

There is a general feeling among miners of Ontario who have had to do with phosphate that mica does not as they say "go down." I think it would be well to hear from some of the practical miners here upon that point. Perhaps Dr. Ellis can give us an opinion even better than the practical men. It is the coming industry in some of our sections of the country, and we would like to know what we can hope for.

MR. HIGGINSON—With regard to the depth of mica, we have found within the last three weeks mica at a depth of 225 feet from the surface in our phosphate beds, and several of the crystals at that depth were 18 inches by 2 feet in diameter.

DR. ELLIS—So far as I know, the occurrences of phosphate are very closely identified with pyroxene dykes, and these dykes are deep, so that there is no reason why mica should not occur at great depths. In the case of the Villeneuve mine, the conditions are precisely the same as those of the phosphate in the pyroxene dykes. Mr. Franchot mines within 10 feet of the gneissic deposit alongside.

MR. HOPPER—The Sydenham mica people, I understand, get their best mica at a depth of 200 feet.

MR. FRANCHOT—Capt. Watters gets his best mica at a depth of 250 feet.

Messrs. J. Burley Smith, S. P. Franchot and Theo. Doucet also discussed the paper. Prof. Harrington, of McGill University, contributed an interesting address on some of the scientific aspects of the mineral, but as the revised notes of what he said have not been returned up to the hour of going to press, they are withheld until our next issue.

The following paper, by Mr. J. Bawden, of Kingston, was read by the Secretary:—

The Iron Ores of Frontenac and Leeds, Ontario.

The counties of Frontenac and Leeds form the southerly half of an extensive iron ore district, the northerly half of which is made up of the counties of Lanark and Renfrew. The latter portion is not of less interest, indeed there is reason to believe it the richer field of the two, but the greater accessibility of the frontier field by means of the Rideau Canal and the Kingston & Pembroke Railway, and the greater attention given to its features, induce the writer to confine these notes to a summary of what has been learned in the course of mining operations in the district under consideration.

In a series of Canadian Geological Survey reports covering the period from 1870 to 1875, the late Henry G. Vennor gave the results of his labors in Frontenac, Lanark and Renfrew. Prefacing his conclusions with the remark that in the then "imperfect state of knowledge respecting the Laurentian rocks proper and those which immediately follow, or interpose between them and the lower Silurian formation, any positive assertions as to the relative age of a large portion of those examined by him would be hazardous," he groups them under six divisions. (See report for 1874-5, p. 122 etc.) He states his doubt, however, as to their stratigraphical order and whether they represent one or more formations.

Approaching the highest member of Vennor's series the outcrops of the Potsdam formation occur, referred to in Logan's report for 1863 as extending from the straits of Belle Isle to the west side of Knowlton Lake, Loughborough township, a distance of 1,000 miles. This formation appears more extensively in Leeds than in Frontenac. Along its outcrops on the shores of Charleston Lake, and other lake expansions of the Rideau Canal, and on Islands in these waters, red hematite ore is met, but in what quantity no thorough exploration permits the statement. The same ferruginous outcrop extends across Frontenac from Dog Lake in Storrington to the middle of the rear line of Portland, attended at several points with deposits of the same ore. The existence of red and brown hematite in Kennebec, the topography of the south-western part of Hinchinbrooke and local reports, support the presumption that the frontier of the Potsdam sandstone extends throughout Leeds and Frontenac, a distance of 80 miles. In Lansdowne, Storrington and Loughborough, it is crossed by calcite dykes or veins carrying galena and baryta. On its northern boundary, the formation throughout a great part of its course appears in the vicinity of an extensive hypersthene gabbro, with veins and lenses of apatite, pyroxene and black mica.

The red hematites of the Potsdam formation, appear superficially to be altered pyritous deposits. A sample from lot 19, 9th Con. south Crosby, gave 28.14 iron; from lot 2, 7th Con. Bedford, 32.30 iron; Ph. 1.02; from lot 7, 10th Con. Portland, 68.58 iron. I am indebted to the Bethlehem Iron Co., who purchased 30,000 tons of ore from the Wallbridge mine, Hastings, in 1882, for several analyses the mean of which is as follows:

Fe.....	48.278
Si.....	21.73
MngO.....	.251
Mg.....	1.833
Al.....	1.175
CaO.....	6.67
P.....	.036
FeS.....	1.62

