

XI.—*Notes on some North American Pyrrhotites, and other Minerals containing Nickel.*

BY HENRY HOW, D.C.L., PROFESSOR OF CHEMISTRY, UNIVERSITY OF KING'S COLLEGE, WINDSOR, NOVA SCOTIA, *Corresponding Member.*

IT is a well-known fact that Pyrrhotite, or Magnetic Iron Pyrites, frequently, if not invariably, contains nickel, generally with cobalt in various proportions, amounting together from traces, up to nearly six per cent., and that most of the nickel of commerce is derived from this mineral

The following notes contain in the first place the results of the examination of a few varieties of pyrrhotite, occurring in Nova Scotia, New Brunswick, and the United States, chiefly with reference to presence or amount of nickel and cobalt, and they shew also that remarkable differences exist in the intensity of the magnetism displayed, which ranges from distinct polarity in the mass, down to very feeble attraction by a magnet in the finely powdered state of the mineral, and further, that the most feebly magnetic of the specimens examined is that containing the largest per centage of nickel. The subsequent notes relate to other species from Nova Scotia and Newfoundland.

Pyrrhotite from Cape Breton Island, N.S. Of this mineral, four pieces were examined, they were all polar in action on the magnetic needle, one piece being very strongly so; the mineral was in the massive state, with, however, somewhat lamellar structure, associated with quartz. Portions of each of the four pieces were taken together for analysis, the object being to get an average of the whole, which, for the following metals, amounted to

Oxides of nickel and cobalt 0.50 per cent.

in these, on separation by potassium nitrate, there proved to be at least

Metallic nickel 0.36 per cent.

and there was a trifling loss in the operation. The locality of this specimen, I should say, I find is not certainly known to the person from whom I obtained it.

Pyrrhotite from Nictans, Annapolis Co., N.S. The mineral occurs here also massive, with quartz: it attracts both ends of the magnetic needle. Analysis gave:—

Nickel with a little cobalt 0.10 per cent.

Pyrrhotite from Geysers' Hill, Halifax Co., N.S. In this case no note is on record as regards magnetic intensity, but the mineral gave a distinct reaction for nickel.

Pyrrhotite from Latite, New Brunswick. Several specimens from this locality, where, I understand, on good authority, the mineral occurs in considerable quantity, examined at different times, have given results shewing that the quantity of nickel and cobalt is far from uniform. The mineral is massive, finely granular, and attracts both ends of the needle readily. No attempt was made to separate the nickel and cobalt found, the metals were thrown down as oxides, and calculated as from protoxide of nickel,

No. 1	afforded, per cent.	0.09	"nickel."
No. 2	" "	0.36	" "
No. 3	" "	0.80	" "
No. 4	" "	0.40	" "

the "nickel" was proved to contain a considerable proportion of cobalt in the last three cases, no note was preserved as regards the first; in the last, No. 4, manganese was detected before the blow-pipe by the soda test. This sample was averaged on the spot by an experienced person interested in obtaining a correct representation of the deposit, and the "nickel" obtained above is just the average of that got in the three preceding experiments; a circumstance I did not observe till these notes were put together.

Pyrrhotite from Lowell, Massachusetts, U.S. Specimens of this were placed in my hands, last autumn, as of a mineral containing 25 to 30 per cent. of nickel. It is found over a considerable area, and is, I believe, being worked. The mineral is coarsely granular, no crystals were seen on the specimens given to me; it occurs with a highly siliceous rock containing a little mica, specimens running in veins sometimes half an inch thick through the ore in hand-specimens. The magnetism is so feeble that it is only perceived by actual contact of the finely powdered mineral with a magnet, when an

exceedingly small quantity is retained. This property and the similarity in some characters, and in qualitative composition to Pentlandite, together with the statement as to the amount of nickel present, made a quantitative analysis desirable. The results of one on a piece of pure looking mineral were these:—

Sulphur	33.91
Iron	53.75
Nickel	2.41
Gangue	8.30
Magnesia and Loss.. .. .	1.63
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	100.00

which shew conclusively the individuality of the mineral, the composition of Pyrrhotite and Pentlandite being as follows:—

	Pyrrhotite.	Pentlandite.
Sulphur	40	36.0
Iron	60	41.9
Nickel	{ (up to 6 ?)	22.1
	<hr/>	<hr/>
	100	100.0

The nickel obtained in this and in a qualitative analysis gave no indication of cobalt with borax before the blowpipe. On comparison of the per centage of nickel with that in the mineral from Cape Breton Island above, and of the respective magnetic powers, it appears that the polar mineral contains only 0.36 per cent. of "nickel," while this metal in the scarcely magnetic species from Lowell approaches ten times that amount.

Mispickel from Montagu, Halifax Co., N.S. This mineral, frequently associated with gold, which it sometimes holds in visible quantity, in various parts of this province, has before been shewn to contain cobalt at the locality indicated (*Mineralogy of Nova Scotia*, p. 62), by experiments made at Freiberg. The specimen now referred to gave me, approximately,

Metallie Cobalt. 0.09 per cent.

containing manganese, as shewn by the soda test before the blowpipe.

Mispickel from Lunenburg Co., N.S. This was from a gold district some 50 miles S.W. of the preceding. Qualitative tests shewed small quantities of both nickel and cobalt. I may mention that mispickel occurs here in exceedingly well-defined crystals of brilliant lustre.

Matrix of Pickeringite, Newport, N.S. When in 1863 I published (*Journal of the Chemical Society*) the analysis of Pickeringite, which resulted in the establishment of a new group of salts and minerals (*Pseudo-alums, Odling, Outlines of Chemistry*, p. 282, and "*Halotrichite Group*" *Dana, Mineralogy, 5th Ed.*, p. 651), I shewed that the N.S. mineral contained some two thousandths of nickel and cobalt, and that I failed to find these metals in the rock from which the mineral had been formed. The method of attack on the rock used at that time was fusion with carbonated alkali. I have since found that by treating about 50 grains of the slate, taken (by myself) from the interior about two feet from the outer edge, with aqua regia, distinct evidence of the presence of both metals was obtained from the rock, which looked quite free of any sulphides or other minerals of metallic lustre.

Millerite from Tilt Cove, Newfoundland. A specimen of "nickel ore" given to me last year proved to be Millerite; it was of pure yellow colour, in six-sided crystals and plates, associated with pearl-spar and quartz, and a green mineral in small quantity, probably zarate. It appeared to be very pure, giving the blowpipe reactions of sulphur and nickel only. It is found at the same place in "leaves like the purest gold," and also in radiated crusts, such as occur at Gap Mine, Pennsylvania, according to a gentleman who said specimens he had seen from Tilt Cove, were like what I shewed him from the U.S. locality named. From the same authority, I learned that this species forms but a small part of the nickel ore at Tilt Cove, which is chiefly Kupfernickel occurring in pockets with the copper pyrites so largely mined for the last few years. Specimens of this Kupfernickel, in my possession, consist almost entirely of the massive mineral with dolomite. About 113 tons of the ore were shipped in 1869 and the following year; later statements I have not at hand.