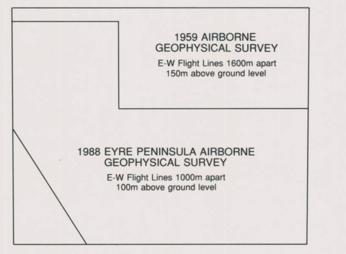
STREAKY BAY

GEOLOGICAL SURVEY OF SOUTH AUSTRALIA
DEPARTMENT OF MINES AND ENERGY ADELAIDE

GEOPHYSICAL DATA

The magnetic pixel maps below combine the data from two airborne magnetic surveys of the STREAKY BAY sheet, and include the 1988 Eyre Peninsula Airborne Geophysical Survey and the 1959 Airborne Geophysical Survey by the South Australian Department of Mines and Energy and the Bureau of Mineral Resources. The data from the older survey were originally collected in analogue form and were recently converted to digital form by the Bureau of Mineral Resources. The data were joined and levelled by Pitt Research Pty Ltd to present a coherent picture for the whole area. A 250 metre grid cell size has been used to present the data in Pixel Map form.

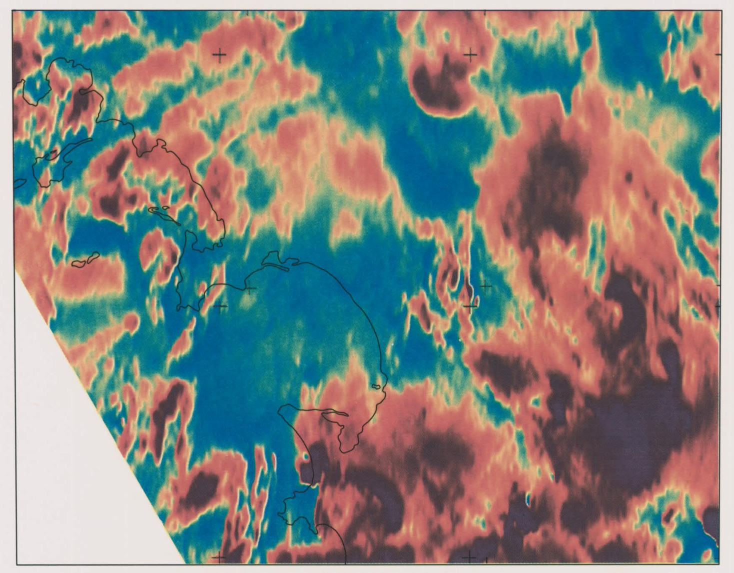


Geophysical data compiled by D.H. Tucker, Ph.D.
Data processing by Pitt Research Pty Ltd

Scale 1 : 1 000 000

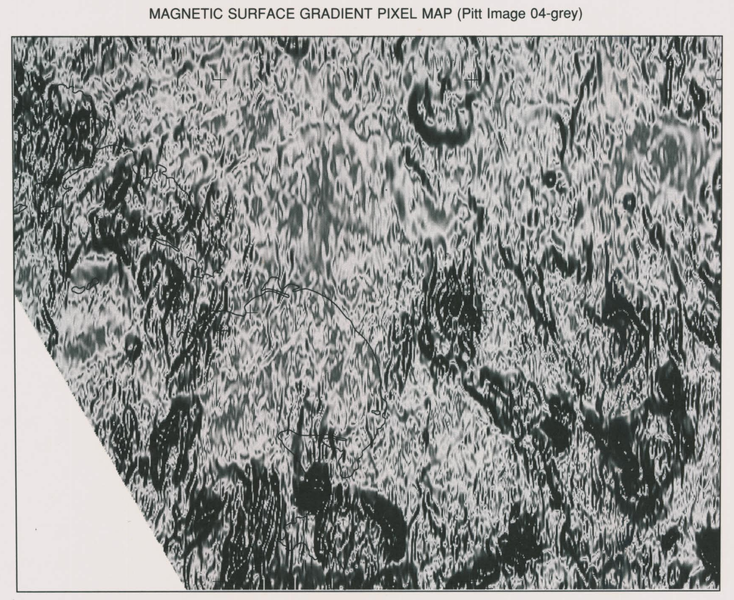
Transverse Mercator Projection

RESIDUALS OF TOTAL MAGNETIC INTENSITY PIXEL MAP (Pitt Image 01-colour)



The Residuals of Total Magnetic Intensity Pixel Map assigns a rainbow range of colour to the amplitude of the data, such that the lowest values are blue and the highest values are red. The colours are linearly applied to the full amplitude range of 3000nT depicted on the sheet.

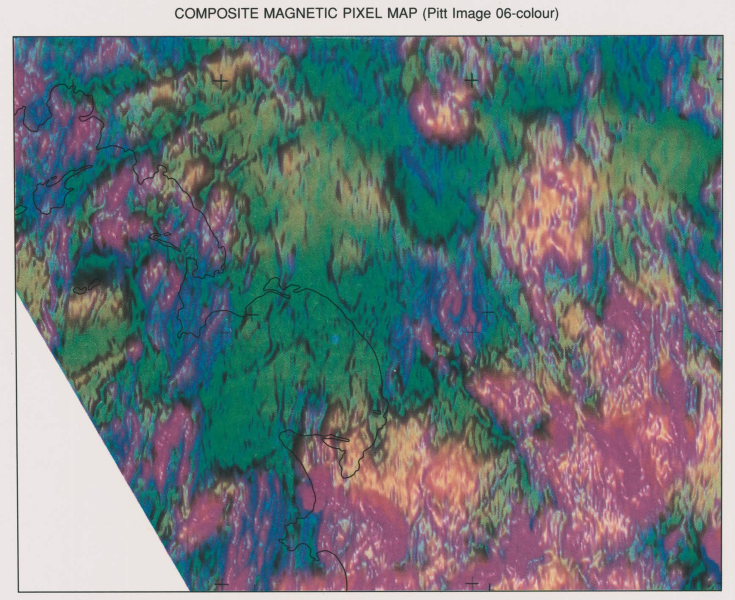
MAGNETIC SURFACE GRADIENT PIXEL MAP (Pitt Image 04-grey)



The gradient technique is particularly useful for highlighting short wavelength anomalies caused by small near-surface magnetic susceptibility changes which have caused sudden changes in the surface "slope" of the data under study.

The Magnetic Surface Gradient Pixel Map depicts the steepest descent slope at any point, in any direction, of the surface representing the Residuals of Total Magnetic Intensity. High gradient is represented by dark areas and low gradient by light areas.

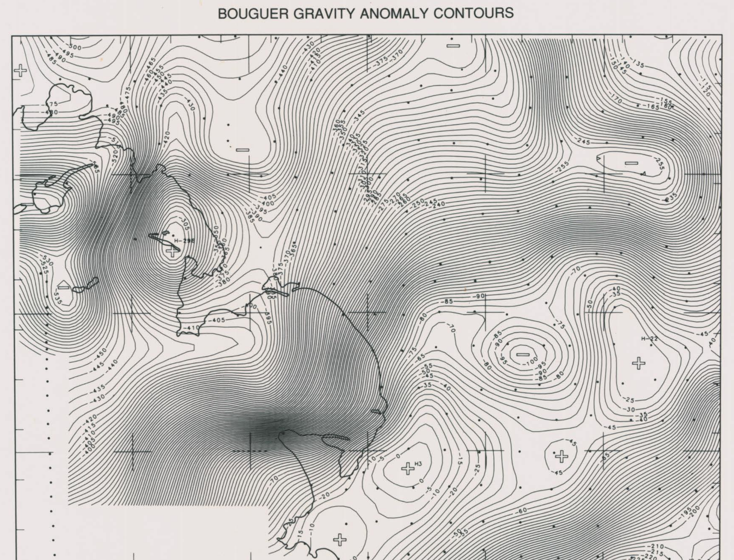
COMPOSITE MAGNETIC PIXEL MAP (Pitt Image 06-colour)



The Composite Magnetic Pixel Map combines the results from three presentations of the magnetic data by assigning a variable to each of the three colour guns available in image processing as follows:
1. Residuals of Total Magnetic Intensity in the red colour gun.
2. Magnetic Surface Gradient in the green gun, and
3. Magnetic Variation in the blue gun.

The first two of these presentations are described above. The Magnetic Variation, used in the blue colour gun, is a mathematical treatment which selectively enhances short wavelength anomalies and steps in the data, known as the amplitudes and enhances the high amplitudes.

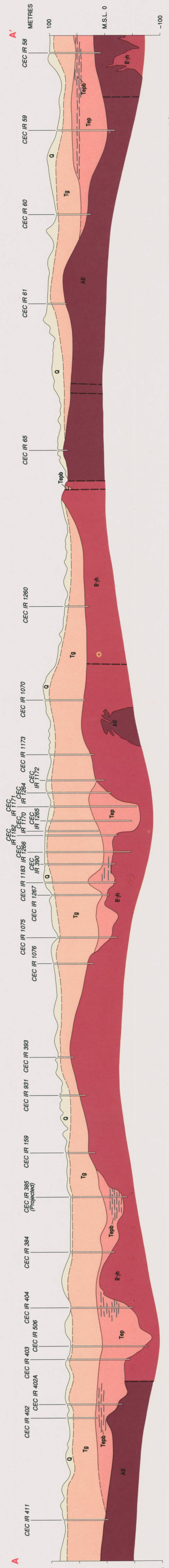
BOUGUER GRAVITY ANOMALY CONTOURS



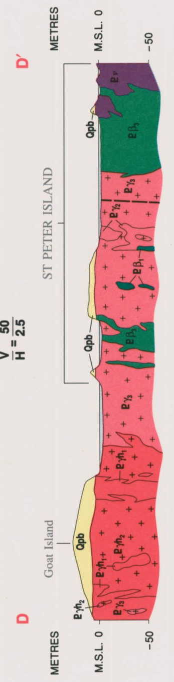
Bouguer gravity anomaly reduction density: 2.67 T/m^3
Station spacing: 7 kilometres onshore, 2.7 kilometres offshore.
Contour interval: 5 micrometres/second squared (0.5 milligal).

Bibliographic Reference: Rankin L.R. and Flint R.B., 1991. STREAKY BAY map sheet. *South Australia. Geological Survey. Geological Atlas 1: 250 000 Series,* sheet SI/53-2.

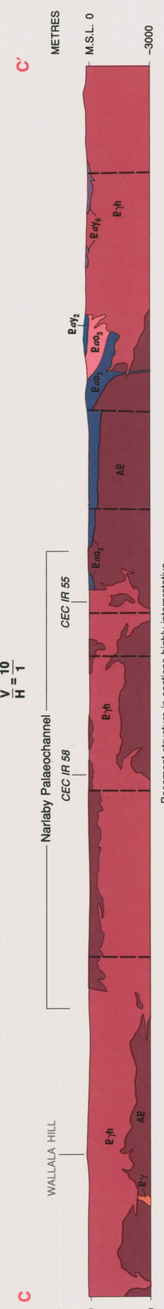
SECTION ENLARGEMENT A - A'



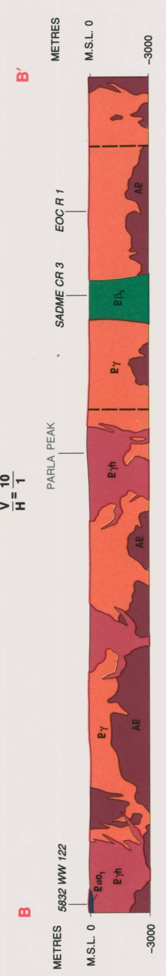
SECTION ENLARGEMENT D - D'



SECTION C - C'

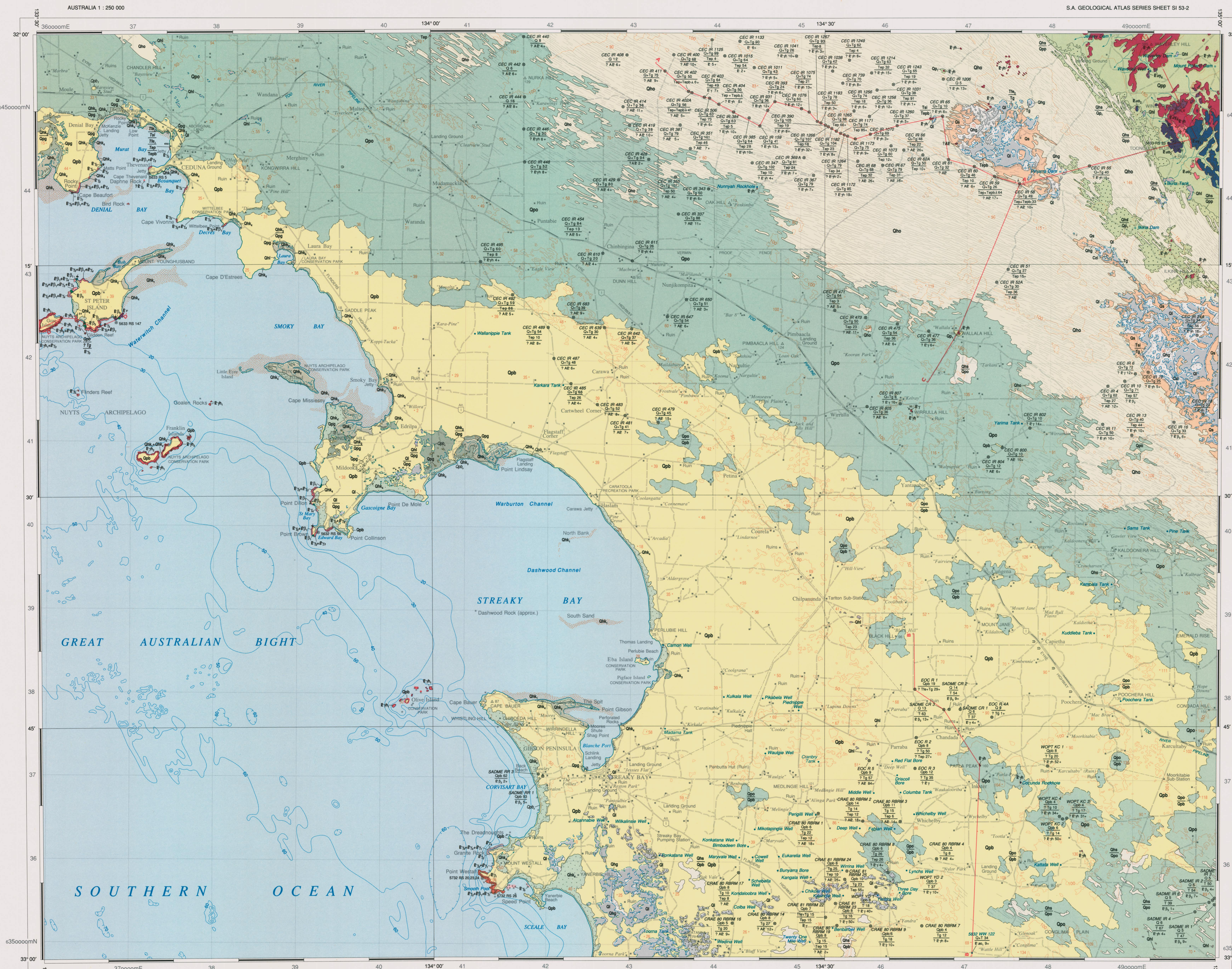


SECTION B - B'



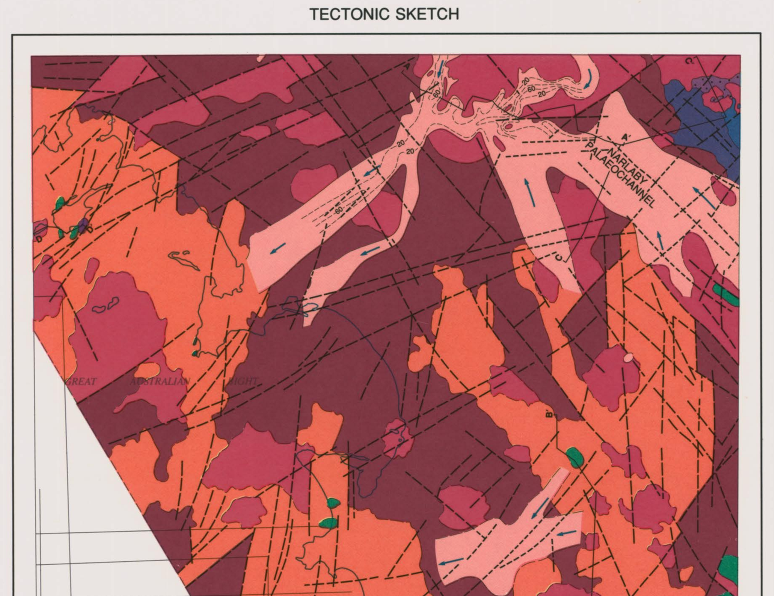
AUSTRALIA 1 : 250 000

S.A. GEOLOGICAL ATLAS SERIES SHEET SI 53-2



FIRST EDITION 1991

TECTONIC SKETCH



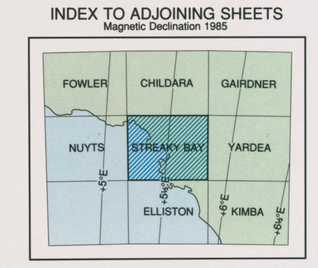
SCALE 1 : 1 000 000

INDEX TO 1 : 100 000 SHEETS

THEVENARD 5633	CARAWA 5733	WIRRULLA 5833
COLLINSON 5632	STREAKY BAY 5732	CUNGENA 5832

INDEX TO ADJOINING SHEETS

Magnetic Declination 1985



Annual Variation +2'

Geological mapping and compilation by L.R. Rankin, B.Sc.(Hons), and R.B. Flint, B.Sc.(Hons), with contributions by A.H. Blissett, M.Sc., S.J. Daly, B.Sc., N. Watkins, B.Sc., and A.J. Parker, Ph.D., Dip.Comp.Sci.

