

December 28, 1921

R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES

Test No. 144

A shipment of 370 pounds of lead carbonate ore was received at the Ore Dressing and Metallurgical Laboratories, January 26, 1921, from the North Star Mine, Kimberley, B.C.

The ore consisted chiefly of lead carbonate, coated and locked up in a mass of iron oxides, formed by the oxidization of the iron sulphides, and gave an analysis as follows:

Lead	(Pb)	..	..	..	..	10.85%	
Iron	(Fe)	..	..	..	..	14.30%	Fe ₂ O ₃ . 20.45%
Alumina	(Al ₂ O ₃)	..	..	..	..	4.55%	
Silver	(Ag)	..	..	..	..	6.55	oz. per ton
Moisture	(H ₂ O)	..	..	..	..	3.60%	

The object of the experimental work was to determine a method of concentration for the ore. A number of small scale tests were made by sulphidizing the lead carbonates and oxides for flotation, using gravity concentration on tables, and by the chloride volatilization process.

A series of tests were first conducted using a combination of flotation and table concentration. In these tests the table tailings were sulphidized with sodium sulphide before flotation. It was thought that a long contact with the sodium sulphide was necessary, but later it was found that much better results could be obtained by allowing the ore only a short contact with the sulphidizing reagent before flotation. The results of two of the first

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series of tests are given below:

Test #4

1000 grams of ore crushed to 60 mesh was agitated for 30 minutes with 20 pounds per ton of sodium sulphide salt $9H_2O$. It was floated and the flotation tailing tailed. The following other reagents were added:

Soda ash	.. ..	1 pound per ton
Coal tar creosote	.. 4 "	" "
Pine oil (#5GNS)	.. 0.4 "	" "

Product	Weight	Pb. %	Pb. grams	Recovery of Pb.	Remarks
Flotation conc.	149	31.35	46.71	45.4	74.4% recovery assuming that 70% of the lead in the middling would report in the concentrate
" midd.	191	7.80	14.90	14.4	
Table conc.	44	44.27	19.48	19.0	
" tailing	360	3.15	11.34	11.0	
" slimes	179	5.86	10.49	10.2	

Test #9

1000 grams of ore crushed to 100 mesh was agitated $1\frac{1}{2}$ hours with 10 pounds per ton of sodium sulphide salt $9H_2O$. It was floated and the flotation tailing tailed.

Product	Weight	Pb %.	Pb. grams	Recovery of Pb.	Remarks
Flotation conc.	155	40.35	62.5	57.6	79% recovery assuming that 70% of the values in the middling would report in the concentrate
" midd.	171	7.25	12.4	11.4	
Table conc.	43	34.33	14.8	13.6	
" tailing	631	2.98	18.8	17.4	

A second series of tests were conducted varying the time of contact with the sulphidizing reagent, and the strength of this reagent used. The strength of solution used is given in terms of Na_2S (Note: The commercial salt contains varying quantities of water). The results of these tests, and reagents used, are given in the tables following.

The procedure followed was to grind the ore wet in a ball mill to 200 mesh, dewater, and pass through a filter press. The solution of sodium sulphide made up to strength required was then added to the cake, and the two agitated together for a certain length of time. It was found that the sulphidization of the lead particles which were free, and exposed to the action of the reagent, took place almost

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Test #144 (3)

instantly, and were easily recovered by flotation. The recovery of the silver values was much more difficult, a maximum of 40% was the best that could be obtained.

In test #30, a strong solution of sodium sulphide was left in contact with the ore for 15 minutes. The solution on being tested showed no free Na_2S . The recovery of the silver values was no greater than when the weaker solution was used for shorter periods of contact. It was also found that the lowest tailing carried 3% lead. The difficulty in obtaining high recoveries of the lead and silver values seems to be due to the physical characteristics of the ore. The particles of lead carbonate and the silver values, in whatever form they occur, seem to be locked up in a mass of iron oxides, which completely film them. Wet grinding to 200 mesh is necessary to remove as much of this coating as possible, and even at this fine state of division, the minerals are not entirely freed, but remain enclosed in the film of iron oxide. This was demonstrated by taking 1000 grams of the ore, grinding and tabling successively by stages until a fineness of 200 mesh was reached. It was found at this stage of crushing, that no more lead was freed to report as concentrate on the table, and the tailing at this stage gave an assay of 3.5% lead.

