O T T A W A August 14th, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1065.

Concentration and Cyanidation of
Gold Ore from the Snowshoe Gold Mines Limited,
Wells, 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 August 14th, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1065.

Concentration and Cyanidation of Gold Ore from the Snowshoe Gold Mines Limited, Wells, British Columbia.

==========

Shipment:

Two bags of gold ore, total weight 140 pounds, were received on July 3rd, 1941 from Mr. Jas. T. McKelvie, Snowshoe Gold Mines Limited, Wells, British Columbia.

Location of the Property:

The property of the Snowshoe Gold Mines Limited, from which the present shipment was received, is situated on Little Snowshoe Creek, in the Cariboo district of British Columbia. The property is some 27 miles east of Wells, British Columbia.

Sampling and Assaying:

After crushing, cutting and grinding by standard methods, a representative sample of the shipment was obtained which assayed as follows:

Gold	-	0.40 oz./ton.
Silver	-	0.12 "
Copper	-	0.03 per cent.
Arsenic	-	0.11 "
Iron	-	10.00 "
Sulphur	-	7.70 "

From the above analysis it can be calculated that the ore contains 14.27 per cent pyrite, 0.24 per cent arsenopyrite, 0.08 per cent chalcopyrite, and 4.48 per cent magnetite.

Microscopical Examination:

Six polished sections were prepared and examined microscopically for the purpose of determining the character of the ore.

Gangue -

Gangue material forms the greater portion of the polished sections and varies in character. The chief components are milky white quartz and soft, light greenish grey rock. The former is transected by narrow, sinuous fractures; the latter appears to be slightly schistose in one section and may represent a chloritic schist. A considerable amount of white carbonate is also present as coarse to fine irregular grains disseminated through quartz.

(Continued on next page)

(Microscopical Examination, cont'd) -

Metallic Minerals -

Pyrite, the only abundant metallic mineral, occurs largely as coarse disseminated grains and small granular aggregates in gangue. It is slightly fractured and healed with gangue and contains irregular inclusions of the same material. Very small amounts of chalcopyrite and pyrrhotite are present as occasional tiny grains in pyrite.

Nine tiny particles of native gold, ranging from 16 microns (=800+1100 Tyler mesh) down to 4 microns (=2300 Tyler mesh) in size, were observed and measured. All occur in pyrite, three grains along narrow fractures and the remaining six grains in dense sulphide.

Investigative Work:

Mr. McKelvie has available for use at the Snowshoe Mine a 35-ton flotation plant, consisting of 4½-ft. Harding ball mill; a drag classifier; a 4-cell gravity flow (Union Iron Works) flotation machine, and a Wilfley concentrating table. There is also a unit flotation machine which might be used in the grinding circuit. It was desired to treat the shipment with a view to ascertaining whether the ore would be amenable to a flowsheet utilizing the above equipment.

Flotation concentration of the ore resulted in obtaining concentrates assaying 2.5 ounces gold per ton at grinds of 55 to 75 per cent minus 200 mesh. The flotation tailings were 0.01 or 0.005 ounce gold per ton and the ratio of concentration was 6.5:1 for the cleaned concentrate.

On regrinding and cyaniding these concentrates, overall tailing losses were from 0.012 to 0.033 ounce gold per ton.

Details of Test Work:

Test No. 1 (A to K). - Flotation Concentration and Cyanidation.

In this test, portions of the ore at minus 14 mesh were ground in a ball mill with different amounts of reagents added as noted. The pulp was then transferred to a Denver flotation machine, conditioned, and a flotation concentrate obtained. In some cases this concentrate was cleaned in a smaller machine in order to disclose the ratio of concentration which could be secured, while in other cases the rougher concentrate was reground and cyanided.

In the tables following are tabulated the amounts of reagents added to the grind, the amounts added to the cell, and various details of the test:

- Reagents Added -

Test No.	Reagents added to grind, lb./ton ore				Reagents added to cell, lb./ton ore		pH of pulp
	Soda ash	Lime	Barrett No. 4 oil	Potassium amyl xanthate	Pine oil	Potassium amyl xanthate	
A	2.0	-	0.044	0.075	0.10	0.075	8.6
B	-	1.4	0.09	0.075	0.10	0.075	8.6
C	2.0	-	0.044	0.075	0.12	0.10	9.1
D	-	1.5	0.09	0.05	0.15	0.10	9.0
E	2.0	-	0.044	0.075	0.10	0.075	8.9
F	-	1.5	0.09	0.075	0.10	0.10	8.7
G	2.0	-	0.09	0.10	0.10	0.075	9.2
H	-	1.5	0.09	0.075	0.10	0.075	8.9
I	1.5	-	0.09	0.10	0.10	0.05	8.6
J	-	1.0	0.09	0.075	0.10	0.075	8.5
K	-	-	0.09	0.075	0.10	0.075	8.4

(Test No. 1, cont'd) -

- Results of Flotation -

Test No.	Grind, % -200 mesh	Assays, Au oz./ton Conc.	Assays, Au oz./ton Tailing	Recovery of gold, per cent	Ratio of concentration	Remarks
A	76.6	2.10	0.01	98.2	4.8:1.	
B	82.2	2.12	0.01	98.1	5.2:1.	
C	80.4	2.56	0.01	97.1	7.5:1.	Cleaned conc.
D	81.4	2.58	0.01	97.9	6.9:1.	" "
E	78.0	1.78	0.005	99.0	4.5:1.	
F	75.0	1.89	0.005	99.0	4.8:1.	
G	71.6	2.00	0.005	99.0	5.0:1.	
H	72.6	1.90	0.005	99.0	4.8:1.	
I	53.8	1.91	0.005	99.0	4.8:1.	
J	63.2	1.85	0.005	99.0	4.7:1.	
K	57.5	1.75	0.005	99.0	4.4:1.	Slow floating.