A.J. Parker, Ph.D., Dip.Comp.Sci., Chief Geologist, Regional Geology Branch.

Geochronology is from Webb *et al.* (1982, 1986), Fanning *et al.* (1988), Cooper *et al.* (1985) and Creaser (1989).

Base map produced by the Division of National Mapping using material supplied by the State mapping authority.

Cartography by the Drafting Branch, Department of Mines and Energy.

Compiled under the direction of R.K. Johns, M.Sc., Director-General, Department of Mines and Energy.

Issued under the authority of the Honourable J.H. Klunder, M.P., Minister of Mines and Energy.

Published 1991

SCALE
1:250 000

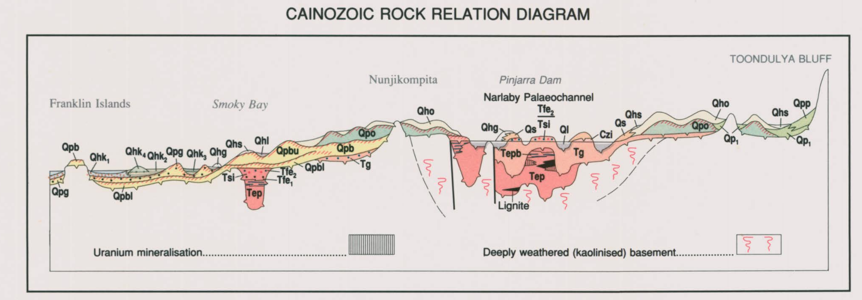
KILOMETRES 5 0 5 10 15 20 25 KILOMETRES

PRINTED IN AUSTRALIA
A.B. CAUDELL, DIRECTOR AND GOVERNMENT PRINTER
SOUTH AUSTRALIA

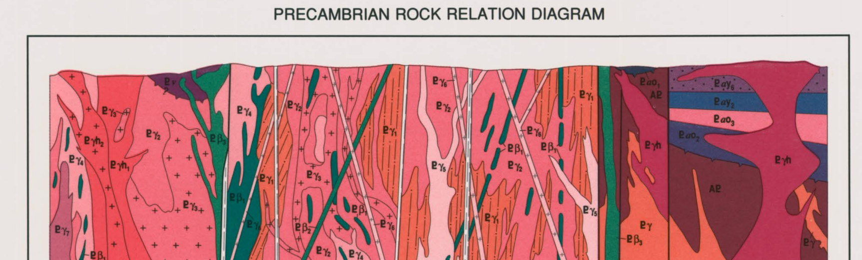
Grey numbered lines indicate the 10 000 metre Australian Map Grid

Transverse Mercator Projection. Australian Geodetic Datum, 1966.

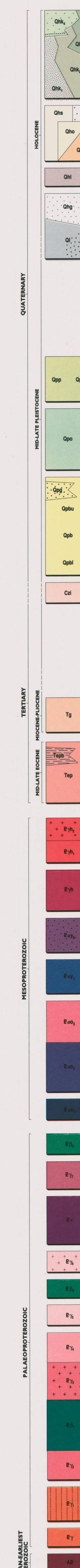
CAINOZOIC ROCK RELATION DIAGRAM



PRECAMBRIAN ROCK RELATION DIAGRAM



REFERENCE



QUATERNARY — HOLOCENE

ST KILDA FORMATION: Holocene coastal sediments.

Qhs$_1$ - SEMAPHORE SAND: Foredune and dune sand, showing trend of foredunes. White to cream quartz and shelly sand. Locally includes calcareous sand reworked from BRIDGEWATER FORMATION.

Qhs$_2$ - Supratidal to extratidal flats (rarely inundated): Carbonate and gypsum mud, clay, silt and sand.

Qhs$_3$ - Intertidal mangrove woodland (regularly inundated) and supratidal samphire-algal marsh (occasionally inundated): Organic and carbonate mud plus shelly sand and mud.

Qhs$_4$ - Shallow subtidal to intertidal sand flats, consisting of quartz and skeletal carbonate sand.

Qhs - Unvegetated mobile aeolian quartz sand dunes and sand spreads. Where thin, shown as overprint on underlying unit.

Qho - Vegetated quartz self dunes, sand spreads and as veneers on Pleistocene cores of inland dunes. Partly reworked to form thin veneers of Qho.

Qs - Brown and yellowish-brown, fine to medium-grained aeolian quartz sand spreads within depressions surrounding playa lakes.

Inland claypan sediments: Red-brown clay and silt.

Qhg - Gypsiferous aeolian sand dunes fringing playa lakes: Spreads of white to pale yellowish-brown sandy silt and clayey sand with powder gypsum and gypsum crusts within depressions around the lakes. Includes gypsiferous silt and sand of Pleistocene age which are commonly reworked.

Ql - Saline carbonate and gypsiferous playa lake clay and silt of coastal salinas (LE HUNTE FORMATION equivalent) and continental salinas (YAMBA FORMATION equivalent): Includes clay and silt of Pleistocene age which are commonly reworked (black dot overprint).

PALAEOSOLS

Multiple, commonly coalescing horizons of calcrete. Includes thick, indurated horizons of pink, cream and grey, massive, laminar and nodular calcrete developed near the top of the Lower Member of the BRIDGEWATER FORMATION, massive sheet and nodular calcrete developed within the Upper Member of the BRIDGEWATER FORMATION, nodular, sheet and biscuity calcrete developed within the self dune cores of the WIABUNA FORMATION, and soft, nodular and biscuity calcrete and carbonate soils developed within the calcareous silt drapes of the WIABUNA FORMATION and within Qpa and Qpl. Also minor (? dolomitic) calcrete developed on top of PIDINGA FORMATION and GARFORD FORMATION. (Rock Relation Diagram only).

QUATERNARY — MID-LATE PLEISTOCENE

Qpp - Alluvial reddish-brown and yellow-brown gravelly and sandy clay, silt and sand with soft earthy carbonate within and flanking the Gawler Ranges (POORAKA FORMATION equivalent).

Qp$_1$ - Thin, colluvial, reddish-brown, orange-brown and yellow-brown loamy sand and gravelly clay with nodules of calcrete south of the Gawler Ranges. Possibly includes HINDMARSH CLAY equivalent.

WIABUNA FORMATION: Thin, brown, yellowish-brown, reddish-brown and fawn-grey aeolian silty and clayey calcareous sand. Typically forms calcreted cores of inland self dunes, commonly draped by thin veneers of Holocene quartz sands (Qho and Qhs). Also forms drapes of calcareous silt overlying calcreted BRIDGEWATER FORMATION. Silt drapes contain abundant calcreted pupal cases of *Leptopius* duponti, plus horizons of nodular and soft calcrete. Most likely reworked from, and may be in part an inland facies equivalent of the BRIDGEWATER FORMATION (Upper Member).

GLANVILLE FORMATION: Marine to intertidal shelly sand and clay, locally calcreted at the top. *Anadara trapezia* and *Euplica bidentata* (molluscs) and *Marginopora vertebralis* (foraminifer) are characteristic. Calcreted foreshores of medium to coarse-grained skeletal carbonate sand.

BRIDGEWATER FORMATION: Soft, white to cream-fawn fine to medium-grained aeolian calcarenite, locally subdivided into Upper (Qpbu) and Lower (Qpbl) Members. Coastal dune facies contains very large (up to 10m) tabular foresets with interbeds of white-lawn silt (Upper Member) and red silt (Lower Member). Multiple coalescing horizons of calcrete developed throughout the BRIDGEWATER FORMATION with thick indurated calcrete typically developed near the top of the Lower Member, and less-indurated calcrete typically developed within the Upper Member. Calcreted pupal cases of native bees and the weevil *Leptopius* duponti, and shells of the land snail *Bothriembryon barretti* are common.

ILKINA FORMATION: Laminated, white and yellowish-brown ferruginous sand, with bands of crystalline gypsum, pale green gypsiferous, sandy and gritty clay and silt. Disconformably overlies the GARFORD FORMATION.

TERTIARY

Nodular, mottled and pisolitic ferricrete and massive to botryoidal limonite-goethite laterite developed within clay and sand of the GARFORD FORMATION (Nanaby Palaeochannel) and as a capping on top of ferruginised and silicified PIDINGA FORMATION (Ceduna area).

Silcrete developed within quartz sand and silt of the PIDINGA FORMATION and GARFORD FORMATION.

Ferruginous mottling and ferricrete developed within the sand and silt of the PIDINGA FORMATION and GARFORD FORMATION. Commonly overprinted by Tsi silcrete.

GARFORD FORMATION: Oxidised lacustrine, fluvial and colluvial sediments comprising fine to coarse-grained orange, pale yellow, red and purple angular to well-rounded silty sand; khaki to grey-green and brown silty clay and black carbonaceous clay and silt. Silcreted and ferricreted horizons common.

PIDINGA FORMATION: Highly variable, reduced to oxidised, fine-grained to gravelly, subangular to rounded fluvial sand; variable thicknesses of grey-brown, cream-grey and black carbonaceous clay. Abundant humic material, and sparsely abundant silicified wood fragments (Cadlarie area). Sands contain up to 5% pyrite, and, where oxidised, limonite. Uranium mineralisation associated with redox fronts in fluviatile sand. Minor local marginal-marine sand, laminated silty sand and ? intertidal estuarine/humid facies containing abundant siliceous sponge spicules, algal forms and foraminifera (WWG WEDGER equivalent, Tepb).

GAWLER CRATON

MESOPROTEROZOIC

Pink, medium, even-grained granite plus minor aplite and garnet-bearing pegmatite. Abundant pyrite (≤3%). Comagmatic with ꞒP$_{ch_2}$. Pegmatites have miarolitic texture.

Grey, medium to coarse-grained porphyritic granite to adamellite, with abundant orthoclase and quartz phenocrysts (≤10mm). Orthoclase phenocrysts commonly rimmed by albite. Contains up to 3% pyrite.

Pink to pale reddish, fine to medium-grained leucocratic granite, granodiorite and adamellite with veins of micrographic, aplite and pegmatite. Minor biotite, muscovite and hornblende. Accessory zircon, allanite, sphene, magnetite and fluorite. Radiometric age (Rb-Sr) 1478±38 Ma (Hiltaba-Minnipa area, YARDEA 1 : 250 000 sheet). (U-Pb) 1514±32-24 or 1585±16 Ma (Hiltaba area).

YARDEA DACITE: Massive porphyritic dacite and rhyodacite. Cream-coloured, brown and pink phenocrysts of plagioclase (≤10mm) and minor smaller orthoclase and clinopyroxene phenocrysts within a fine-grained, granophyric matrix of quartz, orthoclase and chlorite. Groundmass is typically stained by amorphous hematite.

EUCARRO DACITE: Massive porphyritic dacite and rhyodacite. Euhedral to subhedral phenocrysts of quartz, plagioclase, orthoclase and altered amphibole up to 5mm across within a groundmass of granophyric quartz and feldspar. Minor rhyodacitic breccia and agglomeratic obsidian containing brecciated fragments of rhyodacite.

BITTALI RHYOLITE: Grey, pale green, pale brown and cream-coloured rhyolite to rhyodacite. Sparse, euhedral to subhedral phenocrysts of plagioclase, pale yellowish-brown. Abundant subhedral to anhedral phenocrysts of quartz, feldspar and amphibole within a groundmass of quartz, feldspar and sanidine. Rare small olivine phenocrysts, and chlorite pseudomorphing pyroxene (and olivine). Flow banding is common.

WAGANNY DACITE: Reddish-brown porphyritic dacite to rhyodacite with phenocrysts of plagioclase, minor orthoclase and quartz, (≤2mm) in an aphanitic or micrographic matrix. Phenocrysts are typically subhedral, with quartz commonly embayed. Flowbanding is common and typically convoluted. Occasional thin horizons of rhyolitic ignimbrite, reworked lapilli tuff and brecciated obsidian. Red-brown staining by amorphous hematite. Radiometric age (U-Pb) 1591±3 Ma (Toondulya Bluff).

Highly weathered porphyritic rhyolite. Equivalent to rhyolite at Mt. Cooper (ELLISTON 1 : 250 000 sheet). Subsurface only (Water Well 5832 WW122).

PALAEOPROTEROZOIC

Diorite to gabbro plugs and dykes containing plagioclase+hypersthene+clinopyroxene, with accessory magnetite, apatite, pyrite and epidote. Intrudes the NUYTS VOLCANICS (St Peter Is.).

ST FRANCIS GRANITE: Massive, grey to pink porphyritic, leucocratic granite with up to 40% feldspar phenocrysts. Intrudes ꞒPγ_2 and ꞒPγ_4 (Cape Beaufort). Equivalent to porphyritic granite at Point Peter (NUYTS 1:250 000 sheet).

NUYTS VOLCANICS: Pink-grey rhyolite with abundant quartz and pink-white plagioclase and orthoclase phenocrysts (≤2mm) within a granophyric groundmass. Weak vertical foliation evident. No primary layering visible in outcrop, but wave-washed beach cobbles exhibit eutaxitic textures, with agglomeratic breccia horizons and fiammé. Intruded by ꞒPβ_3 diorite. (St Peter Is.). Radiometric age (U-Pb) 1627±2 Ma (St Peter Is.). Equivalent to rhyolite (ꞒPa) on St Francis Island (NUYTS 1 : 250 000 sheet).

Thin (0.5 - 10m) aplite and pegmatite dykes. Aplite typically pale pink to off-white, occasionally with coarse-grained, feldspar-rich centres. (Rock Relation Diagram only).

Thin (≤5m) dykes of fine-grained diorite to dolerite with sharp contacts. Margins commonly have a mylonitic fabric.

Plugs and dykes of medium-grained, weakly foliated, pink porphyritic granite. Pale-pink microcline phenocrysts (≤15mm) are common. Radiometric age (biotite K-Ar) 1516±11 Ma.

Medium-grained, weakly to moderately foliated granodiorite to adamellite, with abundant orthoclase and plagioclase phenocrysts. Abundant enclaves of diorite/dolerite. Comagmatically intrusive with ꞒPγ_2, ꞒPβ_1 and ꞒPγ_3. Contains minor isolated pegmatitic lenses.

Fine to medium-grained, weakly foliated, grey granodiorite dykes comagmatically intrusive with ꞒPγ_2, ꞒPγ_4 and ꞒPβ_1. Some dykes exhibit conspicuous mesoscopic magmatic banding on eastern margins. Medium-grained, massive to weakly foliated grey granodiorite to adamellite with up to 10% hornblende. Radiometric age (U-Pb) 1620±4 Ma (Point Brown).

