257

REPORT
of the
ORE DRESSING AND METALLURGICAL LABORATORIES

Concentration and separation of the values in a lead-zinc-gold-silver ore from Bunker Hill claims, Alice Arm, British Columbia

C. S.Parsons

Shipment: A shipment of 200 pounds of ore was received October 16, 1926 from Edgar Trethewey, Alice Arm, B.C. The sample was from the Bunker Hill Claims, Alice Arm.

Characteristics and analysis of sample: The sample received was a heavy sulphide ore containing galena, zinc blend, gold, and silver. The analysis of the sample was as follows:

Lead	12.72 %
Zinc	7.63 %
Gold	0.28 oz/ton
Silver	17.98 "
Iron	28.67 %

Purpose of tests: The purpose of the experimental tests which follow is to determine a method of concentration and separation by which would be produced marketable lead and zinc concentrates. The recovery of the gold and silver values presents the most difficult problem and considerable experimental work was performed in an endeavour to increase the recoveries of these two metals.

Experimental Tests

Tests Nos. 1 to 5 are a series of flotation tests, and tests 4a and 5a are made in an attempt to recover part of the gold remaining in the flotation tailings. In the selective flotation tests, 1000-gram samples were used, taken from the original large sample which had been crushed to -14 mesh. The general procedure followed in making these tests was to grind the ore in a small ball mill with certain reagents and float first for the lead and then for the zinc after the addition of other reagents.

257

Reagents:

Test No. 1 - Soda carbonate 6 lb/ton Added to ball mill.
Sodium cyanide 0.25 " time contact 20 mins.
Note - when tested before flotation the pulp was found to be still acid.

Lead flotation - Soda carbonate 3 lb/ton
Phospho-cresylic 0.15 "

Zinc flotation - Soda carbonate 1 ")Time contact of 3
Sodium sulphiate 2 ")mins. before floating
Copper sulphate 2 ")
Xanthate 0.2 "
Pine oil to froth

Test No. 2 - Soda carbonate 6 lb/ton Added to ball mill, time
Soda Sulphite 2 " contact 25 minutes

Lead flotation - Soda carbonate 2 lb/ton
Phospho-cresylic 0.15 "

Zinc flotation - Soda ash 1 lb/ton) Time contact of
Copper sulphate 2 ")3 mins. before
Xanthate 0.2 ")flotation

Test No. 3 - A duplicate of No. 2, but with 2 pounds additional soda ash added to ball mill, making 8 pounds.

Test No. 4 - A duplicate of No. 1, but adding 10 pounds per ton of soda ash to ball mill and no additional soda ash to cells

Test No. 5 - The ore was ground finer in this test than in the preceeding one.

Soda ash 12 lbs/ton Time contact in ball
Sodium cyanide 0.4 " mill 30 minutes

Lead flotation - Phospho-cresylic 0.15 lb/ton

Zinc flotation - Copper sulphate 1.5 ") Contact of 3 mins
Xanthate 0.3 " before flotation

Test No. 5a - A cyanide test was made on the tailing from test No. 5 The extremely basic nature of this ore causes high consumption of cyanide, so that the ordinary method of 24 to 48 hours contact is not practical. It was hoped that the gold and silver remaining in this tailing might be in such a form that would go into solution rapidly and that a 60 to 75% recovery might be obtained in a few hours contact, which would keep the consumption of cyanide within economic limits. The following test was therefore made with this idea in view.

Amount of flotation tailing used		500 grams
Pulp made up to		1:2
KCN	0.1 % -	0.78 grams NaCN
Lime	5 lbs/ton -	1.25 grams
Time cyaniding		4 hours
Cyanide consumption		2.16 lbs/ton
Lime consumption		2.9 "
Assay of flotation tailing (cyan.head)		0.16 oz/ton
Assay of cyanide tailing (4 hrs contact)		0.12 "
Extraction by cyaniding		23 %

Screen test on cyanide tailing:

Mesh	Wt gms.	Wt %	Assay	Content	% of values
+200	57.5	11.3	0.17	1.58	12.9
-200	450.0	88.7	0.12	10.64	87.1

Summary: Five flotation tests were run, one table test on the flotation tailing from test No. 4 and a cyanide test on the tailing from test No. 5. The table test and cyanide test were run in order to determine if part of the gold remaining in the flotation tailing could be recovered. In the first four flotation tests the ore was ground to approximately -65 mesh, 75% passing 200 mesh. In the fifth test the ore was ground finer so that 87% passed 200 mesh. Two different depressant reagents were used for the zinc and iron, namely sodium cyanide and sodium sulphite.

