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

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 905.

Cyanidation, Amalgamation and Concentration of a Gold Ore from the Bristol Mines Limited, Gold Bridge, British Columbia.

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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Shipments:

Two samples of gold ore from the Bristol Mines Limited were received on June 7th, 1940. Sample No. 1, of 150 pounds, was representative of the ore body and Sample No. 2, of 50 pounds, was of a special nature. The

test work was performed mainly on Sample No. 1. The shipments were sent by Mr. A. E. Stromberg, Bristol Mines Limited, c/o Goldbridge Trading Company, Gold Bridge, British Columbia.

Location of the Property:

The property of the Bristol Mines Limited from which the present samples were received is situated on Tommy Creek, Bridge River area, Lillooet mining district, British Columbia.

Characteristics of the Ore:

Twelve polished sections, six for each sample, were prepared and examined microscopically for the purpose of determining the character of the ore. Since the microscopic characters of both samples are essentially the same this description covers them together.

Gangue -

The gangue consists of highly siliceous, dark grey rock with rather abundant, white, iron-free carbonate as disseminated grains and narrow discontinuous stringers.

Metallic Minerals -

Metallic mineralization consists almost entirely of an intimate admixture of pyrite and arsenopyrite in which the former mineral predominates. Both minerals occur as coarse to very fine disseminated grains and small patches consisting of multiple individuals. Inclusions of gangue are numerous and in many places gangue impregnates the sulphides so extensively as to give the surface cut by

(Characteristics of the Ore, cont'd) -

the section a lace-like appearance. A negligible amount of chalcopyrite is present as very rare tiny particles in gangue.

Nothing was learned as to the mode of occurrence of gold, since neither native metal nor gold minerals are visible in the sections.

Sampling and Analysis:

After crushing, cutting, and sampling by standard methods, representative portions from each shipment assayed as follows:

	Shipment No. 1.	Shipment No. 2.
Gold, oz./ton	0.24	2.00
Silver, "	0.09	0.79
Iron, per cent	8.29	10.67
Copper, per cent	Trace	0.08
Sulphur, "	4.10	6.14
Arsenic, "	1.86	4.04

Investigative Work:

The test work was conducted mainly on the representative Sample No. 1. This ore proved to be extremely refractory, not amenable to either cyanidation, amalgamation or concentration. Some 9 per cent of the gold was extracted by cyanidation at a grind of 90 per cent minus 200 mesh. Amalgamation of jig and blanket concentrates gave no appreciable extraction of the gold, and the results of flotation and table concentration gave only some 55 per cent of the gold in the concentrates, assaying slightly

(Continued on next page)

(Investigative Work, cont'd) -

over 1.0 ounce gold per ton.

Roasting of the raw ore followed by cyanidation of the calcine gave an extraction of 73 per cent of the gold. On Sample No. 2, straight cyanidation gave an extraction of only 9.5 per cent at a grind of 85 per cent minus 200 mesh in 48 hours' agitation.

Tests Nos. 1 to 13 were conducted on Sample No. 1 and Test No. 14 on Sample No. 2.

Details of the Test Work:

Test No. 1 (A - F). - Cyanidation.

Portions of the ore at minus 14 mesh were ground in cyanide solutions of 1 pound NaCN per ton strength to pass 82.9 per cent minus 200 mesh in Tests Nos. 1-A and 1-B 94.0 per cent minus 200 mesh in Tests Nos. 1-C and 1-D, and 90.2 per cent minus 200 mesh in Tests Nos. 1-E and 1-F. The pulps were then bottle-agitated for 24 or 48 hours. Sufficient lime was added during the grinding and agitation periods to ensure an alkalinity of from 0.10 to 0.15 pound CaO per ton of solution. In Tests Nos. 1-E and 1-F, 0.25 and 0.75 pound of coal oil were added to the grind.

(Continued on next page)

(Test No. 1, cont'd) -

Results of Cyanidation: (Feed, 0.24 Au oz./ton)

Test No.	Grind, % -200 mesh	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, ml. N/10 KMnO4/litre
1-A	82.9	24	0.22	8.3	1.0	0.15	1.4	11.7	170
1-B	82.9	48	0.22	8.3	1.0	0.15	1.4	14.7	230
1-C	94.0	24	0.22	8.3	1.0	0.10	1.6	11.8	190
1-D	94.0	48	0.22	8.3	1.0	0.10	1.6	15.8	270
1-E	90.2	24	0.22	8.3	1.0	0.10	0.8	11.8	150
1-F	90.2	48	0.22	8.3	1.0	0.10	0.8	11.8	170

In Tests Nos. 1-E and 1-F coal oil was added to the grind in order to prevent any possible re-precipitation of the gold on account of some graphitic carbon being present in the ore sample.

