CANADA
DEPARTMENT OF MINES
HON. T. A. CRERAR, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

BUREAU OF ECONOMIC GEOLOGY
GEOLOGICAL SURVEY

MEMOIR 195

Mineral Deposits in Renfrew County and Vicinity

BY

B. C. Freeman

OTTAWA
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1936

Price, 25 cents No. 2419

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CONTENTS

Illustration

19392—1½

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INTRODUCTION

Renfrew county lies southwest of Ottawa river. The town of Arnprior is at its extreme eastern point and is about 32 miles due west of the city of Ottawa. The maximum length of the county, along Ottawa river, is approximately 115 miles, and the maximum width, near the south border, is approximately 60 miles. It is irregular in shape, with a "panhandle" about 50 miles long in the northwestern part lying between Ottawa river and Algonquin park. The area is somewhat more than 3,000 square miles. It is bounded by Ottawa river on the northeast; on the south by the counties of Lanark, Frontenac, and Lennox and Addington; on the west by Hastings county and Nipissing district.

The area is drained by turbulent streams, tributary to the Ottawa. The main ones, named in order from south to north, are: Madawaska, Bonnechère, Snake-Muskrat, Indian, Petawawa, and Chalk rivers. The main line of the Canadian Pacific railway crosses the county along the Ottawa valley, and in addition the Kingston and Renfrew branch of this system serves some of the south part of the county. The Montreal-North Bay division of the Canadian National railways enters the county opposite Portage du Fort, Quebec, continues along the Ottawa valley to Pembroke, swings west along the valley of Indian river, and passes out of the county.

The Ottawa-Parry Sound branch of the Canadian National follows the Bonnechère valley as far west as Golden Lake and then crosses to the Madawaska valley near the west side of the county. A branch of the Canadian Pacific parallels this railway between Renfrew and Eganville. Pembroke and Golden Lake are connected by another branch of the Canadian National railways.

Many good roads make communication easy in most of the area. Some of the western part, however, lacks passable roads and as a result certain townships are semi-isolated. The area adjacent to Algonquin park lacks roads entirely and is difficult of access.

The field work covered most of Renfrew county and extended beyond into the adjoining parts of other counties. John Gnaedinger was a competent assistant.

Many of the examinations were quite cursory. Where the prospect was practically undeveloped and outcrops were poor not much could be seen. In such cases a detailed examination was not made because in the absence of exposures, either natural or in trenches, no information could be obtained.

In the case of a promising prospect being actively developed a very detailed examination was made.

TOPOGRAPHY

The topography of the district is varied but can be classed as: (1) the low, comparatively level, eastern part, and (2) a rocky upland, western part. The lowland comprises the Ottawa valley and the lower parts of the valleys of the main tributaries. There are, however, isolated basins within the upland area and groups of low, rocky hills out in the lowland. Near the western limits of the lowland the rock cover is sand, and the soil is poor. Most of the basins within the upland area are also filled by sand rather than clay. Generally speaking, the lowland area has a deep soil with few rock exposures and the upland has a thin soil with many exposures.

BIBLIOGRAPHY

Geological work has been carried on in this region at intervals since 1845. Many reports, articles, and maps have been published and a few of the most useful are listed below.

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GENERAL GEOLOGY

The rocks in Renfrew county and adjacent regions may be classified, according to their age and structural relationships, into three groups: (1) a basal complex; (2) Palæozoic sediments; and (3) unconsolidated Quaternary deposits. The succession of formations is as follows:

[1] The publications so marked are accompanied by areal geological maps.

Table of Formations

Quaternary.....	Champlain.....	Clay, sand, and gravel
	Glacial.....	Boulder clay, boulders, gravel, and sand
Palæozoic.....	.....	Limestone, shale, sandstone, dolomite
Precambrian basal complex..		Diabase dykes
		Metamorphic pyroxenite
	Batholithic intrusives....	Pegmatite Granite and granite-gneiss
	Buckingham series.....	Basic intrusive rocks
	Grenville series.....	Sedimentary gneisses (garnet gneiss, sillimanite gneiss, biotite gneiss) Quartzite Crystalline limestone

PRECAMBRIAN BASAL COMPLEX

The rocks over almost all the region are made up of various types that have been, in part, greatly changed from their original character and are now intermingled in a very intricate manner. The main rock types in order of age, oldest to youngest, are: the Grenville series composed of crystalline limestone, quartzite, and sedimentary gneisses; basic intrusive rocks; granite and granite-gneiss; pegmatite; metamorphic pyroxenite; and diabase dykes. Granite and granite-gneiss make up by far the greatest amount of the rocks, underlying large areas and being present in large and small masses in all the older rocks.

GRENVILLE SERIES

The limestone is a glistening white, dark grey, or in a few places, a reddish colour. It is coarse grained, made up in most places of crystals about one-eighth to one-quarter inch wide, although crystals an inch in width do occur. The main constituent is, of course, calcite, but certain other minerals are scattered in parallel bands or zones in the rocks, and as these minerals are harder than calcite they stand up slightly on weathered surfaces and give the outcrops a characteristic rough appearance. These minerals are chiefly white diopside, tremolite, amber mica, graphite, pyrite, and pyrrhotite. Pieces of other rocks are abundant in most of the limestone and these inclusions have a stretched, crumpled shape caused by the limestone flowing around them when the rock series was folded or otherwise deformed.

The quartzite varies from white to light grey or pink in colour. It is usually massive with thin bands at wide intervals. The massive, light-coloured bands are made up principally of quartz grains, with varying amounts of feldspar, chlorite, black mica, hornblende, magnetite, pyrite,

and titanite. The dark bands contain much more black mica and hornblende, and less quartz and feldspar.

Included in the sedimentary gneisses are three main types: garnet, gneiss, and biotite gneiss. The garnet gneiss is a light to dark grey, highly foliated rock, that contains red garnet, usually in zones. The most abundant mineral is quartz and microcline, plagioclase, sillimanite, and biotite are also present. The sillimanite gneiss is grey, but the abundant sillimanite fibres give it a somewhat yellowish tint. Quartz and sillimanite are the most abundant minerals, but biotite, feldspar, and garnet are also present. The biotite gneiss is a dark grey to black, granular rock, rather poorly foliated due to the large number of quartz grains. The chief minerals are quartz, biotite, and feldspar. All these rocks are fine grained, the crystals being rarely over one twenty-fifth inch wide, except for the garnets, which in many places have a width of one-quarter inch or more. All these types grade into one another, so that there are biotite gneisses with much garnet, garnet-rich sillimanite gneiss, sillimanite in biotite gneiss, etc. They represent the muddy, or shaly, phases of the original Grenville sediments and owe their present character to metamorphism.

BASIC INTRUSIVES

Practically all the basic intrusives belong to the Buckingham series—a series of pyroxene-bearing intrusive rocks ranging in composition from peridotite to granite pegmatite. They were so named by M. E. Wilson who studied them first in the Buckingham region in Quebec. The most abundant types are gabbro, anorthosite, pyroxene diorite, and pyroxene syenite. In Renfrew county the chief type is a gabbro. The largest intrusive mass noted in the course of field work is in McKay township, which is east of Algonquin park and north of Indian station on the Canadian National railways. The rock is in concessions II, III, and IV, about a mile from the west side of the township.

The gabbro is dark grey to nearly black in colour, and is composed mainly of crystals of black augite and yellowish green labradorite with a greasy lustre. The labradorite is partly in lath-shaped crystals and partly in granular masses that fill lath-shaped areas. Probably lath-shaped crystals were crushed into the masses of granular labradorite. The crystals vary in size from place to place, but they probably average about one-quarter to one-half inch in length.

Several other minerals are present, in addition to the augite and labradorite. Very badly shattered red garnet is quite conspicuous in the more granulated parts of the rocks and is accompanied by biotite in black, shiny flakes. Both minerals occur around the borders of augite crystals. Pyrrhotite and magnetite occur very sparingly in minute crystals scattered throughout the rock. A few veinlets, up to 1 inch in width, of plagioclase with a little quartz, are present. These small veins do not have sharp contacts with the surrounding rock and may be segregations formed when the magma was crystallizing. Material from these veinlets has yielded assays for gold, silver, copper, nickel, and platinum, but in very small amounts, and the deposits seem to be too small for profitable extraction.

GRANITE AND GRANITE-GNEISS

The most abundant rocks throughout the area are granite, granite-gneiss, or closely related rocks such as syenite or granodiorite. They are present in large to small masses in all the older rocks, and underlie most of the western and northern part of the district.

These granitic rocks are medium to fine grained, salmon red or pink to grey, in some places banded but in others quite massive. The banding is caused by the crowding of the dark minerals into certain bands and their absence in neighbouring bands. The minerals present are quartz, microcline, orthoclase, plagioclase, hornblende, biotite, and various others in very small amounts. The most common rock type is a quartz-rich, microcline granite with both hornblende and biotite. The approximate percentages are quartz about 25 per cent, microcline 50 per cent, plagioclase 15 per cent, and hornblende and biotite 20 per cent. The various accessory minerals, magnetite, pyrite, apatite, and titanite, are present in varying, but always small, amounts. The proportions of the main constituents vary a great deal in different masses, but do not cause much change in the appearance of the rock.

PEGMATITE

Pegmatite is the name applied to lens- or dyke-shaped rock masses with a coarse and variable grain. They may be of almost any composition, but by far the greatest number have about the same composition as a granite and are often called giant granite. They occur in and near granite and granite-gneiss masses and range in size from little stringers to great masses several hundred feet long and 200 feet wide. The chief minerals are quartz, potash feldspar, usually microcline, and plagioclase, usually very soda rich; in addition magnetite and tourmaline are present, and in some dykes a large number of rare minerals, such as beryl, columbite, and radioactive minerals, occur.

The pegmatite is very closely related to the granite, having been formed from the same magma, and represents the last material to crystallize from it. Since it is formed in such a manner it must necessarily occur close to granite and most often is actually within the granite mass. Because the crystals are large they can be easily separated from one another, and pure feldspar is obtained from pegmatites.

METAMORPHIC PYROXENITE

Scattered throughout the district, and in adjacent regions in Ontario and Quebec, are irregular masses or bands of rock elongated in the direction of the strike of the rocks with which they are associated. These masses are composed principally of a pyroxene, most commonly diopside, with white or pink calcite, apatite, phlogopite, tremolite, scapolite, and many other minerals. They have been called pyroxenites or pyroxenite dykes, basic pegmatites, apatite veins, contact metamorphic deposits, and metamorphic pyroxenite. Since they are generally believed to be rocks of a secondary type and to have been formed by the action of some igneous

rock on the Grenville limestone, Wilson[1] has adopted the term metamorphic pyroxenite to distinguish them from true pyroxenite dykes, which are igneous rocks that do not owe their origin to metamorphic processes.

