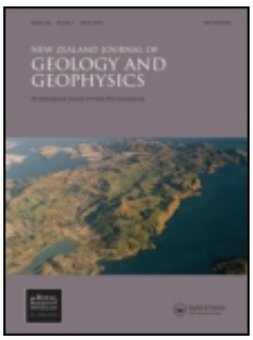

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A BOREHOLE SURVEY OF ILEMITE-BEARING BEACH SANDS AT CAPE FOULWIND, WESTPORT

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Summary

Posthole boring of dune sands on Nine Mile Beach, south of Cape Foulwind, Westport, shows that the surface sand to a depth of 20 ft contains an average of 5·5% of magnetically recoverable ilmenite.

Boring of dunes covering approximately half of Nine Mile Beach, has proved more than one million tons of ilmenite in sands above groundwater level. This represents only a small fraction of the total ilmenite present, above and below groundwater level, over the full extent of Nine Mile Beach.

INTRODUCTION

Previous work by Cox (1881), Hutton (1950), Nicholson and others (in press) has established the presence in beach sands of the West Coast, South Island, of appreciable quantities of ilmenite. Evaluation of the tonnages of ilmenite available and the percentage concentration of ilmenite in the sands was not carried beyond the stage of a preliminary reconnaissance survey, based on surface sampling and old dredging records. The purpose of the present investigation is to confirm by shallow drilling in one representative area, that ilmenite is present in the bulk of the sands and is not confined to small surface concentrates, to assess the magnetically recoverable percentage of ilmenite in the sand of that area, and to assess roughly the tonnage of ilmenite available above ground water level.

For this purpose, drill sampling was conducted on sand dunes between Tauranga Point and the Okari River. The area was chosen as representative of West Coast beach sand deposits, and because of its accessibility and proximity to Westport.

DRILLING METHODS

Drilling equipment consisted of a 3 in. hand-operated posthole borer with pipe extensions to permit boring to 30 ft depth. 20 ft proved to be the maximum depth attainable in sand, progress beyond that depth being extremely slow and unreliable owing to the scraping of

sand from the walls of the hole during withdrawal and replacement of the drill rods and auger.

Drilling was stopped immediately if ground water was reached, progress below groundwater level being impossible owing to caving of the hole.

Material removed from the boreholes was carefully sampled on the spot by coning and quartering, a 20 lb sample being double-bagged whilst still damp, and transported to Wellington for further treatment.

Boreholes were sited as shown on the sketch map (Fig. 1), lines of holes being set out across the coastal dunes at 1-mile intervals. In addition, shallow (10 ft) holes, Nos 16, 17, 18, 19 were drilled at points intermediate between the above lines to give a fairly regular drilling pattern over the whole of the area, although no attempt was made at precise grid-boring.

