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January 22nd, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 944.

Gold Ore from the Brookfield Gold District  
of Nova Scotia.

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



CANADA  
DEPARTMENT  
OF  
MINES AND RESOURCES  
MINES AND GEOLOGY BRANCH

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Gold Ore from the Brookfield Gold District  
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Shipment:

A shipment of ore, total weight 125 pounds, was received on November 18th, 1940. The sample was taken from the East Mine of the Brookfield Mines Limited, Brookfield Gold District, Nova Scotia.

The shipment was submitted by J. P. Norrie, Inspiration Mining and Development Company, Limited, Amos, Quebec.



Purpose of the Investigation:

The shipment was made to determine the amenability of the ore to straight cyanidation or other simple milling practice.

Character of the Ore:

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

Gangue -

The gangue consists of greyish white quartz and siliceous, dark greenish grey rock. The quartz is transected by narrow sinuous fractures many of which are filled with soft rock material, and some also contain very finely divided sulphide.

Metallic Minerals -

The metallic mineral content of the polished sections is very small and is represented chiefly by sparsely disseminated pyrite. This mineral occurs as coarse to very fine irregular grains with the finer sizes predominating. Many grains are brecciated and cemented with quartz but some show no evidence of fracturing. A small quantity of arsenopyrite is present as irregular, disseminated grains, medium to fine in size. Some are slightly fractured and corroded, and some contain small inclusions of gangue.

Since no gold is visible in the sections nothing was learned as to how this metal occurs. It is probable, however, that its mode of occurrence is similar to other ores of this district.



Sampling and Analysis:

The shipment was prepared for analysis by standard methods and was found to contain:

Gold	-	0.14 oz./ton
Silver	-	0.05 "
Arsenic	-	0.06 per cent
Copper	-	0.02 "
Iron	-	2.87 "
Sulphur	-	0.88 "

Investigative Procedure:

The sample was treated by concentration by jigs, blankets and flotation. The jig and blanket concentrates were amalgamated. The jig and blanket tailings and the amalgamated concentrates were cyanided.

Results of Test Work:

Preliminary tests showed the presence of a small amount of free gold.

Amalgamation of the jig and blanket concentrate recovered 42.9 per cent of the gold. Cyaniding the residue recovered 81.2 per cent of the gold in it within 48 hours, giving an overall extraction of 89.3 per cent of the gold, with a final tailing of 0.015 ounce gold per ton. The grind was 64 per cent minus 200 mesh.

Grinding to 97 per cent minus 200 mesh gave the same tailing, 0.015 ounce gold per ton, with a recovery by amalgamation of 67.9 per cent of the gold and the same overall recovery of 89.3 per cent.

Concentration of the sulphides, followed by regrinding and cyaniding them with the ore, resulted in a tailing of 0.01 ounce gold per ton within 16 hours. The

(Continued on next page)



(Results of Test Work, cont'd) -

extraction was 92.9 per cent by cyanidation with a regrind of the sulphides.

Longer agitation did not increase the extraction.

There was no appreciable fouling of the cyanide solution in these tests.

Details of the Tests:

Test No. 1. - Jig and Blanket Concentration; Amalgamation of the Concentrates; Cyanidation of the Blanket Tailing and Amalgamated Concentrates.

A sample of the ore was ground in a ball mill at a dilution of 4 parts solids to 3 parts of water to give a product 64 per cent minus 200 mesh.

The ore was concentrated by jigging in a Denver laboratory mineral jig and passing the jig tailing over blanket strakes.

After a microscopic examination of both concentrates they were combined and barrel-amalgamated. After separating the mercury and amalgam, the amalgamated concentrates were mixed with the blanket tailing and then filtered.

Portions of the material were then repulped in cyanide solution and agitated at a dilution of 1 part solids to 2 parts of cyanide solution containing 1.0 pound NaCN per ton and also lime for protective alkalinity.

