difficult to follow that the writer was not positive of the claim. The discovery consisted of a highly inclined quartz vein containing inclusions of the 5-20 inch felsite dike which formed the footwall and of the Keewatin diabase which comprised the hanging wall. The quartz, the felsite dike and the hanging wall rock were well mineralized with sulphides.

may be had. Large sand plain areas exist. The road from the eastern boundary to the creek crossing, south of Errett lake, passes through jack pine sand plain country. There are numerous prominent sand ridges in the northwest section of the township.

The entire township is well timbered and there are many excellent patches of black spruce and of poplar. T. S. Woollings and Co., of Englehart, hold a timber permit for Black and Lee townships. Pulp wood cutting operations were commenced in the spring of 1920. Camps have been constructed in various parts of the township and by the fall of 1920 several thousand cords of pulp wood awaited shipment over the company's railroad to which steel is being laid from mileage 181 on the Temiskaming and Northern Ontario railroad westward into Black township.



Defiance peak, Black township, comprised of slate-like greywacké and conglomerate.

Geologically the outstanding feature of the township is the numerous remnants of the Cobalt series. In Black township as in the balance of the area the dominant rock types are Keewatin. Considerable fissuring, schistosity and mineralization was noted, particularly in the northeast part of the township. In this section there are some old stakings upon which much trenching has been done and a few test pits sunk. About one half mile west of Defiance peak there are some old workings, 30 to 40 feet deep, judging from the dump, on a highly mineralized calcite vein containing numerous fragments of the basaltic wall rock. The vein shows a banded structure of calcite and some basic material now largely altered to chlorite, heavily

mineralized with sulphides. Sphalerite is the most abundant mineral—then iron pyrites, galena and chalcopryrite in decreasing amounts as named. A grab sample failed to show any gold values. In the vicinity much mineralization was seen and it was thought that this section merited more intensive prospecting. Small areas of Algoman granite are exposed in the northeast and southwest of the township.

The only work in progress during the summer of 1920 was on claims along the trail west of Malloch lake. Here some blasting has been done on a vein complex in the Keewatin dolerite consisting of numerous lenticular shaped veinlets of quartz, slightly mineralized with pyrites. A 12-foot test pit has been sunk on a mineralized chlorite schist sheer zone, the strike of the schistosity being south 50 degrees east magnetic and dip almost vertical. The joint planes and planes of schistosity have been infiltrated with calcium carbonate. Values in gold are reported from this locality.

Benoit

The Temiskaming and Northern Ontario Railway runs through the centre of Benoit township, making all parts readily accessible; in addition road allowances have been cut and well used trails are numerous.

At present the only post office in the Black River area is situated at Bourkes, although it is understood that an application has been made for the organization



A settler's home and clearing along the Black river, in Benoit township.

of another in the north of the township on the railroad, about one half mile south of Scotties Springs, where a thriving settlement has recently been established. Black River is the proposed name of the new post office.¹

Many quarter sections have been taken up as homesteads, much of the land is cleared and some is under cultivation. During the summer of 1920 there was an influx of settlers into the northern half of the township, especially along the Black river and the railroad.

The topography of the township is generally flat and the land well drained. Swampy areas are not large. The northwest quarter of the township is largely sandy with occasional rock outcrops. A splendid growth of poplar and spruce suitable for pulp wood is scattered throughout the township and many cords have already been cut by the enterprising settlers.

¹ During the summer of 1921, Scotties Springs P.O., was opened at Yorkston station on the T. & N. O. railway in Cook township just north of the Benoit boundary.

There are few outcrops of rock and these are neither of great extent nor elevation, but rise, as low rocky knolls of greenstone and diabase, above the comparatively level clay-covered land. The rocks of the township are nearly all basic lavas of Keewatin age, the only variations being the small areas of granite, diabase and sediments of the Cobalt series. Feldspar-porphry dikes are numerous.



Camp buildings of Bourkes Mines, Ltd., Benoit township, looking northeast from shaft.

