COMMONWEALTH OF AUSTRALIA.

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BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

REPORT No. 1949/110

PLAN NOS. QG21 - 2B - 1
Q25 -10B - 5A
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BEACH SANDS INVESTIGATION.

AN INVESTIGATION OF THE VARIATIONS IN THE COMPOSITION OF HEAVY MINERAL CONCENTRATES IN THE BROADBEACH RECREATIONAL AREA AND OF THE THORIA CONTENT OF THE MONAZITE IN THE AREA.

by

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DEPARTMENT OF SUPPLY AND DEVELOPMENT.

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SUMMARY.

Results are given of investigations carried out to detect any variation in the relative proportions of the several heavy minerals in heavy concentrates separated out from beach sands of the Broadbeach Recreational Area. The possible variation of the thoria content of monazite in the area is also investigated. Results indicate a systematic variation from east to west in the proportion of Zircon, rutile and ilmenite in the concentrates. The thoria content of the monazite in the area is shown to be constant within experimental limits.

INTRODUCTION.

This small area was selected to begin a study of any variation which might occur along the coast in the relative proportions of the several heavy minerals in the concentrates and the thoria content of the monazite.

It is clear that the conditions affecting transport or deposition of the heavy minerals vary gradually along a beach viz. from south to north, but it is probable that these condition change relatively sharply at right angles to the beach viz. from east to west. It may be expected that any systematic variation in the distribution of the heavy minerals will reflect these changes in the conditions of transport and deposition. Again, the oldest deposit in any area is the westernmost deposit, and each deposit in order from west to east is progressively younger. Actually, it is believed that all of the deposits were formed within a short period, and differ very little in age. The compositions of the concentrates being transported along a particular beach may however have changed during the brief period between the formation of the successive deposits. That is, the compositions of the concentrates could vary in an east-west direction because of two reasons : changing conditions of transportation and deposition, and changes in composition over a period of time.

The area under consideration is traversed by two bore lines which extend from the beach to about 1000 feet west of the beach, and are 320 feet apart from north to south. No attempt was made to detect any variation in the compositions of the concentrates from north to south. As noted above, any such systematic variation would be of small magnitude and over this short distance would probably be masked by random variation.

The thoria content of the monazite deposited at any particular time may be expected to be virtually constant along a given beach or along a part of the coast supplied from any

particular source of monazite. However, the thoria content of the monazite which is being supplied to a beach may possibly change during a period of time. For example, the headwaters of the streams which, it may be supposed, are transporting the monazite grains from their initial sources, may work back into areas containing monazite of slightly different thoria content. During this investigation an attempt was made to ascertain whether any variation occurs in the thoria content of the monazite from east to west, that is, in the younger and older deposits.

LOCALITY.

The Broadbeach Recreational Area is adjacent to the beach near the northern end of the town of Broadbeach. Plans and sections of the area are given at the end of this report. The beach extends in a northward direction from a headland, "South Nobby" at its southern end to the mouth of the Nerang River, a total distance of nine miles. The Southern portion of the beach, from Hythe Street to Peerless Avenue is within the town boundary of North Burleigh and is called Mermaid Beach. The middle portion of the beach from Peerless Avenue northwards to 1st Avenue is within the boundary of the town of Broadbeach and is called Broadbeach. The northern portion of the beach extends through Surfer's Paradise and Southport East, where it is called Main Beach, and continues northward to form the eastern edge of the "Spit", a sandspit which extends for 2½ miles from Jubilee Bridge near the northern end of Main Beach to the mouth of the Nerang River.

SAMPLING OF THE AREA.

