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R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1313.

Concentration and Amalgamation of a Gold Ore from
the Metchell Shaft Dump, King Solomon's
Dome Mine, Dawson, Yukon Territory.

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Shipment:

Two bags of gold ore, weighing 195 pounds, were received on November 14th, 1944, from Mr. H. G. Henderson, Dawson, Yukon Territory. Sample No. 1 consisted of "Quartz from Dump" and Sample No. 2 of "Schist from Dump".

Location of the Property:

The Metchell Shaft Dump is situated between "Gold Bottom" and the right fork of the Hunker, Dawson Mining District, Klondike Mining Division, Yukon Territory.

Sampling and Analysis:

After crushing, cutting and grinding by standard methods, representative samples of the two shipments were obtained which assayed as follows:

	<u>Quartz from Dump</u>	<u>Schist from Dump</u>
	<u>Oz./ton</u>	
Gold -	0.61	0.22
Silver -	0.165	0.09
	<u>Per Cent</u>	
Iron -	2.93	7.45
Sulphur -	0.20	1.11
Lead -	0.01	0.03
Copper -	Trace.	Trace.

Characteristics of the Ore:

Both samples consisted of badly oxidized material. Hand specimens and polished sections from both samples and a panned jig and blanket concentrate from Sample No. 1 were examined megascopically and microscopically. This report combines the results of all examinations.

The Ore -

Since the samples are similar, except for gangue material, they need not be described separately. In Sample No. 1 the gangue consists essentially of coarse white quartz, and in Sample No. 2 it is composed of soft, slightly schistose, greenish-grey rock which encloses rather numerous small lenses and narrow stringers of fine-grained white quartz. Rock and quartz both carry rather abundant, finely disseminated carbonate, and both are extensively stained and coated with rusty brown iron oxides.

Metallic minerals are very sparsely distributed through gangue and are represented by pyrite, "limonite", chalcopyrite, galena(?), and native gold. Pyrite occurs in gangue as euhedral to anhedral crystals ranging from about

(Characteristics of the Ore, cont'd) -

three millimetres down to only a few microns in size. As already mentioned, "limonite" is prevalent as brown stains and earthy coatings on gangue and also as small scattered grains many of which enclose tiny remnants of pyrite. Very rare tiny grains of chalcopyrite and of a soft, white mineral, probably galena, are visible in the polished surfaces. A tiny particle of gold, about six microns (2300 mesh) in size, occurs between quartz grains in one section of Sample No. 2 but none was found in the sections of Sample No. 1.

Concentrate from Sample No. 1 -

A jig and blanket concentrate from Sample No. 1 was panned and was seen to contain numerous grains of free gold, largely as somewhat flattened flakes. Some of the grains are so small as to be just visible under the binocular microscope, but the coarser sizes preponderate and range up to about $1\frac{1}{2}$ millimetres in diameter. The gold is bright in colour, with rough, shaggy surfaces (see Figure 1).

