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DEPARTMENT OF MINES AND TECHNICAL SURVEYS

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MINES BRANCH INVESTIGATION REPORT IR 59-83

DAVIS TUBE TESTS ON TWO SAMPLES OF IRON ORE FROM DARLING TOWNSHIP, ONTARIO, SUBMITTED BY MR. W. L. BEATON, NORTH AUGUSTA, ONTARIO

by

J. L. GIROUX

MINERAL PROCESSING DIVISION

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SUMMARY OF RESULTS

At -200 mesh, the concentrate of the low grade sample assayed 65.72% Fe, but the recovery was only 18.6% at this size fraction.

At the same mesh, the concentrate of the high grade sample assayed 66.02% Fe, and the recovery was 45.25%.

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INTRODUCTION

Shipment and Instructions:

Two samples of iron ore were brought to the Mines Branch laboratories on June 23, 1959, by Mr. W. L. Beaton, North Augusta, Ont. One sample was designated high grade and weighed 264 lb, the other was designated low grade and weighed 108 lb.

Mr. Beaton asked to have Davis tube tests made for the purpose of determining the grade of concentrate and the recovery that could be obtained by this means.

Location of Property:

These samples were taken from lot 17, Darling township, Lanark county, Ontario, about 50 miles west of Ottawa.

Sampling and Analysis:

From these two lots of iron ore, representative samples were obtained for a mineralogical examination.

Each sample was then crushed to -14 mesh and from each of them, a head sample was cut for chemical analysis. The samples were assayed and reported as follows:

Low grade sample -

Total Fe	16.54%
Fe in Insol.	2.20%
Acid Sol. Fe	14.34%
Insoluble	68.00%

High grade sample -

Total Fe	30.42%
Fe in Insol.	6.30%
Acid Sol. Fe	24.12%
Insoluble.	59.28%

ORE MINERALOGY REPORT*

Samples, Purpose and Method

Four polished sections, two from each sample, were prepared and examined microscopically in order to determine the characteristics of the ores. All mineral identifications are based on the microscopic study and on X-ray diffraction patterns of powder samples taken from the polished sections.

High Grade Sample

In the polished sections, gangue consists of a medium to fine grained assemblage of amphibole (grunerite), albite, quartz and zircon and bears a few local light brown stains of iron oxides.

To unaided eyes, metallic minerals are distributed rather finely and evenly throughout rock as irregular grains and small granular aggregates in both polished sections. Although moderately abundant in each polished surface, metallic mineralization would not occupy more than 50 percent by volume at most. Each mounted specimen is attracted to the poles of a small horseshoe magnet brought close to its polished surface.

Under a microscope, magnetite is seen to be the only abundant ore mineral in the two polished sections. It is disseminated through gangue as medium coarse to fine anhedral grains and subhedral crystals which sometimes form small granular masses. Magnetite particles enclose rare small inclusions of gangue and a small proportion of them occur in fine-grain sizes. An approximately average field is pictured in Figure 1.

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* Ore Mineralogy Report No. M-1672-E, July 23, 1959, by W. E. White

Comparatively small quantities of goethite and hematite are visible as irregular particles in gangue and as narrow borders along some grains of magnetite. One tiny particle of pyrite, about 20 microns (+800 mesh) in size and two small grains of ilmenite are also present in the two polished sections. All three grains of these two minerals are alone in gangue and are not intimately associated with magnetite. Because of its similar appearance to magnetite in polished section, ilmenite may be somewhat more abundant than the two grains identified by the writer. Nevertheless, as represented in the two polished sections, these two minerals (pyrite and ilmenite) are present in very small amounts.

Low Grade Sample

When viewed with the naked eye, these two polished sections appear very similar to those prepared from the high grade sample, except that they are not nearly so well mineralized. In fact, metallic minerals appear to be almost entirely absent in one of them and neither is attracted by a small horseshoe magnet, even when its poles touch the polished surface.

Under a microscope, ilmenite proves to be the most abundant ore mineral in the polished sections as occasional small anhedral grains which range up to 2.5 mm (-6+8 mesh) in size. Some particles of ilmenite enclose small inclusions of gangue and show narrow twinning lamellae.

Magnetite particles are not so prevalent as those of ilmenite in the two polished sections and are generally smaller in size. They usually occur alone in gangue but are intimately associated with ilmenite in two or three places.

