

3 ✓ Dr. Walker  
Tillson }

# FILE COPY

O T T A W A      November 17th, 1941.


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

Investigation No. 1119.

Mill Tailings from Trout Lake, British Columbia.

-----  
-----  
-----

BUREAU OF MINES  
DIVISION OF METALLIC MINERALS  
—  
ORE DRESSING AND  
METALLURGICAL LABORATORIES

  
CANADA  
DEPARTMENT  
OF  
MINES AND RESOURCES  
MINES AND GEOLOGY BRANCH

O T T A W A      November 17th, 1941.

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

Investigation No. 1119.

Mill Tailings from Trout Lake, British Columbia.

Shipment:

=====

A shipment of two samples of material, designated Sample No. 1, Dump Tailing, weight  $11\frac{1}{2}$  pounds, and Sample No. 2, Hillside Tailing, weight 10 pounds, was received on August 16th, 1941. These samples were submitted by J. M. Tillen, Trout Lake, British Columbia.

In his request letter, Mr. Tillen states:

(Shipment, cont'd) -

"These samples are from the old Silver Cup-Nettie P mill, situated at Five Mile on Lardeau Creek in the Lardeau mining division of British Columbia. The mill was designed to treat the ores from the Nettie P and Silver Cup mines. The plant was in operation about 1903-4, and about 10,000 tons of ore were milled. The recovery was very low. The mill was shut down and never operated again."

Characteristics of the Samples:

Both samples varied from coarse to fine material, including lumps of clay. Panning disclosed some sulphides which were badly oxidized.

Purpose of the Investigation:

The shipment was made to determine a method of recovering the silver in the form of a high-grade concentrate.

Investigative Procedure:

In order to determine the character of the material and the values in the various sized products, panning tests and screen analyses were made on each sample of the shipment.

Flotation tests were then made and included variations of grinding and the use of reagents.

Results of Test Work:

The results disclose that the original grind of this ore had slimed a great deal of the silver. 55 per cent of the silver was found in the material passing through a 325-mesh screen. This slimed material is very difficult to recover by flotation.

The material is very badly oxidized, due to exposure on the dump since 1904.

(Continued on next page)



(Results of Test Work, cont'd) -

The tailings are very acid, requiring 22 pounds of soda ash per ton to get a pH of 8.3 to 8.5.

Concentration by flotation gave a recovery of 60.9 per cent of the silver, in a concentrate containing 47 ounces of silver per ton. Increasing the grade of concentrate to 94.9 ounces of silver per ton lowered the recovery to 30 per cent of the silver in the feed.

Water-washing the material prior to flotation, apart from decreasing the amount of soda ash consumed, was of no benefit to the recovery.

Sampling and Analysis:

The shipment was sampled by standard methods and was found to contain:

	Sample No. 1. Dump Tailing.	Sample No. 2. Hillside Tailing.
Gold, oz./ton	0.025	0.105
Silver, "	9.62	13.24
Copper, per cent	0.08	0.04
Lead, "	1.58	1.68
Zinc, "	0.90	0.50
Mercury,	Trace	Trace

A screen sizing test was made on each sample as received:

Mesh No.	Sample No. 1. Weight, per cent	Sample No. 2. Weight, per cent
+ 14	1.23	3.20
- 14+ 20	4.33	0.97
- 20+ 28	7.39	2.63
- 28+ 35	9.26	7.90
- 35+ 48	13.10	13.12
- 48+ 65	8.44	12.84
- 65+100	7.95	12.60
-100+150	7.61	12.96
-150+200	4.78	7.13
-200	35.91	26.65
	100.00	100.00

A screen analysis was made on each sample of tailing, with the following results:

Sample No. 1. - Dump Tailing.					
Product	Weight, per cent	Assays, oz./ton		Distribution, per cent	
		Au	Ag	Au	Ag
+ 65 mesh	43.75	0.025	4.34	37.02	19.93
- 65+100 "	7.95	0.03	3.01	8.07	2.51
-100+200 "	12.39	0.015	5.43	6.29	7.06
-200 "	35.91	0.04	18.70	48.62	70.50
Feed <sup>Ⓢ</sup>	100.00	0.0295	9.53	100.00	100.00

Sample No. 2. - Hillside Tailing.					
Product	Weight, per cent	Assays, oz./ton		Distribution, per cent	
		Au	Ag	Au	Ag
+ 65 mesh	40.66	0.045	6.81	15.69	19.88
- 65+100 "	12.60	0.06	7.52	6.51	6.84
-100+200 "	20.09	0.12	12.53	20.67	18.07
-200 "	26.65	0.25	28.85	57.13	55.21
Feed <sup>Ⓢ</sup>	100.00	0.12	13.93	100.00	100.00

Feed assays calculated values.

