MAR 19540007: BURMIS

Received date: Dec 31, 1954

Public release date: Jan 01, 1956

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MINES BRANCH

CANADA

A-5

Ottawa, May 10, 1954.

REPORT

of the

MINERAL DRESSING AND PROCESS METALLURGY DIVISION.

Investigation No. MD3034.

Magnetic and Gravity Concentration Tests on a Sample of Iron Ore from the West Canadian Collieries Limited, Blairmore, Alberta.

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.

(Copy No. 7 .)

700624
700639
700652
INDEXING DOCUMENT NOS. 700665

CANADA

DEPARTMENT

OF

Mines Branch

MINES AND TECHNICAL SURVEYS

OTTAWA May 10, 1954.

REPORT

of the

MINERAL DRESSING AND PROCESS METALLURGY DIVISION.

Investigation No. MD3034.

Magnetic and Gravity Concentration Tests on a Sample of Iron Ore from the West Canadian Collieries Limited, Blairmore, Alberta.

Shipment:

A shipment of one bag of iron ore, net weight 70 pounds, was received at the Mines Branch Laboratories on December 8, 1953. It was submitted by Mr. W. Bird, General Manager, West Canadian Collieries Limited, Blairmore, Alberta.

In his letter, Mr. Bird said, in part, that the shipment was a mixture of samples of No. 1, a channel sample from the 34 foot bed, and No. 2, a channel sample from the 6 foot bed, in the face of the drift.

Location of the Property:

The correspondence stated that the location of the property was in the N.E. 1/4 L.S. 10, section 22, township 8, Range 3, west of the Fifth Meridian, in southwestern Alberta.

Geologically, the beds are located in the basal Belly River sandstones.

Purpose of the Investigation:

In correspondence covering the shipment, Mr. Bird asked for a complete analysis of the sample and concentration tests to determine whether titanium (present as ilmenite) could be separated, and if not would the titanium content be detrimental in the process of smelting the ore and to the quality of the steel and cast iron produced.

He also asked for advice, in reference to titanium, for the best method of separating titanium from iron ore and where this is now being done.

Character of the Ore:

The ore, as received, consisted of rusty brown fragments of rock. Some of the fragments were covered with yellow to brown patches. The whole sample appeared to be severely weathered and oxidized.

Polished sections were prepared from selected specimens of the shipment and were examined microscopically.

