

Nodulizing Flotation Concentrates

In the latter part of 1917 there were carried out near Princeton, in Similkameen district of British Columbia, by Mr. R. M. Draper, of Southboro, Massachusetts, U.S.A., formerly with the U.S. Metals Refining Co. at Chrome, New Jersey, some experiments for the Canada Copper Corporation in nodulizing copper concentrate from a preliminary small concentration plant the company had for some time been using in testing methods for the concentration of copper ore from its mines on Copper Mountain, at which much exploratory and development work had been in progress for several years.

This company now owns and operates mining properties in Boundary and Similkameen districts, and copper smelting works at Greenwood in the former district, previously owned and worked by the British Columbia Copper Co. Much of the commercial ore in the company's largest mine, the Mother Lode in the neighborhood of Greenwood, having been exhausted, mining operations have for some time past been largely concentrated at the Copper Mountain mines, at which about 12,000,000 tons of copper ore is estimated to have been practically proved to occur, with a reasonable prospect of considerably more being developed, when much more work shall have been done on the large group of mineral claims in the locality owned by the company.

In passing, it may be mentioned that the company's smelting plant at Greenwood is modern in design and equipment and is likely to be used in smelting ore and concentrate from its Copper Mountain mines. In a published paper, descriptive of this plant, Mr. Frederic K. Brunton, formerly superintendent of the works, stated that it "is of special interest to metallurgists for several reasons. It was successfully smelting in blast-furnaces the lowest-grade copper ore of all plants in America. In order to do so, it had to run at very high efficiency, which necessarily required a large tonnage per square foot of hearth area, together with the minimum amount of labor and other costs. The furnaces smelted daily 2,250 tons of ore (6.62 tons per sq. ft. of hearth area), carrying 0.85 per cent. of copper, at a smelting cost of \$1.18 a ton. The entire plant required 130 men to operate it and keep up repairs, showing a labor efficiency of about 17.5 tons per man per day." Of the three blast-furnaces, two are 51 by 360 in. and one 51 by 240 in. at the tuyeres, making the total smelting capacity 2,400 tons a day.

The process of nodulizing concentrates is carried out by passing the material through a revolving kiln, the while subjecting it to sufficient heat to cause the fine particles to roll up and adhere together in a ball; at the same time care must be taken not to make the temperature in the kiln hot enough to melt the concentrates.

While nodulizing is no longer an experiment with oil as fuel, the process having been introduced at Chrome five or six years ago, and since used on a commercial scale, it is believed to be quite an experiment on flotation concentrate, using coal-dust as fuel, certainly so far as known in the North-west.

The position was that, while the Canada Copper Corporation had satisfied itself as to the adaptability of the flotation process for the concentration of ores from its Copper Mountain mines, which ores have been estimated to have an average assay value of 1.74 per

cent. copper, the problem of how best to make the fine flotation concentrate suitable for charging into the blast-furnace had not been solved. Hence the experimental work on nodulizing conducted near Princeton last year by Mr. Draper for the company.

It happens that there is at East Princeton, distant about twelve miles from the Copper Mountain mines, a cement-manufacturing plant that had for some time been inoperative, so, notwithstanding that the cement rotary kiln available there is of present standard size and larger than had been found suitable for nodulizing at Chrome, it was used by Mr. Draper in carrying out his experiments there. The dimensions of this kiln are: length 125 ft., and inside measurement 7 ft. It is about 25 ft. longer than need be for the nodulizing work for which it has been used. Despite this disadvantage, however, very successful results were achieved by Mr. Draper; the nodulized product being material of a character suitable for reduction in the blast-furnace, with about 82 per cent. of its sulphur content retained, which is an important consideration in a country where the percentage of sulphur in the ores available for smelting is generally already too low.

It was estimated that a 100-ft. rotary kiln would nodulize from 100 to 125 tons of flotation concentrate in 24 hours. At East Princeton both mine run and slack coal is obtainable from a nearby coal-mine, while included in the equipment of the local cement works is all the plant requisite for drying and pulverizing the coal, which, after having been pulverized, is fed into a hopper, from which it runs into a blast-pipe and is blown thence into the kiln. Electricity is generated at the cement works for other uses, so that the comparatively small amount of power required for operating the kiln is obtainable at small cost, while the charge for labor in attending to the kiln and, as well, for repairs to it, is quite small.

It may be added that, while quite successful results were obtained in nodulizing flotation concentrate from both the Copper Mountain plant and another mill at Highland Valley, in Ashcroft mining division of British Columbia, experiments made with table concentrate, also at East Princeton, were not so successful.

Results of Previous Work.

For the information of those not already familiar with the results previously achieved in nodulizing both blast-furnace flue dust and fine sulphide concentrates, the following excerpts have been made from a paper by Mr. Lawrence Addicks, of Douglas, Arizona, presented at the Salt Lake, Utah, meeting of the American Institute of Mining Engineers in August, 1914 (see Trans. A.I.M.E., Vol. XLIX., 1914, pp. 500-6), in which an account is given of what had then been done to solve a problem arising from the "constantly increasing piles of unsmelted blast-furnace flue dust," that at the smeltery connected with the Chrome, New Jersey, refinery of the U.S. Metals Refining Co., had proved embarrassing; and from the discussion of that paper.

Mr. Addicks wrote, in part: "The charge was fine and 10 to 15 per cent. of it was blown into the flue. Sulphur was at that time too scarce to make the sintering of the finer part of the charge attractive, and raw-ore smelting in a reverberatory with a partly oxidized charge was not to be thought of.

"A great many schemes were considered, including leaching, blowing into the converters, and briquetting,