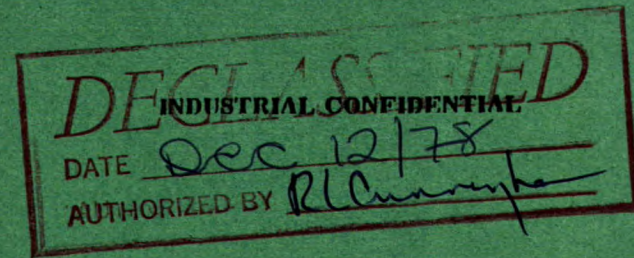


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CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 67-17

**CONCENTRATION OF MAGNETITE ORE  
FROM JAYBEE LANDRY EXPLORATION  
AND MINING COMPANY LIMITED,  
SUDBURY, ONTARIO**

by

**T. O. LLEWELLYN**

**MINERAL PROCESSING DIVISION**

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SUMMARY OF RESULTS

The investigation showed that cobbing at coarse sizes (Tests 1 and 2) did not produce an acceptable shipping product.

By cobbing at -10 mesh, a 98.42% recovery with a grade of 60.0% iron was obtained. This cobbled concentrate was re-ground to pass a 100 mesh screen and subjected to a second stage of magnetic concentration. An overall recovery of 96.97% with a grade of 68.77% iron was obtained.

Other tests showed a decrease of less than 0.5% in recovery when the fineness of grinding was increased from 10 to 48 mesh before wet cobbing but the grade of concentrate increased over 5% to 65.2% iron at 48 mesh. These cobbled concentrates were further ground to pelletizing size and concentrated, producing a final product with a grade better than 70.0% iron. The copper content did not exceed 0.01%.

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## INTRODUCTION

Shipment

On August 16, 1966, a shipment of iron ore, weighing 525 lb., was received at the Mines Branch laboratories from Mr. J. Bardswich, Managing Director, Jaybee Landry Exploration and Mining Company Limited, Sudbury, Ontario.

Location of Property

The shipment was from a property which is located in Hess Township within a mile of the village of Cartier, Sudbury Mining Division, Sudbury, Ontario.

Description of Property

In his letter dated July 25, 1966, Mr. Bardswich mentioned that a dip needle survey of the deposit suggests a potential of 6,000 to 8,000 tons per vertical foot. Deepest penetration to date was 76 feet vertically in orebody. It was also mentioned that there is a possibility of finding other similar occurrences on the property.

Purpose of the Investigation

The following information was requested:

- 1 Feasibility of producing an acceptable shipping product by crushing, screening and magnetic concentration in the minus 2 inches plus 3/8 inch size.
- 2 Determine the degree of grinding, followed by magnetic concentration, required to produce an acceptable concentrate.
- 3 Copper content of concentrates.

Sampling and Analysis of the Shipment

Because coarse cobbing tests were requested, the shipment was not crushed and sampled according to standard procedures. After the initial coarse cobbing test the products were weighed, crushed and sampled for test analysis. After a second stage of crushing the fractions were recombined in proportion to their initial weights and a representative head sample was riffled out for chemical analysis.

The analysis of the head sample is reported in Table 1.

TABLE 1

Chemical Analysis of Head Sample

| Constituents | %     |
|--------------|-------|
| Total iron   | 51.30 |
| Soluble iron | 50.80 |
| Silica       | 8.57  |
| Sulphur      | 0.091 |
| Phosphorus   | 0.02  |
| Copper       | 0.036 |

Note: Analyses in the tables below are for soluble iron.

Test Procedure

As requested, the ore was crushed to minus 2 in., and screened on a 3/8 in. mesh screen producing two fractions, one minus 2 in. plus 3/8 in. and the other minus 3/8 in. The minus 2 in. plus 3/8 in. fraction was dry cobbled (Test 1) which produced a concentrate, middling and tailing with the percentage weight and assay shown in Table 2.

The minus 3/8 in. fraction was weighed and then sampled for analysis of soluble iron and the results included in Table 2.

A series of cobbing tests were carried out at different particle sizes. These cobbled concentrates were reground to various sizes and subjected to a second stage of concentration.

Test 2 Magnetic Cobbing at -1 In.

Each of the three products of Test 1 was crushed to minus 1 inch. A sample for assay was riffled from each product. The rejects of these three products were combined with a proportional weight of the -3/8 in. fraction of the original sample for further treatment. The combined product was split into two parts. One fraction was used in Test 2 and the other fraction was used in Tests 3 and 4. In Test 2, the material was concentrated by the Ball-Norton dry belt separator producing a concentrate, a middling and a tailing. For sampling purposes each product was crushed to minus 1/4 in. and riffled to give a sample for assay and a reject. The results of Test 2 are shown in Table 3.

