O T T A W A November 15th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 906.

Gold Ore from the Hoyle Gold Mines, Limited,
Pamour, Ontario.

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Shipment:

Six bags of ore, total net weight 460 pounds, were received on April 3rd, 1940, from the Hoyle Gold Mines, Limited, Pamour, Ontario. The shipment was submitted by J. M. C. Dunlop, Mine Manager, Hoyle Gold Mines, Limited, Pamour, Ontario.

Location of the Property:

The property is situated in the Whitney and Cody townships, in the Porcupine area, northern Ontario. It adjoins the Pamour Porcupine Mines Limited on the east.

Characteristics of the Ore:

Six polished sections were prepared and examined under a reflecting microscope for the purpose of determining the character of the ore.

Gangue -

The gangue is composed of fine-textured, greenish-grey rock containing rather abundant, fine, disseminated carbonate which gives a moderately strong microchemical reaction for iron. The rock also contains small patches of white quartz and is crossed by narrow veinlets of the same material.

Metallic Minerals -

Metallic minerals are rather sparingly and erratically scattered through the gangue and, in places, are very intimately admixed. In their approximate order of abundance those present in the sections are: pyrite, pyrrhotite, arsenopyrite, chalcopyrite, sphalerite, and magnetite.

Pyrite preponderates as small masses and coarse to fine irregular grains and cubic crystals disseminated in gangue. Besides numerous inclusions of gangue, it contains small grains of the other sulphides, especially pyrrhotite and chalcopyrite. The greater portion of pyrrhotite, however, occurs in gangue as coarse to fine

(Characteristics of the Ore, cont'd) -

irregular grains. A considerable quantity of arsenopyrite is present in gangue, largely as medium to fine subhedral crystals. Small amounts of chalcopyrite and sphalerite are visible as small grains in gangue; these two minerals are often closely associated. Tiny grains of magnetite are locally present but its total amount is very small.

Since neither native gold nor gold minerals were observed in the sections nothing was learned as to this metal's mode of occurrence.

Sampling and Assaying:

The ore was crushed and sampled by standard methods. The sample assayed as follows:

Gold	-	0.185 oz./ton
Silver	-	0.05 "
Iron	-	6.27 per cent
Sulphur	-	1.90 "
Arsenic	-	0.18 "
Copper	-	0.02 "

Results of Experimental Research:

The experimental work consisted of:

(1) Straight cyanidation of the ore;

(2) Flotation and cyanidation of the reground concentrates;

(3) Concentration of the ore by tabling, followed by cyanidation of reground table sands and table slimes; and

(4) Investigations on the flotation tailing, to determine the cause of the high gold values in the flotation tailing.

(1). Straight cyanidation of the ore ground

(Continued on next page)

(Results of Experimental Research, cont'd) -

to 86.1 per cent minus 200 mesh gave a gold extraction of 81.1 per cent. The cyanide tailing assayed 0.035 ounce of gold per ton.

(2). Concentration of the ore by flotation (Test No. 3) gave flotation tailings which assayed 0.015 ounce of gold per ton of solids; a gold recovery of 93.1 per cent. The flotation concentrate assayed 3.05 ounces of gold per ton. The ratio of concentration was 17.0 into 1.

Cyanidation of the flotation concentrates, ground to 98 per cent minus 325 mesh, gave cyanide tailings of 0.87 and 0.65 ounce per ton after agitating the pulps for 24 and 16 hours respectively. The higher gold content in the 24-hour cyanide tailing indicates that reprecipitation of gold takes place during agitation. The reducing powers of the 24-hour and 16-hour cyanidation solutions were 950 and 710 millilitres of N/10 $KMnO_4$ per litre, respectively.

Regrinding the above cyanide tailings to 58.2 per cent minus 10 microns and cyaniding for 24 hours gave cyanide tailings which assayed 0.22 and 0.24 ounce of gold per ton.

Copper in the cyanide solutions after the first stage cyanidation was high, namely 0.34 and 0.28 pound per ton of solution for 24-hour and 16-hour agitation, respectively.

This method of treatment gave gold recovery of about 86 per cent. The overall tailings contained from 0.0275 to 0.0263 ounce of gold per ton of ore.

