REPORT
of the
ORE DRESSING AND METALLURGICAL LABORATORIES

Report No. ~~224~~ 220

Concentration of the lead-zinc ore of the Reader Mine, Calumet Island, Quebec.

by C. S. Parsons
Introductory by W. B. Timm.

The commanding position of lead in the metal markets of the world has resulted in an active search for new lead properties, and the opening up of idle properties. Hence a visit was made by the writer on November 13th. 1924, to the Reader Mine on Calumet Island.

Situation: The property comprises lots 9, 10, 11, and 12, Range IV Township of Calumet, County of Pontiac in the Province of Quebec. It is situated in the southern part of the island, one half mile from the Roche Fendue channel of the Ottawa river, three miles from the village of Bryson and the recent power development at Calumet Falls and six miles from Campbells Bay on the Ottawa-Waltham branch of the Canadian Pacific Railway.

Operation: The property was operated intermittently from 1896 to 1913 by the Grand Calumet Mining Co. Ltd; the Calumet Metals Co. and the Calumet Zinc and Lead Co. In 1898, 1100 tons of high grade ore was shipped to Belgium. In 1910 a small concentrating plant was built and trial shipments of lead and zinc concentrates were made to the Balbach smelter, Newark, N.J. In 1912 a 150-ton concentrator was built, equipped with jaw crusher, coarse rolls, screens, fine rolls, jigs, Huntingdon mill, Wifley and Overstrom tables. This mill was operated for a few months and was closed down. It was later destroyed by fire.

220

Occurrence: There are two main breaks, striking west of north and east of south, 1400 feet apart at the southern exposures and 630 feet apart at the northern exposures. The western zone was opened up by prospect pits and shafts for 2100 feet along the strike. The eastern zone was opened up by prospect pits and shafts for 1800 feet along the strike.

Development: This consists of four shafts varying in depth from 74 feet to 146 feet; several smaller shafts varying in depth from 17 feet to 35 feet, and numerous prospect pits. The total amount of drifting is approximately 500 feet from the main shafts.

Concentration products from milling operations: A marketable lead product was made. This contained on the average 65% lead, 8% zinc, 0.5% copper, and 87 ozs. silver. A low grade zinc product was obtained containing on the average 3.5% lead, 28% zinc, 18 ozs. silver, and of high iron content. The tailing losses were high. Before the advent of oil flotation, lead-zinc-silver ores possessing the characteristics of this ore presented a difficult problem in the matter of their concentration and separation of the minerals to obtain marketable products. The selective flotation of lead-zinc ores has been the solution to the problem in a great many cases and the results of the experimental work conducted by Mr. Parsons on this ore show that marketable products with high recoveries can be obtained, so that one of the chief difficulties of the earlier operations has been overcome. Comparatively cheap power is also now available from the recent developments at Calumet Chutes, 3 miles distant. Mr. Parsons report on the experimental work follows:

Shipment for Experimental purposes: A shipment of four samples was received at the Ore Testing Laboratories November 15th. submitted by W. B. Timm, Department of Mines, Ottawa. It consisted of a sample taken from the stock piles, weight 25 lbs. representing the ore mined, for the purpose of experimental tests. A sample of selected high grade ore, for analysis to determine

if a marketable product could be sorted from the ore for direct shipment to the smelter; a sample of supposed ground mill feed for analysis to obtain an idea of the assay value of the feed to the concentrator destroyed by fire; and a sample of the old concentrator tailings. From the analysis it will be seen that the latter two samples are not representative ones, especially that of the mill tailings, but denote that there were high tailing losses with the former methods of concentration.

Analysis of samples for experimental purposes: The samples were designated nos. 1, 2, 3, and 4, and gave on analysis the following values:

Description of sample	Lead %	Zinc %	Iron %	Silver oz/ton	Gold oz/ton
No. 1 - stock pile ore	3.35	7.08	4.82	9.50	
No. 2 - Selected high grade ore	16.52	28.26	8.35	39.78	0.02
No. 3 - Supposed ground mill feed	2.12	10.04	8.93	3.15	
No. 4 - Mill tailings	1.77	12.15	8.16	8.20	

Purpose of experimental tests: The object in conducting experimental tests was to determine whether the ore could be concentrated by the improved methods of concentration of this type of ore, with the production of marketable lead and zinc products and with high recoveries of the values. When the mine was last operated the only method available was gravity concentration on jigs and tables. The recovery of the lead and silver values was low due to the tendency of the galena to slime badly during crushing operations. The iron pyrite and zinc blende being of practically the same specific gravity could not be separated by gravity means, and reported as a zinc-iron middling too low in zinc to be of market value. In order to obtain a marketable zinc product from this zinc-iron middling roasting was required to change the pyrite to the magnetic form, followed by magnetic separation. This method was not only costly but was hard to control, and with the exception of a few instances was not successful from an economic standpoint.

Experimental Tests

The tests were conducted on sample no. 1, the stock pile

ore, as oxidization had not taken place to any appreciable extent. A table test was made on the ore crushed to 20 mesh to determine the results from gravity concentration. Three flotation tests were conducted on the ore ground to varying degrees of fineness as given in the screen tests following, to determine the results from selective flotation. The reagents used in making the flotation tests are given in a separate table, and the results of the table and flotation tests are also given in tabulated form.