Details of Tests:

Test No. 1. - Flotation in Natural Pulp.

The feed for this test was made up of portions from each sample reground in a ball mill to 90 per cent minus 200 mesh with tap water. No alkaline reagents were added.

The reagents added to the grind were 0.2 pound of Aerofloat Reagent 208 and 0.15 pound of Aerofloat Reagent 25 per ton of feed.

The pulp was transferred to a flotation machine and after dilution was found to have pH, 6.1.

The pulp was conditioned 5 minutes with 0.1 pound

(Test No. 1, cont'd) -

Reagent 301 per ton and after adding 0.05 pound of pine oil per ton a black slimy froth was recovered. Reagent 301 was added in stages until no further froth was recovered, a total of 0.2 pound per ton. An addition of pine oil was required. A total of 0.10 pound per ton pine oil was used.

The flotation period was 12 minutes and the pH of the pulp at the end was 5.7, indicating increased acidity.

The flotation concentrate was recleaned without reagents.

Results:

Product	Weight, per cent	Assays, oz./ton		Distribution, per cent		Ratio of concentration
		Au	Ag	Au	Ag	
Feed	100.00	0.04 <sup>Ⓢ</sup>	10.94 <sup>Ⓢ</sup>	100.00	100.00	
Rough conc.	24.7	0.12 <sup>Ⓢ</sup>	29.77 <sup>Ⓢ</sup>	71.66	67.23	4.1:1.
Cleaner conc.	9.2	0.26	53.03	60.00	44.60	10.9:1.
Middling	15.8	0.03	15.97	11.66	22.63	6.5:1.
Flot. tailing	75.3	0.015	4.76	28.34	32.77	

<sup>Ⓢ</sup> Calculated values from the products of the test.

Lead in conc. = 4.30 per cent.  
Zinc " " = 6.22 "

Test No. 2. - Flotation.

A flotation test was made on a feed composed of equal amounts of both samples reground to 56 per cent minus 200 mesh.

The reagents added to the grind were:

	Lb./ton.
Soda ash	= 4.0
Aerofloat No. 25	= 0.14

Reagents added to the pulp in the flotation machine were:

(Continued on next page)

(Test No. 2, cont'd) -

	<u>Lb./ton.</u>
Sodium silicate	- 2.0
Copper sulphate	- 1.0
Potassium amyl xanthate	- 0.2
Pine oil	- 0.1

The rough concentrate was recleaned with 1.0 pound of sodium silicate per ton.

Product	Weight, per cent	A s s a y s, oz./ton		Distribution, per cent		Ratio of concentration
		Au	Ag	Au	Ag	
Feed <sup>⊙</sup>	100.00	0.052	11.06	100.00	100.00	
Rough conc. <sup>⊙</sup>	12.33	0.28	48.76	66.38	54.35	8.1:1.
Cleaner conc.	3.46	0.77	94.90	51.08	29.68	28.9:1.
Middling	8.87	0.09	30.77	15.30	24.67	11.3:1.
Flot. tailing	87.67	0.02	5.76	33.62	45.65	

<sup>⊙</sup> Calculated values.

A higher-grade concentrate was recovered than was obtained in the preceding test, with a sacrifice of recovery.

Test No. 3. - Flotation and Superpanner Test of Flotation Tailing.

The feed was composed of equal amounts of both samples and was reground to 81 per cent minus 200 mesh.

The reagents added to the grind were:

	<u>Lb./ton.</u>
Soda ash	- 17.5
Barrett's No. 4 oil	- 0.15
Sodium sulphide	- 2.0

Reagents added to the flotation machine were:

	<u>Lb./ton.</u>
Potassium amyl xanthate	- 0.25
Pine oil	- 0.05

(Continued on next page)

(Test No. 3, cont'd) -

A second addition of reagents included:

	<u>Lb./ton</u>
Soda ash	5.0
Copper sulphate	1.0
Potassium amyl xanthate	0.25

pH of pulp 8.3.

