O T T A W A November 20th, 1940.

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of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 920.

Sink-and-Float Tests on a Sample of Gold-Silver-Copper Ore from Telkwa, British Columbia.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
—
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METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
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Shipment:

Two sacks of ore, net weight 123 pounds, were received on September 24th, 1940. The shipment was submitted by G. F. MacDonnell, Conwest Exploration Company Limited, Royal Bank Building, Vancouver, British Columbia.

Location of Property:

This ore was taken from the Hunter Basin property of Conwest Exploration Company Limited, near Telkwa, British Columbia.

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 -

In the polished sections gangue forms the minor portion of the mineral content, and consists of milky-white quartz and soft, dark-grey rock material. The latter appears to be dolomitic in character.

Metallic Minerals -

In order of decreasing abundance the metallic minerals present in the sections are: chalcopyrite, bornite, magnetite, hematite, and mineral "Y". All are very intimately admixed with the copper minerals preponderating.

Chalcopyrite. Massive chalcopyrite is abundant; a minor amount is present also as coarse to fine disseminated grains with the coarser sizes predominating. It is intimately contaminated with stringers and inclusions of gangue as well as inclusions of the other metallics.

Bornite has the same modes of occurrence and contains the same inclusions as chalcopyrite. In places rods and blebs of chalcopyrite are oriented along crystallographic

(Continued on next page)

directions in bornite. These inclusions are also distributed at random in the host.

Magnetite is prevalent as disseminated grains and small masses which, in places, are extensively impregnated with gangue. It also contains numerous inclusions of hematite and of the copper minerals.

Hematite is present in small amount, largely as tiny irregular grains in magnetite.

Mineral "Y". Rare tiny inclusions of an anisotropic, galena white, unknown mineral are visible in chalcopyrite and bornite. Due to their small size all standard tests were unsatisfactory and the mineral could not be identified.

An isolated specimen of massive galena and sphalerite was also found in the ore sample.

Sampling and Assaying:

Owing to the coarse size at which the tests are run and the small weight of the sample, a head sample could not be obtained. The heads as calculated from the products were as follows:

Gold - 0.725 oz./ton
Silver - 9.58 "
Copper - 12.78 per cent.

Experimental Tests:

The ore was to be tested as to its suitability for treatment by the Huntington-Heberlein sink-and-float process. The object of such treatment would be to raise the grade of ore shipped to smelter by elimination from run-of-mine ore of a low-grade fraction which would not be

(Continued on next page)

(Experimental Tests, cont'd) -

economic to ship. Having regard to the returning charges in force, such low-grade fraction would be of high enough grade for flotation feed, but this aspect was not considered in the present examination.

Examination was carried out by "bucket tests". These are small-scale density separations carried out under static conditions using as separating medium the substantially stable fine galena-water suspension employed in the Huntington-Heberlein sink-and-float plant. The effective density of separation is altered by control of the water/solid ratio of the suspension.

The "bucket tests" demonstate the suitability, or otherwise, of this process for treating the ore. If affirmative they determine

(a) the optimum conditions as to size range of ore and density of medium for plant operation; and

(b) the metallurgical results which may be anticipated for plant operation.

Preliminary Tests:

A. Preliminary work established that the percentage elimination falls off rapidly for sizes coarser than $\frac{3}{4}$ inch and that a medium density of at least 2.85 can be used.

B. A portion of the ore was accordingly crushed to $-\frac{3}{4}$", the fines (-8 mesh) screened out, and the $-\frac{3}{4}$"+8 mesh fraction subjected to a size-density analysis. In this analysis the sample is divided into a number of density

(Continued on next page)

(Preliminary Tests, cont'd) -

fractions (by separating at successively higher densities) and each density fraction is further subdivided by sizing. All fractions are then weighed and assayed.

A study of the results so obtained discloses the limits as to size range and medium density which would result in the production of a 'float' which could be economically rejected.

The results are tabulated in the Size-Density Analysis table shown on Page 7. From these it is concluded that

(a) the ore size range to be treated should be $-\frac{3}{4}"+\frac{1}{4}"$, and

(b) optimum density for the separating medium should be 2.90.

Final Test:

On separating a portion of the sample under the determined conditions, the results obtained were those shown in the following tabulations designated as Tables I, II, and III.

The procedure was

(1) crush to $-\frac{3}{4}"$,

(2) screen on $\frac{1}{4}"$, and

(3) separate the $-\frac{3}{4}"+\frac{1}{4}"$ fraction in galena medium of density 2.90.

Table I.

Distribution of Products from Crushing.

