TR9-163-167

R. 467, R. 468, R. 469

5. HAMPSHIRE IRON ORE INVESTIGATION

Samples for Metallurgical Testing

1. Four samples, each representing types of material showing in the trenches and old workings, were taken for metallurgical testing. These samples were not representative but material easily available and should give an indication of what to expect. The samples were:—

Sample No.	Weight (kg)	Description
1.	16.5	South Trench.
2.	9.4	North Trench, top 3 feet of soil.
3.	6.8	North Trench, bottom section.
4.	4.0	Pearson's workings.

Objects of Tests and Methods Used

2. The tests were made with a view to meeting Tradasia's specifications for an iron concentrate, namely:—

(*a*) grade (all products) 64 per cent iron and not less than 60 per cent.
(*b*) lump ore, sizing minus 50 mm plus 6 mm.
(*c*) powdered ore, sizing minus 6 mm.

3. The methods tried were:—

(*a*) washing and screening at minus 50 mm, plus 6 mm;
(*b*) jig concentration at minus 7 mesh (2411 micron);
(*c*) magnetic concentration at:—
(i) minus 50 mm, plus 6 mm, and
(ii) minus 7 mesh (2411 micron).

Washing and Screening Tests

4. The samples were broken by hand to pass a 50 mm screen and then wet sized on a 6 mm screen.

5. The results were:—

Washing and Screening Results.

Sample No.	Fraction — 50 mm + 6 mm Grade (per cent Fe*)	Fraction — 50 mm + 6 mm Recovery (per cent)	Fraction — 6 mm Grade (per cent Fe*)	Fraction — 6 mm Recovery (per cent)	Head Grade (per cent Fe*)
1.	50.5	82.0	45.4	18.0	49.5
2.	60.2	41.5	53.0	58.5	55.7
3.	58.3	74.4	66.5	25.6	60.2
4.	44.6	74.6	47.5	25.4	45.3

* Note:—Iron is hydrochloric acid soluble iron only.

6. Comments on these results:—

(*a*) No sample, as received, was up to Tradasia's grade requirement, viz. 64 per cent.

(*b*) This method of treatment has produced no satisfactory lump product.

(*c*) Tradasia's grade was met by the fine fraction of Sample 3, but recovery in this product was only 25 per cent.

(*d*) It was therefore concluded that washing and screening was unsuitable for treating this ore.

7. The coarse fraction (— 50 mm, + 6 mm) referred to above was subjected to a sorting using a hand magnet.

8. The results were:—

Magnetic Separation—Coarse Material

Sample No.	Magnetic Concentrate (per cent Fe*)	Magnetic Concentrate (per cent)	Magnetic Tailing (per cent Fe*)	Magnetic Tailing (per cent)	Total Lump Material (per cent Fe*)	Total Lump Material (per cent)
1.	58.4	39.8	44.6	42.2	50.5	82.0
2.	63.7	32.2	50.0	9.3	60.2	41.5
3.	62.2	67.6	35.9	6.8	58.3	74.4
4.	49.7	32.4	41.3	42.2	44.6	74.6

* Note:—Iron is hydrochloric acid soluble iron only.

9. Comments on these results:—

(*a*) Only two samples approach the required grade, viz:—Sample 2, 63.7 per cent and Sample 3, 62.2 per cent iron, but recoveries of 32.2 per cent and 67.6 per cent respectively are unsatisfactory.

(*b*) These tests have enhanced the grade in all cases (average improvement about 5 per cent) but a satisfactory recovery has not been obtained, Sample 3 being the best with only 67.6 per cent.

(*c*) Therefore it is unlikely that a magnetic concentrate can be satisfactorily made at this coarseness.

(*d*) From these tests it would appear unlikely that a satisfactory lump product can be made magnetically.

Jig Concentration Tests

10. The whole of the material was crushed in a jaw crusher to pass a 7 mesh (2411 micron) screen. Upon this, jig and magnetic separation tests were made.

