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DEPARTMENT OF MINES AND RESOURCES
BUREAU OF MINES
CANADA

Ottawa, July 17, 1946.

R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2078.

Summary of Experimental Test Work on Ore Shipment "A"
from the Giant Yellowknife Gold Mines Property,
at Yellowknife, Northwest Territories.

Note:

This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

(Copy No. 16.)

O T T A W A

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Property:

The property of the Giant Yellowknife Gold Mines from which the sample of ore was received is located in the Yellowknife district, Great Slave Lake, Northwest Territories.

Shipment:

On March 26, 1946, a shipment of 20 bags of ore with a total weight of 2,513 pounds was received under instructions from A. K. Muir, Manager.

This lot of ore was designated as Shipment "A" and was made up from mine and deck sample rejects from the 200 level of the mine.

Sampling and Analysis:

The total weight of ore as received was spread out on the concrete floor of the receiving room and coned and quartered and half of the shipment reduced to approximately $\frac{1}{4}$ -inch size.

From this, 300 pounds was cut out in a Jones sampler and reduced to approximately 20 mesh. A head sample was taken from this in the Jones sampler and sent for assay and analysis. The remainder was reduced to minus 20 mesh and bagged for investigative purposes.

The analyses made on the head sample gave the following results:

Gold	-	0.6533 oz./ton
Silver	-	0.10 "
Copper	-	0.03 per cent
Zinc	-	0.08 "
Iron	-	7.75 "
Arsenic	-	1.29 "
Sulphur	-	3.12 "
Lead	-	None detected.
Antimony	-	" "
SiO ₂	-	52.5 per cent
CaO	-	5.02 "
MgO	-	5.36 "
Al ₂ O ₃	-	14.82 "

A screen analysis of the head sample revealed the following:

On Mesh	Weight, per cent	A s s a y s				Distribution, per cent			
		Oz./ton	Per cent	Au	Fe	As	S	Au	Fe
48	30.58	0.66	7.68	1.42	3.02	30.9	28.8	30.2	28.6
65	9.36	0.60	8.32	1.33	3.62	8.6	9.5	8.6	10.5
100	8.18	0.61	8.65	1.26	4.03	7.6	8.6	7.1	10.2
150	8.52	0.60	8.48	1.16	4.46	7.9	8.8	6.8	11.8
200	6.77	0.67	9.13	1.61	4.71	7.0	7.6	7.5	9.9
-200	36.59	0.68	8.16	1.57	2.56	38.0	36.7	39.8	29.0
Total	100.00	0.6532	8.16	1.44	3.23	100.0	100.0	100.0	100.0

Characteristics of the Ore:

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

Gangue -

The gangue is a mixture of white quartz, light to dark green rock, and rather abundant finely disseminated carbonate. From the rate of its reaction to a drop of HCl applied to a polished surface, the latter constituent is probably dolomitic in character. Since the rock material is soft and shows signs of a slight schistosity in a few places, the whole assemblage may represent a silicified and carbonated chloritic schist.

Metallic Minerals -

Pyrite and arsenopyrite are disseminated unevenly through gangue as medium coarse to extremely fine anhedral to euhedral crystals which in many places are very closely associated. While each of these two minerals occurs in grain sizes which range down to the limits of the microscope (about one micron), the average size of the arsenopyrite crystals is much smaller than that of the pyrite. Both sulphides, especially pyrite, contain occasional to rare tiny inclusions of the gangue and metallics.

Small amounts of chalcopyrite and sphalerite, alone and associated, are visible as occasional small grains in gangue, rarely in pyrite. Rare tiny irregular particles of grey copper (tetrahedrite-tennantite) occur in the same manner. Due to their fine sizes sufficient material could not be obtained for satisfactory microchemical tests, but

(Characteristics of the Ore, cont'd) -

this mineral is probably towards the antimony end of the series.

Two tiny particles of gold were observed and measured. One is elongated in shape, about 24 x 8 microns in size, and lies in a pit between two grains of pyrite. The other is more or less equidimensional in shape and is almost, but not completely, surrounded by pyrite. See Figure 1.

Figure 1.

PHOTOMICROGRAPH OF POLISHED SECTION, SHOWING A TINY PARTICLE OF GOLD (YELLOW) CLOSELY ASSOCIATED WITH PYRITE (WHITE) WHICH IS EMBEDDED IN GANGUE (GREY).

A 200-mesh Tyler screen opening is outlined in white.
Magnification, X600.

Conclusions:

Test work on this Shipment "A" ore would indicate that it is considerably more refractory than either the Outcrop Ore or the Shipment No. 3 on which some extensive investigation was conducted at the Bureau of Mines' ore dressing laboratories in 1945.

Straight cyanidation of the ore, or any of its products, in the natural state yielded unsatisfactory results, extraction being very low. This is substantiated by the results in Tests Nos. 2, 8, and 10. Investigation, both microscopically and from test work, would indicate that the gold and arsenopyrite in the ore are very intimately associated and that in any line of test work fine grinding would be necessary. Test No. 1 showed that 17.4 per cent of the gold was amenable to amalgamation at 92.4 per cent minus 200 mesh.