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(Test No. 1, cont'd) -

Results:

<u>Amalgamation of Jig and Blanket Concentrates.</u>			
Test No.	Assays, Au oz./ton	Recovery, per cent	
	Feed	Combined blanket tailing and amalgamated concentrates	
1	0.14	0.08	42.86

<u>Cyanidation of the Blanket Tailing and Amalgamated Concentrates.</u>									
Test No.	Agitation, hours	Assays, Au oz./ton	Feed Cyanide, lb./ton tailing	Extraction of gold, per cent	Final titration, lb./ton soln. NaCN	Reagents consumed, lb./ton ore	CaO	Reducing power, ml. N/10 KMnO <sub>4</sub> per litre	
1-A	24	0.08	0.02	75.00	1.00	0.20	0.89	5.00	--
1-B	48	0.08	0.015	81.25	1.00	0.15	0.93	5.10	44.0

Summary of Test No. 1:

Gold recovered by amalgamation	=	42.86	Per cent
Gold remaining in the amalgamation tailing	=	57.14 per cent.	
Gold extracted in 24 hours	=	75.0 per cent,	
	=	57.14 X 0.75	= 42.86
Overall extraction of gold	=	85.72	
Loss in cyanide tailing	=	14.28	
	Total	- - -	<u>100.00</u>
Gold extracted in 48 hours	=	46.43 per cent	
Gold recovered by amalgamation	=	42.86	"
Overall extraction	=	89.29	"
Loss in cyanide tailing	=	10.71	"
Total	- - -	100.00 per cent.	

A few pieces of coarse gold were seen in the jig concentrate and some fine particles of gold were detected in the blanket concentrate under the microscope.



Test No. 2. - Jig Concentration; Amalgamation of the Concentrate. Flotation of the Jig Tailing and Amalgamated Concentrate; Table Concentration of Flotation Tailings.

A sample of ore was ground 65 per cent minus 200 mesh in water at a dilution of 4:3.

The ground ore was jigged and the jig concentrate was amalgamated. After separating the mercury and amalgam the amalgamated concentrate was mixed with the jig tailing, filtered, and sampled.

The remainder of the filter cake was repulped in a flotation machine and conditioned for 20 minutes with 2.0 pounds of soda ash per ton. After adding 0.2 pound of amyl xanthate and 0.10 pound of pine oil per ton a concentrate was recovered which was cleaned without reagents.

The flotation tailing was passed over a Wilfley table and separated into a table concentrate and sand and slime tailings. The products were assayed.

Results:

<u>Amalgamation of Jig Concentrate.</u>			
<u>Assays, Au oz./ton:</u>		<u>Recovery, :</u>	
<u>Amalgamation:</u>	<u>per</u>	<u>flotation feed,</u>	
<u>Feed :</u>	<u>tailing :</u>	<u>cent :</u>	<u>per cent</u>
0.14	0.11	21.43	78.57

Flotation of Jig Tailing and Amalgamated Concentrate.

<u>Product</u>	<u>Weight, :</u>	<u>Assay, :</u>	<u>Distribution :</u>	<u>Ratio of</u>
	<u>per</u>	<u>Au</u>	<u>of gold,</u>	<u>concen-</u>
	<u>cent</u>	<u>oz./ton</u>	<u>per cent</u>	<u>tration</u>
Feed	:100.00	0.11	100.0	
Cleaner conc.	: 1.56	5.28	78.0	64:1.
Cleaner tailing	: 1.28	0.30	3.6	78:1.
Flot. tailing	: 97.16	0.02	18.4	

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(Test No. 2, Results, cont'd) -

Table Concentration of Flotation Tailing.						
Product	Weight, per cent:		Assay, : Au : :oz./ton:	Distribution : of gold		Ratio of : concen- : tration
	In : test	In : feed		In test	In feed	
Table feed	:100.00	97.16	0.02	100.0	18.4	
Table conc.	: 1.86	1.81	0.10	10.4	1.9	54:1.
Table sands	:					
tailing	: 27.16	26.39	0.02	30.3	5.6	
Table slimes	:					
tailing	: 70.98	68.96	0.015	59.3	10.9	

Summary of the Test:

	<u>Per cent</u>
Gold recovered by amalgamation	- 21.43
Gold recovered in flotation concentrate, 78.57 X 0.78	- 61.28
	<u>82.71</u>
Gold in flot. cleaner tailing	- 2.83
Gold in flotation tailing = 14.46 per cent.	
Gold in table concentrate	- 1.50
Gold in table sand tailing	- 4.38
Gold in table slime tailing	- 8.58
	<u>100.00</u>
Total	- per cent.

