1945/2

Monazite in beach sand concentration

Queensland and New South Wales

by

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DEPARTMENT OF SUPPLY AND SHIPPING.

MINERAL RESOURCES SURVEY BRANCH.

MONAZITE IN BEACH SAND CONCENTRATES, QUEENSLAND AND NEW SOUTH WALES.

Report No. 1945/2.

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Locality Map. Scale 1 inch = 48 Miles.

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MINERAL RESOURCES SURVEY

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INTRODUCTION.

A reconnaissance survey indicates that monazite is the only likely source of thorium in Australia and further, that the beach sands on the eastern coast for approximately 170 miles on either side of the Queensland-New South Wales border contain by far the largest reserves of monazite. For this reason a special investigation of these sands has been conducted.

An inspection was made during September, 1944, together with Mr. H. F. Whitworth, Curator of the Mining Museum, New South Wales Geological Survey, of the beach sand deposits and of the various plants engaged in the production of concentrates from the sands. Samples were taken, where necessary, to supplement the known information about the composition of the sands and of the different mill products, mainly with a view to ascertaining the distribution and disposal of monazite in the concentrates. Determinations of composition are based upon grain counts of the samples carried out by Mr. Whitworth. It has been found in making counts that the natural process of concentration on the beaches also effectively sizes the particles and that there is little variation in grain size. Grain counts on fractions of different sizes and determinations of average grain size checked against the specific gravity of the component minerals showed that there could be very little error in determining the composition of a sample of concentrate by grain count. In many cases the composition determined in this way has been checked by chemical assay and found to agree generally within the limits of experimental error. If observation has shown that the grains of one constituent in a sample are consistently smaller or larger than the other minerals, a correction factor has been determined and applied to the grain counts.

Throughout this report the terms "concentrates," "heavy mineral concentrates," "beach sand concentrates", etc. refer, except where otherwise specified, to the total heavy mineral content of the beach sands in the deposits worked. A fairly clean separation of the quartz sand from the heavy minerals, which consist mainly of zircon, rutile and ilmenite, is effected by means of shaking tables. However, in some plants a high-gravity cut containing monazite, cassiterite, zircon and other minerals, is taken from the top edge of the table, or other cuts may be made to separate fractions of different composition, so that the term "table concentrates" is not always synonymous with the term "concentrates" as defined above.

The location of the various places referred to in this report is shown on the accompanying locality map.

PROCEDURES OF DIFFERENT OPERATORS.

COFF'S HARBOUR MINERALS, WOOLGOOLGA, N.S.W.

This syndicate, which is closely associated with Mineral Deposits Syndicate and Australian Titanium Company, operating in Queensland, worked first a deposit on the ocean beach near Woolgoolga and later one a little distance inland from the beach, but the concentrates produced from the latter deposit were not satisfactory to the overseas buyers and production had ceased some time prior to our visit.

Milling practice had been separation of the lighter quartz sand from the heavy minerals by shaking tables, with a small cut at the top of the table to separate a monazite-rich fraction. The main product was shipped abroad as a zircon-rutile -ilmenite concentrate, about 60 tons of which are still in stock at Woolgoolga. The monazite-rich fraction had been re-tabled and now consists mainly of zircon with 25 per cent. monazite. About 1½ tons of this concentrate are stored at the plant at Woolgoolga. The original proportion of monazite in the heavy mineral concentrate would probably be about 0.6 per cent.

BRITISH MINERALS COMPANY, YAMBA, N.S.W.

This company is under the same management as Southport Minerals, Southport, Queensland. It also had not been operating for some time.

A grab sample from a dump at the plant, estimated at over 200 tons of sand, contained 67 per cent zircon, 14 per cent rutile, 17 per cent ilmenite and 0.5 per cent monazite. Concentrates from a sample from a hole dug in the Yamba surfing beach, the source of the Company'y beach sands, contained 81 per cent zircon, 8.5 per cent rutile, 8.5 per cent ilmenite and 0.8 per cent monazite. Closure of the plant seems to have been partly due to the low rutile content of the sands.

ZIRCON RUTILE LIMITED, BYRON BAY, N.S.W.

Most of Zircon Rutile's production comes from the Seven-Mile beach, south of Byron Bay.

