DEPARTMENT
OF
MINES

DIVISION OF
ORE DRESSING AND
METALLURGY

CANADA

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REPORT
of the
ORE DRESSING AND METALLURGICAL LABORATORIES

Report No.200

The concentration of molybdenite ore from the properties of the Molybdenite Reduction Company, near Amos, Quebec.

Shipments: A shipment of molybdenite ore of approximately ten tons, in three separate lots, was received at the Ore Dressing and Metallurgical Laboratories, Mines Branch, Department of Mines, Ottawa, August 24, 1923. The shipment consisted of the following lots:

Lot No.	No.bags	Net wt.lbs.	Locality from which samples were taken
1	150	12,064	Shaft dumps from veins nos. 4 and 4a Lacorne Township
2	75	6,070	Twelve other veins in Lacorne Township.
3	25	2,052	Two veins in Malartic Township.
Total	250	20,186	

From a report submitted with the shipment, the three separate lots are supposed to be average and representative samples of the ore from the Company's properties in Lacorne and Malartic Townships, Pontiac Co. Quebec.

Purpose of Experimental Tests: The object in view in conducting experimental tests was to determine whether the ore was amenable to treatment by flotation of the molybdenite from the gangue minerals with the production of a high grade marketable product with a high recovery of the molybdenite values. Small scale preliminary tests previously made had shown very encouraging and satisfactory results. Tonnage

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check tests, or tests on a much larger scale were desired, on the results of which the installation of a treatment plant at some point on the company's properties was contemplated.

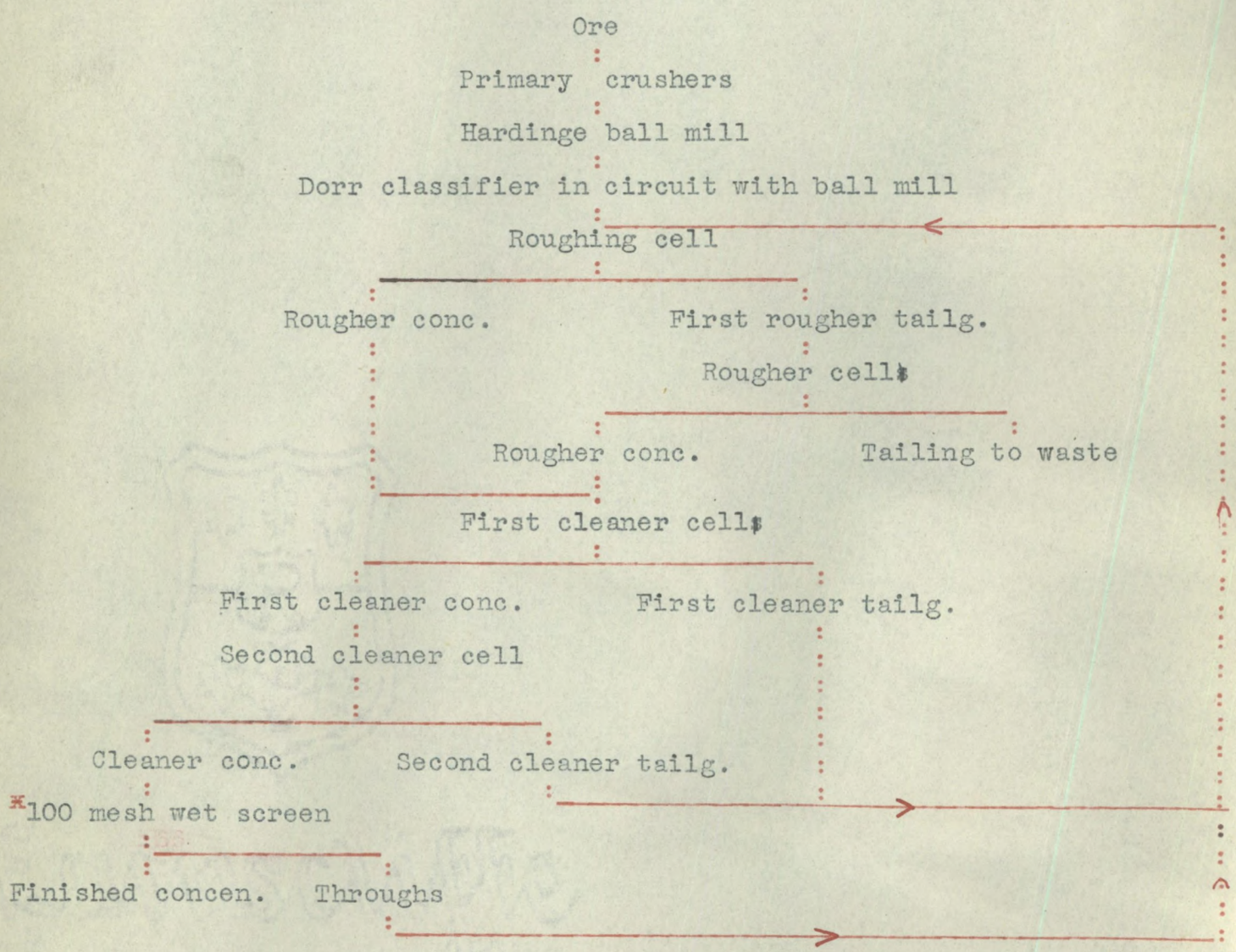
Arrangements for Experimental Tests: Arrangements were made whereby the company's consulting engineer, Mr. H. H. Claudet, would co-operate with the officials of the Mines Branch in supervising the whole operations with respect to the experimental work on this ore, and who would submit to the company a separate report describing more fully and in detail the operations in conducting the mill runs and the results obtained therefrom. A copy of his report was to be filed with the Department for reference.