The crystals of the various minerals in the metamorphic pyroxenites are large and of various shades of green, pink, and white so the rock has a mottled appearance. In places they contain deposits of amber mica or of molybdenite. Apatite was once mined from these rocks.

DIABASE DYKES

These dykes are part of an easterly trending system. They vary in width from less than a foot to several hundred feet. The rock is a typical diabase, dark grey to black in colour, and fine to coarse grained. The chief minerals are plagioclase and augite, with some ilmenite. The minerals are almost everywhere altered and the outcrop of the dykes is in many places a rusty gossan. They are not very common in the region.

PALÆOZOIC ROCKS

Palæozoic rocks occur in the county as flat-lying beds consisting principally of limestone, and to a lesser extent of shale, sandstone, and dolomite. The rocks are all marine sediments of Ordovician age.

There is an extensive area of these rocks near Arnprior, and another in the Bonnechère valley around Golden Lake and Eganville, at which place the stone is quarried for lime.

QUATERNARY DEPOSITS

The uncemented material at the surface is of two types: (1) materials deposited from the melting of the glacier that covered the greater part of northeastern North America during the great Ice age, and (2) materials laid down on the floor of an immense gulf of the ocean that occupied the lower St. Lawrence and Ottawa valleys for a time after the wasting away of the ice-sheet.

GLACIAL DEPOSITS

The materials that were deposited from the glacier are of two types: (*a*) unsorted sand and gravel forming boulder clay and bouldery sand and gravel, and (*b*) roughly sorted sand and gravel carried by water from the melting of the glacier ice. In the higher parts of the region this glacial material is the only bedrock cover. In the lowlands it in turn is covered by the material deposited from the waters of the above-mentioned gulf.

CHAMPLAIN SEA DEPOSITS

During the period following the disappearance of the great ice-sheet, either the land was lower or the sea was higher, or both, and as a consequence the waters of the ocean flooded over the St. Lawrence and Ottawa valleys forming a large gulf that has been named the Champlain Sea.

[1]Wilson, M. E.: "Arnprior-Quyon and Maniwaki Areas, Ontario and Quebec"; Geol. Surv., Canada, Mem. 136 (1924). *See also* various other reports by the same author on adjoining regions.

Materials washed into this sea were spread out over its floor, and later when the area was raised the sea floor became dry land. The muds deposited well out from the shore of the gulf formed the mantle of clay now found in the lowlands of the Ottawa valley and its tributaries such as the Bonnechère. The coarser material deposited near the ancient shoreline forms the sand of the extensive sand-plains of the upper parts of the valleys. There is a very extensive development of such a plain in the Madawaska valley around Combermere, Barrys Bay, and Madawaska. These Champlain sediments are very well sorted and well bedded. In places they reach a thickness of 75 feet, and in many places are 15 to 20 feet thick. The clay is stoneless and some of it is suitable for making bricks and drain-tile.

MINERAL DEPOSITS[1]

GOLD AND PLATINUM

Gold is found 30 miles or more south of the district, in quartz veins with one or more of the following minerals: calcite, pyrite, arsenopyrite, chalcopyrite. Such veins are not very common in Renfrew area and where found are usually quite small. Gold assays have been reported in many places, but all were from grab samples and represent mineral curiosities and not ore.

Admaston Township

(1) [2]*Lot 5, Concession XII.* There are two occurrences. The rock is Grenville limestone and grey biotite gneiss, exposed only in small knolls surrounded by drift. The dip is vertical or nearly so and the strike is about north 10 degrees east. On one knoll of gneiss, 30 feet long and 10 feet wide, a pit has been sunk to a depth of 20 feet at the intersection of a 1-foot quartz-chalcopyrite vein and a 2-inch quartz stringer. The vein strikes north 70 degrees east and dips 80 degrees to the south. It has been followed for only 60 feet. The stringer is parallel to the strike and dip of the gneiss and to the north grades into a narrow pegmatite. The ground slopes away from the knoll and is swampy. The vein appears to pinch out toward the bottom of the pit and is not disclosed in open-cuts along its line of strike.

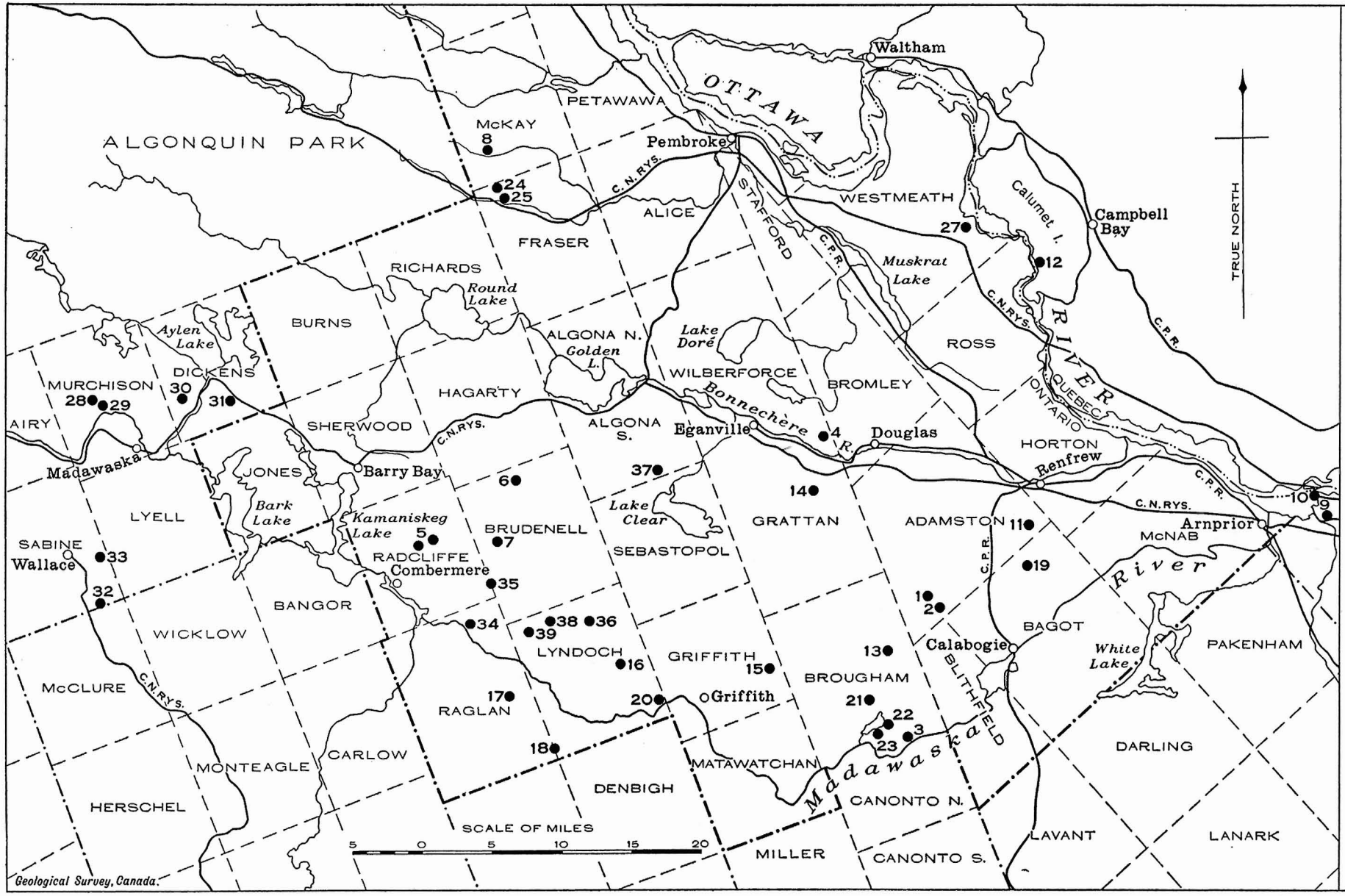
The other deposit on lot 5 is in limestone and is even smaller and lower in grade.

(2) Lot 3, Concession XII. This deposit consists of gold-bearing calcite stringers in a 2-foot sheared zone in medium-grained, dark grey, somewhat magnetic gabbro. A $3 gold assay has been reported, but the exposure is very small.

Brougham Township

(3) Lot 11, Concession I. The country rock is hornblende schist cut by a very large number of granite and pegmatite dykes. Some of the pegmatite dykes carry so much quartz that they can be classed as feld-

[1] The deposits are in Renfrew county unless otherwise specified.
[2] These numbers refer to locations shown on Figure 1.



INDEX TO MINERAL PROPERTIES

PRECIOUS METALS

1. *Admaston Tp., Con. XII, lot 5.*
2. *Admaston Tp., Con. XII, lot 3.*
3. *Brougham Tp., Con. I, lot 11.*
4. *Wilberforce Tp., Con. II, lots 2 and 3.*
5. *Radcliffe Tp., Con. IX, lots 16 to 30.*
6. *Brudenell Tp., Con. XV, lots 18 and 19.*
7. *Brudenell Tp., Con. X, lots 31 and 32; Con. IX, lot 30.*
8. *McKay Tp., Platinum.*

LEAD AND ZINC

9. *Fitzroy Tp., Con. VI, lots 22 to 24. Kingdon Mine, Galetta.*
10. *Fitzroy Tp., Con. VI, northwestern end.*
11. *Admaston Tp., Con. III, lot 2. Renfrew Zinc Mines.*
12. *Calumet island, Quebec, R. IV, lots 9 to 11. Calumet Lead and Zinc Mine.*

MOLYBDENITE

13. *Brougham Tp., Con. XI, lot 7. Hunt Mine.*
14. *Grattan Tp., Con. XI, lot 11.*
15. *Griffith Tp., Con. IV, lot 31. Spain Mine.*
16. *Lyndoch Tp., Con. VIII, lot 10. Jamieson Mine.*
17. *Raglan Tp., Con. IX, N½ lot 27.*
18. *Raglan Tp., Con. II, lot 35.*
19. *Bagot Tp., Con. IV, lots 27 and 28. Phoenix Molybdenite Corp.*

GRAPHITE

20. *Lyndoch Tp., Con. II, lots 1 and 2.*
21. *Brougham Tp., Con. VI, lot 17.*
22. *Brougham Tp., Con. III, lot 16.*
23. *Brougham Tp., Con. III, lots 17 and 18.*

FELDSPAR

24. *Fraser Tp., Con. XVI, N½ lot 24.*
25. *Fraser Tp., Con. XVI, S½ lot 24 and lot 23.*
26. *Head Tp., Con. A, lot 14 (not on index map).*
27. *Westmeath Tp., Con. IX, lot 3.*
28. *Murchison Tp., Con. VIII, lot 19.*
29. *Murchison Tp., Con. VIII, lot 18.*
30. *Dickens Tp., Con. V, lot 27.*
31. *Dickens Tp., Con. III, lot 14.*
32. *Sabine Tp., Con. I, lots 28 and 29.*
33. *Sabine Tp., lot 28, west of Hastings road.*

NEPHELINE

34. *Raglan Tp., Con. XVIII, lots 23 and 24.*
35. *Brudenell Tp., Con. V and VII, lot 34.*
36. *Lyndoch Tp., Con. XIV, lot 13.*
37. *South Algona Tp., Con. I.*

BERYL

38. *Lyndoch Tp., Con. XV, lot 23.*
39. *Lyndoch Tp., Con. XV, lots 30 and 31.*

To illustrate Memoir No. 195, "Mineral Deposits of Renfrew County and Vicinity," by B. C. Freeman.

