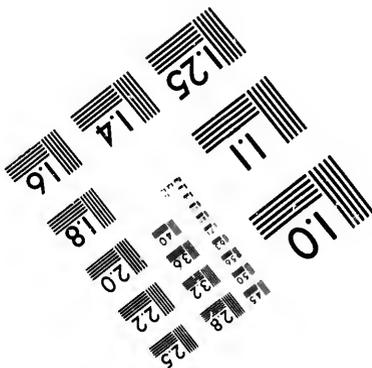
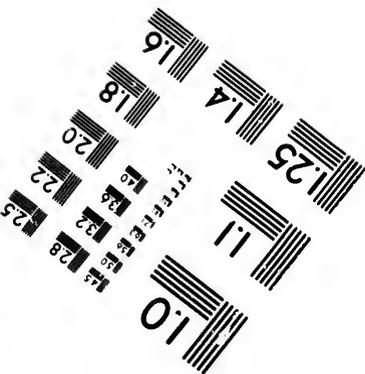
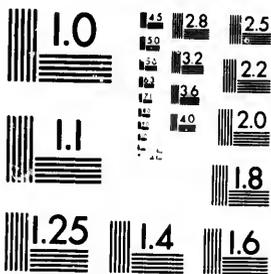


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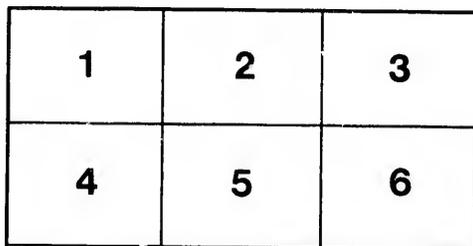
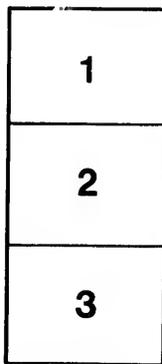
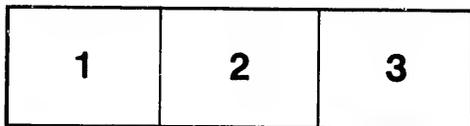
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GEOLOGICAL SURVEY OF CANADA  
ALFRED R. C. SELWYN, C. M. G., LL. D., F. R. S., DIRECTOR

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PRELIMINARY REPORT

ON THE

GEOLOGY OF A PORTION OF CENTRAL ONTARIO

SITUATED IN THE

COUNTIES OF VICTORIA, PETERBOROUGH AND HASTINGS

TOGETHER WITH THE RESULTS OF AN EXAMINATION OF

CERTAIN ORE DEPOSITS OCCURRING IN THE REGION

BY

FRANK D. ADAMS, M.A.P., SC., PH.D.



OTTAWA

PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST  
EXCELLENT MAJESTY

1894



# GEOLOGY OF A PORTION OF CENTRAL ONTARIO

SITUATED IN THE

## COUNTIES OF VICTORIA, PETERBOROUGH AND HASTINGS.

The present report contains a brief summary of the results of a preliminary geological examination of that portion of Central Ontario comprised in sheet 118 of the Ontario series of geological maps on a scale of four miles to one inch, now in course of preparation, together with the results of an examination of certain mineral deposits to which attention has recently been attracted, and which lie to the south of the above mentioned sheet in the townships of Dalton, Digby, Lutterworth, Somerville and Galway. This preliminary examination was made in order to ascertain the general geological structure of the district in question, thus laying a basis for its detailed mapping and study which it is hoped will be commenced next summer.

Sheet number 118 embraces about 3,500 square miles and is situated to the north of Lake Ontario and to the south of the River Ottawa, in the counties of Victoria, Peterborough and Hastings. In order to describe its position more accurately it may be stated that the four corners of the sheet lie in the townships of Digby, Finlayson, Hagarty and Grimsthorpe, respectively. The district was, geologically speaking, almost a *terra incognita*, the only geological information extant concerning it, being a few notes on the occurrence of crystalline limestone and gneiss at various points, made by Mr. Alex. Murray in connection with two traverses which he carried through this district as far back as 1853, together with one or two general references in scattered papers by other authors.

Area described.

Geologically speaking a *terra incognita*.