Characteristics of the Ore: A superficial examination of the ore from the three lots show it to possess very similar characteristics with respect to molybdenite content and gangue, which consists of quartz, a considerable amount of sericite (a thin flake mica), a little iron pyrites and tourmaline. Feldspar and fluorite are also present in small amounts. The molybdenite is mainly associated with the sericite, although it occurs with the quartz and other gangue minerals in smaller amounts. The molybdenite flake is quite heavy but not usually large. Molybdite, the yellow oxide of molybdenum, and iron, occur in such small amounts that it is of no commercial importance. It is an oxidization product of molybdenite and is less likely to be found below the surface weathering. A comparison of the analysis of the various lots shows this to be the case, as the shaft ore of Lot No. 1 contains more molybdenite and less molybdite. The ore on the whole is very similar to that of Indian Peninsula to the west, and these occurrences of molybdenite to the south of Amos, Que. are of a different type to the majority of Canadian deposits.

Sampling and Analysis: The three lots were sampled separately, care being taken to obtain accurate samples for analysis. They were reduced first in a Blake crusher set at $\frac{3}{4}$" and in rolls set at 3/16". A tenth part was cut out by a Vezin sampler. By stage grinding and cutting after each stage of reduction, samples of about 100 grams ground to 150 mesh were submitted for analysis. The analysis of each lot was determined as follows:

Lot No.	Total molybdenum (Mo) as molybdenite (MoS_2)	Molybdite MoO_3	Molybdenite MoS_2
1	2.33 %	0.014 %	2.316 %
2	1.52	0.027	1.493
3	1.88	0.023	1.857

Experimental Tests: The method used for the recovery of the molybdenite content in this ore was one that is considered to be the best practice for concentrating molybdenite ores. It consists of crushing the ore in primary crushers, grinding inball mills in close circuit with classifiers to the required fineness to free the molybdenite and floating the molybdenite from its gangue by the oil flotation process The flow sheet used was as follows, with slight modifications for the various runs:



*Note: It may be advisable to dispense with the 100 mesh wet screen as this ore contains very little impurities, such as iron pyrites, an a high grade concentrate should be produced without the addition of the screen.

Lot No. 2, consisting of 5,942 pounds, was run first, followed by Lot No. 3, of 1,989 pounds. These two lots were considered as one run

as Lot No. 3 was too small ~~to make~~ to make a separate run. A partial clean up of the plant was made before running Lot No. 1, so that the concentrates could be kept separate and an idea of the results on the smaller lots obtained in order to make any changes in operation considered necessary.before running the larger lot. Lot No. 1 consisting of 11,826 pounds was run last.

It is a very difficult matter in a run of a few tons, to obtain ideal operating conditions at once. The nearest approach to actual mill conditions is the best results obtained over any one period of time during the operations. It is also difficult to obtain a full recovery of mineral owing to a considerable portion of the pulp remaining as residue in the ball mill, in the elevators, in the classifiers, in the cells, pipes, etc., and losses which would not occur in practice under contimual operation are inevitable in a short mill run. In order to keep these losses as low as possible, it was decided to consider all three lots together, and to make only one clean up at the end. This clean up was figured as a residue, and the molybdenite content in it determined.

