DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

Ottawa, June 18, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2068.

Summary of Flotation Tests on Samples of
Sulphide Ore from East Sullivan Mines Limited,
Val d'Or, Quebec.

Note:
This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

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BUREAU OF MINES
DIVISION OF METALLIC MINERALS
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ORE DRESSING AND
METALLURGICAL LABORATORIES

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MINES AND GEOLOGY BRANCH

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Shipment:

Four samples of diamond drill core were received on April 15, 1946, from Mr. B. S. W. Buffam, consulting engineer of East Sullivan Mines Limited, at Val d'Or, Quebec. The following details of the samples were submitted:

Sample No.	Weight, pounds	Hole No.	Footage
1	16½	7	430-500
2	3½	7	375-390
3	2	7	335-350
4	7½	24	245-270

Purpose of Investigation:

In a letter dated April 9, 1946, Mr. Buffam requested preliminary metallurgical tests and information concerning the association of the gold and silver with the sulphides.

Location of the Property:

The samples are from diamond drill cores of the East Sullivan Mines Limited property located in Bourlamaque township, northwestern Quebec.

Sampling and Analysis:

The samples were crushed, sampled and assayed by standard methods. The results are tabulated below:

	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4
Gold, oz./ton -	0.075	0.015	0.115	0.055
Silver, " -	1.82	1.44	1.56	2.87
Copper, per cent -	3.58	11.26	8.82	2.04
Zinc, " -	5.80	0.25	0.31	10.54
Iron, " -	31.62	21.32	21.62	24.48
Sulphur, " -	25.44	17.54	18.12	25.94
Lead, " -	N.d.	N.d.	N.d.	N.d.
Arsenic, " -	N.d.	N.d.	N.d.	N.d.

N.d. = None detected.

Microscopic Examination:

Twenty-four polished sections, six from each sample, were prepared and examined under a reflecting microscope for the purpose of determining the character of the ore.

Metallic Minerals -

The metallic minerals observed in the polished sections are: pyrite, chalcopyrite, pyrrhotite, sphalerite, magnetite, galena, and arsenopyrite. These minerals occur in very intimate admixtures and in varying amounts in each sample but, in general, only the first four named above are abundant. Since the four samples differ only in the relative abundance of the ore minerals contained in them, they will not be described separately in this report.

Pyrite, the most abundant metallic mineral considering all four samples as a whole, is disseminated through gangue as coarse to fine crystals and grains which range down to only a few microns in size. In general, however, the

(Microscopic Examination, cont'd) -

coarser sizes predominate but in some places, particularly in the sections from Sample No. 4, the finer grain sizes are numerous. In places, too, pyrite grains are aggregated into small masses up to about one centimetre in diameter. This mineral contains small inclusions of gangue and grains of the other sulphides.

Chalcopyrite is prevalent in all four samples, especially so in Nos. 2 and 3 where it is the most abundant metallic mineral. Besides occurring as inclusions within other sulphides, it is visible as small masses and coarse to very fine grains scattered unevenly through gangue, alone and associated with other sulphides, especially with sphalerite and/or pyrrhotite. Like pyrite the copper sulphide encloses inclusions of gangue and metallic minerals.

Pyrrhotite is common in most sections except in those from Sample No. 4. Like pyrite and chalcopyrite it is present largely as granular masses and disseminated grains whose average size is smaller than that of pyrite. Also, like these minerals, it entirely surrounds rather numerous small grains of gangue and other sulphides, especially chalcopyrite and sphalerite.

Sphalerite has the same modes of occurrence as chalcopyrite with which it is frequently associated. It is, however, not so evenly distributed as the copper mineral; in Samples Nos. 4 and 1 zinc sulphide is abundant but in Nos. 2 and 3 it is only sparingly present. It frequently contains numerous tiny dots and dashes of chalcopyrite characteristic of many sphalerites but the total quantity of copper sulphide locked up in this way is small. In some places, however, these tiny inclusions form definite alignments thought to be due to ex-solution. In other places, too, especially in the

(Microscopic Examination, cont'd) -

sections from Sample No. 4, the tiny inclusions in sphalerite are composed largely of pyrrhotite and pyrite.