Conclusions: The best practice indicated by these tests points to the production of a lead concentrate high in iron sulphides in order to recover as much gold as possible. A grade of 50% lead seems to strike a balance. The lower the grade of lead product, the greater the loss of zinc in that product. The tests indicate that 90% of the lead may be recovered in a concentrate containing 50% lead and 85% of thezinc in a concentrate containing 45% zinc. The grade of the zinc concentrate can without doubt be raised to 48 or 50% by recleaning, without affecting the recovery. Approximately 50% of the gold can be recovered in the lead concentrate and 80% of the silver. The silver reporting in the zinc concentrate can also be considered recovered. The gold in the zinc concentrate is too low to be paid for by the smelter.

In regard to reagents, there is very little to choose between the use of cyanide and the use of sodium sulphite. Cyanide seems to be slightly the better reagent. Time contact of these reagents is essential, and a mill will require surge tanks to obtain at least 30 minutes contact before the lead flotation and 10 minutes between the lead and zinc flotation.

The table and cyanide tests for the recovery of the gold and silver in the flotation tailing were not successful. These values are evidently locked up in the pyrite.

Results of flotation tests -

Product	Weight		Assays					Per cent of values				
	grams	%	Pb %	Zn %	Au oz	Ag oz	Fe	Pb	Zn	Au	Ag	
Lead concentrate	132.0	13.2	72.23	0.20	0.52	81.20	6.84	75.2	0.4	25.7	60.8	Test No. 1
Lead middling	106.0	10.6	12.27	7.47	0.66	30.3	29.88	10.2	11.0	26.3	18.2	
Zinc concentrate	132.7	13.8	5.48	44.95	0.02	10.02	12.27	5.7	82.8	1.0	7.5	
Zinc tailing	626.5	62.9	1.31	0.67	0.20	3.82	34.86	8.9	5.8	47.0	13.5	
Lead concentrate	230.5	22.9	45.30	4.35			17.3	86.7	18.9			Test No. 2
Zinc concentrate	133.0	13.2	6.69	35.84			17.0	7.4	66.0			
Tailing	643.5	63.9	1.10	2.25			35.02	5.9	20.1			
Lead concentrate	183.2	19.2	59.90	3.58	0.84	77.76	11.06	85.3	9.0	47.7	79.4	Test No. 3
Zinc concentrate	133.0	14.0	3.62	46.70	0.20	7.92	11.66	3.8	85.8	8.4	5.9	
Tailing	636.5	66.8	2.20	0.60	0.22	4.14	35.85	10.9	5.2	43.8	14.7	
Lead concentrate	204.5	20.5	62.0	2.76	0.76	75.32	10.70	92.1	7.6	54.9	82.7	Test No. 4
Zinc concentrate	157;5	15.9	1.51	41.37	0.28	6.17	16.0	1.7	87.9	9.4	4.4	
Tailing	633.5	63.6	1.35	0.52	0.16	3.80	36.02	6.2	4.5	35.7	12.9	
Tabling flotation tailing -												
Table concentrate	100.4	20.1			0.22	2.48				30.2	15.1	Test No. 4a
Table middling	172.0	34.4			0.10	2.48				23.4	25.8	
Table tailing	119.1	23.8			0.14	3.46				22.7	17.9	
Table slimes	108.5	21.7			0.16	6.26				23.7	41.2	
Lead concentrate	232.1	23.2	49.29	4.64	0.52	65.4		91.7	14.6	49.0	83.2	Test No. 5
Zinc concentrate	144.3	14.4	2.21	41.53	0.18	8.58		2.6	81.0	10.5	6.8	
Tailing	623.6	62.4	1.13	0.52	0.16	2.94		5.7	4.4	40.5	10.0	