The presence of considerable sericite, especially in Lot No. 1, presented another problem in the concentration of this ore. Consisting of thin flakes of mica, if recovered in the operations would mean a valuable by-product worthy of consideration. In running Lot No. 1, an effort was made to produce a mica product from the second rougher cell and this product is considered in the recapitulation of the results. Sufficient of this product was not produced to have any bearing on the results of the tests, and as the recovery of the molybdenite was of first importance, this problem was left for future consideration.

Results of Experimental Tests: The following tables give the details of the products from the test operations:

Lot No. 1	Net weight received	12,064 lbs	
	Deduct loss during sampling due to amount of sample, dust, floor sweepings, etc.	238	
	Net weight to ball mill		11,826 lbs
Lot No. 2	Net weight received	6,070	
	Deduct loss as above	128	
	Net weight to ball mill		5,942
Lot No. 3	Net weight received	2,052	
	Deduct loss as above	63	
	Net weight to ball mill		1,989
Total weight to ball mill			19,757

Weights, assays, and content of ore treated:

Lot No.	Net weight to mill - lbs.	*Assay MoS_2 %	Molybdenite content Lbs per ton	Molybdenite content Total content
1	11,826	2.316	46.32	273.89
2	5,942	1.493	29.86	88.71
3	1,989	1.857	37.14	36.93
Totals & averages	19,757	2.02	40.40	399.52

*Note - molybdenum present as oxide deducted

Weights, assays, and content of molybdenite concentrates obtained:

Product	Run No.	Dry weight lbs.	Assay MoS_2 %	Content MoS_2 lbs.
Concentrates produced from lots nos. 2 and 3	1	33.0	84.40	27.85
	2	32.0	89.48	28.63
	3	34.0	91.35	31.06
		99.0	88.40	87.54
Concentrates produced from lot no. 1	4	275.5	91.80	236.39
Total concentrates produced		356.5	90.80	323.93

Weights, assays, content and percentages - Total products obtained:

Product	Net weight lbs.	Assay MoS_2%	Content MoS_2 lbs.	% of total MoS_2 in ore
Total concentrates obtained	356.5	90.80	323.93	81.08
Mica product from rougher cell Lot No. 1	164.0	2.37	3.89	0.97
Residue - clean up of mill	1089.5	3.75	40.82	10.21
Tailings, weight by difference	18147.0	0.10	18.15	4.54
Loss, unaccounted for	--	--	12.74	3.20
Totals and averages	19757.0	2.02	399.53	100.00

Summary of Results: The results of the mill run show the following:

With an average mill feed of 2.02% molybdenite, a concentrate averaging 90.8% molybdenite was obtained with an average tailing over the whole operations of 0.10% molybdenite. This is equivalent to a recovery of about 95% of the molybdenite content of the ore.

The grade of the concentrates produced was above the usual market requirements, which call for 85% molybdenite. As the test proceeded the grade gradually increased from 84.4% MoS_2 in the first run, to 91.8% in the fourth run, and there were no doubt intervals in the latter run where a higher grade was being produced, showing that with continuous

operation under more ideal milling conditions, improvement on the grade produced in this test run could be expected.

Considering the grade of the ore, 2.02% molybdenite, the average tailing of 0.10% molybdanite obtained was most satisfactory. In the first run, the tailing was higher than the average, being 0.14% molybdenite, while as the test proceeded a lower tailing was being produced, and in the fourth run a tailing of 0.07% molydenite was being made, showing that with continuous operation a lower tailing assay could be expected.

The tables giving the results from the mill run show a loss unaccounted for. This is due to unavoidable spills and leakages during operations on such a small quantity of ore. They also show a residue from clean up operations containing considerable molybdenite, which is not recovered in a test of this nature, but which would not occur in the operation of a molybdenite mill. In continuous operations there would be only two products, namely a marketable concentrate, and a tailing, so that the only fair way to arrive at the recovery is to calculate it from the tailing assay. Taking 0.10% molybdenite, the average tailing obtained, this would give a recovery of 95.2% of the molybdenite values in the ore.

Conclusions: The ore received for the mill run is of an exceptionally good grade, somewhat higher than the average for molybdenite ores in Canada. It is of a different character from the majority of Canadian ores, in that it is associated mainly with sericite and quartz, and comparatively free from sulphides other than molybdenite. In this respect it can be classed as a clean ore.

It is very amenable to concentration by flotation. Its physical character, and the absence of appreciable quantities of other sulphides such as copper and iron, make it an attractive milling ore. It is not difficult to grind, the molybdenite being freed at about 40 mesh. These characteristice permit of an exceptionally high grade product being produced with a very high recovery of the molybdenite.