Fine to medium-grained amphibolite, diorite, dolerite and lamprophyre dykes. Dykes are typically subparallel to the foliation within the granitoids, and are commonly foliated. Comagmatic intrusion within ꞒPγ_2, ꞒPγ_3 and ꞒPγ_4 has resulted in a variety of textures ranging from back-veining of dykes by granite, dyke margins consisting of a mixed granodiorite hybrid and intense disruption and mingling to form abundant enclaves of dolerite/diorite.

Pink, fine to medium-grained, weakly to moderately foliated granite to adamellite, grading to medium to coarse-grained red-pink granite with up to 20% pink-red microcline (≤20mm) plus minor biotite+opaques. Comagmatic with ꞒPβ_1, ꞒPγ_3 and ꞒPγ_4.

Medium to coarse-grained megacrystic granite gneiss. Abundant K-feldspar megacrysts (≤40mm) within a mylonitic matrix of quartz+feldspar+biotite. (Point Westall area). Medium-grained gneissic granite with folded biotite foliation (Wittelbee Point area). Radiometric age: (Rb-Sr) 1547±566 Ma (Point Westall).

Undifferentiated foliated to unfoliated granitic gneisses and granitoids of uncertain stratigraphic position. Includes enclaves of ꞒPβ_1.

ARCHAEAN-EARLIEST PROTEROZOIC — SLEAFORD AND MULGATHING COMPLEXES

Undifferentiated Archaean - Early Proterozoic granitoids, gneisses and ?metasediments.

Local occurrence only, limits not shown........ *Qpb$_u$*

STREAKY BAY

SOUTH AUSTRALIA

Explanatory Notes

1:250 000 Geological Series — Sheet SI 53-2

Geological Survey of South Australia

Department of Mines and Energy
South Australia

1:250 000 Geological Series — Explanatory Notes

STREAKY BAY

SOUTH AUSTRALIA

SHEET SI 53-2 International Index

L.R. Rarkin and R.B. Flint

Issued under the authority of

The Hon. J.H.C. Klunder, M.P.

Minister of Mines and Energy

Peacock Publications, Adelaide
1991

CONTENTS

Page

Rankin, L.R. (Leigh Ronald), 1959-

Explanatory notes for the STREAKY BAY 1:250 000 geological map.

ISBN 0 7308 1931 0.

1. Geology — South Australia — Streaky Bay. I. Flint, R.B. II. South Australia. Dept. of Mines and Energy. III. Geological Survey of South Australia. IV. Title. (Series: 1:250 000 geological series — explanatory notes (Geological Survey of South Australia)).

559.4238

ISSN 0572-0125

Edited and designed by J.F. Drexel.

Drafting and reprographics by SADME Drafting Services Branch.

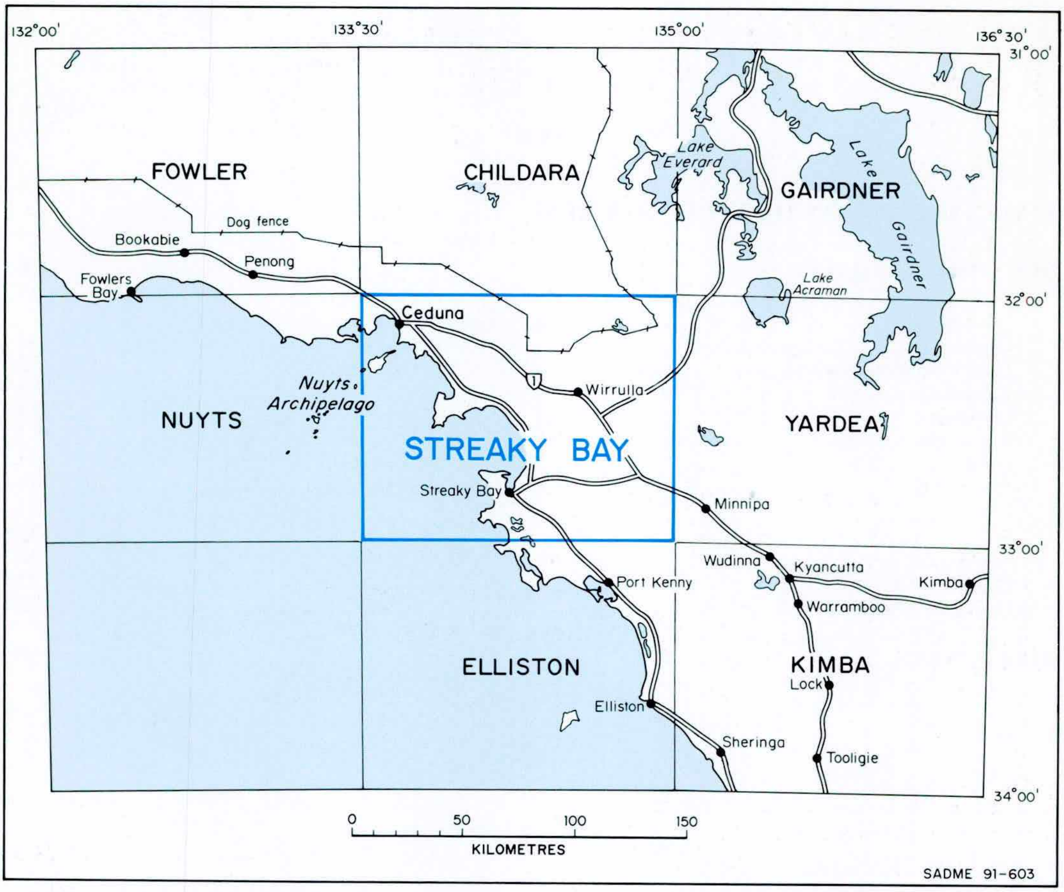


Fig. 1 Regional locality plan, STREAKY BAY sheet area.

Explanatory Notes for the STREAKY BAY 1:250 000 Geological Map

L.R. Rankin and R.B. Flint

INTRODUCTION

The STREAKY BAY 1:250 000 geological map area is located between latitudes 32° and 33°S, and longitudes 133°30' and 135°E, on the west coast of Eyre Peninsula (Fig. 1). Adjacent geological maps are CHILDARA (Blissett, 1980), ELLISTON (Flint, 1989), FOWLER (Firman, 1978), GAIRDNER (Blissett, 1985), KIMBA (Flint and Rankin, 1989), NUYTS (Flint, 1986) and YARDEA (Blissett *et al.*, 1988).

The principal towns are Ceduna and Streaky Bay, with smaller centres of population at Smoky Bay, Poochera, Cungena, Wirrulla and Haslam. The area is serviced by the Eyre Highway, Flinders Highway and Port Lincoln-Thevenard railway.

Much of the land has been cleared for agriculture, with extensive native scrub remaining only in the Great Victoria Desert/Gawler Ranges area north of the Dogfence. The dominant agriculture is rotation cereal cultivation and livestock grazing. Major cereals are wheat and barley; sheep are the most important livestock. Streaky Bay and Ceduna are local ports for professional fishing whereas Thevenard is a deep-sea port for loading of grain, and gypsum which is mined at Lake Macdonnell on NUYTS.

Mapping of STREAKY BAY was based on Department of Lands 1980 colour aerial photographs at a scale of 1:40 000. Geological boundaries were transferred to 1:100 000 topographic base maps, and are available from SADME as black and white paper prints.

PHYSIOGRAPHY

Climate

(from Laut *et al.*, 1977a,b; Schwerdtfeger, 1985)

The climate varies from mild and mediterranean along the coast to hot and dry inland. Rainfall is low, and decreases steadily inland in both quantity and reliability. Mean annual rainfall varies from 375 mm south of Streaky Bay to less than 300 mm in the northeast.

The average summer (January) maximum and minimum temperatures for Streaky Bay are 28.6°C and 15.4°C, respectively. The average winter (June) maximum and minimum temperatures are 16.9°C and 8.6°C.

Landforms

(from Laut *et al.*, 1977a,b; Twidale and Campbell, 1985b)

Landforms are dominated by complexes of calcreted, calcareous dunes and plains, siliceous seif dunes, and minor hilly terrain in the northeast (Fig. 2).

The Gawler Ranges (northeastern STREAKY BAY) form a series of prominent, rounded hills separated by broad alluvial floodplains. Hills around Waverley Hill exhibit minor development of flared slopes, tafoni, gnamma and other features typical of subsurface weathering of granite hills.

Southwest of the Gawler Ranges is the southeastern extent of the Great Victoria Desert, comprising saline depressions and surrounding seif dunefields. Twidale and Campbell (1985b) separated the vegetated seif dunes into the slightly elevated Nunnyah Plain (north of Nunnyah Rockhole), and Kwaterski Dunefield. The Nunnyah Plain grades southwards into an extension of the Tuckey Plain, which in turn grades southwestwards into the older calcreted sands of the Chandada Plains. This latter area comprises undulating plains with relief of less than 20 m, and no surface drainage.

The Kwaterski Dunefield and associated salt lakes occupy the narrow, elongate Corrobinnie Depression (Jack, 1912; Bourne *et al.*, 1974).

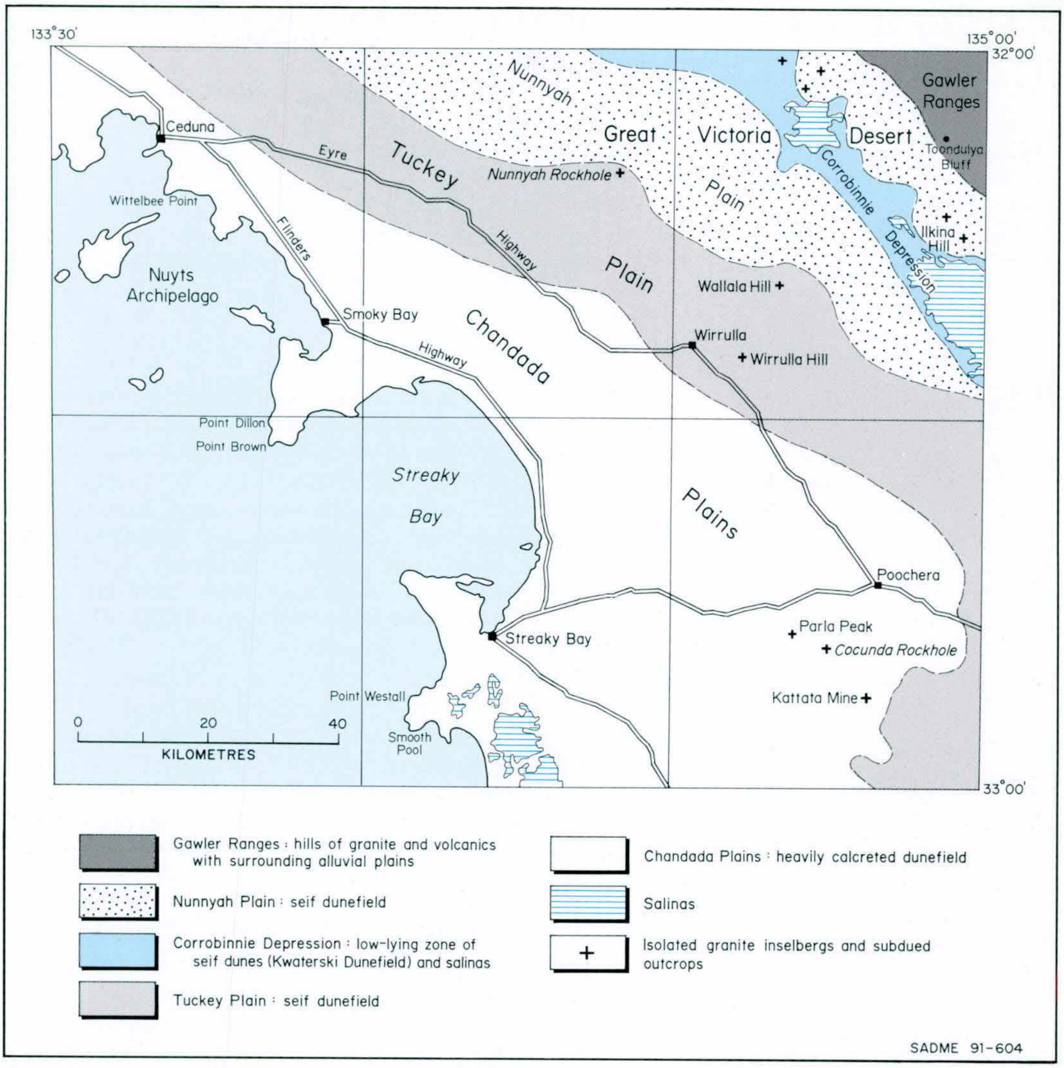


Fig. 2 Principal physiographic features, STREAKY BAY.

This is a shallow (<30 m) depression, trending northwesterly for nearly 200 km from Balumbah (KIMBA), across YARDEA, to west of Toondulya Bluff (STREAKY BAY). In part, the location of the Corrobinnie Depression coincides with the underlying Tertiary Narlaby Palaeochannel.

Flanking the northern margin of the Corrobinnie Depression are numerous scattered granitic outcrops which form low hills (e.g. Ilkina Hill), small tors (<3 m high) and low shields.

Other isolated inselbergs occur at Wallala Hill, Wirrulla Hill, Parla Peak and Cocunda Rockhole. Subsurface weathering forms, such as tafoni, rillen, flared walls, polygonal cracking and gnamma, are common.

Coastal geomorphology is dominated by low cliffs incised into the Pleistocene Bridgewater Formation, with narrow sandy beaches and coastal dunes. Crystalline basement outcrops form wave-cut platforms at Ceduna, Wittelbee Point, Point Dillon, Point Brown, Point Westall, Smooth Pool, and on islands of Nuyts Archipelago.

Most of the landforms on STREAKY BAY were developed during the Cainozoic; no older land surfaces are evident at the modern land surface.

Vegetation

(from Laut *et al.*, 1977a,b)

The Gawler Ranges have a mixed cover of low open woodland with shrub understory, low mixed chenopod shrubland and herbaceous vegetation. The hills have a cover of *Eucalyptus dumosa* subsp. (pileata), *E. socialis*, *Triodia irritans*, *Stipa* spp. and *Bassia* spp., with minor *Casuarina cristata* on the footslopes. The floodplains between the hills contain *Acacia sowdenii*, *Maireana sedifolia* and *E. porosa*.

The Great Victoria Desert has a cover of *E. socialis* and *Triodia irritans* on the dunes, and *E. socialis* and *E. gracilis* in the interdunal corridors. Around the inland lakes there is a low open woodland and mallee scrub with chenopod understory. The dunes have a cover of *E. socialis* and *Casuarina cristata*, with *Acacia sowdenii* and *Maireana sedifolia* in the interdunal corridors. The lake depressions are populated by *Arthrocnemum* sp. and *Pachycornia tenuis*.

The Chandada Plains have been mostly cleared for agriculture but some native vegetation remains, comprising mainly *E. diversifolia*, with *E. socialis*, *E. gracilis* and *Melaleuca lanceolata* along the near-coastal zone. *E. incrassata* and *Melaleuca uncinata* occur on the plains near Wirrulla. The coastal and near-coastal dunes have a healthy cover of *Olearia axillaris*, *Leucopogon parviflorus* and *Acacia sophorae*. Isolated inselbergs have minor *Dodonaea attenuata*.

The tidal flat zones contain mangrove swamps of *Avicennia marina* var. *resinfera*. Surrounding the coastal lakes are growths of *Melaleuca halmaturorum*, *Arthrocnemum halocnemoides*, *Salicornia quinqueflora* and *Suaeda australis*.

HISTORICAL NOTES

(from Cockburn, 1984; Twidale and Campbell, 1985a)

The first inhabitants of the STREAKY BAY region were aboriginals of the Wirangu and Gugada tribes (Berndt, 1985). The Wirangu inhabited the coastal zone of western Eyre Peninsula and portions of the Nullarbor Plain. The Gugada inhabited the northwestern portion of Eyre Peninsula.