Superpanner tests on the flotation tailing (Test

(Continued on next page)

(Results of Experimental Research, cont'd) -

No. 2) showed presence of fine free gold. The superpanner concentrate (sulphides, mostly pyrrhotite) was put through magnetic separator, and the magnetic product (pyrrhotite) was amalgamated to remove any free gold. The amalgamation residue assayed 0.265 ounce of gold per ton.

(3). Concentration of the ore by tabling, followed by cyanidation of reground table sands for 24 hours, then combining the 24-hour agitation pulp (reground table sands) with the table slimes and cyaniding for 24 hours, gave cyanide tailings which assayed 0.015 and 0.02 ounce of gold per ton. The copper in the cyanide solution was 0.04 pound per ton of solution.

The reground table sands and slime pulp is very slow in settling. The settling rate was about 0.26 ft. per hour at the pulp densities from 40 to about 55 per cent solids.

(4). Investigations on the flotation tailing showed presence of free gold. Some gold particles were flaky and some elongated. The latter appear to have been rolled into elongated form, probably during grinding.

The sulphides in the flotation tailing are essentially pyrrhotite with small amounts of pyrite and arsenopyrite. (Superpanner Test No. 6).

A sample of flotation tailing (Au, 0.03 ounce per ton) was treated by aqua regia to remove the sulphides

(Continued on next page)

(Results of Experimental Research, cont'd) -

and the gold associated with them, also the free gold. The aqua regia residue assayed 0.005 ounce of gold per ton of flotation tailing. This would indicate that an appreciable amount of gold in the flotation tailing is not associated with the insoluble gangue.

Flotation tailing (Au, 0.015 ounce per ton) cyanided for 24 hours gave a cyanide tailing assaying 0.015 ounce of gold per ton.

EXPERIMENTAL TESTS:

The data of the experimental test work follow in detail:

Straight Cyanidation of the Ore.

Test No. 1.

A sample of ore was ground with sodium cyanide and lime at 57 per cent solids to 86.1 per cent minus 200 mesh. The pulp was agitated 24 hours at 1.5:1, liquid-solid ratio.

Results of Cyanidation:

Assays, Au oz./ton: Feed	Tailing	Extraction: of gold, per cent	Final titration, lb./ton of solution: NaCN	CaO	Reagents consumed, lb./ton solids: NaCN	CaO
0.185	0.035	81.1	0.96	0.04	1.06	3.1

Reducing power of the cyanide solution:

130 ml. of N/10 $KMnO_4$ per litre.

Flotation and Cyanidation of Flotation Concentrates.

Test No. 2.

A sample of ore was ground to about 65 per cent minus 200 mesh with 1.5 pounds of soda ash and 0.033 pound of Reagent No. 301 per ton of ore. The following reagents were added to the Denver flotation cell:

	Lb./ton of ore
Copper sulphate	0.5
Reagent No. 301	0.067
Pine oil	0.021

The rougher concentrate was cleaned by refloating; no additional reagents were used.

Results of Flotation:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
Feed	100.00	0.185	100.0
Concentrate	4.12	3.84	85.5
Middling	2.72	0.30	4.4
Tailing	93.16	0.02	10.1

Ratio of concentration = 24.3:1.
pH of flotation solution = 9.3.

A portion of the flotation tailing was concentrated by means of the Haultain superpanner. No attempt was made to recover all the sulphides. Three particles of free gold were observed. The superpanner concentrate was mostly pyrrhotite. This concentrate was put through a Dings magnetic separator. The magnetic concentrate, which weighed 2.22 grams, was amalgamated to remove any free gold which might still remain in the product. The amalgamation residue assayed 0.265 ounce gold per ton.

(Continued on next page)

(Test No. 2, cont'd) -

Four hundred grams of flotation tailing was screened through 200-mesh screen. The minus 200 mesh product (263.1 grams) was sized by means of the Haultain infrasizer. The infrasizer was operated for 5 hours and 15 minutes, at a differential pressure of 18 inches of water. The cones dropped from a height of 5/16 inch at a rate of 63 drops per minute. The cones were clamped to the cone rack. Standard golf balls were used. The analyses of the sized products were as follows:

Analysis of Sized Products.

Mesh or microns	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
+200 mesh	34.23	0.03	56.7
-200 mesh +56 microns	2.82		
-56 +40 microns	12.15	0.02	12.4
-40 +28 "	9.73	0.02	9.9
-28 +20 "	10.10	0.01	5.2
-20 +14 "	7.45	0.01	3.8
-14 +10 "	6.10	0.01	3.1
-10 microns	17.42	0.01	8.9
Total	100.00	0.02	100.0

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Test No. 3.