Sampling for Variation in Composition of Concentrates.
Samples were taken from the bores located along the two bore lines - Line 564N and Line 244N. To examine the composition of the concentrates systematically from east to west, the samples obtained from the bores were grouped into twelve composite samples. Of these, composite sample C1 represents the eastern extremity of the area defined by bores 160E, and 140E in Line 564N, and bores 155E and 135E in Line 244N. Composite sample C2 was made up from the samples of bores 95E and 70E in Line 564N along with the samples of bores 100E and 65E in Line 244N. Similarly, proceeding from east to west, samples C3 to C12 were made up. Each of these samples was carefully divided into two equal portions. One portion was used to determine the content of zircon, rutile and ilmenite in the concentrate, while the other portion was used to determine the monazite content. Details of the preparation of these samples are given in Table 1.

TABLE 1.

GROUPING OF BORE SAMPLES
INTO COMPOSITE SAMPLES

COMPOSITE SAMPLE	LINE 564N BORE	LINE 264N BORE	COMPOSITE SAMPLE	LINE 564N BORE	LINE 264N BORE
C 1	160E 140E	155E 135E	C 7	285W	295W
C 2	95E 70E	100E 65E	C 8	345W	345W
C 3	15W	10W	C 9	385W 405W	397W
C 4	65W	75W	C10	685W	700W
C 5	115W	105W 120W	C11	825W	800W
C 6	185W 205W	195W	C12		850W to 925W

The distribution of the deposits of heavy minerals as shown in plan at the end of the report suggests that deposition may have occurred in two stages, the earlier stage resulting in the deposit shown as Block 11 and the later stage in the deposit shown as Block 1. The concentrates in these Blocks were represented by Samples 1 and 11 made up by combining appropriate portions of composite samples as shown in Table 11.

TABLE 11.

GROUPING OF COMPOSITE SAMPLES OF TABLE 1
INTO SAMPLES REPRESENTATIVE OF BLOCKS 1 AND 11

SAMPLE	AREA REPRESENTED BY SAMPLE	CONCENTRATES USED IN MAKING UP SAMPLE
1.	Block 1	Appropriate portions of composite samples C1 - C9
11.	Block 11	Appropriate portions of composite samples C10 - C12

DETERMINATION OF PERCENTAGE COMPOSITIONS.

TABLE 111A COMPOSITIONS OF COMPOSITE SAMPLES.

COMPOSITE SAMPLE	PERCENTAGE COMPOSITION					
	MONAZITE DETERMINED RADIO-METRICALLY	ZIRCON	RUTILE	ILMENITE	GARNET*	OTHER * MINERAL
C 1	0.46	40.3	31.9	24.5	0.8	2.0
C 2	0.62	42.1	32.8	23.0	0.8	0.5
C 3	0.33	37.7	34.1	24.4	1.4	2.0
C 4	0.65	44.6	31.2	22.1	0.45	0.85
C 5	0.48	37.9	34.5	24.5	0.8	1.8
C 6	0.42	36.0	34.7	24.9	1.1	2.8
C 7	0.39	38.7	33.6	24.5	1.1	1.6
C 8	0.38	35.4	35.2	25.5	0.8	2.6
C 9	0.55	35.7	33.9	27.1	0.7	2.0
C10	0.56	37.4	33.1	26.0	0.8	1.9
C11	0.45	34.9	35.6	25.0	1.2	2.8
C12	0.55	36.0	34.8	25.5	1.1	2.1

* Some of the garnet and "Other Minerals" is separated from the heavy mineral concentrate during concentration on the Wilfley Table. However, the concentrate cannot be entirely cleaned from garnet and "Other Minerals" without there being some loss of rutile and ilmenite, and so some garnet and "Other Minerals" is left in the concentrate.

TABLE 111B

COMPOSITIONS OF CONCENTRATES ON BLOCKS 1 and 11

SAMPLE	MONAZITE DETERMINED RADIO-METRICALLY	ZIRCON	RUTILE	ILMENITE	GARNET	OTHER MINERALS.
*Sample1 (Block 1)	0.50	39.5	33.0	25.0	0.9	1.0
*Sample11 (Block 11)	0.52	36.6	34.5	27.4	0.4	0.5

* Sample 1 and Sample 11 were further cleaned of garnet and "Other Minerals" by additional concentration on the Wilfley Table.

