DEPARTMENT OF MINES
SOUTH AUSTRALIA

RB 67/23

MINERAL RESOURCES

KANGAROO ISLAND CO. CARNARVON

- State Planning Office -

by

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NON METALLICS SECTION

CONTENTS

PLAN ACCOMPANYING THE REPORT

Kingscote geological map 1:250,000 series

Rept. Bk. No.67/23
G.S. No.4052
D.M.618/68

31st July, 1968

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ABSTRACT

Mineral deposits and regional geology are summarised and future prospects for mineral development are discussed. Gypsum and construction materials are the only commodities being produced at present. Metallic minerals associated with a regional fault require further evaluation. Ceramic materials and heavy mineral sands may be exploited in the future.

INTRODUCTION

As part of an assessment of the future development of Kangaroo Island, the Director of Planning, State Planning Office, requested a resume of the mineral resources.

In this report, current mining operations and potential mineral deposits are described in relation to the regional geology of the island. Mineral tenure of the land is discussed.

GEOLOGICAL SETTING

Geological mapping of the island was carried out by Sprigg (1954) and is shown on the accompanying plan.

Basement rocks are principally of Cambrian age with some possibly Precambrian.gxcept for extensive coastal outcrops they are largely obscured by a veneer of aeolian sand, laterite or calcrete. The basement formations, which are a south-westerly continuation of those underlying Fleurieu Peninsula, are disrupted by at least two zones of regional faulting. The Cygnet and Snelling faults are

expressed as a prominent escarpment trending in an east-west direction through the central part of the island. To the south, schistose argillaceous quartzite and slate, equated with the Kanmantoo Group (Cambrian) are exposed in creeks underlying a nodular lateritic crust. Massive phyllites and interbedded quartzites occurring adjacent to the escarpment were correlated by Sprigg (op cit) with the Adelaide System (Precambrian) but Thomson (1963), after further mapping, equates these rocks with the Stokes Bay Sandstone of Cambrian age.

North of the Cygnet-Snelling fault escarpment basement rocks consist of sandstone, conglomerate and limestone, also of Cambrian age but deposited in a different facies to the Kanmantoo Group sediments to the south.

The Cassini Fault lies along the coastline between Cape Cassini and Emu Bay and is correlated by Thomson (op cit) with a fault near Rapid Bay. The faults are steeply dipping upthrust structures along which there has also been some lateral displacement.

Granite rocks intrude the basement sequence at Cape Willoughby, Daw's Diggings and along the south coast between Kirkpatrick Point and Cape Mersaint. These are post Cambrian in age and may be equivalents of the lower Palaeozoic granites of the mainland with which metalliferous mineral deposits are associated.

Glacial till of Permian age, comprising clay, boulder beds and fluvioglacial sediments occur to the west of Kingscote and sand, gravel, and clay with obscure leaf impressions of presumed Permian age have been observed near Pennoshaw.

Tertiary polyzoal limestone occupies restricted outcrops at Kingscote and westerly along the southern margin of the Permian as far as Cygnet River settlement. Limestones of similar age are recorded from near Cape Willoughby.

Basalt flows of late Cainozoic age cap a group of mesas overlying Permian sediments west of Kingscote.

Pleistocene calcareous aeolianite blankets almost the entire southern portion of the island and forms prominent cliffs along the south coast. Mobile carbonate sand dunes of a type similar to those being exploited at Coffin Bay have been derived from the aeolianites.

Siliceous sand dunes, developed along the southern shore of Nepean Bay, contain a low but significant proportion of heavy minerals.

South of the Cygnet fault escarpment, in the Hundreds of Haines and McGillivray, salt and gypsum have accumulated in saline lakes and lagoons.

MINERAL TENURE AND MINING OPERATIONS

With a few exceptions around Kingscote and in Hundred of Dudley, mineral rights throughout the island are reserved to the Crown.

The Flinders Chase fauna and flora reserve, located in the extreme western end of the island, is reserved from the operation of the Mining Act.

Several leases are held over the gypsum deposit at Salt Lagoon in Sections 22, 25, 48^{A-M}, 262 Hundred of Haines (Mineral Sections 2296-2298) by Colonial Sugar Refinery Co. Ltd. Washed and crushed gypsum is transported by motor trucks for a distance of 14 miles to bulk loading facilities at Ballast Head, located near the settlement of American River.