The first Europeans to land in South Australia were the Dutch aboard the *Gulden Zeepaert*, captained by Francors Thijssen. In 1627, Thijssen sailed along southern Australia as far east as Nuyts Archipelago, named by him after Pieter Nuyts, Councillor Extraordinary of the East India Government at Batavia, who accompanied Thijssen on the voyage. St Pieter Island (now St Peter Island) was named after the Councillor's patron saint.

The French explorer D'Entrecasteux sailed along the coast in 1792, and Matthew Flinders, aboard the *Investigator*, charted the coastline of Eyre Peninsula in 1802. Many geographical features, including Point Westall and Point Brown, were named after members of Flinder's exploration party; others were named from their appearance, notably Smoky Bay, Streaky Bay and Denial Bay.

Flinders then sailed on to Encounter Bay, near the modern site of Victor Harbor, where he met Baudin, captain of the French exploration vessel *Le Géographe*. Baudin continued mapping westward along the coastline as far as Murat Bay. Many of the existing geographical names on STREAKY BAY, including Murat Bay, Cape Thevenard, Descrés Bay and Cape D'Estrées, were named by him.

In 1839, Edward John Eyre, after whom Eyre Peninsula was named, travelled from Port Lincoln exploring the far west coast (Eyre, 1845).

In 1843, sailors Cummings and Harris walked from the whaling station at Murat Bay to Point Drummond, later reporting the presence of excellent agricultural land (SA register, 16 and 20 December, 1843; Smith, 1843). The land around STREAKY BAY appeared suitable for grazing to many explorers although varying seasonal conditions around Denial Bay brought conflicting reports.

The South Australian government set up an agricultural advisory centre at Streaky Bay in the 1900s, and in 1929 the Port Lincoln-Cummins railway was extended to Ceduna, as was the Tod River pipeline which greatly increased the availability of freshwater to the community. Widespread mechanisation of land-clearing and farming techniques after World War II have resulted in extensive clearing of the native vegetation and the establishment of large-scale agriculture.

PREVIOUS INVESTIGATIONS

Geology

The first reported geological investigations on STREAKY BAY were by Brown (1885) during regional investigations of western South Australia, and Jack (1912, 1922) who examined the geology, hydrogeology and mineral potential of parts of STREAKY BAY and produced the first geological maps of the area.

Segnit (1933) and Segnit and Dridan (1938) mapped both the basement and overlying Cainozoic sediments in the Robinson Freshwater Basin area.

Regional geological investigations on STREAKY BAY recommenced in 1967 (Walker and Botham, 1969), resulting in production of a preliminary 1:250 000 map sheet (Botham, 1969). The inland Cainozoic sediments were examined by Firman (1967a,b), and Harris (1979b) conducted palynological studies on Tertiary fluvial sediments in the Robinson Freshwater Basin.

In February 1974, SADME conducted a helicopter-based geological survey of all islands adjacent to Eyre Peninsula. Petrological descriptions of the samples collected are presented in Steveson (1974), and geochronology of selected samples is summarised by Webb *et al.* (1982, 1986). Geochemical data are presented in Rankin and Flint (1989).

Coastal granitic exposures were mapped by Watkins and Flint (1983), who recognised a very complex history of intrusion and deformation; detailed geochemistry and interpretation of magmatic layering were published later by Berry and Flint (1988). Rankin and Flint (1989) modified and refined correlations between exposures of Palaeoproterozoic granitoids on STREAKY BAY.

The Gawler Range Volcanics and Hiltaba Suite granite on northeastern STREAKY BAY were mapped in conjunction with mapping of GAIRDNER (Blissett, 1985) and YARDEA (Blissett *et al.*, 1988). Geochronology of the Gawler Range Volcanics and Hiltaba Suite granite in the southwest of the Gawler Ranges, including Toondulya Bluff, was examined by Cooper *et al.* (1985), Jagodzinski (1985) and Fanning *et al.* (1988).

Regional geological descriptions of basement to STREAKY BAY are included in Glenn *et al.* (1977), Rutland *et al.* (1981), Parker *et al.* (1985), Rankin (1987) and Parker (1990). The regional framework is shown on the 1:2 000 000 scale *Tectonic map of South Australia* (Flint and Parker, 1982) and on the 1:1 000 000 scale *Geological map of the Gawler Craton* (Flint *et al.*, 1984).

Coastal Quaternary sediments on STREAKY BAY were examined by Ambrose and Kinsman (1973), Belperio *et al.* (1983, 1988), Murray-Wallace and Kimber (1987), and Belperio (1988a). The genesis of inland lacustrine evaporites was studied by Warren (1980, 1982).

Various geomorphological aspects of the STREAKY BAY area have been studied by Bourne *et al.* (1974) and Twidale *et al.* (1976, 1977, 1987). A summary of the geomorphology of the region is given in Twidale and Campbell (1985b) and Twidale *et al.* (1987). A 0.9 kg meteorite, discovered 11 km southeast of Streaky Bay in 1989, has been identified as a L4b chondrite by Wallace and Pring (1991).

Geophysics

Regional geophysical surveys, including gravity, airborne and marine magnetics and seismic, have been conducted over STREAKY BAY since 1953 (Fig. 3). Airborne magnetic surveys were flown by BMR, SADME and Adastra Hunting in 1953 and 1955-56 as part of a major aeromagnetic survey of Eyre Peninsula in an attempt to locate large-scale iron ore deposits. The surveys were flown initially at a height of 460 m and later at 160 m, with a line spacing of 1.6 km. Data were processed by SADME and published as 1:250 000 map sheets (Webb, 1965).

Three circular aeromagnetic anomalies — Inkster, Cungena and Ripon — defined during this survey prompted further local investigations (Fig. 3; Whitten, 1963). Detailed ground magnetic and gravimetric surveys were conducted (Dowling and Moorcroft, 1959; McMutrie and Moorcroft, 1959; Webb, 1961), and six rotary holes were drilled in the Inkster anomaly, three in the Cungena anomaly and three in the Ripon anomaly. All anomalies result from plugs of magnetite-bearing hypersthene gabbro within a principally granitic basement (Whitten, 1960, 1963).

An aeromagnetic survey by Aeroserv Ltd for Outback Oil Co. NL and Shell Development (Aust.) Pty Ltd (1966) at a spacing of 12.8 km and height of 460 m (ASL) and 170 m (AGL) covered the southern offshore section of STREAKY BAY and most of the onshore area around Streaky Bay. Marine magnetic profiles were recorded by Western Geophysical Co. of America while recording marine seismic surveys for Outback Oil NL in conjunction with Australian Occidental Pty Ltd (1981) during exploration of the offshore section of the Polda Basin. Two aeromagnetic and radiometric lines were flown by Geoex for Carpentaria Exploration Pty Ltd (1980) during exploration in the Narlaby Palaeochannel area.

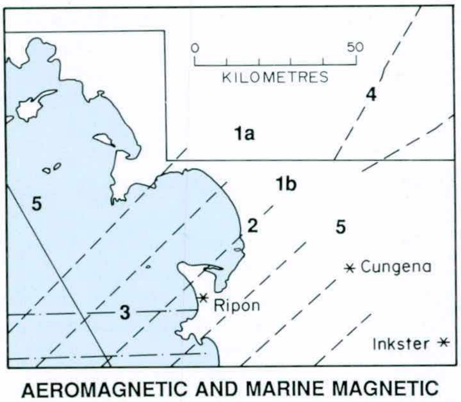
The northern section of the STREAKY BAY aeromagnetic survey (Region 1a, Fig. 3) has been digitised and reprocessed by BMR (1986); the southern section survey was reflown at a height of 100 m and line spacing of 1 km during the

AEROMAGNETIC AND MARINE MAGNETIC

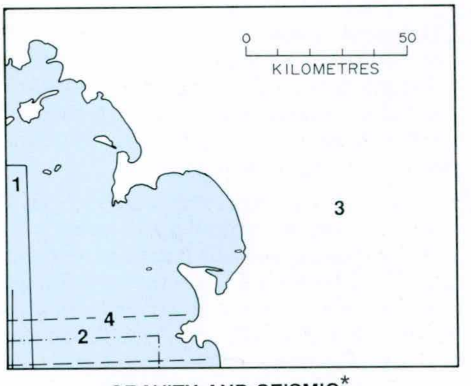
REGION	SPACING (km)	ELEVATION (m)	FLOWN BY	FOR	DATE	REFERENCE
1a,b	1.6 EW	152	Adastra Hunting	SADME - BMR	1953 - 56	Webb (1965)
2	12.8 NE and SW	170 AGL 460 AGL	Aeroserv Ltd	Outback Oil Shell Development	1966	SADME Env. 648
3	Marine magnetics		Western Geophys. Co. of America	Australian Occidental	1980 - 81	SADME Env. 3988
4		45	Geoex	Carpentaria	1980	SADME Env. 3420
5	1.0 EW	100	Geoterrex	SADME	1988	

GRAVITY AND SEISMIC*

REGION	SPACING (km)	BY	FOR	DATE	REFERENCE
1*		Compagnie Generale de Geophysique	BMR	1970 - 73	BMR Record 1975/151
2*			Target Exploration and Bridge Oil	1970 -71	SADME Env.1726
3	7.2 x 7.2	Wongela Geophysical	SADME - BMR	1976	Gerdes (1975) BMR Bulletin 196
4*		Western Geophysical	Australian Occidental	1980 -81	SADME Env.3988



AEROMAGNETIC AND MARINE MAGNETIC



GRAVITY AND SEISMIC*

SADME 91-605

Fig. 3 Major geophysical surveys, STREAKY BAY.

SADME Eyre Peninsula aeromagnetic survey in 1988. Digital data from these two surveys have been combined by Pitt Research Pty Ltd. Pixel maps generated include residuals of total magnetic intensity, magnetic surface gradient and composite magnetics which are printed in colour on the STREAKY BAY geological map.

A gravity survey of STREAKY BAY was conducted by Wongela Geophysical Pty Ltd on behalf of SADME and BMR (Fraser and Pettifer, 1980) and a 1:250 000 Bouguer anomaly map compiled by Gerdes (1975). Offshore seismic refraction surveys were conducted by Compagnie Generale de Geophysique (1975) for the BMR as part of their Australian Continental Shelf Project. One line of a seismic refraction survey run by Target Exploration Pty Ltd (1971) and Bridge Oil during exploration of the Polda Basin also extends onto STREAKY BAY.

STRATIGRAPHY

STREAKY BAY lies within the central region of the Gawler Craton, a large crystalline basement province consisting of variably deformed Late Archaean to Mesoproterozoic rocks (Thomson, 1970; Parker *et al.*, 1985, 1988; Fanning *et al.*, 1988). Three tectonic megacycles are recognised within the Gawler Craton (Fanning *et al.*, 1988):

1. Late Archaean-Palaeoproterozoic: an Archaean volcano-sedimentary sequence complexly deformed, metamorphosed and intruded by granitoids during the Sleafordian Orogeny (*c*.2500-2300 Ma). This is known collectively as the Sleaford Complex on Eyre Peninsula; its equivalent to the northwest is the Mulgathing Complex.
2. Palaeoproterozoic: several discrete phases of sedimentation and volcanism (including the Hutchison Group in the Cleve Subdomain; Parker and Lemon, 1982), with associated magmatism (Lincoln Complex), deformation and metamorphism during the Kimban Orogeny. Sedimentation and magmatism were operative *c*.2000-1600 Ma (Fanning *et al.*, 1988) but deformation and metamorphism were restricted largely to 1850-1700 Ma.
3. Mesoproterozoic: extensive anorogenic volcanism *c*.1590 Ma (Gawler Range Volcanics) with contemporaneous clastic and volcaniclastic sedimentation associated with extensive contemporaneous granitoid plutonism (Hiltaba Suite).

Outcrops of Precambrian rocks on STREAKY BAY are limited, but excellent exposures of Lincoln Complex granitoids, Palaeoproterozoic volcanics, Gawler Range Volcanics and Hiltaba Suite occur on narrow wave-cut platforms on headlands and offshore islands, in the Toondulya Bluff area, and as minor isolated outcrops in the Great Victoria Desert. Elsewhere, Precambrian rocks are covered by a blanket of Tertiary and Quaternary sediments varying in thickness up to 125 m (Fig. 4). The areal distribution of these older units shown on the Tectonic Sketch is highly interpretive and deduced predominantly from aeromagnetic data.

Late Archaean-Palaeoproterozoic

The subsurface presence of Archaean to Palaeoproterozoic rocks of the Sleaford (AᵽP*s*) and (?)Mulgathing (AᵽP*m*) Complexes on STREAKY BAY is interpreted from the continuation of magnetic domains from neighbouring YARDEA and KIMBA where Sleaford Complex is exposed. This basement most likely consists of gneissic granitoids and paragneisses. The origin of weathered chlorite+sericite schist found in several drillholes, including CEC IR 531 (Carpentaria Exploration Co. Pty Ltd, 1981a,b), is enigmatic and the rock may represent minor metasediments of the Sleaford Complex, though alternatively it may be either younger, sheared granitoids or unrecognised Hutchison Group metasediments. Identification of basement lithologies from these drillholes is difficult, as only highly weathered rockchips have been recovered.

A small outcrop of highly weathered, well foliated quartzofeldspathic gneiss 13 km west-northwest of Pinjarra Dam has been identified tentatively as Archaean on the basis of the regional magnetic patterns.

Palaeoproterozoic

Lincoln Complex

Basement exposures west of the Gawler Ranges are dominated by weakly to intensely deformed mafic and felsic intrusives. The following descriptions of coastal exposures are adapted from Watkins and Flint (1983), and Rankin and Flint (1989).

Undifferentiated Granitoids (Ᵽγ)

At Wirrulla Hill, a small outcrop of banded gneissic granite and aplite is intruded by Mesoproterozoic granite of the Hiltaba Suite (Ᵽγh). The gneissic granite is considered to be Lincoln Complex, although no precise correlation with exposures along the coast is possible.

In the Narlaby Palaeochannel area, drillhole intersections of intensely weathered, kaolinised, foliated gneiss with minor amphibolite have been correlated with the Lincoln Complex (on the basis of regional magnetic patterns) and are included in this unit.

Gneisses (Ᵽγ_1)

This unit comprises granitic gneisses found on wave-cut platforms at Point Westall-Smooth Pool and Wittelbee Point.