Figure 1. Index showing location of mineral deposits in Renfrew county, Ontario, and vicinity.

spar-bearing quartz veins. Considerable stripping and trenching have been done. The most favourable looking deposit is a small, irregular quartz vein, about a foot wide. It contains many pyrite stringers, ranging in width from very fine streaks up to one-half inch, cutting through the quartz in various directions.

Wilberforce Township

(4) Lots 2 and 3, Concession II. The country rock is grey to red granite-gneiss. Schistosity is vertical and strikes due north. Two quartz veins are present on a knoll. One is 2 to 4 inches wide and strikes north 85 degrees east; the other is a mere stringer and strikes due north. Both are vertical and carry black pyroxene and pyrite. Three hundred feet west across a depression is a small opening on a 2-foot quartz vein, vertical and striking north 35 degrees west. The vein has been stripped for only 5 feet and contains pyroxene and pyrite. The material taken out of the small pit assayed 85 cents a ton.

Rockingham and Halfway Prospects

Scattered prospects in Brudenell and Radcliffe townships have received considerable attention recently. They can be divided into three groups: (5) lots 16 to 30, con. IX, Radcliffe tp.; (6) lots 18, 19, con. XV, Brudenell tp.; (7) lot 30, con. IX, and lots 31 and 32, con. X, Brudenell tp.

The last-named group is near Rockingham post office in an area of Grenville sediments, principally limestone. The others are in gneissic granite. All the prospects in the granite are ordinary pegmatites, consisting of quartz and feldspar with an occasional speck of pyrite or arsenopyrite. In no place were large values obtained and none of the prospects is at all promising.

The prospects near Rockingham are in limestone, pyrite-bearing mica schist, or grey granodiorite. The pyrite in the mica schist weathers to iron rust. Much of the limestone contains a dark green to black pyroxene, which has been reported to be valuable, but is really worthless. The grey, igneous rock on the hill north of the post office and store contains quartz, feldspar, pyroxene, and titanite. The titanite is red-brown in colour, is in flattish, wedge-shaped crystals up to one-quarter inch across, and makes up in places as much as 1 per cent of the rock. It has been mistaken for tin ore.

(8) McKay Township

The gabbro mass in McKay township contains a few veinlets consisting of quartz and feldspar which have yielded traces of platinum, gold, silver, copper, and nickel.

COPPER AND NICKEL

Copper occurs in the prospect on lot 5, con. XII, Admaston tp., and copper and nickel have both been reported from the gabbro in McKay township.

LEAD AND ZINC

Reference: Alcock, F. J.: "Zinc and Lead Deposits of Canada"; Geol. Surv., Canada, Ec. Geol. Ser. 8, 1930.

Both lead and zinc have been mined in this district, but none of the properties is now being worked. Lead and zinc almost always occur together, but one is usually present in larger amount than the other.

The lead deposits are comparatively free from zinc, and they occur along faults in the rocks. These fault veins are made up mostly of white calcite and galena, with small amounts of sphalerite, fluorite, barite, selenite, and hematite. In Madoc area, Hastings county, veins of this type carry sufficient fluorite to be worked for that mineral. Such veins are widespread over the eastern part of Renfrew area and are found in the Palæozoic limestone as well as in the Grenville. Lead is the only metal that is not confined to the Precambrian rocks here.

Zinc deposits form lens-like masses in the Grenville limestone and gneiss. The minerals present are zinc blende, galena, pyrrhotite, pyrite, and chalcopyrite. A trace of gold is present in a few places.

When prospecting one should be on the lookout for the sulphite minerals mentioned, which may be in rusty zones. The calcite-lead veins have parallel walls and are sharply set off from the country rock. No lead and zinc deposits occur in large masses of granite.

Fitzroy Township

Kingdon Mine, Galetta: (9) Lots 22-24, Concession VI. The mine is on Chats island in Ottawa river and is 5 miles east of Arnprior. A calcite vein, averaging 5 feet in width and 2,700 feet long, contains galena in grains, clusters of crystals, and thin sheets. Very small amounts of other minerals are present.

Work was carried on in 1884 and 1885, but mining did not start until 1914. From then until a few years ago, when the mine closed down, almost the whole lead production of Ontario came from this mine. About 25,000 tons of lead have been recovered.

The deposit has been described fully by M. E. Wilson.[1]

Campbell Lead Prospect: (10) Northwestern End of Concession VI. At various times in the past small veins have been worked on this property. At high water the prospect is covered by Ottawa river.

Admaston Township

Renfrew Zinc Mines: (11) Lot 2, Concession III. This property is less than 4 miles from the town of Renfrew and is thus within easy reach of good transportation. The country rock is typical Grenville limestone, usually white in colour, although some of it is pink. Round knots of tremolite are very abundant, forming half of the rock mass in some places. The tremolite is in long, slender crystals that extend out from a central point, and that form ball-like masses up to 4 inches across.

The rocks strike north 40 degrees east and are almost vertical, dipping in places 85 degrees to the southeast and in others 80 degrees to the north-

[1] Geol. Surv., Canada, Mem. 136.

west. The natural exposures are poor but the cover is thin. It is not difficult to strip the rocks and considerable stripping and trenching have been done.

Crystals of zinc blende are very abundant in the limestone in a zone about one-third mile long. The zone strikes northeast, but is not sharply marked off from the unmineralized rock. The mineralized zone does not extend over much more than a width of 50 feet in any place, although some zinc blende can be found over a width of 100 feet or more.

Most of the stripping has been done at the northeast end of the mineralized zone and at that place, too, the zone has been diamond drilled by twenty holes, making a total of 4,745 feet of core. The drilling disclosed a large body of mineralized rock, too low in grade to be workable at present metal prices.

Three sulphides, zinc blende, galena, and pyrite, are present in the ore. Calcite and tremolite are abundant, and actinolite, biotite, apatite, and quartz are present in small amounts. Tremolite forms long, slender crystals, but the other minerals occur in fairly even-sized grains. The texture and grain of the ore, the lack of definite boundaries, the minerals present, and the order in which they were deposited, all indicate that the ore was formed by contact metamorphism of the Grenville limestone. Ore deposits of this type are usually lens-like or bunchy, so a succession of ore-bodies may be found. The prospect has been well explored by stripping, trenching, and diamond drilling, but the exploration did not develop workable deposits.

Calumet Zinc and Lead Mine

(12) Lots 9-11, Range IV, Calumet Island. Campbells Bay, on the north shore of Ottawa river, is the nearest railroad station. Work was carried on intermittently between 1893 and 1926, but not much ore has been mined since 1918 when 1,100 tons were shipped, the average grade of the ore being 32 per cent zinc and 9 per cent lead. Some silver is present in the ore, as well as a small amount of copper and a trace of gold. The ore-bodies occur as lenses along two shear zones in dark green, medium-grained, schistose amphibolite.

A detailed description of the property was made by R. W. Goranson.[1]

MOLYBDENUM

Reference: Eardley-Wilmot, V. L.: "Molybdenum"; Mines Branch, Dept. of Mines, Canada, Rept. No. 592, 1925.

Molybdenum is an important alloy element and its use in alloy steels is increasing. During the war it was in great demand, the price was very high, and many deposits were opened up. After the war the industry passed through a difficult period, but now the use of alloys containing molybdenum is well established and the industry has recovered.

Only one mineral, molybdenite, the sulphide of molybdenum, is important as an ore mineral. Molybdenite is a soft, flaky, blue-black mineral that resembles graphite so much that the two minerals are frequently mistaken for one another. The streak made by molybdenite on glazed paper when rubbed very thin becomes greenish black, but a graphite

[1] Goranson, R.W.: Geol. Surv., Canada, Sum. Rept. 1925, pt. C, pp. 105-124.

streak remains black on rubbing. The price of molybdenite concentrate is now about 50 cents a pound, and material containing 1 or 2 per cent of molybdenite makes workable ore if sufficient tonnage of ore can be handled to make low working costs.

There are many molybdenite deposits in Renfrew county and vicinity. All are small but many are high grade. All the deposits are associated with granite, granite-gneiss, or pegmatite. In some places the molybdenite occurs in veins or as clusters, in the granite or pegmatite, whereas in other localities it is scattered along the contact of these rocks with Grenville limestone. The more important deposits are of the latter kind and in prospecting it is well to look for places where pegmatite has intruded the Grenville limestone forming metamorphic pyroxenite.

In the reference listed twenty-six molybdenite deposits in Renfrew area are listed and twenty are described. The following table, taken from pages 117 and 118, gives the outstanding facts about these occurrences.

