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CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MINES BRANCH

Ottawa, October 31, 1957.

# REPORT

of the

MINERAL DRESSING AND PROCESS METALLURGY DIVISION

M. D. Test Report No. 913-OD

Heavy-Media Separation Tests on a Sample of Iron Ore from West Canadian Collieries Limited, Blairmore, Alberta.

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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.

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Mines Branch
Division of
Mineral Dressing
and
Process Metallurgy

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DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

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M. D. Test Report No. 913-OD.

Heavy-Media Separation Tests on a Sample of Iron Ore from
West Canadian Collieries Limited, Blairmore, Alberta.

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Shipment and Instruction:

Three bags of ore, weighing 286 pounds, were received at the Mines Branch on July 3, 1957. The sample was submitted by Mr. W. Bird, Manager, West Canadian Collieries Limited, Blairmore, Alberta. In a letter dated June 7, 1957 from Mr. Bird, it was stated that this shipment was a composite sample prepared from three different samples of ore previously tested at the Mines Branch and reported in Investigation No. MD3187, April 8, 1957, which gave results of concentration and magnetic roasting tests. Mr. Bird requested

that "Sink and Float" tests be carried out on this sample.

Purpose of Test Work:

Tests were made to determine if gangue, low in iron, could be rejected from the sample by means of Heavy-Media Separation, and to compare the results of these tests with those of magnetic cobbing as described in Investigation Report MD3187, April 8, 1957.

Location of the Property:

The sample was from an area near Burmis, Alberta. The exact locations of the three samples making up this composite sample are given in Investigation No. MD3187.

Sampling and Analysis:

The sample, which, as received, was minus 1 inch material, was quartered in a Jones riffle. One quarter of the sample, weighing approximately 70 pounds, was split into two parts. One part was crushed to 14 mesh and a head sample was cut out by conventional methods. The second part, weighing about 35 pounds was retained for a Sink and Float test.

The analysis of the head sample gave the following results:

| | | |
|---|---|---|
| Iron (total Fe) | - | 37.30 per cent |
| Silica ($SiO_2$) | - | 21.62 " " |
| Titanium dioxide ($TiO_2$) | - | 6.09 " " |
| *Magnetic | - | 46.07 " " |

*The percentage of magnetic material in the sample was determined by a Davis Tube magnetic separation.

Test Work:

The sample of minus 1 inch material, which had been reserved for a

Sink and Float test, was screened on an 8 mesh screen. The minus 8 mesh material, which is not normally amenable to Sink and Float beneficiation, was weighed and assayed. The minus 1 inch plus 8 mesh portion was screened on 7/8, 3/4, 5/8, 1/2 and 3/8 inch mesh screens.

The screened fractions were treated separately in a galena-water medium, having densities of 2.75, 2.80 and 2.85. The "sink" fraction from the lower medium density was treated in the medium at the next higher density in each case. The above density range was chosen because the previous investigation had indicated that the main gangue minerals in the sample were quartz, calcite, dolomite and chlorite having specific gravities varying from less than 2.69 to greater than 2.96.

The products obtained from the test were weighed and assayed. The products from the minus 3/8 inch plus 8 mesh fraction were screened on 3 and 6 mesh respectively and these finer sized fractions assayed separately.

Results of the Sink and Float Test:

| Product | Weight, per cent | Assays, per cent | | | Distribution, per cent | | |
|---|---|---|---|---|---|---|---|
| | | Fe | $TiO_2$ | Mag.* | Fe | $TiO_2$ | Mag. |
| Float @ 2.75 | | | | | | | |
| -1 + 7/8 inch | 0.6 | 6.1 | 1.67 | 2.8 | 0.1 | 0.2 | 0.1 |
| -7/8 + 3/4 " | 0.8 | 11.0 | 1.99 | 6.2 | 0.2 | 0.3 | 0.1 |
| -3/4 + 5/8 " | 0.8 | 11.3 | 1.99 | 8.4 | 0.2 | 0.3 | 0.1 |
| -5/8 + 1/2 " | 0.9 | 15.4 | 2.16 | 11.2 | 0.4 | 0.3 | 0.2 |
| -1/2 + 3/8 " | 0.9 | 15.3 | 2.32 | 10.5 | 0.4 | 0.4 | 0.2 |
| -3/8 inch + 3 mesh | 0.6 | 30.0 | 2.14 | 8.3 | 0.5 | 0.2 | 0.1 |
| -3 + 6 mesh | 1.1 | 17.6 | 2.79 | 13.3 | 0.5 | 0.5 | 0.3 |
| -6 + 8 mesh | 0.9 | 23.5 | 3.59 | 22.8 | 0.6 | 0.5 | 0.5 |
| Av. F @ 2.70 | 6.6 | 16.3 | 2.39 | 11.1 | 2.9 | 2.7 | 1.6 |

