COMMONWEALTH OF AUSTRALIA.

MINISTRY OF NATIONAL DEVELOPMENT.

~~DEPARTMENT OF SUPPLY AND SHIPPING.~~

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

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MINERAL DEPOSITS OF THE FINGAL-CUDGEN AREA NORTHERN NEW SOUTH WALES.

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MINERAL DEPOSITS OF THE FINGAL-CUDGEN AREA, NORTHERN NEW SOUTH WALES.

SUMMARY.

The deposits of heavy minerals along the East Coast of Australia are being investigated primarily to determine their content of monazite. The principal deposit in the Fingal-Cudgen area occurs beneath the dunes adjacent to the beach, from Fingal Point to the northern end of the Camping and Recreation Reserve at Kingscliffe, approximately 4 miles south of Fingal Point. Two smaller deposits occur over the southern mile or so of the area, parallel to the main deposit and up to 300 feet west of it. The deposits contain 63,600 tons of zircon-rutile-ilmenite-monazite concentrates, of which an estimated 330 tons is monazite. The average grade is 502 lbs. of heavy mineral concentrate per cubic yard of sand. The width of the deposits ranges from 40 feet to 220 feet and averages 114 feet.

The average thickness of the deposits is 2.25 feet, and the thickness of overburden is 7.3 feet. With the exception of the southernmost 500 feet, in the vicinity of the camping ground, the deposits are available for mining. In the northern portion of the main deposit, from Fingal Point to bore line 6000S (6000 feet south of Fingal Point), and in the southern portion from 16975S to 19890S, the heaviest of the heavy minerals, viz., monazite and zircon, are present in substantially constant proportions. In the middle portion of the main deposit, between 6000S and 16975S, the quantities of monazite and zircon are notably reduced. In the smaller deposits the proportions of monazite and zircon decrease steadily from south to north.

A. INTRODUCTION.

1. General Purpose of the Investigation. The primary aim of the "Beach Sands Investigation" is to determine the reserves and the distribution of monazite in the deposits of heavy mineral sands along the East Coast of Australia. These deposits contain very large reserves of zircon and rutile (Fisher 1949 (a) and (b)) for which they are being exploited at various localitities, mainly from North Stradbroke Island in Queensland to Ballina in New South Wales. The monazite forms little more than 0.5 per cent of the mixed concentrates, but can be recovered as a by-product during the separation of the other minerals. Monazite, a phosphate of cerium, lanthanum, praseodymium and other rare earths, with thorium silicate, is utilised commercially as a source of cerium and of thorium. In this investigation, the thorium content of the monazite is being determined on the basis of its radioactivity.

2. Situation. The Fingal-Cudgen Area comprises a beach and associated dunes extending approximately 4 miles from Cudgen Point to Fingal Point, and the low lying coastal plain between the dunes and the Tweed River. Fingal Point, at the northern end of the area, is 2¾ miles south of Point Danger, which is crossed by the Queensland-New South Wales State Boundary. Plans of the area, and a locality map, are included in Plate 1 at the end of this report.

3. Access. The Pacific Highway crosses the Tweed River at about the middle of the western margin of the area and continues southwards along the eastern bank of the river. A main road from the Highway Bridge follows the eastern bank of the river northwards to Fingal Point. A second main road, Chinderah Road, runs easterly from the Highway approximately 2½ miles south of Fingal Point, and at the coast, meets Marine Parade, which runs southwards adjacent tothe beach as far as Cudgen Point. The nearest railhead is the terminus of the Brisbane-Tweed Heads railway at the Town of Tweed Heads, 4½ miles north by the Pacific Highway from Chinderah Road. The nearest railhead of the New South Wales railways is at Murwillumbah 13½ miles southwards along the Pacific Highway.

4. Mining Tenements. At the time of the investigation, leases or applications for leases were held as follows :-

M.L.1 A.J. Knowles, Brisbane.
P.M.D. 3 A.J. Knowles, Brisbane.
M.L. 4 J.P. Murphy, Tweed Heads.
M.L. 2 A.J. Knowles, Brisbane
G.L.2. J.Cooley, Tweed Heads.

Special Lease Applications:

No.148. J.P. Murphy, Tweed Heads.
No.159. J.P. Murphy, Tweed Heads.
No.157. J.P. Murphy, Tweed Heads.
No.158. J.P. Murphy, Tweed Heads.

5. Responsibility for Sections of this Report. The several sections of this report were compiled by those who were most directly responsible for the conduct of the respective portions of the work. In general, however, each member of the staff assisted in several phases of the investigation. T.D. Dimmick, now an officer of the Queensland Geological Survey, carried out the preliminary field work in the area. J.Ward, assisted by L.R.Lee was responsible for Laboratory work, including the separation and examination of minerals. Miss L.M. Edhouse conducted radiometric determinations of quantities of monazite, and investigations of the thoria content of the monazite. D.E. Gardner supervised the work.

B. TOPOGRAPHY.

The beach and the adjacent dune belt sweeps northwards from Cudgen Point in a broad curve concave towards the ocean, and terminates against the solid rock at Fingal Point. The crests of the dunes rise to a height of more than 30 feet above mean low water in the northern half of the area, but in the southern half the crest heights are mostly below 30 feet. The width of the dune belt varies from 132 feet to 660 feet, and averages 466 feet. Between bore lines 1500S and 9000S, adjacent to the lagoons shown on Plate 1, Fig. 2, the width is, for the most part, less than 300 feet. Plate 1, Fig.2 shows that lagoons appear west of the dunes between lines 1500S and 5250S, and between lines 6000S and 9000S. The western boundary of the sandy area crosses the 10500S and 9000S bore lines at 2200W and 357W respectively. The occurrence of the lagoons and of this boundary suggests that the Tweed River may at one time have flowed some distance east of its present course, and have eroded the western portions of the dune area between bore lines 9000S and 1500S, thus resulting in the observed narrowing of the dune strip between these lines. Confirmation of this supposed erosion of the dune by the river is obtained from the profiles of Plates 2 and 2A. Thus in the southern half of the area, a prominent dune ridge, which may be termed the Westerly Dune Ridge, occurs some distance west of the beach dunes. This ridge appears in the sections of the bore lines as shown in Table A.

TABLE A. The Westerly Dune Ridge.

Bore Line	Co-ordinate of Crest of Westerly Dune Ridge.
10500S	1060W
12000S	1400W
13975S	1270W
15475S	985W
16975S	900W
18575S	640W

The sections of Plate 2A show that the dune, which has an elevation of 29 feet at the 10500S boreline terminates between the 10000S and 9000S lines. Again examining the area between this westerly ridge and the beach, it can be seen on the section of line 16975S that a massive dune ridge, which may be called the Central Dune Mass, occurs between the 705W and the 165W coordinates, and the "Beach Dunes" occur from 165W to 35E. The Central Dune Mass can be traced from the 19890S bore line northwards as in Table B.

TABLE B. The Central Dune Mass.

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Bore Lines.	Coordinates between which the Central Dune Mass Occurs.
19890S	880W to 335W
18575S	720W to 250W
16975S	705W to 255W
15475S	610W to 240W
13975S	615W to 35W (?)
12000S	445W to 30W
10500S	495W to 175W
	The Dune from 913W to 630W extends for only a short distance from north to south.
9000S	357W to 157W

The Central Dune Mass is very narrow on the 9000S line, and does not occur on 7500S line. Presumably, the erosion which removed the Westerly Dune Ridge between the 10500S and 9000S lines partly removed the Central Dune Mass at the 9000S line and terminated it at a point between the 9000S and 7500S lines.

The supposed former channel of the Tweed River can similarly be traced in the northern portion of the area, where it follows approximately the eastern boundary of the northern lagoon. The sections of Plate 2 show that, from lines 7500S to 4500S inclusive, only the Beach Dunes occur. Dune masses on lines 6000S and 4500S, which appear to be the Central Dune Mass, are actually north-westerly trending active dunes, formed in recent years. The outline of this dune on line 4500S can be seen in Plate 1. Fig. 2 The Central Dune Mass does appear on line 3000S from the edge of the lagoon to 237W, and on line 1500S from 427W to 230W. In the latter line, the Western Dune Ridge also appears, its crest being at 640W. The erosion of the dunes outlined above indicates that the eastern bank of the Tweed River in former times encroached as far easterly as the foot of the Beach Dunes between bore lines 9000S and 3000S. It is quite possible that the river formed an outlet to the sea a few hundred feet south of the 6000S bore line. There the crests of the dunes are at a lower elevation than those traversed by the 6000S line. It will be noted too that on the latter bore line the crests rise to about 21 feet, where as on the 7500S and 4500S lines the crests rise to 38 and 36 feet respectively.

A low lying sandy area which included the lagoons shown in Plate 1. with smaller somewhat swampy patches, extends westwards from the coastal dune belt to the Tweed River. The swampy patches become more extensive in the western portion of the area between Chinderah Road and the lagoon a mile to the north, and in the southern portion of the area, at the foot of the higher country which runs approximately west-southwest from the village of Kingscliffe.

The sand which forms the seaward side of the foredune is fixed mainly by Spinifex, with blady grass in places, coastal couch, goatsfoot convolvulus and pigface. The tops of the foredune, subject to severe wind action, are covered in many places by dense clumps of a native heath. The western or landward side of the foredune supports a mixed dune scrub, including trees such as Banksia, Lillipilli, Cupania and Cupaniopsis, with vines, heath, bracken, grasses and rush-like sedges.

The low lying country between the dune belt and the river has mostly been cleared for cultivation and for grazing. Stunted swamp sheoak surrounds the lagoons and is seen, with paper bark tea tree, in the swamps at the southern edge of the area.

C. GEOLOGY.

1. General. The coastal dunes and the low-lying sandy flat between the dunes and the river are composed of recent unconsolidated quartz sand. Near the present beach, the dunes contain small quantities of heavy minerals. The higher country 2½ miles west of

__CONTD.__

Fingal Point is made up of steeply dipping lower Palaeozoic sediments, capped by Pliocene basalt, which occurs mainly above the 150 foot contour. A mass of Pliocene basalt outcropping approximately a mile to two miles to the south-east, where it is crossed by the Pacific Highway, persists downwards below river level. A short distance west of Chinderah Bay, Pliocene basalt again caps lower Palaeozoic sediments, mainly above the 150 foot contour. The higher country at the southern end of the Fingal-Cudgen area consists of Pliocene basalt, which continues below sea level in the vicinity of Cudgen Point, and probably for about two miles in a West-southwesterly direction from Cudgen Point.

2. The Coastal Dunes. During prolonged periods of calm weather the prevailing ocean winds blow sand from the beach into a low dune ridge or foredune at the top of the beach. At the time of the investigation sea erosion during stormy weather had caused the top of the beach to ~~advance~~ recede landwards, e.g. on bore line 3000S and 7500S to the foot of the high dune appearing on these lines at 93W, and 115W respectively. This high dune apparently represents a former foredune built up when the top of the beach maintained a constant position for a considerable period.

The prominent dune described in section B "Topography", as the Westerly Dune Ridge apparently marks the position of a former beach which curved around from south of 18575S/640W through 13975S/1270W to 1500S/640W and northwards to the basalt of Fingal Point.

The Central Dune Mass of section B "Topography" appears to be made up of two or three old foredunes, which developed in succession in a quiet period of only slight changes in conditions of sea level or of supply of sand. Undoubtedly the Central Dune Mass, prior to the erosion which removed it between lines 9000S and 3000S, swept unbroken from Cudgen Headland to Fingal Point. The sections of the bore lines on the southern part of the area show a steep sandy scarp in the position given in Table C.

__TABLE C.__ __Sandy Scarp at Southern End of Area.__

Bore Line	Coordinate of Scarp.
20390S	430W
19890S	355W
19125S	230W
18575S	224W
16975S	195W

It is probable that, at a comparatively recent date, the beach top advanced westerly to the position of this scarp. Possibly the erosion which formed this scarp was contemporaneous with the erosion which removed the middle portions of the Western Dune Ridge and the Central Dune Mass. Investigations of the mineral deposits of the Palm Beach Area, Queensland, and the Tweed-Fingal Area, Northern New South Wales, gave evidence of erosion of dunes, similar to that noted above in the Fingal-Cudgen Area. In the Palm Beach Area, towards the southern end, an abrupt sandy scarp occurs, comparable with that seen in the Fingal-Cudgen Area. In the Tweed-Fingal Area a truncated westerly dune ridge appears at the southern end, similar to the Westerly Dune Ridge of the Fingal-Cudgen Area.

No westerly dune ridge appears at the north of the Tweed-Fingal Area. The latter area is a sandspit terminating at its northern end at the mouth of the Tweed River, and probably the whole spit, excepting the small portion of the western dune at the southern end, was inundated. It is possible that further investigations along the coast may permit correlation of the evidences of erosion in some of the beaches.

3. Deposits of Heavy Minerals.

During stormy weather heavy minerals may be deposited on the upper part of the beach. A deposit appears as a "seam" which may have an unbroken length of several thousand feet, and a maximum width near the northern end, of the order of 50 feet. The "seam" is thickest near the top of the beach, and tapers off wedge-shaped down the beach. The waves and surf sweep onto the beach from a direction somewhat to the south of east, and tend to transport the heavy minerals northwards along the beach. As a result, the heaviest deposits appear on the northern portion of the beach, southwards from the headland. The sections of plates 2 and 2A do not show any newly formed deposit on the present beach, but seams appear beneath the dunes adjacent to the beach, in the positions of former beaches a little to the west of the present beach.