From the results obtained in these earlier tests, roasting and cyaniding a flotation concentrate appeared to be the logical line of endeavour. Although it was realized that fine grinding might lower the efficiency of the roasting operations, it was realized that a high overall extraction must first come from a high flotation recovery, and special emphasis was placed on obtaining a high recovery in the preliminary operation with a tailing low enough to warrant discarding without further treatment.

Flotation even at 97.6 per cent minus 325 mesh as in Test No. 17, where the grinding was done all in one stage, failed to yield 95 per cent recovery or a tailing less than 0.045 ounce gold per ton.

However, with the same total grinding time, the same total flotation time and the same overall quantity of reagents, where the grinding and flotation were done in

(Conclusions, cont'd) -

two stages as in Tests Nos. 18, 19 and 20, flotation recovery increased to 97.3 per cent of the gold and a tailing loss of 0.025 ounce gold per ton was obtained.

It is not certain whether the difference in results is due to what may be described as a chemical reaction, overcome due to the filtering operation between stages of flotation, or whether it is due to the mechanical action of ore particle reduction in the two stages of grinding. In an endeavour to determine this, Test No. 21 was conducted.

Roasting operations, conducted along the lines of the Beattie low-temperature method and the Forward high-temperature method, as well as certain modifications of these methods, failed to reduce the arsenic content of the calcine below 1.25 per cent from a percentage of 4.5 in the concentrate. Cyaniding the calcine with 48, 51 and 72 hours of agitation gave extractions of from 85 to 92.5 per cent of the gold, with an overall recovery of 84 to 87.7 per cent.

As was, perhaps, to be expected, the higher flotation recoveries from finer grinding were accompanied by lower gold extractions from the calcines and, as a result, lower overall recoveries.

From the results of the test work on this Shipment "A" ore, roasting and cyaniding the roasted product **might well prove** to be the troublesome part of the operation and one on which considerable experimentation would be warranted.

As in previous experimental work on previous ore shipments from this property, low ratios of concentration can be expected. The addition of sodium silicate in the primary flotation cell as a depressant of the gangue slime, failed to materially reduce the percentage of flotation concentrate and was accompanied by higher flotation tailings.

DETAILS OF INVESTIGATIVE TESTS:

Test No. 1.

1,000 grams of ore was ground to 92.4 per cent minus 200 mesh and amalgamated with 7 c.c. mercury, 0.5 gram CaO, 1,000 c.c. water, and six pebbles.

Mercury recovered and pulp filtered, sampled and assayed.

Results -

Assay of heads	=	0.6533 Au oz./ton
Assay of tailings	=	0.54 " "
Extraction of gold	=	17.4 per cent.

500 grams of amalgamation tailings was cyanided at 2 to 1 dilution for 48 hours.

Results -

Assay of amalgamation tailings	=	0.54 Au oz./ton
" " cyanide residue	=	0.41 " "
Extraction of gold	=	24.1 per cent
Overall recovery of gold	=	37.3 " "
NaCN consumed, lb./ton ore	=	0.8
CaO " " "	=	6.16

Test No. 2.

1,000 grams ore ground to 93.6 per cent minus 200 mesh (A).

1,000 grams ore ground to 97.4 per cent minus 200 mesh or 92.8 per cent minus 325 mesh (B).

Both pulps cyanided at 2 to 1 dilution for 48 hours.

Results -

	A	B
Assay of heads, Au oz./ton	= 0.6533	0.6533
" " residue, Au oz./ton	= 0.415	0.40
Extraction of gold, per cent	= 36.5	38.8
NaCN consumed, lb./ton ore	= 1.28	1.96
CaO " " "	= 6.88	8.20
NaCNS (combined A and B), per cent	= 0.0153	
Reducing power (c.c. N KMnO ₄ per 10 1,000 c.c.)	= 156	

An infrasizer test on the cyanide residue from Test

(Details of Investigative Tests, cont'd) -

No. 2B revealed the following:

Micron:Weight, Size : per : cent	A s s a y s				Distribution, per cent			
	Oz./ton:	Per Cent			Au	Fe	As	S
+56 : 0.98)	:	:	:	:	:	:	:	:
-56+40: 15.97)	: 0.67	: 8.30	: 1.95	: 5.17	: 28.2	: 18.5	: 28.6	: 25.4
-40+28: 17.42	: 0.58	: 7.05	: 1.80	: 4.38	: 25.1	: 16.1	: 27.1	: 22.3
-28+20: 20.43	: 0.30	: 7.30	: 1.44	: 3.58	: 15.3	: 19.6	: 25.5	: 21.3
-20+14: 10.44	: 0.36	: 6.70	: 0.83	: 2.91	: 9.3	: 9.2	: 7.5	: 8.9
-14+10: 9.22	: 0.44	: 7.25	: 0.83	: 2.62	: 10.1	: 8.8	: 6.7	: 7.7
-10 : 25.54	: 0.19	: 8.30	: 0.21	: 1.94	: 12.0	: 27.8	: 4.6	: 14.4
Totals: 100.00	: 0.403	: 7.61	: 1.15	: 3.41	: 100.0	: 100.0	: 100.0	: 100.0

Test No. 3.

