CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 60-66

RECOVERY OF GOLD FROM 'JIM GROUP' ORE SUBMITTED BY LT. COL. F. H. M. CODVILLE, DUNCAN, B. C.

by

R. W. BRUCE

MINERAL PROCESSING DIVISION

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COPY NO. 19

JUNE 30, 1960

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SUMMARY OF RESULTS

At a grind of from 60 to 70% -200 mesh 85% of the gold in sample No. 1 is free milling and can be recovered by barrel amalgamation.

Flotation of this ore sample recovered 95% of the gold in a flotation concentrate. Retreating the flotation concentrate by barrel amalgamation and cyanidation gave overall gold recoveries of 71.6% and 93.2% respectively.

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* Senior Scientific Officer, Mineral Processing Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

INTRODUCTION

Location of Property:

The property known as the "Jim Group" is located in the Cariboo Mountains near Duncan, B.C.

Shipment:

On January 11, 1960, a shipment of ore was received from Lt. Col. F.H.M. Codville, R.M.D. 1, Duncan, B.C. The shipment consisted of two samples; one labelled sample No. 1 weighing 30 lb and the other sample No. 2 weighing 4 lb.

Nature of Investigation Requested:

In a letter dated November 17, 1959, Colonel Codville said that the property had been worked during the summer months for the recovery of gold by means of a 15-ton Gibson's amalgamator. However, recently the recovery of gold had fallen off and he wished to have some preliminary tests run to determine the reason for this and for information on the best method for recovering the gold from these samples.

Sampling and Analysis:

Sample No. 1 was said to be from "A" vein in the south crosscut. Sample No. 2 was said to be from the "B" vein in the north crosscut.

After selecting specimens for microscopic examination, both samples were crushed to -10 mesh and head samples were cut out by conventional methods. The rejects from the sampling were set aside for investigative tests.

Head Sample Analysis:

	Sample No. 1	Sample No. 2
Gold (Au)	- 0.135	0.005 oz/ton
Silver (Ag)	- 0.075	12.75 " "
Lead (Pb)	- 0.18	17.16 %
Zinc (Zn)	- 0.14	6.17 "
Iron (Fe)	- 2.17	9.49 "
Sulphur (S)	- 1.37	12.76 "

MINERALOGICAL EXAMINATION*

Introduction

Mineral specimens from each sample were submitted to the Mineral Sciences Division for mineral identification and the association of the gold. For this purpose, four polished sections, two from each sample, were prepared and studied under an ore microscope. Mineral identifications were confirmed or established by means of X-ray diffraction patterns.

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* Taken from Internal Report MS-60-21 by Wm. E. White, Mineral Sciences Division, March 15, 1960.

Sample No. 1

In the polished sections gangue consists largely of milky white quartz with small dark patches of soft, fine muscovite and clay. Coarse, cubic pyrite is abundantly and unevenly scattered through the gangue and, to the unaided eye, this appears to be the only metallic mineral present. Under the microscope, however, tiny, sparsely disseminated particles of rutile are also visible in one polished surface and the pyrite is seen to contain small inclusions of galena, sphalerite, native gold and gangue. The metallic mineral inclusions are usually located near a border in a pyrite grain, (Figure 1).

All of the gold seen occurs in pyrite in one piece of ore. The largest particle observed measures 52 microns (280 mesh) in its longest direction.

Sample No. 2

Metallic minerals vary somewhat in the three pieces of ore composing the two polished sections of sample No. 2 but the gangue is the same in each and consists of white quartz and creamy white siderite, (Figure 3). Massive sphalerite and galena predominate in two of the mounted fragments but small proportions of both minerals occur also as coarse to fine, disseminated particles, which sometimes follow fractures in

quartz. Each mineral contains inclusions of the other as well as those of pyrrhotite, pyrite, and galena. Where massive sphalerite and galena adjoin, the boundary between the two is often somewhat corroded as if one has attacked and replaced the other, (Figure 2).

