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MINES BRANCH INVESTIGATION REPORT IR 73-43

CONCENTRATION INVESTIGATION OF DRILL CORE SAMPLES OF ILMENITE ORE FROM THE GASTON GAUTHIER PROPERTY, ST. URBAIN, CHARLEVOIS COUNTY, P.Q.

by

G.W. RILEY

MINERAL PROCESSING DIVISION

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SUMMARY OF RESULTS

The drill core samples submitted assayed as follows:

Hole No	Footage	% Sol Fe	% TiO_2
1	0-140	11.76	7.89
1	140-305	9.71	4.31
4	0-100	11.60	7.32
4	100-170	10.56	4.86

The ilmenite occurs in complex ilmenite-hematite grains disseminated in gangue. The ilmenite-hematite grains in the upper parts of the cores contain more hematite than those in the lower parts of the drill holes; the lower parts of the cores contain more magnetite than the upper parts. The highest grades of ilmenite concentrate produced from the upper parts of Cores 1 and 4 had an average assay of 40.62% sol Fe and 36.04 TiO_2 with a recovery of 38.5% of the sol Fe and 51.2% of the TiO_2. The highest grades of ilmenite concentrate produced from the lower parts of Cores 1 and 4 had an average assay of 33.42% sol Fe and 37.32% TiO_2 with a recovery of 19.4% of sol Fe and 48.9% of the TiO_2. Magnetite concentrates from the upper parts of Cores 1 and 4 recovered less than 5% of the sol Fe whereas magnetite concentrate from the lower parts recovered about 27% of the sol Fe. Although the magnetite concentrates assayed about 70% sol Fe, the TiO_2 content was about 1% which exceeds the maximum accepted by most steelmakers.

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Direction des Mines
Rapport d'Investigation IR 73-43

Etude de concentration sur des échantillons de carottes de forage d'un minerai d'ilmenite de la propriété de Gaston Gauthier St-Urbain, Comté de Charlevois, P.Q.

par

G. W. Riley*

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Résumé

L'analyse chimique des échantillons de carottes de forage donne les résultats suivants:

Trou No.	Profondeur	% Fe (soluble)	% TiO_2
1	0-140	11.76	7.89
1	140-305	9.71	4.31
4	0-100	11.60	7.32
4	100-170	10.56	4.86

L'ilménite se présente sous forme de grains complexes d'ilménite-hématite disséminés dans la gangue. Les grains d'ilménite-hématite dans les carottes provenant des parties moins profondes contiennent plus d'hématite que celles des sections plus basses; par contre, ces dernières ont plus de magnétite que les carottes en provenance des parties supérieures.

Les concentrés les plus riches, que l'auteur ait pu produire à partir des sections moins profondes des carottes de forages Nos 1 et 4, ont une teneur moyenne de Fe soluble de 40.62% et de TiO_2 de 36.04% avec une récupération de 38.5% du fer soluble et de 51.2% de l'oxide de titanium. A partir des zones plus profondes des mêmes échantillons, soit les Nos 1 et 4, les concentrés analysent en moyenne 33.42% de Fe soluble et 37.32% de TiO_2 pour des récupérations respectives de 19.4% et 48.9%. Les concentrés de magnétite provenant des parties supérieures des carottes de forage Nos. 1 et 4 ramassent moins de 5% du fer soluble, alors que ceux des parties inférieures contiennent environ 27% de ce fer. Même si l'analyse des concentrés de magnétite est autour des 70% de Fe soluble, leur contenu de TiO_2 se situe à environ 1% et excède ainsi le maximum permis par la plupart des fabricants d'acier.

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INTRODUCTION

Location of Property

The ilmenite ore submitted for investigation was from the Gaston Gauthier property, near St. Urbain, Charlevoix County, P. Q.

Purpose of Investigation

In his letter of November 15, 1972, Mr. P. E. Dumont, P. Eng., Consulting Engineer for Mogau Titanium Inc. requested that we investigate the beneficiation of this ore, suggesting that we try the Jones high-intensity magnetic separator. He also stated that a potentially large deposit remains to be indicated by further drilling.

Shipment

On November 20th, 1972, 198.5 lb of split diamond drill core was received at Mines Branch. This shipment consisted of four groups of samples:

Group 1	Hole 1,	0-140 ft	weight 75.5 lb;
Group 2	Hole 1,	140-305 ft	weight 112.0 lb;
Group 3	Hole 4,	0-100 ft	weight 61.5 lb;
Group 4	Hole 4,	100-170 ft	weight 49.5 lb.

