Report No. 237

The concentration of a zinc-silver ore from the Wonderful mine, Sandon, B.C.

by J. S. Godard

Shipments: A shipment of 235-lbs of a lead-zinc ore from the Wonderful mine, Sandon B.C. was received at the Ore Dressing and Metallurgical Laboratories October 22, 1925. It was designated as sample of feed to the Alamo concentrator, operated by the Cunningham Mines Ltd. at Alamo.

Characteristics of the ore: The ore was tentatively classed as lead-zinc-silver, but on analysis was found to contain only 0.35% lead. The principle gangue is silica, but some graphite as graphite schist, some siderite, and a small quantity of a manganese mineral, presumably rhodochrosite, are present. Silver amounting to about 8 oz/ton is associated with the sulphides, principally the zinc.

Sampling & Analysis: The ore as received, ½" size, was thoroughly mixed and cut twice in a Jones sampler. One cut was reduced to -14 mesh and cut twice, then further reduced to -48 mesh before cutting the head sample. Analysis showed the ore to contain

Lead	0.35%	Zinc	9.52 %
Silver	7.80 oz/ton	Insol	61.70 %
Sulphur	7.09 %	Manganese determined qualitatively	

Purpose of Experimental tests: The flow sheet at the Alamo concentrator consisted of grainding, screening on Callow belt screen, tabling out the lead, dewatering the table tailing and slimes, flotation of the slimes, and flotation of the zinc. The loss of silver was high, and the recoveries of both lead and zinc were poor. Selective flotation was considered as a means of effecting a saving of the silver and increasing the recoveries and grades of concentrates in the case of both the lead and zinc. The possibility of making a zinc concentrate containing the silver and disregarding the small quantity of lead present was also considered. With the above two purposes in view, tests as tabulated below were undertaken:

Test No	Product	Weight %	Assays			Percent of values		
			Pb %	Zn %	Ag oz	Pb	Zn	Ag
1	Lead conc.	10.4	4.01	2.95	13.56	99	3.1	18.5
	Zinc "	21.4	tr	43.18	28.00		94.6	78.5
	Tailing	68.2	tr	0.33	0.33		2.3	3.0
2	Lead conc.	11.6	3.80	2.81	13.50	99	3.3	20.0
	Zinc "	20.8	tr	44.50	29.00		95.3	77.0
	Tailing	67.6	tr	0.21	0.36		1.4	3.0

The tailings from Tests Nos. 1 and 2 were screened -

Test No	Mesh	Weight %	Cumulative %
1	+65	0.5	0.5
	+100	9.4	9.9
	+150	11.6	21.5
	+200	13.0	34.5
	-200	65.5	100.0
2	+65	0.1	0.1
	+100	1.9	2.0
	+150	6.8	8.8
	+200	10.7	19.5
	-200	80.5	100

Reagents used for Tests Nos. 1 and 2

Lead reagents:	Soda carbonate	5.0 lb/ton	Added to ball mill
	Thiocarbanilide	0.2 "	"
	Cyanide	0.5 "	"
	Pine oil #5	0.04 "	" Ruth
Zinc reagents:	Copper sulphate	2.0 "	" "
	Xanthate	0.5 "	" "
	Pine oil #5	0.04 "	" "

Summary: There is very little difference between these tests. Evidently grinding as in No. 1 is sufficiently fine to make the separation

Test No. 3 - Selective flotation at 65 mesh: 6 lots of ore of 1000 grams each at -14 mesh were ground and floated separately in a Ruth machine. The lead concentrates were combined and cleaned. The zinc concentrates were similarly treated. All the tailings were combined.

