O T T A W A September 24th, 1941.

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ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1098.

Sink-and-Float Tests on a Sample of Copper-Zinc Ore from the Normetal Mine at Dupuy, Quebec.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
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CANADA
DEPARTMENT
OF
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Shipment:

One drum of ore, net weight 380 pounds, was received on December 11th, 1940. The sample was submitted by D. E. Bourke, Mill Superintendent, Normetal Mining Corporation Limited, Normetal, Quebec.

Location of Property:

The property from which this ore is taken is located a few miles north of the town of Dupuy, in Abitibi county, northwestern Quebec.

Character 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 forms the minor portion of the sections and is scattered throughout sulphide masses as grains and small patches. It consists essentially of smoky-grey quartz with abundant, finely disseminated carbonate which gives a moderately strong microchemical reaction for iron.

Metallic Minerals -

Metallic mineralization is heavy and consists of an intimate admixture of sulphides, chiefly as coarse-textured, granular masses. The latter are usually composed of one or another sulphide which predominates and encloses inclusions of the others. A smaller but considerable percentage of the sulphides occurs also as coarse to fine disseminated grains. These, too, are intimately mixed.

Pyrite preponderates, largely as granular aggregates but is also disseminated as irregular grains and cubes. It has been the first sulphide mineral formed and has been attacked and corroded by sphalerite, chalcopyrite, and pyrrotite around margins and along fine fractures.

Sphalerite and chalcopyrite, the next most abundant metallics, occur largely as small masses and grains filling in around the grain boundaries of pyrite aggregates. Both minerals are also present as small inclusions in dense pyrite

(Character of the Ore, cont'd) -

and as irregular grains disseminated in gangue. In places, tiny dots and rods of chalcopyrite are numerous within sphalerite.

In one or two sections, pyrrhotite is common in gangue as medium to fine irregular grains most of which are associated with pyrite, sphalerite, or chalcopyrite. It also occurs as occasional small inclusions within these three sulphides.

Galena is present in almost negligible quantity as small inclusions in pyrite, while two small grains of magnetite in sphalerite, and one of arsenopyrite in a granular mass of pyrite, are visible in the sections.

Sampling and Assaying:

No head sample was taken for assay from the shipment, owing to the nature of the test; but head sample assays calculated from the products of a test are as follows:

Copper	-	1.905 per cent.
Zinc	-	4.25 "
Gold	-	0.028 oz./ton.

Experimental Tests:

A sample of the ore was treated by the sink-and-float process with the idea of rejecting a fraction of the ore that would be too low-grade to repay milling costs.

The ore was crushed to pass through a 7/8" screen and all material finer than 8 mesh was screened out since it is too fine to be treated by the sink-and-float process.

A size-density analysis was then made to determine the most satisfactory conditions under which a sink-and-float

(Experimental Tests, cont'd) -

separation should be made. This was done as follows:

The ore at -7/8"+8 mesh was sized by screening at 1/8" intervals to give the following products: -7/8"+3/4"; -3/4"+5/8"; -5/8"+1/2"; -1/2"+3/8"; -3/8"+8 mesh.

Density separations were then made separately on each size fraction over a range of densities starting at 2.80. The portion which sank at 2.80 was retreated at 2.825, giving an intermediate fraction and one heavier than 2.825. The latter was again retreated at 2.85, giving a final sink product, a float, and two intermediate products.

The intermediate products can be combined with either the sink or the float, depending on their grade, and in this way the proper density at which the separation should be made is determined. The size range best suited for the product to be treated is also determined by both assay value and percentage elimination at both ends of the range treated in the size-density analysis. This may mean crushing to a finer maximum size, screening to a coarser minimum size, or both at the same time.

The density separations are made under static conditions in a bath of substantially stable galena medium. The medium is a suspension of fine galena and water and its density can be controlled to an accuracy of 0.01 by altering the proportion of the two components. The medium used is the same as would be used in a large-scale plant test.

The results of the size-density analysis are set out in the following table:

(See Pages 5 and 6)

SIZE-DENSITY ANALYSIS.

(S.F. Test No. 22 - Normetal)

Size Fractions	-6+8 Mesh		-4+6 Mesh		-3+4 Mesh		-3/8"+3 Mesh	
	- W e i g h t P r o p o r t i o n s -							
DENSITY FRACTIONS	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed
Float @ 2.80	34.92	2.39	29.60	2.18	20.37	1.84	15.96	2.11
Float @ 2.825; sink @ 2.80	12.46	0.85	10.05	0.74	8.78	0.80	6.50	0.86
Float @ 2.85; sink @ 2.825	5.60	0.38	5.11	0.38	4.22	0.38	3.92	0.52
Sink @ 2.85	47.02	3.22	55.24	4.06	66.63	6.02	73.62	9.75
TOTAL -	100.00	6.84	100.00	7.36	100.00	9.04	100.00	13.24

	- A s s a y s (Au, oz./ton; Cu and Zn, per cent) -											
	Cu	Zn	Au	Cu	Zn	Au	Cu	Zn	Au	Cu	Zn	Au
Float @ 2.80	0.51	1.21	0.02	0.21	0.81	0.01	0.15	0.71	0.01	0.24	0.35	0.01
Float @ 2.825; sink @ 2.80	1.03	1.57	0.06	0.49	0.76	0.01	0.26	0.61	0.005	0.16	0.35	0.0025
Float @ 2.85; sink @ 2.825	1.73	2.66	0.01	0.83	1.52	0.02	0.78	0.66	0.02	0.34	0.33	0.02
Sink @ 2.85	3.24	7.35	0.02	2.94	6.34	0.02	2.47	5.73	0.025	2.35	5.53	0.02

SIZE-DENSITY ANALYSIS.