Zircon, Rutile and Ilmenite: It was noted above that each composite sample was divided into two equal parts. One portion was subjected to magnetic separation on a Frantz "Isodynamic" Separator thus producing a magnetic fraction made up of ilmenite, monazite, garnet and other minerals such as tourmaline and epidote, and a non-magnetic fraction of zircon and rutile. A monazite concentrate was produced from the magnetic fraction by further magnetic separation. The three fractions - monazite concentrate, remainder of the original magnetic fraction, and the non-magnetic fraction, were weighed and their compositions determined by grain-counting.*

* In future investigations the composition of the non-magnetic fraction will be determined by electrostatic separation and

The figures obtained for zircon and rutile are considered to be accurate to withon +0.5, that is, to within 1.5%; and the figures for ilmenite correct to within +0.1, that is, to within 0.4%

MONAZITE. Using the above method, only a very small quantity of monazite concentrate is obtained. This concentrate has an approximate composition of 70% monazite with 30% tourmaline and leucoxene. Because of the large difference in sizes and specific gravities of the monazite and the impurities, it is not possible to take a sample of this concentrate of grain-counting without the risk of segregation of the impurities from the monazite. Hence, the grain-counting method used for the determination of zircon, rutile and ilmenite as described above would not give the same order of accuracy if applied to the determination of percentage monazite. A better order of accuracy for percentage monazite was obtained radiometrically.

RADIOMETRIC WORK by MR. NEWMAN.

Geiger - Muller gamma ray counting equipment was standardised for the monazite and the mixed concentrates of the area by the following method : A quantity of 99% monazite was prepared from the area. Weighed amounts of this monazite were mixed with weighed amounts of zircon, rutile and ilmenite to form samples having the approximate composition of the mixed concentrates i.e. the composite samples. The counting rate given on the Gieger - Muller equipment by these samples of known monazite content was recorded. The second portion of each composite sample was then tested by means of the calibrated equipment and the Geiger - Muller count for each sample was converted into percentage monazite.

The compositions of the composite samples are given in Table IIIA while the compositions of concentrates in Block I and II are given in Table IIIB.

Thoria Content of Monazite.

Monazite concentrates were separated out from three composite samples, the first representing the completed area ; the second representing Block I and the Third representing Block II. Details of these monazite samples (MA, MI and MII) and the composite samples from which they were prepared are given in Table IV.

TABLE IV. MONAZITE SAMPLES FOR ESTIMATION OF THORIA.

MONAZITE SAMPLES	AREA REPRESENTED	SAMPLES USED.
M A	Complete Area	1 to 12 of Table I
M I	Block I	Sample I of Table II viz. Samples 1-9 of Table I.
M II	Block II	Sample II of Table 2 Viz. Samples 10-12 of Table I.

Sample MA contained 98+% of monazite while samples MI and MII contained 95+% of monazite. The thoria content of these monazite samples was tested by comparison with a

standard sample of known thoria content.

(1) The Standard Sample: This sample contained monazite supplied by Zircon - Rutile Ltd. of Byron Bay. According to chemical analysis the thoria content of this monazite is 6.6%

(11) Samples representing the complete area i.e. sample MA. Geiger-Muller tests on this sample showed the monazite to contain radioactive material in the same proportion as the standard sample within the experimental limits of ±5%, so that the thoria content of monazite in the Recreational Area may be taken to be (6.6 ± 0.3)%

(111) Samples for the comparison of the thoria content of monazite in the eastern or younger deposits with that of monazite in the western or older deposits i.e. samples M1 and M11. Geiger - Muller tests showed that the activity of the monazite in the two samples varied by 1.9%. Samples M2 having the higher activity. The variation of individual counts taken in the Geiger - Muller tests indicated a possible error of about 3% in the comparison of the two samples.

Analysis of results of grain - counting on the monazite concentrates indicate a possible error of 1%. This does not allow for any error introduced by estimation of the average number of grains in a field, but only by variation of the number of grains of impurity counted in each field.