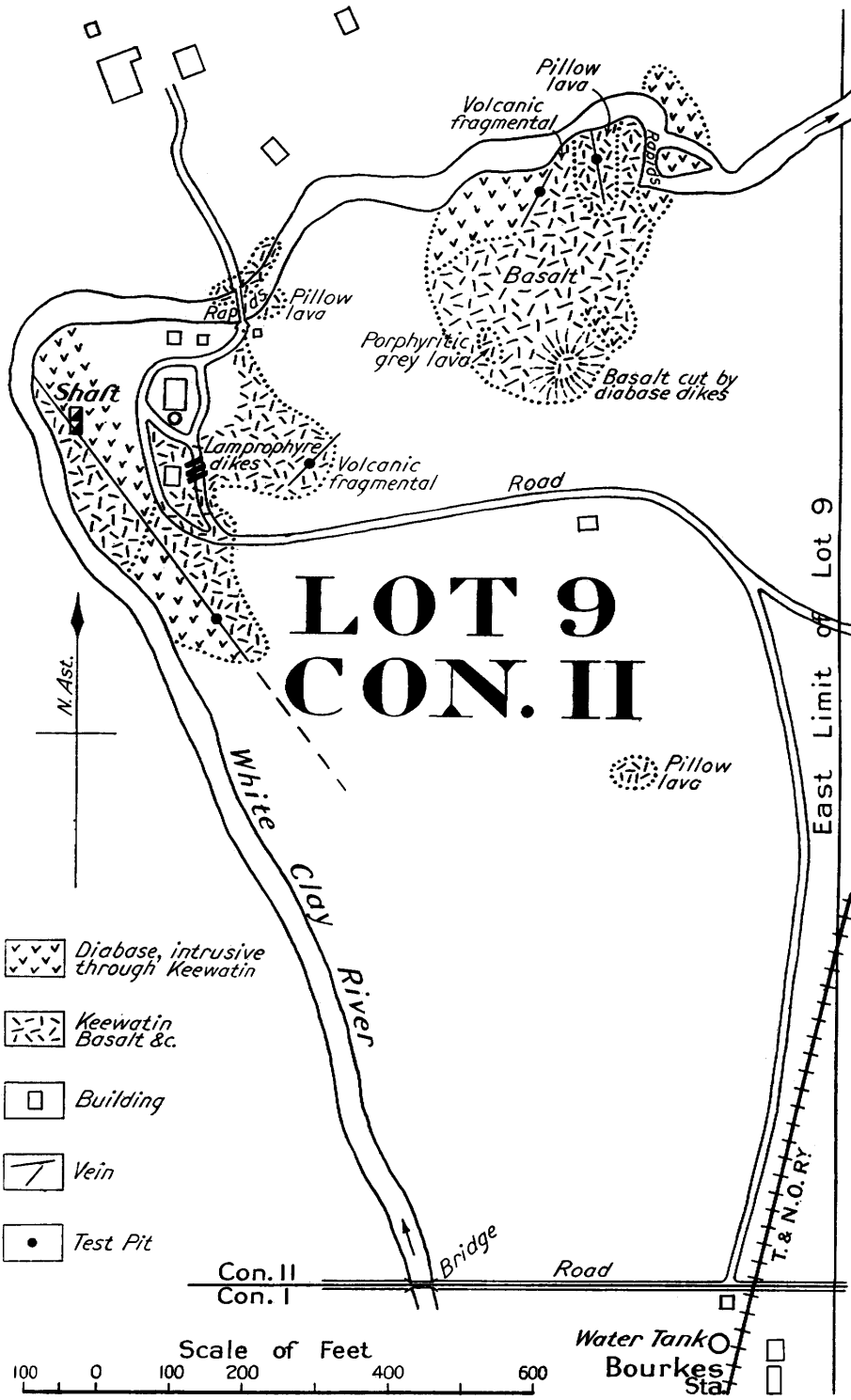


Head frame and boiler house, Bourkes Mines, Ltd.

Gold has been found on several properties, and in practically every instance the values were obtained from quartz veins in the greenstone. Much of the greenstone in Benoit is quite schistose.

*Bourkes Mines, Limited**.—This property comprises the south half of lot nine in the second concession of Benoit. The rock outcrops are confined to a bend in the White Clay river; the geology is shown on the accompanying rough plan of the com-

(*) Reference has already been made to this prospect by A. G. Burrows. See *Gold Bearing Veins in Benoit Township, Ont. Bur. Mines Report, Vol. 26, 1917, pp. 248-251.* The asterisk (*) where it occurs again refers to the 1917 Report.



Plan of Bourkes Mines, Limited, scale 250 feet to the

pany's premises. The White Clay river crosses the lot. Barometric readings of the water level showed a drop of 20 feet across the property. This drop is made up of rapids and small cascade falls of from one to four feet at various points along the river, chiefly in the portion of the stream flowing east.

