O T T A W A December 20th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 929.

Cyanide Residue from the
Delnite Mines Limited, Timmins,
Ontario.

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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Shipment:

Eighteen pounds of cyanide residue was received on October 19th, 1940, from Mr. J. Beattie, Manager, Delnite Mines Limited, Timmins, Ontario.

A previous shipment of ore from this company was received on May 4th, 1939, and Investigation No. 775 of the Bureau of Mines (1939) describes the method used whereby the gold is extracted and the present cyanide residue obtained.

Location of the Property:

The property of the Delnite Mines Limited from which the present shipment was received is situated in Deloro township, Porcupine area, northern Ontario.

Sampling and Analysis:

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

Gold	-	0.125 oz./ton
Silver	-	0.055 "
Arsenic	-	5.42 per cent
Sulphur	-	16.04 "
CO_2	-	11.40 "
Graphitic carbon	-	0.18 "

The above results indicate that the residue contains 11.8 per cent arsenopyrite and 25.7 per cent pyrite.

A screen test on the shipment showed 99.1 per cent minus 325 mesh.

Results of Investigative Work:

The present sample of cyanide residue from the Delnite mill was collected over a period of two months and is representative of those times when the loss has been above normal. At the Delnite mill the ore is ground to about 65 per cent minus 200 mesh with a jig in closed circuit with the primary mill and classifier. The classifier overflow is floated and the dewatered flotation concentrates combined with the jig concentrates and reground in cyanide solution to pass 99.0 per cent minus 325 mesh and agitated.

It was desired by the mine management that

(Continued on next page)

(Results of Investigative Work, cont'd) -

an examination of this sample be made and such tests be performed as might be necessary to determine, if possible, the reason for the high tailing loss.

The test work on the shipment comprised additional agitation in cyanide solutions, both with high and with low lime content; superpanning and infrasizing tests; and selective flotation of the pyrite and arsenopyrite.

The work indicated that a large part of the refractory gold was contained in the sulphides, particularly arsenopyrite, in submicroscopic form which was not amenable to cyanidation. Additional agitation in cyanide solution of high lime content succeeded in increasing the extraction of the gold to a slight extent.

Details of Tests:

Test No. 1 (A and B). - Superpanning.

Portions of the residue were concentrated on a Haultain superpanner and the different products were assayed for gold and arsenic.

Results:

(1-A).

Product	Weight, per cent	Assays Au, oz./ton	Assays As, per cent	Distribution, per cent Au	Distribution, per cent As
Feed	100.00	0.125	5.52⊕	100.0	100.0
Conc. (tip)	0.40)	0.26⊕	31.45	8.8	2.3
Conc. (bulk)	3.90)		12.88		9.1
Sands	45.90	0.14	5.76	51.4	47.9
Slimes	49.80	0.10	4.51	39.8	40.7

⊕ Calculated.

(Continued on next page)

(Test No. 1, cont'd) -

Results, cont'd -

(1-B).

Product	Weight, per cent	Assays, Au, oz./ton	Assays, As, per cent	Distribution, per cent, Au	Distribution, per cent, As
Feed	100.00	0.125	5.58®	100.0	100.0
Conc. (tip)	1.40	0.41®	21.22	12.8	5.3
Conc. (bulk)	2.50		10.04		4.5
Sands	56.40	0.13	5.72	58.6	57.8
Slimes	39.70	0.09	4.55	28.6	32.4

® Calculated.

A microscopic examination of the concentrates showed the tips to be composed mainly of arsenopyrite and the bulks mainly of pyrite. After washing the concentrates with ether, in order to remove the adhering flotation reagents, and with dilute hydrochloric acid to brighten any gold particles, a second examination under a high-power binocular microscope failed to reveal the presence of any free gold.

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Test No. 2. - Infrasizing.

A portion of the residue was passed through the Haultain infrasizer and the different sized products assayed for gold and arsenic.

(Continued on next page)

(Test No. 2, cont'd) -

Results of Infrasizing:

Size, in microns	Weight, per cent	Assays Au, oz./ton	Assays As, per cent	Distribution, per cent Au	Distribution, per cent As
Above 56	0.10	0.24	3.41		0.1
56 to 40	0.32		5.53	10.8	0.3
40 to 28	5.49		7.27		7.3
28 to 20	14.11	0.24	7.64	25.6	19.8
20 to 14	14.96	0.17	6.89	19.2	18.9
14 to 10	13.14	0.17	6.06	16.9	14.6
Below 10	51.88	0.07	4.09	27.5	39.0
Totals	100.00	0.13	5.45	100.0	100.0

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Test No. 3. - Flotation Concentration.