D. METHOD OF TESTING.

1. Mapping. The positions of the bore lines from 00 to 3000S were related by chaining to the residential allotments in the area, and to the eastern training wall of the Tweed River. Bore lines 4500S and 7500S were similarly related to the training wall. Lines 5250S and 6000S were mapped along with the north western peg of G.L. 2 and the north-western corner of allotment 455 in a theodolite survey of this portion of the area. Line 12000S was related in a plane table survey, to the application peg at the south-eastern corner of ML4 and to the nearby allotments, Nos. 349 to 363. Bore lines 13975S to 20890S inclusive were mapped by chaining to the surveyed allotments in the Village of Kingscliffe. A plan showing the bores in the Fingal-Cudgen Area, on a scale of 500 feet to the inch, is given in Plate 1. This plan was based on Military Maps, 1 mile series, Zone 8, Nos. 213A and 224 and on the New South Wales Lands Department plan of the Parish of Terranora, (Scale, 1 inch equals 40 chains) and plan of the Village of Kingscliffe, Parish of Cudgen (Scale, 1 inch equals 4 chains). The geological boundaries were sketched on to the Military Maps mentioned above, and are approximate only.

2. Boring Boring to ground water was by means of a post hole digger or auger, lengthened as required with 5 foot lengths of piping, coupled by screw joints. Below ground water level, or below the depth to which sampling of loose sand could conveniently be done with a post hole digger, about 20 feet, the bore hole was cased with light 3-inch boiler tubing, and a sand pump used. Before boring was started, the bore sites were levelled, using a telescopic alidade set up on a plane table. The datum for levels was high water mark, which was assumed to have the level given in the Tide Table of the Queensland Department of Harbours and in the Tide Table of the Queensland Department of Harbours and Marine, plus one to two feet added for the wash of the surf. The levels of the bores were determined to within about 3 inches, and checked by back levelling.

Preliminary boring of the beach and adjacent dunes was carried out during August and September 1948, when bores were put down to ground level. Additional boring to ground water level was undertaken in July 1949, to define the boundaries of the deposits. In November 1949 some of the earlier bores were deepened and sampled below water level, and some scout boring was done in the low lying country between the coastal dunes and the Tweed River.

3. Sampling. During the preliminary boring, samples were taken of any sand which appeared to contain appreciable quantities of heavy minerals, and a single sample was made up from the overburden. During the later boring, the bores were sampled in sections from top to bottom, whether mineral appeared to be present or not. The reason for this complete sampling is that concentrates with a comparatively high zircon content tend to be grey rather than black, and are liable to left unsampled. Samples taken from the bore holes were reduced by quartering to a convenient size, about 700 to 1000 cubic centimetres, and bagged for despatch to the field laboratory.

4. Laboratory Work. (a) Estimation of Quantities of Heavy Minerals. The bore samples were dried. and 700 ccs. of each sample was weighed.

The heavy mineral concentrates were then separated from the 700 ccs. of sample by means of a laboratory Wilfley Table, and the weights and volumes of the dry concentrates were measured. The quantities of heavy minerals in the samples were then expressed as weight per cent, and "lbs/per cu.yd" (pounds weight of heavy mineral concentrate per cubic yard of sand) and are given in Table 7 at the end of this report.

<u>(b) Determination of Compositions of Concentrates</u>. The average percentage composition of the heavy mineral concentrates in the area was obtained from a composite sample from each bore line. The composite sample was divided into two portions - one portion for the determination of the percentage zircon, rutile and ilmenite, the other portion for the determination of percentage monazite.

<u>(i) Zircon, Rutile and Ilmenite</u>. The sample was separated magnetically on a Frantz Isodynamic Separator giving a magnetic fraction made up mostly of ilmenite with a little monazite, garnet and tourmaline, and a non-magnetic fraction of zircon and rutile. The zircon and rutile concentrates were separated electrostatically. The magnetic fraction and the zircon and rutile concentrates were weighed; the composition of the magnetic fraction was determined by grain counting.

<u>(ii) Monazite</u>. The percentage monazite in concentrates was determined by means of Geiger-Muller gamma-ray counting equipment. A quantity of high grade monazite was prepared from concentrates of the area. The counting rate given on the Geiger-Muller equipment by the monazite was recorded, and the number of counts per gram per minute due to this monazite was calculated. Similarly, the second portion of the composite sample of the area which had been set apart for the radiometric determination of monazite was tested. Allowance was made for the radioactivity of the zircon, rutile and ilmenite, and the number of counts per gram per minute due to the monazite in the sample was calculated. From comparison of the counts/gram/minute of the high grade monazite, and the monazite in the composite sample, the percentage monazite in this sample was calculated.

<u>(c) Variation in the Composition of the Heavy Mineral Concentrates, and in the Thoria Content of the Monazite.</u>

<u>(i) Composition of Concentrates</u>. In order to detect any variation which might occur in the composition of the heavy mineral concentrates across the deposits from east to west, portions of concentrates obtained from bores along the bore lines 19890S and 15475S were grouped into composite samples C1-C6. To detect any variation along the deposits, portions of concentrates obtained from Block 1 (shown in Plate3) were grouped into composite samples C7-C12. To avoid possible masking of south-north variation by east-west variation, concentrates from the more easterly bores only of Block 1 were used in making up the composite samples C7-C12. The bores from which concentrates were taken to make up the composite samples are shown in Table 1.(a).

<u>Table 1.(a) Fingal-Cudgen Area</u>. Preparation of composite samples to examine distribution of Heavy Minerals.

COMPOSITE SAMPLE	BORES FROM WHICH CONCENTRATES MAKING UP COMPOSITE WERE TAKEN	LINES ALONG WHICH BORES ARE SITUATED.	DIRECTION IN WHICH POSSIBLE VARIATION INVESTIGATED
C1	20E	19,890S	EAST-WEST.
C2	37W - 70W		
C3	203W - 295W		
C4	130E - 60E	15,475S	
C5	00 - 80W		
C6	195W		
	40W - 80W	20,390S	SOUTH-NORTH
C7	20E - 70W	19,890S	
C8	35E - 30W	16,975S	
	130E - 45W	15,475S	
C9	40W	14,725S	
	140E - 90E	13,975S	
	00 - 30W	11,250S	
C10	30E - 30W	10,500S	
	15E - 32W	9,000S	
C11	30E - 60W	6,000S	
	35E - 35W	4,500S	
C12	60E - 40W	1,500S	
	250E - 150E	00	

As in the case of the composite sample of the area discussed in the preceding paragraph, each composite sample was divided into two protions. The composition of each composite sample was determined by the method outlined in paragraph (b).

<u>(ii) The Thoria Content of Monazite.</u> A monazite concentrate was separated out from a composite sample representing the whole area. The thoria content of this monazite ~~in composite~~ was tested radiometrically by comparison with a standard monazite sample containing 6.6% thoria. The thoria content of the monazite in composite samples representing Block 1 and Block 2 (shown in Plate3) was similarly tested. The bores from which concentrates were taken to make up the composite samples of Block 1 and Block 2 are shown below in Table 1 (b)

TABLE 1 (b) Fingal-Cudgen Area. Preparation of composite samples to examine possible variation in the thoria content of monazite.

COMPOSITE	BORES FROM WHICH CONCENTRATES MAKING UP COMPOSITE WERE TAKEN	LINES ALONG WHICH BORES ARE SITUATED.
BLOCK 1	250E - 150E	00
	60E - 40W	1500S
	40E - 65W	3000S
	35W - 90W	4500S
	30E - 250W	6000S
	30E - 30W	7500S
	15E - 127W	9000S
	30E - 70W	10500S
	00 - 110W	11250S
	140E - 90E	13975S
	40W - 120W	14725S
	130E - 80W	15475S
	35E - 30W	16975S
	37W - 70W	19890S
	40W - 80W	20390S
BLOCK 2	195W	15475S
	115W - 165W	16975S
	200W	18575S
	140W - 220W	19125S
	255W - 295W	19890S
	160W - 240W	20390S

<u>E. RESULTS OF THE INVESTIGATION.</u>

<u>1. Distribution of the Mineral Deposits.</u>

<u>(a) Extent.</u> The plans of Plate 1 and the sections of Plates 2 and 2A show that the deposits of heavy minerals occur almost entirely within the coastal dunes adjacent to the beach. viz. the "Beach Dunes" of "Section B: Topography". No deposits are associated with the "Westerly Dune Ridge" nor with the "Central Dune Mass". Appreciable concentrations of heavy minerals were intersected in the 6000S line from 650W to 950W, approximately 700 to 1000 feet west of the present beach, but this deposit must be of very limited extent, since boring on the 5250S and 6750S lines failed to locate any extension of it. Some years ago portions of this area were filled, probably with sand from the nearby Beach Dunes. The heavy mineral deposit in the western part of line 6000S may have originated in this way.

The deposits beneath the Beach Dunes extend from the northern end of the area southwards past the southernmost bore line (line 20390S).

The southern extremity of the deposits lies within a built up area and camping ground which extends from the 20390S bore line to the mouth of Cudgen Creek, a distance of approximately 3000 feet. This area was not tested. At the 18575S bore line, and from 12000S to 14725S, the deposits are narrow and thin. Over the whole area, the width of the deposits ~~varies~~ ranges from 40 feet to 220 feet, and averages 114 feet. The average overall thickness is 2.25 feet.

In the southern end of the area three separate deposits, each approximately parallel to the beach, can be distinguished. The westernmost deposit, which may be termed the "Western Deposit", is associated with the sandy scarp or old beach line discussed earlier in Section C. "General Geology : The Coastal Dunes". The Western Deposit appears on bore lines 19890S and 15475S, respectively, from 335W to 203W and at 195W, and may be traced to line 14725S, at 240W. The eastermost of the three deposits, which may be termed the "Easterly Deposit", appears to be continuous with the main deposit underlying the Beach Dunes in the northern portion of the area. An "Intermediate Deposit" appearing in the western portion of the Beach Dunes, is seen on bore lines 19890S and 15475S respectively, from 70W to 37W and 80W to 00. This Intermediate Deposit cannot be recognised with certainty north of bore line 10500S.

(b) Shape and attitude. The Deposits beneath the dunes appear to have the form of narrow seams extending unbroken for some thousands of feet parallel to the beach. In the sections (Plates 2 and 2A) the seaward dip of the seams, mentioned in section 3C "Geology" : Deposits of Heavy Minerals", is illustrated in most of the bore lines. The lenticular or wedge shape of the seams is suggested in the sections of line 3000S, 4500S, 6000S, 7500S, 11250S, and 14725S. The actual shape of a seam is not always well defined by the profiles, because the boreholes are in general too far apart.

In several of the borelines, e.g., lines 3000S and 4500S, deposits of heavy minerals, lower in grade than the beach seams, were intersected at comparatively high levels in the dunes. These deposits, formed from sand blown up from the beach by the wind, are irregular in shape and attitude, and in longitudinal extension. It is probable that many patches of such aeolian deposits occur between the bore lines.

(c) The Levels at which the Deposits Occur. Deposits occur within two distinct ranges of levels. viz. the beach seams and the aeolian deposits. The beach seams have upper levels which range up to about 12 feet, the level of the top of the beach during periods of high tides caused by stormy weather. Their lower levels appear to be at or above mean sea level. The wind formed deposits may have upper levels exceeding 30 feet, as on the 3000S bore line. In their lower levels, viz. down dune on the seaward side, the aeolian deposits merge into the upper extremities of the beach deposits, from which they were derived. Additional data on the levels of the deposits is given is Table 2.

TABLE 2 Fingal-Cudgen Area. Levels of Deposits.
Giving the maximum and minimum levels in the bore lines.

GRADE	LEVELS OF DEPOSITS REFERRED TO MEAN LOW WATER.			
LB.PER.CU.YD	TOP OF DEPOSIT (FT)		BOTTOM OF DEPOSIT (FT)	
Over 300	Average	9.1	Average	4.3
	Extreme Range	4.2-16.2	Extreme range	2.1 to 7.3
	Usual range	5 to 11 Ø	Usual range	3 to 5 Ø
120 to 300	Average	9.6	Average	5.1
	Extreme range	4.3 to 32.8	Extreme range	2.2 to 16.0
	Usual range	6 to 8 Ø	Usual range	3 to 5 Ø1
		18 to 24 X		15 to 21 X *

Remarks : Ø Deposits formed by wave action
X Deposits formed in dune by wind action.
* These are aeolian deposits which grade down dune into the beach deposits. Probably the grade remains above 300 lb/Cu.yd for some distance ~~of dune~~. up the dune, above the beach deposits.

2. Origin of the Deposits. In the section C3, "Geology 1 Deposits of Heavy Minerals" It is stated that, during stormy weather deposits of heavy minerals may be deposited onthe upper part of the beach. The sections of Plates 2 and 2A show that at various past periods, although massive sand dunes existéd adjacent to the beach, for considerable intervals no deposits were formed at all.

It does not seem possible that the period required to build the Dunes between the Western, Intermediate and Easterly Deposits could have passed without seasonal storms. The inference is that the Fingal-Cudgen Beach received three separate accessions of heavy minerals. In Section C, "General Geology: The Coastal Dunes", it is suggested that the erosion which formed the sandy scarp at the southern end of the area may have been contemporaneous with the erosion of the dunes between bore lines 10500S and 1500S, and possibly, with erosion in the Palm Beach Tweed-Fingal Areas. Extending this supposition, it may be that similar erosion took place contemporaneously further south along the coast, and that deposits of heavy minerals further south were exposed, and transported northwards. A ~~(southern)~~ relatively small quantity of these heavy minerals a rrived at the southern end of the Fingal-Cudgen beach forming the Western Deposit. One may suppose that large volumes of common beach sand, silica, dislodged by the general erosion, then covered the source of supply of the heavy minerals and the same common beach sand also covered the newly-formed Western deposit before much of the mineral had been transported north of the 14725S line. Similarly, a fresh supply of heavy minerals formed the Intermediate Deposit. Siliceous sand was deposited in large quantities for a further period, after which the beach became stabilized, and a foredune developed, with its crest at the positions shown in Table D.

TABLE D. Position of Foredune developed at end of PERIOD OF HEAVY DEPOSITION OF SILICEOUS SAND.

Bore Line	Coordinate of Crest of Foredune
20390S	00
19890S	5W (Approx.)
16975S	65W (Approx.)
15475S	30E
13975S	Removed by erosion (?)
11250S	70W
9000S	Between 97W and 30W
7500S	115W (?)
6000S	Does not occur (Eroded?)
4500S	90W (?)
3000S	93W
1500S	May be 150W

The stabilization of the beach apparently took place when the bulk of the siliceous sand made available by the erosion had been transported and distributed.