The sands as mined are passed over Wilfley tables for the removal of quartz, then carted 8 miles by lorry to the separation plant at Byron Bay. A second concentrating plant was in the course of erection on Tallow Beach, east of Byron Bay, and pending its completion, high-grade sands from this beach were being carted direct to the Byron Bay plant. Here the zircon in the concentrates is floated off, the residue being then tabled to remove any remaining quartz sand and to separate a monazite-rich fraction. The main product from the tables is a rutile-ilmenite concentrate. This is dried and passed through electromagnetic separators to remove the ilmenite which is rejected to the dump. Both the ilmenite and the rutile contain small quantities of monazite estimated by grain count at 0.2 and 0.1 per cent respectively, but most of the monazite is contained in the small high-gravity cut from the cleaner, table, from which it is separated in a small flotation plant. No monazite could be detected in the zircon concentrate. The Manager of Zircon Rutile Limited stated that their present production of monazite is about 1 ton per month, which is sold to Rare Earth Metals Company, 422 Collins Street, Melbourne. None of the separated monazite is exported and the only monazite which is shipped overseas is a very small proportion in the rutile concentrates. The company estimates that the monazite content of their heavy mineral concentrates is 0.7 to o.8 per cent. A grain count on a sample taken from Tallow Beach returned monazite 0.8 per cent, zircon 64.2 per cent, rutile 14 per cent, ilmenite 19 per cent. The composition of the concentrates from the Seven-Mile Beach is zircon 50-60 per cent, rutile 23 to 28 per cent, ilmenite 16-21 per cent. It is also estimated by the management of Zircon Rutile Limited that they could obtain a 75 per cent recovery of the total monazite in the concentrates by suitable modifications to their plant, which would involve the introduction of flotation cells for the monazite between the zircon flotation units and the cleaner tables. Maximum output would be 3-5 tons per month from 700-1000 tons of concentrates.

METAL RECOVERIES PTY. LTD., NEW BRIGHTON, N.S.W.

This company is mining mixed sands of lower grade than any of the other operating concerns - only about 20 per cent concentrates - from deposits behind the coastal dunes near the mouth

of Crabbe's Creek, 4 miles north of New Brighton.

Concentration is effected at the workings by tables, from which a heavier fraction high in zircon and containing monazite, cassiterite, etc., and a lighter fraction relatively higher in rutile are separated. These are carted 4 miles along the beach to the main plant where they are dried and passed through an electro-magnetic separator for the removal of ilmenite and other magnetically susceptible minerals. This magnetic reject, of which there is over 1000 tons stacked near the plant, contains nearly all the monazite of the original sands. A grab sample from the dump showed 2.7 per cent monazite. The more complete segregation of the monazite into the ilmenite fraction as compared with the other plants using an electro-magnetic separator is apparently due to the high magnetic intensity at which the Metal Recoveries machine is operated. This company has an electrostatic separator on order and they hope to be in a position soon to separate the zircon-rutile concentrate into its component minerals.

The high-rutile concentrate (rutile 45-50 per cent) is exported, but at present most of the zircon-rich concentrate is stockpiled, the amount at 31/12/44 being estimated by the management at 944 tons. The composition of this by grain count on a grab sample taken from the dump was zircon 91.3 per cent; rutile 8.7 per cent; monazite, minute trace, less than 0.05 per cent. A sample of the same fraction before passing through the magnetic separator returned zircon 62.1 per cent, rutile 14.4 per cent., ilmenite 23.1 per cent., monazite 0.8 per cent. A sample from the beach deposit, after removal of quartz, gave zircon 50 per cent., rutile 22 per cent., ilmenite 27 per cent., monazite 0.3 per cent. The last result is fairly close to the composition of the heavy sands of Byron Bay beaches and also of those of Cudgen and Fingal farther north, but differs materially from that indicated by the early production returns of the company, which suggested a ratio of zircon to rutile of approximately 55:45.

PORTER AND DERRICK, CUDGEN HEADLANDS, N.S.W.

Porter & Derrick (since December 31st. 1944, trading under the name of Titanium Alloy Manufacturing Co. Ltd.,) are mining a very productive beach south of Cudgen Headland, a few miles south of Tweed Heads.

Their complete concentrating and separating plant is just behind the beach, close to the deposit. Mill procedure comprises tabling to remove quartz, drying, eliminating ilmenite with a magnetic separator and splitting the resultant zircon-rutile concentrate by electrostatic separators into separate zircon and rutile concentrates, each 90 to 92 per cent.pure.