750 c.c. solution from Tests Nos. 2A and 2B combined were de-aerated with 0.2 gram $PbNO_3$ and 0.1 gram NaCN for 30 minutes under vacuum. Zinc dust, 0.5 gram, was added as a precipitant and agitated for $7\frac{1}{2}$ minutes, still under vacuum.

Results -

Assay of pregnant solution = 0.104 Au oz./ton
 Assay of barren solution = 0.001 " "
 R.P. (c.c. N $KMnO_4$ per 1,000
 $\frac{10}{10}$ c.c. solution) = 158
 NaCNS, per cent = 0.0148

Test No. 4.

750 c.c. solution as in Test No. 3 precipitated under same conditions except that 0.35 gram NaOH was included and 0.4 gram aluminium dust was used as a precipitant.

Results -

Assay of pregnant solution = 0.104 Au oz./ton
 " " barren solution = Trace.
 R.P. (c.c. N $KMnO_4$ per 1,000 cc. solution) = 150
 $\frac{10}{10}$
 NaCNS, per cent = 0.0133

(Details of Investigative Tests, cont'd) -

Test No. 5.

2,000 grams of ore was ground to 95.7 per cent minus 200 mesh and then transferred to a flotation cell.

Reagents Added:

To Grinding -

Lb./ton

Soda ash	-	2.00
Reagent No. 208	-	0.2
Reagent No. 301	-	0.1
Pot. amyl xanthate	-	0.1
Aerofloat No. 25	-	0.07

To Conditioning -

Pot. amyl xanthate	-	0.10	pH, 10.5
CuSO ₄	-	1.00	(5 mins.)

To Flotation -

Pine oil	-	0.10	(13 mins.)
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Results:

Products	:Weight, : per : cent	A s s a y s				Distribution,			
		: Oz./ton:	Per cent			per cent			
		: Au	: Fe	: As	: S	: Au	: Fe	: As	: S
Flot. conc.	: 21.5	: 2.70	: 20.0	: 4.86	: 14.67	: 94.89	: 57.1	: 94.9	: 97.4
Flot. tailing:	: 78.5	: 0.04	: 4.12	: 0.071	: 0.107	: 5.11	: 42.9	: 5.1	: 2.6
Total	: 100.0	: 0.612	: 7.53	: 1.10	: 3.23	: 100.00	: 100.0	: 100.0	: 100.0

267 grams of concentrate was roasted by the Beattie method.

Loss in weight = 14.98 per cent.

Analysis of calcine:

Gold	-	3.17 oz./ton
Iron	-	22.5 per cent
Arsenic	-	1.24 "
Sulphur	-	1.38 "

167 grams of roasted concentrate was ground to 99.4 per cent minus 325 mesh and cyanided at 3 to 1 dilution for 48 hours.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results -

Assay of roasted conc.	=	3.17 Au oz./ton
Assay of cyanide residue	=	0.24 " "
Extraction of gold	=	92.43 per cent
NaCN consumed, lb./ton conc.	=	4.08
CaO " " "	=	11.04
Overall recovery of gold	=	87.71 per cent

Test No. 6.

1,000 grams of ore ground to 94.6 per cent minus 200 mesh. Amalgamated with 7 c.c. mercury, 0.5 gram CaO, 1,000 c.c. H₂O, and six pebbles.

Results -

Assay of heads	=	0.6533 Au oz./ton
Assay of tailing	=	0.526 " "
Extraction of gold	=	19.49 per cent

Tailings repulped and floated with the addition of the following reagents:

Reagents Added:

<u>To Conditioning -</u>	<u>Lb./ton</u>
Soda ash	- 2.0
Reagent No. 301	- 0.1
Aerofloat No. 25	- 0.07 pH, 10.8
CuSO ₄	- 1.00 (5 mins.)
Pot. amyl xanthate	- 0.20
<u>To Flotation -</u>	
Pine oil	- 0.10 (7 mins.)

Results:

Products	Weight, per cent	Assays				Distribution, per cent			
		Oz./ton Au	Per cent Fe	Per cent As	Per cent S	Au	Fe	As	S
Flot. conc.	22.07	2.12	18.6	6.08	14.8	88.9	51.3	88.7	95.3
Flot. tailing	77.93	0.075	5.0	0.22	0.21	11.1	48.7	11.3	4.7
Total	100.0	0.526	8.0	1.51	3.43	100.0	100.0	100.0	100.0

Additional extraction on heads by flotation of amalgamation tailing = 71.53 per cent
 Overall recovery of gold = 91.07 " "

(Details of Investigative Tests, cont'd) -

Test No. 7.

2,000 grams of ore was ground to 96.6 per cent minus 200 mesh.