Sampling and Analysis

After selecting specimens at various footages from Cores 1 and 4 for mineralogical examination each group of samples was crushed to minus $\frac{1}{4}$ inch. Approximately 15 lb was riffled out of each group and crushed to minus 10 mesh. Chemical analyses of a head sample riffled from the minus 10-mesh material of each group are shown in Table 1.

TABLE 1

Chemical Analysis of Head Samples*

Sample	Analysis % Sol Fe	TiO_2
1 - Hole 1, (0-140 ft)	11.76	7.89
2 - Hole 1, (140-305 ft)	9.71	4.31
3 - Hole 4, (0-100 ft)	11.60	7.32
4 - Hole 4, (100-170 ft)	10.56	4.86

* From Internal Report MS-AC-72-557

MINERALOGICAL EXAMINATION

Drill core specimens were sent to the Mineralogical Section of the Mineral Sciences Division for mineralogical examination. The mineralogical report* is summarized hereunder:

The ilmenite occurs in complex ilmenite-hematite grains disseminated in gangue, and ilmenite-hematite grains are more plentiful in samples from the tops of the drill holes than in samples from the bottoms. The complex ilmenite-hematite grains are composed of ilmenite and hematite lamellae. The ilmenite-hematite grains from the tops of drill holes contain wide and narrow hematite lamellae and consist of about 65% ilmenite and 35% hematite. Grains from the bottoms contain only narrow hematite lamellae and consist of about 80% ilmenite and 20% hematite but the grains are associated with magnetite and some are partly altered to rutile and goethite.

DETAILS OF THE INVESTIGATION

Tests 1, 2, 3 and 4.

A 1000-gram sample of the crushed minus 10-mesh material from each group was ground to minus 325-mesh. The ground material was treated individually in a Jones high-intensity magnetic separator at 0 amp to remove any highly magnetic material. The non-magnetic material was then treated in a Jones high-intensity magnetic separator at 5 amp. Results of the test are shown in Table 2.

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* Mines Branch Mineralogical Report IR 72-63 - Mineralogical Examination of a Titanium Ore from the Gauthier Property in Quebec - by W. Petruk.

TABLE 2

Results of Tests 1, 2, 3 and 4

Product	Weight %	Analysis %		Distribution %	
		Sol Fe	TiO_2	Sol Fe	TiO_2
Test 1, Hole 1 (0-140 ft)					
0 amp Mag Conc	4.0	25.84	7.15	9.3	3.8
5 amp Mag Conc	17.8	30.01	25.86	48.1	61.5
Tailing	78.2	6.04	3.32	42.6	34.7
Feed	100.0	11.10	7.49	100.0	100.0
Test 2, Hole 1 (140-305 ft)					
0 amp Mag Conc	7.7	49.93	2.30	37.2	3.8
5 amp Mag Conc	13.9	21.89	20.86	30.6	61.2
Tailing	78.4	4.08	2.11	32.2	35.0
Feed	100.0	9.93	4.72	100.0	100.0
Test 3, Hole 4, (0-100 ft)					
0 amp Mag Conc	3.7	30.33	6.58	9.8	3.2
5 amp Mag Conc	17.4	29.78	24.42	45.4	55.8
Tailing	78.9	6.48	3.96	44.8	41.0
Feed	100.0	11.41	7.62	100.0	100.0
Test 4, Hole 4 (100-170 ft)					
0 amp Mag Conc	7.8	48.52	2.48	39.0	4.4
5 amp Mag Conc	12.2	22.07	21.63	27.8	60.0
Tailing	80.0	4.02	1.95	33.2	35.6
Feed	100.0	9.69	4.39	100.0	100.0

Tests 5,6,7 and 8

The TiO_2 grades of the concentrates from Tests 1,2,3 and 4 were so low that it was decided to reject a large proportion of the gangue material at a coarse size (65 mesh) by preliminary concentration in the Jones high intensity magnetic separator to reject coarse gangue and low-grade middlings and reduce the entrapment of gangue during grinding. A 1,000-gram sample of the crushed minus 10 - mesh material from each group was ground to minus 65 mesh and passed through a Jones high intensity magnetic separator at 0 amp to remove any highly magnetic material. The non-magnetic material was then passed through the magnetic separator at 5 amp. The rougher magnetic concentrate was ground to minus 325 mesh and passed through the magnetic separator at 5 amp to produce a cleaner concentrate. Results of these tests are shown in Table 3.

