O T T A W A April 11th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1201.

Flotation Concentration of Copper Ore from the Amity Copper Mine, Boston Creek, Ontario.

(Copy No. 21.)

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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Shipment:

A sample, weighing 35 pounds, was received on March 4th, 1942. This sample was picked at random from the ore dump of the Amity Copper Mine, at Boston Creek, Ontario. The sample was submitted by D. M. Briden, Dobie, Ontario.

Purpose of Investigation:

Mr. D. M. Briden requested, in his letter of February 25th, 1942, "to have flotation test run on it (i.e., on the sample submitted), giving complete analysis of the copper concentrate. Also if it would be possible to recover the iron pyrite. Would also appreciate the quantity of reagents used so that I may be able to get a rough estimate of costs, etc."

Characteristics of the Ore:

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

Gangue -

Gangue material consists chiefly of siliceous, dark greenish-grey rock, which carries considerable carbonate (calcite) as finely disseminated grains and tiny veinlets. In several fragments it exhibits a schistose structure along which some metallics and carbonate are distributed. A small amount of milky white quartz is also present.

Metallic Minerals -

In their order of abundance, the metallic minerals present in the sections are: chalcopyrite, pyrite, magnetite, pyrrhotite, galena and sphalerite.

Chalcopyrite and pyrite, the only really abundant metallics, occur as small masses and as coarse to fine irregular grains disseminated in gangue. Each mineral contains inclusions of gangue and of the other.

Magnetite is locally common in gangue as small, anhedral grains which are often associated with the sulphides. In one fragment, however, the grains of iron oxide are almost

(Characteristics of the Ore, cont'd) -

free of sulphides and appear to be accompanied by carbonate along narrow bands which probably follow a residual schistosity in the gangue.

A small amount of pyrrhotite is present as occasional, tiny grains in gangue and in pyrite. Negligible quantities of galena and sphalerite, usually associated with chalcopyrite, are visible in gangue as rare, small grains.

Sampling and Analysis:

As received, the sample of ore was minus half inch crushed material. This product was crushed to minus 14 mesh and sampled by a standard method. The analyses were as follows:

Gold (Au)	=	0.005 ounce per ton.
Silver (Ag)	=	0.46 " " "
Copper (Cu)	=	6.35 per cent.
Zinc (Zn)	=	0.05 "
Lead (Pb)	=	0.15 "
Sulphur (S)	=	9.93 "
Pyrite (FeS_2)	=	5.0 "
Arsenic (As)	=	Nil.
Nickel (Ni)	=	Nil.

Experimental Tests:

The experimental tests consisted of flotation concentration for the recovery of the copper and the pyrite. Copper concentrates were obtained which assayed from 27.94 to 26.14 per cent copper and contained from 93.6 to 95.7 per cent of the copper in the ore. The copper cleaner tailings contained from 4.2 to 2.0 per cent of the copper in the mill feed. In mill practice the cleaner tailings would be returned to the head of the circuit, this would increase the copper recovery slightly. The calculated values of the copper flotation tailings were 0.20 per cent copper.

Analysis of copper concentrate of Test No. 1 was

(Experimental Tests, cont'd) -

as follows: gold, 0.03, and silver, 1.85 ounces per ton; copper, 27.94; zinc, 0.15; lead, 0.63; iron, 29.81; silica, 6.48; alumina (Al_2O_3) 1.19; magnesia (MgO), 0.63; and lime (CaO), 0.66 per cent; arsenic, antimony and bismuth, nil.

The pyrite concentrate (Test No. 2) assayed 41.30 per cent sulphur; and the ratio of concentration was 25.77 into 1. In practice, some of the pyrite in the copper and the pyrite cleaner tailings would be recovered, thus the ratio of concentration would be lowered.

The amounts of reagents used for copper flotation were: lime, 2.0; sodium cyanide, 0.10; potassium amyl xanthate, 0.08; and pine oil, 0.124 pound per ton of ore. For flotation of pyrite, 0.50 pound of copper sulphate and 0.06 pound of sodium ethyl xanthate per ton of ore, were used.

Details of Tests:

Test No. 1.

The ore was ground at 57 per cent solids to 79.6 per cent minus 200 mesh with 2.0 pounds of lime and 0.10 pound of sodium cyanide per ton of ore. The copper minerals were floated using 0.08 pound of potassium amyl xanthate and 0.124 pound of pine oil per ton of ore; the froth was removed for 8 minutes. For pyrite flotation, 1.0 pound of copper sulphate and 0.08 pound of sodium ethyl xanthate per ton were used; the froth was removed for 6 minutes.

The rougher copper concentrate and the rougher pyrite concentrate were cleaned by refloating; no reagents were used. The froth was removed for 5 minutes in each case.

(Continued on next page)

(Test No. 1, cont'd) -

pH of the pyrite flotation tailing solution - 7.9.
" " " copper cleaner " " - 8.7.
" " " pyrite " " " - 8.6.

Results:

Product	Weight, per cent	Analysis, per cent Cu	S	Pyrite	Distribution of copper, per cent	Ratio of concentration
Feed	100.00	6.47			100.0	
Copper concentrate	21.66	27.94			93.6	4.62:1.
Cu cleaner tailing	6.34	4.32			4.2	
Pyrite concentrate	4.30	1.09	36.77		0.7	23.26:1.
Pyrite cleaner tailing	4.22	0.59			0.4	
Pyrite rougher tailing	63.48	0.11		0.07	1.1	

* Calculated value.

The analysis of the copper concentrate was as follows:

Gold	-	0.03 oz./ton.
Silver	-	1.85 "
Copper	-	27.94 per cent.
Zinc	-	0.15 "
Lead	-	0.63 "
Lime	-	0.66 "
Magnesia	-	0.63 "
Alumina	-	1.19 "
Silica	-	6.48 "
Iron	-	29.81 "
Arsenic	-	Nil
Antimony	-	Nil
Bismuth	-	Nil.

Test No. 2.

This test was similar to Test No. 1 with the exception that the amounts of copper sulphate and sodium ethyl xanthate were reduced to 0.50 and 0.06 pound per ton respectively.

(Continued on next page)

(Test No. 2, cont'd) -

Results:

Product	Weight, per cent	Analysis, per cent Cu	S	Pyrite	Distribution of copper, per cent	Ratio of concentration
Feed	100.00	6.39			100.0	
Copper concentrate	23.40	26.14			95.7	4.27:1.
Cu cleaner tailing	5.56	2.30		21.8	2.0	
Pyrite concentrate	3.88	1.15	41.30		0.7	25.77:1.
Pyrite cleaner tailing	3.43	1.05		4.2	0.6	
Pyrite rougher tailing	63.73	0.10		0.11	1.0	

Calculated value.

The copper in the rougher copper tailing was 0.20 per cent (calculated value).

Conclusions:

The results of the above investigation show that it is possible to obtain a copper concentrate assaying about 27 per cent copper and containing around 95 per cent of the copper in the ore.

Iron pyrite can be recovered by flotation. The sulphur content of the concentrate obtained was rather low, namely 41.30 per cent. The ratio of concentration was 25.77 into 1, but in mill practice some of the pyrite in the copper and in the pyrite cleaner tailings would be recovered. This would lower the ratio of concentration. Unless the pyrite in the ore is appreciably higher than in the sample on which these tests were conducted, it would not be economical to treat the ore for pyrite recovery.

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