Reagents Added:

<u>To Grinding -</u>	<u>Lb./ton</u>
Soda ash -	1.5
Sodium silicate -	1.5
Reagent No. 301 -	0.1
Reagent No. 208 -	0.2
Pot. amyl xanthate -	0.1
 <u>To Conditioning -</u>	
Pot. amyl xanthate -	0.1 pH, 10.5
CuSO ₄ -	1.0 (5 mins.)
 <u>To Flotation -</u>	
Pine oil -	0.10 (13 mins.)

Results:

Products	:Weight, : per : cent	: A s s a y s				: Distribution, : per cent			
		:Oz./ton:	: Per cent			: Au :	: Fe :	: As :	: S
		: Au	: Fe	: As	: S	: Au	: Fe	: As	: S
Flot. conc.	: 17.4	: 3.32	: 21.6	: 8.01	: 17.4	: 92.7	: 48.0	: 91.8	: 98.1
Flot. tailing	: 82.6	: 0.055	: 4.95	: 0.15	: 0.0%	: 7.3	: 52.0	: 8.2	: 1.9
Total	: 100.0	: 0.62	: 7.84	: 1.51	: 3.08	: 100.0	: 100.0	: 100.0	: 100.0

Test No. 8.

2,000 grams of ore was ground to 95.4 per cent minus 200 mesh.

Reagents Added:

<u>To Grinding -</u>	<u>Lb./ton</u>
Soda ash -	0.50
Reagent No. 301 -	0.10
Reagent No. 208 -	0.20
Pot. amyl xanthate -	0.10
Aerofloat No. 25 -	0.07
 <u>To Conditioning -</u>	
CuSO ₄ -	1.0 pH, 8.2
Pot. amyl xanthate -	0.1 (5 mins.)

(Continued on next page)

(Details of Investigative Tests, cont'd) -

To Flotation -

Pine oil - 0.10 (13 mins.)

To Cleaner Cell -

Sodium silicate - 1.0 (6 mins.)

Results:

Products	:Weight, : per : cent	A s s a y s				Distribution, per cent			
		:Oz./ton:	Per cent						
		: Au	: Fe	: As	: S	: Au	: Fe	: As	: S
Cleaner conc.	: 16.0	: 3.74	: 23.0	: 7.79	: 18.8	: 93.1	: 47.5	: 92.7	: 96.3
Cleaner tailing	: 12.0	: 0.10	: 6.5	: 0.22	: 0.36	: 1.9	: 10.1	: 1.0	: 1.4
Flot. tailing	: 72.0	: 0.045	: 4.55	: 0.10	: 0.10	: 5.0	: 42.4	: 5.4	: 2.3
Total	: 100.0	: 0.040	: 7.73	: 1.34	: 3.12	: 100.0	: 100.0	: 100.0	: 100.0

205 grams cleaner conc. roasted by Beattie method.

Loss in weight = 17.56 per cent.

Analysis of calcine:

Gold - 4.42 oz./ton
 Iron - 27.5 per cent
 Arsenic - 1.28 "
 Sulphur - 1.33 "

119 grams of roasted concentrate was ground 20 minutes to 99.6 per cent minus 325 mesh and cyanided at 4 to 1 dilution for 48 hours.

Results -

Assay of roasted conc. = 4.42 Au oz./ton
 Assay of cyanide residue = 0.28 " "
 Extraction of gold = 93.66 per cent
 NaCN consumed, lb./ton conc. = 4.96
 CaO " " " = 12.80
 Overall extraction from flotation and cyaniding = 87.20 per cent Au.

172 grams cleaner tailings cyanided at 3 to 1 dilution for 48 hours without regrinding.

Results -

Assay cleaner tailings = 0.10 Au oz./ton
 Assay of cyanide residue = 0.06 " "
 Extraction of gold = 40.0 per cent
 NaCN consumed, lb./ton = 2.28

(Details of Investigative Tests, cont'd) -

CaO consumed lb./ton = 10.44
 Overall extraction on heads from
 cyaniding cleaner tailings = 0.76 per cent

250 grams flotation tailing cyanided at 2 to 1
 dilution without grinding for 48 hours.

Results -

Assay of flotation tailing = 0.045 Au oz./ton
 Assay of cyanide residue = 0.03 "
 Extraction of gold = 33.40 per cent
 NaCN consumed, lb./ton = 0.64
 CaO " " = 4.16
 Overall extraction on heads,
 per cent gold = 1.67
 Total overall recovery = 87.20
 +0.76+1.67 = 89.63 per cent

Test No. 9.

2,000 grams of ore ground to 96.0 per cent minus
 200 mesh. In an endeavour to lower tailings loss, the amount
 of flotation reagents was increased. Flotation time also
 increased.

Reagents Added:

<u>To Grinding -</u>	<u>Lb./ton</u>
Soda ash	0.5
Reagents No. 301	0.2
Reagents No. 208	0.3
Pot. amyl xanthate	0.3
Aerofloat No. 25	0.105

<u>To Conditioning -</u>	
Pot. amyl xanthate	0.20 pH, 8.7
CuSO ₄	2.0 (5 mins.)

