O T T A W A September 2nd, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1082.

Analysis, Cyanidation and Concentration of Mill Products from the Arntfield Gold Mines Limited, Arntfield, Quebec.

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:

Four pounds of assay rejects (representing a composite mill head), one winchester of barren solution, and 14 grams of gold precipitate were received on July 31st, 1941, from Mr. F. H. Hartman, Arntfield Gold Mines Limited, Arntfield, Quebec.

Location of the Property:

The property of the Amtfield Gold Mines Limited from which the present shipments have been received is situated in Beauchastel township, about 13 miles west of Noranda, in northwestern Quebec.

Sampling and Analysis:

The 4-pound shipment of assay rejects of the composite mill head screened 83 per cent minus 200 mesh and assayed as follows:

Gold	-	0.10 oz./ton.
Sulphur	-	1.44 per cent.
Pyrrhotite	-	0.03 "
Copper	-	Trace.
Nickel	-	Trace.
Selenium	-	Trace.
Tellurium	-	Trace.
Arsenic	-	None indicated.
Graphitic carbon	-	0.01 per cent.

The winchester of barren solution assayed as follows:

Reducing Power	-	208 c.c. N/10 $KMnO_4$/litre.
KCNS	-	0.24 grams/litre.
Copper	-	0.03 "
Nickel	-	0.003 "
Total sulphur	-	0.13 "
Selenium) Tellurium) Lead)	-	None detected.

The assay of the gold precipitate was as follows:

		Per cent
Gold	-	36.94
Silver	-	19.26
Silica	-	2.58
Iron	-	0.35
Aluminium	-	0.46
Calcium	-	2.48
Magnesium	-	0.06
Sulphur	-	3.66
Lead	-	6.38
Copper	-	2.63
Vanadium	-	0.08
Manganese	-	0.01
Nickel	-	0.01
Zinc	-	12.68
Selenium	-	0.48
Tellurium	-	0.49
Arsenic) Antimony)	-	None detected.

Investigative Work:

Mr. Hartman, of the Arntfield Gold Mines Limited, reported that:-

> "In the refining down of the gold-zinc precipitates obtained in our cyanide mill we have recently run into difficulties due to the formation of a matte-like material next to the bullion button. From present indications this material appears to be high in copper. In addition to the above source of the trouble, the values tied up in our mill circuit have lately become considerably higher than we would expect. The question naturally arises whether we have run into some 'hard-to-treat' substance in the ore we are now milling."

Mr. Shoemaker, the consulting engineer for the company, in his letter of July 26th, 1941, also drew our attention to the milling difficulties and in addition requested a flux formula to handle the precipitate without production of matte.

The test work on the precipitate and solution samples was confined to chemical analysis, with the results outlined previously.

On the pulp sample, tests comprising cyanidation together with superpanning and infrasizing of the resultant cyanide residues, were conducted.

The results showed that a residue of 0.01 ounce gold per ton could be obtained in 24 hours' agitation. The superpanning and infrasizing tests showed that a fairly close relationship between the gold and the sulphide existed and that the finer-sized particles contained the least amount of gold.

Details of Tests on the Composite Mill Head Sample:

Test No. 1 (A - C). - Straight Cyanidation.

In Tests Nos. 1-A and 1-B the sample was agitated in cyanide solution of 1 pound NaCN per ton strength for 24 hours. Enough lime was added during the agitation to maintain protective alkalinity and a titration result of from 0.15 to 0.20 pound per ton of solution. Test No. 1-C was conducted similarly to Tests Nos. 1-A and 1-B. Sufficient lime was added in this case, however, to give a titration result of from 0.45 to 0.5 pound per ton of solution. The cyanide residue was assayed for gold and the pregnant solution for reducing power.

Results: (Feed: 0.10 ounce gold per 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 ore NaCN	Reagents consumed, lb./ton ore CaO	Reducing power, c.c. N/10 $KMnO_4$/L.
A	24	0.01	90.0	0.9	0.15	0.3	4.5	20
B	24	0.01	90.0	0.9	0.20	0.3	4.5	18
C	24	0.01	90.0	1.0	0.45	0.3	7.1	20

Test No. 2. - Superpanning.