The geology of the district comprised in sheet 118 may be briefly summarized as follows: The district is a hilly one, which, leaving out of consideration the superficial or drift deposits, is occupied exclusively by the very ancient crystalline rocks of the Laurentian System with the possible exception of the south-east corner of the area in Chandos, Wollaston, Limerick, Cashel, Mayo and the adjacent townships, which is underlaid in part by the Hastings series of Mr. Vennor, by him and by Mr. Macfarlane in 1869, considered to, in some respects, resemble the Huronian,\* and a small outlier of Silurian limestone which was discovered in the township of Lynedoch, just beyond the eastern limit

\* Report of Progress, Geol. Survey of Can., 1869, pp. 5-6.

of the sheet, but which is believed to extend over the boundary of the sheet into the township of Raglan.

In the southern and eastern portions of the sheet the Laurentian contains an abundance of crystalline limestone and has all the characters of the Grenville series of Sir William Logan, in which series as is well known nearly all the mineral deposits of economic value occurring in the Laurentian in Quebec and Eastern Ontario are found. In the north-western portion of the area on the other hand our explorations have so far failed to discover any crystalline limestone, the country being apparently occupied by gneiss alone. As townships in which this crystalline limestone is especially abundant, Lutterworth, Minden, Snowdon, Dysart, Glamorgan, Monmouth, Cardiff and Brudenell may be mentioned, as well as the township of Galway lying to the south of the area embraced in sheet 118.

Occurrence of  
the Grenville  
series.

The discovery of so large an area of the Grenville series in this district is most encouraging, as indicating the probable occurrence in it of large and valuable mineral deposits.

The relation of the Grenville series, in this district, to the rest of the Laurentian which is free from limestone, has not as yet been definitely determined, although the limestones and their associated gneiss seem in certain cases to partially inclose areas which contain no limestone. Another noteworthy fact is that throughout the area occupied by these Laurentian rocks, the dip is uniformly in an easterly direction usually at moderate angles. Only at one or two points have westerly dips been observed and these are quite local.

Hastings  
series.

The relation of the Hasting series, occurring in the south-east corner of the sheet, to the Laurentian above described, is also as yet uncertain. Like the relations of the subdivisions of the Laurentian to one another this can be determined only as the area is mapped in detail. One of the most marked characters of the Hastings series in this district is the great development in it of pyroxenic and hornblendic rocks, many of which are without doubt of eruptive origin, and which serve to obscure the relation which it bears to the Grenville series. The rocks of the two series as seen in this area are otherwise not very unlike petrographically, but it must be noted that the portion of the Hastings series included in this sheet was supposed by Mr. Vennor to represent only its lower horizons, while the upper portions containing the conglomerates, shales, &c., which are well developed further south, are here absent. In this south-east corner there are also several large intrusive masses of granite, probably of the same age as those which occur immediately to the south. These occurrences augur well for the discovery of gold in this district; since, as Mr. Coste has shown, the gold deposits

of the Hastings district are all intimately associated with these southern granites.

In addition to these great intrusions of pyroxenic rocks and of granite, a very extensive and most remarkable mass of nepheline syenite was discovered in the townships of Faraday and Dunggannon. The exact distribution of this has not as yet been worked out, but it has been traced for a distance of over seven miles in an approximately east and west direction, from the York River, about the middle of the township of Dunggannon, across the Hastings road to a point some distance west of the village of Bancroft, in the township of Faraday. This is a rare rock, found in but few places in the world and never before discovered in our Laurentian System. The nepheline is very abundant, forming in many places an almost pure nepheline rock. The mass is flanked on the south along a considerable part of its course by crystalline limestone and it is also intimately associated with a fine grained feldspathic rock resembling aplite. It is of a prevailing gray colour and often has a distinct foliation coinciding with that of the associated rocks. The rock in places becomes exceedingly coarse in grain, individuals of nepheline as much as two feet and a half in diameter having been observed by the York River on Range XI. of Dunggannon, near the side line of lots 12 and 13. Although this mineral is one which has no great economic value, masses such as those referred to would sell for considerable prices as mineral specimens. In this nepheline syenite, in the form of veins and irregular masses, the beautiful blue mineral sodalite was found in a number of places. A good specimen of it from lot 29, range XIII. of Dunggannon, is on exhibition in the museum of the Geological Survey in Ottawa. On lot 25, range XIV. of Dunggannon, however, on the property of Mr. John Bowers, these veins and masses attain a very considerable size and are somewhat numerous. Some of these, consisting of bright blue sodalite, ten by ten by four inches in size were observed, and probably larger specimens could be obtained by blasting. This mineral could be employed as a substitute for *Lapis Lazuli* in the manufacture of various ornamental objects, and such large masses would also have a very considerable value as mineral specimens. A specimen of it which was cut and polished for me by Mr. R. Forsyth of Montreal, shows that the mineral would present a handsome appearance when so prepared. Being a surface specimen however, it was found to be traversed by minute cracks which caused it to crumble somewhat readily; these would however in all probability not occur in the unweathered specimens obtained some distance below the surface. The occurrence of certain other interesting minerals has also been noted in this rock and a special paper on it is being prepared.