Samples of ore were ground to 66.1 per cent minus 200 mesh with 1.5 pounds of soda ash and 0.033 pound of Reagent No. 301 per ton of ore. The following reagents were added to the Denver cell:

	Lb./ton of ore
Copper sulphate -	0.50
Reagent No. 301 -	0.067
Pine oil -	0.021

The rougher concentrate was cleaned by

(Continued on next page)

(Test No. 3, cont'd) -

refloating. The middling product (tailing from cleaning circuit) was combined with the second mill discharge and the combined product treated by flotation using the above reagents and amounts. This operation was repeated for the 3rd, 4th and 5th charges.

Results of Cycle Flotation:

Product	Weight, per cent	Gold assay, oz./ton	Distribution of gold, per cent	Other assays, (per cent) Cu	As	S
Feed	100.00	0.195	100.0			
Flot. conc.	5.87	3.05	92.0	0.16	2.88	24.40
Flot. middling - E.	0.84	0.25	1.1			
Flot. tailing - A.	)	0.015				
" " - B.	)	0.015				
" " - C.	) 93.29	0.015	6.9			
" " - D.	)	0.015				
" " - E	)	0.015				

pH of primary flotation solution D = 10.0.
Ratio of concentration = 17.0:1.

The flotation concentrate was filtered and ground at 66 per cent solids to 98.0 per cent minus 325 mesh, with 11.3 pounds of lime per ton of concentrates. All the lime was consumed during grinding.

The pulp was filtered and portions of the sample were repulped with tap water for cyanidation.

Cyanidation - 1st Stage.

Test No.	Agitation, hours	Dilution, liquid to solid	Assays, Au oz./ton Feed	Assays, Au oz./ton Tailing	Extraction of gold, per cent	Final titration, lb./ton of solution NaCN	Final titration, lb./ton of solution CaO	Reagents consumed during cyanidation, lb./ton solids NaCN	Reagents consumed during cyanidation, lb./ton solids CaO
3-A	24	2.56:1.	3.05	0.87	71.5	1.06	0.09	7.17	24.0
3-B	16	2.56:1.	3.05	0.65	78.7	0.88	0.13	5.35	22.4

The 24-hour cyanide tailing was higher in gold

(Continued on next page)

(Test No. 3, cont'd.)

content than the 16-hour cyanide tailing. It appears that reprecipitation of gold takes place during agitation. The reducing powers of the cyanide solutions from the 24-hour and 16-hour agitations were 950 and 710 millilitres of N/10 $KMnO_4$ per litre, respectively.

The cyanidation pulps from the above tests were filtered and thoroughly washed and the solids were reground at about 50 per cent solids to about 58 per cent minus 10 microns with lime and sodium cyanide. The pulps were agitated for 24 and 48 hours.

Cyanidation - 2nd Stage.

Cyanide tailing	Agitation, hours	Dilution, liquid to solid	Assays, Au oz./ton Feed	Assays, Au oz./ton Tailing	Extraction of gold, per cent	Final titration, lb./ton of solution NaCN	Final titration, lb./ton of solution CaO	Reagents consumed, (grinding and cyanidation), lb./ton of solids NaCN	Reagents consumed, (grinding and cyanidation), lb./ton of solids CaO
3-A	24	2.80:1	0.87	0.22	74.7	1.12	0.05	3.36	11.1
3-A	48	2.80:1	0.87	0.22	74.7	1.00	0.07	4.29	19.1
3-B	24	2.85:1	0.65	0.24	63.1	1.08	0.05	3.59	14.0
3-B	48	2.83:1	0.65	0.22	66.2	1.24	0.10	5.03	19.3

Analysis of Final Cyanide Solutions.