Porter & Derrick do not separate the monazite, although they have produced small quantities by re-concentrating the heaviest fraction on the tables. A sample of this material contained 89 per cent. monazite, the remaining 11 per cent. consisting mainly of zircon and rutile. Most of the monazite, (approximately 80 per cent.) goes into the zircon concentrate which is exported, and nearly all the remainder is stockpiled in the ilmenite reject. The following sample results illustrate the distribution of the various products :-

TABLE 1.

Composition of Samples from Porter and Derrick's Workings.

No.	Description of Sample	Zircon Per cent.	Rutile Per cent.	Ilmenite Per cent.	Monazite Per cent.
1.	Seam on beach	54.7	22.2	21.1	0.5
2.	Feed to Electro-	57.5	18.9	21.2	0.7

No.	Description of Sample	Zircon Per cent.	Rutile Per cent.	Ilmenite. Per cent.	Monazite. Per cent.
	magnetic separator. (Essentially the same material as Sample 1.)				
3.	Feed to electrostatic machine, after rejection of ilmenite.	66.0	29.4	2.8	0.6
4.	Ilmenite reject	-	-	-	0.8
5.	Rutile concentrate				Slight trace less than 1.0
6.	Zircon concentrate	91.9	-	-	0.9

The general composition indicated by the results of sample Nos. 1 and 2 corresponds fairly well with that shown in production records, which show a range in zircon content of 50 to 65 per cent., rutile 15 to 25 per cent., ilmenite 20 to 25 per cent.

RUTILE SANDS PTY., CURRUMBIN, QUEENSLAND.

Rutile Sands Pty. are mining a very rich beach at Tugun, just south of Tugun Headland, and carting the ore to their concentrating plant at Currumbin, 2 miles farther north, where it is tabled to remove quartz sand. The whole of the concentrate from the tables is bagged and shipped - no separation of ilmenite or of a monazite-rich fraction is made. A sample from the beach deposit returned zircon 53.3 per cent., rutile 23.0 per cent., ilmenite 21.2 per cent, monazite 0.8 per cent., and one of the bagged concentrates, zircon 48.4 per cent., rutile 26.4 per cent., ilmenite 23.5 per cent., monazite 0.7 per cent.

AUSTRALIAN TITANIUM COMPANY, TUGUN, QUEENSLAND.

This company has a small plant near Currumbin, consisting of tables only, the feed for which is drawn from the Mineral Deposits Syndicate's workings near Little Burleigh, six miles to the north. A small monazite-rich cut is made at the upper end of the tables, and is later re-tabled to effect further concentration. A sample of this re-tabled concentrate contained 18.5 per cent monazite.

MINERAL DEPOSITS SYNDICATE, SOUTHPORT, QUEENSLAND.

Several leases are held by this Syndicate between Burleigh and Southport. At the time of inspection, deposits were being worked at Little Burleigh, about 2 miles north of Burleigh Heads, and at Broad Beach just south of Surfers' Paradise, behind the coastal dune.

The sand is carted to the plant on the western bank of the Nerang River, at Southport, where it is passed over tables to eliminate quartz sand. A small monazite-rich cut is also separated on the tables. At the time of our visit part of the table concentrates was being dried on iron plates and then passed through electromagnetic separators to remove the ilmenite. Some concentrates from the tables were being exported direct. A larger drier, of sufficient capacity to handle all the concentrates, was being built and electrostatic separators were shortly to be installed to effect separation of the rutile and zircon.

Following is the composition by grain count of several samples taken:-

TABLE 11.

COMPOSITION OF SAMPLES FROM MINERAL DEPOSIT WORKINGS.

No.	Description of Sample.	Zircon Per cent.	Rutile Per cent.	Ilmenite Per cent.	Monazite Per cent.
1.	Heavy Minerals Seam at Little Burleigh.	53.3	18.5	25.5	0.9
2.	Heavy Minerals Seam at Broad Beach.	44.5	28.1	25.3	0.4
3.	General samples of table concentrates.	38.5	29.1	30.2	0.8
4.	Sample of table concentrates less monazite-rich cut.	41.4	26.7	29.6	0.8
5.	Monazite-rich cut from primary tabling.	-	-	-	14.6
6.	Retabled monazite-rich cut.	-	-	-	25.0
7.	Cleaned monazite concentrate.	-	-	-	98.0 (Est.)

