REPORT
of the
ORE DRESSING AND METALLURGICAL LABORATORIES

Experimental tests on gold ore from the
K.V.Mines, Ltd., Paulson, B. C.

J. S. Godard

Shipment: A shipment of ore, 117 pounds, was received at the Ore Dressing and Metallurgical Laboratories, June 29, 1925 from the property of the K.V. Mines Ltd., at Paulson, B.C. The shipment was made by Mr. P. H. Fraser of Vancouver, B.C.

Characteristics of the ore: The ore consists of marcasite, white iron pyrites, with which is associated small quantities of the sulphides of lead, zinc, and copper, as well as gold and silver. The gangue material is siliceous. Platinum was reported to have been found in this ore, but analysis failed to disclose the presence of any of the metals of this group.

Sampling & Analysis: The entire sample was crushed to ¼" and cut twice then reduced to 14 mesh and cut once, then ground to -150 mesh before cutting the head sample. Analysis showed it to contain:

Copper	0.05 %	Arsenic	trace
Lead	0.07 %	Silica	69.0 %
Zinc	0.12 %	Silver	0.80 oz/ton
Iron	10.95 %	Gold	0.48 "

Purpose of experimental tests: Experimental tests were desired to determine methods for the recovery of the values. The proximity to a smelter makes a method of treatment that would concentrate the values into a shipping product for the smelter desirable.

Test No. 1.- Flotation and tabling: Two 1000 gram lots of ore were cut at -14 mesh, and ground to 100 mesh, then floated

separately in a Ruth machine. The rougher concentrates from each lot were combined and cleaned. The tailings were combined and tabled on a small Wilfley table.

Product	Weight %	Assay Au oz/ton	Percent of values
Flotation conc.	15.1	2.32	72.9
" middling	7.1	0.40	5.8
Table concentrate	1.1	1.86	4.2
" tailing	47.1	0.11	10.8
Slimes	29.6	0.10	6.3

Analysis of the flotation concentrate gave - silver 3.88 oz/ton; lead 0.46%; Zinc 0.46%; copper 0.23%; arsenic trace; cobalt nil; nickel nil; iron 43.46%

Flotation reagents:	Soda carb	5 lbs/ton	ball mill
Lot No. 1	Xanthate	0.6 "	Ruth
	TT mixture	0.10 "	"
	Pine oil #5	0.10 "	"
	Sulphuric acid	10.0 "	"
Lot No. 2	Water gas tar) C.T. creosote)	1.0 "	ball mill
	Sulphuric acid	10.0 "	Ruth
	TT mixture	0.1 "	"
	Fumol #6	0.05 "	"

No additional reagents used for cleaning concentrate

Tests Nos. 2, 3, & 4 - Cyanidation: Three cyanidation tests were made on 600 gram lots of this ore. The table below gives the details.

No.	Mesh	Dilution	KCN %	Assay Heads	Assay Tails	Extraction %	Consumption KCN lb/tn	Consumption CaO	Time hrs.
2	-100	1:2	.10	0.48	0.02	95.8	2.0	4.0	62
3	-100	1:2	.20	0.48	0.03	93.8	1.5	5.1	62
4	-200	1:3	.15	0.48	0.02	95.8	2.2	4.3	62

All grinding done in pebble jar, discharge screened and oversize returned for further grinding.

Tests Nos. 5, 6, 7, 8, & 9 - Flotation: Five flotation tests were on lots of 1000 grams of ore at -14 mesh. Grinding done in pebble jar.

Test No.	Product	Weight %	Assay Au oz/ton	Assay Fe %	Percent of values Au	Percent of values Fe
5	Concentrate	20.4	1.04	37.33	49.3	79.4
	Middling	9.8	0.16	4.10	3.7	4.2
	Tailing	69.8	0.29	2.25	47.0	16.4
6	Concentrate	16.5	1.16	44.02	38.0	68.7
	Middling	7.2	2.20	20.14	31.5	13.7
	Tailing	76.3	0.20	2.44	30.5	17.6
7	Concentrate	18.2	1.56	44.17	59.9	76.2
	Middling	8.7	0.84	10.13	15.4	8.3
	Tailing	73.1	0.16	2.24	24.7	15.5
8	Concentrate	17.2	1.40	44.42	50.1	72.0
	Middling	9.4	1.15	14.24	22.4	12.6
	Tailing	73.4	0.18	2.22	27.5	15.4
9	Concentrate	13.2	1.24	43.76	34.1	57.8
	Middling	9.5	1.66	22.03	34.9	21.0
	Tailing	77.3	0.18	2.74	31.0	21.2

