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## ILMENITE DEPOSITS IN NEW ZEALAND

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### Summary

A reconnaissance survey in 1948 shows that on the South Island West Coast beaches between Karamia and Jacksons Bay there is available upwards of 1,000 million tons of dredgable sand from which ilmenite and small amounts of radioactive minerals and gold could be recovered.

The most important locality is immediately south of the Buller River, near Westport, where two large beach deposits are estimated to contain over 90 million tons of sand. Nineteen posthole bores, ranging in depth from 4 to 20 ft, averaged 5.5% of ilmenite, assaying 44% to 45%  $\text{TiO}_2$ .

### INTRODUCTION

Though knowledge of ilmenite deposits in New Zealand (Fig. 1) is still very incomplete as regards quantities and average  $\text{TiO}_2$  content, the fundamental difference between the ironsands of the North and South Islands (West Coast) has long been known. Cox (1881) of the New Zealand Geological Survey pointed out that in the latter the magnetite and the ilmenite occur as individual grains, whereas, as shown by Skey (1898), the titanium in most North Island sands occurs mainly in titanomagnetite.

Magnetic concentration of Taranaki ironsands (Hutton, 1945) yields a major, strongly magnetic fraction of *titanomagnetite* containing 49.99%  $\text{Fe}_2\text{O}_3$ , 29.46%  $\text{FeO}$ , 8.57%  $\text{TiO}_2$ , 0.39%  $\text{V}_2\text{O}_5$ , and a minor, less strongly magnetic fraction of *titanhaematite* containing 83.1%  $\text{Fe}_2\text{O}_3$ , 5.8%  $\text{FeO}$ , 9.6%  $\text{TiO}_2$ . On the other hand, magnetic concentration of South Island sands gives a strongly magnetic fraction of *magnetite* containing no  $\text{TiO}_2$ , and a larger, weakly magnetic fraction of *ilmenite* containing 44% to 45%  $\text{TiO}_2$ .

This paper is based on a reconnaissance survey in 1948 by D. S. Nicholson and W. R. B. Martin, and sand separations and chemical analyses by J. J. S. Cornes. The location and quantity data from this reconnaissance survey are the best available to date, but chemical work in progress by one of the authors (W.R.B.M.) will modify and amplify the preliminary chemical analyses reported here. This paper summarises the knowledge available in 1949 of ironsands of the South Island, with particular reference to their value as a source of ilmenite. Ilmenite deposits in the North Island have since been investigated by Nicholson and Fyfe (1958).

In January 1947, the Dominion Laboratory (unpublished data) in reporting to the Geological Survey on samples collected for Dr

