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RB 530

DEPARTMENT OF MINES

SOUTH AUSTRALIA

Preliminary Report on

THE THORIUM RESOURCES

of

SOUTH AUSTRALIA

by

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URANIUM & FUEL SECTION

GEOLOGICAL SURVEY

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Plan showing Location of Occurrences Attached.

H.O. Report No. Refer 530

G.S. Report No. Refer 673

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THE THORIUM RESOURCES

of

SOUTH AUSTRALIA

1. INTRODUCTION

The following is submitted as a summary of the present knowledge of the distribution of thorium in the State of South Australia. The aim has been to assemble the information contained in the numerous departmental reports and to record the degree of investigation to which each occurrence has been subject. It is thus based almost entirely on work by a number of officers and is intended to be used as a basis for future exploration. No active field work has been done to test any conclusions that may be contained herein.

2. GENERAL NOTES

Only two possible economic deposits of thorium are known in the state and in each case the metal would be produced as an accessory. These are a beach deposit at Moana and the uranium deposit at Crocker Well. The mineral monazite has been reported from a number of other widespread localities but in only small amounts.

No specific search for thorium minerals has ever been undertaken; its discovery has always been made in the course of investigations for other minerals or as an accessory mineral in already established mines. As a result of this, the discovery of the mineral has often been treated as incidental and few observations of size and grade have been made. It is, however, safe to say that no large deposits are known.

The principal mineral which occurs is monazite.

3. NATURE OF THE DEPOSITS

Deposits are of two kinds - as primary minerals associated with acid igneous activity (pegmatites) and as secondary minerals, being mechanical concentrations by stream or wave action. Each deposit is related either directly or indirectly to areas of Pre-Cambrian rocks.

4. LOCATION OF THE DEPOSITS

The most frequent deposits of beach and creek sands occur along the coast of Fleurieu Peninsula and Kangaroo Island. Other occurrences have been reported at intervals along the whole coastline of South Australia.

Primary deposits occur at Crocker Well, Mt. Painter, Myponga - Yankalilla, near Kersbrook, in the Middleback Ranges, Kings Bluff (near Olary) and at Glenloth (south of Tarcoola).

5. THE DEPOSITS IN DETAIL

5.1. Fleurieu Peninsula & Kangaroo Island

Occurrences of primary monazite have been reported from the Archaean rocks of the Yankalilla,- Myponga area.

In the vicinity of Yankalilla, all of the Archaean outcrops were subject to close ground prospecting using a Ratac Geiger counter. In all, 18 thorium occurrences were found. Of these, 17 were associated with pegmatites and assays of grab samples showed a thoria (ThO_2) content ranging between 0.05% and 0.4%. The other occurrence was in a small quantity of mud (less than 1 ton) surrounding a spring, which assayed 5.3% ThO_2. The report on which this summary is based concludes that "the Archaean mass in the Yankalilla area could possibly yield small pockets of high grade thorium mineralisation or large tonnages of low grade thorium bearing pegmatite. The area has been covered in sufficient detail to have eliminated the possibility of there being any large surface

uranium deposits in it". This latter conclusion would also apply to thorium.

In section 60, Hd. of Myponga, a high thoria monazite (8% ThO_2) was found in a soft sheared zone in Archaean rocks. Limited outcrop and insufficient trenching at the time of the inspection precluded any evaluation of the size or quality of the prospect.

Reference. Mining Review 101. Pages 61-63 - reports by R.C. Rowley, Assistant Geologist

Other small monazite prospects have been found in the central and southern Mt. Lofty Ranges, e.g. Sections 235 and 239, Hd. Yankalilla and Section 319, Hd. Encounter Bay (D.M. 251/55).

All of the Archaean rocks in the vicinity of Adelaide have been prospected by low level air-radiation methods without significant discoveries being made.

The increasing prominence of rutile as a strategic mineral has led to attention being turned to the heavy mineral beach sand deposits of the state. Numerous samples have been received from the public but departmental activities to date have been confined to plotting and recording of these sample details and inspections of the better deposits.

