REPORT ON EXAMINATION AND BORING OF ALLUVIAL DEPOSITS AT FRASER BEACH TERRACE KING ISLAND.

PRELIMINARY STATEMENT

In the year 1905 the British Flag Prospecting and Mining Syndicate No Liability applied for and were granted 6 reward claims for tin over an area of 125 acres. These leases were situated north of and adjacent to the mouth of the Fraser River.

The syndicate started mining operations on their south-eastern section with experimental plant in the following year, but suspended work after six months owing to the unsuitability of the concentrating machines and lack of funds. Four special concentrating tables capable of handling about one cubic yard per hour are said to have been constructed locally, a four horse-power portable steam engine for operating installed and a 3000 gallon capacity Worthington pump set up to provide a water supply.

For the operating period the mine manager reported excavating 1584 cubic yards of material and passing 866 cubic yards over the tables thereby producing 5 tons 10 cwts 2 qrs 81lbs of tin and 1 oz 13 dwts 14 grs of gold to a net value of £250.2.6d.

The original leases expired in 1911 and since that date portion of the ground has been held under various names at different times but very little actual mining has been undertaken.

In 1926 an application was received from J. McK. Bowling to lease 76 acres under number 9620/M covering the old workings and this is held under mineral lease at the present time.

LOCATION AND ACCESS.

King Island is situated about 55 miles north-west of Tasmania at the western entrance to Bass Straits and is midway between the mainland of Australia and Tasmania. The island's greatest length is 40 miles in a meridional direction and its breadth at the widest part is 16 miles.

The property under examination is Crownland and part of the township reserve of Narracoopa. It is situated on the east coast of the island and immediately north of Fraser River mouth. Fraser jetty at Narracoopa settlement lies 1 mile to south-east and it is to this port that a steamer calls bi-weekly, in suitable weather, on its way between Tasmania and Melbourne and return.

A main road with an excellent surface for motor traffic connects Narracoopa settlement with the principal township Currie on the West Coast, and this road passes within a few chains of the property.

TOPOGRAPHY.

The principal topographical feature of the area is represented by a raised beach in the form of a terrace running parallel to and adjoining the present Fraser Beach on the inland side, the latter forming portion of Sea Elephant Bay.

The terrace which is 4 to 6 feet above high water mark is coincident in height with the sand dune at present forming behind the beach. The terrace surface is generally level although it is broken slightly by lagoons and depressions in lines parallel with the beach. The western edge of the terrace evidently represents a previous high water mark, and rising sharply to the west of this line are old sand dunes which increase in height in a northerly direction.

The crest of these old dunes stretches westerly with an undulating surface, extending for about a half mile from the old workings, but is much wider further north. A low coastal range rises steeply to some 200 feet from the western edge of the old sand blows. The drainage system, which is in a youthful stage, is represented by Fraser River and its tributaries. Evidence of a recent uplift is visible where the main stream is seen to be cutting into its old sediments and near the mouth has perpendicular banks up to 20 feet in height where it has corroded its bed down into Palaeozoic slates and quartzites.

There is some evidence that before the uplift occurred Fraser River had shifted its course a good deal in the vicinity of its mouth and had probably been working over its own flood plain.

As is so often the case with beach-line sand dune topography, lagoons have formed behind the present dunes near stream junctions with the sea. In the case of the smaller creeks sand banks debar direct flow over the beach, the water having recourse to seepage through the sand.

King Island as a whole has distinct features of an old peneplain which has been raised in recent times, thereby giving increased cutting power to the streams near the coast line.

GEOLOGY.

The geological structure of the island is somewhat difficult to fathom owing to a deep mantle of alluvium and detrital matter; few exposures of rocks in situ being the rule.

The number of rock types in the area under examination is small.

Palaeozoic slates and quartzites, similar in structure to the great series of Cambro-Ordovician sediments in Tasmania, are the bedrock. In the vicinity of Fraser River and beach these rocks are seen to be dipping to the south-west at from 25° to 35°. Along the shore some five chains south of Fraser River a dyke of Lamprophyre eighteen inches wide, probably representative of the Devonian intrusives, traverses the above mentioned rocks in a south west-north-east direction.

Tertiary limestones teeming with marine organisms outcrop with level bedding on the beach at the Blow-hole about 4½ miles north of Fraser River.

Old sand dunes west of Fraser Beach are composed of loosely aggregated ilmenitic sandstones of recent age underlying surface sand and in places resting on river clays and gravels, the whole overlying Palaeozoic slates and quartzites. Belonging to the same period as the sandstones and overlying similar rocks are the black sands of Fraser Beach terrace, while of still more recent date is the sand dune at present forming behind Fraser Beach.

THE MINERAL DEPOSIT.