	1st Stage Cyanidation		2nd Stage Cyanidation			
	3-A, 24 hrs.	3-B, 16 hrs.	3-A, 24 hrs.	3-A, 48 hrs.	3-B, 24 hrs.	3-B, 48 hrs.
Reducing power, ml. of N/10 $KMnO_4$ per litre	950	710	475	625	560	740
KCNS, gm./litre	1.52	0.89	0.77	1.05	0.93	1.28
Copper, lb./ton of solution	0.34	0.28	0.04	0.06	0.04	0.06

(Continued on next page)

(Test No. 3, cont'd)

Summary of Results:

	24-Hour 1st Stage Cyanidation		16-Hour 1st Stage Cyanidation	
	24-hr. 2nd Stage Cy.	48-hr. 2nd Stage Cyan'dn.	24-hr. 2nd Stage Cy.	48-hr. 2nd Stage Cy.
Extraction of gold in the concentrate, per cent	92.8	92.8	92.1	92.8
Gold in the ore, oz./ton	0.195	0.195	0.195	0.195
Overall tailing, Au oz./ton	0.0263	0.0263	0.0275	0.0263
Overall gold recovery, per cent	86.5	86.5	85.9	86.5
NaCN consumed, lb./ton of conc.	10.53	11.46	8.94	10.38
" " , " " ore	0.62	0.67	0.52	0.61
CaO " , " " conc.	46.4	54.4	47.7	53.0
" " , " " ore	2.72	3.19	2.80	3.11

The 24-hour and 48-hour cyanide tailings of the 2nd stage agitation test No. 3-A were combined, and 310 grams of pulp was sized by Haultain infrasizer. The infrasizer was operated for 6 hours and 12 minutes, at a differential pressure of 18 inches of water. The cones dropped from a height of 5/16 inch at a rate of 63 drops per minute. The cones were clamped to the cone rack. Standard golf balls were used.

Gold Assay of Sized Products.

Microns	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
+56	0.26	0.80	14.0
-56 +48	3.88		
-48 +28	7.39	0.58	18.1
-28 +20	9.26	0.45	17.6
-20 +14	10.45	0.34	15.0
-14 +10	10.51	0.24	10.7
-10	58.25	0.10	24.6
Total	100.00	0.236	100.0

Table Concentration and Cyanidation.

Test No. 4.

A sample of ore was ground to 86 per cent minus 200 mesh in a solution of sodium cyanide and lime. The ground pulp was then concentrated by tabling. The table sands were reground in a cyanide and lime solution and agitated 24 hours. After 24 hours' agitation the pulp (reground sands) was combined with the table tailing and the combined pulp was cyanided 24 hours at a dilution of 1.5 into 1.

The ratio of concentration by tabling was 7.3 into 1.

Results:

Screen Test on the Final Cyanide Tailing.

Mesh	Weight, per cent
+150	1.4
-150 +200	4.6
-200	94.0
	100.0

		Primary grinding	Cy'nn. of reground sands	Cy'nn. of reground sands and slimes
Dilution (liquid to solid)		0.75:1.	4.30:1.	1.5:1.
Solution titration:	NaCN, lb./ton sol'n	0.90	1.24	1.00
	CaO, " "	0.20	0.42	0.05
Reagents consumed:	NaCN, lb./ton solids	0.33	2.43	0.34
	CaO, " "	1.8	18.3	1.3
Reducing power, ml. of N/10 $KMnO_4$/litre				120
KCNS, gm./litre				0.20
Copper, lb./ton of solution				0.04

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(Test No. 4, cont'd)
(Results, cont'd) -

Cyanidation.				
Assays, Au oz./ton		Extraction of gold, per cent	Total reagents consumed, lb./ton ore	
Feed	Tailing		NaCN	CaO
0.185	0.015	91.9	1.00	5.6

Test No. 5 (A, B, and C).

These tests were similar to Test No. 4. Settling tests were carried out on the final cyanide tailings.

Results of Cyanidation:

Test No.	Assays, Au oz./ton Feed	Assays, Au oz./ton Tailing	Extraction of gold, per cent	Final titration, lb./ton solution NaCN	Final titration, lb./ton solution CaO	Total reagents consumed, lb./ton ore NaCN	Total reagents consumed, lb./ton ore CaO
5-A	0.185	0.02	89.2	1.10	0.09	1.08	5.4
5-B	0.185	0.015	91.9	0.95	0.04	1.10	5.3
5-C	0.185	0.015	91.9	1.02	0.06	1.00	5.5

Additions of Reagents:

To 5-B cyanide pulp, 0.50 pound of ammonium sulphate per ton of solids.
To 5-C cyanide pulp, 2.0 pounds of lime per ton of solids.

After the above reagents were added the pulps were agitated before conducting the settling tests.