Supplies of heavy minerals, then becoming exposed south of the Fingal-Cudgen Area, were transported and deposited, still with considerable volumes of siliceous sand, on the Fingal-Cudgen beach. Concentration of the heavy minerals was effected during stormy weather, and possibly during a period of renewed erosion of the beach, resulting in a deposit of comparatively uniform composition from the southern ~~side~~ to the northern end of the beach. This deposit is represented by the main deposit, the Easterly Deposit, of the present day1

After cessation of active dune building, The Tweed River cut through the Beach Dunes a short distance south of the 6000S bore line. The southern portion of the Beach Dunes then terminated as a spit at the river mouth. The period during which the river mouth occupied this position could not have been long; otherwise considerable erosion of the dunes north of the break through would have taken place.

At the time the river mouth had been barred, presumably by the development of a sand spit across it, the beach for some distance south of the 6000S line must have been embayed. Heavy minerals were transported northwards from about the southern end of the embayment, which was presumably some distance north of the 14825S line, and were arrested near the northern end of the embayment, near the 6000S line. This may explain the samll size of the deposits from 11250S to 14725S.

3. Reserves.

(a) Total Reserves. A summary of the total reserves of heavy mineral and quantities of overburden is given in Table 3, while a statement of the reserves between each pair of bore lines appears in Table 6. Details of bores and samples are given in Table 7. When computing the reserves it was necessary to decide, somewhat arbitrarily, the minimum grade of sand which should be included, and the minimum thickness of sand of a given grade. The minimum grade has been fixed at 120 lbs. weight of heavy mineral concentrate per cubic yard of sand. This is a little greater than 4 per cent by weight (Footnote). The minimum quantity of mineral was decided on the basis that the product of thickness of seam in feet times pounds of heavy mineral per cubic yard should be at least 300. Thus a seam which has a grade of 600 lbs of concentrate per cu.yd must be at least 6 inches thick, and seam of minimum grade, 120 lbs. per cu.yd., must have a thickness of at least 2 ft. 6 inches. Actually, the Fingal-Cudgen deposits are predominatly much higher in grade than the minimum grade given above. The overall grade, as stated in Table 3, is 502 lbs per cubic yard, and it can be seen in Tables 6 and7 that a comparatively high grade is maintained at each bore line.

(b) Quantities now Available for Mining. Plate 1 shows that the deposits occur almost entirely within the boundaries of leases or applications for leases. It is believed that substantially all of the reserves given in Table 3 will be available for mining.

4. Distribution of the Minerals Throughout the Area.

(a) The Observed Distribution. The percentages of zircon, rutile, ilmenite and monazite in the composite samples of Table 1, are given in Table 4 (a)

TABLE 4 (a) Variation in Mineral Composition of Concentrates.

COMPOSITE SAMPLE	PERCENTAGE COMPOSITION (NEGLECTING THE PERCENTAGE OF GARNET AND "OTHER MINERALS."				
	ZIRCON	RUTILE	ILMENITE	MONAZITE	
C1	48.7	30.6	19.8	0.66	EAST-WEST.
C2	36.3	31.3	21.6	0.78	
C3	48.0	31.2	20.2	0.59	
C4	46.3	30.2	22.5	0.99	
C5	40.3	36.3	22.6	0.76	
C6	36.9	39.7	22.9	0.48	
C7 198905–203905	48.1	31.2	20.0	0.64	SOUTH-NORTH
C8 169755	47.0	31.4	20.9	0.65	
C9 154755–139755	41.6	34.7	23.0	0.76	
C10 112505–90005	42.1	35.1	22.2	0.57	
C11 60005–46005	49.1	29.2	21.0	0.63	
C12 15005–00	49.3	28.9	21.0	0.71	

The composition of the composite samples C1 to C3 from line 19890S and C4 to C6 from line 15475S suggests that the percentages of monazite and of zircon in the concentrates tend to decrease from east to west, across the deposits, while the percentages of rutile and of ilmenite tend to increase.

The variations in the composition of the concentrates from south to north, along the deposits, are illustrated graphically in Plate 3, Fig. 2. In the southern portion of the area i.e. from line 20390S to line 9000S (C7-C10) the percentage zircon tends to decrease while the percentages of rutile and ilmenite increase. However in the northern portion of the area, line 6000S to line 00 (C11-C12), there is an abrupt rise in the percentage of zircon

+FOOTNOTE: Figures for weight per cent and pounds per cubic yard may be interchanged on the basis that 1 per cent by weight equals 30 lb. per cu. yd (approximately). This relationship holds reasonably well up to about 30 per cent, but as the percentage by weight continues to rise above 30. the number of pounds weight of mineral corresponding to each 1 per cent becomes increasingly larger.

TABLE 3

FINGAL-CUDGEN AREA : SUMMARY OF QUANTITIES.

BLOCK AS SHOWN IN PLATE 1.	AREA OF DEPOSIT SQ. YDS.	WEIGHT OF HEAVY MINERAL CONCENTRATE TONS.	VOLUME		AVERAGE THICKNESS		AVERAGE GRADE OF DEPOSIT LBS/CU.YD
			DEPOSIT CU.YDS	OVERBURDEN. CU.YDS	DEPOSIT FT.	OVERBURDEN FT.	
BLOCK 1.	308,820	59,784	248,484	760,826	2.5	7.4	518
BLOCK 2.	53,526	3,796	25,498	125,226	1.3	7.0	334
TOTAL	362,346	63,580	283,982	886,052	2.25	7.3	502

Average Composition of Concentrate, and Weight of Each Mineral.

	MONAZITE	ZIRCON	RUTILE	ILMENITE	GARNET. X.	OTHER MINERALS Ø
PERCENTAGE	0.52	41.7	35.1	22.2	0.2	0.28
WEIGHT (TONS)	330.6	26,513	22,317	14,115	127,2	178.0

X. This figure is somewhat low: varying proportions of garnet are lost when the sand is being tabled.

Ø The "other minerals" are chiefly tourmaline, epidote, spinel, corundum and amphibole.

to a figure somewhat higher than that of zircon in the extreme south of the area, while the percentages of rutile and ilmenite decrease to a figure similar to that of rutile and ilmenite in the southern portion of the area.

The percentage monazite tends to increase from line 20390S up to line 13975S, decreases abruptly in the section which included lines 11250S to 9000S, and in the northern portion of the area, from line 6000S to line 00, increases again to a percentage of the same order as that which applies in the southern portion of the area.

(b) Suggested Causes of the Observed Distribution of Heavy Minerals

(i) General. It may be expected that, in general, the proportions of the heavier minerals in the concentrates, viz. monazite and zircon, should decrease northwards along a beach. The truth of this assumption seems to be borne out by the present day overall distribution of the minerals along the coast. Thus, Fisher (1948) points out that there is a gradual decrease in the proportions of zircon and an increase in rutile and ilmenite from the mouth of the Clarence River northwards to South Stradbroke Island, Imposed on this general trend of distribution is a minor fluctuation within each beach area. In the Palm Beach Area, Queensland the distirbution of the heavy minerals appears to reflect in a minor way the overall distribution along the coast, viz. a decrease in monazite and zircon in a northward direction. Modifications to this distribution are effected where the concentrates are subjected to erosion or transport other than transport along the beach. For example, at the northern end of Palm Beach, the concentrates are exposed to the tidal currents flowing into and out of Tallebudgera Creek. Here an enrichment in monazite and zircon is observed, and has been brought about presumably, by selective removal of rutile and ilmenite by the tidal currents. In the Tweed-Fingal area, New South Wales, the proportions of monazite and of zircon do not decrease uniformly from south to north. Instead, in the northern half of the deposits, a sharp increase is observed. An attempt has been made to explain this distribution by extending the theory already adopted for the northern tip of the Palm Beach area, viz. enrichment in monazite and zircon because of removal of rutile and ilmenite by tidal currents and in addition, probably removal of rutile and ilmenite by wind action.

In the Fingal-Cudgen area the simple picture of the distribution of the heavy minerals observed in the Palm Beach area appears in some measure in the southern part of the area, but is not apparent along the beach as a whole. Other factors appear to have overshadowed the tendency towards enrichment in rutile and ilmenite northwards along the area, and will be discussed in the following two paragraphs which deal respectively with the distribution of the heavy minerals across the deposits, viz. from east to west, and along the deposits viz. from south to north.

(ii) East-West Variation. In section F.1. "Distribution of the Mineral Deposits", it is suggested that, towards the end of a period of erosion, the Fingal-Cudgen deposits of heavy mineral were transported northwards from sources south of Cudgen Point. The deposits near the southern end of the area, for example, the three separate deposits intersected on bore lines 19890S and 15975S, are separated by siliceous dune sand. Presumably, this sand covered the sources of supply of heavy minerals at intervals, while being transported along the coast. Hence the Fingal-Cudgen Area received three separate accessions of heavy minerals, which could be expected to have somewhat differing compositions. If rutile and ilmenite were being transported along the coast at a more rapid rate than monazite and zircon, and if the successive deposits of heavy minerals arriving at the Fingal-Cudgen Area originated from the same locality south of Cudgen Point, it could be expected that the successive deposits from west to east in the southern part of the Fingal-Cudgen Area would become progressively richer in monazite and zircon. The samples taken along the 19890S and the 15975S bore lines do in general show an increase in monazite and zircon from west to east, although the middle sample on the 19890S line viz. Sample C2 fails to conform with this trend. A random variation such as that appearing in sample C2 which represents the intermediate deposit, may indicate that the heavy minerals of the deposit concerned were transported from a source a little to the north or to the south of the source of the heavy minerals in the adjacent deposits.

(iii) South-North Variation. It is proposed first to examine.

The distribution from south to north along the Intermediate and the Western deposits of the southern end of the area.

Of these, the Western deposit cannot be traced north of the 14725S bore line, and the Intermediate deposit cannot be traced with certainty north of the 13975S line. Probably then, these deposits represent small supplies of heavy minerals which arrived at the southern end of the area, and worked northwards for 5000 to 6000 feet, before becoming buried by siliceous dune sand. The data of Table 4 (a) has been rearranged below in Table 4 (b) to show the distribution of heavy minerals in these deposits on bore lines 19890S and 15475S.

TABLE 4 (b) Fingal Cudgen Area.
Distribution of Heavy Minerals from South to North in the Intermediate and Western Deposits.

DEPOSIT AND COMPOSITE SAMPLE	PERCENTAGE COMPOSITION				BORE LINE.
	ZIRCON	RUTILE	ILMENITE	MONAZITE.	
WESTERN					
C3	48.0	31.2	20.2	0.59	19890S
C6	36.9	39.7	22.9	0.48	15975S
INTERMEDIATE.					
C2	46.3	31.3	21.6	0.78	19890S
C5	40.3	36.3	22.6	0.76	15975S

Table 4 (b) shows that, in these deposits the proportions of monazite and zircon distinctly decrease in a northerly direction.

The Easterly Deposit. The Easterly Deposit appears to extend continuously to the northern end of the Fingal-Cudgen Area, although some uncertainty exists from about 13975S to 12000S. In Section E.(b) "Origin" (of the deposits) it is suggested that, at a fairly late stage of the northward movement of siliceous sand, and abundant supply of heavy minerals was uncovered south of Cudgen Point, and was carried northwards with siliceous sand and deposited on the Fingal-Cudgen Beach. In this way the beach received a deposit of heavy minerals comparatively low in grade, large in volume and of uniform composition from end to end. Note the similar compositions of the concentrates at the northern and the southern ends. viz. samples C1, C4, C7, and C8 at the southern end, and samples C11 and C12 at the northern end.

Later erosion of the beach and dunes resulted in the removal of silica, with concentration of the heavy minerals into higher grade deposits. Apparently during or just after the period of erosion and concentration, the Tweed River formed an outlet to the sea a few hundred feet south of the 6000S bore line (see Section B, "Topography") . Erosion of the beach south of the river mouth resulted in a partial removal of the deposits from somewhere north of line 16975S, northwards to the river mouth. When the river mouth was subsequently barred, heavy minerals, more particularly rutile and ilmenite, drifted northwards along the embayment of the beach. As a result the proportions of rutile and ilmenite are increased from about 14725S (Note composition of Sample C9. Footnote) to somewhere north of line 9000S (note composition of sample C10). Lines 15475S (Sample C4) and 16975S (Sample C8) are high in monazite.

The high zircon - monazite content of the northern portion of the area from 6000S to 00 (sample C11 and C12) has been explained as an initially high concentration due to "flooding" of the Fingal-Cudgen beach with siliceous sands carrying a comparatively low concentration of heavy minerals, uniform in composition. It is possible too, that small quantities of heavy minerals are transported past Fingal Point. If so, larger proportions of rutile-ilmenite would be removed in this way, resulting in a higher content of zircon-monazite in the deposits for some distance south of the headland.

5. Thoria Content of the Monazite. Figures for the determinations of thoria are given in Table 5. It is seen that the thoria content of the monazite from Block 1, Block 2 and from the entire area is 6.6%,

Footnote: on next page.

6.6 per cent and 6.7 percent respectively.

FOOTNOTE: Sample C9 has a comparatively high monazite content, but it includes concentrate from line 15475S which is extraordinarily high in monazite.

TABLE 5. FINGAL - CUDGEN AREA : THORIA CONTENT OF MONAZITE.

