

Since the discovery of the camp, approximately 100 claims (i.e., 4,000 acres) have been carefully prospected by stripping and trenching and only a small fraction of this area has been the subject of underground work and operations to-day are confined to twenty-five claims.

The area on which mineral rights are still held is therefore considerably larger than the likely prospecting area which is practically all blanketed. Prospectors who do not own claims have no incentive to try their luck at Gowganda and owners who will not prospect or develop their claims are only a detriment to

this or any other district. To-day Gowganda furnishes a splendid illustration of the "Paralysis of Mining District by the Holding of Idle Claims," a common enough condition, most ably written up by Mr. E. B. Kirby in 1909.

The hope of Gowganda is that as transportation facilities and other conditions improve, the great idle area will be gradually but thoroughly explored and the result of this exploration, judging by the record of the camp to date, should be the development of several small or medium sized mines whose aggregate silver production would make a very respectable total.

DECREASE OF VALUES IN ORE SHOOT WITH DEPTH

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The paper read by Mr. F. L. Garrison at the March meeting of the Canadian Mining Institute, being on a subject of vital importance and containing comments on a large number of well-known deposits, invites discussion. All will doubtless agree with his statement that payable deposits do not usually persist in great depth. The history of mining operations is quite clear on this point. Most of the known deposits which were rich enough near the surface to be mined profitably are at a depth of a few hundred or a few thousand feet, unprofitable, either on account of decrease in values or increase in cost of mining. In the great majority of cases it is decrease in values rather than increase in cost that results in abandonment. That there are deposits containing rich ore at depth and little or none at or near surface is quite probable; but they are not likely to be discovered. They who have explored deposits in the belief that increased values would be found at depth have good reason to conclude that such is not a common occurrence.

The term "deep mining" has a significance varying according to the district under consideration, and a general discussion of the subject presents many difficulties. I will not attempt to deal with the larger subject, but will simply add some notes on deposits in Michigan and Ontario recently studied. The copper mines here in Houghton County, Michigan, include some of the deepest mines in the world. The Porcupine and Cobalt deposits are of particular importance to Canadians. Some observations on these three districts may, therefore, be of interest to members of this Institute.

The deposits in the districts mentioned are very different; but they have some features in common. The ore in each case is the native metal—Michigan copper, Porcupine gold and Cobalt silver. All are of about the same age, being in rocks generally called Pre-Cambrian. The Michigan copper deposits are in the series of volcanic and sedimentary rocks which is known as the Keweenawan. The Cobalt silver deposits are in Keewatin, Huronian and Keweenawan rocks, and were probably also formed in Keweenawan time. The Porcupine gold deposits are in Keewatin and Huronian rocks and were probably formed during the Huronian period. All three districts are in glaciated areas and except for changes coincident with change in character of enclosing rock the ore at depth,

so far as shown by development, is composed of the same minerals and is in all respects very similar to the ore found in the same deposits near the surface.

In several respects, however, the deposits differ. The Michigan copper deposits are in bedded rocks. The richest ore is a coarse conglomerate averaging 15 feet in thickness. All the others being worked are the amygdaloidal upper parts of bedded volcanic rocks. The copper in both types of rock is partially in the form of a filling and partially as a replacement of rock constituents. The Cobalt silver deposits are chiefly in the form of very small vertical veins of rich ore on either side of which there is some silver in minor fractures in the wall rock. The enclosing rocks are seldom schistose and comparatively few of the fissures which have been filled with ore show signs of extensive differential movements. The rocks have been much fractured, but the individual fractures are not extensive. The Porcupine gold quartz deposits are in rocks that have been much crushed and altered. The region has evidently been very extensively fissured and some of the individual fissures were long and probably deep.

The deposits in the three districts are therefore of very different types. The origin of the spaces which were filled with ore was entirely different, and it is probable that there was little in common between the ways in which the ore was deposited in the three districts. The Michigan copper deposits persist to depths of thousands of feet. The Cobalt silver ore shoots are commonly but a few hundred feet deep. The Porcupine gold deposits have not yet been extensively developed. From their character it is likely that the gold mines will be deeper than the silver mines, but the extent of individual ore shoots is yet unknown.

‡Michigan Copper Mines.

There are at present in Michigan 19 mines, which are producing large quantities of copper, and a few others which are producing small quantities. Many of the mines are over 2,000 feet deep on the inclination of the lodes, which varies from 37 to 73 degrees, and three mines have workings which are over one mile down on the dip. The deep mines are the Tamarack and the Calumet & Hecla, which are on the Calumet conglomerate lode, and the Quincy, which is on the Pewabic amygdaloid lode. The Calumet lode dips at 38 degrees near surface and at 37 degrees 30

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‡A description of these mines will be found in volume on Mineral Resources of Michigan, 1912, Michigan Geological Survey.