Hence, results indicate that within experimental limits, there is no variation in the thoria content of the monazite in samples M1 and M11.

CONCLUSIONS

(1) There is a definite decrease from east to west of the proportion of zircon in the concentrates with a corresponding increase in the proportion of rutile and ilmenite. This is shown in Table V.

TABLE V.

VARIATION IN THE PROPORTION OF ZIRCON, RUTILE AND ILMENITE

COMPOSITE SAMPLES	DISTANCE IN E-W DIRECTION COVERED BY BORES	ZIRCON	RUTILE	ILMENITE
1 - 4	230 feet	41.2	32.4	23.5
5 - 7	280 "	37.5	34.3	24.6
8 -10	355 "	36.5	34.1	26.2
11-12	125 "	35.4	35.1	25.2

(2) No definite systematic variation was found in the proportion of monazite in the concentrates. However, in general, the higher values of monazite are associated with the higher values of zircon.

(3) The thoria content of monazite in the area is (6.6 ± 0.3)% and within experimental limits no difference was found between the thoria content of monazite from the younger deposits and that of monazite from the older deposits.

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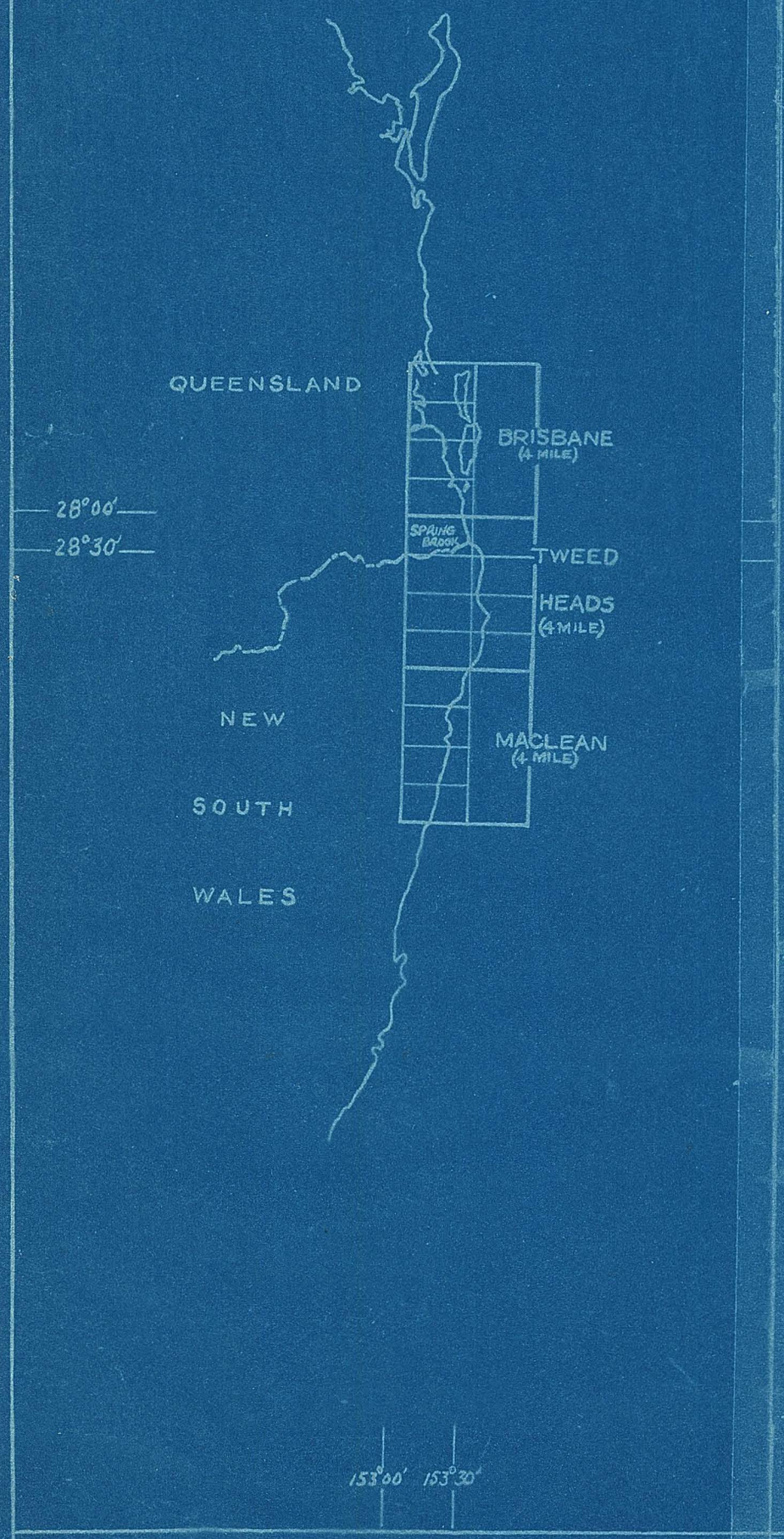
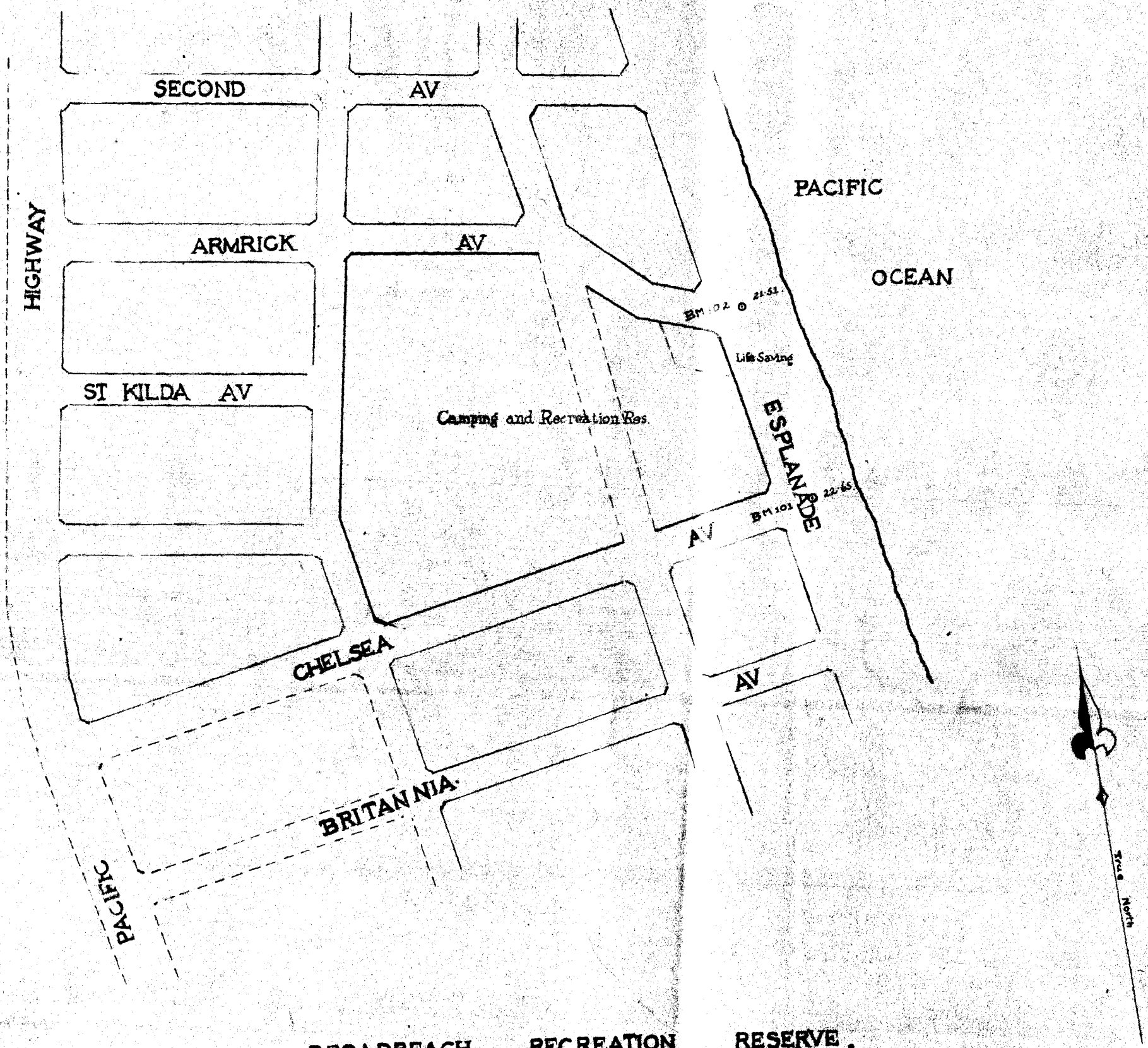
MILITARY REFERENCE MAP