A portion of the residue was pulped and transferred to a Denver flotation machine. 0.5 pound of soda ash per ton was then added and the pulp conditioned for 10 minutes. A pyrite concentrate was then obtained by the further additions of 0.10 pound butyl xanthate and 0.035 pound of pine oil per ton. Six pounds of soda ash and 1.0 pound of copper sulphate per ton were then added, bringing the pH of the pulp to 9.3. After 10 minutes' conditioning an arsenopyrite concentrate was obtained by the addition of 0.10 pound amyl xanthate and 0.05 pound pine oil per ton. The pyrite and arsenopyrite concentrates were cleaned on a smaller flotation machine.

(Continued on next page)

(Test No. 3, cont'd) -

Results:

Product	Weight, per cent	Assays Au, oz./T	Assays As, p.c.	Distribution, percent Au	Distribution, percent As	Ratio of concentration
Feed	100.00	0.125	5.42	100.0	100.0	
Pyrite conc.	10.28	0.17	3.95	14.0	7.5	9.2:1.
Pyrite middling	15.51	0.15	4.51	18.6	12.9	
Arsenopyrite conc.	7.62	0.38	13.31	23.2	18.7	13.1:1.
Arsenopyrite middling	8.74	0.22	6.92	15.4	11.2	
Tailing	57.85	0.06	4.66	28.8	49.7	

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Test No. 4 (A to E). - Cyanidation.

In Tests A and B the residue was agitated in cyanide solution of 3 pounds NaCN per ton strength for 24 and 48 hours. The solution was kept barely alkaline with a lime titration of 0.05 to 0.10 pound per ton.

In Tests C and D the solution was kept strongly alkaline with lime titrations of 0.5 to 0.6 pound per ton. Conditions otherwise were similar to A and B.

In Test E, the residue was aerated in a lime pulp for 16 hours, filtered, and washed prior to agitation in cyanide solution of 3 pounds per ton strength. The lime content was kept at 0.5 to 0.6 pound per ton.

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(Test No. 4, cont'd) -

Results: (Feed, 0.125 Au oz./ton).

Test No.	Agitation, hours	Tailing assay, Au oz./ton	Extraction of gold, per cent	Titration, lb./ton solution NaCN	Titration, lb./ton solution CaO	Reagents consumed, lb./ton residue NaCN	Reagents consumed, lb./ton residue CaO	Reducing power, ml. N/10 $KMnO_4$ per litre
4-A	24	0.125	-	2.90	0.10	7.3	20.8	310
4-B	48	0.120	4.0	2.90	0.10	8.3	25.4	330
4-C	24	0.11	12.0	2.80	0.55	3.9	31.7	260
4-D	48	0.10	20.0	2.90	0.60	6.0	35.7	300
4-E	24	0.10	20.0	3.00	0.60	2.0	17.2⊕	80

⊕ 6 pounds of lime additional were used during aeration.

Summary and Conclusions:

Superpanning and infrasizing tests on the residue showed the tendency of the larger-sized particles to carry more gold, in ounces per ton, than the smaller sizes. The percentage of distribution of the gold was fairly even in the aggregates of the different sized particles, as shown in the infrasizer test. The arsenical assays followed the gold assays fairly closely and the percentage of distribution of this mineral indicated the tendency of a large part of the arsenopyrite to report in the smallest size particles. In the superpanning tests no free gold was visible.

The selective flotation test further emphasizes the tendency, as shown in the arsenopyrite concentrate, for the higher gold and arsenic assays to report together.

The cyanidation tests gave results which showed

(Continued on next page)

(Summary and Conclusions, cont'd) -

the beneficial effect, in gold extraction, of a high lime content in the cyanide solutions; and also the decrease apparent in the fouling of the solution when aeration in a lime pulp preceded cyanidation.

The report indicates that a large part of the gold in the residue is of a refractory nature and is not amenable to cyanidation. This gold is contained in sub-microscopic form in the sulphides, particularly arseno-pyrite, and roasting of these sulphides followed by cyanidation would be the only feasible means of recovering this type of gold.

The results further indicate that grinding of the concentrates in a lime pulp, followed by aeration prior to cyanidation, should decrease the fouling of solutions with a subsequent lowering of the amount of barrens to be discarded. In the cyanide agitation a high lime content of the solutions is advisable; this procedure can be more readily adhered to if the amount of carbonates in the flotation concentrate is kept at a minimum.

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