

O T T A W A    October 21st, 1940.

R E P O R T

of the


ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 909.

Concentration and Cyanidation Tests on  
a Sample of Arsenical Gold Ore from  
the Cadillac Area, in Quebec.

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

  
CANADA  
DEPARTMENT  
OF  
MINES AND RESOURCES  
MINES AND GEOLOGY BRANCH

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Concentration and Cyanidation Tests on  
a Sample of Arsenical Gold Ore from  
the Cadillac Area, in Quebec.

Shipment:

Five sacks of ore, total weight 525 pounds,  
were received on August 7th, 1940. The shipment was  
submitted by G. A. McTeigue, President, Central Cadillac  
Mines Limited, 712 Transportation Building, St. James  
Street West, Montreal, Quebec.

Location of the Property:

This ore was taken from the property formerly owned and operated by Thompson Cadillac Mining Corporation and located near the west boundary of Cadillac township, Abitibi county, Quebec.

Character of the Ore:

The ore carries some free gold and some refractory gold associated with arsenopyrite. The gangue is quartz and some carbonate.

Sampling and Assaying:

The five bags contained five individual samples, designated as Nos. 3451, 3452, 3453, 3454 and 3455, which were separately assayed for gold. A composite sample was then prepared by mixing together portions from each bag in the ratio of the weights received.

The five samples received were assayed and reported as follows:

<u>Sample No.</u>		<u>Au oz./ton</u>
3451	-	0.1025
3452	-	0.09
3453	-	0.14
3454	-	0.105
3455	-	0.19

The composite sample assayed as follows:

Gold	=	0.1425 oz./ton
Silver	=	0.04 "
Arsenic	=	0.90 per cent.

Experimental Tests:

A series of small-scale tests was conducted along the lines suggested by the shippers. They included

gravity concentration, flotation, amalgamation, and cyanidation. While some of the gold is free the refractory gold is associated with arsenopyrite which must be concentrated and roasted. By this means 85 per cent of the gold in the ore can be extracted.

The tests are described in detail as follows:

Tests Nos. 1 and 2. - Cyanidation of the Ore.

Samples of the ore were ground in cyanide solution, 1.0 pound per ton NaCN, and agitated for periods of 24 and 48 hours at 1.5:1 dilution. Lime was used for protective alkalinity. The cyanide tailings were assayed for gold. The superpanner failed to show any trace of undissolved free gold in the tailings.

Results:

Screen Analysis, 24-Hour Cyanide Tailing.

Mesh	Weight, : : per : : cent	Assay, : : Au : oz./ton	Distribution, : : per cent
+100	: 3.36	0.02	1.30
-100 +150	: 7.00	0.025	3.39
-150 +200	: 14.42	0.03	22.37
-200	: 75.22	0.05	72.94
Cyanide tailing	: 100.00	0.0516	100.00

Screen Analysis, 48-Hour Cyanide Tailing.

Mesh	Weight, : : per : : cent	Assay, : : Au : oz./ton	Distribution, : : per cent
+100	: 2.84	0.02	1.10
-100 +150	: 5.98	0.02	2.32
-150 +200	: 13.94	0.03	21.64
-200	: 77.24	0.05	74.94
Cyanide tailing	: 100.00	0.0515	100.00

(Continued on next page)

(Tests Nos. 1 and 2, cont'd) -

Summary of Results, Tests Nos. 1 and 2:

(Feed sample assay, 0.1425 Au oz./ton.)							
Test	Period of	Tailing	Extraction	Final titration	Reagents		
No.	agitation	assay	per	lb./ton	consumed	lb./ton ore	
	hours	oz./ton	cent	NaCN	CaO	NaCN	CaO
1	24	0.0516	63.86	1.20	0.09	1.80	9.85
2	48	0.0515	63.86	0.92	0.12	2.62	10.20

The reducing power of the final solutions from Tests Nos. 1 and 2 were 250 and 320 millilitres of N/10  $\text{KMnO}_4$  per litre, respectively.

Referring to the above screen analyses, the fact that the fine fractions assay so much higher than the coarser ones indicates the association of refractory gold with fine arsenopyrite.

Test No. 3. - Gravity Concentration and Amalgamation Followed by Cyanidation.

A sample of the ore was given a preliminary grind and treated in a jig to remove free gold. The jig concentrate was then amalgamated in a mortar and the amalgamation tailing reunited with the jig tailing as feed to cyanidation.

The feed to cyanidation was reground in cyanide solution to give a product comparable in fineness to that of Tests Nos. 1 and 2 and then agitated for 24 hours at 1.5:1 dilution. The solution was kept at 1.0 pound NaCN per ton by additions of the salt from time to time. The cyanide tailing was assayed for gold.

(Continued on next page)

(Test No. 3, cont'd) -

Results:

Feed sample - 0.1425 Au oz./ton  
Cyanide  
tailing - 0.05 " "  
Extraction - 64.9 per cent.  
Reducing power of  
solution - 360 ml. N/10  $\text{KMnO}_4$  per litre.

<u>Reagents</u>	<u>NaCN</u>	<u>CaO</u>
Final titration, lb./ton sol.	0.88	0.02
Consumed, lb./ton ore	1.32	6.95

The result of this test indicates that the high tailing assays in the tests so far conducted are not due to undissolved free gold but rather some other form of refractory gold.

Test No. 4. - Cyanidation of a Flotation Concentrate.