At Point Westall-Smooth Pool, the unit is a coarse-grained, megacrystic granitic gneiss. The megacrysts, which constitute up to 40% of the

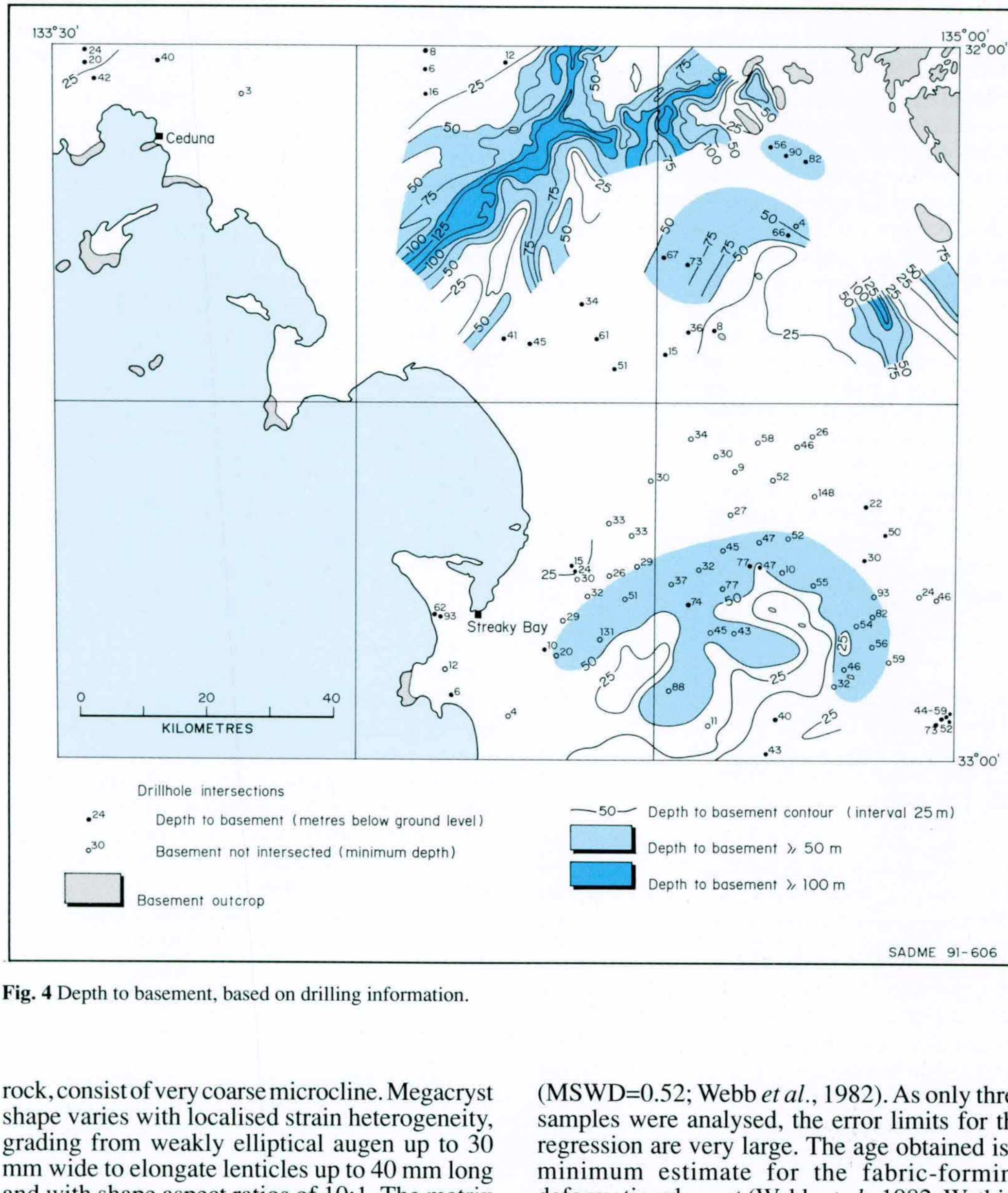


Fig. 4 Depth to basement, based on drilling information.

rock, consist of very coarse microcline. Megacryst shape varies with localised strain heterogeneity, grading from weakly elliptical augen up to 30 mm wide to elongate lenticles up to 40 mm long and with shape aspect ratios of 10:1. The matrix of the gneiss is quartz+feldspar+biotite, and has been deformed, producing a gneissic to mylonitic foliation. The foliation trends approximately 170° and is vertical.

A small outcrop of medium-grained granite gneiss at Wittelbee Point has a moderate-intensity biotite foliation which is folded.

These gneisses are correlated regionally with other granite gneisses found at Cape Adieu, Rocky Point and Cape Bell on NUYTS (Flint, 1986).

A three-point Rb-Sr isochron on samples from Point Westall produced an age of 1547±566 Ma, with a $^{87}Sr/^{86}Sr$ initial ratio of 0.7054±0.021 (MSWD=0.52; Webb *et al.*, 1982). As only three samples were analysed, the error limits for the regression are very large. The age obtained is a minimum estimate for the fabric-forming deformational event (Webb *et al.*, 1982; Watkins and Flint, 1983).

St Peter Suite (Ꝑ γ_{2-5}, Ꝑ β_1) — New Name

Units of the St Peter Suite represent a complex comagmatic intrusive sequence. The numerical sequence (Ꝑγ_{2-5}, Ꝑβ_1) described below does not necessarily imply order of intrusion.

Ꝑγ_2 comprises a pink, fine to medium and even-grained granite grading to a pink-red medium to coarse-grained granite with microcline and plagioclase phenocrysts up to 30 mm. The granite is leucocratic, with less than 3% visible mafic minerals, and is weakly to moderately well foliated. At Wittelbee Point the granite intrudes gneissic granite ($Ꝑ\gamma_1$).

At Point Brown, the red granite is intruded by a suite of weakly foliated, medium-grained granodiorite dykes ($Ꝑ\gamma_3$) trending approximately 010-035° and varying in width from 1 to 15 m. Inclusions of red granite occur in the dykes. The eastern margins of some dykes exhibit cyclic banding of felsic and mafic-rich layers in a zone up to 0.3 m wide. Berry and Flint (1988) concluded that the banding is due to dynamic crystal sorting along the dyke margins during magma injection. Granodiorite dykes are rare at Wittelbee Point and Ceduna. On the northern coastline of St Peter Island, fine-grained granodiorite dykes with diffuse margins contain inclusions of pink granite ($Ꝑ\gamma_2$) and porphyritic granodiorite ($Ꝑ\gamma_4$). On southern St Peter Island, a massive to moderately well foliated, medium-grained, hornblende-rich granodiorite to adamellite contains up to 10% hornblende and biotite; this is correlated with the granodiorite dykes ($Ꝑ\gamma_3$) due to similarity of composition. Locally, the granodiorite has a spaced foliation defined by subvertical microshear planes. Contacts between the granodiorite-adamellite and adjacent granite ($Ꝑ\gamma_2$) are typically diffuse, with enclaves of both lithologies within each other. A large xenolith of the adamellite is enclosed within Hiltaba Suite granite on Goat Island.

On northern St Peter Island and at Cape Beaufort, pink, even-grained granite ($Ꝑ\gamma_2$) and locally porphyritic grandiorite ($Ꝑ\gamma_3$) are intimately intermixed with a comagmatic phase of grey, weakly to moderately well foliated, medium-grained porphyritic adamellite to granodiorite ($Ꝑ\gamma_4$). The latter contains up to 8% biotite. Contacts between $Ꝑ\gamma_2$ and $Ꝑ\gamma_4$ vary from sharp to gradational, with nebulous enclaves of each lithology within the other. The granodiorite dykes ($Ꝑ\gamma_3$) on St Peter Island contain enclaves of both $Ꝑ\gamma_2$ and $Ꝑ\gamma_4$, but also occur as enclaves within $Ꝑ\gamma_4$.

At Point Westall, $Ꝑ\gamma_4$ is represented by a medium-grained, moderately well foliated grey porphyritic granodiorite, with pink euhedral to lenticular plagioclase phenocrysts up to 30 mm across. This granodiorite intrudes the megacrystic granite gneiss ($Ꝑ\gamma_1$). At Wittelbee Point, a pink porphyritic granite, correlated with $Ꝑ\gamma_4$, occurs adjacent to the coarse-grained pink granite ($Ꝑ\gamma_2$). The contact between the two units is masked by a 10 m thick aplite.

Comagmatic with the granitoids $Ꝑ\gamma_2$, $Ꝑ\gamma_3$ and $Ꝑ\gamma_4$ are diorite and amphibolite dykes ($Ꝑ\beta_1$). One 50 m wide dyke at Point Brown is lamprophyric, containing abundant coarse (up to 10 mm wide) euhedral hornblende phenocrysts within a fine to medium-grained groundmass of clinopyroxene, hornblende, biotite, plagioclase and quartz. The lamprophyre may be either part of this suite ($Ꝑ\beta_1$) or a younger episode of basic intrusion (?$Ꝑ\beta_3$).

The diorite dykes are typically intensely disrupted and back-veined by the host granitoids, resulting in disrupted but semi-continuous dykes. Large zones within the granitoids often contain abundant enclaves of diorite which are commonly elongate parallel to the granitoid foliation. These textures are typical of mingling of comagmatic mafic and felsic magmas (Cook, 1988; Zorpi *et al.*, 1989). The dykes are typically subparallel to the foliation, vary from massive to well foliated and are locally (on St Peter Island) folded and lineated. The intensely deformed dykes have a retrograde amphibolite mineralogy, with hornblende and biotite replacing pyroxene. Spectacular examples of disrupted dykes occur within the granitoids on St Peter Island, Cape Beaufort and Point Brown. At Point Westall and Wittelbee Point, $Ꝑ\gamma_2$ and $Ꝑ\gamma_4$ granitoids contain excellent examples of agmatitic zones, with up to 30% (by volume) of elongate diorite enclaves up to 5 m long mingled with the granitoids. Locally, inclusions of $Ꝑ\gamma_2$, $Ꝑ\gamma_3$ and $Ꝑ\gamma_4$ are found within the diorite dykes.

At Point Westall-Smooth Pool, a medium to coarse-grained pink porphyritic granite ($Ꝑ\gamma_5$) intrudes $Ꝑ\gamma_1$, $Ꝑ\gamma_2$, $Ꝑ\beta_1$ and $Ꝑ\gamma_4$ as both plugs and dykes. The dykes trend 350°-010°, parallel to a weak biotite foliation within the early granitoids. The granite commonly contains pink microcline phenocrysts up to 15 mm across within a medium-grained matrix of quartz, feldspar and biotite. Similarity of dyke orientation and foliation infer that this porphyritic granite may also be part of the St Peter Suite.

Intrusive Setting

Contacts between the dykes and the granitoids vary; both sharp intrusive contacts subparallel to the granitoid foliation, and gradational contacts exhibiting hybrid zones of granodiorite produced by magma-mixing and partial assimilation of the diorite, are present.

The granitoids are all weakly to moderately well foliated. Foliation in each phase consistently trends 350°-010°, with dips varying from 80°W to 80°E. On St Peter Island, local zones of intense foliation have trends of 080°-130°. Within these zones, and adjacent to margins with large diorite bodies, the comagmatic granitoids have undergone moderately intense deformation and grainsize reduction to produce intimately intermixed mafic and felsic 'streaky' gneisses.

Berry and Flint (1988) reported low K_2O/Na_2O and high CaO values for the comagmatic sequence at Point Brown, indicating that the suite is similar to I-type granitoids of White and Chappell (1983). Predominance of biotite-rich granite and granodiorite suggest that the suite fits into the Caledonian-style I-type post-kinematic orogenic granitoids of Pitcher (1982). A common, comagmatic source for the suite is indicated by near-identical trace-element patterns (Berry and Flint, 1988).

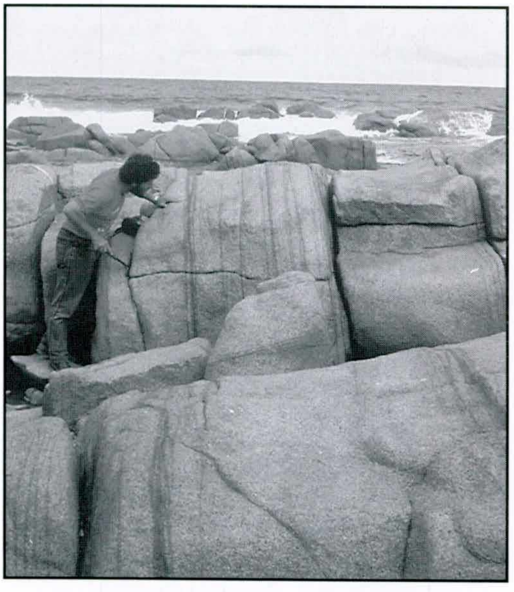
The red granite (Ꝑγ_2) at Point Brown was grouped with samples of leucogranite from Nuyts Archipelago to produce a Rb-Sr total rock isochron age of 1541±38 Ma (Webb *et al.*, 1982, 1986), while K-Ar mineral ages of 1554 and 1589 Ma were obtained from the diorites (Webb *et al.*, 1982). These ages are minimum estimates only.

A better estimate for intrusive age of the St Peter Suite was obtained by U-Pb zircon geochronology on a granodiorite from Point Brown. Five of six zircons analysed yielded discordant U-Pb analyses which produced an upper intercept of 1619±15 Ma. One zircon grain was concordant with a $^{207}Pb/^{206}Pb$ age of 1620±4 Ma, providing the best estimate for the crystallisation age of the zircons, granodiorite dyke and other magmatic phases of the St Peter Suite (Flint *et al.*, 1990).

Below: A spaced foliation defined by microshear planes within hornblende-rich adamellite (Ꝑγ_3), St Peter Island. Photo 38501.

Top right: Lamprophyre dyke (?Ꝑβ_1) containing abundant coarse-grained hornblende in a clinopyroxene+hornblende+biotite+feldspar matrix, Point Brown. Photo 23701.

Bottom right: Amphibolite dyke (Ꝑβ_1) within grey granodiorite (Ꝑγ_3) at Point Brown. The sequence has been intruded by late-stage aplite veins (Ꝑγ_6), and is weakly sheared. Photo 38568.

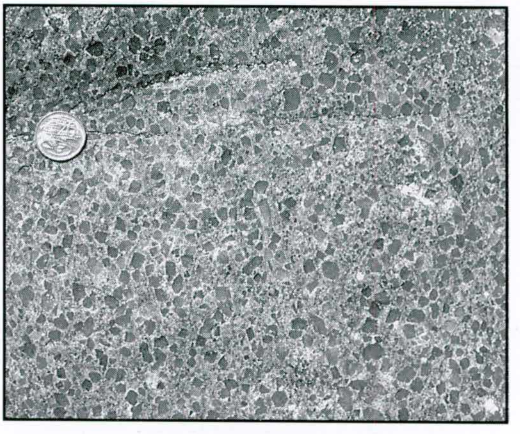


Diorite (Ꝑβ_2)

This unit, which occurs locally at Wittelbee Point and Point Brown, consists of thin (<5 m wide) dykes of fine-grained diorite (Ꝑβ_2) which crosscut earlier intrusive phases Ꝑγ_{1-4} and Ꝑβ_1. Margins are sharp with no hybridisation, suggesting that these dykes represent a late intrusion, post-dating crystallisation of the granitoids. Dyke orientation is highly variable.

Aplite and Pegmatite (Ꝑγ_6)

Aplite and pegmatite dykes of several generations are common at all coastal exposures. Many dykes commonly post-date the foliation-forming event that affected most of the earlier granitoid intrusives, and they crosscut the younger diorite dykes (Ꝑβ_2). Aplite dykes are pale pink to off-white, with occasional coarse-grained feldspar-rich phenocrysts. Dyke widths are typically less than 1.5 m, although some at Wittelbee Point range up to 10 m wide.



Other Igneous Units

Nuyts Volcanics (Ꝑ*v*) — New Name

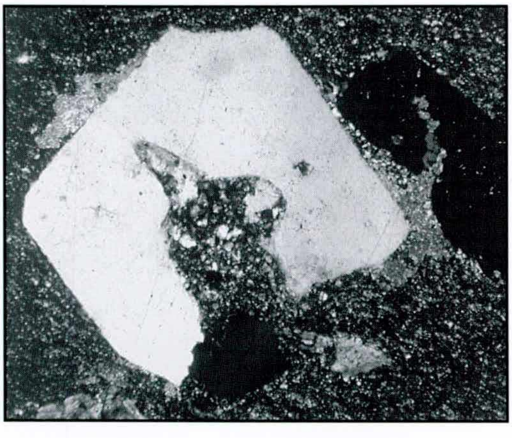
The Nuyts Volcanics on the southern coastline of St Peter Island comprise pink to grey, fine-grained porphyritic rhyolite. Phenocrysts up to 3 mm are common (up to 30%), consisting of quartz and feldspar with occasional mafic-rich cores. Some compositional variation is evident, with ratios of quartz to feldspar phenocrysts varying from predominantly quartz to predominantly feldspar. No primary layering is evident in outcrop, although wave-washed cobbles display eutaxitic textures, agglomeratic horizons and fiammé, indicating an extrusive origin.

The rhyolite has a moderate-intensity foliation defined by alignment of very fine-grained micas and quartz. The rhyolite is intruded by a medium-grained diorite to gabbro (Ꝑβ_3), but other stratigraphic relationships including the base and top of the sequence are not known.

The rhyolite exhibits similar major and minor-element geochemical trends to rhyolites and rhyolitic dykes on St Francis Island (NUYTS; Flint, 1986; Rankin and Flint, 1989). Both volcanic suites appear to have I-type within-plate affinities using the minor-element discrimination diagrams of Pearce *et al.* (1984). However, the rhyolite on St Peter Island has some A-type magma affinities including low Al_2O_3 (<13%) and very low CaO (<1.5%).

One sample of rhyolite from St Peter Island was incorporated with rhyolites from St Francis and Hart Islands to produce a Rb-Sr Model 1 isochron age of 1490±12 Ma (IR=0.7056±0.0005; Webb *et al.*, 1986). Webb *et al.* interpreted the rhyolite as equivalent to the Gawler Range Volcanics on the basis of Rb-Sr isochron ages determined for the latter (1510±15 Ma for Ealbara Rhyolite and 1529±33 Ma for Yardea Dacite on YARDEA).