The extremes are, Fe, 36.62; Si, 41.47; Fe, 56.9; Si, 9. The minor constituents are almost invariable. This ore is found with a boundary of dolomite on either side, similar to the position of the ore on lot 2, 7th Con. Bedford. The occurrences of hematite north of the Potsdam formation, so far discovered are few. One of specular ore on lot 1, 9th Con. Palmerston, lies at an elevation above the Robertsville magnetic ore mine on lot 2,

adjoining. The hematite occurrences are enumerated hereunder:

Escott—Lot 7, 2nd Con.; lot 17, 6th Con.
Lansdowne—Lot 13, 10th Con.; lots 17, 18, 8th Con., lot 20, 7th Con., rear of Lansdowne, lot 11, 12th Con.
Bastard—Lot 23, 10th Con.
S. Crosby—Lot 19, 9th Con.
Limonite—Lot 1, 11th Con., rear of Lansdowne, lot 21, 7th Con., Bastard.
Loughboro'—Lot 7, 9th Con.; lot 25, 13th and 12th Concessions.
Portland—Lot 7, 10th Con.; lot 6, 14th Con.
Bedford—Lot 15, 3rd Con.
Palmerston—E ½ lot 1, 9th Con.
Kennebec—Lot 11, 8th Con.

The first furnace and forge built in Ontario at the beginning of this century, were supplied with ore from lot 11, 12th Con., rear of Lansdowne. Tradition does not speak well of the character of the material made. Nevertheless the wide distribution of a ferriferous formation like the Potsdam and the little disturbance it has undergone in these counties, should encourage the search for hematite ores under the drift and alluvium wherever the least indication warrants it. If the ore grades low the time is perhaps at hand when it will be found economical to roast it, to render it susceptible of magnetic separation.

The magnetic ores of Frontenac and Leeds, as well as Lanark and part of Renfrew, are assigned by Vennor to synclinal lines in successive terranes distinguished by lithological characteristics. A locality not referred to by Vennor, extends from lot 5 in the 11th to 5 in the 13th Con., reappearing on lot 3 in the 13th Concession of Portland. Whether this is all in one formation is as yet unknown. On lot 5, 13th Con., the ore is said to be of good quality. On lot 3, 13th Con. (485 ft. A.S.), a ferruginous quartzite, breaking with a diagonal cleavage, yields a varying percentage of ore. A somewhat similar ore on lot 2, 3rd Concession of Bedford, gave the following:—

	(1)	(2)	(3)
Fe.....	71.75	51.	26.40
Si.....	4.20	22.2	....
Al.....	....	6.8	....
CaO.....	1.60	....	....
S.....	.70	....	....
P.....	....	....	0.032
MngO.....	.25	....	....
TiO ₂.....	....	....	.872

In the next range (552 ft. A.S.) on lot 3, 3rd Concession Bedford, a hard crystalline magnesian limestone accompanies the ore. At one opening the ore is disseminated in small grains through the rock, giving on analysis 23.70 Iron, Ph. .009. On the same lot, a pit 8 feet deep, shows a vein 3 feet wide, samples from which gave Fe., 63.50; Ph., trace; Ti., .080; S., 105. This range has not been explored any distance.

The succeeding range, proceeding northerly, is the 6th in Vennor's series, the elevations in which are from 500 to 600 feet A.S. The range extends about twelve miles in Bedford, and if extended to lots in North Crosby supposed to be in the range, is twenty miles in length. At its north-easterly termination in Bedford it is faulted between the 9th and 10th Concessions, and it would seem there are throws and displacements at several points near its south-west extremity. Here the ore is irregularly distributed through syenitic rock in bodies of more or less value. At 70 feet in depth, quantities of black tourmaline accompany the ore. About a quarter of a mile distant, the ore is found in dolomitic rock, in which it can be traced fully a mile, when the rock again changes character. The dolomite on the north wall gives place to hornblende rock, and this changes again with the depth of the formation so as to lead to the belief that superficial overflows have changed the character of the overlying rock. In the further course of the range a remarkable development of schorlaceous schist enclosing crystals of black mica occurs on lot 9, 5th Concession. The ore mined on this range has presented varying characteristics, being remarkably pure during the earlier operations. It is for the most part highly crystalline, and has shown comparatively little sulphur until reaching the last few fathoms of work in the main shaft. The following assay is the mean of several analyses made for the Ohio Iron Co., of Zanesville, Ohio, the former lessees of the mine:—