Conclusion from Microscopic Examination -

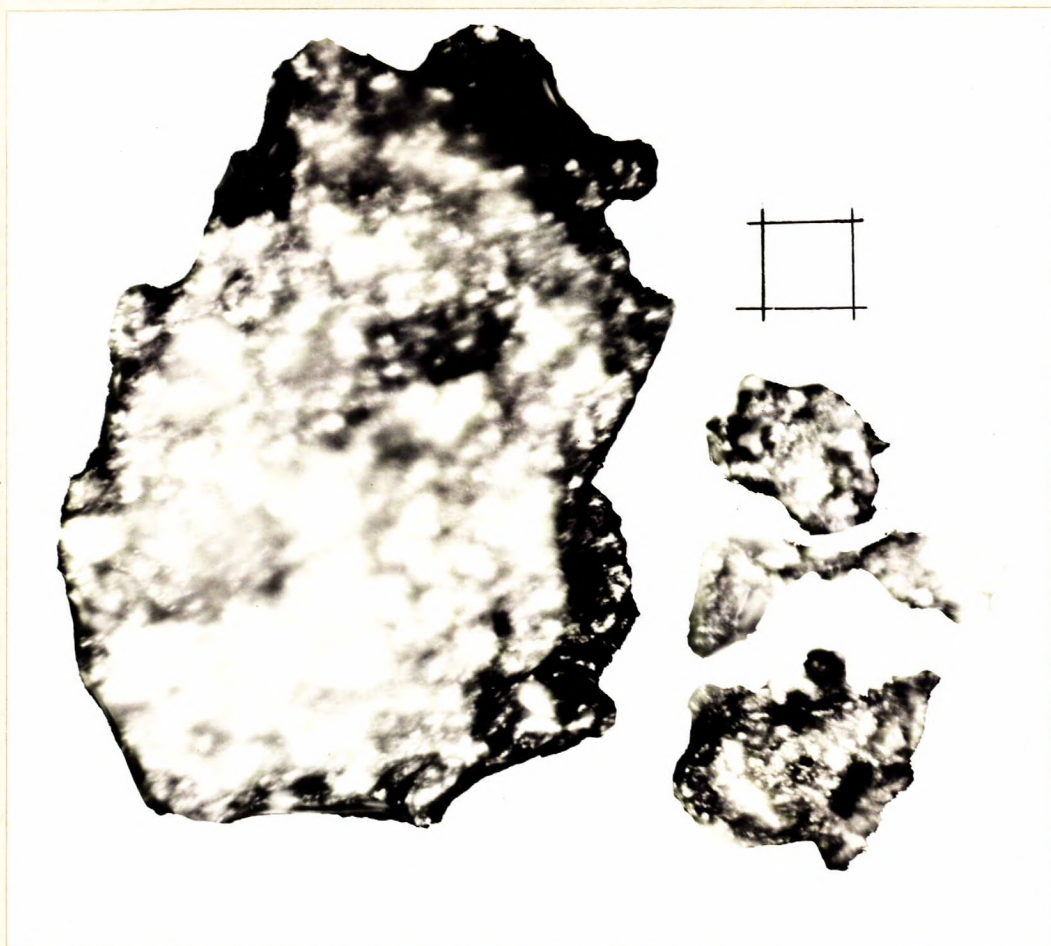
Although the examination of polished sections and a panned jig and blanket concentrate revealed the presence of some finely divided gold in both ore samples, by far the greater percentage of this metal occurs as coarse free grains and recovery by amalgamation should prove satisfactory.

(Figure 1 appears on next page, 3a.)
(Text is resumed on Page 4.)

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(Characteristics of the Ore, cont'd) -

Figure 1.



X80.

PHOTOMICROGRAPH OF FOUR GRAINS OF FREE
GOLD FROM A JIG AND BLANKET CONCENTRATE FROM
SAMPLE NO. 1, SHOWING THEIR GENERAL SHAPES
AND SIZES.

A 100-mesh Tyler screen opening
is superimposed.

Investigative Work:

Mr. Henderson, who is joint owner of the property, desired in his letter of October 22, 1944, to receive our recommendation for concentration and recovery of the gold. When the war is over he hopes to install the proper reduction equipment. Mr. Henderson also stated that he obtained recoveries of 93 per cent and 61.9 per cent of the gold in the Quartz and Schist, respectively, by the use of a small stamp mill on the property.

This report shows that a recovery of 85 per cent of the gold in the Quartz sample is possible by means of jig, blanket and table concentration followed by amalgamation of these concentrates. On the Schist sample a recovery of 55 per cent of the gold was obtained using the same flow-sheet, and finally, using equal parts of both samples, a recovery of 75 per cent of the gold was secured.

DETAILS OF THE TEST WORK:

Tests Nos. 1 to 6.

Tests Nos. 1 and 2 were conducted on the Quartz sample, Tests Nos. 3 and 4 on the Schist sample, and Tests Nos. 5 and 6 on equal portions of each sample.