Molybdenite Deposits and Occurrences in Renfrew County

Township	Locality and name	Mode of occurrence	Quantity of ore shipped	Classification	Remarks
Admaston	Con. IX, lot 9, Gorman	Sulphide, pyroxene contact zone of limestone and gneiss.	21½ tons; 117 lbs. MoS_2 recovered.	E.	Ore low grade; some trenching.
"	Con. XIII, lot 8, Kiley	Heavy sulphide contact zone of bands of limestone and gneiss.	Nil	C.	Some trenching. Ore in old well, several tons extracted.
Bagot	Con. IV, lot 28, Phoenix Molybdenite Corp. (Taylor).	Pyritic pyroxene stringers in gneiss, red granite, and bands of limestone.	84 tons; 4 tons MoS_2	B.	Shafts, quarry, and trenching. Ore high grade.
"	Con. IV, lot 27, Phoenix Molybdenite Corp. (Canadian Molybdenite Co.).	Limestone-gneiss contact	1,520 lbs. cobbed; 60 lbs. MoS_2 recovered.	E.	Shaft and trenching.
"	Con. X, lot 15, Hunter	Limestone-pegmatite contact and gneiss.	100 lbs. flake	F.	Trenching and one pit.
"	Con. XII, lot 28, Culhane	Massive pyroxene on greenstone contact in red granite.	35 lbs. picked	C.	Four pits. Possibilities at Snake lake.
Blithfield	Con. I, lot 29, Quilty	Heavy flat sulphide contact pyroxene zone between red granite and limestone.	19 tons; 120 lbs. MoS_2 recovered.	C.	One quarry and five pits. Ore low grade.
Bromley	Con. V, lot 24, Cole	Pyroxene mass	1½ tons	E.	Several small pits.
Brougham	Con. I, lot 17, Box	Flakes in pegmatite in gneiss	½ ton	F.	Ore 0·5% MoS_2. A few shafts and one pit.
"	Cons. XI, XII, lots 7-9, Hunt mine	Metamorphic pyroxene contact in pegmatite granite and limestone.	7,000 tons; 50 tons MoS_2 produced.	A.	Extensive tunnels and shafts; 10,000 tons mined; 30-ton mill and plant; ore still in sight.
"	Con. XI, lot 16, Ross	Flat sulphide bands in gneiss	720 tons, about 7 tons MoS_2 recovered.	B.	Two large quarries and shaft. Ore 1% MoS_2. Ore still in sight.
"	Con. XI, lot 17, O'Brien (International)	Ill-defined gneiss limestone contacts.	500 tons	C.E.	Extensive shafts, pits, trenches. Ore low grade and very scattered. Extensive buildings.
"	Con. XII, lot 18, O'Brien farm	Pegmatite-gneiss-limestone contacts.	Nil	F.	Two pits.
"	Con. XIII, lot 13, Maloney	Ill-defined gneiss limestone contacts.	Nil	E.	Few small pits. Many small, low-grade occurrences.

"	Con. XIV, lots 35–36, Sunset	Sulphide contact pyroxene in hornblende gneiss.	20 tons cobbed, 936 lbs. of MoS_2 recovered.	C.E.	70-foot shaft, pits, and trenches; about 400 tons low-grade ore extracted.
Griffith	Cons. IV and V, lots 31–32, Spain mine.	Metamorphosed pyroxene pegmatite zone in hornblende pyroxene-monzonite gneiss.	100 tons, 3½ tons MoS_2 recovered.	A.	One large pit, shaft, and stripping; about 1,000 tons low-grade ore extracted; large masses of MoS_2 found; 50-ton mill, ore still in sight.
"	Con. IV, lots 33–34, Legree	Sulphide contact pyroxene in hornblende gneiss.	Nil	C.	Pits and trenches. Ore about 0·75%.
Lyndoch	Con. II, lot 34, McCoy		2 tons	C.	Two small pits. Two tons milling ore extracted.
"	Con. VIII, lots 5–6, Jamieson mine	On gneiss-limestone contact with much pyrite.	280 tons, about 6 tons MoS_2 recovered.	B.	Two large pits, shaft and trenches; 200 tons 1% ore on dump.
"	Con. VIII, lot 9, Legree	On pegmatite contact in gneiss and limestone.	150 lbs. cobbed	C.	Three pits and strippings, 5 tons milling ore extracted, continuation of Jamieson vein.
Matawatchan	Con. VI, lot 3, Wilson	Wide pyroxene-pegmatite contact in gneiss.	Nil	C.	A few shots. Possible large low-grade deposit.
Raglan	Cons. IX, X, lot 27, Windle-Liedke	In pegmatite dyke in limestone	Nil	E.	A few pits. One ton 2% ore cobbed.
"	Con. XVIII, Craigmount corundum	In fine seams in corundum-bearing syenite.	Nil	E.	No development for MoS_2.
Ross	Con. II, lot 22, Haley	In quartz-pegmatite band in biotite-gneiss.	18 tons cobbed. About 700 lbs. MoS_2 recovered.	D.	40-foot shaft and large pit; apparently all ore now extracted.
"	Con. IX, lot 7, Elliott	With pyrites in limestone	Nil	F.	Some pits.
Sebastopol	Range C, lots 36–38, Ziebath	Pegmatite between gneiss and limestone.	Nil	F.	Two small pits.

In the above tabulation the following *tentative* classification has been adopted for grading purposes.

A. Economic conditions favourable, and probably a considerable producer.
B. Probable producer.
C. Has possibilities and worthy of further investigation.
D. Has possibilities on a small scale, suitable for economic hand cobbing.
E. Prospect not very encouraging.
F. Prospect not worthy of further investigation.

Several of the more promising of the deposits were visited and, in addition, four deposits not listed. These are located as follows: Grattan township, lot 11, concession XI; Admaston township, lot 15, and lot 17, concession XII; Raglan township, lot 35, concession II. Very few deposits have been worked since 1919, and in the intervening time the outcrops have weathered badly.

Brougham Township

Hunt Mine: (13) Lot 7, Concession XI. This property is also known as the Renfrew Molybdenum Mines, Limited. It lies on the south slope of mount St. Patrick and is 12 miles west of Ashdod station on the Kingston-Renfrew branch of the Canadian Pacific railway. Most of the mining was done between 1915 and 1918; since that time the mine has lain idle.

The chief rock types present are pegmatite, on the top of the hill, and crystalline limestone on the slopes. The ore deposit is at the contact between these two rocks. In some places the main minerals are calcite, green pyroxene, and scapolite; in other places most of the mass is made up of pyrite and pyrrhotite. The molybdenite is more abundant where there is much pyrite and pyrrhotite.

The deposit is a typical contact metamorphic deposit, formed as a result of the intrusion of the pegmatite into the limestone. The whole pegmatite mass should be good prospecting ground, because other deposits may also have been formed. The mine was closed down after the great drop in the price of molybdenite and may be worth reopening.

Grattan Township

(14) Lot 11, Concession XI. This deposit, on the farm of John Wren, is 4 miles from Caldwell station on the Ottawa-Parry Sound branch of the Canadian National. Some development work was done in 1918.

The country rock is grey gneiss intruded by pink granite. On a granite ridge 500 feet long there is an irregular pegmatite dyke striking north 70 degrees east, dipping vertically, and from 1 to 5 feet wide. Molybdenite flakes and pyrite grains are scattered through the pegmatite. In places there is so much quartz that the pegmatite resembles a quartz vein. In these vein-like masses, composed of quartz, biotite, pyroxene, and a little feldspar, and calcite, there are masses of molybdenite and pyrite up to an inch across.

This deposit is small and not very rich. There has been no production.

Griffith Township

Spain Mine: (15) Lot 31, Concession IV. This property is 8 miles southwest of Dacre. Work was done between 1912 and 1920, but the production was small. The buildings are wrecked and the workings are full of water.

The country rock is crystalline limestone and grey hornblende-monzonite gneiss. Small dykes and masses of pegmatite are present in the gneiss.

The molybdenite occurs mainly in an area 100 feet by 75 feet, on which a pit was sunk to a depth of 10 to 25 feet. The molybdenite is in

small veins and stringers in pegmatite and gneiss, near impure crystalline limestone. The veins are made up mainly of dark pyroxene, pyrite, and magnetite, with a few grey garnets and a little calcite.

Since the veins are very irregular, and nowhere very wide, all the mass must be mined. The grade of the mass is about 1 per cent molybdenite.

Lyndoch Township

Jamieson Mine: (16) Lot 10, Concession VIII. This property is in the central part of Lyndoch township several miles from a road. It is 30 miles from the railroad, Barrys Bay, Eganville, and Caldwell, all on the Ottawa-Parry Sound branch of the Canadian National railways, being equally distant. The deposit is on the top of a high, steep hill. The country rock is fine-grained pink granite, cut by a few pegmatites.

The molybdenite is in a vertical vein, striking north 55 degrees east, which has been trenched over a length of 200 feet and to a depth of 12 feet. At the northeast end a 45-foot shaft was sunk. The vein is about 8 feet wide at the top and, according to Bert Lambert who worked in the mine, has pinched to a width of only 1 foot at the bottom of the shaft. On the southeast wall of the vein there is a large amount of coarse white and pink calcite, with mica crystals one-eighth inch in size, and some green pyroxene. This probably is a remnant of crystalline limestone that was caught up by the granite magma. The chief gangue minerals are altered grey-green pyroxene and green-black mica. Seams and crystals of pyrite cut across the pyroxene. Quartz and microcline are present in scattered groups of crystals. Rounded masses of arsenopyrite 2 or 3 inches across are surrounded by calcite, quartz, and chalcopyrite. Some of the larger calcite masses contain half-inch round masses of galena and sphalerite. In some vugs there are perfect little quartz crystals, both clear and amethyst coloured, and pale green fluorite, in calcite. The presence of galena led one operator to try to develop a lead mine. No work has been done in recent years.

The great distance from the railroad, the lack of roads, and the small size of the deposit combine to hinder its development.

Raglan Township

Liedke Prospect: (17) North ½, Lot 27, Concession IX. This property is 25 miles south of Barrys Bay on the Ottawa-Parry Sound Branch of the Canadian National railways, near the village of Schutt, and is crossed by the Wingle-Schutt road. The area is quite high and there are many small, low knolls of bare rock. The country rock is pink granite, intruding crystalline limestone and mica schist. A pegmatite dyke 25 feet wide dips vertically and strikes north 15 degrees east along the contact between a band of limestone and mica schist. It is exposed in scattered outcrops over a length of 1,500 feet, with limestone on the east and mica schist on the west. In some places the granite is in contact with the pegmatite, in other places it is 100 feet away.

The dyke is mostly fine grained, but has large (1- to 2-inch) crystals of red feldspar. It is composed of quartz, red feldspar, and black tourmaline with an occasional flake of molybdenite.