A minor amount of magnetite is present in Samples Nos. 1, 3 and 4, where it occurs in gangue and in sphalerite as small, unevenly scattered grains and crystals which range up to about 200 microns (-65 +100 Tyler mesh) in size. In the polished surfaces from Sample No. 3 the grains of magnetite are often in association with chalcopyrite.

Galena is visible in small amount in Samples Nos. 1 and 4 as scattered grains in gangue usually associated with sphalerite, pyrrhotite, and/or pyrite; a few grains were observed entirely within sphalerite. The largest grain seen is about 0.5 mm. in diameter but the majority of those observed are much smaller in size.

One crystal of arsenopyrite, 120 microns (-100 +150 Tyler mesh) in size, is visible in Sample No. 2 but none was observed in the other three samples.

No gold was found in the twenty-four polished sections although each was carefully traversed under a high power objective. This is to be expected, however, because of the small amount of this metal present in the drill cores.

Gangue -

While metallic mineralization is, in general, quite heavy in the polished surfaces, gangue material is locally abundant and consists essentially of fine-grained, grey quartz which, in several sections, is transected by narrow sinuous fractures.

Conclusions from Microscopic Examination -

The ore minerals occur in complex associations but in grain sizes such that moderately fine grinding will likely release the major portion of them for concentration purposes. Since minor but appreciable percentages of each, however,

(Microscopic Examination, cont'd) -

occur in the finer sizes, very fine grinding will be necessary to free some of them and it may be economically impossible to release all of them in this way.

Since no gold or silver minerals were observed in the sections nothing definite was learned as to their modes of occurrence. As regards silver, however, it is reasonable to assume that this metal will accompany the galena; an indication of this is given in the fact that Sample No. 4, in which galena is most abundant, assays highest in silver.

Conclusions:

1. The ore, as represented by the samples tested, responded satisfactorily to flotation concentration.

2. Good grades of copper concentrates and zinc concentrates were obtained with satisfactory recoveries, as illustrated by Tests Nos. 5, 7 and 8.

3. The gold and silver recoveries were satisfactory, with the greater percentage of the values reporting in the copper concentrate.

4. Due to the small weight of sample, no grinding tests were carried out. All flotation tests were made on relatively finely ground ore.

5. The copper float should be carried out at a pH of 10 and the zinc float at a pH of 12+. Thiocarbanilid and cresylic acid for the copper float, and copper sulphate, potassium ethyl xanthate and pine oil for the zinc float, appeared to give the best recoveries.

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EXPERIMENTAL TESTS:

Test No. 1.

A 2,000-gram charge of Sample No. 1 was ground in a ball mill to give a product 78 per cent minus 200 mesh.

(Continued on next page.)

(Experimental Tests, cont'd) -

Reagents Added:

To Grind - Lb./ton

Sodium carbonate - 1.00

To Copper Float -

Potassium amyl xanthate - 0.10
Sodium cyanide - 0.10
Thiocarbanilid - 0.25
Pine oil - 0.06

pH = 10.5

Collection = 15 minutes.

To Zinc Float -

Copper sulphate - 1.50
Potassium ethyl xanthate - 0.05
Pine oil - 0.02

pH = 10.5

Collection = 15 minutes.

Zinc concentrates cleaned once.

Results:

Product	Wgt., per cent	Assay, oz./ton		Assay, per cent			Distribution, per cent				
		Au	Ag	Cu	Zn	Fe	Au	Ag	Cu	Zn	Fe
Feed (calc.)	100.0	0.082	1.85	3.12	5.20	33.98	100.0	100.0	100.0	100.0	100.0
Cu conc.	19.0	0.36	6.92	13.51	6.22	44.20	83.9	71.0	82.3	21.6	24.7
Cl. Zn conc.	8.4	0.02	1.34	1.68	27.35	27.75	2.1	6.1	4.5	41.9	6.9
Cl. Zn tlg.	3.8	0.02	2.38	1.29	3.45	40.10	0.9	4.8	1.6	2.4	4.5
Tailings	68.8	0.015	0.49	0.53	2.71	31.57	13.1	18.1	11.6	34.1	63.9

The zinc recovery in this test was very poor and the zinc concentrate was very low grade and contained too much iron.

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Test No. 4.

A 1,000-gram charge of Sample No. 1 was ground in a ball mill to give a product 76 per cent minus 200 mesh. A copper concentrate and a zinc concentrate were removed. Both concentrates were cleaned twice.