-

Test No. 2. - Cyanidation.

As the previous test showed some fouling of the cyanide solutions, as evidenced by the reducing power, it was decided to supply fresh cyanide solutions after the grind and also after several hours of agitation.

The ore at minus 14 mesh was ground in cyanide solution of 1 pound NaCN per ton strength to pass 85 per cent minus 200 mesh. The pulp was then filtered, washed, sampled, and repulped with fresh cyanide solution and agitated for 7 hours. The pulp was then filtered, washed, sampled and repulped with fresh cyanide solution as before and agitated for 15 hours. Finally, a further 7-hour period of agitation was conducted on the repulped sample. During the different grinding and agitation periods enough lime was added to maintain alkalinity.

(Continued on next page)

(Test No. 2, cont'd) -

Results of Cyanidation: (Feed, 0.24 Au oz./ton)

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, ml. N/10 $KMnO_4$ per litre
Grind 35 minutes	0.22	8.3	1.00	0.10	0.80	6.0	30
7	0.22	-	0.96	0.10	0.10	4.2	70
15	0.22	-	1.00	0.10	0.15	1.8	150
7	0.22	-	0.96	0.10	0.10	1.0	50

As shown by the above, the application of fresh cyanide solution was not successful in increasing extraction.

-

Test No. 3. - Infrasizing and Superpanning.

In order to ascertain the relationship between the gold and the sulphides and also to determine definitely whether the gold remained in the finer-sized particles after grinding and agitation in cyanide solution, a portion of the cyanide residue from Test No. 1-D, assaying 0.22 ounce gold per ton, was passed through the Haultain infrasizer as follows: The residue screened 94 per cent minus 200 mesh. The plus 200 mesh product assayed 0.24 ounce gold per ton and 4.46 per cent sulphur.

The minus 200 mesh product was passed through the Haultain infrasizer with the following results:

(Continued on next page)

(Test No. 3, cont'd) -

Results of Infrasizing:

Size in microns	Weight, per cent	Assays Au, oz./ton	Assays S, per cent	Distribution, per cent Au	Distribution, per cent S
Above 56	2.8	0.42	8.62	5.4	6.7
56 to 40	11.1	0.26	4.49	13.0	13.8
40 to 28	11.6	0.25	4.58	13.0	14.7
28 to 20	11.2	0.24	4.00	12.1	12.4
20 to 14	9.3	0.23	4.22	9.4	10.9
14 to 10	8.8	0.22	3.45	8.5	8.4
Below 10	45.2	0.19	2.64	38.6	33.1
Totals	100.0	0.22	3.61	100.0	100.0

Another portion of cyanide residue, from Test No. 1-A, assaying 0.22 ounce gold per ton, was concentrated on the Haultain superpanner.

Results of Superpanning:

Product	Weight, per cent	Assays Au, oz./ton	Assays S, per cent	Distribution, per cent Au	Distribution, per cent S
Feed	100.00	0.22©	4.10	100.0	100.0
Conc. tip	1.39	1.14	57.20©	7.1	15.9
Conc. bulk	2.71	1.00	28.80	12.1	19.0
Sands	56.96	0.195	2.92	49.6	40.6
Slimes	38.94	0.18	2.58	31.2	24.5

© Calculated.

The sands screened 75.4 per cent minus 200 mesh and the slimes screened 99.0 per cent minus 325 mesh.

The tip of the panner concentrate was examined under the binocular microscope and was seen to consist of pyrite and arsenopyrite with no gold visible.

Both the infrasizer and superpanning tests on these cyanide residues demonstrate that extremely fine grinding of the ore does little to improve the extraction of the gold

(Continued on next page)

(Test No. 3, cont'd) -

in cyanide solution, the minus 10 micron sized particles assaying 0.19 ounce gold per ton in the infrasizer test and the slime particles, which screened 99 per cent minus 325 mesh, assaying 0.18 ounce gold per ton in the super-panning test.