TABLE 2

Results of Dry Cobbing at -2 in. + 3/8 In.  
(Ball Norton Separator)

Test 1

| Product           | %<br>Weight | %<br>Fe | % Fe<br>Distribution |
|-------------------|-------------|---------|----------------------|
| Mag concentrate   | 56.40       | 53.40   | 60.05                |
| Middling          | 19.80       | 49.00   | 19.34                |
| Tailing           | 8.00        | 29.80   | 4.74                 |
| -3/8 in. fraction | 15.80       | 50.40   | 15.87                |
| Head *            | 100.00      | 50.16   | 100.00               |

\* Calculated

TABLE 3

Results of Dry Cobbing at -1 In.

Test 2

| Product         | %<br>Weight | %<br>Fe | % Fe<br>Distribution |
|-----------------|-------------|---------|----------------------|
| Mag concentrate | 47.77       | 56.1    | 53.35                |
| Middling        | 38.06       | 51.3    | 38.86                |
| Tailing         | 14.17       | 27.6    | 7.79                 |
| Head *          | 100.00      | 50.23   | 100.00               |

\* Calculated

Test 3 Dry Cobbing at -1/4 In.

The second portion of the -1 in. sample was crushed to -1/4 inch. A small fraction was removed by riffing for Test 3. The remainder of the material was crushed to -10 mesh for subsequent tests. From the -10 mesh material a head sample was riffled out for assay. Results of Test 3 are shown in Table 4.

TABLE 4  
Results of Dry Cobbing at -1/4 In.

Test 3

| Product         | % Weight | % Fe  | % Fe Distribution | R/C    |
|-----------------|----------|-------|-------------------|--------|
| Mag concentrate | 86.91    | 57.0  | 97.25             | 1.15:1 |
| Tailing         | 13.09    | 10.7  | 2.75              |        |
| Head *          | 100.00   | 50.94 | 100.00            |        |

\* Calculated

TABLE 5  
Results of Screen Test on Tailing Test 3

| Mesh           | % Weight |
|----------------|----------|
| -1/4 in. + 6 M | 22.90    |
| -6 in. + 8 M   | 7.63     |
| -8 in. +10 M   | 8.02     |
| -10 M          | 61.45    |
| Total          | 100.00   |

Test 4 Wet Magnetic Cobbing at -10 m

About 3200 grams of the -10 m material was riffled out for Test 4. The results of Sala wet magnetic separation are given in Table 6. A screen test was made on the concentrate.

TABLE 6

Results of Wet Magnetic Cobbing at -10 m

Test 4

| Product         | % Weight | % Fe  | % Fe Distribution | R/C   |
|-----------------|----------|-------|-------------------|-------|
| Mag concentrate | 83.10    | 60.00 | 98.42             | 1.2:1 |
| Tailing         | 16.90    | 4.75  | 1.58              |       |
| Head *          | 100.00   | 50.66 | 100.00            |       |

\* Calculated

TABLE 7

Results of Screen Test on Concentrate Test 4

| Mesh    | % Weight | % Acum |
|---------|----------|--------|
| -10+14  | 17.05    | 17.05  |
| -14+20  | 21.00    | 38.05  |
| -20+28  | 13.20    | 51.25  |
| -28+35  | 10.70    | 61.95  |
| -35+48  | 7.85     | 69.80  |
| -48+65  | 7.15     | 76.95  |
| -65+100 | 6.95     | 83.90  |
| -100    | 16.10    | 100.00 |
| Total   | 100.00   | -      |

Test 5 Magnetic Concentration at -100m

Microscopic examination, of the screen fractions of Test 4 cobbed concentrate, showed the presence of a quantity of unliberated material. This cobbed concentrate was stage ground to -100 mesh and then concentrated by the Jeffrey-Steffensen 3 drum separator. The results are given in Table 8.