Metallic mineralization in the third polished fragment consists preponderantly of an intimate admixture of pyrite, marcasite, and pyrrhotite, which frequently exhibits a shredded appearance, (Figure 3). Besides numerous inclusions of gangue, small, irregular particles of chalcopyrite are locally common and rare, tiny grains of galena and sphalerite are present here and there throughout the metallic mass.

No gold was observed in sample No. 2

Discussion

The fact that all the gold seen in the sections is in one piece of ore in one sample indicates, perhaps, that its occurrence may be quite "spotty" in character. Also, the fact that the largest of some thirty grains of gold observed is only 52 microns in greatest dimension and that all are in pyrite suggest that this metal is associated with the latter mineral and occurs in fine grain sizes.

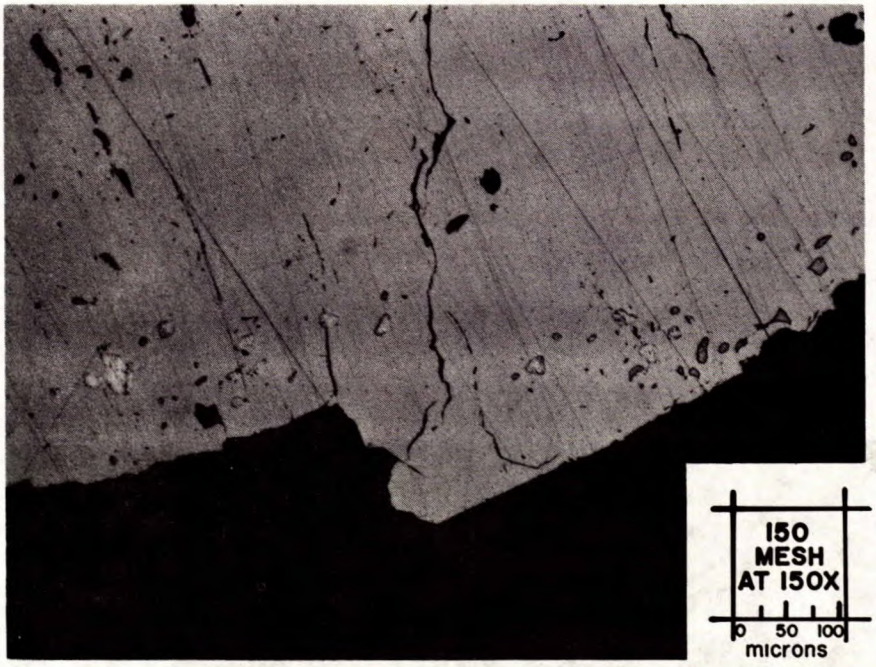

Figure 1 - Photomicrograph of polished section, sample No. 1, showing tiny particles of gold (white) and galena (dark grey), both with relief, near border of pyrite grain (light grey); quartz is black as are polishing pits, scratches and fractures.