The cyanide residue from Test No. 1-A was concentrated on a Haultain superpanning machine, with the following results:

Product	Weight, per cent	Assays Au, oz./ton	Assays S, per cent	Distribution per cent Au	Distribution per cent S	Fineness
Feed	100.0	0.0098@	1.44	100.0	100.0	83 % -200 mesh
Panner conc.	1.79	0.13	46.94@	23.5	58.4	-------
Panner 1st sands	10.53	0.0075	0.335	8.2	2.4	99.0% -200 mesh
Panner 2nd sands	47.64	0.01	0.772	47.9	25.5	81.0% -200 "
Panner slimes	40.04	0.005	0.491	20.4	13.7	98.0% -325 "

@ Calculated.

(Continued on next page)

(Test No. 2, cont'd) -

The panner concentrate was examined under a powerful binocular microscope and was seen to consist mostly of pyrite plus a few quartz and magnetite particles.

No free gold was visible.

Test No. 3. - Infrasizing.

The cyanide residue from Test No. 1-B was screened to plus and minus 200 mesh. The plus 200 mesh portion was assayed for gold and sulphur and the minus 200 mesh product was passed through the Haultain infrasizer, with the following results:

Size, in microns	Weight, per cent	Assays Au, oz./ton	Assays S, per cent	Distribution per cent Au	Distribution per cent S
Above 56	2.17	0.11	16.318	24.2	24.9
56 to 40	10.47	0.02	2.702	21.2	19.9
40 to 28	11.51	0.01	1.981	11.1	15.7
28 to 20	13.11	0.01	1.462	13.1	13.5
20 to 14	13.08	0.005	0.766	6.1	7.0
14 to 10	11.22	0.005	1.005	5.1	7.9
Below 10	38.64	0.005	0.409	19.2	11.1
Totals	100.00	0.0099	1.423	100.0	100.0

The plus 200 mesh portion assayed 0.015 ounce gold per ton and 1.765 per cent sulphur, giving a calculated head assay result of 0.0108 ounce gold per ton and 1.48 per cent sulphur.

Conclusions:

On the composite mill sample the analysis does not show any reason why the gold should be refractory to extraction by cyanidation. This material, consisting of assay rejects, screened 83 per cent minus 200 mesh. After agitating a portion in cyanide solution for 24 hours, a residue of 0.01

(Conclusions, cont'd) -

ounce gold per ton was obtained. This residue was infrasized and gave assays of 0.005 ounce gold per ton in the minus 20 micron sizes. The pregnant solution was assayed for reducing power and gave a result of 20 c.c. N/10 $KMnO_4$ per litre.

On the winchester of barren solution the assay results show rather a large amount of nickel. This may cause part of the gold to remain in the barren solution. This condition may be alleviated by periodic dropping of the filter cake and avoiding the building-up of the nickel in the press. The reducing power of 208, while much higher than that obtained from the pulp sample, is still not too high for normal operating conditions.

The assay of the gold precipitate shows comparatively large amounts of selenium, tellurium, sulphur, and copper.

The presence of these amounts of selenium and tellurium in the precipitate would, in fusion, cause considerable loss of gold in the slag through the action of gases formed, which would tend to agitate the molten metal and deposit the gold in small-shot form in the slag. The presence of copper and sulphur would form a matte which also could carry a gold content of considerable importance. To overcome these difficulties it is suggested that the precipitate be roasted prior to fusion. This would eliminate practically all of the three most objectionable constituents, namely, selenium, tellurium, and sulphur.

The following flux formula is recommended for

(Conclusions, cont'd) -

this precipitate:

		Per cent
Borax	-	60
Nitre	-	19
SiO_2	-	13
Soda	-	8
		100

Use equal parts of flux and precipitate and fuse at 2100° F.

The use of nitre in this flux in place of manganese should reduce the amount of copper in the bullion.

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