- Cyanidation of Flotation Concentrates -

The concentrates from Tests Nos. E, F, G, H, I, J and K were reground in a ball mill in cyanide solution of 3 pounds NaCN per ton strength and agitated at a 3:1 dilution for 24 hours. Sufficient lime was added during the grinding and agitation periods to maintain alkalinity.

Results:

Test No.	Grind, % -325 mesh	Assays, Au oz./ton Feed	Assays, Au oz./ton Tailing	Extraction of gold, per cent	Overall extraction, Au per cent	Reagents consumed, lb./ton NaCN	Reagents consumed, lb./ton CaO	Reducing power of solution, c.c. N/10 KMnO4 per litre
E	82.0	1.78	0.065	96.35	95.4	0.78	6.2	226
F	82.0	1.89	0.075	96.10	95.1	0.71	6.3	208
G	99.0	2.00	0.04	98.00	97.0	0.78	5.5	170
H	99.0	1.90	0.04	97.90	97.0	0.82	5.5	210
I	61.0	1.91	0.14	92.70	91.8	0.73	5.7	300
J	80.0	1.85	0.09	95.10	94.1	0.70	5.7	270
K	78.0	1.75	0.06	96.60	95.6	0.65	6.0	260

(Summary follows on next page)

(Test No. 1, cont'd) -

Summary of Test No. 1.

Test No.	Overall tailing loss, Au oz./ton
E	0.018
F	0.019
G	0.012
H	0.012
I	0.033
J	0.024
K	0.018

Test No. 2 (A and B). - Roasting of Flotation Concentrate.

As the grade of concentrate produced by flotation was rather low grade for shipping to the smelter, it was decided to roast the concentrates in an endeavour to produce a shipping grade.

The cleaned concentrates of Tests Nos. 1-C and 1-D were taken and roasted in a muffle furnace at a temperature of 500° C. During the operation the concentrates were rabbled frequently.

Results:

Test No. of conc.	Loss in weight, per cent	Assay of calcine, Au oz./ton	Comparative increase, gold, per cent
1-C	32.32	4.05	34.4
1-D	31.24	3.58	28.0

Test No. 3 (A-B-C-D). - Straight Cyanidation.

Portions of the ore at minus 14 mesh were ground in cyanide solutions of 1 pound NaCN per ton strength to different degrees of fineness. The pulps were then agitated for 24- or 48-hour periods. Sufficient lime was added to the

(Test No. 3, cont'd) -

grind and agitation to maintain protective alkalinity.

Results:

(Feed: 0.40 Au oz./ton)

Test No.	Agitation, hours	Grind, % -200 mesh	Tailing assay, Au oz./ton	Extraction of gold, per cent	Titration, lb./ton solution NaCN	Titration, lb./ton solution CaO	Reagents consumed, lb./ton ore NaCN	Reagents consumed, lb./ton ore CaO	Reducing power, c.c. N/10 KMnO4/L.
A	24	62.6	0.045	88.8	1.0	0.20	0.60	5.0	54
B	48	59.0	0.03	93.5	0.9	0.15	0.75	5.2	70
C	24	81.0	0.035	91.3	0.9	0.20	0.70	5.3	46
D	48	77.2	0.03	93.5	1.0	0.15	0.85	5.7	60

Summary and Conclusions:

The results of the test work show that flotation of the ore, followed by regrinding and cyanidation of the flotation concentrates, gave the best method of treatment.

By this procedure a flotation tailing was obtained assaying 0.005 ounce gold per ton at a grind of 60 per cent minus 200 mesh. The cleaned flotation concentrates assayed 2.5 ounces gold per ton and the cyanide residue from these concentrates 0.04 ounce gold per ton, at a regrind of 99.0 per cent minus 325 mesh. The overall tailing loss was 0.015 ounce gold per ton.

Alternately, roasting of the flotation concentrates produced a shipping product assaying 4.0 ounces gold per ton with a loss in weight of 30 per cent.

By straight cyanidation of the ore a cyanide residue was obtained assaying 0.03 ounce gold per ton at a grind of 60 per cent minus 200 mesh in 48 hours.

(Concluded on next page)

(Summary and Conclusions, cont'd) -

The microscopical examination of the polished sections showed that all the gold observed was in pyrite, either along a fracture or in dense pyrite.

From the above summary of the test work, it is evident that the gold can be readily concentrated by flotation but that owing to the large amount of sulphides in the ore the grade of concentrate produced will be rather low for shipment to a smelter. However, this flotation concentrate is amenable to cyanidation and this method of treatment will eliminate transportation and smelter charges.

While no free gold was observed in the polished sections or during the test work, it would be advisable, as a precautionary measure, to install a unit cell or gold jig in the grinding circuit.

oooooooooo
ooooo
o

HLB:GB.