MONAZITE CONCENTRATE	BLOCK 1.	BLOCK 2.	ENTIRE AREA (Blocks 1&2)
FINGAL-CUDGEN MONAZITE CONCENTRATE (FC) SEPARATED FROM THE MIXED HEAVY CONCENTRATES OF THE BLOCK.	Monazite (m1) = 99.4 Zircon = 0.1 Ilmenite = 0.2 Other Minerals = 0.2 100.0	Monazite (m2) = 99.3 Zircon = 0.1 Ilmenite = 0.3 Other Minerals = 0.3 100.0	Monazite (m2+m1) = 99.6 Ilmenite = 0.3 Other Minerals = 0.1 100.0
STANDARD MONAZITE CONCENTRATE (SC) MADE UP OF THE STANDARD MONAZITE (ms) AND ZIRCON ETC.	Monazite (ms) = 99.6 Zircon = 0.2 Other Minerals = 0.2 100.0	Monazite (ms) = 99.6 Zircon = 0.2 Other Minerals = 0.2 100.0	Monazite (ms) = 99.6 Zircon = 0.2 Other Minerals = 0.2 100.0
MASS (IN GRAMS) OF FINGAL - CUDGEN MONAZITE CONCENTRATE (FC)	11.120	11.088	10.518
MASS (IN GRAMS) OF MONAZITE (m1, m2 AND m1+m2) IN FINGAL-CUDGEN MONAZITE CONCENTRATE (FC)	11.053	11.010	10.476
MASS (IN GRAMS) OF STANDARD MONAZITE CONCENTRATE (SC)	11.132	11.132	11.132
MASS (IN GRAMS) OF STANDARD MONAZITE (ms) IN STANDARD MONAZITE CONCENTRATE (SC)	11.087	11.087	11.087
EXCESS OVER BACKGROUND (COUNTS PER MINUTE) DUE TO STANDARD MONAZITE CONCENTRATE (SC)	638	638	638
EXCESS OVER BACKGROUND (COUNTS PER MINUTE) DUE TO FINGAL-CUDGEN MONAZITE CONCENTRATE (FC)	639	633	615
COUNTS/GRAM/MINUTE OF FINGAL-CUDGEN MONAZITE (m1, m2 and m1 + m2)	$\frac{639}{11.053} = 57.8$ (Counts due to zircon negligible)	$\frac{633}{11.010} = 57.5$ (Counts due to zircon negligible)	$\frac{615}{10.476} = 58.7$ (Counts due to zircon negligible.)
COUNTS/GRAMS/MINUTE OF STANDARD MONAZITE. (ms)	$\frac{638}{11.087} = 57.5$	57.5	57.5
PERCENTAGE THORIA [x] IN MONAZITE m1, m2 and m1 + m2)	$(\frac{57.8}{57.5} \times 6.6\%) = 6.6\%$	$(\frac{57.5 \times 6.6\%}{57.5} = 6.6\%)$	$(\frac{58.7}{57.5} \times 6.6\%) = 6.7\%$

x. Calculated on the basis of the thoria content of the standard monazite which chemical analysis gives as 6.6%

The experimental error due to the equipment is (± 0.3 percent). Hence, it may be concluded that the thoria content of monazite from Block 1, Block 2 and from the entire area is the same, within experimental limits, as the thoria content of the standard monazite. viz. 6.6 percent.

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The Beach Sands Investigation along the New South Wales Coast has received assistance from the New South Wales Mines and Lands Departments in the provision of lease plans and parish plans, and from operating companies and individuals who hold leases in the areas investigated. Information regarding leases in the Fingal-Cudgen area has been provided by Mr. J. Cooley of Tweed Heads; Cudgen Rutile-Zircon (Cudgen R-Z) of Kingscliffe; and Tweed-Rutile Syndicate of Tweed Heads. Notes on the vegetation of the area have been compiled from information supplied by Mr. S. T. Blake of the Queensland Department of Agriculture and Stock. In the administrative and supply aspects of the work, much help has been received from the State Controller and Officers of the Department of Supply and Development, Brisbane.

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TABLE 6 LOCALITY **FINGAL-CUDGEN**

BLOCK 1.

DETAILED STATEMENT OF QUANTITIES BETWEEN BORE LINES.

BORE LINES	DISTANCE BETWEEN LINES (YDS)	WIDTH OF DEPOSIT (YDS) AT LINE	WIDTH OF DEPOSIT (YDS) AVERAGE	TOTAL BETWEEN LINES: AREA OF DEPOSIT (SQ.YDS.)	TOTAL BETWEEN LINES: WT. OF MIN. (LBS & TONS)	VOLUME (CUB.YDS) DEPOSIT	VOLUME (CUB.YDS) O'BRDN	AVERAGE THICKNESS (FT) DEPOSIT	AVERAGE THICKNESS (FT) O'BRDN	GRADE OF DEPOSIT (LBS /CU. YD)
00 1500	500	41.3 43.3	42.3	21,150	16,420,500 7,331	16,050	29,200	2.3	5.6	1023
1500 3000	500	43.3 54.3	48.8	24,400	24,600,000 10,982	36,950	60,200	4.5	7.4	666
3000 4500	500	54.3 85.0	69.7	34,800	16,012,000 7,148	49,750	109,000	4.3	9.4	322
4500 6000	500	85.0 123.3	104.2	52,050	20,583,000 9,189	64,200	117,600	3.9	6.8	321
6000 7500	500	123.3 41.7	82.5	41,250	23,156,500 10,338	46,100	66,500	3.3	4.8	502
7500 9000	500	41.7 65.7	53.7	26,850	12,690,500 5,665	14,100	75,400	1.6	8.4	900
9000 10,500	500	45.7 21.7	33.7	16,850	3,691,500 1,648	4,150	31,750	0.7	5.6	890
10,500 11,250	500	21.7 36.7	29.2	7,300	646,500 289	1,325	20,500	0.5	8.4	488
9000 10,500	500	20.0 41.7	30.9	15,400	3,604,000 1,609	5,750	83,350	1.1	16.2	627

TABLE 6 (Contd.) LOCALITY FINGAL-CUDGEN

DETAILED STATEMENT OF QUANTITIES BETWEEN BORE LINES.

BORE LINES	DISTANCE BETWEEN LINES (YDS)	WIDTH OF DEPOSIT (YDS)		TOTAL BETWEEN LINES				AVERAGE THICKNESS (FT)		GRADE OF DEPOSIT (LBS /CU. YD)
		AT LINE	AVERAGE	AREA OF DEPOSIT (SQ.YDS.)	WT. OF MIN. (LBS & TONS)	VOLUME (CUB.YDS)		DEPOSIT	O'BRDN	
						DEPOSIT	O'BRDN			
10,500 11,250	250	41.7 13.3	27.5	6,875	1,720,250 769	2875	41,675	1.3	18.2	598
13,975 15,475	500	16.7 63.3	40.0	20,000	3,611,000 1,612	4,700	14,600	0.7	2.2.	768
15,475 16,975	500	63.3 ———	31.7	15,825	2,109500 942	2,050	4,850	0.4	0.9	1029
14,725 15,475	250	40.0 26.7	33.4	8,325	1,349,250 602	1,275	38,325	0.5	13.8	1058
15,475 16,975	500	26.7 21.7	24.2	12,100	2,895,500 1,293	4,600	44,900	1.1	11.1	629
19,890 20,390	167	27.7 40.0	33.9	5,645	821,807 367	4,609	12,976	2.4	6.9	178
TOTAL OF BLOCK 1.				308,820	133,911,807 59,784	258,484	760,826	2.5	7.4	518

TABLE 6 (Contd.) LOCALITY FINGAL-CUDGEN

DETAILED STATEMENT OF QUANTITIES BETWEEN BORE LINES.

BLOCK2

BORE LINES	DISTANCE BETWEEN LINES (YDS)	WIDTH OF DEPOSIT (YDS)		TOTAL BETWEEN LINES				AVERAGE THICKNESS (FT)		GRADE OF DEPOSIT (LBS /CU. YD)
		AT LINE	AVERAGE	AREA OF DEPOSIT (SQ.YDS.)	WT. OF MIN. (LBS & TONS)	VOLUME (CUB.YDS) DEPOSIT	VOLUME (CUB.YDS) O'BRDN	DEPOSIT	O'BRDN	
15,475 16,975	500	22.7 33.3	28.0	14,000	1,276,500 570	2,800	49,600	0.6	10.6	459
16,975 18,575	533	33.3 21.3	27.3	14,551	1,400,191 625	2,505	40,988	0.5	8.5	559
18,575 19,125	183	21.3 26.7	24.0	4,392	481,290 215	1,446	7,338	1.0	5.0	332
19,125 19,890	255	26.7 60.0	43.4	11,041	2,878,950 1,285	9,996	15,376	2.7	3.3	288
19,890 20,390	167	60.0 53.3	56.7	9,542	2,467,091 1,101	8,751	11,924	2.8	3.7	282
TOTAL OF BLOCK 2.				53,526	8,504,022 3,796	25,498	125,226	1.3	7.0	334

TABLE 7

HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 887' east of portions 356/357 as shown in Plate 1. Fig. 2.
LINE 00.

ALSO LINE 1500S & 3000S.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section 1A.				
250E	0'	2'6"	Tr	
	2'6"	3'3"	1023	2.5
	3'3"	5'	Tr	
200E	0'	8'	Tr	5.9
150E	0'	2"	Tr	
	2"	3"	258	
	3"	3'6"	Not sampled.	
	3'6"	4'	2335	2.0
	4'	4'6"	Not sampled	
126E	0'	4'6"	TR	3.0
Average	0'	8'6"	Tr	
100E	0'	8'6"	Tr	
74E	0'	2'3"	80	
	2'3"	2'9"	247	
	2'9"	4'6"	Not sampled	
	4'6"	4'10"	2069	
	4'10"	8'	Not sampled.	
50E	0'	6'	Tr	
26E	0'	4'	Tr	
00	0'	4'3"	Tr	
	4'3"	5'3"	68	
50W	0'	3'3"	99	
	3'3"	3'6"	1351	
	3'6"	4'	Not sampled	
100W	0'	4'6"	Tr	
	4'6"	5'	430	
	5'	8'	Not sampled	
	8'	9'	Tr	
200W	0'	7'9"	Tr	
300W	0'	21'	Tr	
590W	0'	10'	48.4	
	10'	20'6"	Tr	
647W	0'	14'6"	Tr	

LINE 1500S.
Origin : 512' east of portion 247 as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.				
60E	0'	2'6"	Tr	
	2'6"	3'6"	1100	2.5
30E	0'	1'3"	336	
	1'3"	1'9"	2133	
	1'9"	3'6"	2000	
	3'6"	4'6"	68.5	0.0
Thickness		3'6"	1424	
15E	0'	7'6"	Tr	
	7'6"	8'6"	420	
	8'6"	10'6"	Tr	
	10'6"	12'6"	1141	7.5
	12'6"	13'	Not sampled	
	13'	14'6"	1420	
Thickness		7'	690	

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
10W	0'	14'	Not sampled.	
	14'	14'6"	1483	
	14'6"	17'	Not sampled.	
	17'	18'3"	3264	14.0
Thickness		4'3"	1134	
40W	0'	7'6"	Not sampled	
	7'6"	8'3"	247	
	8'3"	8'9"	68	
	8'9"	10'	Not sampled.	
	10'	11'3"	3265	7.5
	11'3"	12'	1362	
	12'	13'6"	Not sampled	
Thickness		4'6"	1197	
70W	0'	3'	50.6	
	3'	6'	14.5	
	6'	9'	67.4	
	9'	12'	Tr	9.7
	12'	17'	Tr.	
AVERAGE		3.7'	1069	7.3
95W	0'	11'	Missing	
125W	0'	20'6"	Tr	
150W	0'	18'	Missing	
180W	0'	21'	Tr	
230W	0'	11'	Tr	
350W	0'	23'	Tr	
472W	0'	11'6"	Tr	
520W	0'	7'	Tr	
640W	0'	17'6"	Tr	
760W	0'	7'	Tr	
880W	0'	6'	Tr	
1000W	0'	6'	Tr	
1120W	0'	6'	Tr	
1240W	0'	11'	Tr	

LINE 3000S.
Origin : 343 ft. east of southwest corner of portion 425 as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.				
70E	0'	1'6"	Tr	1.8
40E	0'	4"	Not sampled	
	4"	8"	1690	
	8"	2'	Not sampled.	
	2'	3'3"	438	0.3
	3'3"	3'6"	Not sampled.	
Thickness		2'11"	423	
35E	0'	1'	Tr	
	1'	24'6"	1771	1.0
15E	0'	11'6"	Tr	
	11'6"	13'9"	885	11.5
35W	0'	10'	42.8	
	10'	13'6"	52.4	
	13'6"	18'	1025	13.5
	18'	19'6"	Not sampled	

TABLE 7. FINGAL-CUDGEN. HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 343ft. east of southwest corner of portion 425 as shown in Plate 1. Fig. 2.

LINE 3000S. Contd.

ALSO LINE 4500S. 5250S. 6000S.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A. Contd.				
65W	0'	3'	169	
	3'	6'	87.6	
	6'	9'	87.6	
	9'	12'	148	
	12'	15'	177	
	15'	18'	123	0.0
	18'	21'	15	
	21'	31'	Tr	
Thickness		18'	132	
93W	0'	10'	Tr	
	10'	22'	Tr	9.0
Average		5.2'	434	7.5
128W	0'	20'	Tr	
237W	1'	14'	Tr	

LINE 4500S.

Origin : 1041 ft. east of crown of Fingal Rd. as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.				
85E	0'4"	Tr	2.8	
35E	0'	3'	113	
	3'	3'6"	1478	
	3'6"	5'9"	273	0.0
Thickness		5'9"	286	
15E	0'	9'9"	74.9	
	9'9"	10'3"	780	
	10'3"	11'6"	Not sampled	
	11'6"	12'	1730	9.7
	12'	15'	Tr	
Thickness		2'3"	558	
9W	0'	3'6"	Tr	
	3'6"	5'	Not sampled	
	5'	7'	490	
	7'	10'	Tr	
	10'	10'6"	2100	5.0
	10'6"	12'	53.5	
Thickness		5'6"	187	
35W	0'	12'3"	Tr	
	12'3"	13'4"	737	
	13'4"	14'4"	Not sampled	
	14'4"	15'	2310	12.2
	15'	17'	Not sampled	
Thickness		2'9"	850	
56W	0'	13'6"	Not sampled	
	13'6"	14'3"	375	
	14'3"	14'6"	Not sampled	
	14'6"	15'3"	232	13.5
	15'3"	18'6"	Not sampled	
	18'6"	19'	695	
	19'	24'6"	Tr	
Thickness		5'6"	146	
90W	0'	3'	40.5	
	3'	6'	50.6	
	6'	9'	27.0	
	9'	12'	Tr	
	12'	15'	121	15.0
	15'	18'	52.9	
	18'	21'	128	
	21'	24'	Tr	
	24'	27'	52.9	
	27'	30'	57.3	
	30'	33'	108	
	33'	34'	Tr	
Thickness		6'	124	
170W	0'	3'	Tr	
	3'	6'	no sample	
	6'	9'	57.3	19.5
	9'	11'6"	47.2	
	11'6"	13'	Tr	
Average		3.7'	243	10.6
280W	0'	16'	Tr	
330W	0'	11'	Tr	
760W	0'	6'	No Tr.	
880W	0'	11'	Tr	
1000W	0'	6'	Tr	

LINE 5250S.