The company have a plant installed which is apparently in first class condition and exceptionally well housed. The camps are well built and attractively located on the rising ground north of the White Clay river away from the workings.

The surface equipment, in the main, consists of a cookhouse, a bunkhouse, a mine superintendent's residence, a mine office, an equipped assay office, an equipped blacksmith shop, a boiler house with 2-100 H.P. horizontal F.T. boilers, hoist and compressor house with a 12-drill Allis-Chalmers-Bullock compressor and Ingersoll-Rand hoist with cylinders 10 inches by 12 inches. The equipment was installed and buildings completed shortly before the mine closed down.

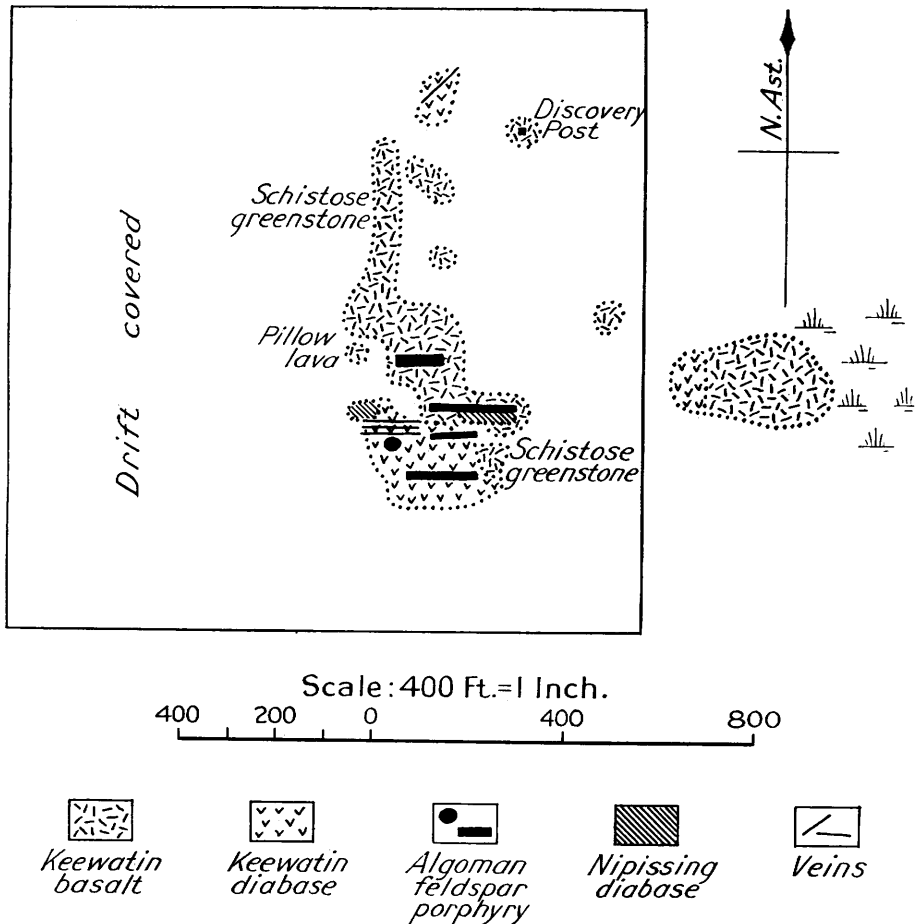
The shaft has been sunk on the main vein, which will be described later, to a depth of 400 feet and some drifting has been done at various levels. The underground workings were filled with water during the summer of 1920 thus preventing an examination of the developed ore body. Many specimens containing free gold are scattered about the dump and some of these are extremely rich in the precious metal. The gold was noted to occur in the quartz associated with calcite, the latter may have been a precipitating agent for the gold. A telluride of gold has also been identified.

The ore body consists of a shear zone striking south 28 degrees east magnetic, dip almost vertical. The rock in this zone is altered to a green contorted schist over a width of from four to eight feet. At the southern limit of the exposure a test pit has been sunk, and here the southwest wall consists of fairly fresh diabase and the northeast of basalt. At the northern limit these conditions are reversed. Into this shear zone have come the mineral bearing solutions filling the cavities and forming veins of quartz and calcite from a fraction of an inch to several inches in width. The gangue and contorted rock have been copiously impregnated with crystals of iron pyrites and lesser amounts of chalcopyrite, galena and molybdenite. Stringers of a deep pink feldspathic mineral, as well as narrow felsitic dikes, have also intruded this contorted rock. In places the wall is well marked while in others it appears to merge into the adjoining rocks.