Screen tests of flotation tailing showing fineness of grinding

Mesh	Test No. 1		Test No. 2		Test No. 3	
	grams	percent	grams	percent	grams	percent
+48	2.5	0.5	0.1	0.0	0.3	0.1
-48+65	18.2	3.6	4.0	0.8	6.5	1.3
-65+100	77.4	15.5	19.6	3.9	39.5	7.9
-100+150	86.0	17.2	53.0	10.6	45.5	9.1
-150+200	62.5	12.7	62.0	12.4	71.5	14.3
-200	252.4	50.5	361.3	72.3	336.7	67.3
Totals	500.0	100.0	500.0	100.0	500.0	100.0

Reagents used in flotation tests

Test No. 1 - 1000 grams ore

Lead reagents:	5 lbs/ton	sodium carbonate
	.2 "	Z cake
	.4 "	sodium cyanide
	.75 "	cresylic acid
Zinc reagents:	2 "	copper sulphate
	.2 "	YZ mixture
	.1 "	TT mixture
	.01 "	Pine oil

Test No. 2 - 1000 grams ore

Lead reagents:	5 lbs/ton	sodium carbonate
	.1 "	QED reagent
	.4 "	sodium cyanide
	.75 "	cresylic acid
Zinc reagents:	2 "	copper sulphate
	.2 "	YZ mixture
	.15 "	TT mixture
	.01 "	Pine oil

Test No. 3 - 1000 grams ore

Lead reagents:	5 lbs/ton	sodium carbonate
	.2 "	Z cake
	.25 "	sodium cyanide
	.75 "	cresylic acid
Zinc reagents:	2 "	copper sulphate
	.5 "	Dominion Tar & Chemical Co's neutral creosote oil No. 2
	.01 "	potassium xanthate

Results of Table and Flotation tests

Test No.	Product	Weight grams	Weight %	Assays Pb. %	Assays Zn. %	Assays Ag.oz.	Percentage of values Pb.	Percentage of values Zn.	Percentage of values Ag.
Table test -									
1.	Concentrate	50.5	2.5	63.68	6.58	139.00	48.4	2.5	33.3
	Middling	610.5	30.5	2.71	14.31	9.38	25.1	65.4	27.5
	Tailing	1339.0	67.0	1.29	3.34	6.10	26.5	32.1	39.2
Flotation tests -									
1.	Lead concentrate	43.7	4.37	55.27	2.10	152.5	69.4	1.4	56.6
	Lead middling	77.2	7.72	11.20	7.63	5.5	24.8	8.3	3.6
	Zinc concentrate	110.7	11.07	0.50	52.21	33.1	1.6	84.3	31.1
	Zinc middling	53.0	5.30	0.62	4.92	6.56	0.9	3.8	3.0
	Tailing	715.9	71.54	0.16	0.21	0.94	3.3	2.2	5.7
2.	Lead concentrate	95	9.5	34.66	4.10	91.7	89.2	5.5	79.4
	Zinc concentrate	162	16.2	1.48	38.70	8.8	6.8	88.8	13.1
	Tailing	748	74.8	0.20	0.54	1.1	4.0	5.7	7.5
3.	Lead concentrate	59.7	6.0	46.54	2.74	134.0	80.9	2.2	72.2
	Lead middling	59.0	5.9	9.02	6.88	28.5	15.5	5.6	15.2
	Zinc concentrate	108.7	10.9	0.32	55.32	4.5	1.0	82.7	4.4
	Zinc middling	35.5	3.5	0.80	15.16	7.44	0.8	7.4	2.4
	Tailing	737.1	73.7	0.08	0.21	0.88	1.7	2.1	5.8

Summary of Results: The results from the table test show that a high grade lead concentrate can be obtained, but with a low recovery of the lead and silver values in the concentrate. A low grade zinc-iron middling was obtained. This test showed the difficulty of concentrating an ore of this type by gravity methods.

The flotation tests conducted were only of a preliminary nature but the separations were so readily obtained with so little attention to manipulation that equally as good results, if not better, should be obtained in actual milling operations. Both the grade of the lead and zinc concentrates and the recoveries of these metals were good as well as the recovery of the silver values. One very important point has been determined, namely that fine grinding increases the proportion of silver values in the lead concentrate as can be seen by comparing the distribution of silver values in test no. 1 to that of tests nos. 2 and 3. The screen tests show that much finer grinding was done in the latter tests. The results of this fine grinding were that the silver content of the zinc concentrate was reduced from 33 ozs. to 4.5 ozs. per ton, thereby increasing the recovery of the silver values in the lead products from 60% to 87%. This increased recovery of silver values with the lead concentrate is a very important item from an economic standpoint in the marketing of the concentrates.

Conclusions: It is resonably safe to assume from the results of the small scale experimental tests conducted that the ore of the Reader mine can be successfully concentrated by selective flotation with the production of high grade lead and zinc products, and with good recoveries of the lead, zinc, and silver values.