The main occurrences of molybdenite are on the east side of the dyke at its contact with crystalline limestone. Where granite is in contact with the dyke there is very little molybdenite. At the north end of the property a pit 20 feet long, 5 to 10 feet wide, and 5 feet deep, has been sunk on the largest contact deposit. On the west side, in the pegmatite, the ore is composed of quartz, feldspar, and green pyroxene in about equal amounts, with small pyrite crystals and molybdenite books up to one-half inch across and one-eighth inch thick. On the east side, next to the limestone, the ore is composed of calcite, light green pyroxene, apatite, pyrite, and molybdenite. In the centre a zone about a foot wide contains a large percentage of pyrrhotite and molybdenite. Deposits of this type are scattered along the contact, but though high grade are all small. The molybdenite in the dyke away from the contact is present in such small amounts that it is not minable.

McCoy Molybdenite: (18) Lot 35, Concession II. This property, owned by Mr. Douglas Perigoe of Toronto, is one lot west of the old McCoy Molybdenite property in Lyndoch township. It is 35 miles south of Barrys Bay and 25 miles east of Detlor. The workings are one-quarter mile east of a large stream that flows north into Madawaska river. A dam has been constructed on this stream to furnish power for the property.

The rock is not well exposed, but judging by the few outcrops it is mostly granite. One small outcrop of mica schist was seen. An area 30 feet by 45 feet has been stripped on a fine-grained pegmatite dyke, trending north 70 degrees west. The dyke has vertical jointing parallel to the direction of schistosity in the nearby schist.

Parts of the dyke contain 2-inch crystals of microcline and some green pyroxene, pyrrhotite, and molybdenite, and these parts look very much like the pegmatite dyke on the Liedke prospect. Some of the molybdenite is in six-sided crystals 2 inches across and $\frac{1}{4}$ inch thick.

Not enough work has been done to show whether the molybdenite is in a definite zone or is scattered in irregular patches throughout the dyke.

Phoenix Molybdenite Deposit

Reference: Eardley-Wilmot, V. L.: "Molybdenum"; Mines Branch, Dept. of Mines, Canada, Rept. No. 592, pp. 83-86 (1925).

The Phoenix Molybdenite Corporation, Limited, is developing a molybdenite prospect on lot 28, con. IV, Bagot tp., Renfrew co. Lot 27 is also owned by the same company. The property is 4 miles northeast of Ashdod station on the Kingston-Renfrew branch of the Canadian Pacific railway and is 8 miles southeast of the town of Renfrew. Good dirt and gravel roads serve the property.

The country is stony farming land, more suitable for grazing than for cultivated crops. The land was once all cleared, but much of it is now in pasture or scrubby forest.

The most striking physiographical feature is a series of parallel ridges, or lines of knolls, trending about north 20 degrees east and paralleling the regional geological structure. Bedrock comes to the surface in many small outcrops on the ridges and knolls and is covered by a thin veneer of stony drift between the outcrops. The depressions between the ridges are swampy.

History. Mr. William Warren, who formerly owned the farm on which the deposit is located, discovered molybdenite when digging a well. He sold the mining rights on lot 28 to Sir Henry Pellatt in 1914. In 1914, 1915, and 1916 work was done on the main stripping near the present shaft under the direction of Mr. M. J. Paterson, who sank a shaft and some test pits and did some stripping. From the ore mined, 2½ tons were hand cobbed. Work was carried on in the autumn of 1917 by Mr. A. W. Taylor. Altogether 7,800 pounds of pure molybdenite and 472 pounds of 65 per cent molybdenite were recovered.

Mr. Warren sold the mining rights on lot 27 to the Canadian Molybdenite Company, Limited, which shipped about a ton of ore, partly hand cobbed, during 1916 and 1917. About 60 pounds of pure molybdenite were recovered from the shipments. In 1919 the Eureka Molybdenite Corporation was formed, but no work was done. In 1923 Mr. F. L. Stinson bought the mining rights and incorporated the Phoenix Molybdenite Corporation, Limited. In 1924 this company bought lot 28 but not much work was done until 1930, when the shaft was deepened to 50 feet.

In 1934 the pit 700 feet north of the main shaft was opened and a mill of 150 tons daily capacity was erected. This rate of mining could not be maintained, however, and the mill was soon closed.

Early in 1935 the shaft was deepened to 100 feet and drifting was carried ahead on this level. A sizable extension of the ore-body in the pit near the shaft was found.[1] In March 1936, 2,000 feet of diamond drilling was completed and it was decided to continue the shaft to the 200-foot level.[2] Power is obtained from the power plant on Madawaska river at Calabogie.

Geology. The rocks exposed on the property belong to the Precambrian basal complex. Xenoliths of the Grenville series of sedimentary rocks are included in a granite batholith.

Crystalline limestone, composed principally of calcite crystals up to one-quarter inch across, with some biotite and pyroxene, is sparingly present. It is grey and weathers readily to a coarse sand. Metamorphic pyroxenite is common in the limestone near the ore zone.

Sandy and muddy phases of the Grenville series are more plentiful. The most abundant type is a fine-grained gneiss formed of alternating grey to pink, and black, bands. The black bands vary in width from mere streaks to well-defined bands 1 inch wide. The pink parts of the light-coloured bands are biotite free, but the grey parts contain a variable amount of biotite scattered among the other constituents. The lighter coloured bands are composed of quartz, about 70 per cent, andesine 20 per cent, microcline 5 per cent, biotite 5 per cent or less, and hornblende, apatite, titanite, magnetite, pyrite, and calcite in small rounded grains. The darker coloured bands differ chiefly in the greater proportion, and the larger size, of the biotite and hornblende grains. This rock was probably an impure sandstone and owes its present character to regional metamorphism. The thicker dark bands, in some places, have very sharp walls and suggest the possibility that they were originally small dykes or small lit-par-lit intrusions of basic rocks, rather than muddy layers in a sandy

[1] Stinson, F. L.: Personal communication, August 30, 1935.
[2] Claudet, H. H.: Personal communication, March 3, 1936.

sediment. In some places the bands of mica schist are as much as 8 feet wide. A band of paragneiss north of the shaft contains thin seams of mica schist which contains, in addition to the minerals listed above, one-eighth inch garnet metacrysts.

The most abundant rock type on the property is a moderate-grained, grey to red, gneissic granite. It is composed of quartz 25 to 30 per cent, microcline and orthoclase 50 to 55 per cent, oligoclase-albite 5 to 10 per cent, biotite and hornblende, each 2 to 10 per cent, and accessory apatite, titanite, pyrrhotite, and magnetite. Coarser grained red streaks of microcline and quartz, paralleling the foliation of the granite, are common. In thin section, these larger crystals appear to be replacing the finer grained minerals.

Pegmatite dykes cut the rocks in every direction, but are principally in the granite, parallel to the foliation. The texture ranges from that of a coarse-grained granite to porphyritic with crystals of microcline up to 3 inches across. The chief minerals are microcline and quartz, but a small amount of plagioclase (oligoclase-albite) and hornblende, as well as accessory titanite and magnetite, are present. In some dykes black tourmaline crystals 1 inch long and $\frac{1}{4}$ inch in diameter are abundant. Some dykes contain a few large crystals of magnetite.

Structure. The rocks here, as everywhere in the Grenville subprovince of the Canadian Shield, have been intensely metamorphosed. The beds are crumpled, drag-folded, and sheared. On the whole, the structural trend is nearly north 20 degrees east, but for short distances in some places it is nearly due north. The dips are all high, most being nearly vertical. In the pit near the shaft the average dip is 75 degrees to the northeast.

Mode of Occurrence of the Ore. The ore occurs in three ways: (1) in the central part of a metamorphic zone between pegmatite and crystalline limestone; (2) in a well-defined vein 4 to 7 feet wide in a fault zone nearly paralleling the dip and strike of the enclosing rocks; (3) in small veins and stringers crossing the main zone at an angle of about 45 degrees.

Mineralogical Relationships. The mineralogy in all three types of ore occurrence is broadly similar, the chief difference being the much greater proportion of pyrite in the veins. By far the largest part of the ore is composed of pyroxene, calcite, quartz, pyrite, and molybdenite. Twenty-two mineral species were identified in the ore and are listed below.

Pyroxene	Microcline	Titanite
Uralite	Oligoclase-albite	Apatite
Chlorite	Tourmaline	Garnet
Serpentine	Scapolite	Magnetite
Red iron oxide	Anhydrite	Martite
Calcite	Hornblende	Pyrite
Quartz	Biotite	Pyrrhotite
		Molybdenite

The most abundant constituent of the ore is a greenish grey to greenish black, massive, altered pyroxene of the diopside-hedenbergite series. The alteration makes it difficult to trace crystal boundaries, but individual crystals in some places are apparently as much as 2 inches long and 1 inch wide. The fresh mineral has a vitreous to resinous lustre. The alteration

products are massive, resinous to earthy, green aggregates made up of one or more of the minerals uralite, chlorite, and serpentine. Microscopic grains of red iron oxides are scattered along the cleavage cracks of the original pyroxene.

Calcite, both pink and grey, is associated with the massive pyroxene and is in pure masses up to 1 inch across. Clear quartz grains occur between calcite and pyroxene in some places and also replace them. One thin section showed ragged remnants of altered pyroxene and calcite in a mass of quartz grains. The silicified ore, represented by this section, is hard, vitreous, and light green in colour.

The pyroxene-calcite-quartz aggregate is the richest ore and contains molybdenite masses in 1- to 2-inch flakes, associated with some pyrite and traces of various other minerals. Scapolite and pyrite occur in notable amounts in some places.

This rich ore grades into leaner ore with smaller flakes of molybdenite, more pyrite and magnetite, and with the pegmatitic minerals, quartz, microcline, and plagioclase. Still farther away the lean ore grades into a pegmatite carrying pyroxene, and this in turn to a normal pegmatite.

Towards the contact with the limestone the rich ore grades into a granular mottled aggregate of green pyroxene and white and grey calcite. This, in turn, grades into coarse marble.

Titanite and apatite are disseminated in microscopic crystals through the whole zone. Tourmaline occurs in the pegmatite and in crystalline limestone, but was not seen in the intermediate zone. The sulphides and oxides, pyrite, pyrrhotite, magnetite, and martite, are most abundant near the pegmatite.

Paragenesis. Study of the mutual relationships of the various minerals shows that the pegmatitic minerals, plagioclase, microcline, quartz, and tourmaline, crystallized early in the sequence. The formation of pyroxene and the recrystallization of the calcite occurred at about the same time. The crystallization of scapolite, garnet, apatite, and titanite followed, and the anhydrite, sulphides, and oxides were late in forming. Quartz was introduced and continued to replace the earlier formed minerals during most of the period of mineralization. The alteration of the pyroxene was apparently late in the sequence.