<u>To Flotation -</u>	
Pine oil	0.10 (15 mins.)

Results:

Products:	Weight, per cent	A s s a y s				Distribution, per cent			
		Oz./ton Au	Per cent Fe	Per cent As	Per cent S	Au	Fe	As	S
Flot. conc.	29.55	2.0	16.5	4.36	10.23	94.4	63.2	96.3	97.0
Flot. tailing	70.45	0.05	4.03	0.071	0.13	5.6	36.8	3.7	3.0
Total	100.0	0.626	7.71	1.33	3.11	100.0	100.0	100.0	100.0

(Details of Investigative Tests, cont'd) -

275 grams of concentrate were roasted by the Beattie method.

Loss of weight
in roasting = 9.8 per cent.

Analysis of calcine:

Gold	-	2.22	oz./ton
Iron	-	16.64	per cent
Arsenic	-	1.55	" "
Sulphur	-	0.91	" "

167 grams of roasted concentrate was ground to approximately 325 mesh and cyanided at 3 to 1 dilution for 48 hours.

Results -

Assay of roasted conc.	=	2.22	Au oz./ton
Assay of cyanide residue	=	0.535	" "
Extraction of gold	=	74.76	per cent
NaCN consumed, lb./ton	=	4.68	
CaO " " "	=	27.72	
Overall recovery from flotation and cyaniding	=	70.5	per cent Au

166 grams concentrate roasted by Forward method.

Loss in weight = 9.64 per cent.

Analysis of calcine:

Gold	-	2.12	oz./ton
Iron	-	17.1	per cent
Arsenic	-	2.9	" "
Sulphur	-	1.44	" "

Results -

Assay of roasted conc.	=	2.12	Au oz./ton
Assay of cyanide residue	=	0.44	" "
Extraction of gold	=	79.1	per cent
NaCN consumed, lb./ton	=	4.0	
CaO " " "	=	24.2	
Overall recovery from flotation and cyaniding of gold	=	74.67	per cent Au

Test No. 10.

2,000 grams of ore ground as in Test No. 9 and floated without Aerofloat No. 25.

(Details of Investigative Tests, cont'd) -

Results:

Products	:Weight, : : per : : cent :	A s s a y s				:	Distribution,			
		: Oz./ton :	Per cent				:	per cent		
			: Au :	: Fe :	: As :			: S :	: Au :	: Fe :
Flot. conc.	: 26.43 :	: 2.2 :	: 16.1 :	: 4.41 :	: 12.17 :	: 94.62 :	: 60.0 :	: 95.9 :	: 97.3 :	
Flot. tailing	: 73.57 :	: 0.045 :	: 3.85 :	: 0.067 :	: 0.12 :	: 5.38 :	: 40.0 :	: 4.1 :	: 2.7 :	
Total	: 100.0 :	: 0.614 :	: 7.08 :	: 1.21 :	: 3.3 :	: 100.0 :	: 100.0 :	: 100.0 :	: 100.0 :	

275 grams concentrate roasted by Beattie method.

Loss in weight = 9.1 per cent.

Analysis of calcine:

Gold - 2.5 oz./ton
 Iron - 17.6 per cent
 Arsenic - 1.55 " "
 Sulphur - 1.01 " "

167 grams of roasted concentrate ground to approximately 325 mesh and cyanided for 48 hours at 3 to 1 dilution.

Results -

Assay of roasted conc. = 2.5 Au oz./ton
 Assay of cyanide residue = 0.475 " "
 Extraction of gold = 31.0 per cent
 NaCN consumed, lb./ton = 5.52
 CaO " " = 28.92
 Overall recovery from flotation and cyaniding = 76.6 per cent Au

115 grams of concentrate ground to 325 mesh and cyanided at 4.35 to 1 dilution for 48 hours.

Results -

Assay of concentrate = 2.5 Au oz./ton
 Assay of residue = 1.16 " "
 Extraction of gold = 47.2 per cent
 NaCN consumed, lb./ton = 9.7
 CaO " " = 22.1
 Overall recovery from flotation and cyaniding = 44.66 per cent Au

(Details of Investigative Tests, cont'd) -

Test No. 11.

Same as Test No. 9 but with 2.0 lb./ton of sodium silicate added to grinding.

Results:

Products	:Weight, : per : cent	: A s s a y s				: Distribution, : per cent			
		: Oz./ton:	: Per cent			: Au	: Fe	: As	: S
		: Au	: Fe	: As	: S	: Au	: Fe	: As	: S
Flot. conc.	: 27.2	: 2.06	: 16.63	: 4.6	: 10.94	: 88.0	: 56.9	: 96.3	: 92.5
Flot. tailing	: 72.8	: 0.105	: 4.70	: 0.066	: 0.33	: 12.0	: 43.1	: 3.7	: 7.5
Total	: 100.0	: 0.636	: 7.95	: 1.3	: 3.2	: 100.0	: 100.0	: 100.0	: 100.0

Test No. 12.