Product	Weight %	Assays- Pb %	Zn %	Ag oz.	Percent of values Pb	Zn	Ag
Lead conc.	4.5	8.84	1.41	22.36	92.2	0.7	13.4
" middling	5.9	0.19	5.27	5.08	2.5	3.2	4.0
Zinc conc.	16.8	0.14	53.11	33.60	5.3	92.9	75.3
" middling	7.2	tr	2.91	3.54		2.2	3.4
Tailing	65.6	tr	0.15	0.44		1.0	3.9

Reagents: Same as in tests Nos. 1 and 2

Summary: Good recoveries were made in the lead, zinc and silver. The lead concentrate appeared much higher than the analysis showed. The reason for this was the presence of graphite which floated with the lead. The carbon in the lead concentrate amounted to 5.64 %

Test No. 4 - Flotation at 65 mesh: The purpose of this test was to concentrate the lead. No attempt was was made to concentrate the zinc. 8 lots of ore of 1000 grams each were ground separately to 65 mesh and floated separately in a Ruth machine. The cleaning of the concentrate was done as follows. Four rougher concentrates were combined and cleaned making a concentrate, then the remaining four rougher concentrates were treated separately similarly. Both cleaner concentrates were combined and re-cleaned, and the concentrates from

this re-cleaned, making in all three middling products.

Product	Weight %	Assays			Percent of values		
		Pb %	Zn %	Ag oz.	Pb	Zn	Ag
Lead conc.	4.9	7.98	1.05	21.52	95.4	0.5	14.5
Middling #1	6.4	0.11	5.67	4.54	1.7	3.9	4.0
" #2	1.3	0.25	3.01	3.42	0.7	0.4	0.6
" #3	0.9	0.98	2.36	4.68	2.2	0.2	0.6
Tailing	86.5	tr	10.24	6.74		95.0	80.3

Reagents:			
	Soda carbonate	5 lb/ton	added to ball mill
	Thiocarbanilide	0.20 "	" "
	Cyanide	0.50 "	" "
	Pine oil #5	0.04 "	" Ruth

Summary: By flotation it seems impossible to raise the lead content of the concentrate above 9%, as in test no. 3. Graphite again appeared in the lead concentrates. It is darker than the galena when seen in the cells and forms a very thin coating over the bubbles. The carbon in the lead concentrate amounted to 6.56%

Tests Nos. 5 & 6 - Flotation at 65 mesh: In tests Nos. 5 and 6, the lead present was disregarded and the ore treated as a zinc-silver ore.

Test No	Product	Weight %	Assay		Percent of values	
			Zn %	Ag oz.	Zn	Ag
5	Zinc conc.	20.0	45.68	32.94	96.8	91.0
	" middling	10.4	1.30	1.94	1.4	2.8
	Tailing	69.6	0.25	0.64	1.8	6.2
6	Zinc conc.	16.6	52.71	37.90	92.5	87.6
	" middling	8.6	5.32	6.18	4.8	7.4
	Tailing	74.8	0.35	0.48	2.7	5.0

Reagents used:				
Test #5	Soda carbonate	5.0 lb/ton	to Ball mill	
	Copper sulphate	2.0 "	Ruth	
	Xanthate	0.4 "	"	
	Pine oil #5	0.08 "	"	
#6	Lime	5.0 "	Ball mill	
	Copper sulphate	2.0 "	Ruth	
	Xanthate	0.4 "	"	
	Pine oil #5	0.08 "	"	

Summary: As far as recoveries are concerned there is little to choose between soda carbonate and lime as a means of producing alkalinity. Slightly better zinc recoveries were obtained with soda carbonate, while the silver results were slightly better when lime was used. The froth in the Ruth machine, using soda carb. is more active, but if a pneumatic type of cell were used, lime could possibly be utilized at a lower cost.

Summary & Conclusions: Selective flotation - Good recoveries of all three metals can be made by selective flotation. There was not sufficient lead values in the ore to make a high grade lead concentrate
Straight flotation - When the lead content is disregarded and the ore treated as a zinc silver ore, good recoveries of both zinc and silver are obtained. The concentratex is of good grade, averaging 50% zinc and 35 oz/ton silver, with recoveries of 95% of the zinc and 90% of the silver values. No difficulty should be experienced in duplicating the results of these tests in mill scale operations.

The reagents used were found entirely satisfactory so no others were tried. If the ore be considered as a straight zinc-silver proposition the alkaline reagent should be added to the ball mill