This occurs as portion of a very fine black sand forming Fraser Beach terrace, extending from Fraser River northerly for approximately 4 miles and having a width of from 2 to 3 chains.

The sand consists essentially of an intimate mixture of quartz, zircon and ilmenite, with some cassiterite and possibly a minute quantity of gold.

This was distributed and deposited, prior to a recent uplift of the strand line, by means of ocean tides and currents after being carried in suspension by Fraser River to the sea from some point or points inland. The present source of the minerals may probably be looked for in the detrital and alluvial deposits in the watershed of Fraser River. The original source of the ilmenite will likely be in a gabbro reported to occur at no great distance to the south west, a hand specimen of which was viewed but of which no rocks were observed in place. The average depth of the deposit where tested was 10 feet, bottom coming closer to the surface at old high water mark and extending more deeply in a seaward direction. From surface down to approximately 2 feet the sand is of a greyish colour carrying a little ilmenite.

Below this mark the deposit becomes darker in colour until at varying depths, usually from 4 to 6 feet from surface, a pan of lightly cemented sand containing much ilmenite comes in, sometimes for 2 to 3 feet in thickness. The cementing material is an oxide of iron evidently deposited by circulating waters and the whole may be easily pulverised by hand. Below the caked region sands are loose again in many places and bottom is usually small waterworn pebbles of slate and quartzite underlain by blue clay, being softened slate, which is here bedrock.

An analysis of a concentrate of black sand, from the old workings, determined by the Chief Government Chemist and Assayer, gave the following result:-

	per cent.
SiO_2 (Quartz,	6.00
Zircon etc.	21.95
Fe_2O_3 and FeO	31.95
TiO_2	39.00
CaO	trace
MgO	0.36
MnO	2.32
SnO_2	0.25

WORKINGS

The workings which were carried out by the British Flag Prospecting and Mining syndicate are on the terrace 7 chains north of Fraser River and in the vicinity of old high water mark. They consist of ground paddocked out to about 10 feet in depth for a length of 2½ chains by approximately ½ a chain in width, The bottom is now water-logged and sand has fallen in from the sides to some extent. No trace of the plant used for this work is now visible.

Two years ago the syndicate now holding the lease installed a water pump on the bank of Fraser River at southern end of the terrace and constructed fluming to the old workings where a trial was made with a special type of sluice-box to concentrate the tin oxide content.

Very little work was done and the experiment evidently proved a failure. The pump and fluming are still in place.

Much shaft and hole digging has been attained in the past in an attempt to prove the deposit. This method has apparently proved unsuccessful owing mainly to the fine nature of the sand which falls in under the treatment and does not give correct samplings throughout the depth. A number of bore holes have also been put down by the former lessees, the method and results of which could not be ascertained, except that it is said that they were bored in 2 lines of alternate holes 200 yards apart.

BORING OPERATIONS.

Twenty four bore holes were sunk on the terrace, during boring operations for a distance of 30 chains over a width of approximately ¾ of a chain. Position of the bores are shown on the accompanying plan. The plant used was a small hand boring one consisting in the main of 3½ inch casing with a 2¾ inch clacker sand pump. Holes were dug out from surface in nearly every case to an average depth of 1'4" before commencing to bore for the purpose of missing fern shrub and other plant roots which penetrated to that depth. Casing was then placed in the hole and driven into the sand. At this stage water was poured into the casing followed by the pump which was then given an up and down vertical motion to secure suspension of sand in the water and the forcing of both into the pump through the clacker. Care was taken to see that the casing was at all times kept below the pump. After filling with sediment the pump was raised to surface, the material bagged and forwarded to the Government Laboratory for assay purposes. 93 sample bags constituting in the vicinity of 1 ton of material was in this way secured.

The following tabulated list shows results of the more valuable mineral contents of the holes as determined from the boring accomplished, together with assays and with assays and weights determined by the Chief Government Chemist and Assayer.

The results are exclusive of one to two foot of surface sand not bored except in the two instances where boring commenced at surface.