Embayed quartz phenocrysts within porphyritic rhyolite of the Nuyts Volcanics. Field of view 1.5 mm. Photo 38570.



However, an older U-Pb zircon age of 1631±3 Ma obtained for the St Francis Island rhyolites by Rosier (1982) and Cooper *et al.* (1985) was interpreted as the extrusion age for the Gawler Range Volcanics. This age is significantly older than the U-Pb zircon age of 1592±3 Ma obtained for the Yardea Dacite by Fanning *et al.* (1988). To clarify further stratigraphic relationships, U-Pb zircon geochronology was carried out on a rhyolite from St Peter Island (Rankin *et al.*, 1990). The analyses were concordant, indicating a crystallisation age of 1627±2 Ma, indistinguishable from the age of 1631±3 Ma for volcanics on St Francis Island. Thus, volcanism within the Nuyts Archipelago was not only contemporaneous but was also a discrete earlier episode than the Gawler Range Volcanics.

On STREAKY BAY, the only known exposures of Nuyts Volcanics are on St Peter Island. Volcanics also occur further to the southwest on other islands in the Nuyts Archipelago, including St Francis, West and Hart Islands. The limited occurrences infer a broad southwest-northeast distribution, but little is known about their lateral extent, lithological variation or nature of any associated sediments. Correlatives are not known elsewhere on the Gawler Craton.

Leucocratic Granite (Ꝑγ_7)

A small plug of pink to grey, massive, leucocratic and highly porphyritic granite intrudes St Peter Suite granitoids at Cape Beaufort. This granite contains less than 1% mafics and up to 40% feldspar phenocrysts of 10 mm maximum width. A similar granite is exposed to the west at Point Peter (NUYTS; Flint, 1986). The stratigraphic position of this highly porphyritic leucogranite is uncertain, but has been correlated with granitoids comagmatic with the Nuyts Volcanics on St Francis and West Islands (NUYTS; Rankin *et al.*, 1990; Flint *et al.*, 1990). This interpretation contrasts with earlier correlations of the granite with the Hiltaba Suite (Rankin and Flint, 1989).

Gabbro (Ꝑβ_3)

On southern St Peter Island, rhyolite of the Nuyts Volcanics is intruded by massive, medium to coarse-grained plagioclase+pyroxene+hornblende(±quartz) gabbro to diorite plugs and associated dykes (Ꝑβ_3). The gabbro is poorly exposed and often intensely altered by Tertiary weathering events, but is also interpreted to underlie adjacent sandy beaches which contain abundant, dispersed heavy minerals. The gabbro is well exposed on the northern coast of the island. Similar, smaller mafic plugs intruding Lincoln Complex granitoids occur at Ceduna and Point Brown.

Drilling by SADME of circular magnetic-high anomalies at Inkster, Cungena and the Hundred of Ripon intersected plugs of medium-grained, hypidiomorphic hypersthene gabbro intruded into foliated granitoids (Aᵽ-Ᵽγ?; Whitten, 1963). The gabbro comprises plagioclase, pyroxene and olivine, with minor magnetite, pyrite, ilmenite and apatite. Pyroxene ranges from hypersthene and bronzite to augite, with partial replacement by hornblende and biotite. The stratigraphic position of these plugs is uncertain, although they post-date Lincoln Complex granitoids.

Gabbroic plugs on St Peter Island show major and minor-element dissimilarities to the earlier generation Ᵽβ_1 diorite/amphibolite dykes (Rankin and Flint, 1989), implying a different origin for the two mafic suites. Field relationships infer that the basic intrusives (Ᵽβ_3) are younger than Nuyts Volcanics but their stratigraphic relationship with the Gawler Range Volcanics is unknown. Rankin and Flint (1989) favoured the interpretation that mafic intrusion occurred prior to eruption of the Gawler Range Volcanics.

Mylonite

The youngest feature seen in coastal exposures of Lincoln Complex are narrow mylonite zones which crosscut all intrusives. Their widths vary from 5 mm to 1 m. Two major orientations of shear planes are evident: one set trends 130-140° and dips 80° southwest; the other trends 020-040° (vertical); the two orientations are interpreted as a conjugate shear set.

On St Peter Island, the 130° shears are commonly displaced dextrally by the 020° shears, typically forming anastomosing networks. At Point Brown, Watkins and Flint (1983) observed small-scale sinistral displacements along the 130° shears. The granitoids have typically undergone only minor recrystallisation adjacent to these shear planes.

At several localities on St Peter Island, the comagmatic granitoids have been intensely deformed within larger scale shear zones, producing intimately intermixed and banded streaky gneisses. Foliations trend approximately east-west. Within these zones, the gneisses exhibit *en echelon* sigmoidal boudins separated by small-scale shear zones.

Mylonitisation postdates intrusion of the St Peter Suite, but shear zones were not observed in the limited exposures of Nuyts Volcanics on St Peter Island. However, mylonite zones are present within equivalent volcanics on St Francis Island (NUYTS; Flint, 1987) implying an episode of mylonitisation during the very late stages of the Palaeoproterozoic.

Mesoproterozoic

Gawler Range Volcanics

Gawler Range Volcanics extend onto the northeastern corner of STREAKY BAY, and both the 'Older' and 'Younger' volcanic suites of Blissett and Radke (1978) and Blissett *et al.* (1988) occur at Toondulya Bluff. Definitions and type sections for formal units within the Gawler Range Volcanics are recorded in Blissett (1975, 1986); map symbols on STREAKY BAY are consistent with those used by Blissett (1987) and Blissett *et al.* (1988) for equivalent units elsewhere in the Gawler Ranges.

'Older' Volcanic Suite

Unnamed Rhyolite (Ᵽao_1)

This unit does not crop out on STREAKY BAY but was intersected in a water bore near Wattle Hill and is considered to be a subsurface extension of the outcrop of volcanics at Mount Cooper (ELLISTON; Flint, 1989). Though extremely weathered and consisting mostly of red clay-rich fragments, the rhyolite was identified as being porphyritic.

Waganny Dacite (Ᵽao_2)

This unit is the lowermost of the Gawler Range Volcanics exposed in the Toondulya Bluff area, and consists of over 1 000 m of red, black and brown rhyolite to dacite. Phenocrysts of plagioclase and minor orthoclase and quartz (up to 2 mm) are common within an aphanitic to microgranular groundmass of quartz, feldspar, mica and opaques. The phenocrysts are typically euhedral, with common embayment of quartz grains. Plagioclase phenocrysts contain abundant fine-grained inclusions of iron oxide. Minor aggregates of chlorite and sphene may represent pseudomorphed ferromagnesian phenocrysts. Accessory phases include fine-grained zircon and apatite. The unit exhibits a ubiquitous red-brown colour due to amorphous haematite.

The Waganny Dacite appears to be composed predominantly of lava flows with lenticular, interlayered ash-flow and lapilli tuffs which are recognised by the abundance of phenocrysts, dacite clasts, ovoid amygdales and vitric shards. Flow banding is common, and highly contorted in places; these zones may represent surge flows within the volcanic pile and/or minor rhyolite dyke injection. Disrupted tuffaceous layering and circular roll-over features indicate flow of hot tuffaceous layers during deposition.

Minor rhyolitic obsidian is also associated with the phenocryst-rich tuffs, and is typically brecciated, with partially devitrified fragments separated by a matrix of quartz, sericite and chlorite. Field mapping by Jagodzinski (1985) suggested that three phases of extrusives could be distinguished by colour differences within the unit. The base of the Waganny Dacite is not seen in the area, and the top is overlain by the Bittali Rhyolite. The Waganny Dacite was dated by U-Pb zircon isotopic analysis at 1591±3 Ma (Fanning *et al.*, 1988).

Bittali Rhyolite (Ꝑ*ao*$_3$)

This unit overlies the Waganny Dacite and comprises grey, green, brown and cream-coloured rhyolite to rhyodacite which weathers to a pale yellowish brown colour. Phenocrysts of subhedral to anhedral plagioclase, orthoclase and embayed quartz are abundant, with rare small olivine phenocrysts and minor chlorite pseudomorphs after olivine and pyroxene. The Bittali Rhyolite has a maximum thickness of 400 m in the Toondulya Bluff area.

Flow banding is common and is typically highly contorted and brecciated. Jagodzinski (1985) suggested that the complexity of flow banding in this unit at Toondulya Bluff indicates the existence of a lava dome and vent complex in the area, although no other evidence for such a complex has been observed.

'Younger' Volcanic Suite

Eucarro Dacite (Ꝑ*ay*$_2$)

Overlying the Bittali Rhyolite east of Toondulya Bluff is the Eucarro Dacite, although the contact is obscured by scree. The formation contains massive, porphyritic rhyodacite to dacite with minor rhyolite. The phenocrysts consist of abundant euhedral to subhedral quartz, plagioclase and orthoclase, plus minor altered amphibole up to 5 mm wide. The groundmass comprises granophyric quartz, feldspar and muscovite. Rare, small olivine phenocrysts have been reported associated with quartz in one sample (Farrand, 1988), indicating a metastable assemblage. Minor aggregates of mosaic quartz may represent secondary infill of vesicles. Accessory phases include zircon, sphene and iron oxides. Minor brecciated agglomeratic obsidian occurs near the top of the unit.

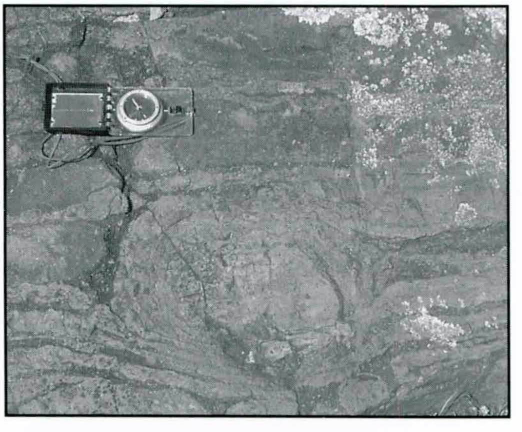
In the Toondulya Bluff area the unit has a minimum thickness of 200 m, although it has a maximum estimated thickness in the Eucarro Hill area of 350 m (YARDEA; Blissett *et al.*, 1988). Flow banding in the unit is commonly disrupted and has been interpreted as representing several individual extrusive flows. The Eucarro Dacite dips gently to the east, although flow banding is occasionally subvertical.

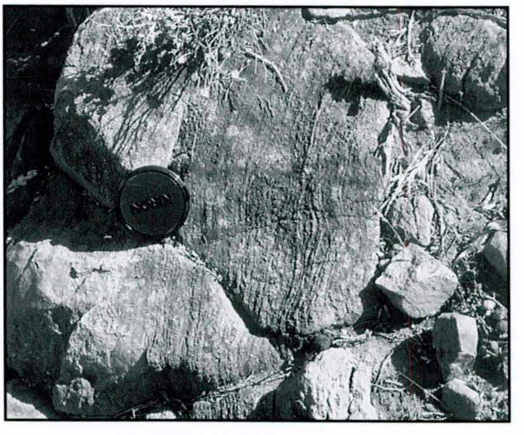
Yardea Dacite (Ꝑ*ay*$_6$)

To the north of the 'Older' Gawler Range Volcanics at Toondulya Bluff, the Yardea Dacite occurs as scattered outcrops intruded locally by Hiltaba Suite granite. The dacite is the most voluminous of the Gawler Range Volcanics lithologies, covering a very large area to the east and north on YARDEA and GAIRDNER, where

Top: Disrupted tuffaceous layering within the Waganny Dacite (Ꝑ*ao*$_2$), Toondulya Bluff. The circular feature may represent a rollover of the layering during flow of the tuff. Photo 38571.

Bottom: Subvertical layering within Eucarro Dacite (Ꝑ*ay*$_2$), Toondulya Bluff. Photo 38572.





it occurs as a low-angle sheet overlying Eucarro Dacite; the top of the unit is unknown. It comprises massive porphyritic dacite and rhyodacite. Phenocrysts of cream, brown and pink plagioclase up to 10 mm across, and minor small orthoclase and clinopyroxene phenocrysts, occur within a fine-grained granophyric matrix of quartz, orthoclase and chlorite. Orthoclase phenocrysts predominate in the Toondulya Bluff area. The groundmass is typically stained by fine-grained, amorphous haematite.

A 2 m thick, finely laminated black dacite containing fresh clinopyroxene and plagioclase occurs at the base of the unit (Jagodzinski, 1985). This is comparable to the black dacite recorded by Giles (1980) at Lake Everard.

U-Pb zircon dating of Yardea Dacite from YARDEA yielded an age of 1592±3 Ma which is indistinguishable from that of the Waganny Dacite from the 'Older' Gawler Range Volcanics (Fanning *et al.*, 1988). Therefore, the entire Gawler Range Volcanics sequence was extruded during a very short period. A pooled regression for all analyses from both the Waganny and Yardea Dacites produced an age of 1592±2 Ma (MSWD=1.9; Fanning *et al.*, 1988). This age is significantly older than the previously derived Rb-Sr dates of ~1530-1500 Ma for the 'Younger' volcanic suite (Compston *et al.*, 1966; Webb *et al.*, 1986).

Hiltaba Suite

The Hiltaba Suite comprises numerous shallow, flat-roofed plugs and plutons of leucogranite, granite, adamellite and granodiorite (Webb *et al.*, 1986). Granitoids of the suite post-date Lincoln Complex intrusives and the Kimban Orogeny, and are massive and undeformed. Cainozoic weathering and sedimentation has produced isolated inselbergs, but granitoids are extensive in the subsurface throughout STREAKY BAY.

Granite (Ᵽγh)

Excellent exposures of pink to red leucocratic granite intruding the Gawler Range Volcanics occur in the Toondulya Bluff area. The granite, part of the 'Hiltaba Granite' of Compston *et al.* (1966), comprises medium to coarse-grained granophyric intergrowths of quartz, microcline, plagioclase and biotite, with minor muscovite and hornblende. Accessory phases include zircon, allanite, sphene, magnetite, fluorite and pyrite. Locally, minor phases of granodiorite and adamellite, as well as pegmatite and aplite veining, are common. Jagodzinski (1985) recognised two main phases of granite in the Toondulya Bluff area: a pink medium-grained granite intruded by minor white microgranite, and red coarse-grained biotite granite.

Exposures of leucocratic granite also occur within interdunal corridors of the Great Victoria Desert, and as highly weathered and kaolinised outcrop and subcrop on the margins of inland gypsiferous lakes. Prominent inselbergs occur at Wallala Hill, Cocunda Rockhole, Parla Peak, and at Wirrulla Hill where the granite intrudes granite gneiss of the Lincoln Complex (Ᵽγ). Granite also occurs extensively in the subsurface as batholiths intruding both Archaean-Palaeoproterozoic gneisses and Palaeoproterozoic Lincoln Complex granitoids.

A Rb-Sr age of 1478±38 Ma was obtained for samples from the Hiltaba-Kokatha area on YARDEA (Webb *et al.*, 1986). However, U-Pb zircon geochronology by Cooper *et al.* (1985) indicated an older intrusive age of 1514 $^{+32}_{-24}$ Ma. The same data have been reinterpreted by Creaser (1989) who suggested an intrusive age of 1585±16 Ma, which is similar to but marginally younger than the extrusive age for the Gawler Range Volcanics.

Granodiorite (Ᵽγh$_1$)

This unit is a medium to coarse-grained, moderately to highly porphyritic grey granodiorite to adamellite. Phenocrysts comprise both quartz and orthoclase, with orthoclase commonly rimmed by albite. The granodiorite occurs on Olive and Franklin Islands, at Goalen Rocks, and on Goat Island where it contains a xenolith of Lincoln Complex hornblende adamellite (Ᵽγ$_3$). Aplite veins and small pegmatite pods are common. The pegmatites contain medium-grained garnet and very coarse-grained feldspar and quartz. The feldspar commonly exhibits a miarolitic texture, indicating a high-level intrusion for the granitoids. Pyrite is abundant with up to 3% visible in most exposures.