Large area of  
nepheline  
syenite.

Silurian  
outlier.

The outlier of Silurian limestone in the township of Lynedoch is of much interest as proving, what was before conjectured, namely, that the flat Silurian limestones of the plains of central Canada were once continuous over the rough and hilly Laurentian country to the north, at least as far back as the Pembroke basin, where an isolated area of these rocks has long been known to exist.

Valuable  
minerals.

Deposits of iron ore, mica, apatite and other valuable minerals were found in the district embraced in the sheet, but as a detailed examination of these and report upon them will be made later on as the mapping of the area progresses, they will not here be further referred to.

Laurentian  
area to south  
of sheet 118.

To the south of the area embraced in sheet 118, there is a narrow strip of Laurentian country lying between the southern limit of 118 and the flat Silurian limestones above mentioned. This strip is underlaid by gneisses which in many places are associated with crystalline limestones and forms a southerly continuation of the district above described as occupying sheet 118. In the western part of this strip in the county of Victoria the existence of certain mineral deposits supposed to be of economic importance having been reported, I was instructed to examine these with a view to determine their character and value. As this district lies outside of the sheet assigned to me for mapping, it will not be included in any subsequent report and I have therefore considered it best to state the results of my examination of these deposits in this place. The assays of the ores I collected have in all cases been made in the laboratory of the Geological Survey under Mr. G. C. Hoffmann, the chemist to the Survey, and may therefore be relied upon as of undoubted accuracy. The consideration of these deposits may be best taken up under the heads of the several townships in which they occur.

*Dalton.*—This township is underlaid by reddish orthoclase gneiss with dark micaceous or hornblendic bands: it is excellently exposed over a large part of the township, but no crystalline limestone was seen nor could the existence of any be ascertained by inquiry. Cutting through the gneiss there are a great number of coarse grained granite veins, composed of quartz and felspar, with black mica or magnetic iron ore or sometimes both. The veins are in some places very abundant and of considerable size. They vary somewhat in size of grain and when very coarsely crystalline the black mica or magnetite is often in masses of considerable size. The former is not of a colour or size to be of economic importance, but in a number of places the latter has attracted considerable attention. From some of these veins excellent hand specimens of iron ore can occasionally be obtained, but they do not contain ore in anything like sufficient quantity to be of economic

value, nor can they be considered as indicating the presence of heavier deposits in this vicinity. Small quantities of iron ore were observed in perhaps a hundred different places in the township; but always occurring in this way. As a locality where these masses of iron ore are larger than usual, attaining a diameter of several inches, lot 26 of range XII. may be cited.

On lot 25 of the same range, gold was reported to have been discovered. On visiting this locality the opening was found to be situated on one of the granite veins above mentioned. The vein was a foot wide and was composed of quartz, felspar and black mica, with a little magnetite, chlorite, iron pyrites and allanite. It cuts orthoclase gneiss with dark hornblende bands, one of these latter forming the foot wall in the opening. A series of specimens were taken representing the average of the vein as exposed in the opening. These were assayed in the laboratory of the Survey, but were found to contain neither gold nor silver. The small yellow grains of iron pyrite may have been mistaken for gold. The occurrence of the somewhat rare mineral allanite in this vein, although in small quantity, is of interest. This mineral was found last summer at three places in the district examined, and was formerly known to occur in but three localities in the Dominion. It is black in colour, possesses a lustre like pitch, and contains several rare elements.