-

Test No. 4. - Flotation and Cyanidation.

In this test the graphitic carbon in the ore was removed by flotation concentration prior to cyanidation.

The ore at minus 14 mesh was ground with 6 pounds of lime per ton to pass 85 per cent minus 200 mesh. The pulp was then transferred to a flotation machine and the graphitic carbon floated off by the addition of 0.03 pound potassium amyl xanthate and 0.03 pound pine oil per ton. The flotation tailings were then agitated in cyanide solution of 1 pound NaCN per ton strength for 24 hours.

Results of Flotation:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.24	100.00	
Flot. conc.	3.33	1.04	14.60	30:1.
Flot. tailing	96.67	0.21	85.40	

The flotation concentrate assayed 1.04 ounces gold per ton and 1.61 per cent carbon.

The flotation tailing was agitated in cyanide solution with the following results:

(Continued on next page)

(Test No. 4, cont'd) -

Results of Cyanidation:				(Feed, Au, 0.21 oz./ton)				
Agitation, hours	Grind, % -200 mesh	Tailing assay, oz./ton Au	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, ml. N/10 $KMnO_4$ per litre
24	85.0	0.21	Nil	0.96	0.15	0.3	5.7	130

It is evident from this test that the removal of the graphitic carbon prior to cyanidation has no beneficial effect on the extraction.

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Test No. 5. - Cyanidation and Charcoal Flotation.

In this test an endeavour was made, by adding activated charcoal to the cyanide grind with subsequent agitation and final flotation of the gold-bearing charcoal from the remainder of the pulp, to obtain an improved extraction of the gold.

The ore at minus 14 mesh was ground in cyanide solution of 0.4 pound per ton strength to pass 94 per cent minus 200 mesh. Four pounds of activated pine charcoal and 6 pounds of lime per ton were added to the grind. The pulp was then agitated for 6 hours and transferred to a flotation machine. The charcoal was then floated by the addition of 0.05 pound potassium amyl xanthate and 0.04 pound pine oil per ton. The resulting flotation concentrate was cleaned in a smaller machine. Prior to flotation the titration of the pregnant solution was 0.4 pound NaCN and 0.15 pound CaO per ton of solution.

(Continued on next page)

(Test No. 5, cont'd) -

Results of Flotation:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.24	100.0	
Flot. conc.	0.96	0.68	2.8	104:1.
Flot. middling	4.57	0.21	4.1	21:1.
Flot. tailing	94.47	0.23	93.1	

The barren solution did not contain any appreciable amount of gold.

The above results indicate that the charcoal process of cyanidation and flotation is not applicable to this type of ore.

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Test No. 6. - Table Concentration and Cyanidation.

The ore at minus 14 mesh was ground in cyanide solution of 1 pound NaCN per ton strength to pass 75.0 per cent minus 200 mesh. The pulp was then passed over a Wilfley table and the resulting table concentrate reground in cyanide solution of 2 pounds NaCN per ton strength to pass 99 per cent minus 325 mesh. The reground concentrate was then added to the table tailings and this product was agitated in cyanide solution of 1 pound per ton strength for 24 and 48 hours.

The weight of the table concentrate was 6.4 per cent of the weight of the feed. The table tailing assayed 0.21 ounce gold per ton.

(Continued on next page)

(Test No. 6, cont'd) -

Results of Agitation of Reground Table Conc. and Table Tailing:

(Feed, Au, 0.24 oz./ton)

Grind, % -200 mesh	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
80.1	24	0.225	6.3	1.0	0.15	0.8	7.6
80.1	48	0.21	12.5	1.0	0.10	0.9	8.7

The total reagent consumption, including cyanide grind, regrinding of table concentrates and agitation of combined products, was:

For 24 hours' agitation -

NaCN - 1.6 lb./ton
CaO - 12.2 "

For 48 hours' agitation -

NaCN - 1.7 lb./ton
CaO - 13.3 "

-

Test No. 7. - Concentration and Amalgamation.

In this test the ore at minus 14 mesh was ground in a ball mill with 2 pounds of soda ash, 0.05 pound of potassium amyl xanthate and 0.05 pound of pine oil per ton to pass 72.8 per cent minus 200 mesh. The pulp was then transferred to a flotation machine and a flotation concentrate obtained by the further additions of 0.1 pound potassium amyl xanthate, 1.2 pounds copper sulphate and 0.08 pound pine oil per ton. The resulting flotation concentrate was cleaned on a smaller machine. The flotation

(Continued on next page)

(Test No. 7, cont'd) -

tailing was passed over a corduroy blanket. The flotation and blanket concentrates were combined and amalgamated with mercury in a mortar.

