Concentrating Methods at the McKinley-Darragh Mine, Cobalt, Ont.

Written for the CANADIAN MINING JOURNAL by A. P. Globe, Mill Supt., McKinley-Darragh Mine.

Before going into the details of concentration at this mine, it should be pointed out that at nearly every mill in Cobalt the mill man has a different proposition in the concentration of Cobalt ores, which calls for some special treatment or permits of some step being omitted, or even permits some practice that would be prohibitive elsewhere

At one mine the values are carried in veins of very high grade ore, the wall-rock carrying very low or no values. Here a large percentage of values can be removed by hand picking or sorting plants. Under these conditions the ore going to the concentrator is reduced to from 10 to 20 ounces silver per ton. This enables the mill to make a high ratio of concentration and also a high grade of concentrates, but a lower extraction than where the veins are of a lower value and the values carried mainly in the wall-rock. The latter does not permit sorting to as great an extent before concentration as the former, therefore the grade of concentrates and ratio of concentration will be lower, but the percentage of extraction much higher, so it is hardly fair to compare such figures as ratio of concentration, average values of concentrates produced and per cent. of extraction.

It is not a matter of concentrating silver, but of the many grades of Cobalt ores.

In the following paper the writer has attempted to give correct information, to the best of his knowledge and belief, and it is to be understood that such figures as tonnage, value per ton, cost per ton and percentage of extraction, each depending one on the other, are estimated to a certain extent; that is, facilities are not provided to weigh every pound of ore and accurately sample mill feed as a customs plant must do. Figures may vary, although the law of averages will correct high and low points over a large tonnage and time.

The general formations milled at the McKinley-Darragh concentrator, are the Huronian slates and conglomerates with a certain amount of Keewatin. Generally the veins are small and split up, yet give a large amount of vein matter.

The metal of economic value in the veins and country rock is silver. It occurs in the form of leaf silver, argentite, ruby silver, dyscrasite, stomeyerite, freieslebenite, associated with smaltite, niccolite, glaucadot, calcite, and other sulphides and arsenides. The wall-rock slates carry a considerable quantity of sulphides and metallics, from a coating or paint of the former to nuggets of the latter. The many combinations formed by the various minerals and gangue give a specific gravity anywhere from 2.7 to 9.9, i.e., from calcite to dyscrascite.

Whereas the cyanide man's salvation often lies in the sliming of his ores, the reverse is the condition here. A certain amount of the values when once slimed will float away and no amount of mechanical concentration will save them, as has been found by returning the pulp over tables again and again under different conditions. As to the question of overcoming this difficulty, it will be seen from the flow sheet and tables that the sliming of values has been considerably reduced.

The accompanying flow sheet illustrates the flow through the mill:

The stamps are provided with slot screen .375-inch x .187-inch aperture, .066-inch wire, 102 drops per minute, 7-inch drop, level discharge, 90 per cent. water. This practice gives stamp duty of about 4.25 tons per 1,250-pound stamp, plus tonnage by-passed equals 146 tons per day of 24 hours for 30 stamps.

The following table gives distribution of values and sizes in feed and discharge of stamps:

FEED.

Mesh.	Per cent.	Assay
On 1¼-inch	11.	19 ounces.
On 1 -inch	14.	19 ounces.
On ¾-inch	21.	19 ounces.
On ½-inch	21.	19 ounces.
On ¼-inch	17.	19 ounces.
Through ¼-inch	16.	19 ounces.

DISCHARGE.

Mesh.		Per cent.	Assay per ton.	Total oz. silver contained in 120 tons.
On	8	17 60	8.00	168.96
	10	4.30	8.24	42.52
	20	16.60	10.20	203.18
	40	15.20	18.32	333.79
	60	7.99	22.16	212.73
	80	6.47	23.60	183.23
	100	6.70	27.56	221.58
	120	1.55	32.36	60.38
	150	1.15	33.92	46.90
	200	3.06	33.76	124.11
Through	200	19.38	29.28	691.40
		100.	19.	2288.78

The run of mine is received in three separate bins, which permits mine sampling of this spotty ore in large lots.

On the first grizzly high grade is picked out and sacked, and after crushing to 3-inch the ore is conveyed to a shaking screen where high grade is again picked out. After crushing to 1¼-inch, the ore is elevated to a trommel 2½ x 6 mesh, where the undersize is washed out and by-passed around the stamps. In this way 18 per cent. is removed. This is joined by the hutch product from 6 Hartz jigs (the largest jig screen being 3-16-inch, round punch). This by-passed material and Hutch product is passed over an 8 x 20 mesh screen, the over-size going to a Hartz jig. The under-size is separated, the sands to table feed, and the slimes are settled and shipped direct, without further treatment. These slimes form about 1 per cent. of the total ore and will average 200 ounces of silver per ton.

The over-size of 8-mesh from the stamp pulp, and tails from fine jig are re-ground in one 8-foot Hardinge conical mill. This product, together with the stamp pulp under-size of 8-mesh, and about 4 tons of sands from original wash (running about 70 ounces per ton) is classified for 10 sand tables and 4 Frue vanners. By coarse crushing only 19.38 per cent. of slimes is made in the batteries, and the value of 17.6 per cent. of the battery pulp is reduced to 8 ounces before fine grinding. With the average stamp pulp