The rough concentrate was recleaned without the use of reagents.

Results:

Product	Weight, per cent	Assays, oz./ton	Distribution, per cent	Ratio of concentration
		Au : Ag	Au : Ag	
Feed <sup>Ⓞ</sup>	100.00	0.051 11.58	100.00 100.00	
Rough conc. <sup>Ⓞ</sup>	31.45	0.14 27.43	86.62 74.49	3.2:1.
Cleaner conc.	11.28	0.34 45.66	74.81 44.48	8.9:1.
Middling	20.17	0.03 17.23	11.81 30.01	4.9:1.
Flot. tailing	68.55	0.01 4.31	13.38 25.51	

<sup>Ⓞ</sup> Calculated value.

A portion of the flotation tailing was screened on a 200-mesh screen. The plus 200 mesh product was assayed. The minus 200 mesh product was concentrated on the Haultain superpanner and the products were assayed.

Results:

Superpanner Concentration of minus 200 Mesh Flotation Tailing.

Product	Weight, per cent	Assays, oz./ton	Distribution, per cent	Ratio of concentration
		Au : Ag	Au : Ag	
Feed	100.00	0.011 5.66	100.00 100.00	
Conc.	1.71	0.085 41.69	12.90 12.58	58.5:1.
Tailing	98.29	0.01 5.04	87.10 87.42	

Plus 200 mesh tailing: Au, 0.01 oz./ton.  
Ag, 2.37 "

This test indicates that 87 per cent of the silver in the minus 200 mesh material is present as very fine slimes.



Test No. 4. - Flotation.

The feed was composed of equal amounts of both samples and was reground to 65 per cent minus 200 mesh.

Reagents added to the ball mill:

	<u>Lb./ton.</u>
Soda ash	14.0
Barrett's No. 4 oil	0.13

Reagents added to the other flotation machine:

8 pounds of soda ash per ton was added to give an alkalinity of pH 8.5.

Reagents Nos. 208 and 301 were added in stages as a 1 per cent solution, at the rate of 0.4 pound of reagent per ton.

0.125 pound of pine oil per ton was used in several additions.

The rough concentrate was recleaned without reagents.

Results:

Product	Weight, per cent	Assays, oz./ton	Distribution, per cent	Ratio of concentration
		Au	Ag	Au : Ag
Feed <sup>Ⓞ</sup>	100.00	0.065	11.45	100.00 : 100.00
Rough conc. <sup>Ⓞ</sup>	35.61	0.146	26.47	80.20 : 82.34 : 2.8:1.
Cleaner conc.	14.79	0.24	47.14	54.58 : 60.91 : 6.8:1.
Middling	20.82	0.08	11.78	25.62 : 21.43 : 4.8:1.
Flot. tailing	64.39	0.02	3.14	19.80 : 17.66

<sup>Ⓞ</sup> Calculated value.

A total of 22 pounds of soda ash per ton of feed was required to give alkalinity to the pulp, of pH 8.5. An increase in recovery is obtained by flotation in an alkaline circuit. There is still a fair quantity of silver in the tailing.

Test No. 5. - Flotation with Varied Reagents.

The feed was composed of equal amounts of both samples and was ground to 65 per cent minus 200 mesh.

Reagents added to the ball mill:

		<u>lb./ton</u>
Soda ash	-	22.0
Aerofloat No. 25	-	0.1
" No. 208	-	0.4

Reagents added to the pulp in the flotation machine were:

0.4 pound No. 301 Aerofloat and 0.15 pound of pine oil per ton, added in stages.

The pulp in the flotation machine had pH 8.7.

Recleaned concentrate with 0.1 pound No. 301 Aerofloat per ton.

Results:

<u>Products</u>	<u>Weight, :</u>		<u>A s s a y s, :</u>		<u>Distribution, :</u>		<u>Ratio of</u>
	<u>per</u>	<u>cent</u>	<u>oz./ton</u>	<u>per cent</u>	<u>per cent</u>	<u>concentration</u>	
	<u>cent</u>	<u>Au</u>	<u>Ag</u>	<u>Au</u>	<u>Ag</u>		
Feed <sup>⊙</sup>	100.00	0.06	11.55	100.00	100.00		
Rough conc. <sup>⊙</sup>	25.98	0.1875	31.59	76.70	71.09		3.85:1.
Cleaner conc.	7.04	0.45	61.61	49.87	37.57		14.2:1.
Middling	18.94	0.09	20.43	26.83	33.52		5.3:1.
Flot. tailing	74.02	0.02	4.51	23.30	28.91		

<sup>⊙</sup> Calculated value.