A recovery of between 70% and 80% of the lead values and 40% of the silver values, seems to be the maximum that could be expected by the combined method of sulphidizing for flotation and tabling the flotation tailing. The control of the sulphidizing condition seems to be simple, gives uniform results, and the above recoveries should be obtained quite readily from the ore, as submitted for test purposes.

Chloride Volatilization Tests

Two small tests were made to determine whether this process was applicable to the ore. The results obtained, as to recovery of the lead and silver values, were practically the same as those obtained by flotation and tabling.

Test #1

Assay of ore	Silver, 6.55 oz.	Lead, 10.85%
Assay of tailing	Silver, 4.61 oz.	Lead, 3.41%
Volatilized	Silver, 35.30 %	Lead, 70.4%

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Test #2

Assay of ore	Silver, 6.55 oz.	Lead, 10.85%
Assay of tailing	Silver, 5.06 oz.	Lead, 4.80%
Volatilized	Silver, 58.70 %	Lead, 29.00%

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REAGENTS USED

Test No.	Strength of solution in dry Na ₂ S salt.	Time	Oils used	Remarks
25	2.20 grams in 500 c.c.	15 mins.	10% C.T.: 80% C.T.C.: 10% Pine Oil - 1 c.c.	Too much frothing oil
26	2.20 " " 1000 "	15 "	Same as test #25 - 1 c.c.	
27	4.40 " " 2000 "	15 "	10% 1-B: 80% C.T.C.: 10% C.T.: and enough crude turps - 1 c.c.	
28	2.20 " " 2000 "	15 "	Same as test #27 - 1 c.c.	
29	4.40 " " 4000 "	15 "	Same as test #28 - 1.5 c.c.	
30	8.80 " " 3000 "	15 "	Same as test #29	
31	2.20 " " 3000 "	3 "	Same as test #29	Added solution directly in cells
32	2.20 " " 3000 "	3 "	10% B-14: 20% C.T.: 70% C.T.C.	Solution added directly to cells. Very high grade looking froth.
33	4.40 " " 3000 "	5 "	Same as test #32	Na ₂ S solution added directly in cells. Very high grade looking froth.
34	4.40 " " 3000 "	5 "	X-Y reagent - 0.25 c.c.	Na ₂ S solution added directly in cells. Very watery looking froth, and voluminous.
35	4.40 " " 3000 "	5 "	10% B-14: 20% C.T.: 70% C.T.C., plus crude turpentine	Quite a heavy good froth. This sample was only crushed for 15 minutes.
36	4.40 " " 3000 "	5 "	10% B-14: 20% C.T.: 70% C.T.C.: - 1 c.c.	This test ground very fine for two hours. Fine looking black froth.

RESULTS OF TESTS

Test No.	CONCENTRATE						MIDDLING						TAILING					
	Weight grams.	Assay		Content		%age of Pb. values	Weight grams.	Assay		Content		%age of Pb. values	Weight grams	Assay		Content		%age of Pb. values
		Pb. %	Ag. ozs	Pb. gms	Ag. gm-ozs			Pb. %	Ag. ozs	Pb. gms	Ag. gm-ozs			Pb. %	Ag. ozs	Pb. gms	Ag. gm-ozs	
25	99	39.75		39.4		37.4	118	13.5										
26	189	31.7				55.0												
27	119	53.35	11.06	63.5		58.9	132	8.96		11.8		10.0	712	4.70		33.5		31.1
28	96	50.7		48.7		44.8	162	10.0		16.2		14.9						
29	131	46.5		60.9		56.2	202	8.5		17.17		15.8						
30	134	49.6	10.36	66.5	1393.6	61.2	86	13.2		11.4		10.3	780	3.97		31.0		28.5
31	148	51.8		76.7		70.5	173	6.4		11.1		10.2	679	3.10		21.0		19.3
32	142	53.5		76.0		70.0	129	7.0		9.0		8.3	761	3.20		24.4		21.6
33	125	59.8		74.8		68.9	86	7.9		6.8		6.3	816	3.3		26.9		24.8
34	91	56.8	10.4	51.7	946.4	47.6	110	13.3	8.96	14.6		13.5	815	5.18	5.4	42.2	4401.	38.9
35	113	61.5	19.6	69.5	2214.8	63.8	59	7.5	6.7	4.4		4.0	856	4.1	4.0	35.1	3430	32.2
36	134	50.3	16.4	67.4	2197.6	61.7	168	8.9	7.4	14.9		13.5	732	3.7	4.28	27.1	3130	24.8