LOCALITY PLAN

QG 21-2B-1



BROADBEACH RECREATION RESERVE.

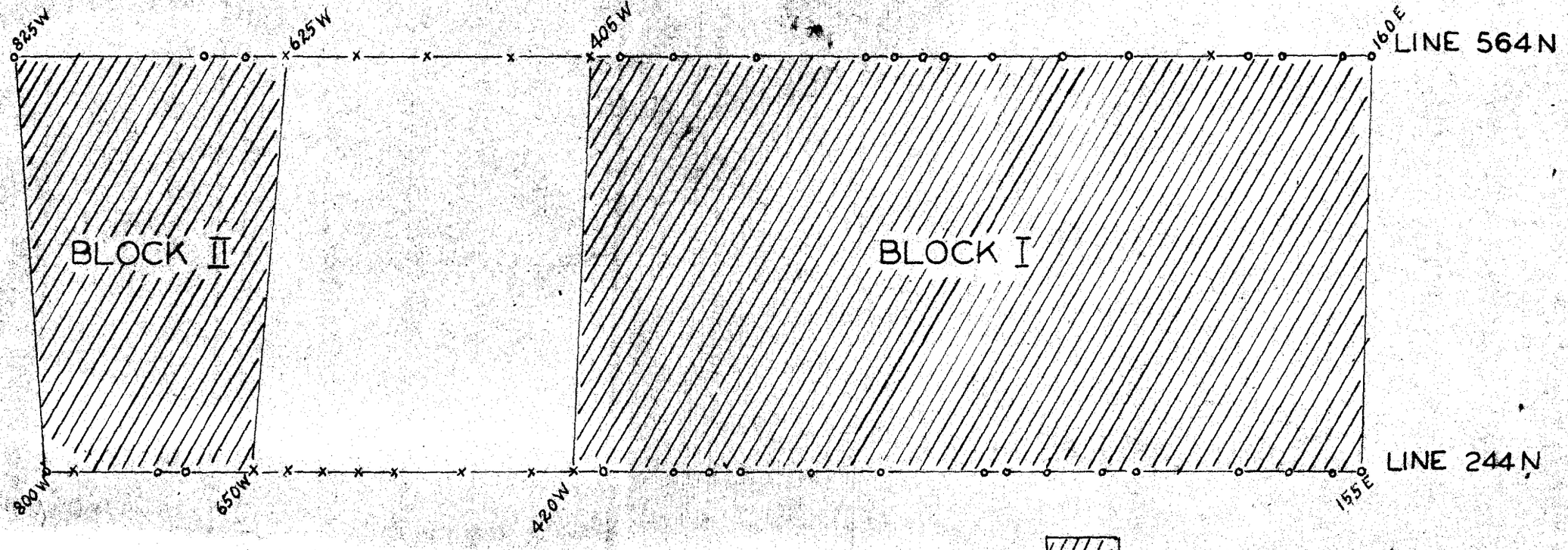
Scale:- 4 Chains to an Inch

Q25-10B-5A.