A sample of the ore was ground 75 per cent through 200 mesh and floated with the following reagents:

	<u>Lb./ton</u>
Soda ash -	3.0
Amyl xanthate -	0.20
Pine oil -	0.10
Copper sulphate -	1.0

The concentrate was reground 99.5 per cent through 325 mesh and agitated 48 hours in cyanide solution, 1.0 pound NaCN per ton, at 3:1 dilution. The tailing was assayed for gold and an average tailing calculated.

(Continued on next page)

(Test No. 4, cont'd) -

Summary of Results, Test No. 4:

(Feed sample assay, 0.1425 Au oz./ton)						
Product	Weight, : : per : cent	Assay, : : Au : oz./ton	Final : : titration, : lb./ton soln	Reagents : : consumed, : lb./ton ore		
			NaCN	CaO	NaCN	CaO
Cyanide tailing from : flotation conc. :	7.2	0.69	0.80	0.05	1.44	3.75
Flotation tailing :	92.8	0.015				
Average tailing :	100.0	0.0636				

Extraction - 55.37 per cent.

Reducing power of final  
solution: 900 ml. N/10 KMnO<sub>4</sub> per litre.

The results of this test are a further indication of the association of refractory gold with arsenopyrite and the need for roasting to liberate it.

Test No. 5. - Cyanidation of Roasted Flotation Concentrate.

A sample of the ore was ground about 50 per cent through 200 mesh and treated in a jig to remove any free gold present. The jig concentrate was amalgamated and the amalgamation tailing reunited with the jig tailing for regrinding to 70 per cent minus 200 mesh and fed to flotation. A concentrate was then floated with the following reagents:

Soda ash	=	4.0	lb./ton
Amyl xanthate	=	0.20	"
Pine oil	=	0.10	"
Copper sulphate	=	1.0	"

The concentrate was not cleaned.

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(Test No. 5, cont'd) -

After sampling for assay the concentrate was roasted in a muffle furnace.

The charge was placed in the cold furnace and allowed to heat up with it. The temperature was raised to 400° C. and held there till all fuming had ceased. The temperature was then slowly raised to 750° C. and held there for one half hour. The heat was then cut off and the charge allowed to cool down with the furnace. The loss in weight was 12.4 per cent. The calcine was blanket concentrated and cyanided.

Concentration Results:

Product	Weight, : per : cent	Assay, : Au : oz./ton	Distribution, : : per cent
Amalgam	:	0.015	12.4
Flotation conc.	: 10.5	0.92	80.1
Flotation tailing	: 89.5	0.01	7.5
Feed (cal.)	: 100.0	0.121	100.0

The washed calcine assayed 1.11 ounces per ton in gold and by blanket concentration and amalgamation 0.07 ounce per ton was extracted from it as amalgam, leaving a feed to cyanidation assaying 1.04 ounces per ton gold. This amounts to 5.05 per cent of the total gold recovered from the calcine as amalgam while 75.05 per cent was treated by cyanidation, these two figures accounting for the 80.1 per cent contained in the flotation concentrate.

Samples of the amalgamated calcine were treated



(Test No. 5, cont'd) -

as follows:

- (1) The unground calcine was agitated in lime water for 12 hours, filtered, and agitated in cyanide solution, 1.0 pound NaCN per ton, for periods of 48 and 72 hours. This material was 89 per cent finer than 325 mesh.
- (2) A sample of calcine was ground in water and filtered, then agitated in lime water for 12 hours, filtered again, and agitated in cyanide solution, 1.0 pound NaCN per ton, for periods of 48 and 72 hours. The reground calcine was 98 per cent finer than 325 mesh.

Summary of Cyanidation Results:

:Grind,:		:Tailing:		:Extraction		: Final		: Reagents	
Agita-:	%	: assay,	: of gold	: Per cent:	: Per cent:	: titration,	: consumed,		
tion, :-325	: Au	: oz./ton:	: Content	: Total	: NaCN	: CaO	: NaCN	: CaO	
hours:	mesh								
48	89	0.11	89.40	67.10	0.80	0.01	1.20	12.0	
48	98	0.10	90.30	67.77	0.88	0.06	1.05	11.8	
72	89	0.10	90.30	67.77	1.04	0.01	1.45	20.5	
72	98	0.095	90.87	68.20	1.12	0.06	1.30	20.2	

Extractions by amalgamation of gravity concentrates were 12.4 per cent and 5.05 per cent. These two figures should be added to any of the figures for cyanide extraction chosen from the foregoing table, to obtain total extraction. The remainder of the gold was lost in the flotation tailing and the cyanide tailing from the calcine.

Conclusions:

It is evident from the tests conducted that the refractory gold is associated with arsenopyrite. The ore also contains some free gold which should be removed by some form of gravity concentration and amalgamated.

The arsenopyrite should be concentrated, roasted and cyanided.

In this way about 85 per cent of the gold in the ore can be extracted.

Former shipments of ore from this property have been tested here and were reported in 1934 and 1935. These two samples of ore showed marked differences in their response to treatment. The latter, however, agrees perfectly with the present shipment in its general behaviour.

The ratio of concentration obtained in Test No. 5 is in the neighbourhood of 10:1 but no cleaning was done on this concentrate. Further testing with cleaning of the concentrates has shown that this ratio can at least be doubled or possibly more than doubled with a well operated flotation circuit.

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