Goethite and pyrite are present as in the high grade

sample but no hematite was seen in the two polished sections. Pyrite is relatively more abundant than in the previous sample. The writer saw about a dozen small grains of iron sulphide, ranging up to 90 microns (-150+200 mesh) in size, in these two sections. Most of them are in gangue but two or three are in ilmenite.

Gangue material is composed of essentially the same minerals as in the high grade sample.

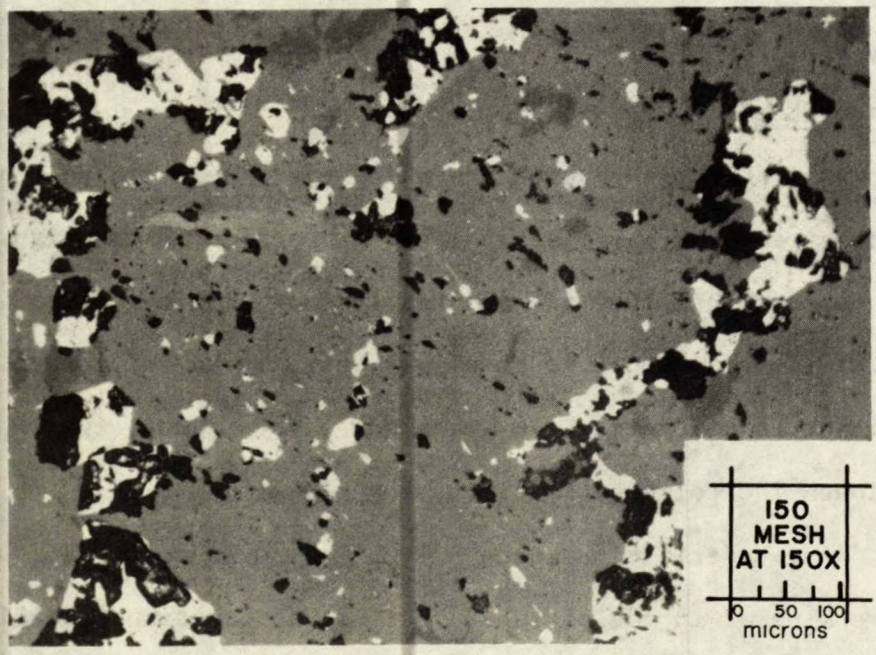

Figure 1

Photomicrograph of typical field in polished sections of high grade sample showing magnetite (white) in gangue (various shades of gray); polishing pits are black.

Details of Investigation:

From each of the two samples submitted, a portion was cut out and screened on 65, 100, 150, and 200 mesh screens and each of the fractions was put through a Davis tube; the concentrates and tailings were assayed for Fe and Insoluble.

The screen size distribution was as follows:

	High Grade Sample, Wt, %	Low Grade Sample, Wt, %
-35 +65 mesh	29.03	34.67
-65+100 "	10.75	11.40
-100+150 "	9.50	9.38
-150+200 "	10.68	9.53
-200 "	40.04	35.02
Total	100.00	100.00

Davis Tube Test Results:

Low Grade Sample: Test No. 1

-35+65 mesh

Product	Weight, %	Assay, %		Distribution in Size Fraction, %	
		Fe	Insol.	Fe	Insol.
Conc.	8.10	28.12	54.32	18.45	6.56
Tailing	91.90	11.92	74.12	81.55	93.44
Total	100.00	13.43	72.98	100.00	100.00

-65+100 mesh

Conc.	6.67	36.62	46.64	19.42	4.51
Tailing	93.33	10.88	75.76	80.58	95.49
Total	100.00	12.59	73.89	100.00	100.00

-100+150 mesh

Conc.	6.32	46.78	30.48	24.79	2.63
Tailing	93.68	9.60	76.24	75.21	97.37
Total	100.00	11.96	73.43	100.00	100.00

Davis Tube Test Results: (cont'd)

Low Grade Sample: Test No. 1

-150+200 mesh

Product	Weight, %	Assay, %		Distribution in Size Fraction, %	
		Fe	Insol.	Fe	Insol.
Conc.	6.37	53.78	21.04	24.60	1.95
Tailing	93.63	11.24	72.12	75.40	98.05
Total	100.00	13.95	68.84	100.00	100.00

-200 mesh

Conc.	3.89	65.72	7.24	18.60	0.26
Tailing	96.11	11.60	73.12	81.40	99.74
Total	100.00	13.76	70.88	100.00	100.00