Results:

Flotation.

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.24®	100.0	
Flot. conc.	6.03	0.81	20.5	16.6:1.
Flot. middling	7.32	0.24	7.3	
Flot. tailing	86.65	0.20	72.2	

The pH of the pulp was 8.6.

Blanket Concentration of Flotation Tailing.

Feed	100.00	0.20	100.0	
Blanket conc.	1.39	1.27®	8.8	72:1.
Blanket tailing	98.61	0.185	91.2	

® Calculated.

Amalgamation of Combined Concentrates.

Assays, Au oz./ton		Extraction of gold, per cent
Feed	Tailing	
0.85	0.85	Nil

Summary:

	Per cent
Gold recovered in flotation concentrate and middling -	27.8
Gold recovered in blanket concentrate -	6.3
Overall recovery -	34.1 per cent.
Gold extracted by amalgamation from combined concentrates -	Nil.

-

Test No. 8. - Concentration and Amalgamation.

The ore at minus 14 mesh was ground to pass 62 per cent minus 200 mesh and the pulp passed through a Denver jig with the jig overflow passing over a corduroy blanket. The combined jig and blanket concentrates were then amalgamated and the amalgam residue added to the blanket tailing. This product was then reground with 2 pounds of soda ash, 0.05 pound of potassium amyl xanthate and 0.05 pound of pine oil per ton to pass 79.8 per cent minus 200 mesh and transferred to a flotation machine. A concentrate was then obtained by the additions of 1.2 pounds copper sulphate, 0.08 pound pine oil and 0.10 pound potassium amyl xanthate per ton. This concentrate was cleaned in a smaller machine.

Results:

Jig and Blanket Concentration.

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.24	100.0	
Jig and blanket concentrates	7.20	0.56	16.9	14:1.
Blanket tailing	92.80	0.215	83.1	

After amalgamation of the combined jig and blanket concentrates the amalgam residue was added to the blanket tailing. This product assayed 0.24 ounce gold per ton, showing no extraction of gold by amalgamation.

(Results continued on next page)

(Test No. 8, cont'd) -

(Results, continued) -

Flotation of Blanket Tailing + Amalgam Residue.

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.24	100.0	
Flot. conc.	5.88	0.86	21.0	17:1.
Flot. middling	6.26	0.24	6.2	
Flot. tailing	87.86	0.20	72.8	

The pH of the pulp was 8.4.

Summary of Test No. 8:

		Per cent
Gold recovered in jig and blanket concentrates	-	16.9
Gold extracted by amalgamation	-	Nil.
Gold recovered in flotation concentrate and middling	-	27.2 per cent.

-

Test No. 9. - Table and Flotation Concentration.

A portion of the ore at minus 14 mesh was ground in a ball mill to pass 41 per cent minus 200 mesh. The pulp was then passed over a Wilfley table and a concentrate and middling product obtained. The table tailing was then reground in a ball mill with 4 pounds of soda ash, 0.05 pound potassium amyl xanthate and 0.05 pound of pine oil per ton to pass 86.6 per cent minus 200 mesh. The pulp was then transferred to a flotation machine and a flotation concentrate obtained by the further additions of

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(Test No. 9, cont'd) -

0.10 pound of potassium amyl xanthate, 0.08 pound pine oil and 1.2 pounds of copper sulphate per ton. This concentrate was cleaned in a smaller machine.

Results:

Table Concentration.

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.25©	100.0	
Table conc.	8.60	0.56	19.3	11.6:1.
Table middling	11.40	0.30	13.6	8.8:1.
Table tailing	80.00	0.21	67.1	

Flotation Concentration of Table Tailing.

Feed	100.00	0.205©	100.0	
Flot. conc.	5.58	1.14	31.1	17.9:1.
Flot. middling	6.37	0.42	13.0	15.7:1.
Flot. tailing	88.05	0.13	55.9	

© Calculated.

The pH of the pulp was 8.7.

Summary:

	Per cent
Gold recovered in table concentrate and middling -	32.9
Gold recovered in flotation concentrate and middling -	29.6
Overall recovery =	62.5 per cent.

