

MINING METHODS AT CREIGHTON.*

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The orebodies of the Sudbury district vary greatly in size, dip and configuration, and the methods of mining are dependent on these factors. The ores are essentially pyrrhotite, chalcopyrite and pentlandite. The enclosing rocks are hard, like the orebodies, and but little timbering is required. They comprise norite, greenstones, quartzites, greywackes and granites. The orebodies dip at angles of from 36 degrees to 90 degrees.

The problem of extracting the ore after the size and configuration of the orebody is known, is a simple one owing to the nature of the ores and the enclosing rocks. Elaborate systems of timbering, caving, slicing or filling do not have to be considered. Where large stopes are to be worked out, pillars are left, and the backs are kept arched while the ore is being removed. Afterwards the pillars are robbed.

Ore was first mined in the Sudbury district by the open-pit method. The surface material was stripped off; the gossan, and overburden, the latter averaging up to ten feet in depth, was removed, and the open-pit method of mining followed. The ore was handled by derricks at first. Later a shaft was sunk adjacent to the open pit in the footwall, and connections were made with the open-pit at different levels. The ore was trammed to the shaft and dumped directly into skips. By this method about 3,000,000 tons were taken from the Creighton. Properties mined by this method were the Evans, No. 2, No. 4, No. 5, No. 6, Frood, Stobie, Crean Hill, Kirkwood, North Star, Victoria, Blezard, Murray and Creighton. Of these the Creighton was the largest pit, being about 670 feet long, 180 feet wide, and 200 feet deep. As the Creighton orebody dips at an angle of about 45 degrees, it was necessary to remove a large tonnage of waste from the hanging-wall. When all the ore, that could economically and safely be mined by the open-pit method, was taken out, the shafts were sunk to lower levels and overhand methods of stoping were adopted, a floor being left below the open pit. Where the ore bodies were narrow, the drifts were timbered over and the ore broken on the timbers. In wide orebodies, dry-wall drifts were used and circular pillars left where necessary.

As the nickel industry grew, and increased tonnages were demanded, it became necessary to more thoroughly prospect the orebodies and plan the work so that a constant large tonnage could be produced. The method of prospecting the orebodies was by means of magnetic surveys and diamond drilling, the relative importance of these two methods being governed by local conditions at each property. In general it may be said that the magnetic survey serves only as an aid in locating an orebody. The prospecting is done by means of diamond drilling. Properties thoroughly drilled were the Frood and Creighton, of the Canadian Copper Company, the Levack, of the Mond Nickel Company, and the Murray, of the British-American Nickel Corporation. In the latter property, for instance, the surface was divided into 200-ft. squares, and a vertical hole drilled at the corners of the squares. By this means the dip, strike, configuration, assay and tonnage are pretty thoroughly known before any ore is removed. This information is sufficient to enable the whole operation of mining the ore to be planned in advance. Power plants, hoisting and sorting arrangements, shafts and equipment are all planned for the most economical handling of certain tonnages.

The magnetic surveys are made by the companies themselves. The diamond drilling is done under contract by drill companies located in Sudbury. The price varies from \$2.75 to \$4.00 a foot, depending on the location and size of contract.

The Creighton orebody has a maximum length of about 1,000 feet, and has been proven to a depth of 2,000 feet measured along its dip, the present ore reserves amounting to about 10,000,000 tons. It dips to the west at an angle of about 45 degrees.

As mentioned before, a large tonnage was removed from this property by the open-pit method of mining, the ore being removed through a 3-compartment shaft sunk in the granite footwall at an angle of 59 degrees near the east end of the orebody. As the depth or workings increased, it became necessary to change from the open-pit method to underground mining.

A second shaft was therefore sunk in the footwall. This was a 4-compartment shaft comprising a manway, two skipways and a compartment for handling men and material. This shaft was sunk near the westerly end of the open pit, and was carried to a depth of 830 feet on an angle of 47 degrees. On the 6th and 10th levels of this shaft a Farrel jaw crusher, with a 30-in. x 42-in. opening, crushing to 6 inches is installed. These crushers are each driven by two 100-h.p. motors and discharge into storage pockets holding approximately 400 tons. The ore from the storage pocket passes into a measuring pocket at the loading station about 60 feet below the haulage level. By this method the skip is loaded in about 10 seconds and the time for a return trip from the 6th level loading station, including loading, is 1½ minutes. The skips, 5-ton capacity, are operated in balance, the hoisting speed being about 1,100 ft. per minute. On the main haulage levels 4½ and 5-ton storage-battery locomotives are used, hauling trains of four 56-cubic foot side-dumping steel cars, which are mechanically dumped at the crushers.

All the ore goes through these crushers, the ore from the upper level being passed down through ore-passes, which discharge into a crusher. Waste rock is handled through separate rock passes and storage pockets, which discharge into the skips 30 feet below the haulage levels.

A third shaft, known as No. 3, is being sunk in the footwall 145 feet southwest of No. 2. It dips at an angle of 55 degrees and is to be continued to the 16th level. This shaft measures 8 feet by 33 feet, and is divided into five compartments, which consist of a manway, two skip compartments, and two cage compartments. The shaft is concreted for a distance of 40 feet below the collar. The skip-track consists of 85-pound rails, resting on wall-plates, which in turn are supported on concrete piers. It is planned to place a crusher below the 14th level station with storage and measuring pockets of the same type as used in No. 2 shaft. Ore-passes will extend downward from the upper levels to this crusher. Skips of 8-ton capacity, hoisting in balance, are to be used. The hoist will have 12-foot drums and a rope speed of 2,500 feet per minute. Stations have been cut in this shaft at the 6th, 8th, 10th, 12th and 14th levels. The first three levels correspond with the similarly numbered levels from No. 2 shaft. The distance between levels is 150 feet measured along the incline. Intermediate or sub-levels are to be driven halfway between these main levels in the footwall and will be numbered 7, 9, 11 and 13. These sub-levels are necessary to remove the broken ore from the footwall owing to the low angle at which the orebody lies.

* Extracts from a report to the Ontario Nickel Commission.