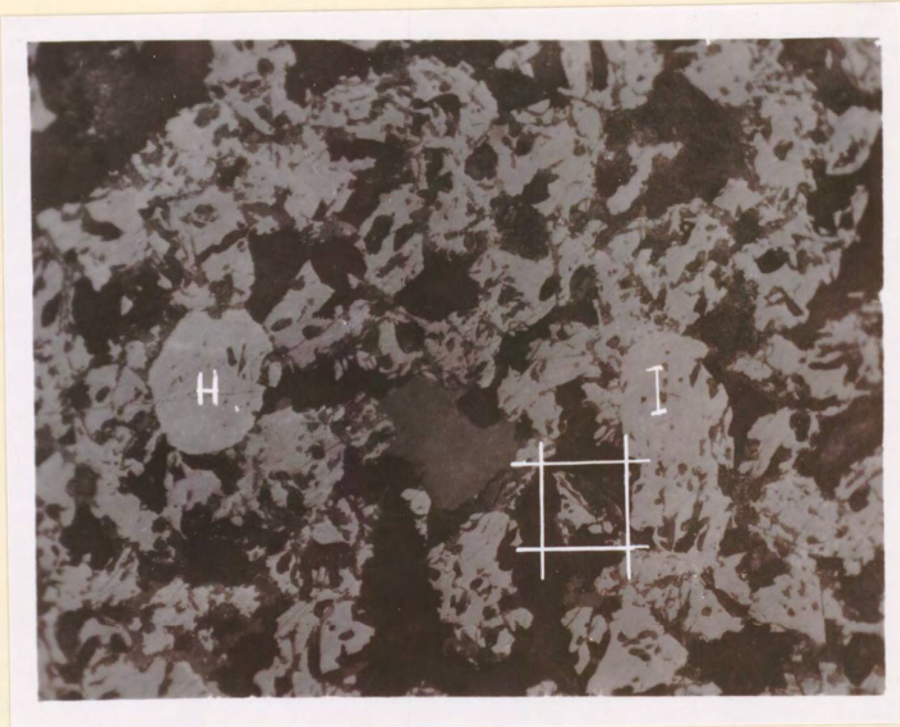
Gangue -

In one polished section, gangue is very subordinate in amount and consists of occasional, more or less equi-dimensional particles of quartz scattered through massive granular magnetite, Fig. 1. In another polished surface, gangue material preponderates and is composed of sub-angular to angular fragments of quartz cemented by fine-grained carbonate material. In this section the metallic mineralization occurs in the fine carbonate matrix, Fig. 2.

Metallic Minerals -

Magnetite predominates in the polished sections, with small amounts of ilmenite (iron-titanium oxide, $FeO.TiO_2$) and hematite also visible. These two minerals are not intimately and finely intergrown with magnetite, however, but substitute here and there for grains of the latter mineral, Fig. 1. In the section of massive magnetite, the individual grains probably average about 125 microns (-100 +150 mesh) in size, while those in the sparsely mineralized sections are, perhaps, a bit smaller.

Fig. 1.



Typical field of massive magnetite (light grey) showing a grain of hematite (H), ilmenite (I) and gangue (medium grey grain near centre); polishing pits are dark grey to black and the white square represents a 200-Tyler mesh screen opening.

Magnification, X150.

-

Fig. 2.

Shows an average field in polished section of sparsely disseminated magnetite (white) in fine carbonate matrix (dark grey rough surface), which also embeds fragments of quartz (medium grey smooth surface); straight black lines are polishing scratches, and white square is a 200-Tyler mesh screen opening.

Magnification, X60.

-

Sampling and Analysis:

The sample was weighed, and after selecting samples for microscopic examination, the ore was crushed to minus 1/4 inch and a head sample was cut on a Jones sampler. The remainder was bagged for investigative purposes.

The head sample was analysed and was found to contain:

Quantitative Analysis:

Iron (Fe)	-	50.76	per cent
Titanium dioxide (TiO_2)	-	7.20	"
Manganese (Mn)	-	0.24	"
Phosphorus (P)	-	0.23	"
Sulphur (S)	-	0.017	"

A small portion of the head sample was submitted to the spectrographic laboratory for determination of the elements present. These, in order of decreasing abundance, were reported as follows:

Qualitative Spectrographic Analysis:

Major constituent:	Iron
Minor constituent:	Silicon
Strong trace:	Titanium

Trace: Magnesium, lead, tin, aluminium, nickel, vanadium, molybdenum, copper, manganese, zinc, cobalt.

Faint trace: Boron, chromium, silver, calcium.

Investigation Procedure:

The ore was concentrated magnetically at different grinds by two different types of magnetic separators.

Gravity concentration tests were made by concentrating the ore, ground to different sizes, on a Wilfley table.

RESULTS OF THE INVESTIGATION:

Test No. 1. - Magnetic Concentration at Grinds from Minus 10 to Minus 200 Mesh by the Crockett Machine.

The results indicated that the grinds of minus 10 to minus 48 mesh were too coarse. Much gangue was found in the concentrates attached to magnetite as middling grains and many magnetite grains were not free of each other. Thus, these concentrates were too low in iron and too high in titanium dioxide and gangue.

At grinds to minus 100, 150 and 200 mesh, the concentrate assayed 62.14, 62.57 and 61.92 per cent iron and 4.45, 4.03 and 3.83 per cent titanium dioxide, respectively, with decreasing recoveries of iron, 77.6, 76.6 and 69.7 per cent. The recovery of titanium dioxide in the concentrates decreased with finer grinding, 36.6, 33.5 and 29.2 per cent, respectively.

Non-magnetic iron in the tailing increased with the finer grinding.

Test No. 2. - Magnetic Concentration by the Jeffrey-Steffensen Machine.

This machine has a rougher and cleaner section, in which the magnetic field of each can be varied by varying the current to the electro-magnets. The rougher concentrate is upgraded in the cleaner section.