At the time of writing a Special Mining Lease (No.168) is held over the heavy mineral sand deposits on Nepean Bay in the name of R. Grasso Pty. Ltd. The lease expires in November, 1968.

Waters surrounding the island and a portion of the island proper are included in oil exploration licences held by Shell Development Aust. Pty. Ltd. (O.E.L. 38) and Beach Petroleum N.L. (O.E.L. 24).

MINERAL DEPOSITS

METALLIC MINERALS

Basement rocks along the Cygnet-Snelling fault contain gold, copper and silver-lead minerals in lode formations. Sporadic mineralisation occurs over a distance of approximately 30 miles, extending from Western River on the north coast to the old Kohinoor Mine located 14 miles southwest of Kingscote. All mining activity took place prior to 1933 and only minor production is recorded. Reference to the individual workings is made by Brown (1908), Jones (1908), Pearson (1931) and Mansfield (1951)

The deposits have some similarity with the larger mining centres in the Callington-Kanmantoo area and the Cygnet-Snelling fault zone will most certainly be the target of mineral exploration in the next few years.

Areas surrounding the granite intrusions will also receive some scrutiny for mineral deposits in the future.

NON METALLIC MINERALS

Gypsum

At the rock gypsum deposit on Salt Lagoon, described by Willington (1958), drilling has defined a reserve of 2.5 million tons of high grade gypsum. Production commenced in 1960 at the rate of 50,000 tons per annum.

No other gypsum deposits are known on the island but the remaining lagoons occur in a similar environment and exploration of these is warranted.

Salt

Small tonnages of salt were won prior to 1920 from the surface of several lakes in Hundreds of Dudley (Pelican Lagoon) Haines, (Salt Lagoon) and Menzies (White Lagoon). These and other lagoons in Hundred of MacGillivray would provide sites for solar evaporation of salt but more suitable sites exist in the lower rainfall areas of the mainland.

Ceramic Materials

White clay is associated with felspar and quarts in a coarse grained pegmatite in Sections 78, 80 Hd. Dudley, (Mineral Sections 991-997). The clay was used prior to 1926 for the manufacture of china and firebricks in a plant located at Hog Bay (Jack 1926). The operation was abandoned after only a few years work.

The dimensions of the pegmatite are obscured by soil but the old workings indicate a minimum length of over 1000ft. and width of at least 100ft. Some coarse grained felspar, capable of hand selection, is reported to occur but in other portions of the dyke the felspar is intimately associated with quarts.

Fireclay is reported to have been worked to a depth of 16 feet and lies under 7 feet of overburden. An analysis (Gaskin and Samson 1951) showed less than 1% fluxes indicating the clay to be moderately refractory.

The deposit is not exploited at present.

Limestone (Johns 1963)

The Cambrian limestones of Fleurieu Peninsula extend onto Kangaroo Island in the Penneshaw area but the beds are thin and of low grade and of no economic importance. Limestone occurring south-west of Penneshaw is dolomitic.

Massive Cambrian limestone outcrops at White Point north of Kingscote. No analyses are available and it is not known whether these beds are economically significant.

Tertiary limestone, similar to the deposits at Cape Willoughby and in the Kingscote-Cygnet River area, is exploited elsewhere in the State for building stone and cement manufacture. The deposits on the Island, although not examined in detail, are unlikely to be suitable for any purpose except local building stone.

Calcareous aeolianite and associated carbonate sands of the south-coast offer a huge potential source of lime for industrial use. A sample of aeolianite from Vivonne Bay showed 82.5% $CaCo_3$ 4.6% $MgCO_3$ 1.3% SiO_2 and 0.3% Fe_2O_3.

Limestone and basalt occurring near The Bluff on the southern shore of the Bay of Shoals were once considered as raw materials of a cement industry to be set up at The Bluff (Jack 1926). However these proposals lapsed.

In summary, although large deposits of limestone occur on the island, it is unlikely that these will be exploited in preference to higher grade deposits on the mainland except as a local source of building stone.

Heavy Minerals

Detailed investigation by private companies and the Department of Mines has shown that rutile (52,000 tons) and zircon (91,000 tons) to the value of $4 million occur in the siliceous dunes on the shore of Nepean Bay (Johns 1966). The deposit is of low grade and insignificant compared with the producing areas of eastern Australia, the average grade of heavy minerals being only 0.31%.

However, other deposits of similar grade occur along the coast of Fleurieu Peninsula which might be worked collectively with the sands at Nepean Bay.