Reagents:

Test No	Mesh	Reagents	Added lb/ton	Added to	Remarks
5	100	Sodium sulphide	5.0	Ball mill	Concentrate cleaned in Janney without further reagents
		Hardwood acid creosote #27 FPL	0.3	"	
		Hercules tar oil	0.1	"	
		Pine oil No. 5	0.1	Ruth	
6	150	Barretts #634	0.4	Ball mill	
		Pine oil No. 5	0.1	Ruth	
		Sulphuric acid	15.0	"	
7	65	Barretts #634	0.4	Ball mill	No results from #634 in neutral pulp. Pine oil and sulphurid acid 3.5 lbs/ton added for cleaning concent.
		Sulphuric acid	15.0	Ruth	
		Pine oil #350	0.45	"	
8	65	P.T.& T. #400	0.28	Ball mill	Pine oil and sulphuric acid 3.5 lbs/ton added for cleaning rougher concentrate
		Pine oil #350	0.27	"	
		Sulphuric acid	18.0	Ruth	
9	150	P.T.& T. #400	0.28	Ball mill	Pine oil and sulphuric acid 3.5 lbs/ton added for cleaning rougher concentrate
		Pine oil #350	0.27	"	
		Sulphuric acid	18.0	Ruth	

Test No. 10 - Amalgamation and tabling: 1000 grams ore -14 mesh was ground wet to 48 mesh and amalgamated. The amalgamation tailing was tabled.

Product	Weight %	Assay Au oz/ton	Assay Fe %	Percent of values Au	Percent of values Fe
Concentrate	8.2	0.60	44.57	23.2	33.3
Middling	4.0	0.48	41.82	9.0	15.2
Tailing	63.2	0.18	6.73	54.0	38.8
Slimes	24.6	0.12	5.69	13.8	12.7

Head sample - gold 0.48 oz/ton
After amalgamation 0.211 "
Gold amalgamated 56.0 %

Recovery:
By amalgamation 56.0 %
In table concentrate 10.3 %
Total recovery 66.3 %

Test No. 11 - Amalgamation at 48 mesh: Results of screen test on amalgamation tailing -

Mesh	Weight %	Assay Au oz/ton	Assay Fe %	Percent of values Au	Percent of values Fe
+65	1.2	0.24	86.2	1.4	1.0
-65+100	7.4	0.32	13.08	11.7	9.1
-100+150	13.3	0.28	13.62	18.3	17.1
-150+200	13.2	0.22	12.09	14.3	15.1
-200	64.9	0.17	9.44	54.3	57.7

Head sample - gold 0.48 oz/ton
After amalgamation 0.203 "
Gold amalgamated 57.7 %

Test No. 12 - Amalgamation and flotation: 1000 grams ore at -14 mesh, ground wet to 48 mesh and amalgamated. The amalgamation tailing was floated and the flotation tailing given a screen analysis.

Product	Weight %	Assay Au oz/ton	Assay Fe %	Percent of values Au	Percent of values Fe
Concentrate	14.1	0.60	43.30	38.3	64.1
Middling	8.4	0.43	19.18	16.2	16.9
Tailing	77.5	0.13	2.34	45.5	19.0
Screen test:					
+65	4.9	0.14	3.74	5.2	7.8
-65+100	7.2	0.15	3.00	8.1	9.2
-100+150	12.7	0.16	2.55	15.2	13.8
-150+200	8.5	0.18	2.21	11.5	8.0
-200	66.7	0.12	2.15	60.0	61.2

Reagents:	P.T.& T. #400	0.28 lb/ton	for rougher concentrate
	Pine oil #350	0.45 "	" " "
	Sulphuric acid	20.0 "	" " "
	TT mixture	0.05 "	" " "
	Sulphuric acid	6.0 "	for cleaning concentrate
	Pine oil #350	0.27 "	" " "
	Pine oil #5	0.05 "	" " "

Recovery:	By amalgamation	53.7 %
	In flotation concentrate	17.8 %
	Total	71.5 %

Test No. 13 - Amalgamation and flotation: The amalgamation tailings were re-ground for flotation - Flotation heads Au 0.21 oz/ton
Fe 10.22 %

Product	Weight %	Assay Au oz/ton	Assay Fe %	Percent of values Au	Percent of values Fe
Concentrate	13.5	0.64	43.10	40.2	57.0
Middling	10.5	0.42	15.05	20.5	15.4
Tailing	76.0	0.11	3.72	39.2	27.6

