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DEPARTMENT OF MINES
CANADA

MINES BRANCH
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OTTAWA, Dec. 31, 1920 191

REPORT

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Test No. 131

A carload of copper ore was received from F. G. Connell Esq., of the Eastern Mining and Milling Co., Eastman, Quebec, February 8th. 1920. The ore consisted of chalcopyrite and iron sulphides in a silicious gangue.

Test work was conducted on this ore to see if it was adaptable to flotation using the Luckenbach reagents instead of oil. The flotation concentrates being produced by oil flotation gave an analysis of 15% to 20% copper, and the Luckenbach reagents were used to determine whether a higher grade product could be obtained with as good a recovery of the copper content.

Experimental work was carried on from February 11, to May 8, 1920. About thirty tests were conducted and from these tests it was proven that by the use of the Luckenbach reagents a higher grade concentrate could be produced than was being obtained, but to obtain this high grade concentrate with a high recovery of the copper values, the cost of reagents would be higher than the cost of oil. This higher cost may be balanced by the higher grade product, depending on the cost of marketing the concentrate.

The following is a description of some of the tests with the results obtained:

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Test No. 24

Ore crushed in a jaw crusher, ground in Hardinge ball mill to 60 mesh, floated in callow cells, making a rougher concentrate, and tailings to waste.

Crude ore	1.35% Cu
Concentrates	7.80% Cu
Tailings	0.28% Cu
Recovery	82.2%

Test No. 25

Four separate runs were made the same as Test 24, only pebbles instead of balls were used for grinding in the Hardinge mill.

	Run No. 1	Run No. 2	Run No. 3	Run No. 4
Crude Ore :	1.35% Cu	1.35% Cu	1.35% Cu	1.35% Cu
Concentrates:	11.80% Cu	12.85% Cu	13.15% Cu	15.55% Cu
Tailings :	0.08% Cu	0.15% Cu	0.13% Cu	0.15% Cu
Recovery :	94.7%	89.9%	91.3%	89.7%

Test No. 27

The rougher concentrates from the four runs of Test 25, were recleaned in the Callow Cells.

Rougher Concentrates	12.23% Cu
Cleaner Concentrates	21.60% Cu
Tailings	1.60% Cu

This tailing would be considered a middling product and returned to the circuit in practice.

Test No. 26

The same procedure as Test 25, with change in amounts of reagents used.

Crude ore	1.35% Cu
Concentrates	23.85% Cu
Tailings	0.45% Cu
Recovery	67.9%

Test No. 29

Eight separate runs were made using varying amounts of reagents. Balls were used for grinding instead of pebbles, otherwise runs same as Test 25.

	Run No. 1	Run No. 2	Run No. 3	Run No. 4
Crude ore :	1.70% Cu	1.70% Cu	1.70% Cu	1.70% Cu
Concentrate:	25.95% Cu	10.60% Cu	11.70% Cu	12.62% Cu
Tailing :	0.40% Cu	0.32% Cu	0.20% Cu	0.14% Cu
Recovery :	77.7%	83.7%	89.7%	92.7%

Test No. 29 cont.

	Run No. 5	Run No. 6	Run No. 7	Run No1 8
Gude ore :	1.70% Cu	1.70% Cu	1.70% Cu	1.70% Cu
Concentrate:	8.40% Cu	11.55% Cu	8.10% Cu	13.85% Cu
Tailing :	0.25% Cu	0.25% Cu	0.12% Cu	1.20% Cu
Recovery :	87.9%	87.1%	94.4%	32.2%

Run No. 8 was made on some badly oxidized ore. This test shows that the Luckenbach reagents cannot be used on this class of ore.

Test No. 30

The concentrates from Test 29 were recleaned by passing them through the Callow cells.

Rougher Concentrates	12.85% Cu
Cleaner Concentrates	25.45% Cu
Tailings	6.40% Cu

The tailings would be considered a middling product and returned to the circuit in practice.

Inv. 131

Compare with Inv 140

SUMMARY AND CONCLUSIONS

The test work so far conducted has been on Copper Ores, namely, "Bruce Mines" and "Anyox" (Hidden Creek No. 2) Ores.

"Bruce Mines" is a straight chalcopyrite ore and is representative of a copper ore very amenable to flotation. "Hidden Creek No. 2" is a complex ore containing much iron pyrites and pyrrhotite as well as chalcopyrite. A selective or preferential flotation is required to float the chalcopyrite from the other sulphides. Experimental work on oil flotation has been carried on for some time by the Granby Consolidated Mining and Smelting Co., and their most promising results are given in the report.

On Bruce Mines Ore, the results of the test work using the Luckenbach Process, both at the Ore Dressing and Metallurgical Laboratories and at the Company's Laboratories at Toronto, show an exceedingly high grade concentrate with a very high recovery of the copper values. This is equally as good, if not better, than could be obtained by oil flotation, and as far as the small scale test work is concerned, it has been proven that the Luckenbach Processes can be used successfully on an ore of the "Bruce Mines" class.