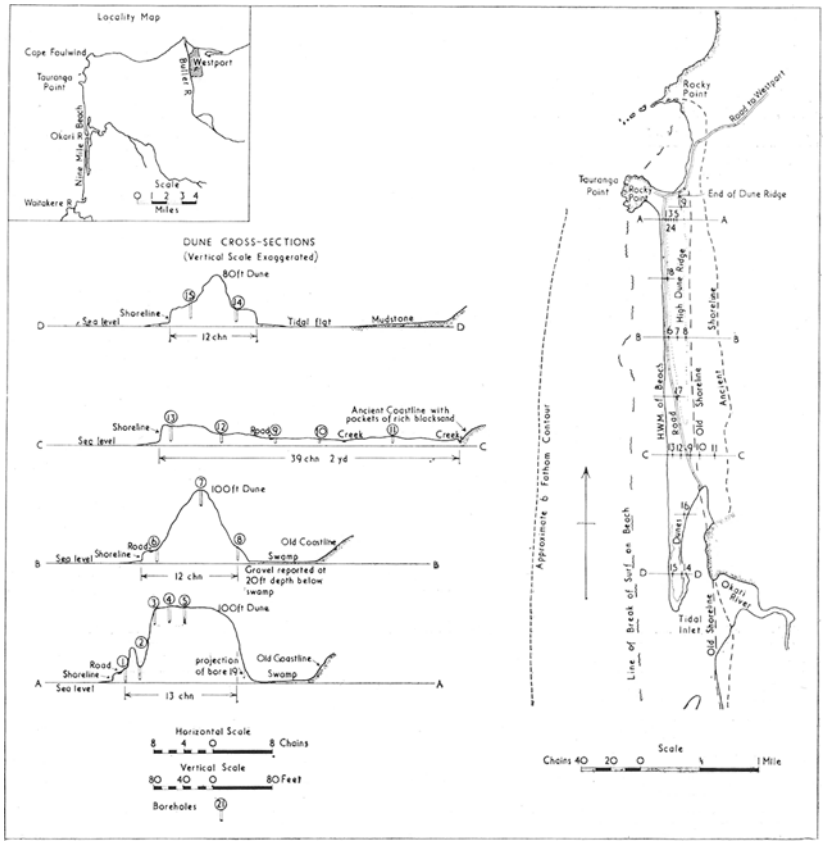

FIG. 1.—Plan and cross-sections of locality bored.

SAMPLING AND SEPARATION OF ILMENITE

The 20 lb samples were dry and free-running by the time they reached Wellington. They were therefore immediately reduced in size to about 1 lb by split trays after thorough mixing. The small samples were finally dried in an air oven at 150° C. 5·00-gram samples were then taken with great care to avoid segregation, which proved somewhat troublesome in the dried material, and any magnetite in the sample was removed by a hand magnet. The sample was then passed twice through a Frantz Isodynamic high-intensity magnetic separator to remove ilmenite. Both passes were made with the following setting:

Transverse slope	20°
Longitudinal slope	15°
Current	0·25 amp
Vibration	moderate
Feed rate	10 to 15 g/hr

The amount of ilmenite removed in the second pass did not exceed 5% of the amount removed in the first pass. Ilmenite removed was weighed to ± 1 mg, and the percentage in the sample calculated. The above procedure was considered to give results similar to those that would be attained by full-scale commercial high-intensity magnetic separation.

The ilmenite thus obtained from all samples was noted to be quite clean, containing very few grains of garnet, and one typical sample on analysis showed 43% TiO_2.

To determine the approximate percentage recovery of ilmenite by the above methods, heads, tails, and concentrates from one sample (hole 10) were analysed for TiO_2, recovery then being calculated as 65%. The writers consider that on a commercial scale this recovery could be improved by the use of more complex treatment methods, possibly involving grinding, electrostatic separation, or flotation.

The average amount of magnetically recoverable ilmenite in sands of the area was calculated at 5·5%.

QUANTITY ESTIMATES

For this approximate assessment of total tonnage of ilmenite above groundwater level in the area sampled, the cross-sectional areas of sand at each line of drill-holes were estimated as follows:

Widths of the dunes at each section were chained, cross-section sketches made on the spot, and heights of peaks determined from Department of Lands and Survey contour maps. The dunes were assumed to be composed entirely of sand, i.e. to contain no basement rocks above groundwater level, an assumption which the writers consider

quite sound from geological evidence, and from reports on the history of the area (1947).

Average heights above groundwater level of the dunes at each cross-section were then estimated in a very conservative manner, allowing 10 ft as the average height of groundwater level above mean sea-level. From these average dune heights and from the chained widths the cross-sectional areas were calculated.

The cross-sectional areas were then averaged and the result multiplied by the total distance between drill-hole lines to estimate the total volume of sand. The total tonnage was then estimated using the value of 1·2 tons per cu. yard of sand, a conservative estimate for the material in question.

From the average of the percentages of ilmenite obtained from all boreholes, the total amount of ilmenite *above groundwater level* in this portion of the area was thus estimated at 1·36 million tons. Details of the quantity estimates are given in Table I.

It is realized that the above method of calculation is not highly accurate, and suitable only for preliminary estimates. It is, however, considered sufficiently accurate for present purposes, since the ore-body could not be completely delineated in depth, length, or width.

DISCUSSION

As indicated by the plan of Nine-Mile Beach, large quantities of sand are present south of the Okari River mouth. This sand was observed to be identical in appearance with that north of the Okari River, and is considered by Furkert (1947) to be of similar origin.