Sampling of beaches has been fairly regular from Outer Harbour south to Sellicks Beach. South from this point the coastline is rocky, with only small beaches occurring in shallow bays. These beaches have been sampled as far south as Yankalilla Gorge.

The beach sands occurring along the coast contain a higher proportion of monazite, in respect to other heavy minerals, than do the deposits of the Eastern States.

Two significant deposits occur along the coast.

At Port Noarlunga in section 318, Hd. Willunga, the beach on the southern bank and just within the mouth of the Onkaparinga River shows a concentration of heavy minerals, over an area of 300 feet by 10 feet and to a depth of 4" to 6" containing 3% of rutile and 1% of monazite. Dunes on the northern bank carry sparsely situated thin bands of heavy mineral.

At Moana in sections 46-350, Hd. Willunga, a deposit occurs north and south of a creek. The sands here have a heavy fraction of about 15% and of this 5% is rutile, 7.5% zircon and 1% monazite. Small bands are reported in the adjacent dunes. The deposit has been reported on in SR 26-5-16. S.A. Rutile Limited.

Other localities where mall amounts of monazite occur are at Maslins Beach (sections 371 & 374, Hd. Willunga), near Hyponga jetty and on the beach below Yankalilla Gorge (section 219, Hd. Yankalilla).

A review of the sample data so far received and tabulated prompts the following statements.

1. Samples taken from the same locality at different times of the year show a variation of mineral content which is too large to be caused through sampling by inexperienced persons. This suggests that there is a seasonal fluctuation of heavy minerals.

2. The better concentrations occur within or adjacent to the mouth of a river or creek. Further, these areas occupy a position immediately north of abrupt easterly movements of the coastline (when travelling north).

3. Inland from the deposits, large masses of Pre-Cambrian rocks occur. Within these rocks are the known thorium bearing pegmatites of the Archaean and the basal grit, of the Adelaide System which contains heavy mineral concentrations. The rivers and creeks mentioned in 1. above drain from these rocks.

4. With regard to commercial prospects, the Moana deposit is the only one which is attractive. The main production here would be rutile and zircon with accessory amounts of monazite. The remainder are not large enough to be independent producers, but could perhaps be worked profitably from a central seperating plant.

5. Almost all of the samples received have been from beaches and there appears to have been little sampling of the dunes, which in the Eastern States are the main producers.

At Middleton Beach, opposite sections 2256 and 2257, Hd. Goolwa, samples showed a monazite content of 1.2% although this varied from time to time. Traces of the mineral occur in the garnet sands of Rosetta Head, sections 2, 3 & 294, Hd. Waitpinga.

No sampling has been done south of the Murray River Mouth but a trip is planned.

On Kangaroo Island promising samples have been obtained from the Eleanor River, near the centre of the island. A dish concentrate showed 15% of monazite as well as a high rutile and zircon content. This sample was taken downstream from Daw's Diggings, where, in 1907, monazite assaying 8.4% ThO_2 was found, with rutile, in alluvial gold diggings. A report in the Record of Mines (1908) states that a number of these Tertiary alluvial flats occur on the island and are worthy of further work. Similar Tertiary beds in the Barossa Valley carry gold and rutile but with no mention of monazite. In 1947 the Department undertook further prospecting in the vicinity of Daws Diggings but no natural concentration of heavy sand was discovered (D.M. 247/47). The monazite crystals found showed well developed crystal faces - i.e., they were not water worn and it was concluded that pegmatites in the near vicinity of the diggings were the source of the monazite. The dense prickly scrub hampered prospecting of the adjacent hills. It appears that further prospecting would be necessary (which would involve burning off the scrub) before the area is definitely abandoned as a source of monazite.