-

Test No. 10. - Table and Flotation Concentration.

The flow-sheet of this test was similar to that of Test No. 9. The initial grind, prior to table concentration, was 72.8 per cent minus 200 mesh and the regrinding of the

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(Test No. 10, cont'd) -

table tailing, prior to flotation, was 94.6 per cent minus 200 mesh. Conditions otherwise followed the procedure of Test No. 9.

Results:

Table Concentration.

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.24©	100.0	
Table conc.	5.15	0.62	13.1	19.4:1.
Table middling	7.02	0.39	11.2	14.2:1.
Table tailing	87.83	0.21	75.7	

Flotation Concentration of Table Tailing.

Feed	100.00	0.21©	100.0	
Flot. conc.	6.36	1.06	31.6	15.7:1.
Flot. middling	7.94	0.38	14.1	12.6:1.
Flot. tailing	85.70	0.135	54.3	

© Calculated.

The pH of the pulp was 8.4.

Summary:

	Per cent
Gold recovered in table concentrate and middling -	24.3
Gold recovered in flotation concentrate and middling -	34.6
Overall recovery =	58.9 per cent.

-

Test No. 11. - Flotation Concentration.

The ore at minus 14 mesh was ground in a ball mill with 6.5 pounds of soda ash, 0.07 pound Aerofloat No. 31 and 0.05 pound of potassium amyl xanthate per ton to pass 86.6 per cent minus 200 mesh. The pulp was then transferred to a flotation machine and a flotation concentrate obtained by the addition of 0.10 pound pine oil, 0.05 pound potassium amyl xanthate, 0.04 pound Reagent No. 301 and 1.4 pounds copper sulphate per ton. This concentrate was cleaned in a smaller machine.

Results of Flotation:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent	Ratio of concentration
Feed	100.00	0.235®	100.0	
Flot. conc.	12.58	1.08	57.4	8:1.
Flot. middling	8.40	0.26	9.2	12:1.
Flot. tailing	79.02	0.10	33.4	

® Calculated.
The pH of the pulp was 9.6.

Raising the pH of the pulp to 9.6 by adding 6.5 pounds of soda ash reduces the amount of the gold in the flotation tailing. The results are still not satisfactory, however.

Test No. 12. - Flotation Concentration.

The ore at minus 14 mesh was ground in a ball mill with 1.5 pounds of soda ash, 0.05 pound potassium amyl xanthate and 0.05 pound pine oil per ton to pass 84 per cent minus 200 mesh. The pulp was then transferred to

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(Test No. 12, cont'd) -

a flotation machine and a pyrite concentrate removed by the addition of 0.03 pound pine oil and 0.03 pound potassium amyl xanthate per ton. Five pounds of soda ash per ton was then added to the pulp which was conditioned for 15 minutes. An arsenopyrite concentrate was then obtained by the additions of 1.5 pounds copper sulphate, 0.05 pound potassium amyl xanthate, 0.05 pound Reagent No. 301 and 0.08 pound pine oil per ton. The pyrite and arsenopyrite concentrates were cleaned on a smaller machine. The different products were assayed for gold and arsenic.

Results of Flotation:

Product	Weight, per cent	Assays: Au, oz./ton	Assays: As, per cent	Distribution, per cent: Au	Distribution, per cent: As	Ratio of concentration
Feed	100.00	0.24 ®	1.72 ®	100.0	100.0	
Pyrite conc.	1.58	0.46	2.93	3.0	2.7	63:1.
Pyrite middling	3.30	0.34	2.44	4.7	4.7	30:1.
Arsenopyrite conc.	11.21	1.14	9.25	52.5	60.2	8.9:1.
Arsenopyrite middling	8.33	0.32	2.26	11.2	10.9	12:1.
Tailing	75.58	0.09	0.49	28.6	21.5	

® Calculated.

The pH of the pyrite flotation was 8.1. That of the arsenopyrite flotation was 9.6.

It is apparent from the results of this test that the gold is largely contemporaneous with the arsenopyrite.

Test No. 13. - Roasting and Cyanidation.