(S.F. Test No. 22 - Normetal, cont'd)

Size Fractions	-½"+3/8"		-5/8"+½"		-¾"+5/8"		-7/8"+¾"		Total	
	- Weight Proportions -									
DENSITY FRACTIONS	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed	% Size fraction	% S.F. feed
F. @ 2.80	17.49	2.89	15.03	2.21	8.87	1.38	8.80	1.47	16.47	16.47
F. @ 2.825; S. @ 2.80	4.80	0.79	3.98	0.59	7.36	1.15	5.83	0.98	6.76	6.75
F. @ 2.85; S. @ 2.825	6.75	1.11	4.71	0.69	4.18	0.65	4.93	0.83	4.94	4.94
S. @ 2.85	70.96	11.71	76.28	11.21	79.59	12.39	80.44	13.47	71.83	71.84
TOTAL -	100.00	16.50	100.00	14.70	100.00	15.57	100.00	16.75	100.00	100.00
	- Assays (Au, oz./ton; Cu and Zn, per cent) -									
	Cu	Zn	Au	Cu	Zn	Au	Cu	Zn	Au	Cu	Zn	Au
F. @ 2.80	0.14	0.41	0.01	0.08	0.61	0.01	0.08	0.71	Trace	0.31	0.56	0.01
F. @ 2.825; S. @ 2.80	0.23	0.30	0.0025	0.28	0.15	0.005	Nil	0.35	0.0025	0.10	0.46	0.0025
F. @ 2.85; S. : 2.825	0.22	0.35	0.005	0.01	0.07	Trace	0.15	0.35	0.005	0.08	0.15	0.005
S. @ 2.85	2.30	5.53	0.02	2.23	5.07	0.12	2.02	5.32	0.02	2.74	4.41	0.02

(Experimental Tests, cont'd) -

Examining the figures in the size-density analysis, it will be noted that in the sizes finer than 3 mesh the assays of the "floats" and intermediate products are too high to allow them to be discarded. In the coarser sizes the same products are low enough in grade to be discarded. It was therefore decided that sink-and-float feed should be screened on 3 mesh and the separation made at a density of 2.85 or perhaps higher. The product finer than 3 mesh is ultimately added to the "sinks" for further treatment.

On this basis the following tables have been prepared:

Table I. - Distribution of Products from Crushing.

Product	Weight, per cent	Assays, Per cent Cu	Assays, Per cent Zn	Assays, Au oz./ton	Distribution, per cent Cu	Distribution, per cent Zn	Distribution, per cent Au
S. F. feed	62.56	1.807	4.02	0.0315	59.35	59.12	70.08
Fines -3 mesh	37.44	2.068	4.64	0.0225	40.65	40.88	29.92
Feed sample	100.00	1.905	4.25	0.028	100.00	100.00	100.00

Table II. - Distribution of Products from S. F. Separation.

S. F. conc.	76.26	2.32	5.14	0.039	97.95	97.56	94.72
S. F. tailing	23.74	0.156	0.412	0.007	2.05	2.44	5.28
S. F. feed	100.00	1.807	4.02	0.0315	100.00	100.00	100.00

Table III. - Summary of Products from Pre-Concentration.

S. F. conc.	47.71	2.32	5.14	0.039	58.14	57.68	66.38
Fines -3 mesh	37.44	2.068	4.64	0.0225	40.65	40.88	29.92
Product for further treatment	85.15	2.21	4.92	0.0318	98.79	98.56	96.30
S. F. tailing	14.85	0.156	0.412	0.007	1.21	1.44	3.70
Feed sample	100.00	1.905	4.25	0.028	100.00	100.00	100.00

Summary:

On the basis of the sample submitted the results may be summarized as follows:

Proportion of ore to be crushed	=	100.00 per cent.
" " " available for S. F. feed	=	62.56 "
" " " to further treatment	=	85.15 "

	Copper per cent	Zinc per cent	Gold oz./ton
Assay of ore received =	1.905	4.25	0.028
" " S. F. feed =	1.807	4.02	0.0315
" " tailings produced =	0.156	0.412	0.007
" " concentrates produced =	2.32	5.14	0.039
" " ore to further treatment =	2.21	4.92	0.0318

Elimination (by weight) of S. F. feed	=	23.74 per cent.
" " of whole ore	=	14.85 "

	Copper	Zinc	Gold
Metal recovery from S. F. feed =	97.95	97.56	94.72
" " " whole ore =	98.79	98.56	96.30

Conclusions:

While the metal recovery in the product for further treatment is high, elimination of low-grade material is low. It may be possible to increase the elimination by separating at a higher density but a further shipment of ore will be needed in order to carry out further tests.

From the mineralogical description of the ore it appears that the copper and zinc minerals are widely disseminated and this condition mitigates against concentration of the ore by this process.

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