Structural Features. In the pit near the shaft the main ore zone is in a well-defined vein, 4 to 7 feet wide, with smooth, slickensided, but wavy walls. The vein almost parallels the dip and strike of the enclosing rocks but cuts across them slightly, so that it lies in some places in paragneiss, in other places between paragneiss and crystalline limestone, and in still others within the crystalline limestone. The vein undoubtedly is a mineralized shear zone. A pegmatite dyke crosses the shear zone at an angle of about 45 degrees, and north of the dyke the zone is offset 5 feet to the west.

There are some small veins and stringers parallel to the main vein and also some parallel to the pegmatite dyke. At first glance the pegmatite seems to cut the vein, but this is not the true relationship. Some small ore stringers cut the dyke and prove that the dyke is older. The dyke, therefore, is located on one of a series of cross faults that have slightly offset

the main shear zone. The mineralizing solutions came in later along the breaks in the rocks. Some molybdenite is bent around fractured pyrite crystals and shows that some deformation followed the deposition of ore.

The vein was cut on the 100-foot level, but there it is a lenticular body 60 feet long and 40 feet wide between pegmatite and crystalline limestone. The pegmatite dyke is also very considerably larger on this level. Diamond drilling has demonstrated that the ore-body continues 100 feet farther down without much change and that other ore-bodies occur to the east of the main body.[1]

Origin. The ore and gangue minerals were formed from emanations leaving the magma that later crystallized to granite. The different forms of the ore-body are due to the different types of wall-rock and to the character of the channels through which the emanations passed.

Development. The ore apparently occurs in nearly vertical, pod-shaped shoots that are related to pegmatite and crystalline limestone. Any rock association of this type should be investigated. The low ground east of the shaft has already been shown to contain ore shoots at no great distance from the main drift. The occurrence of large masses of altered pyroxene-calcite-quartz aggregates is a good indication of ore, but because the molybdenite is in large scattered flakes in this material it will be impossible to determine the grade of ore shoots from drill cores.

General Recommendations for Prospecting. As Renfrew county has more deposits of molybdenite than of any other material except feldspar, there is more probability of finding workable deposits of this ore than of other materials. All of the deposits are near or in granite or pegmatite and all contain minerals characteristic of metamorphic pyroxenites. In almost all of the deposits crystalline limestone is nearby and in the best deposits it is very closely associated with the ore. Therefore, the rock association of pegmatite and crystalline limestone should be searched for. Where metamorphic pyroxenite has been developed in the limestone there is greater probability that a molybdenite deposit will be found. Most of the ore mined has been characterized by small crystals of molybdenite and not by large, spectacular flakes.

GRAPHITE

Graphite is a soft, black, lustrous mineral, in the form of flakes, fibres, or small grains. It is so soft that it will mark paper easily and is used as "lead" in pencils. Graphite is pure carbon and, therefore, has the same composition as charcoal and diamond, but differs from these other forms of carbon in its physical form. It is often called lead by miners.

Graphite occurs in three forms: (1) flake graphite, (2) crystalline or vein, graphite or plumbago, and (3) amorphous graphite. Flake graphite is in the form of thin, flat, almost circular disks, usually about one-eighth inch across. These scales or flakes are scattered through the rock, usually in narrow zones. Crystalline graphite is also called plumbago and vein graphite. It occurs mostly in narrow, sharp-walled veins in the form of very small flakes or in fibres that extend across the vein from wall to wall. It is the purest form of graphite, but most of the veins are

[1] Claudet, H. H.: Personal communication, March 3, 1936.

too small to be mined. Amorphous graphite is in fine grains and does not occur in Ontario and Quebec.

In Renfrew area all the deposits are flake graphite or mixtures of flake and crystalline graphite and occur only in or very close to Grenville limestone. The minerals, calcite, diopside, scapolite, tremolite, biotite, quartz, and pyrite are nearly always present. The deposits are of contact metamorphic type and because igneous intrusions have been so widespread in the area that almost none of the Grenville limestone has escaped some contact metamorphic action, graphite deposits may be present in any part of the region where the Grenville limestone is represented. Most of the known deposits are low grade and only a few can be worked profitably.

Lyndoch Township

(20) Lots 1 and 2, Concession II. This property is on the north bank of Madawaska river, about 4 miles above Griffith. The nearest railroad station is Caldwell, 25 miles away, on the Ottawa-Parry Sound branch of the Canadian National. There is no road between the property and Griffith.

The deposit is a zone of disseminated flake graphite in Grenville limestone and it strikes northeast, parallel with the strike of the rocks. The Grenville is coarsely crystalline, banded limestone made up of wide white bands of pure calcite and narrow dark bands of mica and calcite. The dip of the rock is vertical. Southeast of the graphite zone is a 2-foot pegmatite dyke and near it the limestone contains much grey pyroxene and quartz.

In the graphite zone, which is about 250 feet wide, the limestone contains bands of graphite flakes. At several places near the centre of the zone the rock contains masses of nearly pure graphite, with some calcite and biotite. Smooth, grooved surfaces on the rich, soft ore show that it has been sheared.

The property was discovered by Dan Moriarty of Eganville about 1880, but nearly all of the development work was done in 1917. There are two shafts, one 50 feet, and the other 12 feet, deep. Trenching proved that the graphite zone is at least 1,800 feet long. The zone as a whole is very low grade. Near the centre bands 1½ to 2 feet wide contain over 50 per cent flake graphite. A 10- or 20-foot width along the centre of the zone might average about 10 per cent graphite.

Brougham Township

(21) Lot 17, Concession VI. This deposit is about 500 feet south of the west end of Green lake, a small lake draining into Whitefish lake. It is about 2 miles north of the Black Donald mine in an air line, but 5 miles by road and trail. It is 19 miles from Calabogie station on the Kingston-Pembroke branch of the Canadian Pacific railway.

The country rock is partly pure Grenville limestone and partly interbedded limestone and mica schist. The rocks strike north and dip vertically or to the east. The ore outcrops on the crest of a rocky knoll and a shaft has been sunk on it to a depth of 15 feet. The face of a 100-foot adit, driven slightly south of east from the west slope, is 40 feet under the

collar of the shaft, but since the rocks dip east, and the ore apparently follows the dip, the ore was not cut. The adit would have to be extended about 50 feet to be sure of cutting the downward extension of the ore.

The ore is associated with diopside-bearing rock, formed by contact metamorphic action on the Grenville limestone, and with quartz-tremolite veins. Part of the diopside-bearing rock is a pale greyish green, massive rock with quarter inch grains. Part of it is grey, fine grained, and granular. The coarse type contains a small amount of calcite and quartz. The fine-grained rock contains 5 to 10 per cent quartz and a very small amount of calcite. Quarter inch, circular flakes of graphite are scattered throughout both the coarse and fine-grained rock, but are especially plentiful where these two types of rock come together.

The quartz-tremolite veins are about an inch wide. Some parts of them are solid clear quartz and other parts are made up of blade-shaped crystals of tremolite, one-quarter inch wide and one-eighth inch thick, extending across the vein from side to side but with open spaces between the tremolite blades. There are only a few flakes of graphite in the quartz but there is a narrow selvage of pure flakes on both walls of the veins.

Not much can be seen of the deposit due to the overburden, but judging from the few outcrops and the character of the material on the dump the deposit is both small and lean.

M. J. O'Brien Prospect: (22) Lot 16, Concession III. This deposit is only two lots east of the Black Donald mine. It is very near the north end of the lot and about 700 feet east of the shore of Whitefish lake.

The rocks are Grenville sediments, striking north 55 degrees east and dipping 60 degrees to the southeast. A pit 12 feet square was sunk to a depth of 20 feet on a band of graphite-bearing limestone, and a crosscut was driven from the bottom of the shaft southeast for 20 feet. The workings are now full of water. The graphite band is probably narrow, only 10 or so feet wide at the most, and is low grade.

(23) *Black Donald Graphite Mine*

References: Wilson, M. E.: "Mineral Deposits in the Ottawa Valley"; Geol. Surv., Canada, Sum. Rept. 1919, pt. E, pp. 20-30.
Spence, Hugh S.: "Graphite"; Mines Branch, Dept. of Mines, Canada, Rept. No. 511, 1920, pp. 35-38.

The Black Donald graphite deposit is near the south shore of Whitefish lake and extends beneath it, on lots 17 and 18, con. III, Brougham tp. It is 14 miles by road from the village of Calabogie, on the Kingston-Renfrew branch of the Canadian Pacific railway, and the main office is in this village. The mine is in a region of low, rounded, rocky hills. Whitefish lake, elevation 750 feet, drains south into Madawaska river, which in flood may temporarily reverse the direction of flow of its tributary and raise the level of the lake. The lake level was raised so high in the spring of 1901 that the mine was flooded and had to be abandoned temporarily.

History. Graphite is said to have been discovered here in 1889 by John Moore, but no work was done until 1896 when the Ontario Graphite Company started operations. In 1902 a mill was built at the mine, and a power plant was constructed 2¼ miles southeast of the mine on Madawaska river. In 1904 the property was leased by R. McConnell, who,

following an unsuccessful attempt to recover the part of the main workings lost in the 1901 flood and cave-in, put down the McConnell inclined shaft and later the McConnell shaft (vertical). In 1908 the Black Donald Graphite Company, Limited, leased the property and the following year completely overhauled the mill. The Black Donald Company bought the mine in 1917 and following a disastrous fire built a new mill on a hillside back from the lake. The old hoisting station becoming unsafe, an attempt was made to reach the ore-body under the lake by a level from a vertical shaft near the new mill, but the project had to be abandoned because of water difficulties. The McConnell shaft is now used and ore is brought to this shaft from the north end of the workings under the lake by an inclined haulage drift paralleling the old workings.

Petrology. The main rock type in the vicinity of the Black Donald mine is the Grenville crystalline limestone. Parallel bands of hornblende schist, rusty weathering schist, and pegmatite are included in the limestone.

The crystalline limestone is a coarse, white to grey variety with a large proportion of lime silicate minerals associated with the calcite, and contains darker coloured bands of rock. The chief minerals are calcite, diopside, and amber-coloured mica. Graphite, pyrite, and pyrrhotite are present in varying but always small amounts. The diopside masses vary in size from single small crystals up to masses 5 feet in diameter. The larger masses are in many places partly altered to tremolite and contain quartz in irregular masses and veinlets. In a few outcrops small scattered grains of quartz, orthoclase, plagioclase, and scapolite are present in the limestone.

The hornblende schist is a fine-grained, dark greenish grey to black rock composed of hornblende in flattened, glistening crystals and quartz, plagioclase, magnetite, and pyrite. It probably represents metamorphosed basic dykes.

