In 1897 Prof. Bailey made a careful examination of some of the more importan localities, and calls attention to some of the principal features of the deposits. Compared with Sudbury, they show many features of similarity. (1) The St Stephen beds like those of Sudbury, consist of basic intrusives, as diorite and diabase, with probably gabbro, and norite, associated with heavy beds of quartzite. (2) As at Sudbury the pyrrhotite would seem to be a normal constituent of the dioritic rock, and not an intrusion into the latter. (3) The St. Stephen rocks like those of Sudbury are referable to the Huronian system, and were probably formed under like conditions. On the other hand the average percentage of nickel in the St. Stephen ore, is much smaller than in Sudbury.

Nature of the Ore.

The St. Stephen ore consists of prevailing pyrrhotite with chalcopyrite and a very subordinate amount of pyrite. Through the ore are also small grains of magnetite. The magnetite does not however, so far as I have observed, occur in any considerable masses, but is present simply as an original residual, accessory of the enclosing rock. The pyrrhotite is nearly always finely granular and compact. At times it is nearly pure, without chalcopyrite, and having only isolated grains of silicates, as impurity. But these masses of pure ore are never extensive, and seem to be of comparatively local development. The pyrrhotite is mixed with more or less of the rock silicates, and also contains chalcopyrite. The amount of rocky inclusions varies considerably, as is the rule in such deposits, and in places may equal or exceed the sulphides. The chalcopyrite seems to be irregularly distributed. It seldom occurs in considerable masses, in any degree of purity, but is often closely associated with pyrrhotite, especially where the latter is mixed with a considerable amount of rock.

The relation of the chalcopyrite to the pyrrhotite is very interesting and significant. A number of polished sections of the mixed ore were made, and in all of them the same phenomena were noted. The ore-rock is traversed in various directions by small parting planes and fracture zones. These are apparently the result of a dynamic movement which shattered the rock to a considerable extent. The parting planes do not seem to be confined to any one part of the rock, and traverse both pyrrhotite and rock proper. But they are *most apparent along certain lines where large phenocrysts of feldspar are abundant.* Also in connection with the feldspar, the development of chalcopyrite is most pronounced. The chalcopyrite extends along these lines of weakness in the form of veins, often terminated abruptly against the side of a comparatively fresh feldspar crystal, and ramifying irregularly, between the neighboring minerals, in a network of fine veinlets. In cases where a feldspar crystal has been shattered, and more or less decomposed, the chalcopyrite can be seen, penetrating it in all directions, along the cleavages and partings, in the form of delicate apophyses.

The conclusions to be drawn from these relations are very significant. That the chalcopyrite is a *later introduction* is shown conclusively, and this is an important fact in considering the paragenesis of the ore. It is evident that a dynamic movement has taken place *after* the formation of the principal body of the ore, namely the pyrrhotite. And along these parting planes, due to the dynamic effect, solutions bearing the copper sulphide, have circulated, with the foregoing result.

The conclusions are important in helping to explain certain phenomena of other deposits. Prof. Beck has come to a very similar conclusion with reference to the Sohland deposits, where chalcopyrite is often found along planes of weakness and shear planes.

Already for Sudbury a similar idea was advanced, but here the relations are masked to a large extent by the massive nature of the ore. But with the additional evidence offered by Sohland and St. Stephen, it grows almost to a certainty, that the relations of the chalcopyrite to the pyrrhotite can be explained in the same way for Sudbury.*

Further proofs that the ore-bearing rocks have been involved in a process of dynamic metamorphism are not wanting. The rock has been more or less shattered and brecciated, and numerous cracks resembling faulting planes are present. The minerals in the neighborhood of these seams are often completely granulated and show a marked undulatory extinction. These relations are brought out still more clearly by the microscopical examination. The movement does not seem to have been on an extensive scale however, and has resulted in a brecciation of the minerals themselves, rather than of the rock as a whole. The force has no doubt acted while the rocks, now exposed, were under a considerable load, and the minerals have readjusted themselves, in a somewhat plastic condition, so that their continuity is as a rule preserved. This resulted in the formation of lines of weakness in certain directions, and a somewhat gneissoid structure of the rock, accompanied by a granulation of the minerals.

Besides this, other rocks in the immediate vicinity, show very definite results of movement, which has developed a slickensided structure, along the planes of which the rock parts easily.

The ore-rock itself exhibits a number of minor varieties. That most intimately associated with the ore, is a rather coarse grained variety of gabbro, shading to diabase. It is characterized by the presence of rather large feldspar individuals, often drawn out and compressed. The feldspar as well as the other minerals are in an advanced stage of alteration, especially where ore is developed.

Another variety, only slightly impregnated with ore, is much finer grained and fresher. In appearance the rocks resemble gabbro, and will be more minutely described microscopically.

Microscopical Structure of the Ore.

The method of examination employed is practically similar to that used for the Sudbury deposits. The study of the microscopical relations of the ore and ore-bearing rocks, affords the surest means of determining the true nature and origin of this class of ore-bodies. Taken in connection with the evidence afforded by the megascopic relations, the results have proven most successful, in this case, as well as for Sudbury, in solving the problem of the origin of the deposits.

A large number of thin sections have been examined, including pure ore, and ore associated with varying amounts of rock, so that the results can be taken as representative of the entire deposit.

(1) Specimens of a medium grained, holocrystalline, hypidiomorphic granular rock, carrying a small amount of ore.

The rock is very compact and even grained, of a prevailing dark grey color, with lighter spots of feldspar, and often shows the slickensided structure mentioned above.

*See page 59 reprint "The Ore Deposits of Sudbury, Ontario, Trans. Am. Inst. of Min. Eng., 1903.