Reagents:	P.T.& T. #400	0.28 lb/ton	added to ball mill
	Pine oil #350	0.45 "	" " "
	Sulphuric acid	20.00 "	" " Ruth machine
	Pine oil #350	0.16 "	for cleaning concentrate
	Sulphuric acid	6.0 "	" " "

Recovery:	By amalgamation	56.2 %
	In flotation conc.	18.1 %
	Total	74.3 %

Test No. 14 - Amalgamation and flotation: The amalgamation tailing was re-ground for flotation - Flotation heads Au 0.17 oz/ton
Ag 0.77 "

Product	Weight %	Assay Au oz/ton	Assay Ag oz/ton	Percent of values Au	Percent of values Ag
Concentrate	28.0	0.46	2.24	75.0	81.3
Tailing	72.0	0.06	0.20	25.0	18.7

Recovery:	By amalgamation	gold 64.2%	silver 14.3%
	In flotation concentrate	" 26.8%	" 69.9%
	Total	" 91.0%	" 84.2%

Reagents:			
Heavy hardwood oil S.T.& C.Co.	0.56	lbs/ton	to ball mill
Pine oil #350	0.27	"	" "
Sulphuric acid	15.0	"	to Ruth
Pine oil #350	0.27	"	"

Tests Nos. 15, 16, & 17 - Flotation at 150 mesh:

Test No.	Product	Weight %	Assay Au oz/ton	Assay Ag oz/ton	Percent of values Au	Percent of values Ag
15	Concentrate	30.0	1.18	2.50	80.0	81.4
	Tailing	69.6	0.13	0.25	20.0	18.6
16	Concentrate	30.1	1.60	2.70	93.2	89.2
	Tailing	69.9	0.05	0.14	6.8	10.8
16	Concentrate	24.3	1.50	2.92	85.9	82.5
	Tailing	75.7	0.08	0.20	14.1	17.5

Reagents:

Test No.	Reagents	Quantity lbs/ton	Added to
15	Sodium sulphide	5.0	Ball mill
	Duponts flotation oil	0.40	" "
	Pine oil No. 350	0.16	" "
	Sulphuric acid	18.0	Ruth machine
	Pine oil No. 5	0.02	" "
	Fumol No. 6	0.02	" "
16	Soda carbonate	10.0	Ball mill
	Xanthate	0.80	Ruth machine
	Pine oil No. 5	0.06	" "
17	Barretts No. 4	0.40	Ball mill
	Pine oil No. 350	0.16	" "
	Pine oil No. 350	0.16	Ruth machine
	Pine oil No. 5	0.08	" "
	Sulphuric acid	16.00	" "

Summary:

Amalgamation: Recoveries of the gold by amalgamation at 48 mesh varied from 53 to 64%, with an average of 56%. 14.3% of the silver was amalgamated in test no. 14. The mercury was in good condition after each test.

Cyanidation:

Three small scale cyanidation tests were made. All three showed good extraction of the gold with moderate cyanide consumption. Using a dilution of 1:2 and KCN of 0.10% on ore ground to -100 mesh was equally as effective as more dilute pulp and stronger KCN on -200 mesh material.

Tabling: Tabling the amalgamation tailings did not prove very satisfactory, as considerable gold values remained in the tailings and slimes. Large scale operations on a classified feed would greatly improve the recovery over that obtained in small scale work.

Flotation: A great variety of results were obtained by flotation. The results in the first tests made were disappointing, but this was largely due to partial oxidation of the pyrites. Fresh samples of ore were crushed for tests nos. 14, 15, 16, and 17, with greatly improved recoveries. Test No. 16, using a soda pulp and xanthate was the most satisfactory. Should an acid pulp be used, a considerable reduction in the amount of the sulphuric acid used could be made on mill scale operations and freshly broken ore. In the latter tests the froth was good, though the sulphides are slightly sluggish, not rising quickly, but continuing slowly and steadily to the end.

Conclusions: Amalgamation alone is not sufficient to yield good recoveries, but it could be supplemented by tabling classified amalgamation tailing, or by flotation. Results show that amalgamation should be considered in the treatment of this ore.

Flotation - Good recoveries can be obtained by flotation. The best results were obtained at 150 mesh. It is a question whether the additional recoveries made at 150 mesh over those at 65 mesh would warrant the extra grinding charges. Flotation could be adopted either alone or after amalgamation.

Cyanidation - Good recoveries of the values were obtained by cyanidation on the sample submitted. Before adopting this method of treatment, due consideration should be given to the possibility of the ore becoming more refractory, in which case the results by this method would not be so satisfactory.