It is possible that these deposits will receive more attention in the future.

Gemstones

Carnelian, tourmaline, felspar and garnet of reported gem quality are recorded from the pegmatite in Sections 78 and 80 Hd. Dudley, previously described under ceramic materials. The deposit should provide a continuing source of specimens for amature mineralogists.

Amethyst, sapphire, kyanite, tourmaline, ruby, zircon and topaz have been found at Daw's Diggings in Section

29 Hd. Seddon, in alluvial gold workings located along the flats of the Eleanor River. Monazite is also recorded. However, the gemstones are reported to be all of microsopic dimensions. It is possible that larger specimens may be found upstream closer to the source rocks.

PETROLEUM

For many years small amounts of asphaltic material have been observed along the shoreline of the southern continents, including Kangaroo Island. (Hiern 1959).
Some drilling was undertaken in Sections 330 Hd. Dudley in the belief that the asphaltum had originated from a local seepage.

The asphaltic material is always found between high and low water marks and it is generally accepted that it has been derived from a distant southern source and brought in by the sea.

CONSTRUCTION MATERIALS

Calcrete and nodular laterite occur extensively as a capping over the basement rocks and are used for road construction. Material is won from shallow pits adjacent to construction sites.

Concrete aggregate and bitumen screenings are supplied from the basalt flows west of Kingscote. Intense jointing assists in quarrying but the joint spacing is such that only material of ¾ inch size and less can be produced in quantity.

High quality concrete aggregate in sizes ranging up to 3-in. was provided for the Middle River dam from a quartzite bed located adjacent to the dam site. (Stapledon and Robson 1965 (a).

Sand for concrete fine aggregate is won from a pit known as MacGillivray's, located in Section 82 Hd. MacGillivray. Three samples were tested during investigations for the Middle River dam and the grading of each fell outside of the specification (A77) for concrete fine aggregate. (Stapledon and Robson 1965 (b)). In two samples a slight excess of +3/8" material

was present while the third contained a slight excess of the 100 mesh fraction. Despite this the sand is regarded as suitable for high quality concrete.

SUMMARY AND CONCLUSIONS

Basement rocks consist of Cambrian metamorphic and sedimentary rocks which are a continuation of formations underlying Fleurieu Peninsula. These are mantled by younger rocks ranging from Permian to Recent in age.

Metallic minerals are associated with a major regional fault and although past production is small, intense mineral exploration along the zone can be anticipated in the near future.

Gypsum is the most important of the nonmetallic minerals, a deposit of 2.5 million tons of high grade gypsum occurring at Salt Lake, Hd. Haines.

Ceramic materials have been previously worked near Hog Bay. The deposit is poorly defined but has some prospects for further development.

Large reserves of limestone exist on the island but it is unlikely that these will be exploited in preference to the abundant high grade deposits on the mainland.

A locally significant deposit of heavy minerals occurs on the shore of Nepean Bay which might be developed in the future.

Construction materials for local use are available on the island.