Bunting Claims (Johnson) Nos. 6639-6640.—These claims comprise the west half of lot nine in the first concession of Benoit. On claim No. 6640 most work has been done. The greenstones, with some pillow lava structure and volcanic fragmental rocks, are cut by dolerite (diabase?) dikes. In close proximity to these intrusions are some well defined mineralized veins. Test pits have been sunk and stripping done on several of these. Near the southern boundary of this claim a shallow test pit has been sunk close to a vein junction, on a parallel quartz-vein system in a schistose zone. To a depth of three to four feet the schistose greenstone has been altered to a rusty carbonate. There is much mineralization with sulphides principally iron pyrites. The foregoing vein strikes north approximately, and immediately south of the test pit it is intersected by a quartz vein striking northeast. This latter is bordered by a narrow felsite dike.

*Potter (Wickstead-Maloof) *No. 5381.*—An inclined shaft following the dip vein has been sunk to a depth of 40 feet. Along the footwall between the quartz vein and the pillow lava is a felsite dike heavily mineralized with sulphides. The vein outcrop is rusty and the greatest mineralization is along the footwall adjoining the felsite dike. Native gold was seen in places. The vein also contained specks of galena and some chalcopyrite. A channel sample taken across the vein and footwall dike from a point 12 feet below the surface, the shaft being full of water to this level did not give an encouraging assay for gold.

Scotvold Claims, Nos. 6184-5835.—Claim 6184 comprises the southwest quarter of the north half of lot five in the first concession of Benoit. The country rock is principally pillow lava. Some work has been done on a lamprophyre dike striking north, bordered on the west by diabase and on the east by pillow lava. The dike is mineralized with pyrite and Mr. Scotvold reports an assay of \$3.00 per ton in gold. The dike continued north into Nelson claim No. 5831, and gold values are reported from the dike on this claim also.