The principal impurity in this last sample was cassiterite. The coincidence in the monazite content of sample No. 3 with that of No. 4, from which amonazite cut has been removed, indicates that only a small proportion of the monazite is separated at the top end of the tables. It is probable that these results are abnormal and that routine sampling would show a greater difference in the monazite content of the two products. However, it is the belief of the management that they recover in their monazite concentrate considerably less than half the total monazite in the sands. Production figures indicate that the proportion so recovered is from 15 per cent. to 30 per cent.

SOUTHPORT MINERALS, SOUTHPORT QUEENSLAND.

The plant - tables only - belonging to this Company is also situated in Southport and their sands are mined just north of Little Burleigh. A mixed concentrate is produced and a narrow high gravity monazite-rich cut is stockpiled. No samples were taken.

OTHER DEPOSITS.

Rutile Mineral Sands are reported to have produced, without permit, about 500 tons of mixed concentrates from the Tweed Heads district early in 1944, but their workings were not visited.

Some of the beaches north of Brisbane - Caloundra, Mooloolabah, Maroochydore, Coolum and Noosa were examined. Black sand deposits were found only at the north end of Coolum beach and at Noosa. The Coolum beach sand was in narrow layers of which two samples returned - zircon 15.7 per cent. and 16.7 per cent, rutile 10.2 per cent. and 11.1 per cent., ilmenite 69.8 per cent and 68.2 per cent, monazite 0.4 per cent and 0.4 per cent. At Noosa beach the heavy minerals are greatly diluted with quartz sand and a sample of the surface concentrates contained only 11 per cent. of heavy minerals, comprised as follows: Zircon 24.4 per cent., rutile 19.6 per cent., ilmenite 50.6 per cent., monazite 0.5 per cent. The ilmenite in these samples probably includes some magnetite.

Claims have recently been taken up farther north, opposite the southern end of Fraser Island, in the vicinity of Tin Can Bay

where it is reported that deposits of workable dimensions exist. Grain counts carried out by Mr. Connah of the Queensland Geological Survey on samples collected by Mr. L. C. Ball, Chief Geologist, indicate that the composition of the concentrates is similar to that of the Noosa sample, quoted above.

AVERAGE MONAZITE CONTENT OF THE CONCENTRATES.

The average of ten samples of beach sand concentrates taken from representative working beaches from Yamba to Southport was 0.64 per cent. monazite. Range in monazite content was 0.3 to 0.9 per cent. and there was no significant variation from north to south, the average in each area being practically constant. The average monazite content of the heavy mineral concentrates as a whole might be taken at a round figure as 0.6 per cent.

The following table gives the determinations of the thoria content of the monazite which are at present available. The percentage of rare earth oxides of the cerium group has also been determined for two samples.

TABLE 111.

Thoria Content of Monazite Concentrates.

Producer & Locality.	Analyst.	Monazite Content of Concentrates. Per cent.	Rare Earth Oxides Cerium Group. Per cent.	Thoria Analysis Per cent.	Thoria Content of Pure Monazite. Percent.
Coff's Harbour Synd., Woolgoolga.	Division of Industrial Chemistry. C.S & I.R.	23	-	1.43	6.3
Zircon Rutile Ltd., Byron Bay.	Do.	100	-	7.2	7.2
Do	N.S.W. Mines Dept.	85	-	5.35	6.3
Do.	Do.	-	57.75	5.4	-
Porter & Derrick Cudgen.	Do.	89	54.45	4.6	5.2
Do.	Div. Ind. Chem. C.S. & I.R.	83	-	6.1	7.4
Mineral Deposits Synd., Little Burleigh.	Do.	98	-	7.1	7.3

The average thoria content of the pure monazite according to these analyses is 6.5 per cent. with no significant variations from south to north in the different deposits. Assuming the monazite content of the beach sand concentrates averages 0.6 per cent., the thoria content of such concentrates is 0.04 per cent.

DISPOSAL OF MONAZITE.

PRESENT PRACTICE.

The following list summarizes the method of disposal of the monazite at the time of our examination.

Zircon Rutile Limited.

1. Probably more than 50 per cent. into monazite concentrate, subsequently reconcentrated as opportunity offers and sold in

Australia.
2.Most of the remainder into ilmenite reject and dumped.
3.A small proportion into rutile concentrates, part of which is sold in Australia and part shipped overseas.

Porter & Derrick.

1.Up to 80 per cent. into zircon concentrate and exported.
2.Remaining 20 per cent into ilmenite reject and dumped.

Metal Recoveries Pty. Limited.

1.Practically all into ilmenite dump.