Granite (Ᵽγh$_2$)

This is a pink, medium and even-grained granite to adamellite, which intrudes Ᵽγh$_1$ on Goat Island. At the eastern end of the island, the granite grades to a medium to coarse-grained red-pink variety with rare phenocrysts and diorite xenoliths. The contacts between Ᵽγh$_2$ and Ᵽγh$_1$ vary from sharp to gradational, and fine-grained hornblende has concentrated along the contacts. Aplite dykes are common, while pegmatite pods are less common than in Ᵽγh$_1$. Pyrite is abundant.

The granitoids Ᵽγh$_1$ and Ᵽγh$_2$ are correlated with massive biotite granite which crops out west of Point James (NUYTS; Flint, 1986).


1


2


3


4


5


6


7


8

Colour plates (opposite) of typical Proterozoic lithologies for STREAKY BAY.

1. Mylonitic and megacrystic gneiss (Ꝑγ_1), Point Westall. Photo 23695.

2. Coarse-grained pink granite (Ꝑγ_2) displaying a weak biotite foliation, Point Brown. Photo 38566.

3. Granodiorite dykes (Ꝑγ_3) intruding pink even-grained granite (Ꝑγ_2) at Point Brown. Note the concentration of comagmatic diorite enclaves within the granodiorite. Photo 38567.

4. Contact between pink granite (Ꝑγ_2) and grey granodiorite dyke (Ꝑγ_3) at Point Brown. Note magmatic banding on the margin of the dyke. Photo 23698.

5. Diorite dyke (Ꝑβ_1) within pink coarse-grained granite (Ꝑγ_2) at Point Brown. A grey granodiorite hybrid, formed by comagmatic chemical mixing, extensively veins the diorite along the dyke margins. Photo 23702.

6. Beach cobble of porphyritic rhyolite (Nuyts Volcanics) exhibiting tuffaceous layering with flattened fiammé, St Peter Island. Photo 38569.

7. Leucocratic, porphyritic granite (Ꝑγ_7), Cape Beaufort. The granite locally intrudes the St Peter Suite. Photo 39707.

8. Coarse-grained Hiltaba Suite granite (Ꝑγh) in contact with undifferentiated banded gneiss of the Lincoln Complex (Ꝑγ), Wirrulla Hill. Photo 39708.

Cainozoic

Tertiary

Fluviatile sand, silt and clay of both the Middle-Late Eocene Pidinga Formation and Pliocene Garford Formation were deposited in two major palaeochannel systems on STREAKY BAY. These are the Narlaby Palaeochannel and an unnamed palaeochannel system southeast of Streaky Bay. The distribution of sediments and morphology of the Narlaby Palaeochannel have been defined accurately by extensive drilling by Carpentaria Exploration Co. Pty Ltd (1984). The unnamed palaeochannel to the south has been only roughly constrained by CRA Exploration Pty Ltd (1982). Drilling in this area intersected up to 76 m of carbonaceous clay, silt and sand which, although not dated by palynology, is correlated with Eocene and Pliocene sediments found in the Narlaby Palaeochannel. The Pidinga Formation appears to be restricted to the palaeochannels while the Garford Formation, although thickest within the palaeochannels, extends as a widespread veneer of colluvial and alluvial sand, gravel and lacustrine clay over the crystalline basement. Due to the sporadic drilling on STREAKY BAY it is possible that other palaeochannels remain undefined (Fig. 4).

The Narlaby Palaeochannel is an extensive, 170 km long channel system now hidden beneath a veneer of Quaternary lacustrine and aeolian sediments. The palaeochannel extends northwesterly from near Minnipa (YARDEA), fringing the southwestern edge of the Gawler Ranges and coincident with the Corrobinnie Depression of Bourne *et al.* (1974). Near Yarranna Hill, it is joined by several tributaries and abruptly changes course by 90° to the southwest, ending in the vicinity of Smoky Bay (Figs 4-6 and Tectonic Sketch). The base of the channel starts at 80 m above sea level and finishes approximately 100 m below sea level, an average gradient of approximately 1:1 000. Basement to the palaeochannel comprises highly weathered, kaolinised granitoids and gneisses, indicating that at least one major weathering event occurred prior to deposition of the Middle-Late Eocene Pidinga Formation.

Pidinga Formation (Tep)

Drilling of 1 503 rotary holes by Carpentaria Exploration Co. Pty Ltd has defined the geography of the Narlaby Palaeochannel, and established the presence of up to 80 m of Middle to Late Eocene sediments of the Pidinga Formation (Fig. 5). These include variably reduced to oxidised, fine-grained to gravelly, subangular to rounded fluviatile sand and silt with interbeds of grey-brown, cream-grey and black carbonaceous clay. The sand is predominantly quartz, with accessory pyrite (up to 5%), zircon, rutile and iron oxides, with detectable staurolite, andalusite, kyanite and sillimanite. Binks and Hooper (1984) subdivided the unit into a lower sequence of coarse to gravelly grey-white sand with minor clay, and an upper sequence of fine to medium-grained sand and silt with interbedded clay, typically overlain in the western section of the palaeochannel by a black carbonaceous clay. Palynological samples from this clay gave an age of Middle-Late Eocene with the microfossil assemblage dominated by *Nothofagidites* spp. (Harris *in* Carpentaria Exploration Co. Pty Ltd, 1984). The clastic sediments commonly contain humic material and staining. Lignite has been encountered in many drillholes, with a maximum intersection of lignitic sand and minor lignite of 18 m in CEC IR 385. Pidinga Formation lithologies are similar in the unnamed palaeochannel to the south but the sequence is thinner, with a maximum thickness of 55 m (Fig. 5).

Within CEC IR 58 and 59, an horizon at the top of the Pidinga Formation comprises marginal

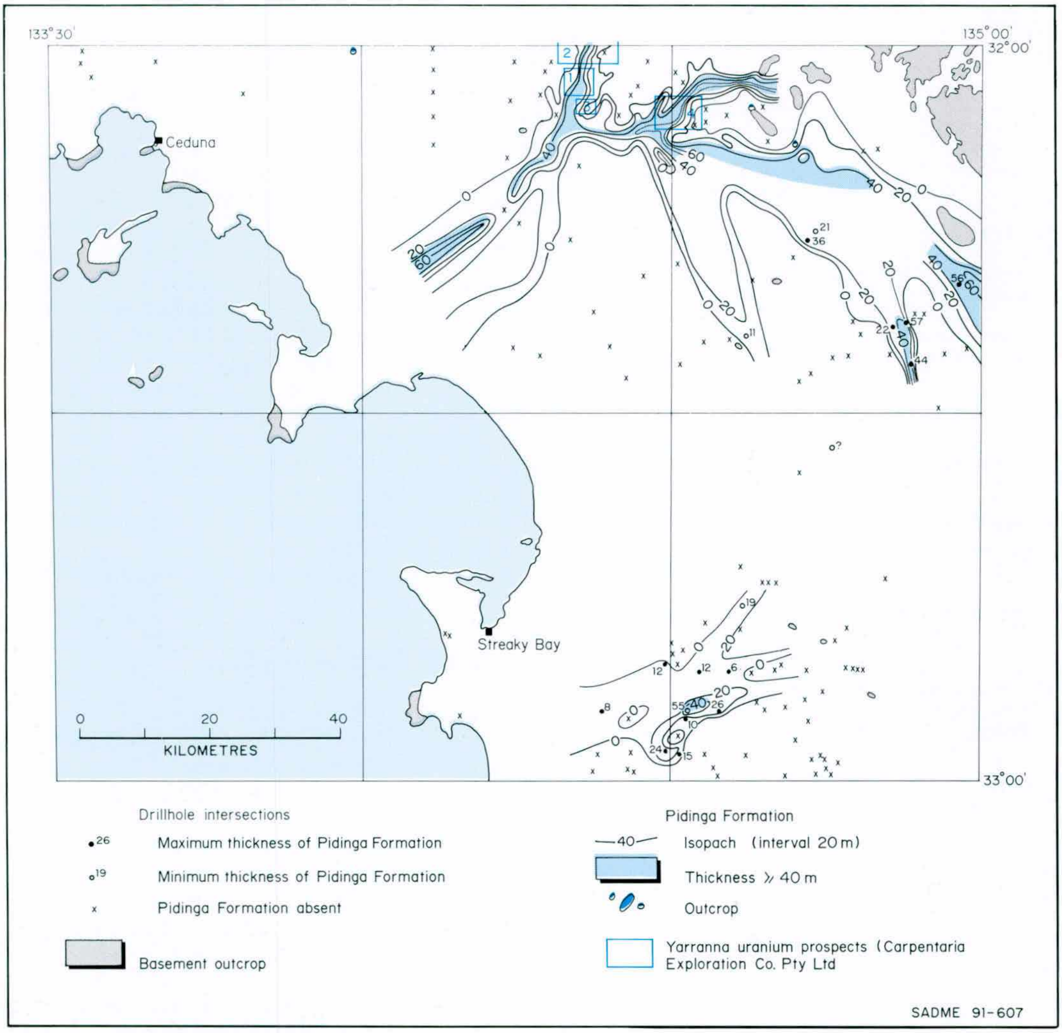


Fig. 5 Isopach map of Pidinga Formation.

marine or estuarine laminated silty sand (Tepb) containing abundant siliceous sponge spicules and minor foraminifera (Farrand, 1988). This horizon, with a known maximum thickness of 12 m, also occurs as isolated outcrops of silty sand and mud, commonly silcreted, on the shores of the inland lakes north of Pinjarra Dam, in the base of a dam northeast of Maltee, and on the foreshore at Ceduna. One outcrop near Pinjarra Dam contains an intertidal intraformational breccia with minor mudflakes contained within a mud-cracked silty sand. The 4 m thick outcrop on the foreshore at Ceduna comprises laminated mudstone overlain by silicified sand containing abundant wood and root fragments, and rare sponge spicules.

The marginal marine horizon is interpreted as a period of widespread transgression of the Eucla Platform at the end of the Eocene, with consequent flooding of the lower reaches of the palaeochannel. Harris (1979a) suggested an upper delta regime which was affected by tidal flooding. Identical relationships are seen within the Yaninee Palaeochannel on KIMBA (Flint and Rankin, 1989) and north of the Ooldea and Barton Ranges, where the maximum marine transgression of the Eucla Platform deposited marginal marine sand (Benbow, 1990). Similar spicule-bearing estuarine sand occurs within the Pidinga Formation at Lake Bring (BARTON; Benbow and Rankin, in prep.). This sand is referred to as the Bring Member (Tepb) of the Pidinga

Formation (Benbow, 1986) and is most likely a lateral equivalent to the Hampton Sandstone of the Eucla Platform (Lowry, 1970; Benbow, 1990 and in prep.).

The provenance of Narlaby Palaeochannel sediments was suggested by Binks and Hooper (1984) to be predominantly weathered Hiltaba Suite granite and Lincoln Complex granitoids and gneisses. They suggested that little detritus was derived from the Gawler Range Volcanics, which were therefore not uplifted to their present position until the late Cainozoic. However, the abundance of detrital embayed quartz grains of probable volcanic origin (Farrand, 1988) suggests that the Gawler Ranges did exist during the Eocene and contributed to sediment supply for the Narlaby Palaeochannel. This is supported by the existence of silcreted conglomeratic sand at Beacon Hill which contains cobbles of quartzite and volcanics (Blissett *et al.*, 1988).

Hos (1978) and Truswell and Harris (1982) recorded a Middle Eocene flora for the Pidinga Formation containing abundant pollen of *Nothofagus* and conifer, with common *Casuarina*, *Beauprea*, *Santalum* and Myrtaceae. The presence of temperate rainforest assemblages, plus oxygen isotope data indicating decreasing ocean temperatures from the Early to Late Eocene (Shackleton and Kennett, 1975), suggest that the Middle-Late Eocene was a period of temperate and wet climate in this region.

The Pidinga Formation is correlated with both the Poelpena Formation of central Eyre Peninsula and the fluviatile Eyre Formation within the Birdsville Basin (Wells and Callen, 1986).

Partly silicified, medium-grained, sponge-spicule-bearing sandstone of the marginal-marine facies of the Pidinga Formation (Tepb). The outcrop lies on the margin of a salt lake 10 km west of Pinjarra Dam. Photo 39709.

Ferricrete (Tfe_1)

Weathering at the top of the Eocene Pidinga Formation has produced limonitic staining within the sand and localised laterite development. At Ceduna, the formation is overprinted by a ferruginous mottling and patchily developed laterite, which has been overprinted subsequently by silcrete (Tsi) and a second ferricrete (Tfe_2).

A laterite horizon is also patchily developed at the top of the Pidinga Formation in the western zone of the Narlaby Palaeochannel, particularly in the Yarranna uranium prospect (Binks and Hooper, 1984). This laterite is overlain by Pliocene sediments, which brackets the laterite age between latest Eocene and Pliocene.

Garford Formation (Tg)

Unconformably overlying the Pidinga Formation and extending onto the surrounding basement is the Garford Formation. It comprises oxidised, fine to coarse-grained, angular to well rounded silty sand, with colours ranging from orange to pale yellow, red and purple. Khaki to grey-green and brown silty clay, black carbonaceous clay, and silt with minor lenses of lignite are also common. Lignitic beds have been dated palynologically by Harris (*in* Binks and Hooper, 1984) as Early Pliocene. Truswell and

Clay of the Garford Formation (Tg) capped by pisolitic ferricrete (Tfe_2); on margin of salt lake 10 km northwest of Pinjarra Dam. Photo 39710.

Harris (1982) recorded a temperate open vegetation for the Early Pliocene of Eyre Peninsula, including Chenopodiaceae, *Casuarina*, Cperaceae and *Eucalyptus*. Rainforest vegetation is indicated by the presence of *Dacrydium*, *Podocarpus*, *Phyllocladus* and rare *Nothofagus*.

The Garford Formation varies in thickness from a veneer of less than 1 m overlying crystalline basement to a maximum of 100 m within the Narlaby Palaeochannel (Fig. 6). Within the palaeochannel area, the Garford Formation has been deposited both as lacustrine clay and as fluviatile sand within channels incised into the underlying Pidinga Formation. This has resulted in the development of isolated mesas of Pidinga Formation surrounded laterally and overlain by Garford Formation (Binks and Hooper, 1984).

The Garford Formation on STREAKY BAY is generally known only from drilling, being covered by a thin (<20 m) but extensive veneer of Quaternary lacustrine and aeolian sediments. However, several minor exposures of ferricreted silty sand and green clay occur on the shores of inland lakes north of Pinjarra Dam and south of Ilkina Hill.

Since only a relatively small percentage of drillhole samples have been dated palynologically, identification of the formation has been based on lithological interpretation in outcrop and in drill cuttings. The interpreted boundary between Garford Formation and Pidinga Formation is therefore approximate only.

Sediment supplied to the Garford Formation is a mixture of weathered basement and reworked Pidinga Formation channel sediments.