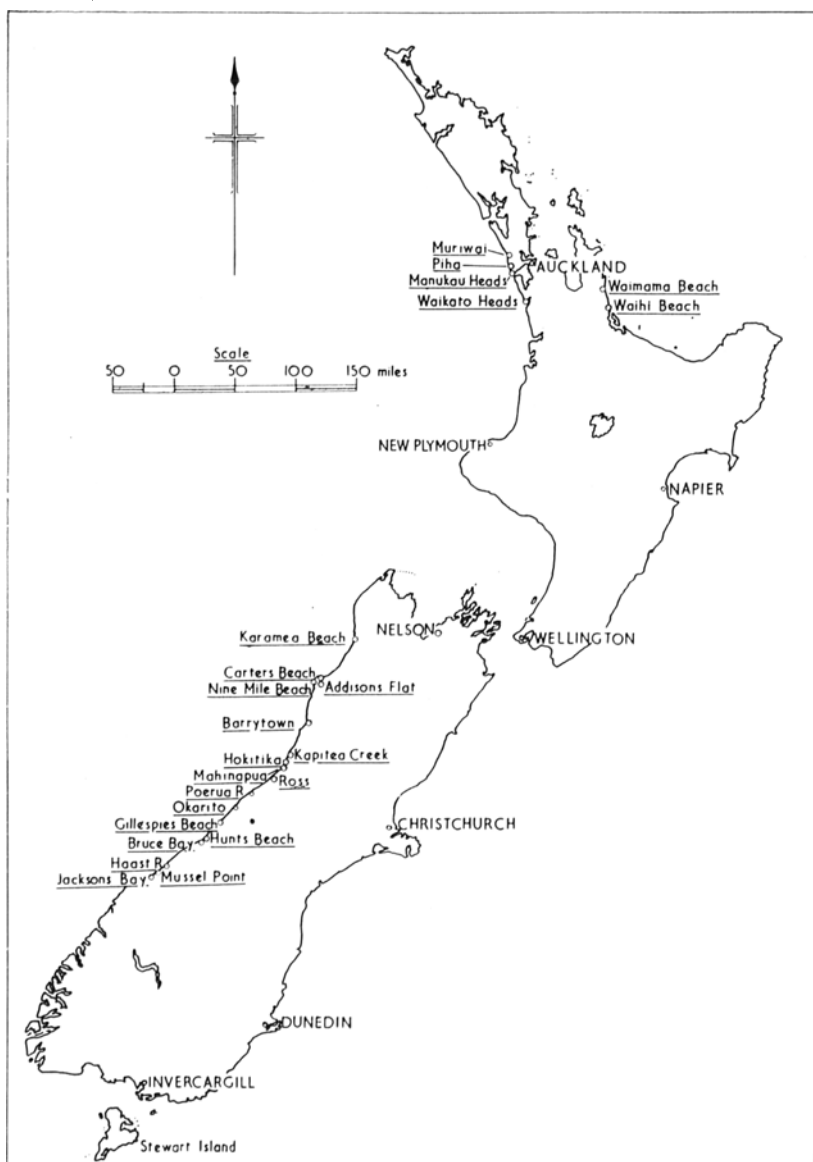


FIG. 1.—Sketch map of New Zealand showing localities of ilmenite deposits (underlined).

Gillson of Messrs Du Pont de Nemours Ltd., commented on a sample of black sand from Waimama Beach on the eastern side of Cape Colville Peninsula. Of this sample 76.5% was ilmenite, containing 44%  $\text{TiO}_2$ . It was commented that there was “probably no great quantity of Cape Colville blacksands”.

A reconnaissance survey by H. E. Fyfe, D. Kear, and D. S. Nicholson (unpublished data) in 1957 showed that ilmenite occurs also on Waihi Beach. Nine posthole bores, average depth 13 ft contained an average of 5.9% of ilmenite. Analyses of three magnetically separated samples of ilmenite gave 40.0%, 34.4%, 27.2%  $\text{TiO}_2$ .

### SOUTH ISLAND DEPOSITS

In a rapid survey, carried out by two of the authors (D.S.N. and W.R.B.M.) primarily to determine the South Island resources of magnetite, all the main deposits between Karamea and Bruce Bay were surface sampled. The main beaches between Bruce Bay and Jackson's Bay were later sampled, so that an assessment of the potentialities of the main beaches of the West Coast as sources of ilmenite is now available.

Results are given in the tables:

Table 1 shows the percentages of ilmenite and magnetite in each

TABLE 1.—Percentages of Ilmenite and Magnetite.

