If this development is to be as great as it should be, there must be certainty and stability in our mining laws.

The history of our legislation shows that suggestion of gaining revenue by the imposition of royalties is a most unwise one.

Twice already has a system of royalties been introduced in this Province, and each time the results have been so disastrous that the royalties so imposed have been abandoned and repealed. There seems no doubt that like causes would again produce like effects. No one suggests that the mining industry should not bear its fair share of necessary provincial taxation; but no special or arbitrary burdens should be placed on it.

GENETIC RELATIONS OF SOME NICKEL-COPPER ORES.*

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Introduction.

Before discussing the ore-deposits of St Stephen, and Sohland in particular, it might be well to briefly review the geological relations of nickel ores, in general. Economically we have to deal with the following classes of Deposits.

(1) Compounds with arsenic, (more rarely antimony,) or with arsenic and sulphur.

(2) Sulphur compounds, including pyrrhotites, and pyrites.

(3) Oxidised compounds, mostly silicates related to serpentine.

Nickel is universally recognized as an associate of pyyrhotite. But it is also well known that in different pyrrhotites the percentage of nickel varies widely. And on this basis, pyrrhotites may be subdivided into two main classes, and this classification is intimately connected with the geological relations of the sulphides.

(1) Pyrrhotite occurs with more or less chalcopyrite and pyrite, as lenses in *acidic gneisses and schists*. These lenticular masses nearly always conform to the foliation of the gneisses, and are often repeated and connected by leaner zones, after the nature of the so-called "fahlbands". Such deposits are of world wide distribution, but the pyrrhotite is *always low in nickel*, seldom containing more than 0.5, and generally less than 0.25. per cent.

(2) The second class is also widely distributed, and from an economic standpoint, calls for special attention. These deposits are also lenticular in shape, but are associated with *basic igneous rocks*, usually of the gabbro type, or their metamorphic equivalents. There is always more or less chalcopyrite and pyrite present, and at times rarer minerals, and the characteristic minerals of the basic rock are always intimately mixed through the prevailing sulphides. Nickel is almost invariably present in the pyrrhotite, at times up to 10 per cent. or more, but on an average, (e.g. in Sudbury), 2 to 4 per cent.

To the latter class of pyrrhotites, the St. Stephen deposits belong.

Many writers in r cent years have attributed a direct igneous origin to this class of pyrrhotites. The sulphides are regarded as original rock constituents, and the theory is that they crystallized, from the cooling magma, in their present position, by a "magmatic segregation."

A thorough investigation of the Sudbury deposits has led me to the conclusion, that this theory of a direct magmatic segregation is untenable. This must, however, not be taken to imply, that the sulphides may not have been, to a large extent, original constituents of the basic magma. Also there may have been a partial concentration, during the cooling of this magma. But from the studies of the Sudbury and St. Stephen ores, there seems to be only one explanation possible, as to their present position. Namely that the deposits are largely secondary replacements along more or less crushed and faulted zones, by means of circulating solutions containing ore, which has been deposited by a metasomatic interchange, with the rock minerals; that is, that the main concentration of the ore, as seen at present, is of a secondary nature, *after the solidification of the magma*, and is not an original direct segregation from the cooling, but still molten magma.

The study of a somewhat similar deposit near Sohland, Germany, has led Prof. Beck, and myself to a similar conclusion in this case also.

As work has been discontinued for the present at St. Stephen, it was impossible to gain access to the mines. I was however furnished with material through the kindness of Messrs. W. K. and A. D. Ganong, of St. Stephen, which has proved amply sufficient for the present investigations On the property from which these samples were taken, two shafts have been sunk, to the depth of 125 feet, and 80 feet respectively. Further prospecting has been done with a diamond drill, and though it is difficult to get exact information, I have been informed that a body of solid ore, 18 feet thick has been located.

St. Stephen, N.B.

While the nickel-copper deposits of St. Stephen have not as yet assumed the importance of producing mines, they are of more than passing interest. Aside from their possible economic value, they supply us with a great deal of information, which throws light on the genetic relations of this class of sulphide ores.

Mr. H. P. Brummel briefly sums up the geological relations of the deposits*, and Prof. L. W. Bailey gives us some further particulars in a later report.**

The Deposits.

Throughout the country north of St. Stephen, are large areas of diorite, with which are associated, more or less extensive deposits of pyrrhotite, and chalcopyrite, the former carrying nickel. The pyrrhotite masses are almost invariably capped by a gossan resulting from the oxidation of the sulphides. The rocks of the entire district consist of coarse and fine grained diabases, and diorites. They show the effects of severe metamorphism, and are often slickensided, and highly charged with sulphides in the vicinity of the ore-bodies.

Attention was first drawn to these deposits after the discovery of similar ores near Sudbury, and analyses showed that the St. Stephen pyrrhotites carried a small percentage of nickel. Numbers of test pits were sunk, showing the wide distribution of the pyrrhotite, and steps were taken to determine their value. Some of the ore bodies proved quite extensive, but the percentage of nickel was low and irregular, generally averaging 0.75 to 2%. In many cases only traces were found, though some samples showed as much as 4%.

*A paper read at the annual meeting of the Canadian Mining Institute, Quebec, March, 1906.

*Geol. Sur. of Can., vol. V, new series, 1890-'91, p. 112 S.S.
**Geol. Sur. of Can., vol. X, new series, 1897, p. 27 M.