The flow-sheet used was similar in each case. Portions of the ore at minus 14 mesh were ground in a ball mill to a fineness of grinding as noted. The pulp was then concentrated in a Denver gold jig and the jig overflow run over a set of corduroy blankets. The jig and blanket concentrates were then amalgamated and the amalgam residue added to the blanket tailings.

This product was then concentrated on

(Details of the Test Work, cont'd) -

a Wilfley table and the table concentrate amalgamated. This amalgam residue was roasted for 1 hour at a temperature of 600° C. The resulting calcine was amalgamated. In the test-work on the different shipments and on the combined lots, tests giving a fine grind and also a comparatively coarser grind were made.

Tests Nos. 1 and 2. On the Quartz Sample.

Jig and Blanket Concentration

Test No. 1 (grind 70.0 per cent -200 mesh)

Product	Weight: per cent	Assays		Distribution: of Gold, per cent	Ratio of concentration
		Au oz/ton	S per cent		
Feed	100.0	0.61	-	100.0	-
Concs.	1.1	38.37	-	69.2	91:1.
Tailings	98.9	0.19	-	30.8	-

Test No. 2 (grind 52.0 per cent -200 mesh)

Feed	100.00	0.61	-	100.0	-
Concs.	1.65	28.62	-	77.4	61:1.
Tailings	98.35	0.14	0.18	22.6	-

The combined jig and blanket concentrates were amalgamated and the amalgam residue added to the blanket tailings. This product assayed 0.22 ounce per ton in gold in Test No. 1 and 0.145 ounce per ton in gold in Test No. 2, giving recoveries of 63.9 per cent and 76.2 per cent of the gold by jig and blanket concentration followed by amalgamation.

Table Concentration of the Blanket Tailings
and Amalgam Residue

Test No. 1.

Product	Weight: per cent	Assays		Distribution: of Gold, per cent	Ratio of concentration
		Au oz/ton	S per cent		
Feed	100.0	0.22	-	100.0	-
Table conc.	1.9	7.13	2.79	61.6	53:1.
Table middlings	1.9	0.40	0.54	3.4	-
Table Tailings	96.2	0.08	0.17	35.0	-

(Continued on next page)

(Tests Nos. 1 and 2, cont'd) -

Test No. 2.						
Product	Weight:		Assays		Distribution: of Gold, per cent	Ratio of concentration
	per cent	oz/ton	Au	S		
Feed	100.00	0.145	-	-	100.0	-
Table conc.	3.07	2.05	-	-	43.5	33:1.
Table middlings	3.83	0.32	-	-	8.4	-
Table tailings	93.10	0.075	0.15	-	48.1	-

These table concentrates were amalgamated giving residues of 0.55 ounce per ton in gold in Test No. 1 and 0.42 ounce per ton in gold in Test No. 2, and recoveries of 20.5 per cent of the gold in Test No. 1 and 8.2 per cent in Test No. 2 of the gold in the ore.

The residues from these amalgamations were roasted at a temperature of 600° C. for 1 hour and the resulting calcine amalgamated. This product assayed 0.28 ounce per ton in gold in Test No. 1 and 0.28 ounce per ton in gold in Test No. 2, giving recoveries of 0.8 per cent and 0.7 per cent of the gold in the ore.

Summary of Tests Nos. 1 and 2.

<u>Gold Recovered by Amalgamation:</u>	<u>Test No. 1,</u>	<u>Test No. 2,</u>
	<u>per cent.</u>	<u>per cent</u>
From jig and blanket concentrates	63.9	76.2
From table concentrates	20.5	8.2
From calcine of table concentrates	0.8	0.7
Overall recovery of gold	85.2	85.1

On Test No. 1 the grind was 70.0 per cent minus 200 mesh.
On Test No. 2 the grind was 52.0 per cent minus 200 mesh.

Tests Nos. 3 and 4. On the Schist Sample.