Mineral Deposits Syndicate.

1.An unknown, but probably minor fraction into a high monazite table concentrate which is reconcentrated and stockpiled or marketed in Australia after further concentration.
2.A considerable fraction exported in mixed concentrates.
3.Most of the monazite in the concentrates put through the electro magnetic separator goes into the ilmenite reject, depending upon the intensity of the magnetic field used.
4. A minor quantity into the zircon-rutile concentrate which is exported.

Australian Titanium Company.

1.An unknown, but probably smaller fraction into a high monazite table concentrate, which is reconcentrated and stockpiled pending further concentration.
2.Probably the major portion of the monazite into the mixed concentrate which is exported.

Rutile Sands Pty. Ltd. All into mixed concentrate and exported.

Southport Minerals. Similar to Australian Titanium Company.

British Minerals Company.)
Coff's Harbour Minerals.) Not working.
Rutile Mineral Sands.)

Table IV calculated on the average monthly throughput (stoppages excluded), illustrates the present practice (September-October, 1944) with regard to the disposal of the monazite.

TABLE IV

PRESENT MONTHLY RATE OF MONAZITE PRODUCTION.

Company	Concentrates Treated	Monazite Content	Recovered	Dumped in Ilmenite Reject.	Exported as Mixed or other Concentrates.
	Tons	Tons	Tons	Tons	Tons
Zircon Rutile Ltd.	400	2.4	1.5 ø	0.5	Very small
Porter & Derrick	700	4.2	-	0.9	3.3 (in zircon concentrate.)
Metal Recoveries Pty. Ltd.	250	1.5	-	1.5	-
Mineral Deposits Syn.	700	4.2	1.0 @	0.7	2.5 x
Coff's Harbour Minerals.	Nil	-	-	-	-
British Minerals Co.	Nil	-	-	-	-
Rutile Sands Pty.	400	2.4	-	-	2.4
Aust. Titanium Co.	200	1.2	0.3 @	-	0.9

Company	Concentrates Treated.	Monazite Content.	Recovered.	Dumped in Ilmenite Reject.	Exported as Mixed or other Concentrates.
Southport Minerals	150	0.9	0.2@	-	0.7
Rutile Mineral Sands	Nil	-	-	-	-
Totals	2800	16.8	3.0	3.6	10.1

ø In monazite concentrate from cleaner tables, which is cleaned up later by flotation.

@ In high monazite cut from primary tables, containing up to 15 per cent. monazite, which is reconcentrated as opportunity offers.

x With the completion of plant improvements now being made, a higher proportion of this monazite will go into the ilmenite reject.

PREVIOUS PRACTICE.

Zircon Rutile Limited.

Since approximately the end of 1943 when electro-magnetic separators were installed, practice has been similar to the present. Prior to that, any monazite not taken out by the cleaner tables went into the rutile-ilmenite concentrate and was sold locally or overseas. During the Company's early history, monazite was produced only as required, if at all, and when not being separated on the cleaner tables presumably all went into the rutile-ilmenite product.

Porter & Derrick.

The present practice was begun only about July, 1944, when the electrostatic machines were put into operation. Until that date, from the latter half of 1942 when the electromagnetic separator was installed, the disposal of the monazite was similar, except that the exported fraction was contained in a zircon-rutile mixed concentrate instead of in a zircon concentrate. Before mid-1942 all the monazite in the sands was exported in the mixed zircon-rutile-ilmenite concentrate.

Metal Recoveries Pty. Limited.

The present practice has not varied.

Mineral Deposits Syndicate.

This company has been rejecting some ilmenite since the end of 1943. Before that, most of the monazite was exported in mixed concentrates. A monazite concentrate from the tables has apparently been produced since early 1942.

Australian Titanium Company, Coff's Harbour Minerals, Southport Minerals: The practice of these companies has been similar to that of Australian Titanium Company at present. A high monazite cut was saved from the tables, but most of the monazite went into the mixed concentrates which were exported.

Rutile Sands Pty. Ltd., British Minerals Co., Rutile Mineral Sands: All the monazite has been exported in the mixed concentrates.

TABLE V.

PRODUCTION AND EXPORTS OF CONCENTRATES.

