DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
REGIONAL SURVEYS DIVISION

RARE EARTHS IN SOUTH AUSTRALIA

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INTRODUCTION

Rare earth minerals have been found in numerous localities in South Australia, but most deposits are small or are low in grade. There has been no production on a commercial scale. The most abundant minerals are those containing variable amounts of uranium and titanium such as davidite, and absite; in addition to monazite, xenotime and allanite.

Residues at the Port Pirie uranium treatment plant accumulated from davidite concentrates produced at the Radium Hill mine between 1954 and 1961 are a potential source of rare earth oxides, and scandium oxide.

OLARY PROVINCE (King, in Campana and King, 1958)

Many occurrences of rare earth minerals are known in the Olary district, about 400 km northeast of Adelaide, where they probably were introduced by Carpentarian granitic intrusions. The davidite lodes in the Radium Hill mine exploited for their uranium content occupy shear zones in metasedimentary rocks of the Lower Proterozoic Willyama Complex. There are similar, smaller, lodes in the Mount Victoria mine and the Spring Hill prospect which carry traces of brannerite as well as davidite; and at Mindamereeka Hill.

Absite containing about 1.43% cerium oxide, 3.71% yttrium oxide and 0.19% scandium oxide is the dominant mineral at Crocker Well, and is intergrown with davidite in the Crocker Well East district. In the Main Eastern prospect, absite apparently passed down into brannerite in depth (Hiern, 1959).

Monazite is widespread in granitic rocks and pegmatites around Mount Victoria and Crocker Well. Detrital grains occur in metasediments near Bimbowrie and Outalpa. Maniw (1970) reported monazite associated with thin veins of phospho-uranylite in micaceous andalusite schist, 10 km northeast of Kalabity. However, only low grade disseminations were intersected in two diamond drill-holes.

Pegmatites in the Olary district contain disseminations and sparse aggregates of allanite and xenotime, with rare samarskite, and traces of fergusonite, euxenite and other minerals. Disseminated allanite is present in granites and granitic gneiss in several localities.

Detrital accumulations of rare earth minerals have so far proved to be insignificant.

MOUNT PAINTER PROVINCE

(Blissett, in Coats and Blissett, 1971)

Scattered deposits have been found near Mount Painter, in the Northern Flinders Ranges, 100 km east-northeast of Leigh Creek. The rare earth minerals were introduced by Ordovician pegmatites cutting the Mount Painter Complex - a suite of Lower Proterozoic metasedimentary rocks (the Radium Creek Metamorphics) intruded by Carpentarian granites. The deposits are generally disseminated, with localised concentrations. Samarskite and monazite occur in hematite-quartz breccias on Radium Ridge and at East Painter. I. Youles (pers. comm.) has observed monazite in vertical lens-shaped bodies up to 15 m wide and 150 m long within biotite-schist near Paralana Hot Springs.

Breccias near Mount Gee, the Armchair and Streitberg Ridge carry small amounts of monazite, allanite and xenotime associated with fine-grained uranite. (I. Youles, Metallics volume - Mt. Painter uranium deposits). Allanite has been noted in pegmatites about 3 km north of Paralana Hot Springs and there are rare traces in the metasedimentary sequence. R.P. Coats (unpub. comm.) has described crystals of brannerite in pegmatite in Yudnamutana Creek, 4 km north of Mount Ward.

NORTHWEST PROVINCE (MUSGRAVE BLOCK)

Whittle (1954, p. 131) recorded abundant crystals of allanite up to 30 cm long in pegmatites near Moorilyanna in the Everard Ranges. Pegmatites near Sentinel Hill in the Musgrave Range contain euxenite.

Allanite occurs in scattered pegmatites and some granites and gneisses forming part of the Musgrave Block, from Ernabella Mission westwards through the Musgrave, Mann and Tompkinson Ranges as far as Mount Davies, near the Western Australian border (Barnes, 1971). Allanite is most abundant towards the eastern end of the Musgrave Range, though not in concentrations of major economic importance.

OTHER MINOR DEPOSITS

Traces of a mineral resembling davidite have been found in granitic gneiss of the Barossa Complex near Houghton (16 km northeast of Adelaide) (Webb and Whittle, 1954).

A band of brannerite 1.5 cm wide was intersected in a diamond drill-hole put down at a uranium prospect carrying pitchblende, uranophane, gummite and meta-autunite, 5 km southwest of Myponga, 38 km south of Adelaide, in gneiss intruded by pegmatites. (Parkin, 1955). Fragments of monazite up to 5 cm across have been observed in a shear zone in similar rocks 1 km farther east (Rowley, 1956).

There are traces of monazite in alluvium and Tertiary sands and gravels at Daws Diggings, near Parndana, 45 km southwest of Kingscote on Kangaroo Island (Brown, 1908, p. 362); and in quartz veins containing a little cassiterite genetically related to Proterozoic aplite and pegmatite, 3 km west of Glenloth Well, about 30 km southwest of Kingoonya (Winton, 1925).

PORT PIRIE RESIDUES FROM RADIUM HILL URANIUM ORE

About 200 000 tonnes of residues was accumulated at the Port Pirie uranium treatment plant after the extraction of uranium from davidite ore from Radium Hill, dump assays of which indicated a content of 0.12% yttrium oxide (Vodic and Haddow, 1967). Analyses of "barren" liquor (i.e. liquor from which uranium had been removed) made by Canning (1963) showed that, when ratios of other rare earth oxides are compared with the figure of 0.12% yttrium oxide obtained by Vodic and Haddow (op. cit.), the residues should contain 0.42% of the "light" group (lanthanum-gadolinium) and 0.23% of the "heavy" group (terbium-lutecium). The most abundant are lanthanum oxide (40% of total rare earth oxides), cerium oxide (25%) and yttrium oxide (17%).