Locality	Grade of Sample	Ilmenite (%)	Magnetite (%)
Jacksons Bay Aerodrome ....	Small surface concentration	3.5	33.8
Midway between Mussel Pt. and Waiatoto R. ....	Average of surface 2 ft	0.1	1.8
Mussel Point ....	Average of surface 2 ft	0.6	0.2
Beach 2 mls S. of Haast River ....	Average of surface 2 ft	0.1	0.1
Beach 1 ml. N. of Haast River ....	Surface concentration	21.6	10.5
Bruce Bay ....	Surface concentration	16	N.A.
Bruce Bay ....	Average surface sand	9	N.A.
Hunts Beach ....	Surface concentration	15.5	N.A.
Gillespies Beach ....	Surface concentration	20	20.8
Gillespies Beach ....	Average surface sand	10	N.A.
Okarito 5 mile Beach ....	Surface concentration	28.6	1.1
Okarito Beach ....	Surface concentration	25	N.A.
Okarito 3 mile Beach ....	Surface concentration	43.7	5.0
Mouth of Poerua River ....	Surface concentration	24	N.A.
Ross Beach ....	Average surface sand	6.2	0.03
Mahinapua, near lake ....	Surface concentration	14	N.A.
Hokitika 1 ml. S. of river ....	Average surface sand	8	N.A.
Kapitea Ck., N. of Hokitika ....	Average surface sand	8.6	1.0
Barrytown ....	Dredge concentrate	28.4	N.A.
Addisons Flat, S. of Westport ....	Surface sand	5.6	0.1
Nine Mile Beach, S. of Cape Foulwind	Surface concentration	25.5	0.9
Carters Beach, Westport ....	Surface concentration	14.6	0.4
7 mls. S. Karamea River ....	Average surface sand	8	N.A.
5 mls. S. Karamea River ....	Surface concentration	27	N.A.

N.A.—Not available.

sample, as determined by separation of the magnetite by hand magnet, followed by electro-magnetic separation of the more feebly magnetic ilmenite from the garnet and non-magnetic minerals, using a magnetic refraction separator (Officer, 1947), and the Frantz Isodynamic Magnetic Separator.

Table 2 gives chemical analyses of ilmenites from the more significant deposits, together with analyses of ilmenites from overseas sources for comparison.

TABLE 2—Chemical Analyses of Ilmenite Samples.

Locality	Fe (%)	TiO <sub>2</sub> (%)	V <sub>2</sub> O <sub>5</sub> (%)	(NbO (%))	Cr <sub>2</sub> O <sub>3</sub> (%)
<b>SOUTH ISLAND ILMENITES</b>					
Gillespies Beach	32.5	44.5	Less than 0.05	2.5	Less than 0.01
Okarito Beach	32.2	44.5	0.05	2.5	0.01
Nine Mile Beach, S. of Cape Foulwind	32.5	45	0.05	2.5	0.01
Karamea, 7 mls. S. of Kara- mea River	32.5	44.5	0.05	2.5	0.01
Pure ilmenite FeO. TiO <sub>2</sub> (theoretical)	36.8 (47.3% FeO)	52.7			
Pure 'arizonite' Fe <sub>2</sub> O <sub>3</sub> . 3TiO <sub>2</sub>	28.0	60.0			
Patea (Taranaki) Titanomagnetite	53.59	7.0-9.0	0.3-0.4	0.7	Nil
<b>FOREIGN ILMENITES (Gillson, 1949)</b>					
Travancore (India) "M.K." (Arizonite-Ilmenite Mixture)	30.6	54.1	0.23		0.09
Travancore "Quilon" (Arizonite-Ilmenite mixture)	24.7	60.4	0.36		0.17
Arkansas	32.1	47.7	0.24		0.53
Norwegian (rock)	35.3	44.0	0.30		0.01
Malay States (tin placer residues)	31.1	53.4	0.04		0.01
Cudgen, New South Wales	32.2	51.2	0.21		2.50
Jacksonville, Florida	22.7	60.3	N.D.		N.D.
Trail Ridge, Florida		64.0			

Table 3 gives estimates of the order of quantities of sand available in the various localities. In making these estimates, it has been assumed that the logical large-scale method of working these deposits would be by some form of dredging, either standard bucket-dredging as for gold or tin or the more mobile dragline-dredging. The length of the beach areas as given is approximately correct, but the figures given

TABLE 3.—Quantities of Sand.