Fe.....	62.73
Si.....	8.03
Mng.....	.58
CaO.....	.65
Mgo.....	3.45
P.....	.0115
S.....	2.41
Ti.....	Trace

Five drill cores taken from the main shaft averaged 110 feet each of mixed greenstone and ore. The latter gave, (mean of several analysis):—

Fe.....	55.48
Si.....	8.04
Ph.....	.003
S.....	.0482
Mgo.....	7.23
CaO.....	3.15
Mng.....	3.52
Al.....	.67
Ti.....	Nil

At Black Lake, lot 8, 4th Concession with syenite foot-wall, greenstone hanging wall, the ore had the following average composition:—

Fe.....	62.03
Al.....	1.22
Si.....	2.56
CaO.....	1.17
Mgo.....	1.72
Mngo.....	.63
S.....	.273
P.....	.0149
Ti.....	.626

Between the range just noted and the next is a distance of 8 miles. The Eagle Lake range, the 5th of Vennor, probably extends from the K. & P. Railway westward some six miles, eastward 20 miles, approaching within 3 miles the C. P. R. line in Bathurst township. Analysis of this ore (Harrington's) gives:—

Fe.....	62.52
Al.....	.67
CaO.....	.33
Mg.....	.82
Ph.....	Trace
S.....	.07
TiO ₂	3.28
Insol. res.....	8.38

Apatite is disseminated in much of the ore in crystals and grains, the latter difficult of separation in the laboratory. The readiness with which titaniferous ores open up when heated to redness and thrown into water, remarked by Auguste J. Rossi, makes it probable this ore could be concentrated to a high grade at moderate expense.

A large phosphate mine at St. George's Lake in Oso is the only mineral producer in a distance of 20 miles, lying chiefly within Vennor's 4th and 5th groups, until the Robertsville mine is reached. It is not to be inferred that this region is nonferriferous. On lot 17, 11th Concession, Olden, magnetic ore is found which gives on analysis (Hoffman's):—

Ferrous oxide.....	28.975
Ferric ".....	68.46
Insol. res.....	1.364
No Titanium.....	....

Magnetic ore is reported to be found on lots 11, 11th concession, 10 in the 4th concession and 7 in the 6th concession of the same township. West of this township brown and red hematite are found on lot 11, 8th concession, Kennebec within two miles of the C.P.R. line.

The Robertsville mine in Vennor's 4th division, A.S. 665 feet, is on lot 2, 9th concession of Palmerston. At 250 feet in depth the ore gave on analysis:—

Fe.....	57.17
Si.....	15.10
Al.....	.29
CaO.....	6.38
Mg.....	2.47
Mno.....	.40
S.....	.08

This mine was a producer for the Charlotte, N.Y., furnace, and it is said supplied selected ore, guaranteed to run 65 Fe, to a furnace at Pittsburgh. On an elevation on the lot adjoining (lot 1, 9th concession,) specular ore is found. Magnetic ore is found in the same range on lots 3, 5, 6, 10 and 11 in the 9th concession, 7 in the 10th and 21, 27 and 28 in the 11th concession of the same township.

West of Palmerston large bodies of magnetic ore are reported to be found in the townships of Clarendon and Barrie. No geological work appears to have been done on this range which is probably on the line of an extensive range of dolomite running north-easterly into South Canonto and thence into Lanark County. The extension of the Brockville and Westport Railway will serve to open up the property.

The magnetic ores of North and South Crosby are connected by Vennor with the feriferous magnesian limestones of Frontenac. He cautiously qualifies his statements however, as to the super-position and order of any member of the series. The principal locality is Chaffey's mine on an Island in Mud Lake, lot 9, 6th concession, South Crosby, which has been a considerable producer and the ore is said to be cheaply mined. The following are analyses:—

Ferrous oxide.....	10.03	....
Magnetic oxide.....	60.57	69.77
Si.....	7.08	7.10
Fes.....	1.53	....
Al.....	3.69	5.65
TiO ₂	11.43	9.80
Ph.....	....	.085
S.....	.82	1.52
Mgo.....	4.96	4.50

In North Crosby, ore from lot 27, 4th concession, gives:—

Fe.....	65.27
Al.....	1.33
CaO.....	.82
Mgo.....	.84
Ph.....	.007
S.....	.12
TiO ₂	1.03
Insol.....	5.25

and ore from lot 2, 9th concession, South Crosby.

Fe.....	63.2
Si.....	6.8
S.....	.02
CaO.....	3.3
Al. and Mg.....	1.8