Geological evidence, and reports from prospectors in the area indicate that the sands should continue for depths of at least 30 ft below average groundwater level. In this connection, it is interesting to note that drill records of the Barrytown Gold Dredging Company Limited, operating in a similar beach deposit, show that black sands persist in that locality to depths of over 60 ft below groundwater level. The writers consider it highly probable that the material below water level will contain similar or higher percentages of ilmenite than the wind-blown dune sand sampled.

Isolated pockets of rich black sand containing 25 to 50% ilmenite were observed along the old coastlines indicated on the plan. These resources are not included in the above estimates.

Hence the present boring campaign has merely touched on the total ilmenite resources of the locality. An accurate estimate of the total amount and grade of ore in the locality would require drilling equipment capable of operating at least 100 ft below groundwater.

TABLE 1.—Calculations for Quantity of Magnetically Recoverable Ilmenite.

BOREHOLE DATA

Bore number	Depth (ft)	Depth to groundwater (ft)	Magnetically recoverable ilmenite (%)	Location of bore	Remarks
1	18·5	—	2·8	Edge of road, 0.2 mile S. of fork in road	
2	17	17	3·6	2 ch. E. of bore 1	Rich at 4 ft, rich at groundwater level
3	19·5	—	3·1	2 ch. E. of bore 2	2 ft of sandy soil at surface
4	20	—	1·7	2 ch. E. of bore 3	2 ft of surface soil, soil band at 12 ft
5	20	—	2·0	2 ch. E. of bore 4	
6	20	—	5·9	At edge of road, 1 mile S. of bore 1	1 ch. from high-water mark
7	20	—	4·1	6 ch. E. of bore 6	
8	18	18	4·5	5 ch. E. of bore 7	
9	5	5	11·0	Edge of road, 1 mile S. of bore 6	
10	4	4	9·7	6 ch. E. of bore 9	1 ft of surface soil
11	8	8	1·7	10 ch. E. of bore 10	2 ft of surface soil
12	10	10	9·5	6 ch. W. of bore 9	4 ft of rich surface sand
13	20·5	—	9·6	6 ch. W. of bore 12	
14	17	17	5·1	3 ch. from E. edge of spit, 1 mile S. of hole 9	
15	20	—	9·5	6 ch. W. of bore 14	
16	10	10	9·3	2 ch. from E. edge of spit, 0·5 mile N. of bore 14	
17	10	—	3·8	Edge of road, 0·5 mile N. of bore 9	
18	10	—	4·3	Edge of road, 0·5 mile N. of bore 6	
19	10	—	3·2	Leeward edge of dune ridge, ch. S. of road	
AVERAGE	15		5·5		

VOLUME DATA

Sketch map cross-section	Estimated average depth to groundwater level	Width	Estimated cross-section area
	(ft)	(yd)	(sq. yd)
A–A	70	286	6670
B–B	40	264	3520
C–C	10	860	2870
D–D	30	264	2640
		AVERAGE	3920

Distance between section A–A and D–D .... 5280 yd
Estimated volume of sand .... 5280×3920 $20{\cdot}7 \times 10^6$ cu. yd
Estimated tonnage @ 1·2 t./cu. yd .... $20{\cdot}7 \times 10^6 \times 1{\cdot}2$ $24{\cdot}8 \times 10^6$ t.
Estimated tonnage of magnetically recoverable ilmenite .... $24{\cdot}8 \times 10^6 \times {\cdot}055$ $1{\cdot}36 \times 10^6$ t.

CONCLUSIONS

(1) The sampling carried out confirms the presence of ilmenite in the bulk of the dune sand between the Okari River mouth and Tauranga Point.

(2) More than one million tons of magnetically recoverable ilmenite is available above groundwater level in sand dunes between the Okari River mouth and Tauranga Point. The dune sand contains an average of 5·5% of magnetically recoverable ilmenite, the content varying between 1·7% and 11%. Approximately 30% of the total tonnage of ilmenite estimated is present in sand averaging 8% ilmenite, the remainder averaging 4% ilmenite.

(3) It is obvious that the total amount of ilmenite available, above and below groundwater level, over the full extent of Nine-Mile Beach, is many times greater than the 1·36 million tons proved by the above borehole survey.

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