Reagents Added:

To Grind - Lb./ton

Sodium carbonate - 5.00
Thiocarbanilid - 0.20
Sodium cyanide - 0.35

(Experimental Tests, cont'd) -

To Copper Float - Lb./ton

Cresylic acid - 0.05

pH = 10.2

Collection = 15 minutes.

To Zinc Float -

Sodium carbonate	-	3.00
Lime	-	2.00
Copper sulphate	-	1.50
Potassium ethyl xanthate		0.30
Pine oil	-	0.05

pH = 11.3

Collection = 10 minutes.

Results:

Product	Wgt., per cent	Assay, oz./ton		Assay, per cent			Distribution, per cent				
		Au	Ag	Cu	Zn	Fe	Au	Ag	Cu	Zn	Fe
Feed (calc.)	100.0	0.081	1.85	3.37	5.92	32.02	100.0	100.0	100.0	100.0	100.0
Cu conc.	9.4	0.50	8.84	27.10	4.03	29.91	58.1	44.8	75.6	6.4	8.8
Cu cl. tlg.	7.9	0.22	4.88	5.06	8.50	32.01	21.5	20.8	11.9	11.4	7.9
Zn conc.	13.6	0.02	1.44	0.99	28.70	26.64	3.3	10.6	4.0	65.9	11.3
Zn cl. tlg.	4.3	0.02	1.42	0.79	6.07	43.32	1.1	3.2	1.0	4.4	5.8
Tailing	64.8	0.02	0.59	0.36	1.09	32.70	16.0	20.6	7.5	11.9	66.2

The copper and zinc recoveries were satisfactory in this test but the grade of zinc concentrate was low and it contained too much iron.

Test No. 5.

A 1,000-gram charge, consisting of 250 grams of each of the four samples, was ground in a ball mill to give a product 76.6 per cent minus 200 mesh. A copper and a zinc concentrate were removed and both concentrates cleaned twice.

Reagents Added:

To Grind - Lb./ton

Sodium carbonate	-	5.00
Thiocarbanilid	-	0.20
Sodium cyanide	-	0.40
Zinc sulphate	-	1.00

To Copper Float -

(Continued on next page.)

(Experimental Tests, cont'd) -

To Copper Float -	Lb./ton
Cresylic acid -	0.06

pH = 10.3

Collection = 10 minutes.

To Zinc Float -

Sodium carbonate	- 3.00
Lime	- 1.50
Copper sulphate	- 1.50
Potassium ethyl xanthate	- 0.30
Pine oil	- 0.06

pH = 11.5

Collection = 8 minutes.

Results:

Product	Wgt., per cent	Assay, oz./ton		Assay, per cent				
		Au	Ag	Cu	Zn	Fe	S	Insol.
Feed (calc.)	100.0	0.072	1.40	5.70	4.17	21.89	24.15	34.33
Cu conc.	11.7	0.28	5.80	31.31	0.86	30.85	33.95	1.12
Cu cl. tlg.	10.9	0.24	3.88	14.88	3.72	32.80	32.25	9.67
Zn conc.	6.0	0.02	1.24	1.57	46.46	13.50	31.51	2.30
Zn cl. tlg.	15.5	0.02	0.82	1.29	3.77	35.20	24.30	21.35
Tailing	55.9	0.015	0.18	0.21	0.53	15.10	19.70	53.13

Distribution, per cent						
Au	Ag	Cu	Zn	Fe	S	Insol.
100.0	100.0	100.0	100.0	100.0	100.0	100.0
45.8	48.3	64.3	2.4	16.5	16.4	0.4
36.5	30.1	28.5	9.7	16.3	14.6	3.1
1.7	5.3	1.7	66.8	3.7	7.8	0.4
4.3	9.1	3.5	14.0	24.9	15.6	9.6
11.7	7.2	2.0	7.1	38.6	45.6	86.5

This test gave very satisfactory results. The grade of the zinc concentrate is slightly low but this could be raised by another cleaning.

Test No. 7.

A 1,000-gram charge, consisting of 250 grams of each of the four samples, was ground in a ball mill to give a product 86.3 per cent minus 200 mesh. A copper concentrate and a zinc concentrate were removed and both concentrates

(Experimental Tests, cont'd) -

were cleaned twice.