5.2. <u>Other beach sand deposits</u>

Deposits of garnet sand in sections 148 15, Hd. Bleaford, Co. Flinders, contain small quantities of monazite, rutile and zircon. Two beach deposits, ¾ mile apart and a dune deposit, inland from one of the beaches were examined and sampled. (Mining Review 92, page 164). The three deposits contain 1500 tons of sand of which

438 tons are heavy minerals - principally garnet. Of this 438 tons, there are 3.5 tons of monazite, 2 tons of rutile and 4 tons of zircon. The deposits are subject to seasonal fluctuations.

A sample submitted from Arno Bay (Hd. Boothby) contained 3.1% of monazite but no other details are known.

Traces of monazite have been found in sands from the following localities:- Whyalla Beach, Pt. Vincent, Ardrossan, Beachport, Tumby Bay and in creek sands from Radium Hill.

5.3. Crocker Well Area

During the recent intense mineralogical survey of the Crocker Well area, a number of thorium occurrences were found. However, as the survey was primarily for uranium, little quantitative work was done in connection with thorium.

A pattern of mineral zoning in the area has been observed, which is made up of four distinct zones with only minor encroachments of adjoining zones. Zone 1 contains areas of dominant thorium mineralisation and is apparently the highest temperature zone. Minerals recognised are monazite, thorite, and orthite. The zone comprises three separate sub-circular areas arranged in an arc and surrounded by zone 2 rocks. Centres of these areas are at Camel Hump (strongest), on the west flank of Mt. Victoria (which is thus east of Victoria Hut Prospect) and at Tombstone Hill. Zone 2 contains uranium - thorium mineralisation with uranium dominant. The zone occurs as a long oval area extending from Billeroo West to south-west of Crocker Well. Minerals contained in this zone are absite, samarskite, euxenite and fergusonite. Absite is the most common mineral and contains 32% UO_3, 13% ThO_2 and 35% TiO_2. A large tonnage of low (uranium) grade absite occurs in the various Crocker Well prospects. Zone 3 consists of rocks containing uranium minerals, chiefly davidite with thorium absent. Zone 4 is made up of rocks containing non radioactive minerals - mainly copper.

Ref. Observations of Mineral Zoning in the Crocker Well Area. D. King, G.S. 203, DR 11-2-70.

5.4. Mt. Painter area

Monazite is a constituent of the uranium bearing lodes of this area and also in the surrounding pegmatite intruded mica schists.

A report in Mining Review 21 states that the quantity of monazite present in the area is probably large but the only analysis made shows a thoria content of only 1.5%.

Monazite is abundantly developed in places at the No. 2 Workings, Radium Ridge, where it is associated with martite and fergusonite. Some hard specimens from these workings showed as much as 30% monazite with sub-ordinate quartz, scattered fergusonite and abundant haematite. The mineral occurs sparsely in the granitised sections of East Painter Bore No. 1.
Ref. G.S. Bulletin 30, Uranium Deposits in S.A. Page 105.

A monazite-bearing pegmatite occurs at Giants Head, 2 miles N.W. of Arkaroola Bore.

A corundum show, reported on by the Government Geologist 1911 (G.S. Reports Vol. 1) was found in an unnamed creek in 1906, 4 miles W. of Mt. Painter and 2 miles E. of Mt. Pitt. Pannings in the creek produced small amounts of monazite and rutile in addition to corundum.

5.5. Radium Hill Area

Although thorium minerals do not occur on the Radium Hill field, mention of it is made to complete the record of major uranium prospects. Here, davidite is the principle mineral and the field would thus fall into Zone 3 of King's Crocker Cell Zoning.

Prospecting for uranium has been confined to the near mine environs although the Archaean rocks extend to the N.S.W. border. However these rocks have no doubt been extensively prospected for silver-lead ores and any thorium lodes would surely have been found.

5.6. Other monazite occurrences

Middleback Range - Mining Review 101, P. 44

Three occurrences of radioactive material in Pre-Cambrian rocks east of the Iron Prince leases were identified as being due to thorium. Grab samples taken from prospects 1 & 2 showed a maximum thoria content of 0.36% while at prospect 3 the highest assay recorded was 0.98% but the average was 0.3%.

The prospects were limited in area and no further work was done.