The rusty weathering schist is especially abundant near the ore deposit and forms the hanging-wall in most places. It resembles pegmatite mineralogically and may be an altered phase of that rock. The minerals present are quartz, potash feldspar, oligoclase-albite, pyrite, and pale yellow or colourless mica. It some places the rock contains no quartz. Similarly, mica may be very abundant or absent. In places scapolite and tremolite are present.

The pegmatite is variable in texture, being fine grained in most places but containing feldspar crystals up to 2 inches across in others. The rock is made up of quartz, albite, and orthoclase with a little mica and apatite. Wilson mentions the presence of tourmaline in both this rock and the rusty weathering schist.[1]

Structure. The rocks near the mine strike northeast and dip steeply, but detailed observations show that they have been deformed into a series of very closely compressed, parallel folds, pitching northeast at an average angle of about 25 degrees. Opposite the Patno shaft rusty weathering schist overlies ore and pitches under crystalline limestone to the northeast. Fifty feet north of this outcrop the same bed dips steeply to the north-

[1] Wilson, M. E.: "Mineral Deposits in the Ottawa Valley"; Geol. Surv., Canada, Sum. Rept. 1919, pt. E, p. 22.

west. Opposite the blacksmith shop another outcrop shows this bed dipping steeply to the southeast. Therefore, the axis of an anticline lies parallel to the road here and just south of it. In the curve of the road south of the new McConnell shaft similar relationships are shown and another parallel anticline is located there.

Character of the Ore. The mineralogy of the ore is simple and differs from that of the wall-rocks only in the amount of graphite present. The ore is high grade and consists predominantly of graphite with calcite, diopside, tremolite, mica, scapolite, quartz, feldspar, and pyrite. The chief impurity is calcite, in crystals or in veinlets cutting the ore. Diopside is usually in very ragged, altered remnants of crystals. The mica is mostly amber or green in colour and an altered, bleached biotite, partly changed to chlorite. Pyrite is common only near the rusty weathering schist. The ore is mainly massive, fine-grained graphite with scattered aggregates of coarse flakes. The large flakes are usually accompanied by a small amount of white calcite.

Origin of Graphite. Graphite may be derived from one or more of three sources, which Wilson has summarized as follows:

" (1) It might represent recrystallized carbonaceous material deposited contemporaneously with the Grenville limestone; (2) it might have been derived from the igneous rocks that have penetrated the Grenville limestone; or (3) it might have been formed by the reduction of the carbon dioxide set free at the time the silication of the limestone to form diopside and other lime silicates occurred."[1]

That the graphite was not formed from original carbonaceous material but was introduced secondarily into the limestone is shown by the following observations:

(1) the presence of included horses of limestone in ore.

(2) The gradational boundaries between limestone and ore in many places, the ore passing into limestone by a gradual decrease in the amount of graphite present.

(3) the sequence of formation of the minerals of the ore-graphite always being the last mineral to be formed.

The mineral association of diopside, scapolite, tremolite, calcite, quartz, and mica is very strongly suggestive of contact metamorphism. The fact that the graphite was introduced last, after the formation of all the other minerals, suggests that it was introduced by the emanations from igneous intrusives.

If the graphite had been formed by the reduction of the carbon dioxide set free when the limestone was silicated and the lime silicates were formed it would be contemporaneous with diopside, scapolite, and tremolite. It is always later than these minerals and cuts across them. The diopside in the ore is also more or less altered.

Therefore, the most valid conclusion is that the graphite was introduced from emanations that silicated the limestone.

Deformation. The ore has been severely sheared and many smooth, grooved surfaces have been formed that bound small irregular blocks or lenses of graphite. One lens seen was 6 inches long, 3 inches wide, and ½ inch thick. The slickensides on one side of the lens were at right angles to those on the other.

[1] Wilson, M. E.: Op. cit., p. 28.

The foot-wall of the main ore-body can be seen in the old workings near the southwest end of the open-cut. At this point the graphite was against polished surfaces of crystalline limestone which indicates that much movement occurred between wall-rock and ore. The deformation of the rocks, producing the closely compressed folds alluded to above, occurred after the formation of the ore. The soft, incompetent graphite yielded very much more easily than the other rocks and was sheared into contorted masses.

The dominant northeast trending folds have been cross-folded by a stress acting at right angles to the dominant stress. This cross-folding is best shown in the mine at the junction of the old northeast and southwest drifts. The ore-body was over 50 feet high on either side of this point, but here was thinned down to a few feet by a northwest trending fold in the roof, at right angles to the main folds.

Form of the Ore-bodies. The form of the deposit in cross-section is a thickened series of drag-folded lenses of ore, more highly compressed in the northeast part than in the southwest part. In the Patno shaft a nearly flat ore-body about 14 feet thick was encountered at a depth of 83 feet. The ore-body mined from the McConnell inclined shaft was an inclined "slab" of ore, 3 to 6 feet above the Patno ore-body and 5 to 14 feet away up dip. It "tailed out" on each side. The ore-body was followed northeast, down a 30-degree incline, for 210 feet, thence southwest up dip and back southeast to a point 50 feet southwest of the McConnell inclined shaft. Ore was also found when excavating the site of the old mill northwest of the main lead. The foot-wall is predominantly crystalline limestone and the hanging-walls, rusty weathering schist.

The ore-body northeast of the junction of the old northwest and northeast drifts, where the marked cross-fold occurs, has been much more severely compressed. The foot-wall at this point is also mainly crystalline limestone and the hanging-wall is schist. New development work there has proved an ore-body 20 feet wide and 3 to 12 feet thick over a length of 50 feet. The strike is north 61 degrees east and is, therefore, not parallel to that of the main lead, which strikes north 50 degrees east at this point.

FELDSPAR AND MICA

Reference: Spence, Hugh S.: "Feldspar"; Mines Branch, Dept. of Mines, Canada, 1932. This report describes all phases of the feldspar industry very fully.

Feldspar is a low-priced mineral, selling for $6 or $7 a ton. The cost of separating it from the other minerals that occur with it in ordinary rocks is so high that it is impossible to recover it profitably. Therefore, feldspar is quarried only from rocks containing large, pure masses of the mineral, and such deposits occur only in pegmatite dykes. Such dykes are very common in the area but most of them are too small, or the spar is so mixed with other minerals that they cannot be worked at a profit. There are, however, some large dykes with clean spar which are, or can be, worked.

The feldspar in Ontario pegmatite is usually the pink microcline variety of potash spar, although some soda-lime spar is also present in some dykes and is recovered. Quartz is always present, often in large,

pure masses. It is usually white, but may be rose or smoky in colour. Quartz is seldom saved because, due to its low price, the cost of transportation in most places is too high to allow profitable mining. Quartz and feldspar are often intergrown in a characteristic manner and this intergrowth is called graphic granite or corduroy spar. Graphic granite is quarried in Maine and North Carolina, but is not regarded as of commercial grade in Canada.

The other chief constituent of pegmatites, besides quartz and feldspar, is mica. This may be either the black, useless variety, biotite, or white mica, muscovite. Muscovite is seldom in good sheets in a dyke having a satisfactory grade of spar, but in a few places it can be saved and marketed. In most quarries mica is regarded as a nuisance because its presence spoils the spar.

Nearly one hundred other minerals occur in pegmatites, but most of them are very rare. In addition to feldspar, quartz, and mica there usually is some black tourmaline, and in a few places some rare-element minerals, such as euxenite. Most of these rare-element minerals are radioactive and have broken and stained the feldspar next to them. Beryl occurs in pegmatite dykes, but only in a very few of them.

Feldspar is mined by simple methods. The rock is drilled by hand or with jackhammers. After blasting, the broken rock is hand cobbed, the waste is hauled to a dump, and the spar is hauled to the railroad. Many small operators work a deposit only in the winter time, since labour is easier to get then and because it is easier to haul the spar over winter roads. Most of the feldspar from Ontario is shipped to Rochester, New York.

Fraser Township

(24) North ½, Lot 24, Concession XVI. This dyke is worked by Mr. Walter A. Barr of Westmeath. It is 1½ miles north of Indian siding, on the main line of the Canadian National railways west of Pembroke. Active mining is carried on during the winter and the spar is hauled to the railroad by team. It is shipped to Rochester, New York.

The dyke has been stripped for 200 feet along its strike and is 30 to 40 feet wide. Quarrying has been carried down about 10 feet and extended about 150 feet along the strike. The country rock is granite-gneiss, the planes of foliation of which strike north 40 degrees east (magnetic) and dip 50 degrees southeast. The dyke is not straight but is in the shape of an S-curve, being parallel to the gneiss at both ends but striking about north magnetic in the centre. The dip of the dyke ranges from 35 to 45 degrees east.

The feldspar is red microcline and is in large masses, up to 6 feet across, free from impurities. At the edges there is a strip of graphic granite 1 to 2 feet wide containing a little biotite and tourmaline.

(25) South ½, Lot 24, and Lot 23, Concession XVI. The deposits are owned by Mr. Jack Collins of Beachburg. They are served by the same road as those previously described. Several openings have been made. One cut is 80 feet long and another 20 feet square and 10 feet deep. The cuts expose much graphic granite, but very little coarse feldspar.

Head Township

(26) Carey Mine: Lot 14, Concession A. This property is three-quarters mile from Mackey station on the Canadian Pacific railway. As the road is all down grade to the station, hauling costs should be extremely low.

The dyke is 70 to 80 feet wide and has been stripped for 200 feet along the strike. It consists of large crystals of pink spar, separated by irregular bodies of quartz. There is a small amount of both white and black mica, a little pyrite, and some garnet in the walls.

The property was worked between 1924 and 1928, and about 3,000 tons of spar was shipped. The pit is 100 feet by 40 feet and 40 feet deep.

Westmeath Township

(27) Lot 3, Concession IX. A very large pegmatite dyke, with clean spar in large masses, occurs on the farm of Peter McLaren. The deposit has not yet been worked but deserves investigation.

Murchison Township, Nipissing District

(28) Cameron Prospect: North ½, Lot 19, Concession VIII. This dyke is exposed on the north slope of a hill, 9 miles from Madawaska station and 2 miles from a road. The slope of the hill is 20 degrees and the exposure is well up the side. Stripping has shown the dyke to extend for at least 40 feet down the slope and 20 feet across it. The edges of the dyke are not exposed.

