



DEPARTMENT OF MINES  
CANADA

MINES BRANCH

O T T A W A      October 7th, 1931.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES

Report No.

399

Experimental Tests on Gold Ore From The  
Bralorne Mines, Ltd., Bridge River,  
Lillooet Mining Division, B. C.

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Shipment:

A shipment of 145 pounds of ore was received June 16th,  
1931, from H.E. Wilmot, manager of the Bralorne Mines, Limited.

The sample was taken from the King vein, main adit level  
of the Lorne Mine, Bridge River, Lillooet Mining Division,  
British Columbia.

Characteristics and Analysis of the Ore:

The sample submitted was a high grade gold ore containing  
considerable free gold of which 20 percent of the total gold was

plus 18 mesh. Of the remainder about 55 percent is free and amalgamable at -48 mesh. The balance of the gold is associated with a small quantity of sulphides, of which arsenopyrite and pyrite predominate. The gangue is of hard quartz.

Analyses of the head sample showed gold 1.41 oz. per ton.

Purpose of Experimental Tests:

Mr. Wilmot requested that a few tests be made for the purpose of obtaining some information that might be of assistance in the design of a mill to recover the gold in this ore. Preference was expressed for a flowsheet that would embody the following steps, namely, grinding in a ball mill, amalgamation, classification, regrinding the oversize, flotation, and either blanket amalgamation of the flotation tailing, or desliming of the flotation tailing and table concentration of the coarser material. The concentrates from these operations to be reground and cyanided for the recovery of the gold.

Summary:

About 55 per cent of the gold was recovered by amalgamation at -48 mesh. Flotation of the amalgamation tailing recovered an additional 41 percent of the gold in the form of a concentrate assaying, Au 6.50 oz/ton, Ag 2.29 oz/ton, Fe 16.3%, As 9.35%. The ratio of concentration was 13.6:1. Cyanidation of this concentrate showed a gold extraction of 92.8 percent, making an overall recovery of 90 percent.

Amalgamation and cyanidation of the amalgamation tailing showed a recovery of 94% percent of which about 55 percent is attributed to amalgamation and 39 percent to cyanidation.

Experimental Tests:

Tests 1 - 2 - 3: Amalgamation Tests.

Ore dry crushed to pass given meshes. Head sample for tests Au 1.13 oz/ton.

Results:

Test 1 - Ore Crushed -35 mesh

Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Recovery %
+ 48	9.2	0.61	11.1	0.51	54.8
+ 65	20.6	0.50	20.4		
+ 100	16.9	0.42	14.0		
+ 200	21.3	0.41	17.2		
- 200	32.0	0.59	37.3		

Test 2 - Ore Crushed 65 mesh

Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Recovery %
+ 100	25.9	0.44	24.6	0.46	59.2
+ 200	29.5	0.40	25.4		
- 200	44.6	0.52	50.0		

Test 3- Ore crushed - 150 mesh

Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Recovery %
+ 200	26.7	0.35	18.5	0.50	55.8
- 200	73.3	0.56	81.5		

Test 4 Amalgamation - Concentration.

A sample of ore was dry crushed to pass 48 mesh, then amalgamated. The amalgamation tailing was deslimed and

the fine product floated, #1 Concentrate. The Coarser product was reground then floated, #2 Concentrate. The tailing from the second flotation was deslimed and the coarser product tabled.

**Results**

Product	Wt. %	Assays Au oz/t	% Value Au
# 1 Concentrate	2.3	5.18	23.8
# 2 Concentrate	3.5	9.68	67.5
Table Concentrate	3.2	0.34	2.2
# 1 Tail	29.1	0.05	2.9
Table Tail #200	24.8	0.03	1.5
Table Tail -200	30.4	0.03	1.8
Slimes	6.7	0.02	0.3

Head sample for test Au 1.13 oz/ton  
 Amalgamation Tailing Au 0.50 oz/ton

Recovery - I By Amalgamation 55.8 %  
 II By Concentration 41.4 %  
 III Total 97.2 %

Ratio of Concentration 11:1

**Test 5 - Amalgamation - Concentration and Treatment of Concentrates.**

In this test 18 lots of ore at -48 mesh were treated as in test #4, except that the flotation concentrates from the first flotation were cleaned once and the middlings deslimed. The coarser product from this desliming operation was combined with the feed to the table. By this method of treatment the grade of concentrate was slightly increased.

The concentrates assayed Au 6.50 oz/ton, Ag 2.29 oz/ton, Cu 0.23 %, Pb 0.08%, Zn 0.30 %, Fe 16.34%, As 9.35%, S 11.15 %/

The ratio of concentration was 13.6:1

Treatment of Concentrates:

Test 5-A

A sample of the concentrates was given a short re-grind in a pebble mill in 1:1 pulp, KCN 0.10%, CaO 10 oz/ton. The pulp was then diluted 3:1 and agitated 48 hours. KCN Maximum 0.20%. At the end of this agitation period the pulp was then filtered and reagitated for 20 hours using the original solution.

Cyanide tailing screened on 200 mesh.

Results

Mesh	Wt. %	Assays oz/t		% Values		Av Tail oz/		Extraction %	
		Au	Ag	Au	Ag	Au	Ag	Au	Ag
+200	11.0	1.23	0.58	23.3	19.3	0.58	0.33	91.1	85.7
-200	89.0	0.50	0.30	76.7	80.7				

Summary

Gold recovery I By amalgamation and cyanidation 97.2% Ref. test #4  
 II By cyanidation 91.1%  
 III Total 88.4%

Reagents consumed lb/ton of Concs. KCN 13.04 CaO 25.6  
 Reagents consumed lb/ton of Ore KCN 0.96 CaO 1.9

Test 5-B

Cyanidation

This test was similar to 5-A in detail except that the concentrates were more finely ground before cyanidation.