31.7.68
MNH:JMM:OB

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SENIOR GEOLOGIST

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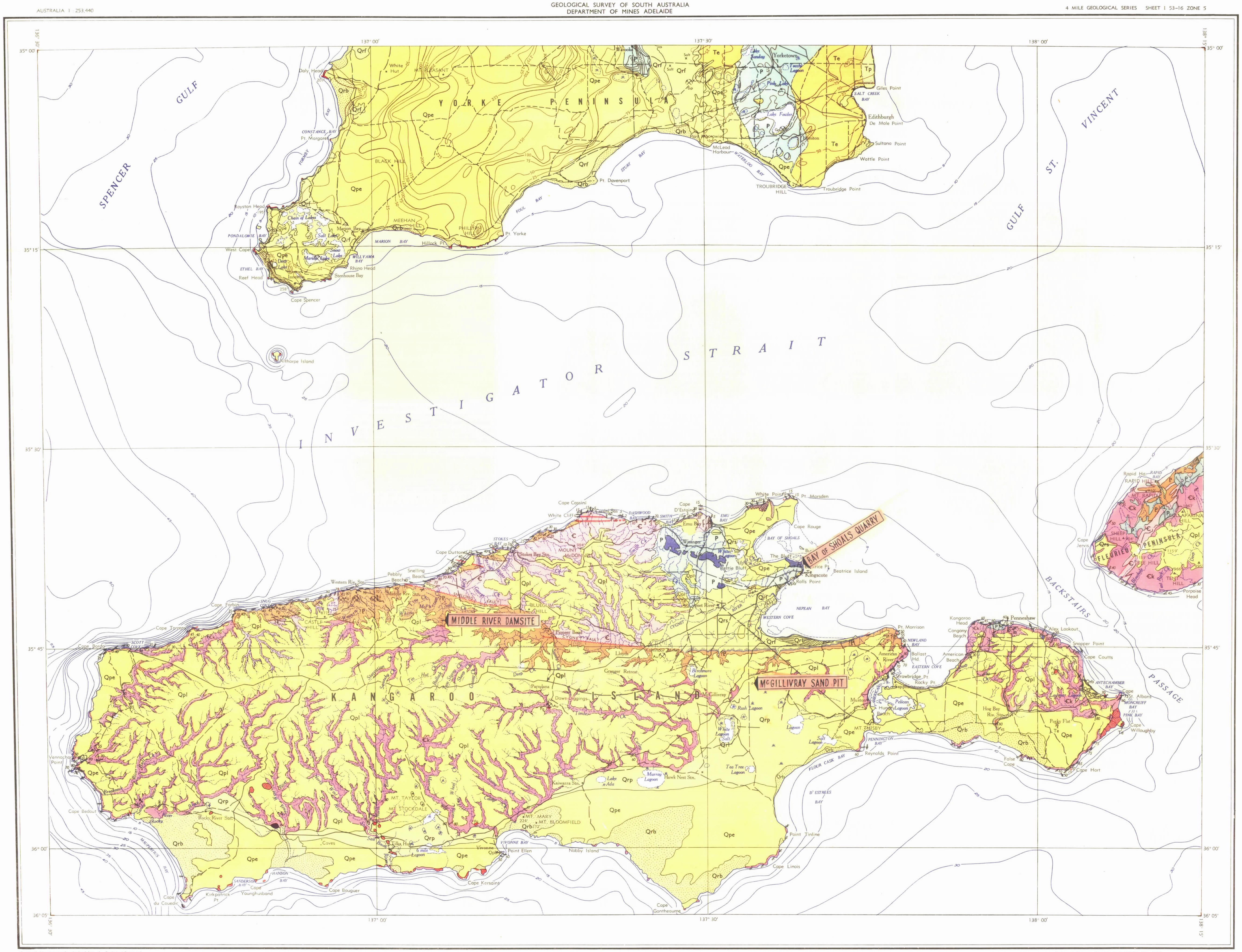
KINGSCOTE

GEOLOGICAL SURVEY OF SOUTH AUSTRALIA
DEPARTMENT OF MINES ADELAIDE

AUSTRALIA 1: 253,440

4 MILE GEOLOGICAL SERIES SHEET I 53-16 ZONE 5

FIRST EDITION 1954



REFERENCE

CAINOZOIC ERA

QUATERNARY — RECENT

- **Qrs** — Creek alluvium, flood plain deposits, escarpment outwash, red and mottled clays
- **Qrb** — Modern beach sands, beach-ridged in low lying sheltered coastal areas
- **Qrp** — Siliceous sands: Redistributed in part from the "A" horizon of the aeolianite dune system and from the laterite profile
- **Qrl** — Swamp and lagoon deposits, *Limnea*, and *Coxiella* clays, saline deposits and siliceous sand. Seed and flour gypsum dunes of southern Yorke Peninsula
- **Qra** — Stranded beach-ridged dunes of the Mid-recent period (Antechamber Bay, Kangaroo Island)
- **Qrf** — Marshy saline flats of the Mid-recent high sea level. Marginal low marine shell banks deeply travertinised

QUATERNARY — PLEISTOCENE

- **Qpl** — Pisolitic and massive laterite with siliceous top soil: particularly well developed on plateau surfaces, also on consolidated aeolianite dune surfaces
- **Qpe** — Consolidated dune limestone (Aeolianite) of the coastal areas; numerous internal unconformities and fossil soil horizons: siliceous white sands and lesser sheet (soil) travertines extend inland
- **Qpb** — Reef shell beds (*Turbo etc.*) at base of aeolianite system (Vivonne Bay; Stokes Bay) and fossiliferous cobble conglomerate of Kingscote