Origin : 1180 ft. east of crown of Fingal Road as shown in Plate 1, Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
400W	0'	3'	133	
	3'	6'	101	
480W	0'	3'	77.5	
	3'	6'	53.9	
	6'	9'	20.2	
	9'	11'	15.2	
560W	0'	3'	67.4	
	3'	6'	Tr	
640W	0'	3'	75.8	
	3'	6'	77.5	
720W	0'	3'	Tr	
	3'	6'	Tr	
800W	0'	11'	Tr	
880W	0'	6'	Tr	
960W	0'	6'	Tr	
1040W	0'	6'	Tr	
1120W	0'	11'	Tr	

Not enough mineral along this line to calculate.

LINE 6000S.

Origin : 1266 ft. east of crown of Fingal Rd. as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.				
60E	0'	1'6"	Tr	0.5
30E	0'	1'	980	
	1'	3'6"	Tr	0.0

TABLE 7

FINGAL - CUDGEN.

HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES: 1266 ft. east of crown of Fingal Rd. as shown in Plate 1. Fig. 2.

LINE 6000S. Contd.

ALSO LINE 7500S. 6750S

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
10W	0'	10'6"	Tr	
	10'6"	10'10"	Missing	
	10'10"	11'	Not sampled.	
	11'	11'6"	2220	11.0
	11'6"	13'8"	Not sampled	
	13'8"	14'	2650	
Thickness		3'	653	
60W	0'	9'6"	Tr	
	9'6"	10'6"	Tr	
	10'6"	10'10"	2008	10.5
	10'10"	13'6"	142	
	13'6"	14'	666	
Thickness		3'6"	214	
120W	0'	2'	Tr	
	2'	3'6"	730	
	3'6"	4'	Not sampled.	
	4'	4'9"	150	2.0
	4'9"	5'9"	1990	
	5'9"	8'6"	176	
Thickness		6'6"	512	
150W	0'	3'	212	
	3'	6'	47.2	
	6'	9'	418	
	9'	12'	293	
	12'	14'6"	145	0.0
	14'6"	15'	1224	
	15'	18'	53.9	
	18'	21'	tr.	
Thickness		15'	259	
190W	0'	7'	94	
	7'	7'6"	629	
	7'6"	8'6"	Not sampled	
	8'6"	9'	795	
	9'	10'	Not sampled	
	10'	15'	Tr.	
Thickness		2'	355	
250W	0'	9"	574	
	9"	3'6"	95	0.0
	3'6"	8'6"	58	
310W	0'	6"	Tr	0.4
Average		3.6'	385	4.1
470W	0'	14'	Tr	
610W	0'	3'	58.3	
650W	0'	3'	176	
690W	0'	3'	102	
720W	0'	3'	94	
770W	0'	3'	74	
810W	0'	3'	341	
850W	0'	3'	Tr	
	3'	3'3"	442	
	3'3"	4'	Not sampled	
890W	0'	3'	Tr	
930W	0'	1'6"	Not sampled	
	1'6"	3'	496	
970W	0'	1'	Not sampled.	
	1'	2'9"	335	
	2'9"	3'	Not sampled.	

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
992W	0'	6"	Not sampled	
	6"	2'	368	
	2'	2'3"	Not sampled	
1040W	0'	3'	33.7	
	3'	6'	295	
	6'	9'	179	
	9'	11'	Tr	
Thickness		6'	237	
1080W	0'	3'	Tr	
	3'	6'	Tr	
1160W	0'	6'	Tr	
1240W	0'	11'	Tr	

LINE 6750S.

Origin : 1382 ft. east of crown of Fingal Road, as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
1160W	0'	11'	Tr	
1240W	0'	6'	Tr	
1320W	0'	11'	Tr	

LINE. 7500S.

Origin : 1780 ft. east of crown of Fingal Road, as shown in Plate 1. Fig. 2.

Section A.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
70E	0'	9"	153	1.9
	9"	1'	Not sampled	
30E	0'	6"	1053	
	6"	1'	Not sampled	
	1'	1'6"	855	
	1'6"	2'	1775	0.0
	2'	3'3"	Not sampled	
	3'3"	3'9"	2440	
Thickness		3'9"	816	
17E	0'	10'	Tr	
	10'	10'9"	1230	
	10'9"	11'3"	Not sampled	
	11'3"	11'5"	2450	10.0
	11'5"	12'6"	Not sampled	
	12'6"	14'3"	2675	
Thickness		4'3"	783	
10E	0'	11'3"	Tr	
	11'3"	12'3"	1619	
	12'3"	12'6"	Not sampled.	
	12'6"	14'	2883	11.2
	14'	15'	1125	
Thickness		3'9"	1885	
30W	0'	10'	Tr	
	10'	11'	1177	10.0
	11'	13'	Not sampled	
	13'	13'3"	574	
	13'3"	16'	Not sampled	
Thickness		3'3"	406	

TABLE 7 HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 1780 ft. east of crown of Fingal Rd., as shown in plate 1. Fig. 2.

LINE 7500S. Contd. ALSO LINE 9000S. 10500S.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A1 Contd.				
55W	0'	3'	40.5	
	3'	6'	30.3	
	6'	9'	40.5	
	9'	12'	47.2	
	12'	15'	74.2	
	15'	18'	104.5	
	18'	21'	86	
	21'	24'	34.4	
	24'	27'	45.7	
	27'	28'	Tr.	
Average		2.7	965	6.9
115W	0'	7'	Not sampled	
	7'	22'	Tr	
241W	0'	5'	Tr	
1400W	0'	11'	Tr	
1450W	0'	6'	Tr	
1560W	0'	6'	Tr	
1640W	0'	6'	Tr	
1720W	0'	11'	Tr	
LINE 9000S.				
Origin: Above top of beach, as shown in Plate 1. Fig. 2.				
Section A1.				
60E	0'	2'6"	Tr	
40E	0'	9"	192	
	9"	3'9"	80.2	0.0
15E	0'	10'	Tr	
	10'	10'6"	920	
	10'6"	12'	Not sampled	
	12'	12'4"	845	10.0
	12'4"	12'9"	Not sampled	
Thickness		2'4"	318	
00	0'	8'3"	Tr	
	8'3"	8'9"	2930	8.2
	8'9"	12'3"	Tr	
32W	0'	8'6"	Tr	
	8'6"	9'	1207	8.5
	9'	9'6"	Not sampled	
	9'6"	9'10"	2387	
	9'10"	11'6"	Not sampled	
Thickness		1'4"	1049	
97W	0'	28'	Tr	9.2
Average		0.8'	897	7.0
Section All.				
97W	0'	28'	Tr	13.0
127W	0'	12'	Tr	
	12'	14'	252	
	14'	15'6"	Not sampled	
	15'6"	17'	Tr	12.0
157W	0'	3'	tr.	
	3'	6'	47.2	
	6'	9'	57.3	
	9'	12'	60.7	
	12'	15'	50.6	13.0
	15'	18'	93.5	
	18'	21'	53.9	
	21'	24'	Tr	
Average		1.0	252	12.5
237W	0'	3'	67.4	
	3'	6'	Tr	
	6'	15'	Tr	
	15'	18'	33.7	
	18'	23'	Tr	
317W	0'	13'	Tr	
357W	0'	5'	Tr	
LINE. 10500S.				
Origin : 3790 ft. east of Pacific highway as shown in Plate 1. Fig. 2.				
Section A1.				
80E	0'	1'6"	Tr	0.75
30E	0'	6"	Not sampled	
	6"	1'	869.2	0.50
	1'	4'9"	Tr	
15E	0'	10'	Tr	0.75
Average		0.25'	869	0.6
Section All.				
00	0'	13'	Tr	14.3
30W	0'	12'6"	Tr	
	12'6"	13'	850	
	13'	13'3"	409	
	13'3"	15'6"	910	12.5
	15'6"	15'9"	Not sampled	
	15'9"	16'3"	1013	
	16'3"	17'	Not sampled	
Thickness		3'9"	830	
50W	0'	7'6"	Tr	
	7'6"	8'6"	109	
	8'6"	10'6"	Not sampled	
	10'6"	11'	54	
	11'	12'	Not sampled	
	12'	12'4"	387	
	12'4"	12'6"	Not sampled	
	12'6"	12'10"	270	
	12'10"	16'	Not sampled	
	16'	16'9"	806	16.0
	16'9"	17'3"	Not sampled	
	17'3"	17'9"	1306	
	17'9"	21'	Tr	
Thickness		1'9"	718	

TABLE 7 HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 3790 ft. east of Pacific Highway as shown in Plate 1. Fig. 2.

LINE 10500S. Contd. ALSO LINE 11250S. 12000S. 13975S

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section All. Contd.				
70W	0'	20'	Tr	
	20'	21'6"	9.9	
	21'6"	22'	627	
	22'	25'	29.7	21.5
	25'	28'	Tr	
Thickness		6"	627	
125W	0'	9'	Tr	
	9'	12'	9.4	
	12'	18'	16.8	21.75
	18'	29'	Tr	
Average		1.2	778	18.0
175W	0'	20'	Tr	
305W	0'	17'	Tr	
375W	0'	20'3"	Tr	
495W	0'	7'	Tr	
630W	0'	17'	Tr	
813W	0'	20'	Tr	
913W	0'	9'	Tr	
1013W	0'	13'6"	Tr	
1060W	0'	18'	Tr	
1180W	0'	6'	Tr	
1330W	0'	8'	Tr	
1530W	0'	8'	Tr	
1730W	0'	8'	Tr	
1930W	0'	6'	Tr	
	6'	8'	Missing	
2130W	0'	6'	Tr	
2430W	0'	6'	Tr	

LINE 11250S.
Origin : at top of beach as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
40E	0'	11'6"	Tr	11.7
00	0'	11'6"	Tr	
	11'6"	12'	687	11.5
	12'	13'	Not sampled	
30W	0'	14'3"	Tr	
	14'3"	14'9"	912	
	14'9"	15'	Not sampled	
	15'	16'	129	14.2
	16'	17'6"	Not sampled	
Thickness		1'9"	334	
70W	0'	6'	Tr	
	6'	9'	32	
	9'	12'	61	
	12'	15'	62	15.1
	15'	18'	Tr	
	18'	21'	21.1	
	21'	24'	Tr	
	24'	27'	15.2	
Average		0.7'	413	13.05
70W	0'	6'	Tr	
	6'	9'	32	
	9'	12'	61	
	12'	15'	62	
	15'	18'	Tr	19.5
	18'	21'	21.1	
	21'	~~Tr~~ 24'	Tr.	
	24'	27'	15.2	

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
110W	0'	3'	Tr	
	3'	6'	Missing	
	6'	9'	Tr	
	9'	12'	Tr	
	12'	15'	Tr	18.0
	15'	18'	Missing	
	18'	21'	154	
	21'	26'	Tr	
Average		1.5'	154	18.7

LINE 12000S.
Origin : Near top of foredune, as shown in plan on Plate 1. Fig. 2. and section in Plate 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
135E	0'	4'	Tr	
85E	0'	6"	Not sampled	
	6"	1'	328	
	1'	4'	Tr	
60E	0'	14'	Tr.	
35E	0'	8'	Tr	
	8'	8'3"	194	
	8'3"	10'	Not sampled	
00	0'	20'6"	Tr	
30W	0'	17'	Tr	
80W	0'	21'6"	Tr	
130W	0'	21'	Tr	
200W	0'	23'	Tr	
300W	0'	17'	Tr	
375W	0'	17'	Tr	
445W	0'	7'6"	Tr	
545W	0'	5'	Tr	
645W	0'	8'	Tr	
800W	0'	9'6"	Tr	
950W	0'	7'	Tr	
1100W	0'	7'3"	Tr	
1250W	0'	21'6"	Tr	
1300W	0'	24'	Tr	

This line not included in calculations as mineral too low in grade.

LINE 13975S.
Origin : 269 ft. east of western fence of Marine Parade, as shown in Plate 1. Fig. 2.

Section A.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
140E	0'	2'3"	161	0.0
90E	0'	0'2"	1672	
	0'2"	8'9"	Tr	0.0
Average		1.2'	266	0.0
60E	0'	8'6"	Tr	
30E	0'	10'9"	Tr	
	10'9"	11'3"	210	
	11'3"	12'6"	Not sampled	
	12'6"	12'9"	940	
	12'9"	18'	Not sampled	
00	0'	17'6"	Tr	

TABLE 7 HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 269 ft. east. of western fence of Marine Parade, as shown in Plate 1. Fig. 2.