CaO titrations of the solution before settling were as follows:

Test No. 5-A: CaO, 0.09 lb./ton of solution.
" " 5-B: CaO, 0.04 lb./ton of solution before ammonium sulphate was added.
" " 5-C: CaO, 0.75 lb./ton of solution.

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(Test No. 5, cont'd) -

Settling Test on Final Cyanidation Pulp.

Time, minutes	Amount of settlement, in feet			Cumulative settlement, in feet		
	5-A	5-B	5-C	5-A	5-B	5-C
Start	0.000	0.000	0.000	0.000	0.000	0.000
15	0.070	0.063	0.075	0.070	0.063	0.075
30	0.067	0.059	0.070	0.137	0.122	0.145
45	0.063	0.058	0.067	0.200	0.180	0.212
60	0.062	0.058	0.065	0.262	0.238	0.277
75	0.061	0.061	0.063	0.323	0.299	0.340
90	0.063	0.061	0.065	0.386	0.360	0.405
105	0.064	0.062	0.060	0.450	0.422	0.465
120	0.065	0.063	0.064	0.515	0.485	0.529
135	0.070	0.065	0.059	0.585	0.555	0.588
150	0.070	0.065	0.062	0.655	0.615	0.650
165	0.060	0.065	0.060	0.715	0.680	0.710
180	0.070	0.065	0.062	0.785	0.745	0.772
195	0.065	0.067	0.053	0.850	0.812	0.825
210	0.062	0.053	0.055	0.912	0.865	0.880
225	0.060	0.060	0.060	0.972	0.925	0.940
240	0.047	0.065	0.054	1.019	0.990	0.994
255	0.048	0.055	0.044	1.067	1.045	1.038
270	0.041	0.040	0.042	1.108	1.085	1.080
285	0.030	0.035	0.040	1.138	1.120	1.120
300	0.029	0.030	0.035	1.167	1.150	1.155

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(Test No. 5, cont'd) -

Settling Rates and Solids Percentages.

	Average settling rate, ft./hour			Per cent solids.		
	5-A	5-B	5-C	5-A	5-B	5-C
Start	-	-	-	40.8	42.8	40.9
For 1 hour	0.262	0.238	0.277	44.5	46.3	44.8
" 2 hours	0.257	0.242	0.264	48.7	50.2	49.0
" 3 "	0.262	0.248	0.257	54.1	55.5	53.8
" 4 "	0.255	0.247	0.248	59.8	61.5	59.0
" 5 "	0.233	0.230	0.231	64.1	66.0	63.5

Screen Tests on Cyanide Residues.

Mesh	Weight, per cent		
	5-A	5-B	5-C
+100	0.2	0.3	0.1
-100 +150	1.3	2.0	1.6
-150 +200	5.2	6.1	5.3
-200	93.3	91.6	93.0
Total	100.0	100.0	100.0

The solids in the final cyanidation pulps settle rather slowly. The rate of settling was not improved by ammonium sulphate nor by lime.

Investigations on Flotation Tailing.

Test No. 6.

This test was conducted with the object of recovering some of the gold in the flotation tailing.

Samples of ore were ground to 65 per cent minus

(Continued on next page)

(Test No. 6, cont'd) -

200 mesh with 1.5 pounds of soda ash and 0.033 pound of Reagent No. 301 per ton of ore. The pulp was transferred to a Denver flotation machine and was conditioned for 10 minutes with 0.50 pound of copper sulphate per ton. Then 0.067 pound of Reagent No. 301 and 0.041 pound of pine oil per ton of ore were added and the froth taken off for 12 minutes. The rougher concentrate was cleaned by refloating; no reagents were used in the cleaning operation. The middling product (tailing from cleaning circuit) was combined with the second mill discharge and the combined product was treated by flotation. This operation was repeated for the 3rd, 4th and 5th mill charges.

Results of Flotation:

Product	Weight, per cent	Gold assay, oz./ton	Distribution of gold, per cent	Other assays, per cent Cu	As	S
Feed	100.00	0.185	100.0			
Flot. conc.	6.01	2.68 ⊕⊕	87.1	0.16	2.73	22.18
Flot. middling ⊕	0.84	0.84	2.8			
Flot. tailing	93.15	0.02	10.1			

⊕ Cleaner tailing from the 5th charge.
⊕⊕ Calculated value.

The ratio of concentration was 16.6 into 1.