NAME OF COMPANY AND TYPE OF CONCENTRATE	TOTAL PRODUCTION TO 30/12/44 Tons	PRODUCTION FOR 12 MNTHS ENDING 30/12/44 Tons	MONAZITE CONTENT %	TOTAL EXPORTS TO 30/12/44 Tons	MONAZITE CONTENT OF EXPORTS Tons	EXPORTS FOR 12 MNTHS ENDING 30/12/44 Tons	MONAZITE CONTENT Tons
Zircon Rutile Ltd.							
Zircon	10118	1589	Nil	8350 @	Nil	1155	Nil
Rutile	1522	1152	0.1	690	0.7	539	0.5
Zircon-Rutile	51 x	Nil	0.6 ?	-	-	Nil	-
Rutile-Ilmenite	6104	75	0.3	4081 @	12.2	90	0.3
Ilmenite	1014 @	651 @	0.2	Nil	-	Nil	-
Monazite	6.4 b	1.4	85.0	Nil	-	Nil	-
Porter & Derrick.							
Zircon	1658	1658	0.9	1658	14.9	1658	14.9
Rutile	875	875	0.1	875	0.9	875	0.9
Zircon-Rutile	10194	4315	0.6	10194 c	61.2	3993	24.0
Zircon-Rutile-Ilmenite	43917	Nil	0.6	43917 c	263.5	Nil	-
Ilmenite	3000 @	2000	0.8	Nil	-	Nil	-
Metal Recoveries Ltd.							
Zircon-Rutile	6548 d	1960	Trace	5407	-	1763	-
Zircon-Rutile-Ilmenite	396	Nil	0.6	396 c	2.4	Nil	-
Ilmenite	2125 @	705 @	2.7	Nil	-	Nil	-
Mineral Deposits Synd.							
Zircon-Rutile	1851	1686	0.1	1824	1.8	1659	1.7
Zircon-Rutile-Ilmenite	11058	4707	0.5	11058 c	55.2	4707	23.5
Ilmenite	826 @	706 @	1.2	Nil	-	Nil	-
Monazite	90 @	45 @	7-25	Nil	-	Nil	-
Coff's Harbour Minerals.							
Zircon-Rutile-Ilmenite	2066	471	0.5	2005	10.0	469	2.3
Monazite	5.5	1.5	25.0	Nil	-	Nil	-
British Minerals Co.							
Zircon-Rutile-Ilmenite	1880	160	0.6	1020	6.1	Nil	-
Rutile Sands Pty. ~~Ltd.~~							
Zircon-Rutile-Ilmenite	7837	5144	0.6	7553	45.3	4870	31.2
Australian Titanium Co.							
Zircon-Rutile	44	Nil	0.1 ?	44	-	Nil	-
Zircon-Rutile-Ilmenite	4175	1986	0.5	4175	20.9	2002	10.0
Monazite	20	10	7-18.0	Nil	-	Nil	-
Southport Minerals.							
Zircon-Rutile-Ilmenite	760	760	0.5	630	3.2	630	3.2
Rutile Mineral Sands.							
Zircon-Rutile-Ilmenite	500 @	500 @	0.6	136	0.8	136	0.8
TOTALS:							
Zircon	11845	3247	0.0 - 0.9	10018	14.9	2813	14.9
Rutile	2397	2027	0.1	1565	1.6	1414	1.4
Zircon-Rutile	18688	7961	Trace-0.6	17469	63.0	7415	25.7
Rutile-Ilmenite	6104	75	0.3	4081	12.2	90.0	0.3
Zircon-Rutile-Ilmenite	72520	13728	0.5 - 0.6	70880	407.4	12814	71.0
Ilmenite	6965	4062	0.2 - 2.7	-	-	-	-
Monazite	122	58	7 - 85	-	-	-	-

x Produced in 1934 - may be zircon-rutile-ilmenite.

@ Estimated - approximate only.

c. Assumed all production exported.

d. Includes stockpile zircon-rich concs. approx. 944 tons.

b Production of monazite from 1/1/43 to 30/6/44 only. Other production not known.

TOTAL PRODUCTION AND EXPORTS.

From the available figures, Table V has been compiled to show the production and exports of the various products and the approximate amount of monazite contained therein. Figures are given for the total quantities since the industry started in 1934 and also for the year ending December 31st. 1944, in order to illustrate the present rate of production.

From Table V, a total of 486.9 tons of monazite has been exported, all of which went to the United States of America, except 3 or 4 tons to the United Kingdom. Of the total exports to the United States, 407.4 tons were contained in mixed zircon-rutile-ilmenite concentrates and 63.0 tons in a zircon-rutile concentrate from Porter and Derrick.