Davis Tube Test Results:

Low Grade Sample: Test No. 1

On the Basis of Original Ore

Product	Weight, %	Assay, %		Distribution Total Feed, %	
		Fe	Insol.	Fe	Insol.
-35+65					
Conc.	3.06	28.12	54.32	6.46	2.32
Tailing	31.61	11.92	74.12	28.30	32.69
-65+100					
Conc.	0.76	36.62	46.64	2.09	0.49
Tailing	10.64	10.88	75.76	8.70	11.25
-100+150					
Conc.	0.59	46.78	30.48	2.07	0.25
Tailing	8.79	9.60	76.24	6.34	9.35
-150+200					
Conc.	0.61	53.78	21.04	2.47	0.18
Tailing	8.92	11.24	72.12	7.53	8.98
-200 mesh					
Conc.	1.36	65.72	7.24	6.71	0.14
Tailing	33.66	11.60	73.12	29.33	34.35
Feed (cal.)	100.00	13.31	71.66	100.00	100.00

Average Grade of Concentrates - 41.33% Fe
- 37.98% Insol.
Rec. in Conc. - 19.80%
Average Grade of Tailing - 11.40% Fe
- 73.96% Insol.

Davis Tube Test Results:

High Grade Sample: Test No. 2

-35+65 mesh

Product	Weight, %	Assay, %		Distribution in Size Fraction, %	
		Fe	Insol.	Fe	Insol.
Conc.	32.4	32.28	55.68	51.30	27.08
Tailing	67.6	14.70	73.36	48.70	72.92
Total	100.0	20.43	68.00	100.00	100.00

-65+100 mesh

Conc.	29.15	38.38	47.28	66.05	20.90
Tailing	70.85	8.12	73.92	33.95	79.10
Total	100.00	16.95	66.05	100.00	100.00

-100+150 mesh

Conc.	26.45	49.60	30.32	53.70	12.91
Tailing	73.55	15.38	73.64	46.30	87.09
Total	100.00	24.44	62.24	100.00	100.00

-150+200 mesh

Conc.	24.75	60.70	16.52	53.00	7.31
Tailing	75.25	17.64	69.12	47.00	92.69
Total	100.00	28.15	56.10	100.00	100.00

-200 mesh

Conc.	14.40	66.02	7.04	45.25	1.50
Tailing	85.60	13.32	76.60	54.75	98.50
Total	100.00	20.98	67.01	100.00	100.00

Davis Tube Test Results:

High Grade Sample: Test No. 2
On the Basis of Original Ore

Product	Weight, %	Assay, %		Distribution in Feed, %	
		Fe	Insol.	Fe	Insol.
-35+65					
Conc.	9.41	32.28	55.68	14.17	8.02
Tailing	19.62	14.70	73.36	13.45	22.04
-65+100					
Conc.	3.13	38.38	47.28	5.60	2.27
Tailing	7.62	8.12	73.92	2.89	8.62
-100+150					
Conc.	2.51	49.60	30.32	5.81	1.17
Tailing	6.99	15.38	73.64	5.02	7.88
-150+200					
Conc.	2.64	60.20	16.52	7.41	0.67
Tailing	8.04	17.64	69.12	6.58	8.51
-200 mesh					
Conc.	5.77	66.02	7.04	17.77	0.62
Tailing	34.27	13.32	76.60	21.30	40.20
Feed (Cal.)	100.00	21.44	65.30	100.00	100.00

Average Grade of Concentrates - 50.97% Fe
- 35.48% Insol.
Rec. in Conc. - 55.76%
Average Grade of Tailing - 12.39% Fe
- 74.45% Insol.

The different recovery figures given in the two sets of tables may appear confusing at first glance, but it should be remembered that those given in the first table of each set refers to the individual size fractions and the second set refers to complete ore sample, all of the size fractions having been re-combined to represent the original samples.

Conclusions and Discussion:

The low grade sample did not give satisfactory results, as the highest Fe recovery, in the concentrate, was only 24.79%. At -200 mesh, the concentrate assayed 65.72% Fe, but the recovery was 18.6%.

The high grade sample gave better results, but while at -200 mesh the concentrate assayed 66.02% Fe, the recovery was only 45.25%.

In both samples, at -200 mesh, the Insoluble was very low in the concentrate. This indicates that the ore would require grinding to -200 mesh in order to produce a satisfactory grade of concentrate.