A portion of the flotation tailing was deslimed by means of a hydraulic classifier. The classification results were as follows:

Hydraulic Classification of Flotation Tailing.

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
Class. feed (Flot. tailing)	100.00	0.02	100.0
Class. sands	30.94	0.02	30.9
Class. slimes	69.06	0.02	69.1

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(Test No. 6, cont'd) -

A few particles of free coarse gold were present in the classifier sands.

The classifier sands were treated by cyanidation for 5, 8, and 17 hours. The cyanide residues assayed 0.02 ounce of gold per ton in each case.

Another portion of flotation tailing was put over corduroy blanket strakes.

Concentration by Corduroy Strakes.

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Strake feed (flot. tailing)	100.00	0.02	100.0
Strake concentrate	9.49	0.02⊕	9.5
Strake tailing	90.51	0.02	90.5

⊕ Calculated value.

A 500-gram sample of the flotation tailing was screened through 65, 100, 150 and 200 mesh screens. The minus 200 mesh product was sized by means of a Haultain infrasizer. Each sized product was concentrated by a Haultain superpanner except the minus 10 micron product.

The concentrates from superpanning of each product were combined for assay. The superpanner tailings from minus 56 micron to plus 10 micron products were combined; and the plus 56 micron to plus 65 mesh products were combined.

Superpanning Results:

Product	Weight, per cent	Assay, Au oz./ton	Distrib'n of gold, per cent	Other assays, per cent As	Sulphide S
Feed (flot. tailing)	100.00	0.024⊕	100.0		
Panner concentrate	2.94	0.22	27.0	0.06	
Panner tailing, +56 microns	37.86	0.02	31.6	0.02	0.26
Panner tailing, -56 microns	39.84	0.02	33.3	Nil	0.24
Infrasizer product, -10 micron	19.36	0.01	8.1	Nil	0.25

⊕ Calculated value.

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(Test No. 6, cont'd) -

The flotation tailing assayed 0.02 ounce gold per ton. The difference between the calculated value and the assayed value may be due to presence of free gold.

Microscopic Examination of the Panner Concentrates:

Product		
+10 -14 micron	-	Mostly pyrrhotite and gangue.
+14 -20 "	-	" " " "
+20 -28 "	-	" " " "
+28 -40 "	-	Mostly pyrrhotite and gangue; pyrite and arsenopyrite present in small amounts.
+40 -56 "	-	Mostly pyrrhotite and gangue; pyrite and arsenopyrite present in small amounts.
+56 micron -200 mesh	-	Mostly pyrrhotite and gangue; arsenopyrite low, less than above; some pyrite.
+200 -150 mesh	-	Mostly pyrrhotite and gangue; arsenopyrite low.
+150 -100 "	-	Pyrrhotite and gangue; arsenopyrite low.
+100 - 65 "	-	Sulphides very low.
+ 65 mesh	-	" " "

Test No. 7.

A sample of ore was ground to about 72 per cent minus 200 mesh with 0.22 pound of Barrett No. 4 coal tar creosote per ton. The pulp was conditioned 6 minutes with 0.15 pound of Reagent No. 301 per ton of ore and the froth

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(Test No. 7, cont'd) -

removed for 10 minutes. Then 1.0 pound of copper sulphate per ton was added and conditioned 10 minutes. 0.05 pound of Reagent No. 301 per ton was added and a second froth was taken off for 7 minutes.

A Fagergren flotation machine was used in this test.

Results of Flotation:

Product	Weight, per cent	Gold assay, oz./ton	Distribution of gold, per cent	Other assays, per cent S	As pyrite
Feed	100.00	0.192	100.0		
1st conc.	7.83	2.02	82.5		
2nd conc.	2.80	0.24	3.5		
Flot. tailing	89.37	0.03	14.0	0.37	0.02

pH of flotation solution: 8.2.
Ratio of concentration (1st and 2nd concentrates combined): 9.4 into 1.

A portion of the flotation tailing was concentrated by jig and panned by hand for microscopic examination. The concentrated product obtained was mostly pyrrhotite with some pyrite present. Several particles of free gold were present, some flaky and some elongated. The latter appears to have been rolled into elongated form, probably during grinding.

Another portion of flotation tailing was treated by aqua regia. This treatment would remove the sulphides and the gold associated with them, also the free gold. The aqua regia residue assayed 0.005 ounce of gold per ton of flotation tailing. This would indicate that an appreciable amount of the gold in the flotation tailing is not associated with the insoluble gangue.