Portions of the ore at minus 14 mesh were roasted in an oxidizing atmosphere for six-hour periods. The temperature was gradually raised to 325° C. where it was held until the fumes of arsenic and sulphur were no longer visible; the ore being constantly rabbled. The temperature was then gradually raised to 650° C. and continued at that temperature for 1 hour. At the conclusion of the roast, the calcine was cooled, weighed and assayed. Portions of the calcine were then cyanided as described below. An analysis of the calcine resulted as follows:

Gold	-	0.26 oz./ton
Sulphide sulphur	-	0.10 per cent
Sulphate sulphur	-	1.05 "
Arsenic	-	0.95 "

The loss in weight was 5.2 per cent.

The cyanidation of the calcine resulted as follows:

(Feed - Au, 0.26 oz./ton)

Test No.	Agitation, hours	Grind, % -200 mesh	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
A	24	84.2	0.095	63.5	2.1	0.10	1.8	12.5
B	48	84.2	0.09	64.4	2.0	0.05	2.2	14.7
C	24	84.2	0.08	69.2	1.9	0.15	3.8	16.0
D	48	84.2	0.075	71.2	1.9	0.10	4.1	18.5
E	24	84.2	0.07	73.1	2.0	0.10	5.1	16.2
F	48	84.2	0.07	73.1	2.1	0.05	5.3	19.0
G	24	84.2	0.10	61.5	1.0	0.10	1.3	15.0
H	48	84.2	0.095	63.5	1.1	0.10	1.5	17.5

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(Test No. 13, cont'd) -

In Tests A, B, G and H the calcine was ground in water, filtered and washed, prior to cyanidation. In Tests C and D the calcine was ground in cyanide and agitated in the grinding solution. In Tests E and F the calcine was ground in cyanide, filtered and washed, and fresh cyanide used for the agitation.

Test No. 14, straight cyanidation on Sample No. 2, shows that the same deposition of the gold prevailed as in Sample No. 1.

Test No. 14. - Straight Cyanidation.

Portions of the ore of Sample No. 2, at minus 14 mesh, were ground in cyanide solutions of 1 pound NaCN per ton strength to pass 85.8 per cent minus 200 mesh. The pulps were then agitated for 24- and 48-hour periods.

Results: (Feed - Au, 2.00 oz./ton).

Agitation, hours	Grind, % -200 mesh	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
24	85.8	1.96	2.0	0.90	0.05	2.1	13.0
48	85.8	1.81	9.5	0.92	0.10	2.7	17.8

Summary and Conclusions:

Sample No. 1 -

Straight cyanidation of the ore at a grind of 94 per cent minus 200 mesh gave an extraction of 8.3 per cent of the gold and a cyanide residue of 0.22 ounce gold per ton in 48 hours' agitation. The pulp settled very slowly and filtered with difficulty. Flotation of the graphitic carbon in the ore followed by regrinding and agitation in cyanide solution of the flotation tailing did not improve this extraction to any great extent.

Grinding in cyanide with the addition of charcoal, followed by agitation and flotation of the gold-bearing charcoal, gave a cyanide residue of 0.23 ounce gold per ton.

Jig and blanket concentration of the ore, followed by amalgamation of the combined concentrates, resulted in no appreciable recovery of the gold by amalgamation.

The best results obtained by flotation concentration were 57.4 per cent of the gold recovered in a concentrate which assayed 1.08 ounces gold per ton and was 12.5 per cent of the weight of the feed.

In the infrasizing test on the cyanide residue it was clearly shown that fine grinding of the ore would not benefit the extraction of the gold to any great extent as the minus 10 micron product assayed 0.19 ounce gold per ton and carried 38.6 per cent of the gold remaining after 48 hours' agitation.

The microscopic examination showed why it was

(Continued on next page)

(Summary and Conclusions, cont'd) -

not possible to produce an economic concentration of the gold-bearing sulphides; the gangue material so impregnates the sulphides as to render them not susceptible to concentration.

Sample No. 2 -

On the high-grade shipment, Sample No. 2, both the microscope and the cyanidation tests showed that the ore is similar to that of Sample No. 1 as regards metallurgical behaviour.

Roasting Treatment -

On Sample No. 1, roasting of the raw ore followed by cyanidation of the calcine gave an extraction of some 70 per cent of the gold.

From the results of the test work this method, as practised by the Getchell Mine, Inc., Red House, Nevada, where the roasting of the raw ore is conducted in rotary kilns, would apparently apply to this ore. As shown in the test work the ore is of an extremely refractory nature and the gold was not amenable to any other method of ore dressing applied in this investigation.

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