TABLE 8

Results of Magnetic Concentration at -100m

Test 5

| Product                    | % Weight |          | Analysis % |      |                  |      |      | % Distribution Fe (cal) |          | R/C<br>in<br>Original<br>Feed |
|----------------------------|----------|----------|------------|------|------------------|------|------|-------------------------|----------|-------------------------------|
|                            | Test     | Original | Fe         | Cu   | SiO <sub>2</sub> | S    | P    | Test                    | Original |                               |
| Combined *<br>Conc + Midds | 84.63    | 70.33    | 68.77      | 0.01 | 3.29             | 0.02 | 0.02 | 98.53                   | 96.97    | 1.42:1                        |
| Mag concentrate            | 82.68    | 68.71    | 69.00      | 0.01 | 3.04             | 0.02 | 0.02 | 96.58                   | 95.05    | 1.46:1                        |
| Middling                   | 1.95     | 1.62     | 59.00      | 0.02 | 13.79            | 0.02 | 0.02 | 1.95                    | 1.92     |                               |
| Tailing                    | 15.37    | 12.77    | 5.65       | -    | -                | -    | -    | 1.47                    | 1.45     |                               |
| Head                       | 100.00   | 83.10    | 60.00      | -    | -                | -    | -    | 100.00                  | 98.42    | -                             |

\* Calculated

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TABLE 9  
Results of Screen Test on Concentrate - Test 5

| Mesh     | %<br>Weight | %<br>Acum |
|----------|-------------|-----------|
| -100+150 | 25.95       | 25.95     |
| -150+200 | 27.70       | 53.65     |
| -200+270 | 9.05        | 62.70     |
| -270+325 | 8.90        | 71.60     |
| -325     | 28.40       | 100.00    |
| Total    | 100.00      | -         |

Tests 7 to 9 Cobbing at -10, -28, and -48 m

The following three tests were carried out to determine the effect on the recovery by cobbing the material crushed to pass three different size screens. Three separate samples were crushed and ground to -10m, -28m, and -48m, respectively, and passed through the Sala Magnetic Separator. The results are given in Table 10. A screen test was made of each concentrate.

TABLE 10  
Results of Cobbing at -10, -28, and -48 m

Test 7                      Feed -10 m Ore

| Product         | %<br>Weight | %<br>Fe | % Fe<br>Distribution | R/C    |
|-----------------|-------------|---------|----------------------|--------|
| Mag concentrate | 84.37       | 59.20   | 98.46                | 1.18:1 |
| Tailing         | 15.63       | 5.00    | 1.54                 |        |
| Head *          | 100.00      | 50.73   | 100.00               |        |

Test 8                      Feed -28 m Ore

|                 |        |       |        |        |
|-----------------|--------|-------|--------|--------|
| Mag concentrate | 79.90  | 62.40 | 98.11  | 1.25:1 |
| Tailing         | 20.10  | 4.80  | 1.89   |        |
| Head *          | 100.00 | 50.82 | 100.00 |        |

\* Calculated

(cont'd)

TABLE 10 (concl'd)

| Test 9          |       | Feed -48 m Ore |        |        |
|-----------------|-------|----------------|--------|--------|
| Mag concentrate | 76.20 | 65.20          | 98.01  | 1.31:1 |
| Tailing         | 23.80 | 4.25           | 1.99   | -      |
| Head *          | -     | 50.69          | 100.00 | -      |

\* Calculated

TABLE 11

Results of Screen Test on Concentrates

Test 7

| Mesh     | %<br>Weight | %<br>Acum |
|----------|-------------|-----------|
| -10 +14  | 14.45       | 14.45     |
| -14 +20  | 19.10       | 33.55     |
| -20 +28  | 13.30       | 46.85     |
| -28 +35  | 11.20       | 58.05     |
| -35 +48  | 8.70        | 66.75     |
| -48 +65  | 8.60        | 75.35     |
| -65 +100 | 7.60        | 82.95     |
| -100     | 17.05       | 100.00    |
| Total    | 100.00      | -         |

Test 8

| Mesh     | %<br>Weight | %<br>Acum |
|----------|-------------|-----------|
| -28 +35  | 22.10       | 22.10     |
| -35 +48  | 19.70       | 41.80     |
| -48 +65  | 16.25       | 58.05     |
| -65 +100 | 13.40       | 71.45     |
| -100     | 28.55       | 100.00    |
| Total    | 100.00      | -         |

(cont'd)

TABLE 11 (concl'd)

Test 9

| Mesh      | %<br>Weight | %<br>Acum |
|-----------|-------------|-----------|
| -48 +65   | 28.75       | 28.75     |
| -65 +100  | 25.20       | 53.95     |
| -100 +150 | 14.25       | 68.20     |
| -150 +200 | 11.40       | 79.60     |
| -200 +325 | 7.45        | 87.05     |
| -325      | 12.95       | 100.00    |
| Total     | 100.00      | --        |

Test 7B to 9B

The cobbled magnetic concentrates of Tests 7, 8 and 9 were reground to 79.5%, 70.2% and 64.5% minus 325 mesh, respectively, and subjected to a second stage of concentration in the Jeffrey separator. The results are shown in Table 12. A screen test was made of each concentrate.