Same as Test No. 10 but with 2.0 lb./ton of sodium silicate added to grinding.

Results:

Products	:Weight, : per : cent	: A s s a y s				: Distribution, : per cent			
		: Oz./ton:	: Per cent			: Au	: Fe	: As	: S
		: Au	: Fe	: As	: S	: Au	: Fe	: As	: S
Flot. conc.	: 24.03	: 2.32	: 16.63	: 4.8	: 11.36	: 90.7	: 55.0	: 96.2	: 94.4
Flot. tailing	: 75.97	: 0.075	: 4.3	: 0.06	: 0.21	: 9.3	: 45.0	: 3.8	: 5.6
Total	: 100.00	: 0.615	: 7.26	: 1.2	: 2.89	: 100.0	: 100.0	: 100.0	: 100.0

Test No. 13.

Same as Test No. 10 but with cresylic acid used in place of pine oil in flotation.

Results:

Products	: Weight, : per : cent	: Assay, : Au : Oz./ton:	: Distribution, : of gold, : per cent
Flot. tailing	: 83.44	: 0.06	: 7.98
Total	: 100.00	: 0.626	: 100.00

(Details of Investigative Tests, cont'd) -

Test No. 14.

This test marked the first of a series to obtain a high flotation extraction and a low flotation tailing.

2,000 of grams ore ground 25 minutes and pulp floated. Pulp filtered and reground for 5 minutes. Floated.

Reagents Added: #1 Stage #2 Stage

To Grinding - Lb./ton Lb./ton

Soda ash	- 0.5	
Reagent No. 301	- 0.1	0.1
Reagent No. 208	- 0.2	0.1
Pot. amyl xanthate	- 0.2	0.1

To Conditioning -

Pot. amyl xanthate	- 0.1 (pH, 8.5)	0.1 pH, 8.5
CuSO ₄	- 1.0 (5 mins.)	1.0 (2 mins.)

To Flotation -

Pine oil	- 0.075 (10 mins.)	0.025 (5 mins.)
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Final grind = 95.0 per cent minus 200 mesh.

Results:

<u>Products</u>	<u>:Weight, : : per : : cent :</u>	<u>: Assay, : : Au : : Oz./ton :</u>	<u>: Distribution : : of gold, : : per cent :</u>
#1 flot. conc.	: 22.3 :	: 2.68 :	: 93.54 :
#1 flot. tailing (calc.)	: 77.7 :	: 0.053 :	: 6.46 :
#2 flot. conc.	: 2.2 :	: 0.42 :	: 1.44 :
Flot. tailing	: 75.5 :	: 0.0425 :	: 5.02 :
Total	: 100.0 :	: 0.639 :	: 100.00 :

Test No. 15.

2,000 of grams ore ground 50 minutes to 93.2 per cent minus 325 mesh.

Reagents Added:

To Grinding - Lb./ton

Soda ash	-	0.5
Reagent No. 301	-	0.3

(Details of Investigative Tests, cont'd) -

	<u>Lb./ton</u>
Reagent No. 208	- 0.3
Pot. amyl xanthate	- 0.3
<u>To Conditioning -</u>	
Pot. amyl xanthate	- 0.2 pH, 8.1
CuSO ₄	- 2.0 (5 mins.)
<u>To Flotation -</u>	
Pine oil	- 0.1 (15 mins.)

Results

Products	:Weight, : per : cent	A s s a y s				Distribution, per cent					
		: Oz./ton:	: Per cent	: Au	: Fe	: As	: S	: Au	: Fe	: As	: S
Flot. conc.	: 21.05	: 2.8	: 17.8	: 6.24	: 13.49	: 94.32	: 51.5	: 93.8	: 96.7		
Flot. tailing	: 78.95	: 0.045	: 4.55	: 0.11	: 0.12	: 5.68	: 48.5	: 6.2	: 3.3		
Total	: 100.0	: 0.625	: 7.33	: 1.4	: 2.93	: 100.0	: 100.0	: 100.0	: 100.0		

Test No. 16. (Companion to
Test No. 15)

In this test the grinding time was divided into 40 minutes primary and 10 minutes secondary. Flotation time was also divided into 10 minutes primary and 5 minutes secondary. Total amount of reagents was also divided. Overall grind = 93.8 per cent minus 325 mesh.

Results:

Products	:Weight, : per : cent	:Assay, : Au : Oz./ton:	: Distribution : of gold, : per cent
#1 flot. conc.	: 20.38	: 2.88	: 93.54
#1 flot. tailing (calc)	: 79.62	: 0.051	: 6.46
#2 flot. conc.	: 4.09	: 0.30	: 1.95
Flot. tailing	: 75.53	: 0.0375	: 4.51
Total	: 100.00	: 0.627	: 100.00

Test No. 17.

2,000 grams ore ground for 70 minutes to 97.6 per cent minus 325 mesh.

Floated as in Test No. 15.