The ore, ground to minus 100 mesh, produced a concentrate which assayed as follows:

Iron	-	62.4	per cent
Titanium dioxide	-	4.08	"
Silica	-	2.61	"
Insoluble	-	7.16	"

The recovery of iron in the concentrate was 64.9 per cent with a ratio of concentration of 1.95:1. This concentrate contained 28.8 per cent of the titanium dioxide in the feed.

Test No. 3. - Magnetic Concentration by the Jeffrey-Steffensen Machine of Ore Ground to Minus 200 Mesh.

The concentrate assayed as follows:

Iron	-	65.7	per cent
Titanium dioxide	-	3.52	"
Silica	-	1.59	"
Insoluble	-	4.44	"

The recovery of iron in the concentrate was 62.7 per cent, with a ratio of concentration of 2.04:1. The concentrate contained 23.7 per cent of the titanium dioxide in the feed, the titanium dioxide analysis of 3.52 per cent being the lowest of all the tests.

Test No. 4. - Gravity Concentration by the Wilfley Table of Feed Sized by Screening Ore Ground to Minus 100 Mesh.

The screen fractions were:

-100 +150	mesh
-150 +200	"
-200	"

The concentrates assayed:

	Iron, Per cent	TiO_2, Per cent
-100 +150 mesh conc.	59.5	5.92
-150 +200 " "	63.6	4.02
-200 " "	62.8	4.91

The combined concentrates assayed (by calculation):

Iron	-	61.18	per cent
Titanium dioxide	-	5.25	"
Silica	-	2.51	"
Insoluble	-	11.0	"

The recovery of iron was 50.88 per cent, with a ratio of concentration of 2.3:1. The concentrate contained 35.34 per cent of the titanium dioxide in the feed.

The middling and tailing assayed as follows:

		Middling (Per cent)	Tailing (Per cent)
Iron	-	55.46	44.38
Titanium dioxide	-	8.17	7.41

the distribution being:

		Middling	Tailing
Iron	-	10.71	38.41
Titanium dioxide	-	12.77	51.89

Test No. 5. - Gravity Concentration by the Wilfley Table of Ore Ground to Minus 200 Mesh.

The products assayed as follows:

	Iron	TiO_2	SiO_2	Insol.
		(Per	Cent)	
Table concentrate	64.5	4.55	1.66	5.84
Table middling	57.2	7.07	-	-
Table tailing	48.0	6.75	-	-

The recovery of iron in the table concentrate was 16.56 per cent, with a ratio of concentration of 7.67:1. The concentrate contained 9.13 per cent of the titanium dioxide in the feed.

The table tailing contained 76.2 per cent of the iron and 83.87 per cent of the titanium dioxide in the feed.

Summary and Conclusions:

The results of the investigation indicated that the best grade of concentrate was recovered by magnetic concentration of a sample of the ore ground to minus 200 mesh using the Jeffrey-Steffensen type of machine.

If a lower grade of concentrate is acceptable a slightly higher recovery of iron could be obtained by the Crockett type of machine, which does not reject the middling product. It picks up the magnetically weaker particles which contain mixtures of magnetite, ilmenite and gangue in varying amounts.

The Wilfey gravity concentration tests indicated that this method would not be satisfactory, due to the loss of magnetic iron in the slime portion of the feed, and to the fact that less titanium dioxide was rejected by this method.

The difficulty of rejecting ilmenite by magnetic concentration leads to the conclusion that it must be attached to the magnetite, as the minus 200 mesh concentrate assayed 3.52 per cent of titanium dioxide. This amount of titanium dioxide in the concentrate may make it unacceptable as feed to the blast furnace, unless it could be mixed with some other raw iron ore or concentrate to bring the overall titanium dioxide content of the mixture below 1.0 per cent.

The microscopic examination of the polished sections indicated that the largest grains of magnetite appear to be in the range of minus 100 plus 150 mesh, and it is expected that ore similar to that received in this shipment would require grinding to minus 100 mesh.