TERTIARY

- LATE — **Tp** — Massed oyster beds (*Ostrea*) with overlying mottled clays and sands at Point Giles, Yorke Peninsula
- EARLY — **Te** — Polyzoal Limestone: Rich in "*Echinoids and Brachiopods*" at Kingscote Cape Willoughby and Edithburgh: Fossil limestone in sink hole at Porky Flat

PALAEOZOIC ERA

- PERMIAN — **P** — Glacial Till: Boulder beds, chiefly clays with numerous granite, gneiss, and quartzite erratics, frequently several feet in length. Also glaciofluvial deposits: sands, gravels, clays and porcellanized clays with obscure leaf remains at Kingscote and 3 miles E.S.E. Penneshaw
- CAMBRIAN TO ORDOVICIAN — **Ꞓk** — Konmantoo Group: Quartzites, argillaceous schistose quartzites and schistose slates: Coarse glaciofluvial conglomerate bands at Penneshaw; ubiquitous slump bedding of Kangaroo Island.
- CAMBRIAN — **Ꞓ** —
  - Pt. Marsden Conglomerate: Massive sandstones coarsely crossed, bedded, and with numerous conglomerate bands containing pebbles and boulders of limestone, schist and red granite
  - White Point Limestone: Massive limestone with plentiful boulders containing "*Archaeocyathinae*", and a few gneiss, schist, and red granite boulders at White Point and Point Marsden.
  - Grey and purple shales with Trilobites (*Redlichia Lusatiops*), Brachiopods (*Acrothele*) and Pteropods (*Hyolithes*) at Emu Bay.
  - Stokes Bay Sandstone: Principally massive coarsely current and slump-bedded red and white sandstones and quartzites. Marbles and calcareous slates on Fleurieu Peninsula

PROTEROZOIC ERA — ADELAIDE SYSTEM

- **P** — Principally massive phyllites; interbedded quartzites near top.

ARCHAEOZOIC ERA

- **A** — Mica schists of Fleurieu Peninsula, locally injected and migmatized with subordinate kyanite sillimanite schists, injection gneisses, pegmatites and ilmenitic quartz veins.

IGNEOUS ROCKS

- Flow basalts of Kingscote and Penneshaw: columnar in part and with steam vesicles (Late Cainozoic)
- Basic and intermediate dyke rocks (Lower Palaeozoic)
- Pg. — Pegmatite with or without tourmaline; mica and beryl; Kaolinized gem pegmatites of "Daws Diggings" and Penneshaw (Lower Palaeozoic)
- Granite, pegmatitic granite, adamellite and granodiorite of lower Palaeozoic: South coast Kangaroo Island
- Granites, gneissic granites and granite gneisses, with intrusive basic dykes of Southern Yorke Peninsula (Archaeozoic)

GEOLOGICAL BOUNDARIES
- OBSERVED
- APPROXIMATE
- INFERRED

BLOCK FAULT
- OBSERVED
- APPROXIMATE

MEDIUM ANGLED REVERSE FAULT
SYNCLINE
ANTICLINE

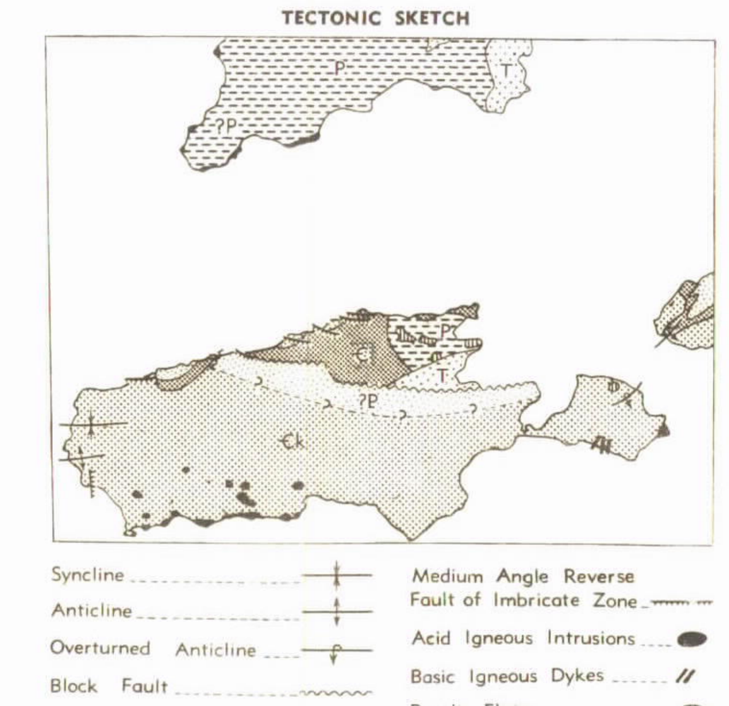
BEDDING
- STRIKE AND DIP — 65
- HORIZONTAL
- VERTICAL
- OVERTURNED — 70

"FACE UP" IN SEDIMENTARY STRATA
STRUCTURE LINES IN BEDROCK
Isolated Glacial Erratics (Permian)