*Digby.*—The western portion of this township may be considered geologically as an eastward extension of the township of Dalton, while in the eastern portion some crystalline limestone appears, causing it in this way rather to resemble the adjacent part of the township of Lutterworth. Granite veins also occur here in great abundance, holding small quantities of iron ore as in Dalton. A number of localities from which iron ore was reported were visited. Among these may be mentioned one about half a mile south of Smudge Lake, where a granite vein eight feet wide was found, in which magnetic iron ore occurs sparingly in strings and patches, the largest of which measures only seven by two inches. Small quantities of iron ore were also found on lot 15 of range VIII. scattered through the gneiss. This ore contains titanitic acid.

On lot 16 of VII. a small string or vein of molybdenite was observed in the gneiss. It was five inches long and one inch and a half wide, and coincided in direction with the strike of the gneiss. It was pure and of good quality, and although this vein is not sufficiently large to be worked with profit, yet its occurrence in this district indicates that larger deposits may be discovered on careful search for them. Molybdenite when pure is worth about fifty cents a pound.

Township of  
Lutterworth.

*Lutterworth.*—In this township there is an abundance of excellent crystalline limestone, especially in that part of it which lies to the east of Gull Lake. Much of this is very pure and constitutes a veritable marble, as on lots 19 of ranges IV. and V., and on lot 20 of V., while elsewhere it contains grains of hornblende, mica, serpentine and other minerals scattered through it. This limestone would yield excellent lime, and could also be employed for building purposes if sufficiently accessible. It is, however, rather coarse grained for very fine work or for statuary.

There is a local tradition that silver was formerly mined at Miner's Bay on the east shore of Gull Lake. No workings are known to exist, however, and no ore is ever known to have been discovered in the vicinity. A little molybdenite in flakes and crystals was found in the gneiss at this locality. This may, on account of its silvery appearance, have been mistaken for an ore of silver.

Molybdenite disseminated through crystalline limestone also occurs on lot 23 of range V.

Molybdenite  
and graphite.

Graphite was observed in small quantities in the gneiss and limestone at several localities. I am informed that it occurs more abundantly on lot 15 of range IV.

A deposit of iron ore on lot 5 in the northern part of range V. and the southern part of range VI. of this township, was at one time worked quite extensively, several hundred tons of ore were extracted and shipped, but work was discontinued seven or eight years ago. Two large openings and several small holes have been excavated in the deposit, but are now for the most part filled with water. The country rock is a reddish gneiss interstratified with many small amphibolite bands as well as with a small band of crystalline limestone.

Iron ore.

The ore body conforms to the strike of the gneiss, but is irregular in width. In one of the main openings it is thirty-five feet wide. This, however, is not all iron ore, since—as is the case with so many of the iron ore deposits in these Laurentian rocks—the ore itself is mixed with a large quantity of various black ferruginous silicates such as hornblende, pyroxene and garnet. The ore body is also cut by many reticulating veins holding quartz, calcite, orthoclase, pyroxene, seapolite, allanite and other minerals. The ore is almost free from pyrite and other sulphides, and specimens selected by me and examined in the laboratory of the Survey were found to be free from titanium, but as above stated, it contains a large proportion of various silicates amounting in the case of a sample examined by Professor Chapman to 23.80 per cent, while other samples would give considerably higher percentages. The presence of these silicates, however, while lowering the percentage

of iron, produces an ore which is easily smelted and which closely resembles the so-called self-fluxing ores of Sweden. The following analysis of the average ore from this "Paxton Mine" is given by Mr. Hamilton Merritt:

Oxide of iron.....	67.77	(Metallic iron	48.64).
Silica.....	19.30		
Alumina.....	0.24		
Lime.....	3.81		
Magnesia.....	3.38		
Sulphur.....	0.03		
Phosphorus.....	None.		
Titanic acid.....	0.15		

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100.68

*Galway (with the adjacent part of Somerville).*—This township is almost entirely occupied by crystalline limestone and the peculiar gneisses usually associated with it. As a field for the discovery of mineral deposits it is one of the most promising townships in the whole area. I had been especially directed to examine certain deposits, supposed to contain nickel, in this district, and accordingly devoted much attention to these, visiting almost every deposit in the township supposed to contain this metal.

Townships of  
Galway and  
Somerville.

These deposits, consisting as they do of pyrrhotite with some pyrite, are often compared to the Sudbury nickel deposits; an examination of the district, however, shows that the geological relations of the two sets of deposits are quite different. The ores in the Sudbury district occur in great diorite intrusives near their contact with granite or with the stratified rocks of the district, which are of Huronian age, while these of the townships of Galway and Somerville occur as impregnations in bands of gneiss belonging to the Grenville series. The two sets of deposits are quite different therefore in mode of occurrence and probably in age, and what has been proved to be true of the former cannot by any means be regarded as indicating what may be expected in the case of the latter. This conclusion, reached from a geological examination of the two areas, is borne out by the results of Mr. Hoffmann's assays.