Microscopic examination of the minus 100 mesh concentrates, obtained by both the Crockett and Jeffrey-Steffensen methods of magnetic concentration, showed that gangue was present in the concentrates. Particles of gangue were seen with attached magnetite and with tiny inclusions of magnetite appearing as dots scattered on the surfaces of the grains of gangue. When the ore was ground to minus 200 mesh, the gangue in the concentrates had the same mode of occurrence but the quantity appears to have been reduced by finer grinding.

Finer grinding liberates more of the non-magnetic iron, present as grains of hematite and also as the yellow-brown to dark brown earthy oxide, limonite. Most of limonite is of slime size and gives a yellow-brown colour to the tailing water. The loss of non-magnetic iron varies from 20 to 30 per cent at grinds of minus 100 to minus 200 mesh. The ore represented by this sample appears to be severely weathered by oxidation, indicating that it may have been taken from or near the surface of the deposit. Unless the extent and character of the ore body is known to be similar in grade to that of the shipment, a representative sample of the deposit or of the proposed mill feed should also be investigated in order to verify the results to be expected in practice.

In those cases where ordinary ore dressing methods fail, the only successful commercial method of separating iron from titanium is by fusion, with a reducing agent (coke or coal) in an electric furnace. However, at present this treatment is only economical where the ore contains around 35 per cent TiO_2, so that this process cannot be applied to the present ore. It appears therefore that this ore can only be exploited by finding a market for an iron concentrate, the iron concentrate to be produced magnetically, and to contain as little TiO_2 as possible.

It is generally considered that when the assay of the iron concentrate approaches 3 per cent of titanium dioxide, it can only be marketed under the most propitious circumstances. The specified analysis of the products to be sold is governed by contract negotiations. The operating companies do not like to purchase a raw material which would disrupt their established metallurgical practice. It may be possible to blend a product containing titanium with other ores or concentrates containing little or no titanium to reduce the titanium content of the mixture and produce a feed suitable for the blast furnace.

The results of this investigation apply only to the ore submitted in the shipment.

Commercial Treatment of Titanium-bearing Ores.

The following notes are appended to this report in order to provide some general information on the treatment of ores containing titanium.

At the MacIntyre titaniferous magnetite operation near Tahawus, New York State, U.S.A., (a property of the National Lead Company), the ore contains approximately 17 per cent titanium dioxide and 35 per cent iron. The concentrating process includes coarse crushing the ore with magnetic cobbing, followed by regrinding the coarse magnetic concentrate and magnetically concentrating it by Crockett Wet Magnetic machines. The iron concentrate is sintered for use as iron ore. The non-magnetic material is hydrosized, the finest particles are floated to recover ilmenite which is shipped to the pigment plants. The coarse material from the hydrosizers is retreated by tables and magnetic separators which produce additional ilmenite concentrate. The ilmenite concentrates contain about 45 per cent titanium dioxide and 34 per cent iron. The iron sinter contains about 50 per cent iron and 10 per cent titanium dioxide.

About one-half of the magnetite concentrates were stock-piled because of insufficient market and the remainder was sintered and sold at a discount because of the high titanium dioxide content.

An example of exploitation of an iron property in which titanium is present in the ore, is that of the Jones and Laughlin Steel Corporation, which owns and operates a property at Star Lake, New York State, U.S.A.

Sinter is produced which contains from 61 to 62 per cent iron and 1.5 to 2.5 per cent titanium dioxide. This sinter is shipped to the Company's various iron and steel plants and blended with other ores to reduce the titanium dioxide content of the blast furnace feed.

In Canada, the Quebec Iron and Titanium Corporation (jointly owned by the Kennecott Copper Corporation and the New Jersey Zinc Company) produces a titanium dioxide concentrate, as a slag, and metallic iron at their plant at Sorel, in the Province of Quebec. The operation is one of reduction in electric furnaces.

An account of their operations has been published in the Engineering and Mining Journal, references: March 1951, page 76, title, "New Smelter Gives the Titanium Industry a Lift", and March 1952, page 72, "World's Major Titanium Mine and Smelter Swing into Full-Scale Production".

Their ore is said to contain 35 per cent titanium dioxide and 40 per cent iron, as hematite.

By the electric furnace process the titanium is concentrated in the slag which assays approximately 70 per cent titanium dioxide and is exported for use in the pigment industry.