Number of bore hole	Depth of Bore hole	Lbs per cubic yd. Tin Oxide.	Lbs per cubic yd. Metallic Tin.	Lbs per cubic yd. Ilmenite	Lbs per cubic yd. Titanium Oxide.	Gold	Metallic Tin Assay %	Titanium Oxide Assay %	Weight of Sediment in lbs.	REMARKS.
1	6'6"	Trace	Trace	1331.2	701.5	Nil	Trace	19.0	48.0	Hole dug out down to 2' from surface before starting boring to get below roots and vegetable matter. Bottom not reached owing to pump jamming and bore abandoned.
2	7'3"	Trace	Trace	1971.4	1039	Nil	Trace	23.0	65.5	2'9" taken out before boring commenced. Pump and casing jammed and hole abandoned.
3	6'9"	36	25.2	3415.3	1800	Nil	0.42	30.0	81.0	Boring from surface. Water worn pebbles struck and could not break through. Presumably bottom.
4	10'2½	5.11	3.58	3110.6	1639,4	Nil	0.07	32.0	104.0	Boring from surface. Bottomed on water worn pebbles overlying slate.
6	8'6"	Trace	Trace	3986.6	2101.1	Nil	Trace	38.0	94.0	Boring started 1'10" from surface, Bottomed on water worn slate and quartzite pebbles underlain by blue clay.
7	6'8"	8.32	5.83	5318.3	2802.9	Nil	0.1	48.0	80.0	Boring commenced 1'8" down from surface. Casing put straight into cemented ilmenite. Bottomed on clay shale with small pieces of carbonaceous shale.
8	8'3"	6.65	4.66	4346.8	2466.6	Nil	0.07	37.0	110.0	1'6" of sand taken out before boring. Bottomed on water worn pebbles and clay.
9	6'7"	3.18	2.23	3386.1	1784.6	Nil	0.05	40,0	58.0	Boring started 1'6" from surface. Bottomed on waterworn pebbles of slate and quartzite.
10		2.75	1.93	2650.1	1396.7	Nil	0.05	36.0	71.0	10" taken out to allow casing to go down, Bottomed on hard boulder.
11	6'9½"	3.75	2.61	3766	1984.8	Nil	0.05	38.0	70.5	10" Excavated before boring. Bottomed on water worn slate and quartzite pebbles.

Number of bore hole	Depth of bore hole	lbs per cubic yd. Tin Oxide.	lbs per cubic yd. Metallic Tin.	Lbs. per cubic yd. Ilmenite	Lbs per cubic yd. Titanium Oxide.	Gold	Metallic Tin Assay %	Titanium Oxide Assay %	Weight of Sediment in lbs.	REMARKS.
12	11'10	Trace	Trace	1506.7	794.1	Nil	Trace	23.0	81.5	11" Did not get to bottom, finished in coarse brown sand 11" taken out before boring commenced.
13	8'0"	Nil	Nil	2357.5	1242.5	Nil	Nil	28.0	71.0	Boring started 9" from surface. Bottomed on partly consolidated clay sand of a cream colour.
14	8'6½"	Nil	Nil	1829.4	977.7	Nil	Nil	24.0	70.0	Boring started 9" from surface, Not bottomed, still in black sand. Casing and rods jamed and hole abandoned.
15	11'5"	Nil	Nil	2127.5	1121.4	Nil	Nil	26.0	98.0	Boring started 1'2" from surface. Bottomed on coarse brown quartz sand with small water worn pebbles.
16	11'1"	Nil	Nil	2585	1362.4	Nil	Nil	30.0	101.5	1'2" of sand taken out before boring. Bottomed on water worn pebbles of slate and quartzite.
17	12'2"	Nil	Nil	2654.7	1399.1	Nil	Nil	34.0	100.0	Boring commenced 1'1" from surface. Bottomed on coarse brown sand and water worn pebbles.
18	8'8½"	Trace	Trace	3209.1	1691.3	Nil	Trace	38.0	77.0	1' of material taken out before boring. Bottomed on small water worn pebbles of slate and quartzite.
19	9'3"	5.28	3.70	4020.4	2118.9	Nil	0.07	40.0	98.0	Boring started 1'2" from surface. Water worn pebbles struck, sediment seeping into casing and casing not going down so hole abandoned.
20	10'7"	4.78	3.35	3087,8	1627.4	Nil	0.07	34.0	101.0	Boring commenced 10" below surface. Bottomed on small water worn pebbles of slate and quartzite.
21	4'0"	4.61	3.23	2632.6	1387.5	Nil	0.07	30.0	37.0	Boring started 1'10" below surface. Casing dropped down into slurry, filled up and pump stuck so hole had to be abandoned.

Number of bore hole	Depth of bore hole	lbs per cubic yd Tin Oxide.	lbs per cubic yd. Metallic Tin. *	Lbs. per cubic yd. Ilmenite	lbs per cubic yd. Titanium Oxide.	Gold	Metallic Tin Assay %	Titanium Oxide assay %	Weight of Sediment in lbs.	REMARKS.
22	9'2"	5.84	4.09	4285.9	2258.8	Nil	0.07	38.0	107.0	1'10" sand taken out before boring, Bottomed on water worn pebbles.
23	7'6"	3.75	2.63	3797.3	2001.3	Nil	0.05	38.0	79.0	Boring started 1'2" from surface. Bottomed on blue clay (soft slate) Few pebbles above clay.
24	11'5"	4.07	2.85	2321.7	1223.6	Nil	0.07	30.0	93.0	Boring commenced 1'5" below surface. Went down to end of available casing and did not bottom. Slurry coming in so hole abandoned.