Everywhere throughout the Laurentian System, as far as explorations have been carried, where bands of crystalline limestone occur these are accompanied by, or associated with, bands of a very rusty weathering gneiss. The gneiss on a fresh fracture is light in colour, often nearly white, the property of weathering with a rusty surface being due in most cases to the dissemination through it in larger or smaller amount of sulphides of iron in the form of the yellow minerals

Pyrrhotite  
and pyrite in  
gneiss.

known as pyrrhotite and pyrite, which on exposure to the weather decompose into hydrated oxide of iron or iron rust. These bands of rusty weathering gneiss are especially large and well developed in the township of Galway and it is in them that openings have been made in a number of places in the expectation of finding nickel or gold and silver. The quantity of the sulphides above mentioned in some of the bands is very large. At several points in the decomposed rusty material forming the "gossan" surface of the bands, pockets of pale green hydrous sulphate of iron or copperas, locally termed "salt," and known to mineralogists as melanterite, often containing several pounds weight of this material, were found. It is also derived from the decomposition of these sulphides of iron, and when obtained in sufficient quantity it is employed in dyeing and tanning as well as in the manufacture of ink and Prussian blue. The following are some of the localities where these mineral deposits were examined:—

Gossan hold-  
ing copperas.

*Somerville, Lot 1, Range XI.*—On this lot which abuts on the township of Galway a very rusty weathering band of gneiss crosses the Bobcaygeon road. It is about 150 yards wide, striking about N. 10° W. with an east dip and is flanked on either side by crystalline limestone. Two shallow pits have been opened in it, exposing the rock for a few feet below the surface. This is seen to contain pyrite disseminated through it in strings and in some places to be rich in garnet. The amount of pyrite contained in the rock must be very considerable and the strings in which it occurs are often of large size. The rock weathers to a loose porous very rusty mass containing in places, in pockets of considerable size, the hydrated sulphate of iron above referred to as a decomposition product of the pyrite. This rock was stated to have been assayed and found to contain a large amount of gold with some nickel. It had also as usual been examined with satisfactory results by a mineral rod man. A number of samples were accordingly taken, those containing as much pyrite as possible being selected, since these would contain the maximum amount of the metals in question. These were assayed in the laboratory of the Survey and found to contain:—

Gold. ....	None.
Silver.....	None.
Nickel.....	Faint trace.

*Galway, Lot 1, Range X.*—Here a hole fourteen feet deep has been sunk in a quartz vein in gneiss. The vein was about two feet thick at the surface and contains some calcite and pyrite with a small amount of pyrrhotite. I was informed by the owner of the property that the ore had been assayed by Professor Chapman of Toronto, who found that

it contained nothing of value, but that an assayer in Oregon had returned it as containing 30 oz. of gold to the ton in addition to silver, nickel and copper. Several specimens were accordingly selected containing more than an average amount of the metallic constituents and these were assayed in the laboratory of the Survey. Mr. Hoffmann reports that they contain :—

Gold.....	None.
Silver.....	None.

The proportion of the metallic constituents in the vein was on an average so small that it was not considered worth while to incur the trouble and expense of assaying it for nickel.

*Galway, Lot 16, Range XV. (north end).*—Here a pit eight feet deep has been sunk in a thick band of very rusty weathering gneiss which appears to strike a little to the east of north and dips to the east at an angle of about 30°. As usual this gneiss is associated with crystalline limestone which occupies the greater part of the lot. In this gneiss there are some bands containing a good deal of garnet as well as some composed of quartzite. All contain both pyrite and pyrrhotite, often in large amount. Masses of these sulphides, especially of the latter as much as seven by twelve inches in size, are seen on the walls of the pit. As the band is so large and the amount of the sulphides present so great, the deposit is well worthy of a thorough exploratory examination. In order to ascertain its probable value a large number of fragments were broken from various places on the walls and bottom of the pit, selected so as to represent as nearly as possible an average of the whole as here exposed. These contained a large amount of both pyrite and pyrrhotite and were assayed in the laboratory of the Survey with the following result :—

Deposits of  
pyrrhotite  
and pyrite in  
gneiss.