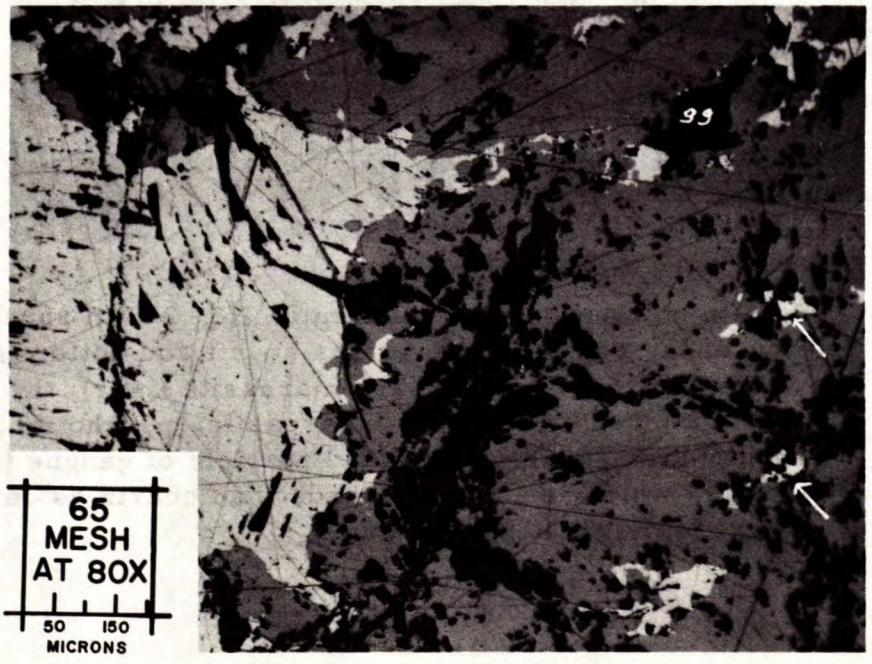

Figure 2 - Typical field in polished section, sample No. 2, showing contact between massive sphalerite (grey) at right and galena (white) at left; the two small groups of white inclusions indicated with arrows are pyrrhotite; all other white inclusions in sphalerite are galena; gangue (gg), polishing pits, and scratches are dark grey to black.

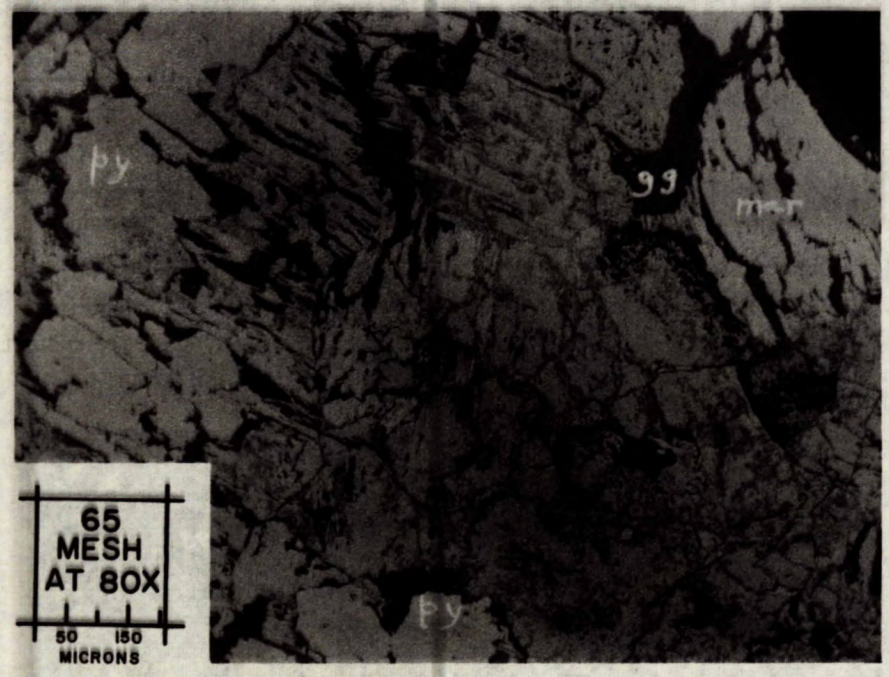

Figure 3 - Field in polished section of sample No. 2 with shredded texture; the coarse white grains at left and bottom are pyrite (py); those at right are marcasite (mar); the central area is a mixture of pyrite, marcasite, pyrrhotite and gangue (dark grey); the marked particle of gangue (gg) is siderite, which is a lighter shade than quartz as can be seen at top right hand corner.

DETAILS OF INVESTIGATION

Sample No. 1

Test No. 1 (Barrel Amalgamation)

A 500 g sample of sample No. 1 was ground in a laboratory ball mill for 30 minutes to 63.5%-200 mesh. The pulp was then amalgamated for 1 hour with 10 ml of mercury.

Results of Test No. 1

	oz/ton Au
Feed -	0.135
Amalgamation tailing -	0.02

Gold Recovery (calc. by diff.) - 85%

Test No. 2 (Gravity Concentration)

A 1000 g sample of sample No. 1 was ground 30 minutes to 69.2%-200 mesh and fed to a Denver mineral jig.