Test No. 6. - Flotation of a Washed Pulp.

The feed for this test was composed of equal amounts of both samples and was ground in water without reagents to 65 per cent minus 200 mesh. The pulp was filtered and washed three times.

(Continued on next page)

(Test No. 6, cont'd) -

The filter cake was repulped in a flotation machine and conditioned with 16 pounds of soda ash per ton, pH 8.3. 0.2 pound of Reagents Nos. 208 and 301 and 0.10 pound of pine oil per ton were added to the pulp in stages as required.

The concentrate was recleaned without reagents.

Results:

Product	Weight, per cent	Assays, oz./ton	Distribution, per cent		Ratio of concentration
		Au	Ag	Au	Ag
Feed	100.00	0.061	11.53	100.00	100.00
Rough conc.	34.41	0.14	26.58	78.57	79.25
Cleaner conc.	12.72	0.31	48.91	64.40	53.92
Middling	21.69	0.04	13.48	14.17	25.33
Flot. tailing	65.59	0.02	3.65	21.43	20.75

Washing the pulp indicates that part of acidity was water-soluble. The consumption of soda ash was reduced by approximately 6 pounds per ton of feed by washing the pulp. No particular increase in recovery or grade of concentrate was obtained.

Test No. 7. - Desliming followed by Flotation.

The feed was composed of equal amounts of both samples.

The feed was deslimed and the resulting sands were reground to 65 per cent minus 200 mesh.

Reagents added to the ball mill:

	Lb./ton.
Soda ash	5.0
Aerofloat No. 25	0.20
" No. 208	0.5

Pulp in flotation machine, alkalinity - pH 7.7.  
 Addition of 2.0 pounds soda ash per ton, pH 9.0.  
 " " 0.40 pound of Aerofloat No. 301.  
 Flotation period, - 7 minutes.  
 Recleaned concentrate with 0.1 pound of No. 301 Aerofloat per ton.

(Continued on next page)

(Test No. 5, cont'd) -

Results:

Product	Weight, per cent	Assays, oz./ton		Distribution, per cent		Ratio of concen- tration
		Au	Ag	Au	Ag	
Feed	100.00	0.06	11.55	100.00	100.00	
Slimes	26.18	0.055	24.35	23.21	55.17	3.8:1.
Rough conc.	16.45	0.22	18.58	58.29	26.46	6.1:1.
Cleaner conc.	2.77	0.96	51.04	42.86	12.24	36:1.
Middling	13.68	0.07	12.01	15.43	14.22	7.5:1.
Flot. tailing	57.37	0.02	3.70	18.50	18.37	

A screen test made on the slime portion of the feed shows 99.3 per cent minus 325 mesh.

55.17 per cent of the silver in the feed reports in the slime overflow. This result indicates that much of the silver occurring in the deposit of mill tailing is extremely fine.

Summary:

The results of the investigation indicate that the feed contains silver in the very fine sizes. The surfaces of the metallic minerals have been badly oxidized.

A concentrate containing 94.9 ounces of silver per ton was made at the expense of a recovery of only 30 per cent of the silver in the feed.

Approximately 55 per cent of the silver in the feed was found in the minus 325 mesh portion.

Using a natural pulp, a recovery of 44.6 per cent of the silver was obtained in a concentrate containing 53 ounces of silver per ton.

Fine grinding did not lower the values in the tailings.

Conclusions:

The investigation indicated that the material will be difficult to treat economically, due in part to the oxidized condition of the material and, also, to the degree of sliming to which the minerals have been subjected in the original grind.

Flotation in a natural pulp would save the expense of using up to 22 pounds of soda ash per ton of feed, required to produce an alkalinity (pH 8.5) normal to flotation practice.

No evidence of the presence of metallic mercury could be discovered in any of the material.

The results of this investigation apply only to the samples submitted.

ooooooooooooo  
oooooo  
oo

WSJ:GHB.