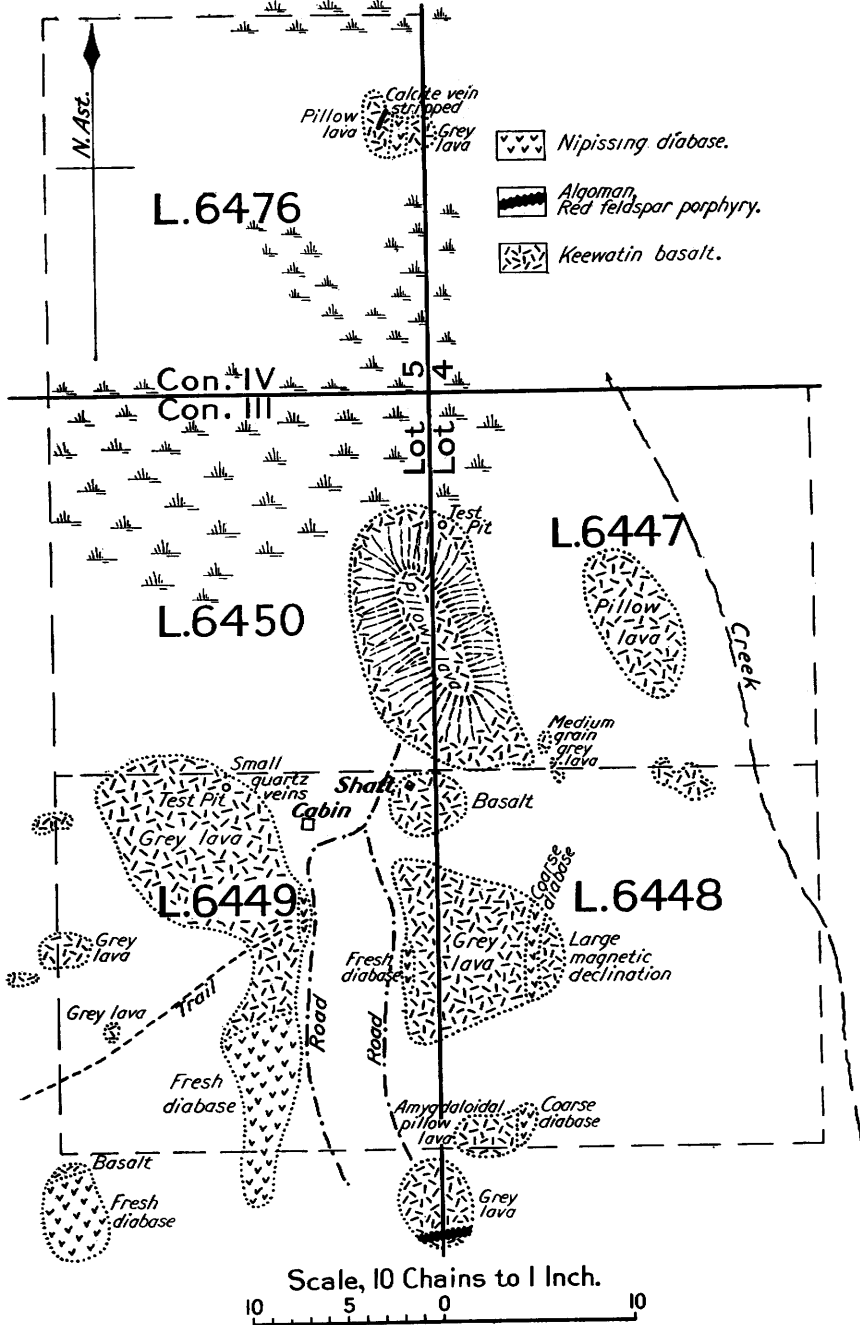


Geological plan of Bergstrand claim, Benoit township.

Bergstrand Claim No. 6850.—This claim is located in the southeast quarter of the south half of lot eleven in the fourth concession of Benoit. A plan of the claim is given on account of the interesting geologic features. Small assays of gold have been obtained from the porphyry dikes and some of the veins. Much surface work has been done and it is the intention of the owner to sink test pits on some of the more promising finds.

Cotterill Claims Nos. 5809, 5921.—The claims comprise the north half of the south half of lot seven in the first concession of Benoit. Considerable surface work has been done and various leads have been stripped and trenched. On claim No. 5921, near the southeast corner, are two parallel veins striking north 87° east and dipping 45 degrees south. The veins are 30 feet apart. The wall rock is somewhat

schistose, volcanic fragmental altered to chlorite and impregnated with iron pyrites. The principal discovery is on No. 5309 and consists of a well defined quartz vein striking south 80 degrees west. The greatest width of the vein is 6 feet and off-shoots extend into the flanking altered rock. In places the main vein splits into a parallel system of veins, each a few inches wide. A test pit has been sunk to a



Geological plan of Thompson-McLeod claims, Benoit township.

depth of 15 feet. Near the bottom of the test pit, the vein which is six feet wide on the surface, divides into a series of veins cutting an altered porphyry and a basic rock impregnated with iron pyrites. Various assays of from \$3.00 to \$24.00 per ton in gold are reported.

Thompson-McLeod.—This group of claims is located in the north half of lots four and five in the third concession of Benoit, and the southeast quarter of the south half of lot five in the fourth concession. A plan of these claims appears in the text. The principal workings consist of an inclined shaft following the dip of a 16 inch wide vein striking south 8 degrees east and dipping about 65 degrees east, cutting a grey lava knoll. On the surface about 15 feet distant is another vein 4 inches wide with parallel dip and strike. From the west side of the knoll an adit has been driven along the strike for 60 feet. The adit connects with the main shaft about 20 feet below the surface. As the shaft was filled with ice to the level of the adit examination at depth was not possible, but the vein is reported to be several feet wide at the bottom of the shaft. The wall rock is schisted for a few feet on either side of the vein. The quartz is of milky white color, and in places it is stained with iron oxide. The wall rock and border of the vein are mineralized with pyrite. Free gold is reported to have been found in several places along the vein.



Thompson-McLeod vein and adit, Benoit township.

*Skjonsbye-Klanderland**.—These claims have already been fully reported upon, only new features therefore will receive mention. A very favourable gold assay of \$21.60 per ton was obtained from a grab sample taken from the dump surrounding a 14-foot shaft which was sunk on a flat lying 8 inch quartz vein. The shaft is located near the west boundary of lot two in the first concession about 10 chains south of the northwest corner of the lot. The wall rock within a few inches of the vein is heavily mineralized with pyrite and chalcopyrite, and there is also some of the same minerals in the vein.