Gold.....	None.
Silver.....	None.
Nickel.....	Faint trace.

*Galway, Lot 16, Range XIV. (south end).*—A pit of about the same depth as in the case of the last deposit has here been sunk on the line of contact between the crystalline limestone and the rusty weathering gneiss. The latter, which where perfectly fresh is light grayish in colour, contains a considerable amount of pyrrhotite, with some pyrite, in strings often several inches wide. If these minerals contained any valuable metal in considerable amount, this deposit would also be worthy of a thorough exploratory examination. Some of the pure pyrrhotite was accordingly selected and was assayed in the laboratory of the Survey. Mr. Hoffmann reports it to contain :—

Gold.....	None.
Silver.....	None.
Nickel (with some cobalt).....	·05 p.c.

This percentage of nickel is of course far too small to give the mineral any value as an ore.

*Galway, Lot 18, Range IV.* ("Reynold's Mine.")—This deposit was examined by my assistant, Mr. A. A. Cole, B.A., who reports that a pit forty by eight and twenty-three feet deep has been sunk on a bed or vein of white quartz, from four to six feet thick, which is interstratified with fine grained dioritic gneiss. Pyrrhotite mixed with pyrite occurs in bands in the quartz. The largest of these appearing at the surface is four inches wide, but expands in places so as to form pockets, while elsewhere the metallic minerals occur finely disseminated through the quartz. A specimen of the pyrite and pyrrhotite, nearly free from gangue, was assayed in the laboratory of the Survey, with the following results:—

Gold.....	None.
Silver.....	None.
Nickel (with some cobalt).....	10 p.c.

Here again the nickel is entirely too low for profitable working.

Openings have also been made in search of nickel at the following localities:—

*Galway, Lot 11, Range XVIII.*—An opening has been made at the contact of rusty gneiss and crystalline limestone; both hold pyrrhotite in small amount in the form of little grains and strings.

*Galway, Lot 11, Range IV.*—Highly quartzose gneiss, often garnetiferous, containing small quantities of disseminated pyrrhotite.

*Galway, Lot 15, Range IV.*—Two small openings in rusty weathering gneiss overlaid by crystalline limestone. A little pyrite and pyrrhotite seen in places.

*Galway, Lot 7, Range A.*—Two openings, one in crystalline limestone, carrying a small quantity of pyrrhotite, and the other in a fine grained gneiss, carrying some pyrite and a little pyrrhotite.

In view of the absence of gold and silver and the very low percentage of nickel present in the heavily impregnated deposits, it has not been considered necessary to assay specimens from these last four localities, where the deposits are similar in character, but poorer in metallic minerals.

The deposits  
unlike those  
at Sudbury.

The examination of these deposits therefore goes to show, that although in some cases the pyrrhotite and pyrite occur in sufficient abundance to enable the deposits to be profitably worked if these minerals were rich in nickel, that, unfortunately, unlike the pyrrhotite of the Sudbury district, they carry nickel only in very small amount. In this connection it is extremely interesting to compare the pyrrhotite depo-

sits of Norway with those of Canada. In Norway, as is well known, there are very large deposits of this mineral, associated with pyrite, which are rich in nickel and have for many years been extensively worked for this metal. These occur intimately associated with great masses of an intrusive rock belonging to the gabbro family, through which the pyrrhotite occurs disseminated, the workable deposits being apparently parts of the gabbro mass especially rich in this constituent.

These Norwegian deposits are the equivalents of the deposits of the Sudbury district in Canada, where similar great pyrrhotite deposits, rich in nickel, are related in precisely the same way to great intrusive masses of a rock closely allied to the Norwegian gabbro and which in Canada is called diorite.

In Canada, as in Norway, the pyrrhotite deposits are probably a peculiar product of the differentiation of the gabbro or diorite magma. Canadian and Norwegian deposits compared.

In Norway there are also bands of gneiss, mica schist, quartzite and other similar rocks heavily impregnated with pyrrhotite and other sulphides. These are called "Fahlbands" and closely resemble those just described from Galway and Somerville. In these the pyrrhotite, although often present in large quantity, is so poor in nickel that it is valueless. In both countries the geological formations and the mode of occurrence of the two classes of deposits are the same and in each case the ores associated with the diorite or gabbro rock are rich in nickel, while those impregnating the gneiss so far as they have been examined, contain hardly any. I know of no case where the value of geological study as applied to ore deposits is better illustrated or where the knowledge obtained from the study of the ore deposits of one land is seen to be of such practical value when applied to those of another land where the geological conditions are the same.