(cont'd)

(Results of the Sink and Float Test, cont'd) -

| Product | Weight, per cent | Assays, per cent | | | Distribution, per cent | | |
|---|---|---|---|---|---|---|---|
| | | Fe | $TiO_2$ | Mag.* | Fe | $TiO_2$ | Mag. |
| Float @ 2.80, Sink @ 2.75 | | | | | | | |
| -1 + 7/8 inch | 0.6 | 14.6 | 1.54 | 6.1 | 0.2 | 0.2 | 0.1 |
| -7/8 + 3/4 " | 0.2 | 13.0 | 2.49 | 8.0 | 0.1 | 0.1 | 0.0(3) |
| -3/4 + 5/8 " | 0.4 | 19.9 | 3.44 | 17.7 | 0.2 | 0.3 | 0.2 |
| -5/8 + 1/2 " | 0.4 | 15.5 | 2.19 | 9.2 | 0.2 | 0.2 | 0.1 |
| -1/2 + 3/8 " | 0.3 | 18.5 | 2.73 | 16.6 | 0.2 | 0.1 | 0.1 |
| -3/8 inch + 3 mesh | 0.5 | 18.2 | 2.79 | 15.6 | 0.2 | 0.2 | 0.2 |
| -3 + 6 mesh | 1.1 | 23.6 | 3.80 | 23.8 | 0.7 | 0.7 | 0.5 |
| -6 + 8 mesh | 0.8 | 33.9 | 5.23 | 40.2 | 0.7 | 0.7 | 0.7 |
| Av. F @ 2.80, S @ 2.75 | 4.3 | 21.7 | 3.30 | 20.3 | 2.5 | 2.5 | 1.9 |
| Float @ 2.85, Sink @ 2.80 | | | | | | | |
| -1 + 7/8 inch | 1.2 | 16.1 | 2.06 | 9.9 | 0.5 | 0.4 | 0.3 |
| -7/8 + 3/4 " | 0.1 | 15.7 | 2.94 | 14.2 | 0.1 | 0.1 | 0.0(2) |
| -3/4 + 5/8 " | 0.9 | 17.8 | 2.25 | 14.4 | 0.4 | 0.4 | 0.3 |
| -5/8 + 1/2 " | 0.5 | 24.6 | 3.65 | 22.4 | 0.3 | 0.3 | 0.2 |
| -1/2 + 3/8 " | 0.5 | 26.3 | 4.15 | 24.2 | 0.4 | 0.4 | 0.3 |
| -3/8 inch + 3 mesh | 0.4 | 21.6 | 3.35 | 20.8 | 0.2 | 0.2 | 0.2 |
| -3 + 6 mesh | 0.7 | 27.4 | 4.33 | 29.5 | 0.5 | 0.5 | 0.5 |
| -6 + 8 mesh | 0.6 | 38.2 | 6.00 | 47.2 | 0.7 | 0.7 | 0.7 |
| Av. F @ 2.85, S @ 2.80 | 4.9 | 23.9 | 3.51 | 22.8 | 3.1 | 3.0 | 2.5 |
| Sink @ 2.85 | | | | | | | |
| -1 + 7/8 inch | 17.0 | 41.8 | 6.47 | 51.9 | 19.0 | 19.0 | 19.5 |
| -7/8 + 3/4 " | 12.4 | 41.8 | 6.40 | 53.6 | 13.9 | 13.7 | 14.7 |
| -3/4 + 5/8 " | 11.6 | 41.2 | 6.37 | 51.7 | 12.8 | 12.8 | 13.2 |
| -5/8 + 1/2 " | 9.3 | 42.2 | 6.27 | 52.4 | 10.5 | 10.1 | 10.7 |
| -1/2 + 3/8 " | 8.7 | 43.4 | 6.70 | 54.0 | 9.7 | 10.1 | 10.4 |
| -3/8 inch + 3 mesh | 5.2 | 41.4 | 6.67 | 52.8 | 5.8 | 6.0 | 6.0 |
| -3 + 6 mesh | 5.6 | 43.6 | 6.87 | 55.1 | 6.6 | 6.7 | 6.8 |
| -6 + 8 mesh | 1.3 | 47.2 | 7.43 | 63.0 | 1.6 | 1.7 | 1.8 |
| Av. S @ 2.85 | 71.1 | 41.9 | 6.51 | 53.0 | 79.9 | 80.1 | 83.1 |
| S-F Feed (calc'd) | 86.9 | 38.0 | 5.87 | 46.5 | 88.4 | 88.3 | 89.1 |
| -8 mesh fines | 13.1 | 33.0 | 5.18 | 37.8 | 11.6 | 11.7 | 10.9 |
| Head (calc'd) | 100.0 | 37.3 | 5.78 | 45.4 | 100.0 | 100.0 | 100.0 |