On Hidden Creek No. 2 ore, the results of the test work, both here and at Toronto, show results equally as good as those obtained by the Granby Consolidated Mining and Smelting Company's engineers after much test work using oil flotation. We are given to understand that results corresponding to their work would be considered satisfactory. We would, therefore, conclude that the Luckenbach Process can be successfully applied to the concentration of Hidden Creek No. 2 ore.

RECOMMENDATIONS

As far as the small scale laboratory work is concerned it has been proven, with respect to the chalcopyrite ores,

that results can be obtained by the use of the Luckenbach Processes which compare favourably with those obtained by oil flotation, and in order to verify these results and to approach very closely to actual milling conditions it will be necessary to carry out the work on a much larger scale.

In order to convince those interested in the flotation of copper ores as to the merits of the process, it will finally be necssary for the Luckenbach Processes Company to come to some agreement with those companies using flotation to give it a thorough and competitive trial in a portion of their mill circuit.

To arrive at the final stages above mentioned, an intermediate one would be the conducting of tests on carload lots of the Flotation Feed of the mills now using flotation in the Ore Dressing and Metallurgical Laboratories of the Mines Branch, Department of Mines. By using the flotation feed, comparative results can be obtained and conclusions arrived at more promptly.

It is, therefore, recommended that the Department of Mines proceed with the small scale laboratory work on other ores, and at the same time action will be taken to secure carload lots of copper ores and especially the flotation feed of those mills using oil flotation, so that the results of the small scale test work can be verified, and the merits of the Luckenbach Non-Oil Flotation Process proven beyond any doubt.

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ACTG. CHIEF OF DIVISION.

RESULTS OF FLOTATION TESTS ON BRUCE MINES COPPER ORE

Test No.	Heads % Cu.	Concentrates % Cu.	Middlings % Cu.	Tails % Cu.	Concentratn. Ratio.	Recovy.
3.	2.80	20.70		.16	1 : 7.8	96.6
4.	2.80	23.45		.40	1 : 10.4	86.9
5.	2.80	29.60		.22	1 : 11.1	94.2
6.	2.80	28.05		.15	1 : 10.0	95.8
7.	2.80	28.45		.32	1 : 11.4	89.8
8.	2.80	23.95		.90	1 : 12.8	69.6
9.	2.80	26.90		.85	1 : 12.5	73.4
10.	2.80	26.65		.13	1 : 9.3	96.1
11.	2.80	29.45		.17	1 : 10.9	94.7
12.	2.80	31.61		.95	1 : 17.9	66.9
14.	2.80	22.45		.30	1 : 7.7	91.5
15.	2.80	28.20		.25	1 : 10.6	92.2
16.	2.90	28.30		.10	1 : 10.0	96.9
17.	2.80	11.05		.10	1 : 5.2	96.6
18.	2.80	18.95		.20	1 : 6.4	94.4
19.	2.80	25.20		.22	1 : 9.6	93.1
20.	2.80	25.75		.30	1 : 10.6	89.9
21.	2.80	27.85		.45	1 : 11.1	86.1
22.	2.80	26.25		.50	1 : 10.2	85.0
23.	2.80	26.30		.45	1 : 10.9	85.5
24.	2.80	25.85		.43	1 : 10.4	86.5
25.	2.80	27.30		.50	1 : 11.1	84.4
26.	2.80	25.10		.40	1 : 10.4	87.0
12A.	1.10	29.28	.96	.07	1 : 28.3	92.4
13A.	1.10	31.87	.81	.03	1 : 29.8	97.2

The above tests were run under the following conditions, except where differences are noted :-

Janney Laboratory Flotation Machine used.
500 grams of Bruce Mine Ore ground to 100 mesh.
Mixed in Pebble Mill 5 minutes, agitated in machine 5 minutes and floated 8 minutes.

FLOTATION TESTS ON BRUCE MINE COPPER ORE

Differences in procedure in running tests : -

Test No.	
19.	Ran three charges of 500 grams each.
20.	No mixing.
21.	"
22.	"
23.	"
24.	"
25.	"
26.	"
12a.) 13a.)	No mixing, agitated 3 minutes and floated.

NOTE:-

Tests 19 - 26 inclusive, form an endurance test. Test 19 was run to obtain a stock of solution. Test 20 was run using only the solution from test 19. Test 21 was ruh using all the solution recovered from test 20, and a small amount of stock. The remaining tests up to 26, were run in this way, each using all the solution recovered from the preceeding test and a small amount of stock from test 19.

Tests showing "a" in the test number were made in Toronto, Ont., by Mr. H. E. Todd.