LINE. 13975S. Contd. ALSO LINE 14725S. 15475S.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
35W	0'	3'	Tr	
	3'	6'	35.4	
	6'	9'	30.3	
	9'	12'	Tr	
	12'	13'	Not sampled	
	13'	13'4"	Tr	
	13'4"	15'	Not sampled	
	15'	17'	Tr.	
155W	0'	19'	Tr	
300W	0'	16'6"	Tr	
475W	0'	17'	Tr	
615W	0'	8'	Tr	
800W	0'	13'	Tr	
850W	0'	13'	Tr	
1015W	0'	8'	Tr	
1220W	0'	14'3"	Tr	
1255W	0'	12'	Tr	
1455W	0'	8'6"	Tr	
1755W	0'	8'	Tr	
2055W	0'	8'	Tr	
2555W	0'	7'	Tr	
3055W	0'	8'	Tr	
3555W	0'	8'	Tr	
4055W	0'	8'	Tr	

LINE 14725S.
Origin : 367 ft. east of west fence of Marine Parade, as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.				
00	0'	9'	Tr	
	9'	12'	78.3	
	12'	21'	Tr	
40W	0'	9'	Tr	
	9'	12'	14.1	
	12'	17'6"	Tr	17.5
	17'6"	17'10"	433	
	17'10"	21'	Tr	
80W	0'	3'	Tr	
	3'	6'	71.8	
	6'	9'	Tr	
	9'	11'	42.7	
	11'	11'3"	2228	11.0
	11'3"	13'6"	118	
	13'6"	16'	Tr	
Thickness		3"	2228	
120W	0'	12'	Tr	
	12'	15'	50.7	
	15'	15'3"	1288	15.0
	15'3"	18'	32	
	18'	21'	Tr	
160W	0'	6'	Tr	
	6'	9'	45.5	
	9'	12'	Tr	
	12'	15'	19.6	15.1
	15'	18'	107	
	18'	24'	Tr	
	24'	27'	86	
	27'	30'	77	
	30'	31'	23	

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Average		0.2'	1426	14.1
200W	0'	3'	77.5	
	3'	6'	Tr	
	6'	22'	Tr	
240W	0'	9'	Tr	
	9'	12'	125	
	12'	25'	Tr	
280W	0'	27'	Tr	
320W	0'	27'	Tr	

LINE 15475S
Origin : 332 ft. east of western fence of Marine Parade, as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.				
220E	0'	2'6"	Tr	0.4
130E	0'	9"	1545	
	9"	3'	Tr	0.0
90E	0'	6"	900.3	
	6"	8"	1356	0.0
	8"	4'4"	Tr	
	4'4"	5'6"	133	
Thickness		8"	1233	
60E	0'	5'3"	Tr	
	5'3"	6'6"	292.1	5.2
	6'6"	8'6"	Tr	
30E	0'	3'	Tr	
	3'	6'	38.8	
	6'	12'	Tr	
	12'	15'	22.4	5.9
	15'	18'	25.3	
	18'	20'6"	Tr	
Average		0.6'	1040	1.4
Section B.				
00	0'	12'	Tr.	
	12'	12'3"	266	12.0
	12'3"	17'	Not sampled	
45W	0'	13'8"	Not sampled	
	13'8"	14'	2676	
	14'	14'3"	Not sampled	
	14'3"	15'	1257	13.7
	15'	16'6"	Not sampled	
Thickness		1'4"	1041	
80W	0'	14'3"	Not sampled	
	14'3"	14'7"	312.4	14.3
	14'7"	19'	Not sampled	
Average		0.8'	900	13.4
100W	0'	16'	Tr	
122W	0'	16'6"	Tr	
Section C.				
172W	0'	7'	Not sampled	
	7'	7'4"	Tr	
	7'4"	9'	Not sampled	
	9'	10'6"	89.6	10.0
	10'6"	14'	Not sampled	

TABLE 7

HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 332 ft. east of western fence of Marine Parade, as shown in Plate 1. Fig. 2.

LINE 15475S. Contd.

ALSO LINE 16975S, 18575S.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section C. Contd.				
195W	0'	9'6"	Tr	
	9'6"	10'6"	388	9.5
	10'6"	15'	Not sampled	
	15'	17'	Tr	
240W	0'	17'	Tr	10.0
Average		0.5'	388	9.75
285W	0'	23'	Tr	
330W	0'	22'	Tr	
390W	0'	19'	Tr	
510W	0'	22'	Tr	
610W	0'	9'	Tr	
875W	0'	11'	Tr	
955W	0'	19'	Tr	
985W	0'	23'	Tr	
1080W	0'	8'	Tr	
1135W	0'	7'	Tr	

LINE. 16975S.
Origin : 423 ft. east of western fence of Marine Parade, as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
35E	0'	2'	410	0.0
00	0'	12'	Tr	
	12'	12'3"	510	
	12'3"	13'	Not sampled	
	13'	14'	803	12.0
	14'	16'	Not sampled	
Thickness		2'	465	
30W	0'	10'6"	Tr	
	10'6"	10'9"	148	10.5
	10'9"	13'	Not sampled	
Average		1.6'	435	8.4
Section B.				
65W	0'	16'6"	Tr	12.6
115W	0'	9'	Tr	
	9'	9'3"	141	
	9'3"	12'	Not sampled	
	12'	13'3"	476	12.0
	13'3"	13'6"	Not sampled	
165W	0'	8'4"	Not sampled	
	8'4"	8'6"	718	8.3
	8'6"	9'	Not sampled	
Average		0.7'	491	11.2
255W	0'	13'	Tr	
320W	0'	18'	Tr	
425W	0'	16'	Tr	
445W	16'	23'6"	Tr	
465W	0'	22'	Tr	
505W	0'	22'	Tr	
545W	0'	22'	Tr	
585W	0'	22'	Tr	
625W	0'	17'	Tr	
665W	0'	16'	Tr	
705W	0'	12'	Tr	
745W	0'	16'	Tr	
785W	0'	12'	Tr	
825W	0'	12'	Tr	
865W	0'	21'	Tr	
905W	0'	22'	Tr	
945W	0'	16'	Tr	
985W	0'	12'	Tr	
1025W	0'	7'	Tr	
1125W	0'	6'	Tr	
1225W	0'	7'	Tr	
1325W	0'	6'	Tr	
1425W	0'	12'	Tr	
1525W	0'	6'	Tr	
1625W	0'	7'	Tr	
1725W	0'	6'	Tr	
2025W	0'	7'	Tr	
2125W	0'	12'6"	Tr	
2225W	0'	7'	Tr	
2325W	0'	6'	Tr	
2525W	0'	7'	Tr	
2825W	0'	6'	Tr	
3125W	0'	12'	Tr	
3425W	0'	6'	Tr	
3725W	0'	7'	Tr	
4025W	0'	12'	Tr	
4325W	0'	7'	Tr.	

LINE 18575S.
Origin : 431 ft. west of Marine Parade as shown in Plate 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
50E			Not sampled	
16E	0'	16'	Tr	
00	0'	3'	11	
	3'	6'	Tr	
	6'	9'	72.1	
	9'	12'	Tr	
	12'	15'	14.5	
	15'	18'5"	Tr	
40W	0'	6'	Tr	
	6'	9'	27.0	
	9'	11'	Tr	
100W	0'	11'	Tr	
Section A.				
160W	0'	3'	25.3	
	3'	6'	Tr	
	6'	7'	79.2	
	7'	7'6"	452	7.0
	7'6"	9'3"	82.8	
	9'3"	11'	Tr	
200W	0'	2'9"	Not sampled	
	2'9"	3'	1250	2.7
	3'	8'	Not sampled	
224W	0'	7'	105	
	7'	10'	Tr	2.9
Average		0.3'	807	4.1
250W	0'	15'3"	Tr	
390W	0'	17'9"	Tr	
565W	0'	16'	Tr	
720W	0'	14'	Tr	

TABLE 7

FINGAL - CUDGEN.
HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 367 ft. east of western fence of Kingscliffe St. as shown in Plate 1. Fig.2.

LINE 19125S.

ALSO LINE 19890 S . 20390S.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
60W	No sampled			
100W	0'	13'	Tr	
Section A.				
140W	0'	6'6"	Tr	
	6'6"	6'10"	435	6.5
	6'10"	8'	Not sampled	
180W	0'	5'6"	Tr	
	5'6"	8'3"	233	5.5
	8'3"	9'	Not sampled	
220W	0'	5'6"	Tr	
	5'6"	5'10"	638	5.5
	5'10"	7'	Missing.	
Average		1.5'	266	5.7
260W	0'	15'	Tr	
300W	No sample			

LINE 19890S.

429 ft. east of western fence of Kingscliffe St. as shown in Plate.1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
60E	0'	1'6"	60.1	0.6
20E	0'	6"	no sample	
	6"	9"	1251	0.5'
	9"	2'6"	No sample	
00	0'	10'	Tr	0.6
Average		0.1'	1251	0.55
Section A.				
5W	0'	3'	42	
	3'	6'	68	
	6'	9'	Tr	
	9'	12'	70	
	12'	12'6"	Tr	
	12'6"	15'	24	
37W	0'	7'	Tr	
	7'	8'9"	Not sample.	
	8'9"	9'3"	503	8.75
	9'3"	12'6"	No sample.	
70W	0'	3'	Tr	
	3'	6'	36	
	6'	9'	295	
	9'	12'	124	6.0
	12'	12'6"	24	
	12'6"	15'	36	
Thickness		6'	210	
120W	0'	3'	80	
	3'	6'	Tr	
	6'	9'	31	
	9'	12'	116	9.0
	12'	15'	46	
	15'	17'	Tr	
Average		3.1'	219	7.4
Section B.				
155W	0'	3'	23	
	3'	6'	77	

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
	6'	9'	80	8.0
	9'	11'	57	
	11'	14'	22	
203W	0'	6'	Not sampled	
	6'	8'	712	
	8'	9'6"	Not sampled	
	9'6"	10'	385	6.0
	10'	11'9"	Not sampled	
Thickness		4'	404	
232W	0'	7'6"	95	5.5
255W	0'	3'	421	
	3'	6'	137	
	6'	9'	Tr	0.0
Thickness		6'	279	
295W	0'	3'	291	
	3'	6'	171	
	6'	9'	60.2	0.0
	9'	11'	21.6	
Thickness		6'	231	
335W	0'	3'	119	
	3'	4'	27	3.0
	4'	7'	Tr	
Average		3.2	292	3.5
395W	0'	17'6"	Tr	
495W	0'	15'	Tr	
540W	0'	21'	Tr	
580W	0'	21'	Tr	
595W	0'	16'6"	Tr	
620W	0'	21'	Tr	
660W	0'	16'	Tr	
700W	0'	17'	Tr	
740W	0'	16'	Tr	
820W	0'	16'	Tr	
900W	0'	12'	Tr	
980W	0'	6'	Tr	
1060W	0'	6'	Tr	
1140W	0'	7'	Tr	
1220W	0'	12'	Tr	

LINE 20390S.

Origin : 492 ft. east of western fen[ce] of Kingscliffe St. as shown in Plate. 1. Fig. 2.

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
00	0'	3'	52.9	
	3'	6'	Tr	
	6'	9'	67.4	7.5
	9'	12'	96.1	
	12'	13'	Tr	
40W	0'	3'	103	
	3'	6'	53.9	
	6'	9'	146	6.0
	9'	13'6"	Tr	
80W	0'	3'	Tr	
	3'	6'	77.5	
	6'	9'	122	6.0
	9'	12'	Tr	
	12'	12'9"	Tr	

TABLE 7 HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : 492 ft. east of western fence of

LINE 20390S. Cont. Kingscliffe St. as shown in Plate 1 Fig.2.

BORE	DEPTH		LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH		LBS/ CU. YD.	O/BRDN FT.
	FROM	TO				FROM	TO		
120W	0'	3'0"	67.4						
	3'0"	6'0"	80.2						
	6'0"	9'0"	41.1	7.5					
	9'0"	12'0"	Tr						
	12'0"	13'0"	Tr						
Average	2.0'	134	6.5						
120W	0'	3'0"	67.4						
	3'0"	6'0"	80.2						
	6'0"	9'0"	41.1	7.5					
	9'0"	12'0"	Tr						
	12'0"	13'0"	Tr						
160W	0'	3'6"	16.8						
	3'0"	6'0"	70.8						
	6'0"	9'0"	154	6.0					
	9'0"	12'0"	Tr						
	12'0"	14'0"	Tr						
200W	0'	3'0"	Tr						
	3'0"	6'0"	73.3						
	6'0"	9'0"	125						
	9'0"	12'0"	33.7	6.0					
	12'0"	15'0"	103						
	15'0"	16'0"	71.1						
240W	0'	2'0"	260						
	2'0"	3'0"	1030						
	3'0"	6'0"	Tr	0.0					
	6'0"	9'0"	Tr						
	9'0"	12'0"	Tr						
280W	0'	3'0"	104						
	3'0"	6'0"	43.8	1.5					
	6'0"	9'0"	Tr						
	9'0"	12'0"	Tr						
Average		2.25'	265	4.1					
360W	0'	3'0"	Tr						
	3'0"	6'0"	86.3						
	6'0"	9'0"	67.4						
	9'0"	12'0"	62.4						
400W	0'	3'0"	30.3						
	3'0"	6'0"	Tr						
	6'0"	12'0	Tr						
440W	0'	3'0"	Tr						
	3'0"	6'0"	Tr						
	6'0"	9'0"	Tr						
	9'0"	21'0"	Tr						

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	TO	LBS/CU.YD.	O/BRDN FT	SECT'L AREA(SQ.FT) MIN. SAND	O/BURDEN.	AREA MIN SAND X AV. GRADE.
LINE 3000S. Origin : 343 ft. east of south-west corner of portion 425 as shown in Plate 1. Fig.2.							
Section A.							
70E	0'	1'6"	Tr				
40E	0'	4"	Not sampled				
	4"	8"	1690				
	8"	2'	Not sampled.				
	2'	3'3"	438				
	3'3"	3'6"	Not sampled.				
Thickness		2'11"	423.				
35E	0'	1'	Tr.				
	2'	24'6"	1771				
15E	0'	11'6"	Tr.				
	11'6"	13'9"	885				
35W	0'	10'	42.8				
	10'	13'6"	52.4				
	13'6"	18'	1025				
	18'	19'6"	Not sampled				
65W	0'	3'	169				
	3'	6'	87.6				
	6'	9'	87.6				
	9'	12'	148				
	12'	15'	177				
	15'	18'	123				
	18'	21'	15				
	21'	31'	Tr				
Thickness		18'	132				
93W	0'	10'	Tr				
	10'	22'	Tr				
Average		5.2'	434				
128W	0'	20'	Tr				
237W	1'	14'	Tr				
LINE 4500S. Origin: 1041 ft. east of crown of Fingal Rd. as shown in Plate 1. Fig. 2.							
Section A.							
85E	0'4"	Tr	2.8				
35E	0'	3'	113				
	3'	3'6"	1478				
	3'6"	5'9"	272				
Thickness		5'9"	286				
15E	0'	9'9"	74.9				
	9'9"	10'3"	780				
	10'3"	11'6"	Not sampled				
	11'6"	12'	1730				
	12'	15'	Tr				
Thickness		2'3"	558				