Kings Bluff (near Olary) - Mining Review 21

Monazite occurs in association with auriferous quartz. No thoria analysis was made and the quantity of mineral was not determined.

Glenloth - Mining Review 42.

Small amounts of monazite and tin occur in a quartz ridge, 4½ miles S.S.E. of Tarcoola and close to the western shore of Lake Harris. The quartz ridge is the more acid phase of a pegmatite dyke, it averages 8' wide and has been exposed by pits over a length of ½ mile. Alluvial gold workings occur nearby.

Kersbrook - Mining Review 21

Small occurrences of monazite have been reported in creeks in the Kersbrook - Chain of Ponds area. The source of this material is presumably the basal grit which outcrops extensively here.

The area was subject to a low level air-radiation survey during the recent uranium search and no sizable occurrences of thorium minerals were reported - see plan MG/392/1 - Mt. Lofty Ranges showing Uranium & Thorium prospects.

Other reported occurrences (not confirmed) are near Paralana (on the E. side of the Flinders Range, near Mt. Painter) near Marea Dam (30 miles N.E.E. of Tarcoola) Mining Review 21.

No mention is made of workable heavy mineral deposits in the basal grits.

6. SUMMARY

The principal thorium mineral occurring in South Australia is monazite, which is found either as a primary mineral in Archaean rocks associated with acid igneous activity, or in secondary mechanical concentrations.

Except in the Far North, the Archaean rocks have been subject to a detailed search for uranium minerals. Although in most cases quantitative data have not been gathered in respect to thorium, occurrences of the element found in this search have always been small.

Only the Crocker Well deposit shows promise as a potential source of thorium. Here the metal would be produced in the chemical separation of uranium from absite.

The South Australian beach sands, although of small dimensions, offer the best prospects for the production of thorium. In these sands, monazite occurs in higher proportions than in the Eastern States.

A beach sand deposit at Moana is considered to be an economic proposition.

The real extent of the South Australian beach and creek sands is not well known and further prospecting, particularly on Southern Eyre Peninsula, Kangaroo Island, Yorke Peninsula, and south of the Murray Mouth, is warranted.

M.N. Hiern

28/3/57

APPENDIX

THORIUM OCCURRENCES IN SOUTH AUSTRALIA

LIST OF LOCALITIES & REFERENCES

Yankalilla & Myponga area - thorium bearing pegmatites

Mining Review 101, Pages 61 & 63.

D.M. 251/55

Archaean rocks in the vicinity of Adelaide

Northern, central and southern hills areas -

Files 17, 18 and 19, Uranium & Fuel

Section File

Beach sand deposits

S.A. Rutile Ltd. SR 26-5-16

Summary of beach sand samples - files in Uranium and Fuel Section - includes all beach sand samples received.

Hd. Sleaford. Mining Review 92. Page 164.

Kangaroo Island

Prospecting at Dews Diggings D.M. 247/47

Dews Diggings Mining Review 6, Page 15

Mining Review 21

Record of Mines 1908, Page 362.

Crocker Well

Observations of Mineral Zoning in the Crocker Well Area.

G.S. Report 203. SR 11-2-70. Also files 30-1 to 30-8, Uranium & Fuel Section.

Mt. Painter

Mining Review 21

G.S. Reports, Vol. 1.

Trans. Royal Soc. Vol. 68 (2) Pages 343-355

G.S. Bulletin 30. Page 105

Middleback Range

Mining Review 101, P. 44.

Kings Bluff

Mining Review 10, Page 25.

Mining Review 21.

Glenloth

Mining Review 42.