PRESENT STORES OF MONAZITE-BEARING PRODUCTS.

The main potential sources of monazite at present are the ilmenite dump at the Metal Recoveries Pty. Limited plant at New Brighton, and the stockpiled monazite concentrates of Mineral Deposits Syndicate and Australian Titanium Company.

It is estimated that Metal Recoveries Pty. Ltd. has separated 2,000 tons or more of ilmenite since operations began, but it is not known whether all of this is stored near the plant. The dump is spread out over a considerable area and would be difficult to measure accurately, but was estimated to contain certainly more than 1,000 tons. A grab sample taken at many places in the dump (below the surface) showed a monazite content of 2.7 per cent., indicating that there may be up to 50 tons of monazite in this dump. It is doubtful whether there is any practicable method of separating out this monazite though it may be possible, by careful regulation of the magnetic intensity, to effect a partial separation with the electromagnetic separator. The concentrate thus obtained could possibly be carted to Byron Bay and there cleaned by flotation in the Zircon-Rutile Limited plant.

Mineral Deposits Syndicate and Australian Titanium Co., are under the same management and work in close association with each other. They reported total stocks of monazite at 30/9/44 of 90 tons, the monazite content of which is estimated at 5 - 10 tons. Most of this could probably be recovered in a fairly clean monazite concentrate by retabling and by electromagnetic and electrostatic treatment on the premises of Mineral Deposits Syndicate at Southport, Queensland.

Messrs. Porter & Derrick should have an ilmenite dump of over 2,000 tons, which is growing at the rate of approximately 140 tons a month and which has a monazite content, according to our sample, of 0.8 per cent. The ilmenite reject from the Zircon Rutile Company's plant is too low in monazite (0.2 per cent) to be worth consideration as a source of monazite.

TOTAL POSSIBLE PRODUCTION.

Table IV shows that the present monthly throughput of the plants is about 2,800 tons, with a monazite content of 16.8 tons, equivalent to, say, 200 tons of monazite per annum. However, recovery under present conditions, either as a high-grade or a low-grade monazite concentrate, is considerably less than 20 per cent. or probably only about 30 tons of monazite per annum or less. Approximately 60 per cent of total monazite in the concentrates is being exported in mixed or other concentrates. Zircon Rutile Limited is the only company whose plant could be fairly readily equipped to make a reasonable satisfactory recovery of monazite, and even if all other plants saved a monazite-rich fraction from the tables and sent it to Zircon Rutile Limited for concentration, it is doubtful, (owing to the high proportion

of monazite which cannot be separated by gravity methods from the zircon, rutile and ilmenite,) whether very much more than 20-30 per cent. of the monazite would be recovered.

From the production figures supplied by Mineral Deposits Syndicate, Australian Titanium Co. and Coff's Harbour Minerals, and assuming a constant head value of 0.6 per cent. monazite in the concentrates, it is estimated that the proportion of the total monazite that is recovered in their monazite concentrate from the tables varies from 10 per cent. up to a maximum of 30 per cent. On these figures a possible 60 tons of monazite (thoria content 3.9 tons) per annum could be collected in a monazite-rich concentrate containing up to 25 per cent. monazite, and if production were urgently required arrangements could no doubt be made for the elimination of the other minerals in this product at some central plant. If Zircon Rutile Limited were to make arrangements to obtain a more complete recovery of the monazite in their concentrates by flotation, this total might be increased by a further 10 - 15 tons per annum. On present information, the only method of obtaining a greater monazite production - up to a possible maximum of 150 tons per annum (75 per cent recovery from 200 tons) would be to arrange for the whole of the output of concentrates, of all operating companies, to be subjected to selective flotation for the removal of monazite. However, on account of the number and location of the deposits, the different methods of concentration employed, and the low monazite content of the beach sands, there does not seem to be any practicable method by which such an arrangement could be made, even under conditions of the most urgent necessity. The maximum production, therefore, that could reasonably be expected is the above figure of 60 to 75 tons per annum, or about 0.2 per cent. of the total tonnage of concentrates treated.

