O T T A W A March 27, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2022.

Preliminary Tests on a Zinc Silicate Ore from the "Oxide Group," Ymir, British Columbia.

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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DIVISION OF METALLIC MINERALS
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Shipment:

A shipment of 332 pounds of ore from the "Oxide Group" claims, located approximately 3 miles from Ymir, British Columbia, was received on January 21, 1946. The sample was submitted by Mr. G. F. MacDonnell, Vice President, International Mining Corporation (Canada) Limited, 85 Richmond Street West, Toronto, Ontario, and was reported to come from surface trenching and tunneling on these claims.

Purpose of Investigation:

It was requested that test work be undertaken in an attempt to obtain a marketable zinc concentrate from the ore.

Analysis and Characteristics of the Ore:

Head Sample Analysis

Gold	-	0.005 oz./ton
Silver	-	1.07 "
Zinc	-	34.70 per cent
Lead	-	2.52 "
Copper	-	0.03 "
Sulphur	-	0.03 "
SiO_2	-	16.12 "
Fe_2O_3	-	24.87 "
CaO	-	0.02 "
H_2O +100° C.	-	10.10 "

Calculations based on this analysis show that the ore is a true silicate of zinc and that there are practically no sulphides present. The iron, reported as Fe_2O_3, is actually hydrous, as is the zinc silicate. The gold and silver contents of the ore are too low for economical consideration.

The sample as received was red in colour and very earthy or crumbly. Microscopic examination of hand samples showed no free silica.

Results of Investigation:

Screening, roasting, electrostatic separation and flotation tests were made but a marketable zinc concentrate was not obtained.

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Details of Test Work:

Table I shows the results of a screen analysis of samples prepared for electrostatic separation tests.

TABLE I. - Screen Analysis

Mesh size	Weight, per cent	Assays, per cent Zn	Assays, per cent Fe	Distribution, per cent Zn	Distribution, per cent Fe
-20 +35	15.5	40.59	9.40	19.7	8.3
-35 +65	19.3	38.02	12.00	23.0	13.3
-65+150	12.9	34.65	15.85	14.0	11.7
-150 (screen)	15.2	31.38	18.60	15.0	16.3
Slimes	37.1	24.26	23.70	28.3	50.4
Total	100.0	31.86	17.47	100.0	100.0

(Details of Test Work, cont'd) -

This table shows that by eliminating the minus 150 mesh material (too fine for electrostatic separation), approximately 45 per cent of the available zinc is lost as a low grade (27.4 per cent Zn) product. Combined with this loss, no noticeable increase in grade was obtained by electrostatic concentration on the coarser-size particles.

Table I also shows that sizing of the ore will not give economical recoveries of zinc.

Reducing atmosphere roasting tests at temperatures in the range of 500 to 650° C. were made in an attempt to convert the iron to a magnetic form but were unsuccessful.

Gravity methods of concentration were not attempted on the ore, as the specific gravity of hydrous zinc silicate (3.3 to 3.6) and of hydrous iron oxide (3.4 to 4.0) are too similar to obtain a satisfactory separation. Also, the crumbly, earthy nature of the ore precludes any hope of successful concentration by jigging.

Acid leaching of siliceous ores is not practical as the silica present forms a "silica gel" which hinders or stops any further hope of concentration.

Flotation tests on the ore were not successful. Attempts were made to sulphidize the zinc silicate but it was found that the iron oxide sulphidized concurrently with the zinc. Attempts to depress one mineral with respect to the other, both with and without sulphidization, did not show promise of success.

Conclusions:

The test work undertaken on the sample of hydrous zinc silicate submitted shows that ordinary methods of concentration will not result in a satisfactory zinc concentrate.

It would appear that the distillation method of concentration, Waelz process, to obtain zinc oxide, is the

(Conclusions, cont'd) -

only way to handle this ore. No test work was undertaken along these lines, as it is felt that a very large tonnage of ore would be required before either a volatilization (distillation) method or a chemical method of concentration would be economical. However, from the literature it would appear that the "Oxide group" ore, analysing high in silica and iron, might be treated by the Waelz process.

The gold and silver contents of the ore are too low to be economical.

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ADDENDUM TO REPORT OF INVESTIGATION NO. 2022, ISSUED ON MARCH 27, 1946, ENTITLED "PRELIMINARY TESTS ON A ZINC SILICATE ORE FROM THE OXIDE GROUP, YMIR, BRITISH COLUMBIA."

Ottawa, April 30, 1946.

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Since Investigation No. 2022 was issued, on March 27, 1946, further work has been undertaken on this silicate ore in an attempt to form the sulphate of zinc using concentrated sulphuric acid.

The amount of sulphuric acid required to sulphate the zinc present in the ore was determined from the following equation and found to be approximately 1060 pounds of 95 per cent sulphuric acid per ton of ore treated. (Head sample analysis 34.70 per cent Zn.)

$$Zn_2SiO_4 \cdot H_2O + 2H_2SO_4 = 2ZnSO_4 + H_2SiO_3 + 2H_2O.$$

Zinc sulphate is soluble in water (80-85 grams per 100 c.c.), so that, following the acid treatment, water leaching will remove the zinc from the pulp. However, the water mixing with the acid remaining in the pulp forms a weak solution of sulphuric acid which takes large quantities of iron into solution. This ferrous iron causes some difficulty when precipitating zinc from the acid solution.

One very serious difficulty was encountered in all test work on this ore, but was particularly noticeable during the sulphation tests, namely, the pulp could not be filtered in a pressure filter. The acid and leach solutions, even when standing under pressure overnight, were neither filtered nor settled. Hence any attempt to treat the ore would entail decantation, with very high losses due to suspended solids

(Addendum to Report of Investigation No. 2022, cont'd) -

in the solution. Also, this would obviate the possibility of re-using any of the solutions.

Once the sulphated zinc has been leached from the pulp the ferrous iron could probably be controlled by the addition of zinc oxide and metallic zinc recovered in an electrolytic cell. It is very doubtful whether the sulphuric acid formed in the cell, as a result of the deposition of zinc, could be sufficiently concentrated to use as sulphating acid.

This method of treating the silicate ore will result in a final zinc product being recovered but appears very costly and uneconomical for other than very high-grade feed. There are no apparent markets for any possible by-products from the operation, so that the total costs would have to be borne by the zinc itself.

Smelting in Retorts.

Zinc silicate is the most difficult of the various ores of zinc to reduce, requiring fine grinding and high temperatures (1200-1500° C.). In general, more readily reducible ores are added to the charge to give a blended feed. The presence of Fe_xO_y is harmful but this effect may be partially overcome by careful furnace control. Ores relatively low in zinc (25 to 35 per cent Zn) and high in iron (10 to 15 per cent Fe) will usually give low recoveries of zinc. Smelter feed usually runs 55 per cent zinc or higher.

No test work has been undertaken on smelting this silicate ore but from discussions with various members of the staff of the Laboratories it would appear to be an uneconomical method of treating the ore. Due to the relatively high temperatures that would be required to break down the zinc silicate (1200-1500° C.), the costs would be very high and

any lowering of the grade of ore to 10-20 per cent zinc would give a low yield of metal per ton of ore treated while increasing the difficulties of treatment due to an increased iron content.

The absence of by-products is a serious handicap to any relatively expensive method of treatment. If the tenure of the ore can be held at approximately 35 per cent Zn, direct smelting, the Waeltz process, or sulphating should be considered, provided the tonnage of ore is large. Small tonnages or lower grades of zinc would, it is felt, definitely make the deposit submarginal.

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Ottawa, Canada,
April 30, 1946.
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