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Test No. 8.

The ore, ground to about 72 per cent minus 200 mesh, was concentrated by jigging. The jig tailing was treated by flotation in a Fagergren cell as follows:

Conditioned 10 minutes with 0.22 pound of Barrett No. 4 coal tar creosote per ton, then added 0.15 pound of Reagent No. 301 and 0.03 pound of pine oil per ton of ore. After floating for 10 minutes, the pulp was conditioned with 1.0 pound of copper sulphate per ton, for ten minutes, then 0.05 pound of Reagent No. 301 and 0.03 pound of pine oil per ton were added and a froth removed for 7 minutes. A second flotation concentrate was obtained by conditioning 10 minutes with 3.6 pounds of sulphuric acid and adding 0.05 pound of Reagent No. 301 per ton of ore.

The jig concentrate was amalgamated.

Results of Flotation:

Product	Weight, per cent	Assay, Au, oz./ton:	Distribution of gold, per cent
Feed	100.00	0.185	100.0
Jig conc.	2.85	1.96⊕	30.2
1st flot. conc.	11.35	1.05	64.5
2nd flot. conc.	3.07	0.05	0.8
Flot. tailing	82.73	0.01	4.5
Amalg. tailing	2.85	0.225	3.5

⊕ Calculated value.

Overall ratio of concentration = 5.79 into 1.

The jig and the first flotation concentrates gave a ratio of concentration of 7.04 into 1.

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(Test No. 8, cont'd) -

The sulphides in the 2nd flotation concentrate were mostly pyrrhotite.

The jig concentrate was observed under a microscope. Some gold particles were flaky and some elongated.

The flotation tailing was concentrated by jig and hand panning. The product was observed under the microscope. No free gold was observed.

Test No. 9.

A sample of ore, ground to about 72 per cent minus 200 mesh, was concentrated by jigging. The jig tailing was treated by flotation in a Denver flotation machine, as follows:

Conditioned 10 minutes with 0.22 pound of Barrett No. 4 coal tar creosote per ton, then added 0.10 pound of Reagent No. 208, 0.10 pound of Reagent No. 301 and 0.03 pound of pine oil per ton of ore, and the froth was taken off for 10 minutes. Then 1.0 pound of copper sulphate per ton of ore was added; after 10 minutes' conditioning, the froth was removed for 10 minutes.

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(Test No. 9, cont'd) -

Results of Flotation:

Product	Weight, per cent	Gold assay, oz./ton	Distribution of gold, per cent
Feed	100.00	0.185	100.0
Concentrate	7.44	2.30*	92.5
Flot. tailing	92.56	0.015	7.5

* Calculated value.

pH of flotation solution = 7.2.

Ratio of concentration = 13.4 into 1.

A portion of the flotation tailing (Au, 0.015 ounce per ton) was cyanided 24 hours. The cyanide tailing assayed 0.015 ounce of gold per ton.

Summary and Conclusions:

Straight cyanidation of the ore ground to 86.1 per cent minus 200 mesh gave a gold recovery of 81.1 per cent. The cyanide tailing assayed 0.035 ounce of gold per ton. (Test No. 1).

Flotation of the ore, followed by two-stage grinding and cyanidation of the concentrates, gave overall gold recovery of 86.5 per cent. The overall tailing was 0.0263 ounce gold per ton of ore. The flotation tailing showed presence of coarse free gold. By placing a jig in the ball mill - classifier circuit the coarse gold would be removed, thus preventing it

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(Summary and Conclusions, cont'd) -

from going into the flotation tailing.

Cyanidation of the flotation concentrates will result in high copper content in the cyanide solution. This will give high zinc dust consumption during gold precipitation, and also high copper content in the gold precipitate. Fouling of the cyanide solution may also be encountered but with the adoption of countercurrent decantation, where about 40 per cent of the solution will go to waste, the excessive fouling may be eliminated.

The highest recovery of gold, 89.2 to 91.9 per cent, was obtained by table concentration and cyanidation of reground table sands and table slimes, the cyanide tailings assaying 0.015 to 0.02 ounce gold per ton. The fineness of grind was 94 per cent minus 200 mesh. The pulp is slow in settling. The settling rate was about 0.26 foot per hour at the pulp densities from 40 to about 55 per cent solids.

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