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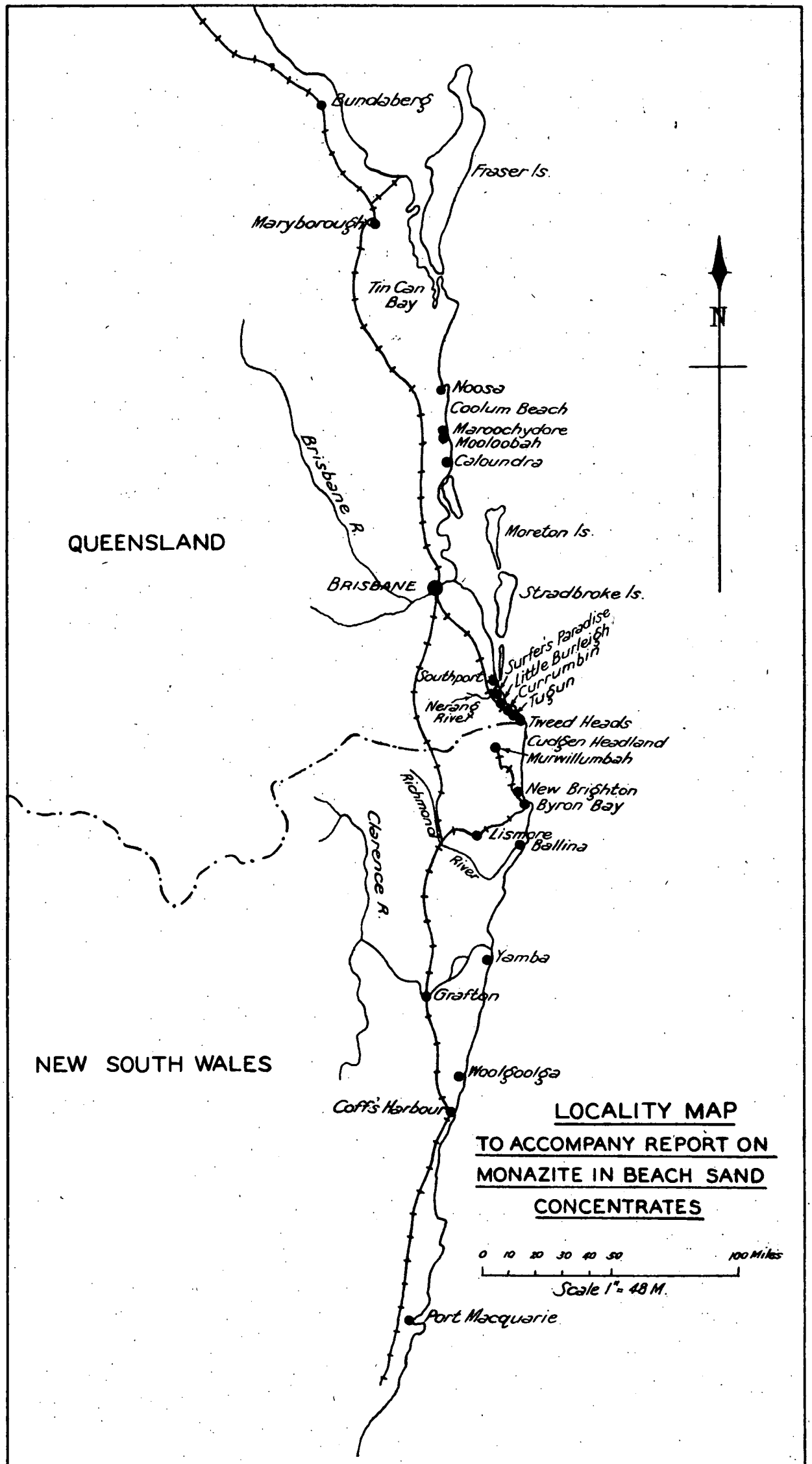
3rd. March, 1945.


Bundaberg
Fraser Is.
Maryborough
Tin Can Bay
N
Noosa
Coolum Beach
Maroochydore
Mooloobah
Caloundra
Brisbane R.
QUEENSLAND
Moreton Is.
BRISBANE
Stradbroke Is.
Surfer's Paradise
Little Burleigh
Currumbin
Tugun
Southport
Nerang River
Tweed Heads
Cudgen Headland
Murwillumbah
New Brighton
Byron Bay
Richmond River
Clarence R.
Lismore
Ballina
Yamba
Grafton
NEW SOUTH WALES
Woolgoolga
Coff's Harbour
LOCALITY MAP
TO ACCOMPANY REPORT ON
MONAZITE IN BEACH SAND
CONCENTRATES
0 10 20 30 40 50 100 Miles
Scale 1" = 48 M.
Port Macquarie
1184