Test No. 3. - Barvel Amalgamation of Ore; Cyanidation of Tailings.

Samples of the ore were ground 97 per cent minus 200 mesh in ball mills, dilution 4:3. After removing the balls, 10 per cent (of dry weight of feed) mercury and 4.0 pounds of lime per ton were added.

After removing the mercury and amalgam, the pulps were filtered and sampled. Portions from each were

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(Test No. 3, cont'd) -

repulped in cyanide solution, 1.0 pound NaCN per ton, at a dilution of 1:2. Lime was added to give protective alkalinity and the pulps were agitated for 24 hours.

Results:

Amalgamation.			
Test No.	Assays, Au oz./ton	Recovery, per cent	
	Feed: Amalgamation		
	: tailing		
3-A	:0.14      0.045	: 67.86	
3-B	:0.14      0.045	: 67.86	

Cyanidation of the Amalgamation Tailing.								
Test No.	Agitation, hours	Feed: Cyanide tailing	Extraction of gold, per cent	Final titration, lb./ton sol'n	Reagents consumed, lb./ton ore			
				NaCN	CaO	NaCN	CaO	
3-A	: 24	0.045	0.015	66.7	1.0	0.30	0.40	4.25
3-B	: 24	0.045	0.015	66.7	1.0	0.30	0.41	4.25

Summary of the Test:

	<u>Per cent</u>
Recovery by amalgamation	- 67.86
Extraction by cyanidation, 66.7 X 0.3214	- 21.43
Overall recovery	- 89.29 per cent.

It was noted that very fine grinding released an increased amount of free gold which could be recovered by amalgamation.

The final cyanide tailing was not lowered.

The results indicate some fine gold in sulphides.



Test No. 4. - Concentration and Regrinding of the Sulphides, followed by Cyanidation.

Samples of the ore were ground in cyanide solution (1.0 pound NaCN per ton), dilution 4:3, to give a product 60 per cent minus 200 mesh.

After concentrating the pulp on a Wilfley table the sulphide portion was reground in cyanide solution. The reground sulphides were mixed with the table tailing.

Portions of the ore were then repulped, at dilution of 1:2, in cyanide solution which was recovered from the grinding operation and made up to 1.0 pound NaCN per ton. The periods of agitation were varied.

Results:

Test No.:	Agitation, hours:	Assays,		Extraction of gold, per cent:	Final titration, lb./ton solution:		Reagents consumed during grind and agitation, lb./ton ore:	
		Feed: oz./ton	Tailing: oz./ton		NaCN:	CaO:	NaCN:	CaO:
4-A :	16	0.14	0.01	92.86	1.15	0.20	0.55	6.50
4-B :	24	0.14	0.01	92.86	0.95	0.25	0.67	6.40
4-C :	30	0.14	0.01	92.86	0.90	0.23	0.77	6.44
4-D :	48	0.14	0.01	92.86	1.00	0.20	0.97	6.50
4-E :	48	0.14	0.01	92.86	1.00	0.20	0.97	6.50

It was noted that the minimum tailing was obtained within 16 hours.

Conclusions:

The results obtained on this sample of Brookfield ore show that straight cyanidation of the ore can be expected to recover 89 per cent of the gold, after removing free gold by jigging. This recovery can be raised to 93 per cent by

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(Conclusions, cont'd) -

regrinding the sulphides in a separate circuit. This can easily be done by passing the ball mill discharge over a concentrating table, regrinding the concentrate and feeding the sulphides to the classifier. A system of classification could also be installed whereby the sulphides are concentrated in the classifier and returned to the mill with the classifier oversize for further grinding.

The investigation shows that a primary grind of 60 per cent minus 200 mesh is sufficient, with from 16 to 24 hours' agitation of the classifier overflow, with this system.

This sample contains only 0.06 per cent arsenic. In previous samples from the same locality, the arsenic was much higher.

Should the arsenic content of the proposed mill feed increase, this factor will materially alter the results. The results shown in this report therefore apply only to grade of ore similar to the sample submitted.

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