Reagents Added:

To Grind -	Lb./ton
Lime	5.00
Thiocarbanilid	0.10
Sodium cyanide	0.40

To Copper Float -	
Cresylic acid	0.09
Thiocarbanilid	0.20

pH = 11.6

Collection = 15 minutes.

To Copper Conc. Cleaning -	Lb./ton
Zinc sulphate	0.30

Zinc Float -	
Lime	3.00
Copper sulphate	3.00
Potassium ethyl xanthate	0.30
Pine oil	0.06

pH = 12.3

Collection = 15 minutes.

Results:

	Wgt., per cent	Assay, oz./ton		Assay, per cent				
		Au	Ag	Cu	Zn	Fe	S	Insol.
Feed (calc.)	100.0	0.059	1.49	5.35	3.54	24.91	20.54	35.00
Cu conc.	12.7	0.23	5.94	29.84	1.40	31.47	26.55	2.42
Cu cl. tlg.	7.2	0.24	4.42	9.97	4.47	30.87	28.29	13.45
Zn conc.	7.7	0.02	1.66	6.52	29.60	20.08	30.45	2.36
Zn cl. tlg.	8.7	0.02	1.34	2.18	5.62	39.28	30.59	8.28
Tailings	63.7	0.015	0.27	0.23	0.42	21.54	15.91	51.53

Distribution, per cent						
Au	Ag	Cu	Zn	Fe	S	Insol.
-	-	-	-	-	-	-
49.3	50.7	70.9	5.0	16.1	16.4	0.9
29.1	21.5	13.5	9.1	8.9	9.9	2.8
2.6	8.5	9.4	64.5	6.2	11.4	0.5
2.9	7.8	3.5	13.8	13.7	13.0	2.1
16.1	11.5	2.7	7.6	55.1	49.3	93.7

The grade and iron content of the zinc concentrate are not satisfactory.

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(Experimental Tests, cont'd) -

Test No. 8.

A 1,000-gram composite charge was prepared with the following weights of each sample:

No. 1 - 200 grams
No. 2 - 250 "
No. 3 - 200 "
No. 4 - 350 "

This charge was ground in a ball mill to give a product 84.0 per cent minus 200 mesh. A copper concentrate and a zinc concentrate were removed and both concentrates cleaned twice.

Reagents Added:

To Grind -		Lb./ton
Lime	-	3.00
Thiocarbanilid	-	0.10
Zinc sulphate	-	1.50
To Copper Float -		
Cresylic acid	-	0.04
Thiocarbanilid	-	0.10

pH = 9.3

Collection = 15 minutes.

To Zinc Float -		
Sodium carbonate	-	2.00
Copper sulphate	-	1.50
Thiocarbanilid	-	0.10
Water gas tar	-	0.15
Coal tar gas	-	0.03
Cresylic acid	-	0.04

pH = 12.1

Collection = 15 minutes.

(Results of Test No. 8)
(appear on Page 11.)

(Experimental Tests, cont'd) -

Results:

	Wgt., per cent	Assay, oz./ton Au	Ag	Assay, per cent Cu	Zn	Fe	S	Insol.
Feed (calc.)	100.0	0.07	1.65	3.95	4.50	25.86	21.88	33.17
Cu conc.	12.2	0.20	6.08	20.52	1.28	27.70	24.54	1.96
Cu cl. tlg.	10.9	0.26	4.82	10.49	5.10	32.21	33.07	10.39
Zn conc.	5.9	0.03	1.11	0.62	47.90	11.35	32.41	1.49
Zn cl. tlg.	5.7	0.03	1.49	1.65	7.93	33.18	31.61	14.16
Tailing	65.3	0.02	0.35	0.27	0.78	25.13	17.72	47.33

Distribution, per cent						
Au	Ag	Cu	Zn	Fe	S	Insol.
-	-	-	-	-	-	-
35.2	45.1	63.3	3.5	13.1	13.7	0.7
40.9	31.9	28.9	12.4	13.6	16.5	3.4
2.6	4.0	0.9	62.8	2.6	8.7	0.3
2.5	5.1	2.4	10.0	7.3	8.2	2.4
18.8	13.9	4.5	11.3	63.4	52.9	93.2

The grade of the copper concentrate obtained in this test was low, but this could probably be increased by further cleaning. The grade of the zinc concentrate could also be increased by cleaning.

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