The metallic iron is purified and cast into billets or pigs for use in the iron and steel industry, as the titanium content in it is very low.

DETAILS OF INVESTIGATIVE TESTS:

Test No. 1. - Magnetic Concentration.

The feeds for this test consisted of 500 gram samples of the ore, which had been crushed to pass the following screens: 10, 20, 48, 100, 150 and 200 mesh.

The samples were concentrated by a Crockett, wet belt type, laboratory-size, magnetic separator. This machine has a permanent magnet and is without any means of varying the strength of the magnetic field. In consequence, all magnetic particles are recovered in the concentrate, together with many particles of gangue having inclusions of magnetite. Occasional grains of barren gangue are sometimes trapped among magnetic grains and are carried into the concentrate.

The six samples of ore were concentrated separately, producing a magnetic concentrate and a non-magnetic tailing from each.

A microscopic examination of each concentrate was made and this disclosed that the coarser particles in the samples ground to pass 10, 20, and 48 mesh contained much gangue material as middling grains and indicated that the magnetite grains were not freed of gangue in the coarser fragments. Much of the attached gangue was of a rusty brown colour indicating presence of oxidized iron.

Minus 100 Mesh Concentrate -

To the unaided eye this concentrate appeared quite black in colour, but under the microscope much gangue was seen as particles with coarse to very fine inclusions of magnetite. The finest particles of magnetite appeared free and clean. Some grains had a rusty appearance. The slime tailing remaining in suspension imparted a yellow-brown colour to the tailing water. Some grains of barren quartz were also seen in the concentrate.

Minus 150 Mesh Concentrate -

The magnetic grains were mostly free at this size. Gangue was present as grains with small inclusions of magnetite as tiny dots on the surfaces. Occasional middling grains of magnetite and gangue were seen, and a considerable number of small rusty patches were observed on the grains of magnetite.

Minus 200 Mesh Concentrate -

To the unaided eye, this concentrate appears the blackest of all the concentrates. The microscopic examination shows that most of the brown coloured material is absent. Gangue is present as in the previously described concentrates. Gangue appears to be less abundant in this concentrate. The small inclusions of magnetite in the grains of gangue are of sufficient size to bring them into the concentrate.

This concentrate appears to be the cleanest of the six concentrates recovered by the Crockett machine.

The products of the tests were analysed, with results reported as follows:

Results, Test No. 1:

Sub-test No. 1 - Minus 10 Mesh Ore:

Product	Weight, per cent	Analysis, per cent				Distribution, per cent		Ratio of Concentration
		Fe	TiO2	SiO2	Insol.	Fe	TiO2	
Feed®	100.0	49.80	6.54			100.0	100.0	
Mag. Conc.	83.0	55.47	6.10	7.57	13.1	92.4	77.4	1.20:1
Tailing	17.0	22.14	8.69			7.6	22.6	
Sub-test No. 2 - Minus 20 Mesh Ore:								
Feed®	100.0	49.25	6.73			100.0	100.0	
Mag. Conc.	77.2	56.76	5.79	6.21	12.1	89.0	66.5	1.29:1
Tailing	22.8	23.76	9.92			11.0	33.5	
Sub-test No. 3 - Minus 48 Mesh Ore:								
Feed®	100.0	47.26	7.23			100.0	100.0	
Mag. Conc.	65.6	59.13	5.38	4.97	10.8	82.1	48.8	1.52:1
Tailing	34.4	24.62	10.75			17.9	51.2	
Sub-test No. 4 - Minus 100 Mesh Ore:								
Feed®	100.0	47.39	7.19			100.0	100.0	
Mag. Conc.	59.2	62.14	4.45	2.90	7.22	77.6	36.6	1.69:1
Tailing	40.8	25.98	11.17			22.4	63.4	
Sub-test No. 5 - Minus 150 Mesh Ore:								
Feed®	100.0	48.83	7.19			100.0	100.0	
Mag. Conc.	59.8	62.57	4.03	2.35	5.71	76.6	33.5	1.67:1
Tailing	40.2	28.40	11.89			23.4	66.5	
Sub-test No. 6 - Minus 200 Mesh Ore:								
Feed®	100.0	48.50	7.16			100.0	100.0	
Mag. Conc.	54.6	61.92	3.83	1.86	4.93	69.7	29.2	1.83:1
Tailing	45.4	32.35	11.17			30.3	70.8	

® Calculated.