PLAN OF MINERAL BEARING SAND

BETWEEN LINE 564N & LINE 244N

SCALE 0 100' 200'

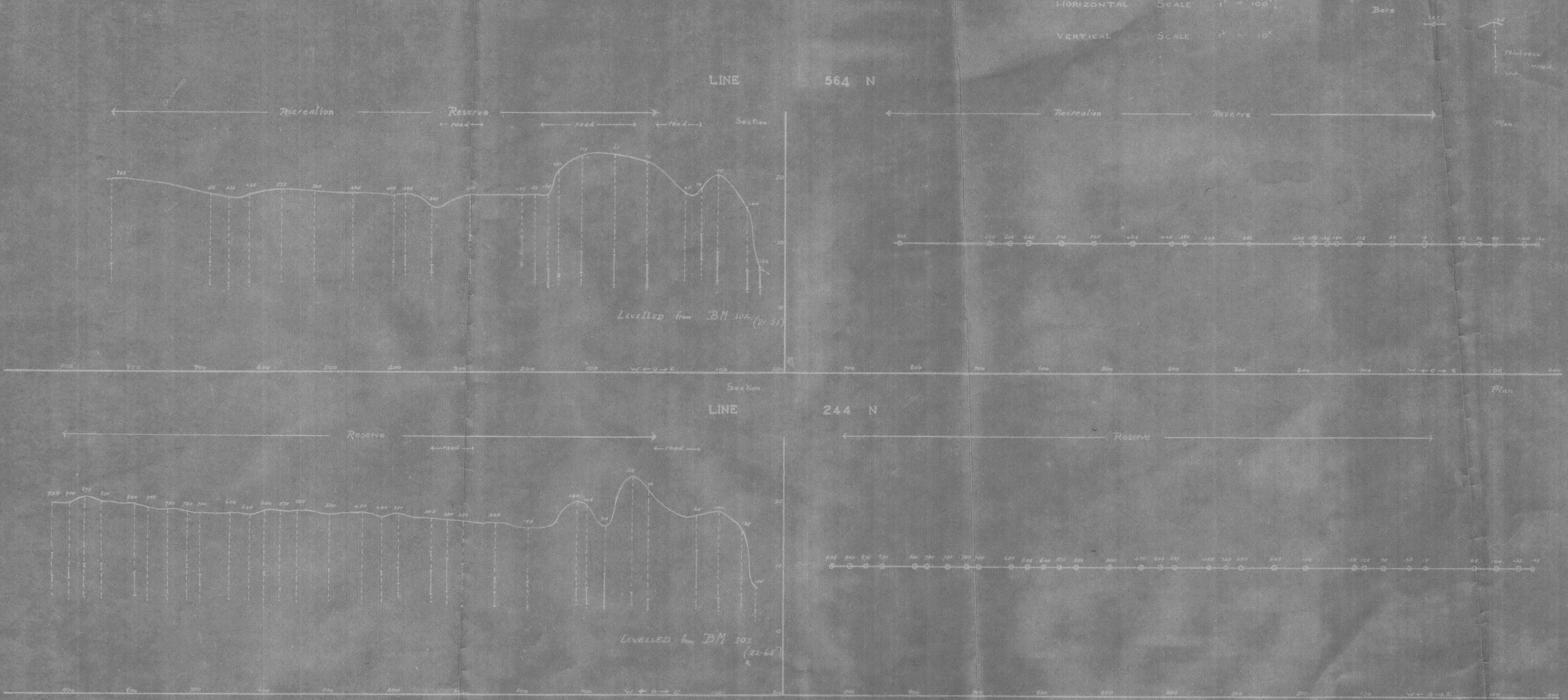


MINERAL BEARING SAND

AREA: BROADBEACH RECREATION RESERVE; SECTIONS ALONG BORE LINES

HORIZONTAL SCALE 1" = 100'.

VERTICAL SCALE 1" = 10'.



Q25-10B-4