TABLE 3

Results of Tests 5, 6, 7 and 8

Product	Weight %	Analysis %		Distribution %	
		Sol Fe	TiO_2	Sol Fe	TiO_2
Test 5, Hole 1 (0-140 ft)					
0 amps Mag Conc	5.3	24.89	7.28	11.7	5.3
5 amps Ro tail	72.7	4.90	2.44	31.5	24.2
5 amps cl Mag Conc	10.9	38.03	31.90	36.7	47.5
Cl tail	11.1	20.53	15.14	20.1	23.0
Feed	100.0	11.31	7.34	100.0	100.0
Test 6, Hole 1 (140-305 ft)					
0 amps Mag Conc	10.9	40.97	3.36	43.4	8.0
5 amps Ro tail	71.1	2.96	0.88	20.5	13.7
5 amps Cl Mag Conc	7.9	30.07	30.74	23.1	53.0
Cl tail	10.1	13.25	11.49	13.0	25.3
Feed	100.0	10.28	4.58	100.0	100.0
Test 7, Hole 4 (0-100 ft)					
0 amps Mag Conc	4.6	28.78	7.37	12.3	4.8
5 amps Ro tail	73.3	3.51	1.59	23.8	16.4
5 amps Cl Mag Conc	12.0	38.41	32.02	42.7	54.0
Cl tail	10.1	22.62	17.52	21.2	24.8
Feed	100.0	10.79	7.11	100.0	100.0
Test 8, Hole 4 (100-170 ft)					
0 amps Mag Conc	10.8	40.93	3.88	44.8	9.8
5 amps Ro tail	71.4	2.76	0.71	20.0	11.8
5 amp Cl Mag Conc	8.1	29.10	30.04	23.9	57.0
Cl tail	9.7	11.48	9.39	11.3	21.4
Feed	100.0	9.86	4.27	100.0	100.0

Tests 9,10,11 and 12

Although the TiO_2 grades of the concentrates from the second series were better than those from the first series of tests they were still below commercial grade. It was decided to reject much of the gangue by gravity separation. A 1000-gram sample of the minus 10 - mesh material from each

group was ground to minus 65 mesh and passed over a Deister table. The gravity concentrate was ground to minus 325 mesh and passed through a Sala low intensity magnetic separator to remove magnetite. The non-magnetic material was passed through the Jones high intensity magnetic separator at 5 amp to produce a magnetic concentrate. Results of the tests are shown in Table 4.

TABLE 4

Results of Tests 9, 10, 11 and 12

Product	Weight %	Analysis %		Distribution %	
		Sol Fe	TiO_2	Sol Fe	TiO_2
Test 9, Hole 1 (0-140 ft)					
Table tails	75.9	5.61	2.46	37.7	24.9
Sala Mag Conc	0.8	63.08	5.76	4.5	0.6
Jones 5 amp Mag Conc	10.7	38.70	34.83	36.6	49.7
Tails	12.6	19.00	14.72	21.2	24.8
Feed	100.0	11.30	7.50	100.0	100.0
Test 10, Hole 1(140-305 ft)					
Table tails	85.0	4.91	1.46	41.6	27.5
Sala Mag Conc	3.9	70.38	0.77	27.3	0.7
Jones 5 amp Mag Conc	5.4	33.84	38.11	18.2	45.5
Tails	5.7	22.70	20.86	12.9	26.3
Feed	100.0	10.04	4.52	100.0	100.0
Test 11, Hole 4 (0-100 ft)					
Table tails	81.9	5.01	2.27	36.0	24.4
Sala Mag Conc	0.7	68.13	1.32	4.2	0.1
Jones 5 amp Mag Conc	10.8	42.55	37.24	40.3	52.7
Tails	6.6	33.72	26.32	19.5	22.8
Feed	100.0	11.40	7.63	100.0	100.0
Test 12, Hole 4 (100-170 ft)					
Table tails	85.1	4.60	1.35	41.4	27.8
Sala Mag Conc	3.7	70.42	1.02	27.5	0.9
Jones 5 amp Mag Conc	5.9	32.99	36.54	20.6	52.2
Tails	5.3	18.83	14.87	10.5	19.1
Feed	100.0	9.46	4.13	100.0	100.0

DISCUSSION

It is unlikely that higher-grade TiO_2 concentrate can be produced because of the ilmenite-hematite complex. The magnetite concentrate contained about 1% TiO_2 which is higher than that acceptable to most steelmakers. These facts, together with the low grade of the samples appear to be against the ore, as represented by the drill core samples, supporting an economic mining operation.

CONCLUSION

Economically feasible recoveries of commercial-grade concentrates of either ilmenite or magnetite cannot be made from these samples by the methods investigated at this time.

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GWR/cb