The large outcrop just south of No. 1 post of claim No. L. 4287 shows two highly inclined lava flows and portions of two others.¹ Leopard rock, porphyritic greenstone, forms belts in some of these flows. In other particulars also, they resemble the Cook township lava flows.

¹ These flows were not seen by the writer but were reported by his assistant.

Webb.—This group of six claims comprises the north half of the north half of lot seven in the first concession of Benoit and the south half of lot seven in the second concession. Extensive surface work has been done and several pits sunk. Gold has been found in flat lying veins just north of the road allowance. The basalt in this vicinity is liberally impregnated with iron pyrites in crystals; some cubes one quarter of an inch in diameter were seen. A red feldspar porphyry dike striking a little west of north crosses the road allowance. The dike is well mineralized. South of the road a shaft has been sunk on the frozen basalt-porphyry contact. In October, at the time our survey party were withdrawing from the field, exploratory work on these claims was resumed under the personal supervision of the owner, G. F. Webb, of Hamilton, Ont. The shaft referred to was dewatered, a tripod horse power hoisting apparatus installed, and sinking resumed.

Melba

All parts of Melba are easily accessible from the Black river, which flows from east to west through the centre of the township.

The rock outcrops are mainly Keewatin and comprise roughly about 15 per cent. of the area. Two occurrences of pillow lava are perhaps worth noting because of their unusual features, one south of Douglas lake where single pillows were observed having a 5-foot major axis, and 2.5-foot minor axis; the other is on the southern boundary west of Kellett lake where the pillows have a porphyritic texture, their major and minor axis being 7 and 4 feet respectively.

Parts of the township are wooded with spruce and poplar suitable for pulp wood. Much of the township is swampy, but in the west half there is a goodly area of high clayey land suitable for agricultural purposes. No sand plain or sand ridge areas were seen. The few prominent hills have already received mention in the opening chapter.

Bisley

The eastern half of the township is largely low, poorly drained, spruce covered country and sand plain or ridge areas. The prevailing rocks are Keewatin and few intrusions were noted. There is one area of fresh diabase a little north of the centre of the township and in the neighbourhood of this some veins and dikes were seen. Prominent hills are confined largely to the vicinity of Lauramay lake, where several rocky hills over 100 feet high, are situated.

Bisley township appears to have been little prospected or travelled although it is accessible from the Black river.

The abnormal magnetic declination, as great as 70 degrees west on the section south from Lauramay lake to the southern township boundary, is worthy of note and investigation.

Bernhardt

The township of Bernhardt is one of the most rugged in the area, possessing many prominent ridges and hills. The height of land between the Hudson Bay and St. Lawrence drainage basins follows a general line from east to west across the centre of the township.

All parts of the township are readily accessible by canoe route from Amikougamí lake. Thanks to the efficient work of the fireranger stationed in this township during the summer of 1920, practically all the trails and portages were brushed out and reblazed, making travel less difficult.

A feature of the geology of Bernhardt township is the large area in the south-west occupied by the granite batholith. Only the approximate boundary of this granitic intrusion was ascertained by sections. The balance of the outcrops in the township are basaltic in type; the only exceptions being the occasional small outcrops of fresh (Nipissing?) diabase along the northern boundary and west of Lancaster

lake and an occasional feldspar-porphry dike. The southern part of the township has been the most prospected, resulting in gold discoveries on several claims. The township as a whole, however, does not appear to have been extensively prospected.

During the summer a few prospectors were engaged on assessment work on their claims and whenever possible these were examined. A few brief descriptions will be given here.

Ayoub Claim, L6075.—This prospect is located on the west shore of the northwest arm of Amikougami lake. The country rock consists of amygdaloidal basalt and pillow lava. At the lake side considerable stripping and blasting away of rock has been done on a quartz vein having some free gold showings. The vein continues into Bourzk claim No. 8242, to the north.

Bourzk Claim, 6354.—This claim is situated at the north end of the northwest arm of Amikougami lake. Considerable trenching, stripping and some blasting has been done on a vein complex in the pillow lava, 20 feet wide striking about north astronomic. The complex consists of a banded light grey to green felsite interbanded with quartz and calcite. In places the calcite bands are 15 inches wide. Minute stringers of a red feldspathic-looking material were also observed. Brecciations of the wallrock and of the felsite were included in the calcite. There was a scant mineralization with pyrite. Mr. Bourzk reports an assay of \$5.40 in gold per ton from this vein.