It was noted that finer grinding increased the loss of non-magnetic iron in the tailings.

The following additional analyses were made on the concentrates:

Mesh	Analysis, Per Cent		
	Sulphur	Phosphorus	Manganese
-10	0.016	0.374	-
-20	0.015	0.359	0.21
-48	0.014	0.216	0.22
-100	0.012	0.185	0.22
-150	0.016	0.146	-
-200	0.012	0.012	-

-

Test No. 2. - Magnetic Concentration.

A sample of ore, ground to minus 100 mesh, was concentrated by a Jeffrey-Steffensen double drum, laboratory-size machine.

This machine differs from the Crockett machine by having a rougher and a cleaner section. The magnetic field is produced by electro-magnets in the drums, and can be controlled, within the limits of the machine, by varying the current to the magnets of each drum.

In concentrating the ore, the machine is operated by controlling the flow of water to each compartment and by adjusting the current to the magnets. In the rougher section, the current was held at the maximum (for this machine) of 2.5

amperes, and in the cleaner section the current was reduced to 1.0 ampere.

The products of the test were: a cleaner concentrate, middling, and tailing. Samples of each product were analysed with results as follows:

Results:

Product	Weight, per cent	Analysis, per cent				Distribution per cent		Ratio of Concentration
		Fe	TiO2	SiO2	Insol.	Fe	TiO2	
Feed*	100.00	49.35	7.27			100.0	100.0	
Mag. Conc.	51.31	62.4	4.08	2.61	7.16	64.9	28.8	1.95:1
Middlings	12.34	57.27	11.30	-	-	14.3	19.2	
Tailings	36.35	28.23	10.40	-	-	20.8	52.0	

* Calculated.

Current to the Rougher, 2.5 amperes
Current to the Cleaner, 1.0 ampere.

-

Test No. 3. - Magnetic Concentration.

In this test, Test No. 2 was repeated with a sample of ore ground to minus 200 mesh and concentrated by the Jeffrey-Steffensen machine.

The products of the test were: a cleaner concentrate, middling, and tailing. Samples of each product were analysed with results as follows:

Results:

Product	Weight, per cent	Analysis, per cent				Distribution, per cent		Ratio of Concentration
		Fe	TiO_2	SiO_2	Insol.	Fe	TiO_2	
Feed*	100.00	51.28	7.27			100.0	100.0	
Mag. Conc.	48.93	65.7	3.52	1.59	4.44	62.7	23.7	2.04:1
Middling	12.35	60.53	9.83			14.6	16.7	
Tailing	38.72	30.11	11.19			22.7	59.6	

* Calculated.

Current to the Rougher, 2.5 amperes

Current to the Cleaner, 1.0 ampere.

It was noted in the two tests Nos. 2 and 3 that the finer grind (minus 200 mesh) produced the highest grade of concentrate, 65.7 per cent iron, but the recovery of iron was lowered from 64.9 per cent of the iron (in Test No. 2) to 62.7 per cent. The content of titanium dioxide in the concentrate was 3.52 per cent, the lowest of all the magnetic concentrates produced in the investigation, but it is expected that it is still too high to be commercially acceptable, unless the concentrate could be mixed with other material (ore or concentrates) containing little or no titanium.

In comparing the results of Test Nos. 2 and 3 with Test No. 1, sub-tests Nos. 4 and 6, in which the ore was ground to approximately the same degree of fineness, the concentrates do not differ very much as to grade in Test No. 2 and sub-test No. 4 (Minus 100 Mesh Ore). The difference in the recoveries of iron of approximately 12 per cent represents the amount of the middling rejected from the concentrate in Test No. 2. In Test No. 3 the grade of concentrate is 3.8 per cent higher in iron than sub-test No. 6, with rejection of a higher grade of middling.

Test No. 4. - Gravity Concentration.