Locality	Length of Deposit (yards)	Average Width of Deposit (yards)	Average Depth of Deposit (feet)	Volume cu yd. × 10 <sup>6</sup>	Tonage × 10 <sup>6</sup> @ 1.5 tons per cu. yd.
Haast R. to Tauperikaka Point	14,000	300	30	42	63
Bruce Bay	7,000	200	30	14	21
Hunts Beach	7,000	400	30	28	42
Gillespies Beach	5,000	300	40	20	30
Okarito Five Mile Beach	4,800	300	30	14.4	21.6
Okarito Three Mile Beach	2,500	300	30	7.5	11.25
Okarito to Waitaki Bluff	12,000	200	30	24	36
Abut Hd. to Poerua River	15,000	200	30	30	45
Bold Hd. to Hokitika	35,000	300	30	105	157.5
Hokitika to Pt. Elizabeth,					
Greymouth	48,000	200	30	96	144
Barrytown	10,000	400	40	53.3	80
Westport—					
Nine Mile Beach	12,000	300	30	36	54
Carters Beach	8,500	300	30	25.5	38.25
Karamea—					
Little Wanganui River to Kohaihai River	28,000	300	30	84	126
					869.6

for the average width and average depth of the sand deposits are open to correction, and could be determined accurately only by an extensive and costly drilling programme, such as would be necessary to delineate the economically exploitable portions of the deposits.

In assessing the average depths, the Department of Mines records of the dredging companies at Barrytown, Paroa, Waimea Creek, Salt-water Beach, Okarito, and Gillespie's Beach have been examined, and conservative figures taken, e.g., drill records for Barrytown Gold Dredging Co. Ltd. show blacksand at depths of 60 ft from the surface, whereas in Table 3 40 ft is taken for the average depth; at Gillespie's Beach drill records show blacksand at depths of over 50 ft from the surface, whereas the average depth taken in Table 4 is 40 ft; and at Okarito, dredging company records show blacksand to over 30 ft from the surface, whereas 30 ft is taken as the average depth.

The old dredges in the other localities mentioned all worked to depths of about 30 ft from the surface and, where depths are not known, 30 ft is considered to be a conservative figure.

### DISCUSSION

As Tables 1 and 3 indicate, all the beaches north of the Haast River contain large tonnages of ilmenite. It is emphasized, however, that all the data given are for surface samples only, and the actual quantities of ilmenite available cannot even be conjectured until average samples

over the full depth of the deposits are available. In assessing the possible resources even apparently low-grade areas, e.g., from Abut Head, south of Ross, to Point Elizabeth, north of Greymouth, have been considered. While not immediately interesting for its ilmenite content, this whole locality also contains small amounts of magnetite, gold, and radioactive minerals, and some sections may possibly be worked at some future date for all the economic minerals.

The most important deposits, considering quantity and grade of material, ease of working, and accessibility, undoubtedly is that near Westport, extending south from the mouth of the Buller River a distance of some 12 miles. Carters and Nine Mile Beaches are estimated to contain some ninety odd million tons of sand, surface concentrates of which show 14% and 25% respectively of ilmenite.

Nineteen posthole bores, average depth 15 ft, by Marshall, Suggate, and Nicholson (1958) on the northern half of Nine Mile Beach showed that the surface sand above water level contained an average of 5.5% of magnetically recoverable ilmenite. In this locality should be mentioned also the Addisons Flat and Charleston raised beach deposits where there is known to exist some millions of cubic yards of black-sand which has been extensively worked for gold. A railway once connected the river harbour of Westport with the deposits north and south of Cape Foulwind and, rebuilt, could provide ready access for large-scale development.

Other possibly important deposits occur north of Haast River, at Bruce Bay, Gillespies Beach, Okarito, near Harihari, Barrytown, Karamea, but all lack access by rail and sea.

Table 2 shows the very important fact that these ilmenites are practically free of chromium and vanadium, and hence should be suitable for the production of titanium dioxide pigments.

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