Cyanide tailing screened on 200 mesh.

Results

Mesh	Wt. %	Assays oz/t		% Values		Av. Tail oz		Extraction %	
		Au	Ag	Au	Ag	Au	Ag	Au	Ag
+200	0.7	2.19	1.10	3.2	2.4	0.47	0.33	92.8	85.7
-200	99.3	0.46	0.32	96.8	97.6				

Summary

Gold Recovery I By amalgamation and Concentration 97.2% Ref. test #4  
 II By cyanidation 92.8%  
 III Total 90.2%

Reagents consumed lbs/ton of Concs. KCN 13.2 CaO 27.4  
 Reagents consumed lbs/ton of Ore KCN 0.98 CaO 2.02

Test 5-C Amalgamation.

A sample of the concentrates, dry crushed -150 mesh was amalgamated to determine the quantity of free and amalgamable gold contained therein.

Amalgamation tailing screened on 200 mesh.

Results

Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/ton	Recovery %
+200	11.0	8.28	16.5	5.51	15.2
-200	89.0	5.17	83.5		

Test 5-D Amalgamation - Cyanidation.

A sample of the concentrates, dry crushed -150 mesh was amalgamated as in test 5-C and the amalgamation tailing was dewatered, and cyanided for 65 hours in 3:1, pulp, KCN maximum 0.20%.

Cyanide tailing screened on 200 mesh.

Results

Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Extraction % Au
+200	10.7	1.14	21.1	0.58	89.5
*-200	89.3	0.51	78.9		

Summary

Head sample to amalgamation	Au 6.50 oz/ton
Amalgamation tailing (Ref. 5-C)	Au 5.51 oz/ton
Recovery by amalgamation	Au 15.2 percent

Heads to cyanidation - Amalgamation tailing	Au 5.51 oz/ton
Cyanidation tailing	Au 0.58 oz/ton
Extraction	Au 89.5 percent

Recovery I By amalgamation	Au 15.2 percent
II By cyanidation	Au 76.0 percent
III Total	Au 91.2 percent

Reagents consumed lbs/ton of Concs.	KCN 11.4	CaO 17.5
Reagents consumed lbs/ton of Ore	KCN 0.84	CaO 1.30

Tests 6-7-8 - Amalgamation - Cyanidation.

In this series of three tests the ore was dry crushed to pass 48 mesh then amalgamated. The amalgamation tailing was then dewatered and cyanided.

In test #6 no regrinding was practical before cyanidation but in tests 7 and 8 the amalgamation tailings were reground to different degrees of fineness in cyanide solution before cyanidation.

Cyanidation was done at a dilution of 2.5:1, the cyanide strength, KCN (max.) was 0.075% and the time of agitation was about 45 hours.

All cyanidation tailings were screened and the products assayed.

For calculation purposes a recovery of 55 percent of the gold is attributed to amalgamation.



Head sample to cyanidation (calculated) Au 0.51

oz/ton.

Results

Screening the cyanidation tailings				Test 6		
Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Extraction %	
+ 65	30.1	0.07	27.6	0.077	85.0	
+ 100	27.5	0.07	25.2			
+ 200	20.7	0.07	18.9			
- 200	21.7	0.10	28.3			

Test 7					
Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Extraction %
+ 200	51.9	0.06	41.8	0.074	85.5
- 200	48.1	0.09	58.2		

Test 8					
Mesh	Wt. %	Assays Au oz/t	% Value Au	Av. Tail Au oz/t	Extraction %
+ 200	29.7	0.05	22.0	0.068	86.7
- 200	70.3	0.075	78.0		

Summary - Tests 6-7-8

Head Sample to amalgamation - Au 1.13 oz/ton  
 Amalgamation tails head sample to cyanidation Au 0.51 oz/ton

Test No.	Recoveries % Total Gold			Reagents Consumed lb/ton	
	Amalgamation	Cyanidation	Total	KCN	CaO
6	55.0	38.3	93.3	0.36	5.1
7	55.0	38.5	93.5	0.66	6.1
8	55.0	39.0	94.0	0.62	8.9

Test #9 - Settling Test.

A small scale settling test was made on a sample of cyanide tailings for the purpose of indicating the settling rate of the pulp in a cyanide solution. The details of the test are as follows:

Dilution 4:1

Solids 30% plus 200 mesh

Cyanide strength, KCN .070% CaO 0.089%.

Cyanide used. Cassels NaCN 127.5% KCN

Temperature of Pulp 71.6° F.

Diameter of cylinder 2.28 ins.

Depth of Column of pulp 12.1 ins.

Readings

Time Mins.	Depth Clear Solution ins.
3	1.65
6	3.10
9	4.35
12	5.35
15	6.18
18	6.77
21	7.22
24	7.62
54	8.90

Conclusions

Two methods of treatment were found to be satisfactory for this ore. They are amalgamation and concentration of the amalgamation tailing and cyanidation of the concentrates, and amalgamation and cyanidation of the amalgamation tailing.

By the first method an excellent tailing is secured as well as a good grade of concentrate and a fairly high ratio of concentration. Extraction of the gold in the flotation

concentrate was as high as 92.8 percent making a net recovery of 90.2 percent.

By the second method net recoveries of 93-94 percent of the gold were obtained.

Of the recoveries obtained about 55 percent may safely be attributed to amalgamation, which owing to the presence of some relatively coarse free gold would seem to be almost essential in any flowsheet designed to treat this ore.