

The only area in Ontario, or central Canada, which has hitherto been found to contain deposits of rich silver ore is that which lies near the head of Lake Superior, nearly 500 miles from Haileybury. While native silver has been found in considerable quantity in these deposits, the sulphide, argentite, is the more characteristic ore. The Silver Islet mine, near Port Arthur, is well known to those interested in the metal industry. Deposits of somewhat similar character, which occur on the mainland, have also been frequently described. The report on "Mines and Mining on Lake Superior," by Mr. E. D. Ingall, of the Canadian Geological Survey, gives an account of this silver-bearing area.

The silver veins in the vicinity of Port Arthur, like those of Haileybury, cut through slate, but the Port Arthur slates are held to be of later age—Animikie—than those of Haileybury, which are what is called, in a general way, Huronian. Much work remains to be done on our metamorphic and igneous rocks before the various formations can be correctly correlated. Both the Port Arthur and Haileybury slates have been disturbed by eruptions of diabase and related rocks.

The rich silver-bearing veins in the Port Arthur district, like those of Haileybury, occur for the most part as vertical fissures which cut fragmental rocks whose beds lie in a nearly horizontal position. Although the fragmental material of which the silver-bearing rocks are composed is not similar in the two districts, the writer is inclined to believe that the ash rocks and agglomerates of Haileybury are of almost, if not exactly the same age, as the argillites Animikie, of the head of Lake Superior.

In this paper the term slate has been used in referring to the fine grained and delicately laminated rocks through which the Haileybury veins cut. This term properly refers to argillites and should not be used except as a convenient field term for all of the finely laminated rocks in the area. Thin sections when examined under the microscope show that the specimens so far investigated represent ash rocks. Coarser varieties, in which the fragments possess a size similar to that of the grains of minerals in a medium grained igneous rock, are found to be made up of pieces of orthoclase, plagioclase, trachytic material, chlorite and calcite which is an infiltration product. The layers of some of the slate-like rocks which lie at the bottom of the cliffs have not been examined in the laboratory.

A correlation of these Haileybury rocks with the slates and tuffs of the area which was marked as being doubtfully Cambrian on Dr. Robert Bell's map of the Sudbury district would be interesting.

Dr. A. E. Barlow has given a very interesting account, (*Geol. Surv. Can., Vol. X, p. 194 I*) of the contact between a granite and the overlying fragmental rocks in the vicinity of Baie des Pères, on the opposite side of Lake Temiscaming from Haileybury. He has shown that this is, so far as has been observed, a unique occurrence—some of the Huronian fragmental material overlying the granite having been derived from the weathering of this rock *in situ*. The present writer recorded the occurrence, some years ago, of a small outlier of Grenville limestone in the vicinity of Lake Kippewa, east of Lake Temiscaming. This limestone and the associated garnetiferous schist have been much disturbed by an intrusion of granite apparently similar to that of Lake Temiscaming. It would, therefore, appear that the Baie des Pères fragmental rocks which rest on the eroded surface of the granite are very much younger than the Grenville veins of the indefinitely so-called Laurentian. The question then arises—are we at present certain that the Baie des Pères fragmental rocks are older than the Animikie?

It is known that rocks similar in character to those of Haileybury lie to the northward. In the writer's report on "Lake Temiscaming to the Height of Land" published in Vol. XI of the Report of the

Bureau Mines, 1902, the following statements are made concerning the slate and breccia-conglomerate or agglomerate in the area examined. P. 217:—"Slate is also seen at the outlet of the lake, passing into conglomerate a short distance down the river. The latter rock appears to overlie the former." P. 219, "On the east shore near this point, the rock has a bedded appearance, the layers being ten or twelve inches thick, slate forming the lower layers with an impure quartzite above. Along this lake these rocks dip at a low angle, 15°, to the southwest. The quartzite, or graywacke carrying quartz grains, lies above the slate, and the conglomerate appears to overlie the quartzite. If this is their order they have either been inverted or they possess a different relationship from that given for similar rocks by the Geological Survey in the report on the Lake Temiscaming map sheet. The question as to their relationship is of economic interest on account of the occurrence of iron ores." P. 220, "The slate along the shore here has a dip of about 7° to the eastward or towards the island just mentioned. A hill up the shore to the northward was found to be composed of conglomerate containing fragments of slate, quartz, gray granite, and a porphyritic gray granite, together with a few red Jasper pebbles associated with hematite. The conglomerate appears to overlie the slate and the whole dips towards the islands, which also contain conglomerate." The word "appears" was used in these sentences on account of it having been held by other writers in the field to the south that the conglomerates or agglomerates were the basal rocks. The present writer having made a hasty examination of the area did not wish to state positively that the rocks, as he saw them, occupied their original relative positions, although they appeared little disturbed. Some of the agglomerate is very loosely cemented together.

Although cobalt and nickel minerals have not been found in quantity near Port Arthur, it is interesting to know that the ore of the Silver Islet and some of the other mines was, at times, coated with cobalt bloom. Niccolite and other minerals carrying cobalt and nickel occur in small amounts in some of these deposits. The only deposits in which quicksilver has been found in Ontario is that of Silver Islet, where chloride of silver is also said to occur as a decomposition product.

Small quantities of cobalt, nickel and silver-bearing minerals occur on Michipicoton Island, Lake Superior. Arsenical compounds of the first two metals have been found at several other localities in Ontario and at Calumet Island, Quebec. It will be noticed that the association of minerals in these Haileybury veins is not unlike that found in some well-known deposits of Germany and other countries. Since these German ore bodies have been worked for many years methods for extracting the metals, cobalt and nickel, from ores of this kind are well proved. Hence little experimenting will have to be done on the Haileybury minerals.

Although little prospecting has been done in the vicinity of the Haileybury deposits, it would appear, from the discoveries already made, that ore-bodies occur there which can be worked profitably for the metals which have been mentioned. It is scarcely probable that nickel will be found in sufficient quantity in these deposits to interfere materially with the lower grade, but large, deposits of the Sudbury area.

Slate and conglomerate, similar in character to those of Long Lake, cover a very large, as yet little prospected, area in northern Ontario. These rocks, along the government railway, a considerable distance south of the deposits described in this paper, contain indications of the presence of cobalt ore.

It is stated in "The Mineral Industry" that "cobalt, which is used in the arts, chiefly in the form of oxide, is obtained from New Caledonia, Australia and Germany, and smelted in France, Germany