Jig and Blanket Concentration

Test No. 3 (grind 72.3 per cent -200 mesh)

Product	Weight:		Assays		Distribution: of Gold, per cent	Ratio of concent- ration.
	per cent	Au oz/ton	S per cent			
Feed	100.00	0.22	-		100.0	-
Concs.	1.02	5.62	-		56.2	55:1.
Tailings	98.18	0.12	0.89		53.5	-

Test No. 4 (grind 56.4 per cent - 200 mesh)

Feed	100.00	0.22	-		100.0	-
Concs.	1.38	6.65	-		41.7	72:1.
Tailings	98.62	0.13	-		58.3	

The amalgamation of the combined jig and blanket concentrates gave recoveries of 40.9 per cent of the gold in Test No. 3 and 40.9 per cent in Test No. 4.

Table Concentration of the Blanket Tailings
and Amalgam Residue

Test No. 3.

Product	Weight:		Assays		Distribution: of Gold per cent	Ratio of concent- ration
	per cent	Au oz/ton	S per cent			
Feed	100.00	0.13	-		100.0	-
Table conc.	4.17	1.00	10.6		32.0	24:1.
Table middlings	1.68	0.48	-		6.2	-
Table tailings	94.15	0.085	0.67		61.8	

Test No. 4.

Feed	100.00	0.13	-		100.0	-
Table conc.	3.30	1.39	14.20		35.6	33:1.
Table middlings	1.45	0.52	5.13		5.8	-
Table tailings	95.25	0.08	0.68		58.6	-

The table concentrates were amalgamated giving recoveries of 12.8 per cent of the gold in the ore in Test No. 3 and 11.9 per cent in Test No. 4.

(Continued on next page)

(Tests Nos. 3 and 4, cont'd) -

The residues from the amalgamation of the table concentrates were roasted for one hour at a temperature of 600° C. and the calcine amalgamated.

Test No. 3 - Roasting and Amalgamation -

Assays of Feed		Assays of Amalgamated Calcine		Recovery of Gold	Loss of S
Au	S	Au	S	by Amalgamation	S
oz/ton	per cent	oz/ton	per cent	per cent	per cent
0.32	10.6	0.26	0.19	1.1	98.2

Test No. 4 - Roasting and Amalgamation -

0.60	14.20	0.44	0.16	2.4	98.9
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Summary of Tests Nos. 3 and 4.

Gold Recovered by Amalgamation:	Test No. 3, per cent	Test No. 4, per cent
From jig and blanket concentrates	40.9	40.9
From table concentrates	12.8	11.9
From calcine of table concentrates	1.1	2.4
Overall recovery of gold	54.8	55.2

On Test No. 3 the grind was 72.3 per cent minus 200 mesh.
On Test No. 4 the grind was 56.4 per cent minus 200 mesh.

Tests Nos. 5 and 6. On Equal Portions of the Quartz and Schist Samples.

Jig and Blanket Concentration

Test No. 5 (Grind 64.9 per cent -200 mesh)

Product	Weight: per cent	Assays		Distribution: of Gold, per cent	Ratio of concen- tration.
		Au: oz/ton	S: per cent		
Feed	100.00	0.92	-	100.0	-
Concs.	2.00	14.63	-	69.7	50:1.
Tailings	98.00	0.13	0.50	30.3	-

(Continued on next page)

(Tests Nos. 5 and 6 cont'd) -

Test No. 6 (grind 54.9 per cent -200 mesh)

Product	Weight:		Assays		Distribution: of Gold, per cent	Ratio of concentration.
	per cent	oz/ton	Au	S		
Feed	100.00	0.42	-	-	100.0	-
Concs.	2.72	10.44	-	-	67.6	37:1.
Tailings	97.28	0.14	0.52	0.52	32.4	-

The amalgamation of the combined jig and blanket concentrates gave recoveries of 69.1 per cent of the gold in Test No. 5 and 61.9 per cent in Test No. 6.

Table Concentration of the Blanket Tailings and Amalgam Residue

Test No. 5.

Product	Weight:		Assays		Distribution: of Gold per cent	Ratio of concentration
	per cent	oz/ton	Au	S		
Feed	100.00	0.13	-	-	100.0	-
Table conc.	2.13	1.56	9.73	9.73	25.5	47:1.
Table middlings	1.80	0.58	4.15	4.15	8.0	-
Table tailings	96.07	0.09	0.44	0.44	66.5	-

Test No. 6.