MAIN ROAD
SECONDARY ROAD
TRACK
TRIANGULATION STATION
MINE
RIVER OR CREEK
SWAMP
SUBMARINE FORM LINES — 5, 10
FORM LINES — 100, 50

FOSSIL LOCALITY
GOLD — Au
SILVER — Ag
LEAD — Pb
GYPSUM — Gp
GEMSTONE — G

TECTONIC SKETCH

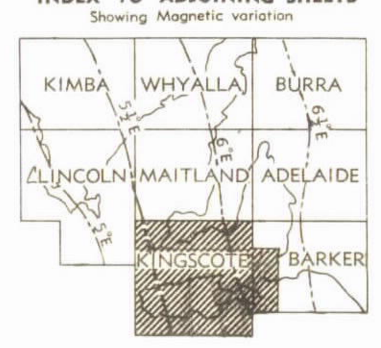


Syncline
Anticline
Overturned Anticline
Block Fault
Medium Angle Reverse Fault of Imbricate Zone
Acid Igneous Intrusions
Basic Igneous Dykes
Basalt Flows

KINGSCOTE
SHEET I 53/16

Copies of this map may be obtained from the Geological Survey of South Australia Dept. Mines Adelaide or Bureau of Mineral Resources Geology and Geophysics Canberra A.C.T.
Printed by the Govt. Photolithographer S.A. for the Geological Survey of South Australia as a contribution to the 4 Mile Geological Map Series of the Commonwealth

INDEX TO ADJOINING SHEETS
Showing Magnetic variation



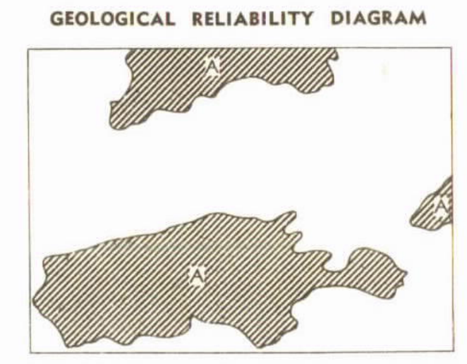
SCALE
4 MILES TO 1 INCH

MILES 2 1 0 2 4 6 8 10 12 14 16 MILES

KILOMETRES 5 0 5 10 15 20 KILOMETRES

Middle River Damsite - Locality Plan.

GEOLOGICAL RELIABILITY DIAGRAM



A Detail geological mapping

Geology of Kangaroo Island by **R. C. SPRIGG** M.Sc. 1953.
Geology of Fleurieu Peninsula by **B. CAMPANA** D.Sc. 1953.
Geology of Yorke Peninsula by **D. KING** M.Sc. 1953.
R. C. SPRIGG Geologist in charge of Regional Map Preparation
Base map compiled from Photogrammetric Section (Dept Lands) plans of Kangaroo Island.
Cartography by Geological Drafting Section Dept of Mines S.A.
Compiled under the direction of S. B. Dickinson M.Sc. Government Geologist
Issued under the Authority of the Honourable A. Lyell McEwin M.L.C. Minister of Mines
Published 1954

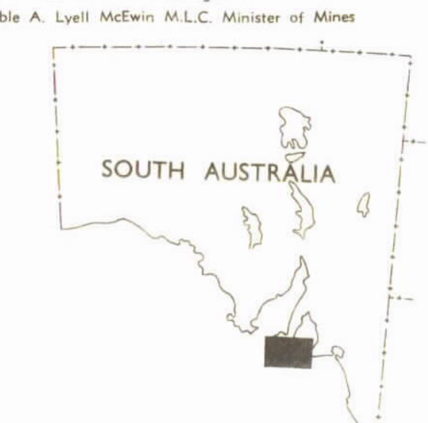


Fig 1

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