Solomon Claim, 6429.—The claim is located on the west side of the northwest arm of Amikougami lake. A 15-foot test pit has been sunk on a 6 to 10-inch quartz vein striking approximately north astronomic. The vein cuts the basalt which has a schistose zone 8 feet wide with 1 to 3 inch quartz stringers paralleling the main vein. Assays, one from the surface of \$18.00 in gold per ton and another from a sample taken across the 8 foot zone at the bottom of the pit of \$4.80 in gold per ton, are reported. The vein has been stripped at intervals across the claim.

Mosher Claim No. 5834.—The Mosher claim is located about 20 chains east of Lancaster lake. Considerable surface work has been done and a test pit sunk on a vein junction located on the northeast of the claim. One vein, 5 inches wide strikes south 45 deg. east magnetic and dips 70 deg. to the southwest. It is located in a shear zone 5 feet wide. The foot-wall of this vein is volcanic fragmental and the hanging-wall is basalt. A channel sample across 18 inches including this vein gave no values in gold or silver. The other is a calcite and quartz vein striking north 15 deg. east magnetic and dipping 70 deg. west. Native silver in fine specks is disseminated in this vein. The owner reports an assay of silver, 37.5 ounces, and gold \$2.20 per ton.

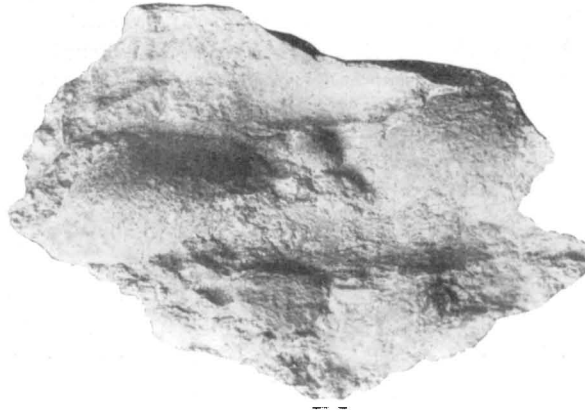
Challenger Gold Mining Company, Limited.—This group comprises seven unpatented claims situated northwest of Blue mountain. The property is best reached by trail from Bourkes. During the summer of 1920 a small party of men was engaged in clearing, building a camp, and in surface work. Some blasting and 300 feet of stripping has been done on a quartz-calcite vein varying from several inches to a few feet wide, striking south 40 deg. west magnetic. The vein, containing masses of the country rock, follows a contact between pillow lava on the northwest and a diabase dike (pre-Algoman?) on the southeast. There is some mineralization with copper and iron pyrites. A sample taken and forwarded by G. R. Webster—the company's president—to the Provincial Assay Office, Toronto, gave \$8.40 in gold per ton. The value of the deposit is not yet determined.

Morrissette

Morrissette township is largely made up of low rolling country with some fine spruce swamps. With the exception of the swamp flanking the Black river and some minor areas, the township did not present many difficulties to travel as was expected from descriptions given to our party. A large sand plain and ridge area exists in the vicinity of the string of spring water lakes north of Nettie lake. A

splendid bird's eye view of Morrissette may be had from a prominent hill about the centre of the township. The Black river was paddled and surveyed southward from the north boundary for a couple of miles, and was found to be navigable even in the low water experienced in 1920. A rough trail, the old Lightning river trail, goes northeast from Jack Post camp, north of the three mile post on the southern boundary, to Columbus lake. The trail running from the northeast of Nettie Lake is also supposed to go to Columbus lake, but this trail could only be followed to the creek junction shown on the map. It was surveyed to this point.

Geologically the area about Nettie lake is extremely interesting although to date no discoveries of economic importance have been reported. Along the east shore of Nettie lake is a continuous outcrop of a rusty weathering carbonate schist which is highly metamorphosed elastic rock. The elastic origin is still readily discernible megascopically. From the lake the ground gradually rises to the east, and inland 20 chains or so are numerous outcrops of conglomerate which very closely resemble the Timiskaming conglomerate in adjacent areas. From the relationship of the rusty schist to the conglomerate and from the fact that the strike of the schistosity is the same as that recorded for the Timiskaming series in the Kirkland Lake area this rock was classified as Timiskaming series. The Keewatin and the elastic rocks are both cut by granite-porphry dikes at many points.



Conglomerate at Nettie lake.