Feed	100.00	0.16	-	-	100.0	-
Table conc.	1.98	3.27	13.19	13.19	40.4	50:1.
Table middlings	1.43	0.80	2.23	2.23	5.3	-
Table tailings	96.61	0.09	0.36	0.36	54.3	-

The table concentrates were amalgamated, giving recoveries of 6.1 per cent of the gold in the ore in Test No. 5 and 12.3 per cent in Test No. 6.

The residues from the amalgamation of the table concentrates were given a oxidizing roast for one hour at a temperature of approximately 600° C. and the resulting calcine amalgamated.

(Continued on next page)

(Tests Nos. 5 and 6 cont'd) -

Test No. 5 - Roasting and Amalgamation -

Assays of Feed		Assays of Amalgamated Calcine		Recovery of Gold	Loss of S
Au	S	Au	S	by Amalgamation	S
oz/ton	per cent	oz/ton	per cent	per cent	per cent
0.33	9.75	0.26	0.26	0.4	97.3

Test No. 6 - Roasting and Amalgamation -

0.66	13.19	0.44	0.39	1.0	97.9
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Summary of Tests Nos. 5 and 6.

<u>Gold Recovered by Amalgamation:</u>	<u>Test No. 5,</u>	<u>Test No. 6,</u>
	<u>per cent</u>	<u>per cent</u>
From jig and blanket concentrates -	69.1	61.9
From table concentrates -	6.1	12.3
From calcine of table concentrates -	0.4	1.0
Overall recovery of gold -	75.6	75.2

In Test No. 5 the grind was 64.9 per cent minus 200 mesh.
 In Test No. 6 the grind was 54.9 per cent minus 200 mesh.

SUMMARY AND CONCLUSIONS:

The test work on the Quartz sample shows that a recovery of 65 per cent of the gold can be obtained by concentration followed by amalgamation. On the Schist sample, a recovery of 55 per cent of the gold was secured following the same methods, and finally a recovery of 75 per cent of the gold was obtained on the combined Quartz and Schist sample using the same procedure.

The concentration methods used consisted of grinding the ore in a ball mill to from 50 to 75 per cent minus 200 mesh; passing the pulp over a gold jig and corduroy blanket, and amalgamating the resulting concentrates. The amalgam residue was added to the blanket tailing and this product concentrated

(Summary and Conclusions, cont'd) -

on a Wilfley table. The table concentrates were amalgamated, the amalgam residue roasted and the resultant calcine amalgamated. Using this flow-sheet, 69.1 per cent of the gold was recovered by amalgamation from the jig and blanket concentrates, 6.1 per cent from the table concentrate, and 0.4 per cent from the calcine. These results were obtained in Test No. 6, using equal quantities of the Quartz and Schist samples. The grind was 54.9 per cent minus 200 mesh.

It was apparent from the results of the different tests that a comparatively coarse grind of 50 per cent minus 200 mesh was sufficient to free the gold and permit its amalgamation. On a grind of 75 per cent minus 200 mesh only a very slight increase in the recovery of the gold was obtained.

The roasting of the amalgam residues and subsequent amalgamation of the calcine did not give an added recovery of the gold sufficient to warrant this operation.

From the above data obtained from the test work on the two ore shipments, it is apparent that better results were obtained from the use of stamp milling as mentioned in Mr. Henderson's letter. By this method a coarser grind could be used and the gold recovery at 93 per cent is 8 per cent higher on the Quartz sample, and at 61.9 per cent some 7 per cent higher in the Schist, than in the method as outlined above. The use of a Wilfley table to concentrate the tailings from the stamp battery, with subsequent amalgamation of the table concentrate, should enhance the overall recovery of the gold. This stamp milling procedure would apply to a small-scale (10 to 20 ton) operation, which, it is presumed from Mr. Henderson's letter of October 2, 1944, he intends building after the war.

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