Concerning these Norwegian Fahlbands, Prof. Vogt, of Christiania, in a recent paper\* writes as follows, and it will be observed that his remarks might be applied almost word for word to the Canadian deposits:

"The Fahlbands are bedded or apparently bedded deposits consisting of pyritous impregnations in certain schists, as for example mica schist, hornblende schist, quartz schist, garnetiferous gneiss, hornblende gneiss, &c., and occurring without any connection with gabbro rocks. The schist containing the ore, which varies in amount from place to

\*"Zeitschrift für praktische Geologie," Jan. 1893, p. 130. This paper, which is continued in the April and July numbers of the same publication, contains an excellent description of the Norwegian deposits. A short paper entitled "The Nickel Deposits of Scandinavia" by the same author, illustrated by cuts, showing the mode of occurrence of the nickel ore, appeared in the "Canadian Record of Science" for April, 1892. A somewhat extended resumé of Prof. Vogt's work is also given by the present writer in a paper entitled "On the Igneous Origin of certain Ore Deposits," in the "Canadian Mining Review," February, 1894.

place, can often, although quite thin, be traced for miles. The geological difference between these and the nickel deposits associated with the gabbro is evident. . . . It must also be emphasized that the pyrrhotite and pyrite of these Fahlbands are invariably characterized by a very small content of nickel and cobalt. Hundreds upon hundreds of analyses of these minerals from the Fahlbands have been made and a very small amount of nickel and cobalt ranging from .1 to .5 per cent has always been found. So far as I am aware no pyrrhotite is known for these Norwegian Fahlbands which contains 1 per cent of these metals."

Iron ore.

Deposits of iron ore are also known to occur in Galway. One of these situated near Swamp Lake on lot 23 of range XII, was visited. The country rock is a reddish gneiss, interstratified with a dark hornblende gneiss, which latter rock in places, for a width of several feet, contains grains and strings of red garnet, yellowish green epidote and magnetic iron ore. Although good specimens of magnetite can be obtained, this mineral is too scattered and not present in sufficient amount at this point to make an ore of much value. If, however, the deposit were traced out on its strike the magnetite might somewhere be found to come in in larger amount. A good specimen of iron ore from this lot was analysed by Professor Chapman and found to contain :

Metallic iron .....	62.60 p.c.
Oxide of manganese .....	1.27 "
Phosphorus .....	0.01 "
Siliceous rock matter .....	12.18 "

Another deposit occurs on lot 27 of range XIV, of Galway. A sample from this was, some years ago, examined by Professor Chapman and found to contain :

Metallic iron .....	62.87 p.c.
Siliceous rock matter .....	13.27 "

Lead ore.

A deposit of lead ore has been opened on lot 20, range A, of Galway. A shaft with lateral drifts has been sunk to a depth of about 100 feet, but this at the time of my visit was filled with water. Near it, however, a short tunnel is driven in the vein from a hill side. In this the vein is seen to vary somewhat in width, but to be fourteen inches wide at its widest part. The vein stone is barite with some calcite, carrying in the tunnel a few grains of iron pyrite, zinc blende and galena. A considerable amount of galena has been taken from the shaft where the vein is said to be somewhat wider and contains the galena in pockets. I am informed that about thirty kegs of galena have been shipped. A number of specimens of the galena and barite as well as a few of calcite and zinc blende now lie about the mouth of

the shaft. As the value of the galena would depend largely on its content of silver, which metal is almost invariably found in galena, but is present in very variable quantity in the galenas from different localities, I selected some of the pure galena from the shaft and handed it to Mr. Hoffmann for examination. It was, however, found to contain neither gold nor silver. Its value will therefore depend on the high percentage of lead which it contains. The vein cuts gneiss which is interstratified with crystalline limestone. A vein similar in character to the one just described and which is probably a continuation of it, is seen on lot 1 of range VII. of the adjacent township of Somerville. It is vertical in position; cuts a highly micaceous gneiss and is exposed in two shallow pits. It is from five to six inches wide and is composed of barite with some calcite, carrying in places a little galena.