(Details of Investigative Tests, cont'd) -

Results:

Products	:Weight, per cent	A s s a y s				Distribution, per cent			
		:Oz./ton:	Per cent						
		Au	Fe	As	S	Au	Fe	As	S
Flot. conc.	: 27.68	: 2.10	: 15.2	: 4.48	: 9.72	: 94.7	: 54.7	: 93.4	: 95.6
Flot. tailing	: 72.32	: 0.045	: 4.8	: 0.12	: 0.17	: 5.3	: 45.3	: 6.6	: 4.4
Total	: 100.00	: 0.6138	: 7.67	: 1.32	: 2.81	: 100.0	: 100.0	: 100.0	: 100.0

210 grams of concentrate roasted by Beatti
method.

Loss in weight = 9.05 per cent.

Analysis of calcine:

Gold	-	2.23	oz./ton
Iron	-	16.50	per cent
Arsenic	-	1.82	" "
Sulphur	-	1.01	" "

141 grams of roasted concentrate ground to 325 mesh
and cyanided for 51 hours at 3.54 to 1 dilution.

Results -

Assay of roasted conc.	=	2.23	Au oz./ton
Assay of cyanide residue	=	0.37	" "
Extraction of gold	=	33.4	per cent
NaCN consumed, lb./ton	=	5.39	
CaO	=	27.33	
Overall recovery	=	79.0	per cent Au

Test No. 18. (Companion to
Test No. 17)

Grinding time was divided into two stages of 50 minutes
primary and 20 minutes secondary. Flotation time divided into
10 minutes primary and 5 minutes secondary. Filtering between
stages. Total reagents divided between primary and secondary
flotation. Final grind = 96.0 per cent minus 325 mesh.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results:										
Products	:Weight, : per : cent	A s s a y s					Distribution,			
		: Oz./ton:	Per cent			per cent				
		: Au	: Fe	: As	: S	: Au	: Fe	: As	: S	
N#1 and #2	:	:	:	:	:	:	:	:	:	:
Plot. conc.	: 28.63	: 2.16	: 14.9	: 4.47	: 9.66	: 96.66	: 58.2	: 97.4	: 97.3	
Plot. tailing	: 71.37	: 0.03	: 4.3	: 0.048	: 0.11	: 3.34	: 41.8	: 2.6	: 2.7	
Total	: 100.0	: 0.6398	: 7.33	: 1.31	: 2.84	: 100.0	: 100.0	: 100.0	: 100.0	

210 of grams of roasted concentrate by Beattie method.

Loss in weight = 9.5 per cent.

Analysis of calcine:

Gold	-	2.35	oz./ton
Iron	-	16.45	per cent
Arsenic	-	1.63	" "
Sulphur	-	0.98	" "

140 grams of roasted concentrate ground to 325 mesh and cyanided at 3.54 to 1 dilution for 51 hours.

Results -

Assay of roasted conc.	=	2.35	Au oz./ton
Assay of cyanide residue	=	0.295	" "
Extraction of gold	=	87.45	per cent
NaCN consumed, lb./ton conc.	=	5.66	
CaO " " "	=	27.61	
Overall recovery, per cent gold	=	84.53	

Test No. 19. (Companion to Tests Nos 17 and 18)

Grinding time was divided into 40 minutes primary and 30 minutes secondary. Final grind = 96.0 per cent minus 325 mesh. Otherwise test same as Test No. 18.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results:										
Products	:Weight, : per : cent	A s s a y s				Distribution,				
		:Oz./ton:	Per cent			per cent				
		: Au	: Fe	: As	: S	:Au	: Fe	: As	: S	
Flot. conc.	: 30.98:	2.0	: 15.82:	3.93:	9.07:	97.3:	63.4:	96.7:	98.1	
Flot. tailing:	69.02:	0.025:	4.11:	0.06:	0.08:	2.7:	36.6:	3.3:	1.9	
Total	: 100.0 :	0.6368:	7.73:	1.26:	2.86:	100.0:	100.0:	100.0:	100.0	

210 of grams of concentrate roasted by Beattie method.

Loss in weight = 8.2 per cent

Analysis of calcine:

Gold	-	2.14	oz./ton
Iron	-	15.30	per cent
Arsenic	-	1.59	" "
Sulphur	-	0.89	" "

142 grams of roasted concentrate cyanided for 51 hours at 3.54 to 1 dilution after grinding to 325 mesh.

Results -

Assay of roasted conc.	=	2.14	Au oz./ton
Assay of cyanide residue	=	0.30	" "
Extraction of Gold	=	86.0	
NaC consumed, lb./ton conc.	=	5.95	
CaO " " "	=	28.46	
Overall recovery, per cent gold	=	83.68	

Test No. 20. (Companion to Tests Nos. 17, 18, and 19)

Same procedure as in Tests Nos. 18 and 19 except that grinding time was divided into 30 minutes primary and 40 minutes secondary. Final grind 95.0 per cent minus 325 mesh.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results:										
Products	:Weight, : per : cent	A n n a l y s e s					Distribution, per cent			
		: Oz./ton:	Per cent				: Au :	: Fe:	: As:	: S
		: Au	: Fe	: As	: A	: Au :	: Fe:	: As:	: S	
Flot. conc.	: 28.8	: 2.08	: 15.2	: 4.43	: 9.81	: 97.12:	: 56.7:	: 97.6:	: 98.0	
Flt. tailing	: 71.2	: 0.025	: 4.7	: 0.045	: 0.068	: 2.88 :	: 43.3:	: 2.4:	: 2.0	
Total	: 100.0	: 0.6168	: 7.72	: 1.31	: 2.87	: 100.0 :	: 100.0:	: 100.0:	: 100.0	

210 grams of concentrated roasted by Beattie method.

