# GM 14259

REPORT ON MAGNETIC CONCENTRATION OF BEACH SANDS FROM NEAR THE JUNCTION OF THE BATISCAN AND ST LAWRENCE RIVERS (INVESTIGATION REPORT IR 60-71)

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 60-71

# MAGNETIC CONCENTRATION OF BEACH SANDS FROM NEAR THE JUNCTION OF THE BATISCAN River AND ST. LAWRENCE RIVERS, P.Q.

CANADA IRON FOUNDRIES LTD.



by

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MINERAL PROCESSING DIVISION

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# MAGNETIC CONCENTRATION OF BEACH SANDS FROM NEAR THE JUNCTION OF THE BATISCAN AND ST. LAWRENCE RIVERS, P. Q.

by

W. S. Jenkins*

## SUMMARY OF RESULTS

The magnetite content of the sands could be recovered by a low intensity magnetic separator in a concentrate assaying, total iron 68.6%, acid soluble iron 67.82%, $TiO_2$ 2.12%, Silica 1.35%. The recovery as soluble iron was 68.1%. The ratio of concentration was 4.4:1.

Reconcentration of the low intensity concentrate at -200 mesh produced a concentrate assaying, soluble iron 70.8% and $TiO_2$ 1.54%.

No vanadium was found in the concentrates.

A high intensity concentrate assayed, total iron 36.3%, soluble iron 23.6%, $TiO_2$ 31.28%, Silica 9.96%. The recoveries of soluble iron and $TiO_2$ were 25.5% and 86.1% in terms of original feed. The overall ratio of concentration was 4.1:1.

A small amount of zircon and a few grains of rutile were seen in the high intensity tailing.

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# INTRODUCTION

## Shipment

The shipment of beach sand, net weight 980 g, was received at the Mines Branch laboratories on April 13, 1960, from Mr. J. E. Rehder, Vice President, Technology, Canada Iron Foundries Ltd., 921 Sun Life Building, Montreal, P. Q.

## Location of the Property

The property is located on the north shore of the St. Lawrence river near the junction of the Batiscan and St. Lawrence rivers.

## Description of the Property

The property consists of approximately 3000 ft of beach, which has been staked at present. The sample is composed of grab samples taken along about 1000 ft of the beach.

## Purpose of the Investigation

In his letter, dated 8th April, 1960, Mr. Rehder requested information as follows, "the iron content of the sample easily separable, whether there are

appreciable amounts of titanium, zirconium or other metals present, and whether they are free or bound with the iron".

## SAMPLING AND ANALYSIS

The +10 mesh portion of the sample, as pebbles of various sizes, was screened out and rejected. The weight of this portion of the sample was 10 g.

The remainder of the sample, 970 g, was concentrated by magnetic separators and the products were analysed. A calculated head analysis was obtained by this method, as follows:

| | |
|---|---|
| Total Iron | 28.6% |
| Soluble Iron | 22.6% |
| Titanium Dioxide | 8.86% |

A semi-quantitative spectrographic analysis was made on the final tailing, which contained the following elements in order of decreasing abundance:

| | |
|---|---|
| Major | Si, Fe, Al, Ca |
| Intermediate | Mg, Na |
| Minor | Ti, W, Ba, Mn, Zr |
| Trace | Ni, Sr, Cu, Cr, Co, V, Be, Cd |

## DETAILS OF THE TESTS

Test No. 1

The -10 mesh sands were concentrated by the Ball Norton low-intensity, dry, magnetic separator. A concentrate and tailing were produced.

Test No. 2

The Ball Norton tailing was concentrated by a Stearns high-intensity, dry, magnetic separator. A concentrate, middling and tailing were produced.

Test No. 3

The Ball Norton concentrate was ground to -200 mesh and concentrated by a Davis tube separator. A concentrate and a tailing were produced.

## MINERALOGICAL EXAMINATION OF THE PRODUCTS OF MAGNETIC CONCENTRATION

Ball Norton Concentrate, Test No. 1

This sample consists largely of magnetite, with small amounts of ilmenite, hematite and gangue minerals. The majority of the magnetite grains appear to be free of

other attached minerals, although some of them contain narrow ilmenite lamellae down to a few microns in diameter. An appreciable amount of the ilmenite, however, appears to be associated with hematite in grains containing little or no magnetite. Almost all the gangue particles contain attached or included magnetite, which is probably responsible for them being drawn into the concentrate.

Stearns Concentrate, Test No. 2

About 60% of this sample, by weight, consists of mutually intergrown ilmenite and hematite. These grains vary from hematite with ilmenite lamellae to ilmenite with hematite lamellae. The lamellae range downward in size to a micron or less in thickness. The remainder of the sample consists largely of the gangue minerals hornblende, pyroxene, quartz, and feldspar. The hornblende and pyroxene have probably been drawn into this concentrate because they contain sufficient chemically combined iron; the quarts and feldspar contain tiny inclusions of magnetite, which obviously have been sufficient to account for their inclusions. The sample also contains a small amount of garnet, which may have been physically entrained.