Results of Test No. 2

Product	Wt. %	Assay Au, oz/ton	Distribution %
Jig conc.	0.7	7.00	33.0
Jig tailing	99.3	0.10	67.0
Feed (calc.)	100.0	0.148	100.0

Test No. 3

A 1000g sample of sample No. 1 was ground 30 minutes to 71.0%-200 mesh, transferred to a flotation cell and floated with the following reagents.

Xanthate Z-5	-	0.1 lb/ton
Aerofloat 15	-	0.1 " "
pH of pulp	-	6.8
Conditioning time	-	5 min.
Flotation "	-	5 "

Results of Test No. 3

Product	Wt %	Assays			Distribution		
		oz/ton	%		%		
		Au	Fe	S	Au	Fe	S
Flotation conc.	3.4	2.55	29.0	30.3	94.7	60.4	81.6
" tailing	96.6	0.005	0.67	0.24	5.3	39.6	18.4
Feed (calc.)	100.0	0.092	1.63	1.26	100.0	100.0	100.0

Test No. 4

A 2000g sample of sample No. 1 was ground to 71.0% -200 mesh and floated under the same conditions as in Test No. 3.

The flotation concentrate was reground and amalgamated 1 hour with new mercury.

Results of Test No. 4

Product	Wt. %	Assays			Distribution		
		oz/ton Au	% Fe	% S	% Au	% Fe	% S
Amalgam	-	*2.74			71.6		
Flot. conc. (amalgam. tail.)	3.1	0.93	31.6	33.0	24.3	54.1	78.5
Flot. tailing	96.9	0.005	0.86	0.29	4.1	45.9	21.5
Feed (calc.)	100.0	0.119	1.81	1.30	100.0	100.0	100.0

* Assay of amalgam given in oz/ton of conc.

Test No. 5

Two 2000 g batches of sample No. 1, ground to 71%-200 mesh, were floated under same conditions as in Tests No. 3 and 4. The flotation concentrate was reground similar to Test No. 4 and cyanided 24 hours with lime with cyanide strengths maintained at 1.0 lb/ton of solution.

Results of Test No. 5

	Wt. %	Assay Au, oz/ton	Distribution %
Cyanide Soln. (calc. by diff.)			93.2
Flot. conc. (cyanide tails.)	3.2	0.135	3.2
Flot. tailing	96.8	0.005	3.6
Feed	100.0	0.135	100.0

Sample No. 2

After sampling and analysis, only 1300 g of this sample was available for test work. The two tests conducted on this sample were carried out with the aim of recovering the gold present by amalgamation. It was not until after the tests were complete that the head sample analyses were received. It is obvious from the results of these analyses that this sample cannot be classed as a gold ore. It does contain a high percentage of lead and zinc with an appreciable amount of silver. If the size of the ore body from which this sample was obtained is large enough for commercial exploitation, investigative tests for the recovery of lead and zinc should be carried out. For these tests a sample of not less than 200 lb would be required.

CONCLUSIONS

As previously stated, sample No. 2 cannot be classed as a gold ore. The following conclusions are, therefore, based on the results of investigative tests for the recovery of gold from sample No. 1.

The gold in this sample is fairly fine-grained and, as far as can be determined, is mostly associated with the sulphide minerals. Medium-fine grinding (60 to 70%-200 mesh) gives good liberation of the gold values. At this fineness of

grind about 85% of the gold is free milling (Test No. 1).

The best flowsheet for good recovery from this ore would be to produce a flotation concentrate, which should contain 95% of the gold, and then to retreat this concentrate by barrel amalgamation (Test No. 4) or cyanidation (Test No. 5) to recover the contained gold.

Straight amalgamation of the ground pulp by one of the commercial amalgamating machines, such as a Gibson's amalgamator, should give reasonably good gold recovery. However, the recovery of gold by such a machine would probably not be as high as was obtained in Test No. 1.

This investigation was of a preliminary nature only. It is to be recommended that as development of this orebody progresses a larger and more representative sample of the ore be shipped to the Mines Branch for further investigative tests.

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