A sample of the ore was ground to minus 100 mesh and screened on a 150 mesh screen. The minus 150 mesh material was screened on a 200 mesh screen. The resulting screen fractions were:

-100 +150	mesh	ore
-150 +200	"	"
-200	"	"

The plus 200 mesh fractions were concentrated on a Wilfley table, producing a table concentrate, middling and tailing from each. The two concentrates were sampled for analysis and the middlings and tailings from each were dried, combined, and ground to minus 200 mesh. This minus 200 mesh material was combined with the original minus 200 mesh fraction and tabled. From this feed, a table concentrate, middling and tailing were produced. The table tailing consisted of three parts which were designated, sand tailing, slime tailing, and slime overflow tailing. Each of the products was sampled and analysed.

During the test, it was noted that the tailing water was a yellowish-brown colour from suspended slime particles. Some of this material was sampled and analysed, and was found to contain:

Iron - 38.3 per cent
Titanium dioxide - 5.69 "

In practice this slimed material would be lost in the tailing by either magnetic or gravity concentration. It indicated that the ore contained, in addition to visible grains of hematite, the fine-sized oxide commonly known as limonite. While it was not apparent in the polished sections, much was seen attached to the coarser-sized particles of magnetite and gangue minerals.

Results: Table Concentration.

Product	Weight, per cent	Analysis, per cent				Distribution, per cent		Ratio of Concentration
		Fe	TiO_2	SiO_2	Insol.	Fe	TiO_2	
Feed®	100.00	52.90	6.54			100.00	100.00	
Conc. -100 +150 mesh	24.20	59.5	5.92	2.93	13.6	27.22	21.91	4.1:1
Conc. -150 +200 "	10.64	63.6	4.02	1.93	8.84	12.79	6.55	9.4:1
Conc. -200 "	9.16	62.8	4.91	2.08	6.57	10.87	6.88	10.9:1
Combined Conc's.®	44.00	61.18	5.25	2.51	11.0	50.88	35.34	2.3:1
Middling	10.22	55.46	8.17			10.71	12.77	
Tailing, Sands	12.85	47.8	6.88			11.62	13.52	
Tailing, Slimes	20.13	45.8	7.60			17.43	23.40	
Tailing Slime O'flow	12.80	38.7	7.65			9.36	14.97	
Combined tailings®	45.78	44.38	7.41			38.41	51.89	
Combined tailing and Middling®	56.00	46.40	7.55			49.12	64.66	

® Calculated.

The results of the table concentration test indicated that titanium dioxide was not separated as completely as by tests using magnetic concentration. The table gave lower grades of concentrates and a lower recovery of iron. The smaller magnetic particles are carried into the tailing, whereas by magnetic concentration they would report in the concentrate.

-

Test No. 5. - Gravity Concentration.

A sample of ore was ground to minus 200 mesh and concentrated on a Wilfley table.

The products from the test were a table concentrate, middling, sand tailing, slime tailing, and slime overflow tailing.

The products were sampled and analysed, with the following results:

Results:

Product	Weight, per cent	Analysis, per cent				Distribution, per cent		Ratio of Concentration
		Fe	TiO_2	SiO_2	Insol.	Fe	TiO_2	
Feed®	100.00	51.28	7.27			100.00	100.00	
Concentrate	13.02	64.5	4.55	1.66	5.84	16.56	9.13	7.67:1
Middling	6.42	57.2	7.07	-	-	7.24	7.00	
Tailing sands	21.13	52.8	6.51			22.00	21.21	
Tailing slimes	31.45	49.7	6.67			30.82	32.34	
Tailing slimes o'flow	27.98	42.4	7.03			23.38	30.32	
Combined tailing®	80.56	48.0	6.75			76.20	83.87	
Combined middling and tailing®	86.98	48.7	6.78			83.44	90.87	

® Calculated.

The concentrate assayed 64.5 per cent iron, but the recovery of iron in it was only 16.56 per cent of the iron in the feed. 76.2 per cent of the iron would be lost in the tailing.

Tests Nos. 4 and 5 indicated that table concentration would not be as satisfactory a method of recovering the iron as would magnetic concentration.

o o o o o o o o o
o o o o o o
o o o

WSJ:(PES)AL.

W. S. Jenkins