TABLE 12

Results of Magnetic Concentration

## Test 7-B

| Product                   | % Weight |          | Analysis % |       |                  |       |      | % Distribution Fe |          | R/C in Original Feed |
|---------------------------|----------|----------|------------|-------|------------------|-------|------|-------------------|----------|----------------------|
|                           | Test     | Original | Fe         | Cu    | SiO <sub>2</sub> | S     | P    | Test              | Original |                      |
| Mag. concentrate          | 80.93    | 68.28    | 70.7       | 0.01  | 0.79             | 0.02  | 0.01 | 95.15             | 93.68    | 1.46:1               |
| Middling                  | 2.62     | 2.21     | 66.6       | 0.012 | 5.30             | 0.028 | 0.02 | 2.89              | 2.85     |                      |
| Tailing                   | 16.45    | 13.88    | 7.2        |       |                  |       |      | 1.96              | 1.93     |                      |
| Head                      | 100.00   | 84.37    | 59.2       |       |                  |       |      | 100.00            | 98.46    |                      |
| Combined *<br>Conc + Midd | 83.55    | 70.49    | 70.57      | 0.01  | 0.93             | 0.02  | 0.01 | 98.04             | 96.53    | 1.42:1               |

## Test 8-B

|                           |        |       |       |       |      |       |      |        |       |        |
|---------------------------|--------|-------|-------|-------|------|-------|------|--------|-------|--------|
| Mag. concentrate          | 85.00  | 67.91 | 70.5  | 0.009 | 0.78 | 0.011 | 0.02 | 95.76  | 93.95 | 1.47:1 |
| Middling                  | 2.49   | 1.99  | 66.0  | 0.012 | 5.91 | 0.031 | 0.02 | 2.62   | 2.57  |        |
| Tailing                   | 12.51  | 10.00 | 8.1   |       |      |       |      | 1.62   | 1.59  |        |
| Head                      | 100.00 | 79.90 | 62.4  |       |      |       |      | 100.00 | 98.11 |        |
| Combined *<br>Conc + Midd | 87.49  | 69.90 | 70.36 | 0.009 | 0.92 | 0.011 | 0.02 | 98.38  | 96.52 | 1.43:1 |

## Test 9-B

|                           |        |       |       |       |      |       |      |        |       |        |
|---------------------------|--------|-------|-------|-------|------|-------|------|--------|-------|--------|
| Mag. concentrate          | 90.66  | 69.08 | 70.20 | 0.009 | 1.19 | 0.012 | 0.02 | 96.61  | 94.69 | 1.45:1 |
| Middling                  | 2.32   | 1.77  | 65.60 | 0.014 | 7.45 | 0.024 | 0.02 | 2.31   | 2.26  |        |
| Tailing                   | 7.02   | 5.35  | 10.05 |       |      |       |      | 1.08   | 1.06  |        |
| Head                      | 100.00 | 76.20 | 65.20 |       |      |       |      | 100.00 | 98.01 |        |
| Combined *<br>Conc + Midd | 92.98  | 70.85 | 70.08 | 0.009 | 1.35 | 0.012 | 0.02 | 98.92  | 96.95 | 1.41:1 |

\* Calculated

TABLE 13  
Results of Screen Tests on Concentrates

| Mesh  | Test 7-B | Test 8-B | Test 9-B |
|-------|----------|----------|----------|
|       | % Weight | % Weight | % Weight |
| +200  | 4.5      | 9.1      | 15.1     |
| +325  | 16.0     | 20.7     | 20.4     |
| -325  | 79.5     | 70.2     | 64.5     |
| Total | 100.0    | 100.0    | 100.0    |

#### CONCLUSIONS

Results of the investigation showed that cobbing of coarse sizes (-2 in. + 3/8 in. and -1 in.) did not produce an acceptable cobbed concentrate.

By cobbing at -10 mesh a 98.42% recovery with a grade of 60.00% iron was obtained. Regrinding this cobbed concentrate to -100 mesh and then concentration by the Jeffrey-Steffensen Separator produced an overall recovery of 96.97% with a grade of 68.77% iron.

Other tests showed slight effect upon the recovery if cobbing was accomplished at -10 m, -28 m, or 48m. By regrinding these cobbed concentrates to pelletizing size and a second stage of magnetic concentration, a final product with an overall recovery of more than 96.5% and a grade better than 70.0% iron was obtained.

#### ACKNOWLEDGEMENT

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