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/CU.YD.	O/BRDN FT	SECT'L AREA (SQ.FT) MIN. SAND	SECT'L AREA (SQ.FT) O/BURDEN.	AREA MIN SAND X AV. GRADE.
9W	0'	3'6"	Tr				
	3'6"	5'	Not sampled				
	5'	7'	490				
	7'	10'	Tr				
	10'	10'6"	2100				
	10'6"	12'	53.5				
Thickness		5'6"	187				
35W	0'	12'3"	Tr				
	12'3"	13'4"	737				
	13'4"	14'4"	Not Sampled				
	14'4"	15'	2310				
	15'	17'	Not sampled				
Thickness		2'9"	850				
56W	0'	13'6"	Not Sampled				
	13'6"	14'3"	375				
	14'3"	14'6"	Not Sampled				
	14'6"	15'3"	232				
	15'3"	18'6"	Not Sampled				
	18'6"	19'	695				
	19'	24'6"	Tr				
Thickness		5'6"	146				
90W	0'	3'	40.5				
	3'	6'	50.6				
	6'	9'	27.0				
	9'	12'	Tr				
	12'	15'	121				
	15'	18'	52.9				
	18'	21'	128				
	21'	24'	Tr				
	24'	27'	52.9				
	27'	30'	57.3				
	30'	33'	108				
	33'	34'	Tr				
Thickness		6'	124				
170W	0'	3'	Tr				
	3'	6'	No Sample				
	6'	9'	57.3				
	9'	11'6"	47.2				
	11'6"	13'	Tr				
Average		3.7'	243				
280W	0'	16'	Tr				
330W	0'	11'	Tr				
760W	0'	6'	No. Tr.				
880W	0'	11'	Tr				
1000W	0'	6'	Tr				
LINE 5250S. Origin: 1180 ft. east of crown of Fingal Road as shown in Plate 1, Fig. 2.							
800W	0'	11'	Tr				
880W	0'	6'	Tr				
960W	0'	6'	Tr				
1040W	0'	6'	Tr				
1120W	0'	11'	Tr				
Not enough mineral along this line to calculate.							

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES : ____________________

BORE	DEPTH FROM	DEPTH TO	LBS/CU.YD.	O/BRDN FT	SECT'L AREA (SQ.FT) MIN. SAND	SECT'L AREA (SQ.FT) O/BURDEN.	AREA MIN SAND X AV. GRADE.
LINE 6000S. Origin: 1266 ft. east of crown of Fingal Road, as shown in Plate 1, Fig. 2.							
610W	0'	3'	58.3				
650W	0'	3'	176				
690W	0'	3'	102				
720W	0'	3'	94				
770W	0'	3'	74				
810W	0'	3'	341				
850W	0'	3'	Tr				
	3'	3'3"	442				
	3'3"	4'	Not Sampled				
890W	0'	3'	Tr				
930W	0'	1'6"	Not Samples				
	1'6"	3'	496				
970W	0'	1'	Not Sampled				
	1'	2'9"	335				
	2'9"	3'	Not Sampled				
992W	0'	6"	Not Sampled				
	6"	2'	368				
	2'	2'3"	Not Sampled				
1040W	0'	3'	33.7				
	3'	6'	295				
	6'	9'	179				
	9'	11'	Tr				
Thickness		6'	237				
1080W	0'	3'	Tr				
	3'	6'	Tr				
1160W	0'	6'	Tr				
1240W	0'	11'	Tr				
Line 6750S. Origin: 1382 ft. east of crown of Fingal Road, as shown in Plate 1, Fig. 2.							
1160W	0'	11'	Tr				
1240W	0'	6'	Tr				
1320W	0'	11'	TR				
LINE 7500S. Origin: 1780 ft. east of crewn of Fingal Road, as shown in Plate 1, Fig. 2.							
Section A.							
70E	0'	6"	1053				
	6"	1'	Not Sampled				
	1'	1'6"	855				
	1'6"	2'	1775				
	2'	3'3"	Not Sampled				
	3'3"	3'9"	2440				
Thickness		3'9"	816				
17E	0'	10'	Tr				
	10'	10'9"	1230				
	10'9"	11'3"	Not Sampled				
	11'3"	11'5"	2450				
	11'5"	12'6"	Not Sampled				
	12'6"	14'3"	2675				
Thickness		4'3"	783				

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Average		1.2'	266						
60E	0'	8'6"	Tr						
30E	0'	10'9"	Tr						
	10'9"	11'3"	210						
	11'3"	12'6"	Not Sampled						
	12'6"	12'9"	940						
	12'9"	18'	Not Sampled						
35W	0'	3'	Tr						
	3'	6'	35.4						
	6'	9'	30.3						
	9'	12'	Tr						
	12'	13'	Not Sampled						
	13'	13'4"	Tr						
	13'4"	15'	Not Sampled						
	15'	17'	Tr.						
155W	0'	19'	Tr						
300W	0'	16'6"	Tr						
475W	0'	17'	Tr						
615W	0'	8'	Tr						
800W	0'	13'	Tr						
850W	0'	13'	Tr						
1015W	0'	8'	Tr						
1220W	0'	14'3"	Tr						
1255W	0'	12'	Tr						
1455W	0'	8'6"	Tr						
1755W	0'	8'	Tr						
2055W	0'	8'	Tr						
2555W	0'	7'	Tr						
3055W	0'	8'	Tr						
3555W	0'	8'	Tr						
4055W	0'	8'	Tr						
LINE 14725S. Origin: 367 ft. east of west fence of Marine Parade, as shown in Plate 1, Fig.2.									
Section A.									
00	0'	9'	Tr						
	9'	12'	78.3						
	12'	21'	Tr						
40W	0'	9'	Tr						
	9'	12'	14.1						
	12'	17'6"	Tr						
	17'6"	17'10"	433						
	17'10"	21'	Tr						
80W	0'	3'	TR						
	3'	6'	71.8						
	6'	9'	Tr						
	9'	11'	42.7						
	11'	11'3"	2228						
	11'3"	13'6"	118						
	13'6"	16'	Tr						
Thickness		3"	2228						
120W	0'	12'	Tr						
	12'	15'	50.7						
	15'	13'3"	1288						
	15'3"	18'	32						
	18'	21'	Tr						

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
160W	0'	6'	Tr						
	6'	9'	45.5						
	9'	12'	Tr						
	12'	15'	19.6						
	15'	18'	107						
	18'	24'	Tr						
	24'	27'	86						
	27'	30'	77						
	30'	31'	23						
200W	0'	3'	77.5						
	3'	6'	Tr						
	6'	22'	Tr						
240W	0'	9'	Tr						
	9'	12'	125						
	12'	25'	Tr						
280W	0'	27'	Tr						
320W	0'	27'	Tr						
LINE 1547S. Origin: 332 ft. east of western fence of Marine Parade, as shown in Plate 1, Fig. 2.									
Section A.									
220E	0'	2'6"	Tr						
130E	0'	9"	1545						
	9"	3'	Tr						
90E	0'	6"	900.3						
	6"	8"	1356						
	8"	4'4"	Tr						
	4'4"	5'6"	133						
Thickness		8"	1233						
60E	0'	5'3"	Tr						
	5'3"	6'6"	292.1						
	6'6"	8'6"	Tr						
30E	0'	3'	Tr						
	3'	6'	38.8						
	6'	12'	Tr						
	12'	15'	22.4						
	15'	18'	25.3						
	18'	20'6"	Tr						
Average		0.6'	1040						
Section B.									
00	0'	12'	Tr						
7	12'	12'3"	266						
	12'3"	17'	Not sampled						
45W	0'	13'8"	Not sampled						
	13'8"	14'	2676						
	14'	14'3"	Not sampled						
	14'3"	15'	1257						
	15'	16'6"	Not Sampled						
Thickness		1'4"	1041						
80W	0'	14'3"	Not Sampled						
	14'3"	14'7"	312.4						
	14'7"	19'	Not sampled						
Average		0.8'	900						
100W	0'	16'	Tr						
122W	0'	16'6"	Tr						

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section C.									
172W	0'	7'	Not Sampled						
	7'	7'4"	Tr						
	7'4"	9'	Not Sampled						
	9'	10'6"	89.6						
	10'6"	14'	Not Sampled						
195W	0'	9'6"	Tr						
	9'6"	10'6"	388						
	10'6"	15'	Not Sampled						
	15'	17'	Tr						
240W	0'	17'	Tr						
Average		0.5'	388						
285W	0'	23'	Tr						
330W	0'	22'	Tr						
390W	0'	19'	Tr						
510W	0'	22'	Tr						
610W	0'	9'	Tr						
875W	0'	11'	Tr						
955W	0'	19"	Tr						
985W	0'	23'	Tr						
1080W	0'	8'	Tr						
1135W	0'	7'	Tr						
LINE 16975S. Origin: 423 ft. east of western fence. of Marine Parade, as shown in Plate 1, Fig. 2.									
35E	0'	2"	410						
00	0'	12'	Tr						
	12'	12'3"	510						
	12'3"	13'	Not sampled						
	13'	14'	803						
	14'	16'	Not sampled						
Thickness		2'	465						
30W	0'	10'6"	Tr						
	10'6"	10'9"	148						
	10'9"	13'	Not Sampled						
Average		1.6'	435						
Section B.									
65W	0'	16'6"	Tr						
115W	0'	9'	Tr						
	9'	9'3"	141						
	9'3"	12'	Not sampled						
	13'3"	13'6"	Not sampled						
165W	0'	8'4"	Not sampled						
	8'4"	8'6"	718						
	8'6"	9'	Not sampled						
Average		0.7'	491						

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
255W	0'	13'	Tr						
320W	0'	18'	Tr						
425W	0'	16'	Tr						
445W	16'	23'6"	Tr						
465W	0'	22'	Tr						
505W	0'	22'	Tr						
545W	0'	22'	Tr						
585W	0'	22'	Tr						
625W	0'	17'	Tr						
665W	0'	16'	Tr						
705W	0'	12'	Tr						
745W	0'	16'	Tr						
785W	0'	12'	Tr						
825W	0'	12'	Tr						
865W	0'	21'	Tr						
905W	0'	22'	Tr						
945W	0'	16'	Tr						
985W	0'	12'	Tr						
1025W	0'	7'	Tr						
1125W	0'	6'	Tr						
1225W	0'	7'	Tr						
1325W	0'	6'	Tr						
1425W	0'	12'	Tr						
1525W	0'	6'	Tr						
1625W	0'	7'	Tr						
1725W	0'	6'	Tr						
2025W	0'	7'	Tr						
2125W	0'	12'6"	Tr						
2225W	0'	7'	Tr						
2325W	0'	6'	Tr						
2525W	0'	7'	Tr						
2825W	0'	6'	Tr						
3125W	0'	12'	Tr						
3425W	0'	6'	Tr						
3725W	0'	7'	Tr						
4025W	0'	12'	Tr						
4325W	0'	7'	Tr.						

LINE 18575S.
Origin: 431 ft. west of Marine Parade as shown in Plate 1, Fig. 2.

50E			Not Sampled	
16E	0'	16'	Tr	
00	0'	3'	11	
	3'	6'	Tr	
	6'	9'	72.1	
	9'	12'	Tr	
	12'	15'	14.5	
	15'	18'5"	Tr.	
40W	0'	6'	Tr	
	6'	9'	27.0	
	9'	11'	Tr	
100W	0'	11'	Tr.	