Loss in weight = 9.5 per cent.

Analysis of calcine:

Gold	-	2.28 oz./ton
Iron	-	16.85 per cent
Arsenic	-	1.40 " "
Sulphur	-	0.87 " "

140 grams of roasted concentrate cyanided at 3.54 to 1 dilution for 51 hours after grinding to 325 mesh.

Results -

Assay of roasted conc.	=	2.28	Au oz./ton
Assay of cyanide residue	=	0.29	" "
Assay of residue	=	87.28	per cent
NaCN consumed, lb./ton	=	5.10	
CaO " " "	=	26.05	
Overall recovery of gold, per cent	=	84.77	

Test No. 21.

2,000 grams of ore ground for 65 minutes with no reagents. Filtered. Repulped and reground with flotation reagents as in Test No. 15. Grinding water from first grinding saved for analysis. Final grind = 97.6 per cent minus 325 mesh.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results:

Products	:Weight,:		A s s a y s				Distribution,			
	: per	:Oz./ton:	Per cent				per cent			
	: cent	: Au	:Fe	: As	: S	: Au	:Fe	: As	: S	
Flot. conc.	: 24.3	: 2.22	:15.5	:4.41	:10.43	:87.2	: 52.6	: 83.8	: 90.0	
Flot. tailing	: 75.7	: 0.105	: 4.48	:0.29	: 0.37	:12.8	: 47.4	: 16.2	: 10.0	
Total	:100.0	: 0.619	: 7.15	:1.29	: 2.81	:100.0	:100.0	:100.0	:100.0	

Analysis of Grinding Water

Parts per million

	<u>Top Water</u>	<u>Grinding Water</u>
pH	- 7.6	8.0
Residue on Evaporation	- 78.5	923.0
Alkalinity (CaCO ₃)	- 35.0	202.8
SiO ₂	- 0.5	2.5
Al	- Slight trace.	Slight trace.
Fe	- 0.1	0.4
Fe ₂ O ₃	- N.d.	N.d.
Ca	- 17.3	38.4
Mg	- 1.3	1.3
Alkalis (as Na)	- 4.3	217.7
SO ₄	- 29.6	147.3
Cl	- 2.0	122.6

Test No. 18, Roast No. 2.

198 grams of concentrate roasted by Beattie method but temperature was raised to the active roasting temperature of 480°C. considerably more slowly than in Test 18, Roast No. 1.

Loss in weight = 9.1 per cent.

Analysis of calcine:

Gold	- 2.40	oz./ton
Iron	- 16.72	per cent
Arsenic	- 1.60	" "
Sulphur	- 0.80	" "

Extraction on calcine by cyaniding = 82.5 per cent gold

Overall recovery of gold, per cent = 79.74.

Test No. 19 (Roast No. 2).

Some roasting procedure as preceding test. Overall recovery of gold, per cent = 82.7.

(Details of Investigative Tests, cont'd) -

Test No. 20 (Roast No. 2).

Same roasting procedure as two preceding tests. Overall recovery of gold, per cent = 80.06.

Test No. 22. (Same general procedure as in Test No. 19).

Results:

Products	:Weight, : per : cent	A s s a y s				Distribution, per cent			
		:Oz./ton: : Au	:Fe	: As	: S	:Au	: Fe	: As	: S
#1 & 2 flot. concs	: 24.63:	2.40	:16.5	:6.37:	11.3	: 95.73:	57.5	: 93.3:	96.8
Flot. tailing	: 75.37:	0.035	: 4.21:	0.15	: 0.12:	4.27	: 42.5:	6.7	: 3.2
Total	: 100.00:	0.617	: 7.23:	1.68	: 2.87:	100.0	: 100.0:	100.0	: 100.0

212 grams of flotation concentrate roasted by Forward method with modifications.

Loss in weight = 6.6 per cent.

Analysis of calcine:

Gold	-	2.59 oz./ton
Iron	-	17.54 per cent
Arsenic	-	1.71 " "
Sulphur	-	1.43 " "

148 grams of roasted concentrate ground to 325 mesh, filtered, repulped, and cyanided for 71 hours at 3.4 to 1 dilution.

Results -

Assay of roasted conc.	=	2.59	Au oz./ton
Assay of cyanide residue	=	0.43	" "
Extraction of gold	=	83.4	per cent
Overall recovery of gold, per cent	=	79.84	
NaCN consumed, lb./ton conc.	=	5.74	
CaO " " " "	=	29.10	

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