An outcrop of fragmental rock is situated along the trail leading from the cabin at the south end of Nettie lake to the workings on the Martin claim. The outcrop consists of an 80-foot hill of pseudo-conglomerate. The matrix is a basaltic rock having a prevailing green color. The pebble and boulder contents consist not only of greenstone and amygdaloidal grey lava, but also pink weathering granite, porphyries and occasionally, red jasper. Some of the pebble and boulder contents are rounded. These may be best seen on the precipitous face on the west side of the hill.

There are numerous dikes of red and grey feldspar-porphyry, granite-porphyry and quartz-porphyry cutting the older formations. The intrusive dikes are confined to the Goodfish Lake, Nettie Lake and Jack Post camp vicinities.

The rocks of Morrissette township are mostly massive and schistose basalts and grey lavas. A high percentage of these are amygdaloidal, and considerable of the basalt has been altered to a rusty weathering carbonate.

Since the claims of the Goodfish lake area have already been amply described by Messrs. Burrows and Hopkins¹ further description will not be given here.

¹ Ont. Bur. Mines Report, Vol. 25, Part 1, 1916, pp. 260-263.

Archambault (Baissonault) Claim No. L 2632.—This claim is in the vicinity of Goodfish lake, its position being shown on the geological map accompanying this report. A line was cut in the direction of the strike from the gold-bearing zone along the contact of the quartz-porphry and the basalt, on the Martin claim No. L 2232, to the above claim. A test pit was sunk on what promises to be a continuation of the Martin-Brennan vein. The test pit is on a carbonate zone along the contact between the greenstone and the quartz-porphry. There is considerable mineralization of molybdenite and other sulphides, and promising assays in gold are reported.

Martin Claim No. L2232.—This claim, near Goodfish lake, has already been described, but at the time of the visit of Messrs. Hopkins and Burrows the shaft was filled with water. Specimens from this claim were seen by the writer showing free gold. The greatest concentration of gold values appears to be along the foot wall, where lamellar native gold occurs with molybdenite.

McKee Claim No. L5399.—This property is also situated near Goodfish lake. Some trenching and blasting has been done on a belt of quartz-feldspar porphyry intruding a volcanic fragmental country rock which has been greatly altered to a rusty weathering carbonate. Nothing is known of the values obtained. The porphyry and the occurrence generally are similar to other properties in the area.

Martin Claims No. 8311 and No. 8501, Nettie Lake.—These claims are about 15 chains east of Nettie lake. During the summer of 1920 surface work was done on the above claims. As yet no important discovery has been made. A granite porphyry, in places altered to a rusty weathering carbonate, intrudes the elastic rocks, but the basalt-porphry contact had not as yet (September 1920) been exposed by trenching. The schistose, metamorphosed elastic rocks and the border facies of the porphyry were well mineralized with pyrite in places.

Post Claim No. LL 4868.—Several test pits and a shaft have been sunk on this property which is located along the southern boundary of Morrissette township. The country rock is basalt and this has been intruded by a quartz-porphry dike striking east and west approximately. The basalt near the contact has been highly altered to a rusty weathering carbonate. Several well-defined veins have been stripped. The shaft, which judging from the dump is 50 to 60 feet deep, has been sunk on a vein near the contact with the quartz-porphry. The vein is heavily mineralized with sulphides, sphalerite, galena, chalcopryrite and pyrite, some of the chalcopryrite has been altered to malachite and azurite. The gangue is quartz, calcite and barite. The vein gave assays of from 4 to 57 oz. of silver per ton and small quantities in gold. A deposit of sulphides 6 to 8 feet wide, principally pyrrhotite, is located about 600 feet a little west of north from No. two post of the claim. The strike of the mineral body is north 62 degrees east magnetic and the dip about vertical. On the south side the sulphide body is bordered with a 5-foot band of felsite.

The wall on the north is much fractured and the fractures filled with ferruginous gouge. Apparently this deposit did not yield favourable assays of gold for only a small test pit was sunk and work discontinued.

Claims in the Vicinity of LL 4868.—In this vicinity a good deal of surface work has been performed. The rock exposures are mainly basalt and are not large. The basalt is often schistose and altered to a rusty weathering carbonate, especially in proximity to the porphyry intrusions. Intrusions of porphyry are numerous. The prevailing strike of the porphyry dikes is east and west. The majority of the veins strike northerly: some cut the the porphyry dikes. As no work was in progress at the time of our visit to this area it is impossible to state whether or not gold or silver values were obtained in sufficient quantities to indicate workable deposits.

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