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
Section A.									
160W	0'	3'	25.3						
	3'	6'	Tr						
	6'	7'	79.2						
	7'	7'6"	452						
	7'6"	9'3"	82.8						
	9'3"	11'	Tr						
200W	0'	2'9"	Not sampled						
	2'9"	3'	1250						
	3'	8'	Not sampled						
224W	0'	7'	105						
	7'	10'	Tr						
Average		0.3'	807						
250W	0'	15'3"	Tr						
390W	0'	17'9"	Tr						
565W	0'	16'	Tr						
720W	0'	14'	Tr						
60W	Not	sampled							
100W	0'	13'	Tr						
Section A.									
140W	0'	6'6"	Tr						
	6'6"	6'10"	435						
	6'10"	8'	Not Sampled						
180W	0'	5'6"	Tr						
	5'6"	8'3"	233						
	8'3"	9'	Not sampled						
220W	0'	5'6"	Tr						
	5'6"	5'10"	638						
	5'10"	7'	Missing.						
Average		1.5'	266						
260W	0'	15'	Tr						
300W	No sample								
LINE 19890S. 429ft. east of western fence of Kingscliffe St. As shown in Plate 1. Fig. 2.									
60E	0'	1'6"	60.1.						
20E	0'	6"	No sample						
	6"	9"	1251						
	9"	2'6"	No sample						
00	0'	10'	Tr						
Average		0.1'	1251						
5W	0'	3'	42						
	3'	6'	68						
	6'	9'	Tr						
	9'	12'	70						
	12'	12'6"	Tr						
	12'6"	15'	24						

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES :

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
37W	0'	7'	Tr						
	7'	8'9"	Not sampled.						
	8'9"	9'3"	503						
	9'3"	12'6"	Not sampled.						
70W	0'	3'	Tr						
	3'	6'	36						
	6'	9'	295						
	9'	12'	124						
	12'	12'6"	24						
	12'6"	15'	36						
Thickness		6'	210						
120W	0'	3'	80						
	3'	6'	Tr						
	6'	9'	31						
	9'	12'	116						
	12'	15'	46						
	15'	17'	Tr						
Average		3.1'	219						
Section B.									
155W	0'	3'	23						
	3'	6'	77						
	6'	9'	80						
	9'	11'	57						
	11'	14'	22						
203W	0'	6'	Not sampled						
	6'	8'	712						
	8'	9'6"	Not sampled						
	9'6"	10'	385						
	10'	11'9"	Not sampled						
	Thickness	4'	404						
232	0'	7'6"	95						
	3'	6'	137						
	6'	9'	Tr						
Thickness		6'	279						
295W	0'	3'	291						
	3'	6'	171						
	6'	9'	60.2						
	9'	11'	21.6						
Thickness		6'	231						
335W	0'	3'	119						
	3'	4'	27						
	4'	7'	Tr						
Average		3.2	292						
395W	0'	17'6"	Tr						
495W	0'	15'	Tr						
540W	0'	21'	Tr						
580W	0'	21'	Tr						
595W	0'	16'6"	Tr						
620W	0'	21'	Tr						
660W	0'	16'	Tr						
700W	0'	17'	Tr						
740W	0'	16'	Tr						
820W	0'	16'	Tr						
900W	0'	12'	Tr						
980W	0'	6'	Tr						
1060W	0'	6'	Tr						

TABLE HEAVY MINERAL AND OVERBURDEN IN BORES

ORIGIN OF CO-ORDINATES

BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.	BORE	DEPTH FROM	DEPTH TO	LBS/ CU. YD.	O/BRDN FT.
1140W	0'	7'	Tr						
1220W	0'	12'	Tr						

PLATE I
REFERENCE
RECENT
Swamp
Low lying, sandy and peaty
Low lying and sandy
Sand
PLIOCENE
Basalt
LOWER PALAEOZOIC
Sediments
Heavy mineral deposits
Bore holes
Lease boundaries
Built up areas
TWEED RIVER
PACIFIC HIGHWAY
CHINDERAH
CHINDERAH ROAD
CUDGEN ROAD
VILLAGE OF KINGSCLIFF
SPECIAL APPLICATION
SOUTH PACIFIC OCEAN
CUDGEN
CUDGEN CREEK
CUDGEN HEADLAND
FIG. 2
SEE TWEED—FINGAL AREA FOR DETAILS OF BORES NORTH OF FINGAL HEAD.
SEE CUDGEN—NORRIES AREA FOR DETAILS OF BORES SOUTH OF CUDGEN HEADLAND
FINGAL HEAD
TWEED RIVER
FINGAL RD.
PACIFIC HIGHWAY
CHINDERAH ROAD
SPECIAL APPLICATION 159
SPECIAL APPLICATION 157
SOUTH PACIFIC OCEAN
FINGAL HEAD
PACIFIC OCEAN
TONY'S IS.
LILLIE'S IS.
CHINDERAH RD.
CHINDERAH IS.
TWEED RIVER
DODD'S IS.
CUDGEN HEADLAND
SCALE
PLAN SHOWING GENERAL GEOLOGY OF AREA
FIG. 3
CABOOLTURE
REDCLIFFE
SAMFORD
BRISBANE
IPSWICH
BEENLEIGH
FLINDERS
TAMBOURINE
SOUTHPORT
DUGANDAN
SPRINGBROOK
COOLANGATTA
TWEED HEADS
QNSLD.
N.S.W.
MT. LINDSAY
MURWILLUMBAH
NORRIES HEAD
TWEED HEADS
BONALBO
NIMBIN
BYRON BAY
TABULAM
LISMORE
BALLINA
ALICE
WOODBURN
COALDALE
MACLEAN
GRAFTON
BRUSH GROVE
NYMBOIDA
BARE POINT
LOCALITY MAP
SHOWING POSITION OF AREA DEALT WITH IN REPORT AND REFERENCE TO AUSTRALIAN 1 & 4 MILE MAP SERIES
ONE MILE MAPS :- "BALLINA"
FOUR MILE MAPS "MACLEAN"
FIG. 1
MINERAL DEPOSITS
OF THE
FINGAL-CUDGEN AREA
NORTHERN NEW SOUTH WALES
PLAN
Scale: 1" TO 500'
BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS
GEOLOGY SECTION
N60-3B-1


5250 S.
10500 S.
4500 S.
3000 S.
6750 S.
9000 S.
1500 S.
7500 S.
6000 S.
00
Bearing 268° M.
LEGEND
120–300 LBS. PER CUBIC YARD
OVER 300 LBS PER CUBIC YARD
MINERAL DEPOSITS
OF THE
FINGAL – CUDGEN AREA
NORTHERN NEW SOUTH WALES
SECTIONS
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.
GEOLOGY SECTION.
PLATE 2
SCALES. 1" TO 100' HORIZ. 1" TO 10' VERT.
DRG NO. N60-3B-2

See lower R.H.S. of sheet for continuation of section
Grazing land
Water level
16,975 S
Line along Pacific St.
Low, sandy, damp & scrubby from 1220' west
Line 283' N. of S.E. corner of street
19,890 S
30' N.th of corner peg Lots 4-5 Block 8 Village of Kingscliffe
14,725 S.
Line 12' S. of corner peg Lots 3-4 Block 7 South of Terrace St. Village of Kingscliffe
15,475 S.
Line 235' S.th of road between hotel & church
Broken dune
20,390 S.
Line 176' S.th of bend at S.E. corner of lot 10 Block 2 Village of Kingscliffe
18,575 S.
19,125 S.
181' N.W. of east corner of lots 3-4 Block 4 (these lots front Kingscliffe St.)
Parallel to Chinderah Rd. 30' S.th of N.th Fence
13,975 S.
Section continued from top L.H.S. of sheet
16,975 S.
11,250 S.
12,000 S.
LEGEND
120–300 LBS. PER CUBIC YARD
OVER 300 LBS PER CUBIC YARD
MINERAL DEPOSITS
OF THE
FINGAL-CUDGEN AREA
NORTHERN NEW SOUTH WALES
SECTIONS
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.
GEOLOGY SECTION.
PLATE 2A
SCALES. 1" TO 100' HORIZ. 1" TO 10' VERT.
DRG NO. N60-3B-2A

MINERAL DEPOSITS OF THE
FINGAL - CUDGEN AREA
NORTHERN NEW SOUTH WALES

FIG. 1

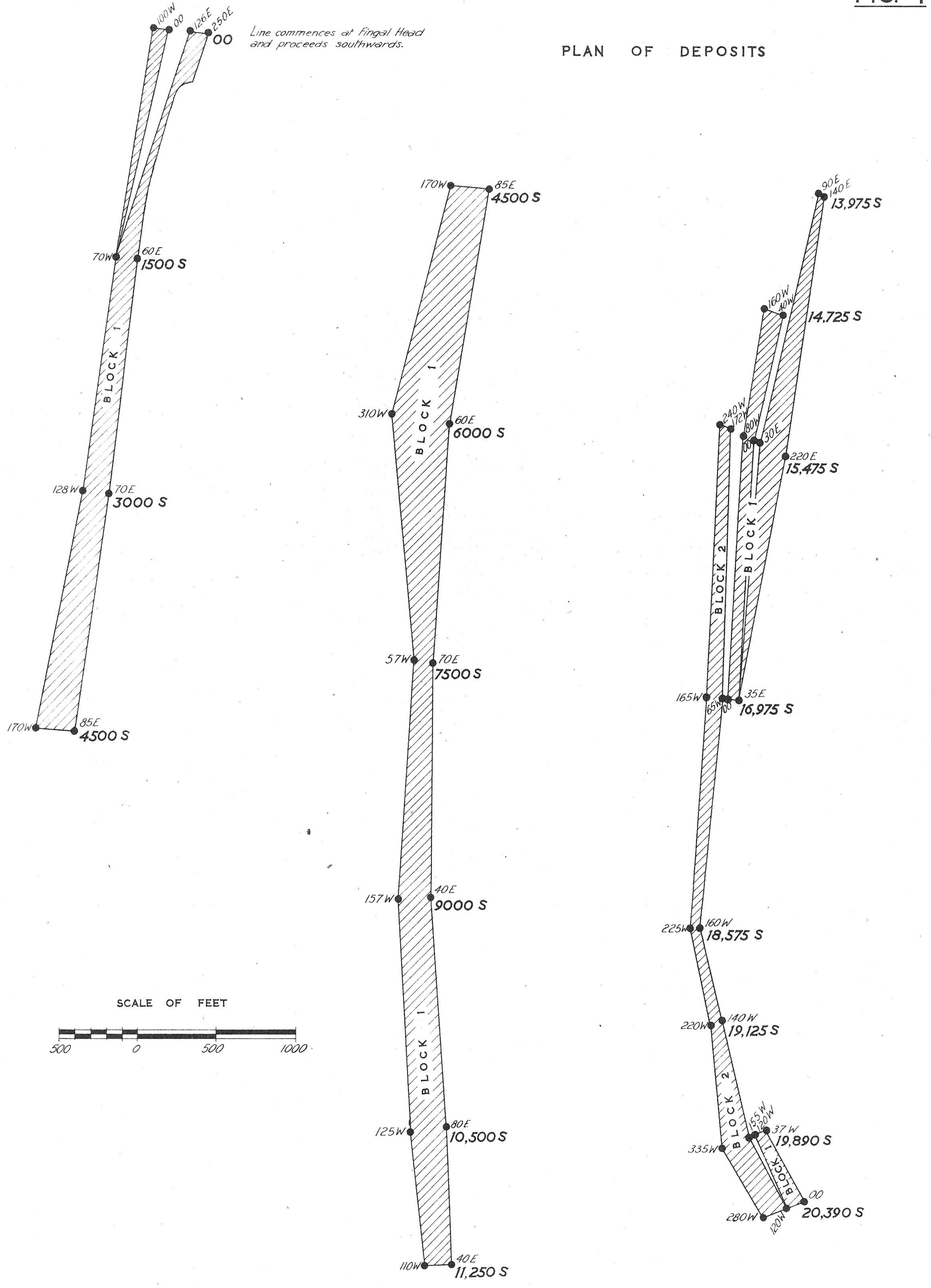
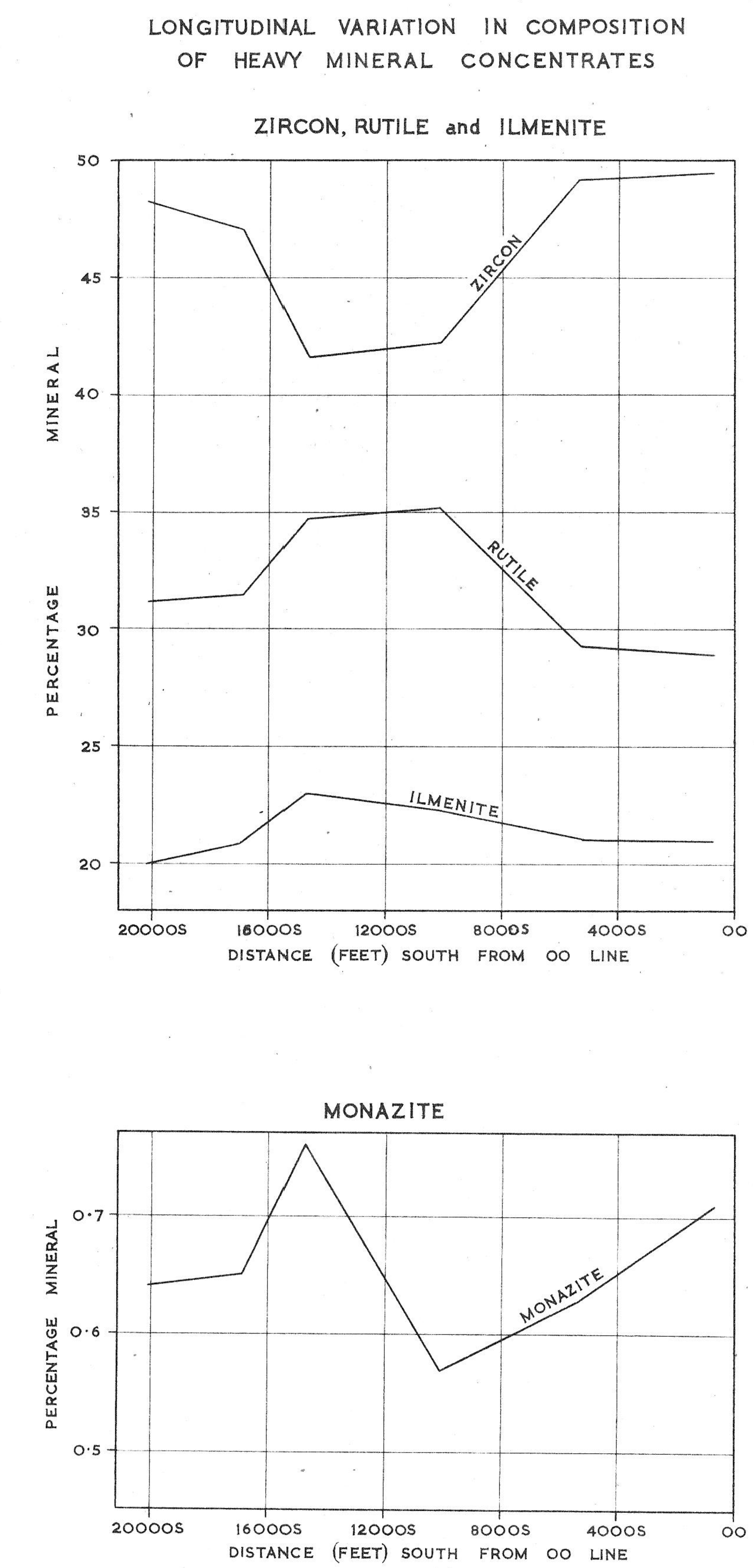


FIG. 2



COMMONWEALTH BUREAU OF MINERAL RESOURCES, SOUTHPORT, QUEENSLAND.