*Magnetics averaging - Fe - 60.6 per cent
$TiO_2$ - 4.4 " "
$SiO_2$ - 5.0 " "

Summary of Results:

| Product | Weight, per cent | Assays, per cent | | | Distribution, per cent | | |
|---|---|---|---|---|---|---|---|
| | | Fe | $TiO_2$ | Mag. | Fe | $TiO_2$ | Mag. |
| S-F Feed (calc'd) | 86.9 | 38.0 | 5.87 | 46.5 | 88.4 | 88.3 | 89.1 |
| Medium Density 2.75 | | | | | | | |
| Float (tailing) | 6.6 | 16.3 | 2.4 | 11.1 | 2.9 | 2.7 | 1.6 |
| Sink | 80.3 | 40.2 | 6.2 | 50.0 | 85.5 | 85.6 | 87.5 |
| Medium Density 2.80 | | | | | | | |
| Float (tailing) | 10.9 | 18.5 | 2.8 | 14.7 | 5.4 | 5.2 | 3.5 |
| Sink | 76.0 | 40.8 | 6.3 | 51.1 | 83.0 | 83.1 | 85.6 |
| Medium Density 2.85 | | | | | | | |
| Float (tailing) | 15.8 | 20.1 | 3.0 | 17.2 | 8.5 | 8.2 | 6.0 |
| Sink | 71.1 | 41.9 | 6.5 | 53.0 | 79.9 | 80.1 | 83.1 |
| -8 mesh Fines | 13.1 | 33.0 | 5.2 | 37.8 | 11.6 | 11.7 | 10.9 |
| Head (calc'd) | 100.0 | 37.3 | 5.8 | 45.4 | 100.0 | 100.0 | 100.0 |

Conclusions:

The results from the Sink and Float test indicate that Heavy-Media Separation does not appear to be a very attractive method for rejecting sufficient gangue rock, low in iron, from the ore. At a medium density of 2.75, only 6.6 per cent of the sample floated, containing 2.9 per cent of the iron in the ore. When the density of the medium was raised to 2.85, 15.8 per cent of the ore was rejected as gangue rock containing 8.5 per cent of the iron. The iron losses in the float product at this higher density represented about 6 per cent of the magnetite in the ore.

The results from this test work were nearly similar to those obtained by magnetic cobbing as previously tested on this ore. However, the results from magnetic cobbing, in which 12 per cent of the ore was rejected as gangue containing 5.3 per cent of the iron, were slightly better. Close examination of both results indicate that iron losses are relatively high in gangue rejected above a fineness of about 10 mesh.

There are two main reasons for poor results from Heavy-Media Separation. The first is that the magnetite is finely disseminated throughout the gangue with the result that very little clean gangue is present in the coarse rock sizes. The second reason is that Heavy-Media Separation is not normally amenable for rejecting gangue of varying specific gravities. This was the case with this ore where the density of the medium had to be high enough to float gangue minerals like dolomite, calcite and chlorite, but at this density a gangue mineral of lower specific gravity like quartz, but containing numerous inclusions of magnetite, is also floated.

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RWB:(PES)VB

R. W. Bruce