11. In the jig tests no attempt was made to attain optimum conditions, all samples being subjected to the same jigging conditions. With more sample, sized feed and experiment, recovery could probably be improved. Gravity concentration was used because any non-magnetic hematite would be recovered.

12. The results from these tests were:—

Jig Concentration

Sample No.	Jig Concentrates Grade (per cent Fe*)	Jig Concentrates Recovery (per cent)	Jig Tailings Grade (per cent Fe*)	Jig Tailings Recovery (per cent)	Head Grade (per cent Fe*)
1.	57.5	52.7	43.5	47.3	49.9
2.	63.5	59.6	47.4	40.4	55.8
3.	65.0	54.6	52.1	45.4	58.5
4.	65.5	45.3	37.4	54.7	46.4

* Note:—Iron is hydrochloric acid soluble iron only.

13. Comments on these results:—

(*a*) satisfactory grades were obtained in Samples 2, 3 and 4, but the recoveries were low, approximately 50 per cent,

(*b*) therefore it was concluded that jigging was unsatisfactory for concentrating this ore.

Magnetic Treatment of Fine Material

14. Similar material to that used for the jigging tests was used for these tests. However, excessive slime made separation poor and desliming on a 100 mesh (152 micron) screen before separation was necessary. Even then some samples still produced a lot of slime when handled. These tests were made under water using a hand magnet.

15. The results were:—

Magnetic Separation—Fine Material.

Sample No.	Magnetic Concentrates Grade (per cent Fe*)	Magnetic Concentrates Recovery (per cent)	Magnetic Tailings Grade (per cent Fe*)	Magnetic Tailings Recovery (per cent)	Slime Materials Grade (per cent Fe*)	Slime Materials Recovery (per cent)
1.	61.4	54.0	41.9	27.6	38.8	18.4
2.	63.9	61.0	45.7	18.9	46.3	20.1
3.	66.9	78.5	27.0	8.7	42.1	12.8
4.	60.1	71.5	37.4	17.0	29.7	11.4

* Note:—Iron is hydrochloric acid soluble iron only.

16. Comments on these results:—

(*a*) a satisfactory grade was made in Samples 2 and 3 only,

(*b*) recoveries are better than by jigging, notably Samples 3 and 4. However the best recovery is still only 78.5 per cent which is not considered good.

General Comment and Conclusions

17. These tests have shown that:—

(*a*) No satisfactory lump product seems possible. Certainly washing and screening is out as a method of obtaining it and recoveries are too low from coarse magnetic separation. It should be noted that much of the material in all samples was easily broken and transport of such lump material would cause a lot of fine material, probably to excess.

(*b*) At 7 mesh satisfactory grades have been made using both jigging and magnetic methods. However, results vary from sample to sample and recoveries are not good. This possibly means finer grinding but in view of the limonite present recovery may be governed by the minerals present.

(*c*) The sample most likely to produce a satisfactory concentrate was No. 3, which may represent the ore at lower levels.

18. In considering the results of the tests the presence of limonite, which has a theoretical iron content of 60 per cent and is therefore a gangue mineral, must be considered. Recoveries appear poor because limonite is not being recovered. While magnetite recovery may be quite good this is masked by the limonite iron. However, the value of the deposit is being assessed on an iron content which includes limonite, hence the iron recoveries cited are realistic in relation to the ore body grade. If a re-appraisal is made on a magnetite content, then metallurgical results should be likewise assessed.

19. Impurities in the two best grade concentrates assayed as follows:—

Product.	Per Cent Fe	Per Cent SiO_2	Per Cent Al_2O_3
Magnetic Conc.	66.9	1.07	1.73
Jig Conc. No. 4	65.5	2.98	1.01

20. Borehole assays to date indicate that sulphur, phosphorus, vanadium, titanium and aluminium should be within Tradasia's requirements. However, no determinations have been made on metallurgical products.