Estimation of reserves of rare earth oxides can be made in several ways. For example, if the 200 000 tonnes of residues averages 0.65% total rare earth oxides as shown above, then there should be 1 300 tonnes present. On the other hand, a total of about 150 000 tonnes of davidite concentrates was sent to Port Pirie from the Radium Hill Mine (Parkin, 1965). The concentrates averaged 10.5% davidite (Almond, 1958). The average rare earth content of the concentrates is not known, but Whittle (1954, pp. 139, 140) showed that typical davidite in the mine carried at least 7% rare earth oxides, all of which (i.e. about 1 100 tonnes) would be concentrated in the residues.

Thus, available information indicates that the slimes may contain over 1 000 tonnes of rare earth oxides. The amount recoverable would require further investigation.

About 135 kg of the scarce compound scandium oxide was recovered from the waste liquor during the last two years of treatment of Radium Hill concentrates at Port Pirie, and the remainder has accummulated in the residue dams. Efforts to develop economic markets for this material have not yet been successful, though small quantities are sold from time to time. If the residues are treated for the recovery of rare earth oxides, recoverable scandium oxide should be extracted and stockpiled for possible future use.

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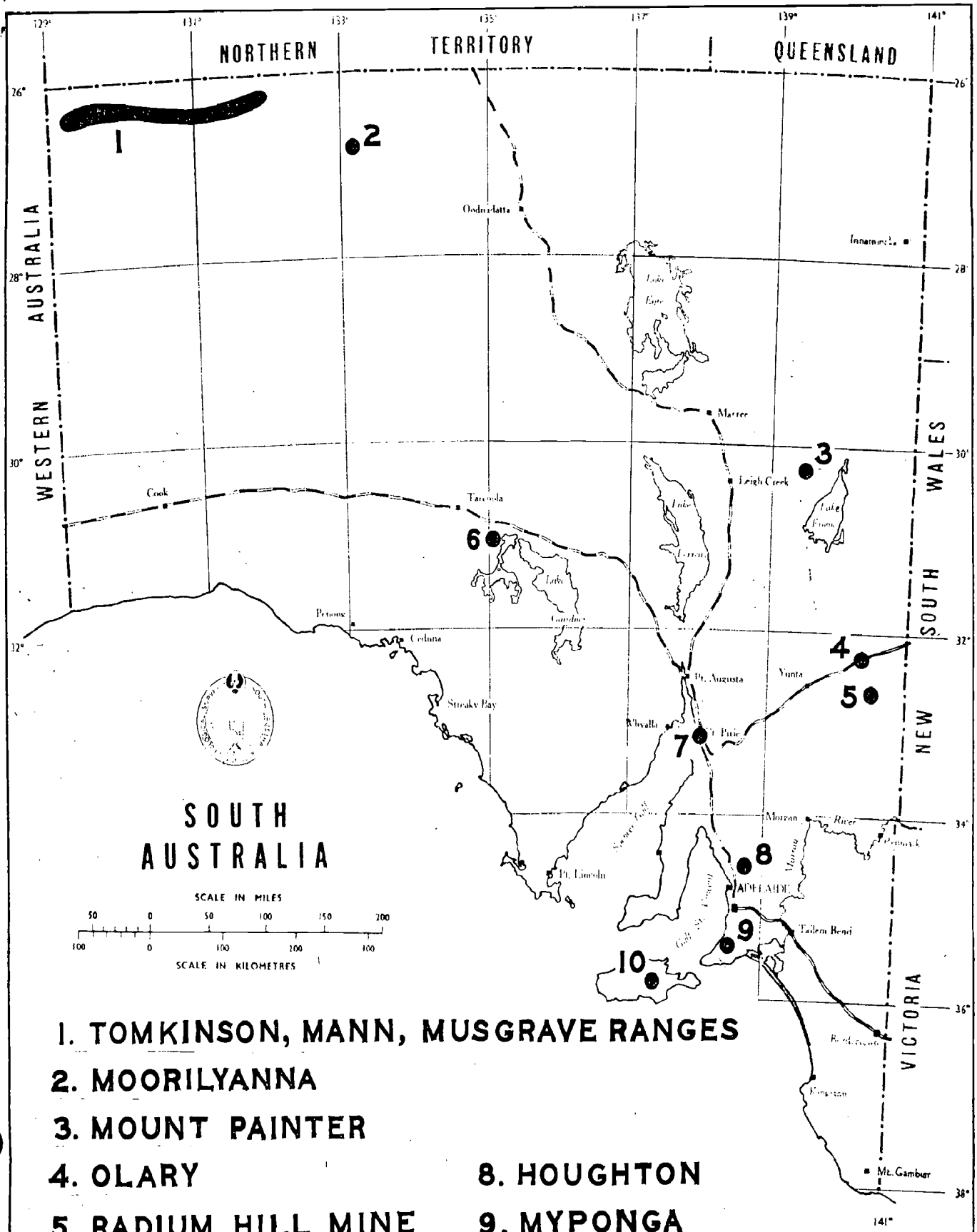

1. TOMKINSON, MANN, MUSGRAVE RANGES
2. MOORILYANNA
3. MOUNT PAINTER
4. OLARY
5. RADIUM HILL MINE
6. GLENLOTH
7. PORT PIRIE
8. HOUGHTON
9. MYPONGA
10. DAW'S DIGGINGS (PARNDANA)

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