The main mineral is pink microcline feldspar, in pure masses up to 8 feet wide. Large, pure masses of quartz are also present and there is some graphic granite. A small amount of biotite, in very small flakes, is present in a few places. A prospect is under option to Mr. Macdonald of Hybla.

(29) South ½, Lot 18, Concession VIII. This property is also northwest of Madawaska and is about half a mile from a road. A pegmatite dyke 50 feet long, 6 feet wide at the centre, and tapering to the ends, is exposed on the west slope of a hill. The minerals are pink microcline, quartz, biotite, and muscovite. The mica is most abundant near the walls. Near the south side of the dyke is a row of large white mica crystals, many of which are over a foot across. The mica is not first class, however, since there is some spotting and ruling.

A pit 35 feet long has been sunk to a maximum depth of 15 feet. At the bottom the dyke has narrowed to a width of one foot and probably pinches out below.

Dickens Township, Nipissing District

(30) Lot 27, Concession V. This property is a mile north of the Ottawa-Parry Sound branch of the Canadian National railways and is several miles from the nearest road, which is at Madawaska. A pegmatite dyke, 30 feet wide in a hollow occupied by a small stream, has been explored by strippings and small pits for a length of 100 feet.

Graphic granite occurs near the edges of the dyke and a strip, containing much dark-coloured muscovite, broken red garnet, and columbite,

occurs in its centre. Most of the dyke is made up of large, clean masses of feldspar and quartz. At the north end the spar is red microcline, but at the south end most of the spar is grey oligoclase.

Water furnishes the chief problem in the working of the property. The stream should be diverted to avoid trouble.

(31) Lot 14, Concession III. A body of reddish spar, carrying quartz and mica, occurs along the railway, 1½ miles west of Aylen Lake siding. It was worked between 1921 and 1923 and 500 tons of spar are reported to have been shipped from an open-cut 60 by 25 feet deep.

Sabine Township, Nipissing District

(32) Lots 28 and 29, Concession I. A 20-foot dyke of pink spar, which outcrops at intervals over a length of 1,000 feet, was worked in a small way in 1924-25. The property is one-half mile east of the Maynooth branch of the Canadian National railways. Besides the spar, considerable free quartz, a great deal of black mica, and some magnetite are present.

Gunter Quarry: (33) Lot 28, West of Hastings Road. This deposit is quite unusual in that most of the spar is the soda-lime variety. The deposit is 2 miles east of Wallace siding on the Canadian National railways. Spar is hauled by wagon over a level road. An opening 175 feet long, 20 to 50 feet wide, and 10 to 15 feet deep has been made in a north-east trending dyke.

Pure quartz, in masses up to 50 feet across, is present with large masses of clean, grey, soda-lime spar. Perfect crystals of pink potash spar, 2 to 5 feet across, occur in the quartz-soda spar masses. Small black mica flakes are present in the spar near the walls and a vein-like mass containing various sulphides (pyrrhotite, pyrite, chalcopyrite, pentlandite, arsenopyrite) occurs at the southwest end of the cut. There is also some coarse graphic granite throughout the dyke. All three of the materials, potash spar, soda spar, and quartz are separated in the quarry and shipped.

NEPHELINE

Nepheline is a grey, or a pale flesh-pink, mineral slightly resembling quartz. It is a sodium aluminium silicate, similar to soda spar in composition. It never occurs in granites or ordinary pegmatites, but occurs in nepheline syenites, which are the rocks from which corundum was formerly mined.

Nepheline can be used very satisfactorily in pottery glaze and its use for this purpose is growing. The areas where corundum was mined should be excellent sources of this mineral, since corundum occurs in large amounts only with coarse-grained nepheline syenites.

The corundum belt was studied in the early part of the century and a report, " Corundum, Its Occurrence, Distribution, Exploitation, and Uses," by A. E. Barlow, was published as Memoir 57, Geological Survey, Canada, in 1915. Very detailed descriptions of corundum and nepheline syenite occurrences are given in this report on pages 178 to 192.

One belt of nepheline-bearing rocks extends from Burgess mines, Carlow township, Hastings county, east to Lake Clear. Minable deposits of nepheline might be found along this belt. A few of the chief deposits of nepheline are listed.

Raglan Township

Craigmont: (34) Lots 23 and 24, Concession XVIII. This was an important deposit of corundum and was worked between 1900 and 1913. Large nepheline pegmatite dykes occur in the rocks making up Robillard mountain. The property is 20 miles from Barrys Bay, the nearest shipping point, and haulage costs would be high.

Brudenell Township

(35) Lot 34, Concession V, and Concession VII. The nepheline syenite in these deposits is foliated and the nepheline may be useless. The deposits are 15 miles south of Wilno station on the Canadian National railway.

Lyndoch Township

(36) Lot 13, Concession XIV. A large mass of nepheline pegmatite has been exposed by trenching on the farm of Mr. Henry Kauffeldt. The mineral is in large, clean masses and appears to be of a good grade. The deposit, however, is 25 miles from the nearest railway station, Eganville and Barrys Bay being equally close. The roads are very poor.

Sebastopol and South Algona Townships

Nepheline syenite underlies most of Sebastopol and the south part of South Algona. In concession I, South Algona (37), the nepheline syenite contains large, clean masses of nepheline. These areas are 5 to 10 miles from Eganville station. The country, however, is quite level and the roads are good. These townships should be the best prospecting ground for nepheline.

BERYL

Reference: Ellsworth, H. V.: "Rare-element Minerals of Canada"; Geol. Surv., Canada, Ec. Geol. Ser. 11, 1932, pp. 228-230.

Beryl is a mineral containing about 5 per cent of the metal beryllium and is the only source of that metal. Beryllium is a very light metal, much lighter than aluminium. It is hard, steel grey in colour, and will take a high polish. It melts at the very high temperature of 1,285 degrees Centigrade (aluminium melts at 658 degrees Centigrade). It resists corrosion and will not rust. It can be alloyed with other metals to form light, strong alloys. The price, however, is so high that it is not much used.

Beryl, from which beryllium is obtained, is a hard, glassy, bluish green mineral which occurs in six-sided crystals in pegmatite dykes. The feldspar in beryl dykes is usually good enough to be mined and most of the beryl produced is a by-product of feldspar mining.

Since the price of beryl is high and the supply is uncertain, it is not in common usage. It will probably be several years before the market for beryl becomes well established.

Lyndoch Township

(38) Lot 23, Concession XV. The presence of this dyke has been known since 1897 but it was very poorly exposed. No work was done until 1926 when Mr. T. B. Caldwell of Perth partly opened it up and took out some beryl. Nothing further has been done. The country rock is fine to medium-grained, red granite made up very largely of quartz and feldspar. The dark-coloured minerals—hornblende, biotite, and magnetite —are in irregular bands and the rock is gneissic. The dyke is about 20 feet wide, strikes north 65 degrees east, magnetic, and is vertical. It has been stripped from the east end for 100 feet, and been explored farther by a pit about 50 feet long, 5 to 10 feet wide, and 3 to 6 feet deep. At the east end the dyke is mostly coarse graphic granite of quartz and microcline. The walls are quite sharp, but the crystals in the dyke near the walls are not over 2 inches across. In the central part, in the pit, there are large crystal masses up to 6 feet in diameter of microcline, albite, and quartz. Part of the microcline is the usual pink kind, but part of it is the beautiful green kind called amazonstone. Much of the albite is in white plates (the variety called cleavelandite), but part of it is in the usual grey masses. The quartz is of different colours, white, smoky, and pale rose.

Scattered through these minerals, but mostly in the microcline that has been partly replaced by albite and a white mica, are crystals of the following: beryl, tourmaline, fluorite, magnetite, cyrtolite, columbite, lyndochite, garnet, and monazite.

Tourmaline occurs in long black crystals with three curved sides. They are usually about $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, but some are 6 inches across. The fluorite crystals are badly shattered and dull violet in colour. In size they range from one-eighth to one-half inch across. Magnetite is in small, irregular masses and is most abundant in the finer grained parts of the dyke. Garnet occurs in reddish crystals and masses up to 2 inches across.

Columbite and lyndochite both contain the rare elements columbium and tantalum. Lyndochite also contains uranium and is radioactive. They are black and here occur in rounded masses and in flat disks. They are ore minerals, and if present in large enough amounts would be valuable. Beryl occurs as well-formed, six-sided crystals, from $\frac{1}{4}$ inch to 8 inches across. In one place the crystals looked like a number of lead pencils in the feldspar. The most usual size is 1 to 2 inches in diameter. Some of the crystals are as much as 3 feet long. The crystals are broken across in many places so that solid pieces more than an inch or so long cannot be obtained. They are pale bluish green, and very few of them are clear. Many of the crystals are surrounded by radiating plates of albite (cleavelandite).

Renfrew Minerals, Limited: (39) South $\frac{1}{2}$, Lots 30 and 31, Concession XV. This property was worked in the summer of 1935, the camp for the men being on Eneos lake by the Quadville-Combermere road, over a mile from the property. The country rock is red gneissic granite. Stripping and trenching have shown the presence of a very large dyke near the south side of a hill. The walls of the dyke are not exposed but it seems

to strike about east, and probably is over 500 feet long. In the open-cut the south side of the dyke strikes north 85 degrees east, magnetic.

The main minerals are red microcline, white albite, and rose, milky, and smoky quartz. Each of these minerals is in large, pure masses, and in the west stripping rose quartz has been exposed for 90 feet. Microcline and albite occur together in some parts in masses 5 feet across, free from quartz. One area near the south side of the stripping consists of graphic granite, composed of quartz and microcline and quartz and albite. The two feldspars are not intergrown. Near this area of graphic intergrowth there are many black plates of columbite in the feldspar. Columbite occurs in the other parts of the dyke in small amounts.

Beryl occurs in the north part of the east stripping. The pegmatite there is finer grained and consists of microcline, quartz, biotite, magnetite, and beryl. The beryl crystals are pale bluish green in colour and up to 8 inches in diameter. Some of the beryl is quite impure with inclusions of biotite and magnetite. No beryl was seen in the large masses of quartz and feldspar.

A gasoline compressor was used to furnish power for a jackhammer and a crew of four men were driving an open-cut, which was 80 feet long in September 1935, into the side of the hill to cross the beryl-rich area, but results were disappointing.

Very little beryl has been found in development work and it seems very probable that there is not enough beryl to make its extraction profitable. There are, however, large amounts of excellent feldspar here and if it could be marketed the dyke might be worked at a profit. The chief difficulty is transportation, as the prospect is at least 25 miles over poor roads to the railroad at Eganville, and hauling costs would be very high.

INDEX