Product	Weight, per cent	Assays Oz./ton Au	Assays Oz./ton Ag	Assays Cu, %	Distribution, per cent Au	Distribution, per cent Ag	Distribution, per cent Cu
S. F. feed	70.03	0.62	8.50	11.51	59.69	62.14	63.05
Fines	29.97	0.97	12.11	15.76	40.31	37.86	36.95
Feed sample	100.00	0.725	9.58	12.78	100.00	100.00	100.00

(Continued on next page)

(Final Test, cont'd) -

Table II.

Distribution of Products from Sink-and-Float Separation.

Product	Weight, per cent	Assays Oz./ton Au	Assays Oz./ton Ag	Assays Cu, %	Distribution, per cent Au	Distribution, per cent Ag	Distribution, per cent Cu
S. F. conc.	69.30	0.84	11.45	15.57	94.22	93.31	93.77
S. F. tailing	30.70	0.12	1.85	2.34	5.78	6.69	6.23
S. F. feed	100.00	0.62	8.50	11.51	100.00	100.00	100.00

Table III.

Summary of Products from Whole Treatment.

S.F. conc.	48.53	0.84	11.45	15.57	56.24	57.98	59.12
Fines	29.97	0.97	12.11	15.76	40.31	37.86	36.95
Prod. for shipping	78.50	0.89	11.70	15.64	96.55	95.84	96.07
S.F.tailing	21.50	0.12	1.85	2.34	3.45	4.16	3.93
Feed sample (cal.)	100.00	0.725	9.58	12.78	100.00	100.00	100.00

Summary of Results:

	Per cent
Proportion of ore to be crushed =	36.70
" " " available for S.F. feed =	70.03
" " " for shipment =	78.50

	Au, oz./ton	Ag, oz./ton	Cu, %
Assay of ore received =	0.725	9.58	12.78
" " S.F. feed =	0.62	8.50	11.51
" " " tailings produced ('float') =	0.12	1.85	2.34
" " " concentrates " ('sink') =	0.84	11.45	15.57
" " product for shipment =	0.89	11.70	15.64

Elimination (by weight) of S.F. feed = 30.70 per cent.
" (" ") of whole ore = 21.50 "

Metal recovery from	Au	Ag	Cu
S.F. feed =	94.22%	93.31%	93.77%
whole ore =	96.55%	95.84%	96.07%

(Size-Density Analysis Table is on next page)

Size-Density Analysis Tabulation.

Size Fractions	-6+8 mesh		-4+6 mesh		-3+4 mesh		-¾"+3 mesh	
	Weight Prop'ns.		Weight Prop'ns.		Weight Prop'ns.		Weight Prop'ns.	
DENSITY FRACTIONS	% size frac-tion	% S.F. feed	% size frac-tion	% S.F. feed	% size frac-tion	% S.F. feed	% size frac-tion	% S.F. feed
Float at 2.85	50.9	2.45	30.8	1.35	34.8	2.60	21.6	18.00
Float at 2.90 Sink at 2.85	22.0	1.06	21.7	0.95	13.2	0.99	9.1	7.58
Sink at 2.90	27.1	1.31	47.5	2.08	52.0	3.88	69.3	57.75
Total	100.0	4.82	100.0	4.38	100.0	7.47	100.0	83.33

	Assays			Assays			Assays			Assays		
	Cu, %	Oz./ton Au	Ag	Cu, %	Oz./ton Au	Ag	Cu, %	Oz./ton Au	Ag	Cu, %	Oz./ton Au	Ag
Float at 2.85	9.01	0.36	6.93	6.23	0.22	4.74	4.24	0.57	3.33	1.89	0.06	1.35
Float at 2.90 Sink at 2.85	13.91	1.77	10.90	10.57	0.49	6.83	8.45	0.38	5.34	3.55	0.25	3.05
Sink at 2.90	24.14	0.835	21.15	22.51	0.35	20.07	22.20	2.21	17.37	15.57	0.84	11.45

Conclusions:

It is concluded that, for the purpose required, sink-and-float treatment by the Huntington-Heberlein process is suitable.

On a basis of the sample submitted it is possible to eliminate 21.5 per cent by weight of the whole ore as a low-grade product, assaying 0.12 ounce gold and 1.85 ounces silver per ton and 2.34 per cent copper, which would be uneconomic to ship to the smelter.

This can be effected by treating 70 per cent of the ore after crushing to $-\frac{3}{4}$", namely the $-\frac{3}{4}"+\frac{1}{4}"$ fraction, at a density of 2.90.

Under these conditions the product for shipment assays 0.89 ounce gold and 11.70 ounces silver per ton and 15.64 per cent copper, and the recoveries are: gold, 96.55 per cent; silver, 95.84 per cent; and copper, 96.07 per cent.

It is recommended that a representative sample of six to eight tons be submitted for confirmatory plant tests.

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