Stearns Middling, Test No. 2

This product consists of about 40% garnet by weight. The other minerals are chiefly ilmenite-hematite,

because they contain sufficient chemically combined iron; the quartz and feldspar contain tiny inclusions of magnetite, which obviously have been sufficient to account for their inclusion. The sample also contains a small amount of garnet, which may have been physically entrained.

Stearns Middling, Test No. 2

This product consists of about 40% garnet by weight. The other minerals are chiefly ilmenite-hematite, hornblende, and pyroxene. Small amounts of quartz, feldspar, and magnetite are also present, the last one largely as inclusions in the gangue minerals.

Stearns Tailing, Test No. 2

This product consists largely of quartz and feldspar, with an appreciable amount of hornblende. Small amounts of garnet, pyroxene and zircon are also present. The amount of zircon in this product is estimated to be about 0.3%. A few grains of rutile were also observed.

Conclusions

The effects of the concentration procedure can be summarized as follows: the magnetite is strongly concentrated by the Ball Norton separator; the ilmenite and hematite are preferentially drawn into the Stearns concentrate, the garnet into the Stearns middling product, and the quartz, feldspar, and zircon into the Stearns tailing. The hornblende and pyroxene are found in all of the Stearns products, probably because they possess distinct ranges in iron contents.*

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* E.H. Nickel, Internal Report MS-60-60, June 23,1960, Mineral Sciences Division.

## TABLE 1

### Results of Magnetic Concentration

Test No. 1-Low Intensity Separation by the Ball-Norton Separator

Feed - 10 Mesh Sands as Received

| Product | Weight % | | Analysis % | | | | | Distribution % | | | | | | Ratio Of Concentration Orig. Feed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | In Test | | | In Original Feed | | | |
| | In Test | In Orig. Feed | Total Fe | Sol. Fe | $TiO_2$ | $SiO_2$ | $V_2O_5$ | Total Fe | Sol. Fe | $TiO_2$ | Total Fe | Sol.Fe | $TiO_2$ | |
| Feed | 100.0 | | 28.6 | 22.6 | 8.86 | | | 100.0 | 100.0 | 100.0 | | | | |
| Mag.Conc. | 22.7 | | 68.82 | 67.82 | 2.12 | 1.35 | N.D. | 54.7 | 68.1 | 5.4 | | | | 4.4:1 |
| Tailing | 77.3 | | 16.72 | 9.32 | 10.84 | - | - | 45.3 | 31.9 | 94.6 | | | | |

Test No. 2 - High Intensity Separation of Ball-Norton Tailing By The Stearns Separator

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feed | 100.0 | 77.3 | 16.72 | 9.32 | 10.84 | | | 100.0 | 100.0 | 100.0 | 45.3 | 31.9 | 94.6 | |
| Conc. | 31.56 | 24.40 | 36.30 | 23.60 | 31.28 | 9.96 | Trace | 68.4 | 79.9 | 91.1 | 31.0 | 25.5 | 86.1 | 4.1:1 |
| Middling | 6.94 | 5.36 | 25.24 | 8.70 | 8.74 | 54.74 | Trace | 10.5 | 6.5 | 5.6 | 4.7 | 2.1 | 5.3 | |
| Tailing | 61.50 | 47.54 | 5.75 | 2.06 | 0.59 | - | - | 21.1 | 13.6 | 3.3 | 9.6 | 4.3 | 3.2 | |

Test No.3 - Davis Tube Concentration of -200 Mesh Ball-Norton Concentrate

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feed | 100.0 | 22.7 | | 67.82 | 2.12 | | | | 100.0 | 100.0 | | 68.1 | 5.4 | |
| Conc. | 94.0 | 21.3 | | 70.80 | 1.54 | | | | 99.1 | 48.8 | | 67.5 | 2.6 | 4.7:1 |
| Tailing | 6.0 | 1.4 | | 10.31 | 25.4 | | | | 0.9 | 51.2 | | 0.6 | 2.8 | |

N.D. = none detected

## CONCLUSION

The magnetite in the sands can be easily recovered by a low intensity magnetic separator of either dry or wet type. The concentrate assayed 2.12% titanium dioxide, and grinding it to -200 mesh did not decrease the titanium dioxide content below 1.54%. These results confirm that a portion of the titanium is combined with magnetite, as described in the mineralogical examination of the Ball Norton concentrate, and could not be separated by ordinary ore dressing methods.

The high intensity concentrate consists of grains containing iron, as hematite and ilmenite, with inclusions of various amounts of silica. This material may have no commercial value.

Negligible amounts of zircon and rutile reported in the high intensity tailing. Neither would be worth recovery.