The average contents of the bore holes have been calculated to be as follows:-

(This does not necessarily represent the value of the deposit)

Tin Oxide	3.59 lbs. per cubic yard
Titanium Oxide	1514.8 lbs per cubic yard.

The above statement does not take into account an average of 1'4" of surface material which was not tested.

The contents of the bore holes were calculated from the weights and assay results (reported as metallic tin and titanium oxide) of the whole of the sediment taken from each bore. In converting the contents to tin oxide it was assumed that the percentage of tin in the oxide was 70%. The analysis shows that the ilmenite consists essentially of ferrous iron (31.95%) with small percentages of MnO (2.32%) and MgO (.36%) together with 39% TiO_2 therefore the theoretical content of TiO_2 (52.7%) in ilmenite was adopted in converting the titanium oxide to ilmenite. In working out the volume of sediment taken from the holes 3.176" was assumed as the diameter of the bore, this being the average between outside (3.478") and inside (2.875") diameters of the casing.

RESERVES

The reserves of ore taken over the area bored and the average depth from surface to bottom, less the ground already worked, is calculated to be 36,000 cubic yards of sand.

A very much higher figure than this may be taken to represent the potential reserves, for the deposit generally appears to continue for at least a ½ mile further in length and to extend across the terrace to the present beach, although apparently with not the same concentration of economic minerals, but no systematic tests have been applied over the whole area.

ILMENITE.

Ilmenite also known as menaccanite and titanic iron ore is a compound of titanium dioxide and oxide of iron FeO TiO_2, when pure it contains:-

Ti 31.6%; Fe 36.8%; O_2 31.6%; or TiO_2 52.63%; FeO 47.37%; but small amounts of TiO2 may be replaced by oxide of iron.

The physical properties of ilmenite are as follows:-

Specific Gravity,	4.5 to 5
Hardness	5 to 6
Melting Point	high
Lustre	Metallic to submetallic
Colour	iron black to brownish black
Transparency	opaque
Tenacity	brittle

Slightly magnetic, greatly increased by heating.

Up till recently ilmenite has been mainly used for manufacturing ferrotitanium and ferrocarbon-titanium. Ferrotitanium is used in small quantities as a scavenger in making cast iron and steel.

Lately ilmenite has been used in the manufacture of a titanium oxide pigment. Pure Titanium-oxide when finely ground produces a white opaque powder of great hiding power. Its opacity is said to be about three times that of white lead and twice that of zinc oxide. It has been found that to precipitate titanium dioxide on barium sulphate or blanc fixe in the proportion of 25% TiO_2 and 75% base, a high grade white article was formed which has better pigmenting properties than the pure oxide and was more economical to produce. It is rather a singular fact that rutile, the natural mineral of titanium oxide, is not suitable for the manufacture of titanium pigments.

Tests executed on samples of titaniferous sands from Fraser Beach terrace in April of last year by the Acting Chief Government Chemist and Assayer go to prove that rutile does not exist in that deposit. The results of the tests and the methods used are outlined as follows:-

Results

No. 1 Sample, crude sand, rutile nil.
No. 2 Sample, believed to have been through magnetic separator, rutile nil.

Methods

1. Separation by microscope followed by chemical tests.
2. Gravitation tests by immersion in cadmium borotungstate solution. Melting with mercurous nitrate and separation of various sections.

Ilmenite containing 52% - 60% TiO_2 according to grade and impurities and landed on the Atlantic seaboard of America was quoted in the Engineering and Mining Journal of 5.1.29 at 9½ to 11 dollars per gross ton. Likewise low grade domestic ilmenite embodying 32% to 35% TiO_2 was quoted at 7 to 8 dollars per gross ton.

Apparently there is no established market for ilmenite in Australia at the present time although it is understood that certain firms are investigating the possibilities for the manufacture of titanium products.

CONDLUSION.

Twenty four holes have been bored over a length of approximately 30 chains and a width of about ¾ of a chain.

Statements have been made concerning the cassiterite and ilmenite contents of the bores. It has been shown that gold results were nil in each case.

As far as the area over which the boring extended is concerned, the results show that good percentages of tin oxide appear in 14 of the bores and that an unusually high concentration occurs at bores No. 3 and No. 5 on either side of the old workings.

Ilmenite values are shown to be high in almost every case although at either ends of the area proved the content is less than the more central portion.

The economic value of the deposit is closely connected with the successful separation and concentration of the valuable minerals contents and this aspect has been dealt with by J.B.Scott State Mining Engineer in his report in 1927 entitled "Black Sand Deposit, Fraser River King Island", and also in a supplementary report in 1928.

The most important consideration next to solving the treatment problem is the establishment of a payable market for ilmenite in Australia.

ASSISTANT GOVERNMENT GEOLOGIST

HOBART,
7th March, 1929.