Korabrook

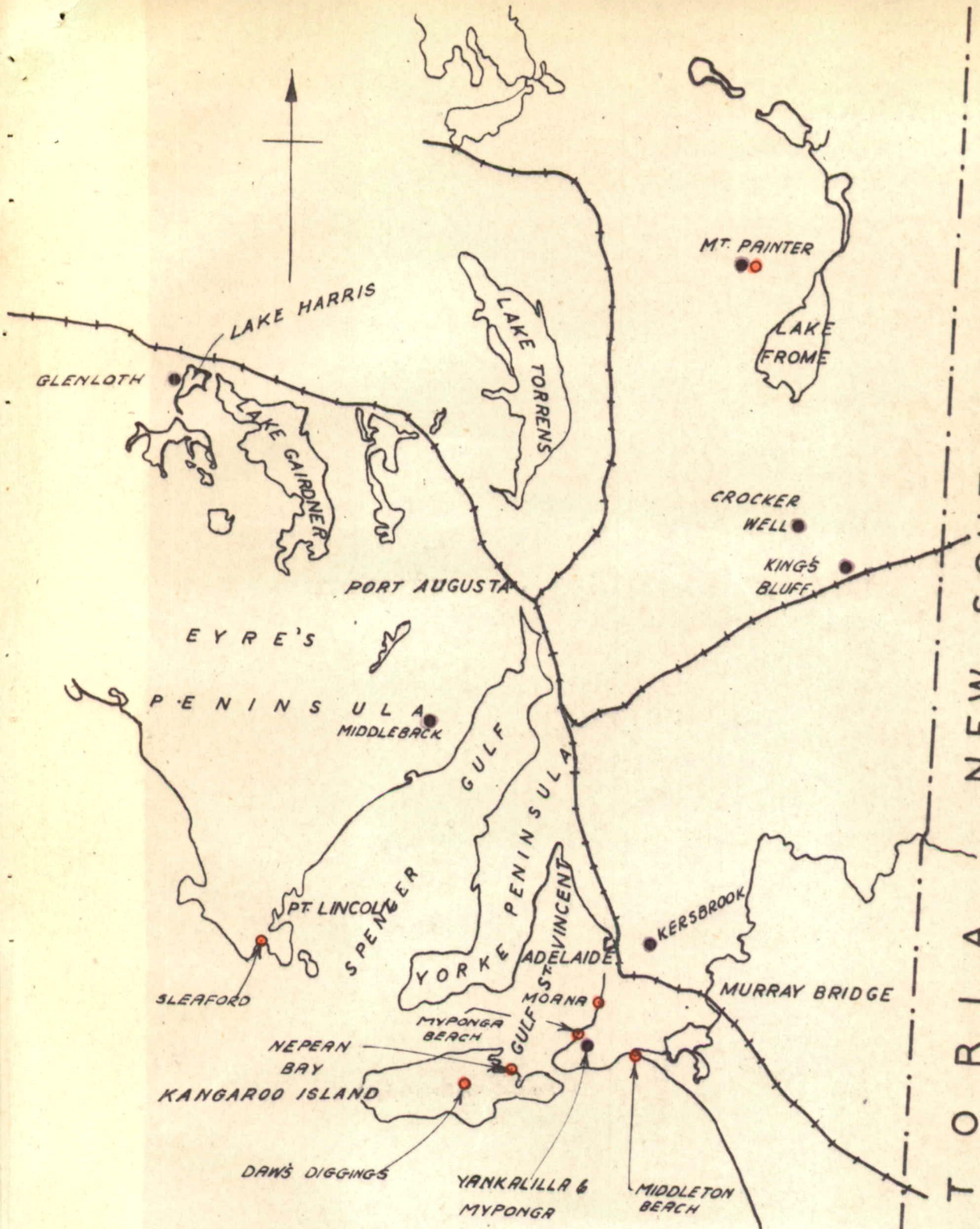
Mining Review 21

D.M. 1193/52

Uranium & Fuel Section File

Monazite in General

Record of Mines Page 362.



MAP OF SOUTH AUSTRALIA SHOWING OCCURRENCES OF THORIUM

Beach & Creek deposits ○

Primary deposits ●

S.A. DEPARTMENT OF MINES					
Approved:	Passed	Drn.	OCCURRENCES OF THORIUM SOUTH AUSTRILIA	D.M.	Scale 64 m/s. to 1"
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