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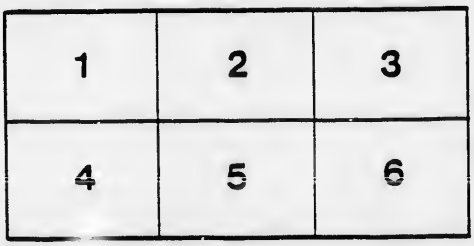

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NOTES ON SOME

NORTH AMERICAN PYRRHOTITES,

AND OTHER

Minerals Containing Nickel,

AND ON THE

RELATIVE COMPOSITION

OF

ΨLEXITE AND FRANKLANDITE;

BY

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CORR. MEM. MIN. SOC. G. B. AND I.

Notes on some North American Pyrrhotites and other Minerals containing Nickel.

Reprinted from the Mineralogical Magazine and Journal of the Mineralogical Society of Great Britain and Ireland, April 1877.

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 show 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 nitrite, 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 Nictaux, 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 Geyser's 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 Latete, 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 showing 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."
"	2	"	"	0.36	"
"	3	"	"	0.80	"
"	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 blowpipe 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 silicious rock containing a little mica, which runs 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 ore were these:—

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

which show 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
	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 Montague. 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 shown to contain cobalt at the locality indicated (Mineralogy of Nova Scotia, p. 6), by experiments made at Freiberg. The specimen now referred to gave me, approximately

Metallic Cobalt . . . . . 0.09 per cent.,

containing manganese, as shown 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 showed 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 showed 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 the 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 color, in six-sided crystals and plates, associated with pearl-spar, and quartz, and a green mineral in small quantity, probably zaratite It appeared to be very pure, giving the blow-pipe 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 showed 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 the last few years. Specimens of this Kupfernickel, in my posssession, 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.

On the Relative Composition of Ulexite & Franklandite.

Reprinted from the Chemical News, Vol. xxxv *p.* 189.

In the *Philosophical Magazine* for April, (p. 286,) Prof. J. Emerson Reynolds describes a new mineral borate, found with Ulexite at Tarapaca, Peru, which he names Franklandite. I wish to point out that, in comparing the composition of the two minerals, the author has adopted the wrong formula for Ulexite. In the *Chemical News*, (vol. xv., p. 192,) I showed that the formula for Ulexite, (then called natroborocalcite, &c.,) originally proposed by myself, but subsequently erroneously termed "Kraut's," was the correct expression of the composition of the mineral. This formula, changed to the new notation, is

$$Na_2O,2CaO,5B_2O_3,15H_2O,$$

and it came to be design[illegible] the name of Kraut because this chemist preferred it to [illegible] among them doubtless to Rammelsberg's

$$Na_2C[illegible]_3,18H_2O,$$

on account of its general[illegible], upon comparison of the numerous analyses published, especially of the Peruvian mineral "Tiza" &c. This formula of Rammelsberg's was particularly shown by Dr Lunge, not to agree so well as "Kraut's," even with its author's own analysis; and another mineral like Ulexite appears to exist in in the same deposit, having closely similar composition, as indicated by the same writer, (*Chem. News*, vol. xv., p. 86:) but, as I mentioned in "Contributions to Mineralogy of Nova Scotia," III. & V., (*Phil. Mag.*, January, 1868 and April, 1870,) the mineral now known as Ulexite occurs here under comparatively simple conditions, affording purer material for analysis than the mixture of salts frequently examined from Peru, and hence, no doubt, the correctness of my formula.

Now, on comparing Ulexite and Franklandite, Professor Emerson Reynolds gives, as the empirical formula of the latter,—

$$2Na_2O,2CaO,6B_2O_3,15H_2O,$$

which differs from mine for Ulexite, above, by having in excess,—

$$Na_2O.B_2O_3;$$

but he takes as the formula of Ulexite that advanced by Rammelsberg, just mentioned as specially shown by Lunge to be incorrect.

It follows that my formula being almost universally received as correct for Ulexite (whatever the other minerals found with this in Peru may be), the difference between this mineral and Franklandite is not, as Prof. Emerson Reynolds gives it, "that the substitution of one molecule of sodic oxide (Na_2O) for three molecules of water is capable of converting Ulexite into Franklandite, as far as composition is concerned," but that the latter differs from the former by containing one molecule of sodium metaborate ($Na_2O.B_2O_3$) in addition.

Windsor, N. S., April 21, 1877.