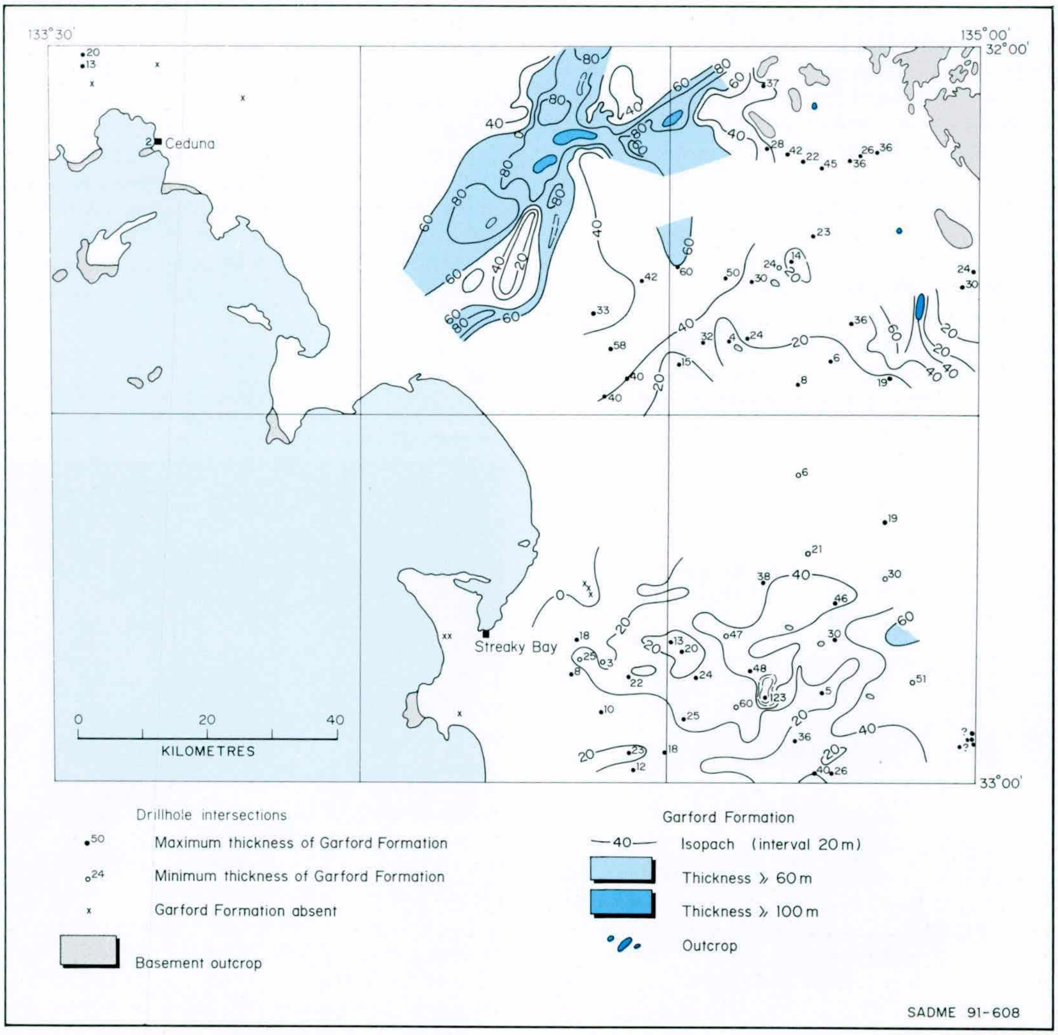


Fig. 6 Isopach map of Garford Formation.

Rejuvenation of the Narlaby Palaeochannel during the Pliocene suggests a high rainfall environment. This is supported by isotopic and palynological data from the Southern Ocean which indicate a warming of the ocean during the Early Pliocene and corresponding high precipitation in Australia following a cold period at the end of the Miocene (Galloway and Kemp, 1981; Truswell and Harris, 1982).

Silcrete (Tsi)

Chalcedonic silcrete and quartz overgrowths have developed in the Pidinga and Garford Formations. The majority of exposures for both formations are silicified and/or ferruginised.

Silcrete overprints Tfe_1 ferricrete within the Pidinga Formation at Ceduna. Within the Narlaby Palaeochannel, the Garford Formation contains multiple silcrete horizons near the top of the sequence (for example in CEC IR 1172, 402, 403). Silcrete development was related to groundwater composition and fluctuations, thus the multiple silcrete horizons are due most likely to changes in the watertable either during or after deposition of the Garford Formation.

Outcrops of silicified Tertiary sand on STREAKY BAY have been worked by Aborigines to produce stone implements.

Ferricrete (Tfe_2)

A second episode of laterite and ferricrete development is evident at Ceduna as ferricreted and silicified Pidinga Formation capped by a nodular, mottled ferricrete. The ferricrete was possibly developed within a thin veneer of Garford Formation sand.

This second ferricrete is also interpreted to occur within Garford Formation sediments on the shore of a lake 10 km northwest of Pinjarra Dam. The ferricrete profile is approximately 1 m thick and varies from a massive to botryoidal limonite-goethite laterite to a pisolitic ferruginous laterite. A ferricrete horizon ($?Tfe_2$) was also intersected in CEC IR 61 within Pliocene sediments.

Ilkina Formation (Czi)

Two exposures of this unit have been recognised on STREAKY BAY — on lacustrine shorelines 9 km east-northeast of Weetara Tank and southwest of Ilkina Dam near Weetara Tank. The latter outcrop comprises 3 m of laminated yellowish brown sand and pale green, gypsiferous clay, with coarse-grained (up to 60 mm) crystalline gypsum. The base of the Ilkina Formation is not exposed but is seen to disconformably overlie Garford Formation in outcrops 6-7 km east on YARDEA (Blissett *et al.*, 1988).

The unit represents a sequence of Late Pliocene saline lacustrine sediments.

Quaternary

Bridgewater Formation (Qpb)

The Bridgewater Formation comprises fine to medium-grained calcareous aeolianites and minor calcareous silt. The unit occurs extensively across STREAKY BAY, lying unconformably over both Archaean-Mesoproterozoic crystalline basement and Tertiary sediments. The thickness varies considerably, ranging from less than 1 m inland to over 90 m in local coastal sections.

These aeolianites are part of a widespread Middle to Late Pleistocene coastal and inland dune system. Coastal dunes were deposited in a high-energy littoral and aeolian environment, forming irregular hummocky dunes with tabular foresets up to 10 m thick (Belperio, 1988a). Inland, thinner veneers of the calcarenites exhibit oolitic grain morphology, indicating reworking of coastal sediments as they were blown inland. Inland dune forms become longitudinal as the continental wind pattern dominates over coastal winds.

During Bridgewater Formation deposition, episodes of sediment accumulation were interspersed with erosion and arid pedogenesis, producing multiple horizons of sheet, nodular and massive calcretes with carbonate soils (Qca).

Firman (1967a,b) divided the Bridgewater Formation into upper (Qpbu) and lower (Qpbl) members on the basis of differing calcrete morphologies throughout the sequence. The lower member is commonly capped by a thick (up to 3 m) horizon of massive, sheet and nodular calcrete which in places is extremely hard. This has been referred to as the Ripon Calcrete (Firman, 1967a,b). The upper member typically contains less-indurated nodular and biscuity calcrete horizons with soft carbonate soil, referred to as the Bakara Soil by Firman (1964, 1967a). However, the identification of specific calcrete events in the field is difficult on a regional basis, as the calcrete horizons typically coalesce and overprint each other. As a result, the distinction between upper and lower members is difficult where exposures are poor, and is complicated by the similarity in lithologies.

Several differences do exist, however, and can be used for local identification. The lower member typically contains red to fawn silt horizons, while the upper member more commonly contains fawn-white silt and abundant calcreted pupal cases of the weevil *Leptopius duponti*. Both members commonly contain shells of the land snail *Bothriembryon barretti* (Ludbrook, 1973,1984) and abundant rhizomorphs.

The Bridgewater Formation is interpreted to have been deposited in coastal backshore dune environments during fluctuating interglacial sea-level stands (Schwebel, 1978). Milnes and Ludbrook (1986) examined the bioclastic fragments that comprise the aeolianites and found evidence of reworked fragments dating back to the Miocene. On this evidence they suggested that accumulation of the lower member could have begun prior to the Middle Pleistocene. This is supported by the recognition in Spencer Gulf of an Early Pleistocene shoreline complex, predating a shoreline complex of the lower member which was deposited in the penultimate interglacial period (*c.*200 000 yrs; Murray-Wallace *et al.*, 1988b). In the Tourville Bay area, the lower member is constrained between the Late Pleistocene Glanville Formation and Early Pleistocene Hindmarsh Clay.

Glanville Formation (Qpg)

This unit comprises richly fossiliferous shelly sand deposited within subtidal-intertidal lagoonal and restricted beach environments. The lagoonal sand flats also contain low (<3 m) foredune ridges of medium to coarse-grained shelly sand. All lithologies are calcreted at the top.

Ludbrook (1984) documented and illustrated the abundant fauna within the Glanville Formation. The species include *Anadara trapezia*, *Katelysia scalarina*, *Euplica bidentata* and the foraminifera *Marginopora vertebralis*. Both *Marginopora vertebralis* and *Anadara trapezia*, which characterise the fauna of the formation, are extinct locally but still survive in warmer waters in northern Australia (Ludbrook, 1978).

The Glanville Formation overlies the lower member of the Bridgewater Formation and is, in part, a lateral facies equivalent of aeolianites in the upper member. Deposition occurred during an interglacial period when the sea level was approximately 2 m above present level (Belperio, 1988a). Belperio *et al.* (1984) determined the age of an equivalent unit (Mambray Formation) from upper Spencer Gulf. Amino acid racemisation on *Anadara trapezia* yielded an age of $110\,000^{+19\,000}_{-17\,000}$ years, whereas thermoluminescence dating yielded age estimates of 96 000±24 000 and 90 000±15 000 years. This event is more reliably dated at 125 000±10 000 years by uranium-series disequilibrium geochronology (Stearns, 1984). The Glanville Formation throughout the west coast area has been correlated with the type Glanville Formation at Port Adelaide by aminostratigraphy (Murray-Wallace *et al.*, 1988a).

Wiabuna Formation (Qpo)

Included within the Wiabuna Formation are calcareous seif dunes, minor siliceous seif dunes and thin veneers of fine calcareous silt. The unit overlies the Bridgewater Formation, onlaps crystalline basement, and is disconformably overlain by thin veneers of Holocene quartz sand (Moornaba Sand).

Firman (1974) stated that the Wiabuna Formation overlies upper Bridgewater Formation in the type area 19 km east of Penong. On STREAKY BAY however, the calcreted dunes and silt spreads overlie the lower member, suggesting that the Wiabuna Formation may be, at least in part, an inland equivalent of the upper member of the Bridgewater Formation. Fine calcareous sand from coastal dunes of the Bridgewater Formation were reworked and blown inland, resulting in the grains having an oolitic texture. The predominant continental wind regime then worked the sand and silt into aeolian seif dunes. These dunes in part mimic the seif dunes of the inland facies of the lower Bridgewater Formation.

The sand contains soft, biscuity calcrete and carbonate soil horizons.

Alluvial and Colluvial Sediments (Qpp, Qp_1)

Alluvial reddish brown and yellow-brown gravelly and sandy clay, silt and sand (Pooraka Formation equivalent, Qpp) were shed from topographic basement highs (notably the Gawler Ranges) during the Pleistocene. These sediments form an apron of variable thickness around and within the Gawler Ranges.

Thin reddish brown, orange-brown and yellow-brown colluvial sand and gravelly clay (Qp_1) surround weathered basement highs south of the Gawler Ranges. This unit may include unrecognised Hindmarsh Clay equivalents. Both the alluvial and colluvial sediments contain soft biscuity calcrete and carbonate soils.

Moornaba Sand (Qho)

A veneer of Holocene orange to pale yellow quartz sand extends over the calcreted Pleistocene inland dunes within the Great Victoria Desert. The sand has a variable thickness of 2-10 m, and is stabilised by thick vegetation cover. The dunes intertongue with orange Qs sand in playa depressions, and in some areas (e.g. northwestern extremity of the lakes) appears to encroach upon and overlie Qs sand and lacustrine sediments. The seif-dune pattern of Moornaba Sand mimics the underlying Pleistocene dunes, suggesting a continuation of the northwest to westerly continental wind regime from the Pleistocene to the Holocene.

The Moornaba Sand thins to the south where the dunes become isolated. Although the southward thinning of the sand suggests that the present sand limit coincides roughly with the limit of deposition, comparison of mapping by Botham (1969) and old black and white aerial plates with the latest mapping indicates that continued agricultural clearing has allowed remobilisation of sand near the southern margin, and subsequent denudation of the underlying calcreted dunes.

Quartz sand remobilised from the Moornaba Sand dunes by both natural and agricultural sources forms thin mobile spreads and minor irregular dunes (Qhs) over the older Pleistocene units.

St Kilda Formation (Qhk_{1-4})

Coastal Holocene sediments of STREAKY BAY were deposited dominantly in small, sheltered bays away from major influence of the open ocean. Development of these coastal sedimentary complexes have been examined in detail by Belperio (1984, 1985, 1988b), Belperio *et al.* (1983, 1988) and Gostin *et al.* (1988).

The St Kilda Formation represents a progradational sequence of subtidal to supratidal coastal sediments deposited typically within sheltered bays and along coastlines. This unit has been subdivided by Belperio (1988b) into several different facies. Qhk_1 represents subtidal sand flats of skeletal carbonate and quartz sand, with skeletal carbonate being produced in the shallower water sea-grass meadows. Shallow sandflats are well developed on the eastern and northeastern side of St Peter Island, south of Denial Bay, surrounding Eyre and Little Eyre Islands, and north of Streaky Bay at Point Gibson.

The sandflats accrete to the low tide mark where they grade into the intertidal mangrove swamps and mud and the high intertidal samphire marshes (Qhk_2). These zones are subject to inundation during the semi-diurnal high tides which reach up to 2 m during spring tides.

Further inland are the supratidal mudflats (Qhk_3) comprising carbonate and gypsum mud, clay, silt and sand, with veneers of cyanobacterial algae. These mudflats are above the normal high-tide range but are inundated occasionally by extra high tides associated with storm surges. The supratidal flats form a thin veneer over the Pleistocene intertidal flats with calcreted fossiliferous Glanville Formation typically less than 0.5 m below the surface. Calcreted, stranded beach ridges associated with the Glanville Formation appear as low rises 1 m above the surface of the supratidal flats.

The skeletal carbonate and minor quartz sand of the subtidal and intertidal zones is reworked into the modern beach ridges and aeolian barrier dunes of the Semaphore Sand (Qhk_4). An excellent record of prograding foredunes can be observed in the Semaphore Sand ridges on Eyre Island, at The Spit (Streaky Bay), and to the north of Mount Younghusband on St Peter Island.

Aeolian dune forms at Wallanippie have migrated along the coast, isolating the supratidal flats from most tidal inundation although washouts of Semaphore Sand inland on the mudflats suggest that rare storm surges occasionally do breach the low dunes.

Two kilometres to the east, in Gascoine Bay, small supratidal flats have been isolated completely from tidal activity by migrating dunes. The flats have consequently undergone a change in sedimentation, with gypsum and carbonate mud deposited due to marine groundwater seepage through the coastal dunes to produce lacustrine deposits (Ql).

The Semaphore Sand also forms prominent dunes along the less-protected sections of coastline on STREAKY BAY, commonly capping the Bridgewater Formation coastal cliffs and occasionally crystalline basement outcrop. Within these zones the aeolian sand also includes reworked carbonate grains from the Bridgewater Formation. Sand dunes and spreads have migrated inland in several localities, in particular at Yanerslie Hill, subsequent to destabilisation due to denudation of vegetation.

The age of the coastal Holocene sediments has been determined at Tourville Bay (NUYTS) by Belperio *et al.* (1988), with infill of the bay by subtidal *Posidonia* sea-grass meadows beginning at 6 800 years BP. Progradation and accumulation of sand were extremely rapid and the embayment had largely infilled by about 5 000 years BP. This implies an accumulation of 7 m thickness of sediment over 100 km^2 in only 2 000 years after the Holocene stillstand (Belperio *et al.*, 1988; Gostin *et al.*, 1988).

Gypsiferous Lacustrine Sediments (Ql, Qg)

South of Streaky Bay and southwest of Toondulya Bluff are two major inland lake complexes. Lake sediments southwest of the Gawler Ranges lie unconformably on Tertiary sediments and weathered crystalline basement.

The lakes coincide with the Corrobinnie Depression.

Lake sediments (Ql) comprise fine silt and clay, with evaporitic gypsum, halite and aragonite. Lakes in the Streaky Bay area and the northern lakes have developed under different hydrogeological conditions.

Lakes of the Streaky Bay area lie within a depression on the Bridgewater Formation, with the lake surface only 0.5 m above mean sea level. The lakes are therefore surrounded by a good aquifer which allows sea-water seepage during summer and autumn when the groundwater level in the lakes is at its lowest. This is accompanied by limited meteoric water percolating through the dunes. Evaporation during summer and autumn has resulted in aragonite precipitating as boxwork carbonates, followed by gypsum, then halite. In winter and spring, meteoric waters infill the lakes, dissolving the halite and some gypsum.

Gypsum is precipitated as both selenite (grains >2 mm) and gypsarenite (sand-sized grains), with subaerial exposure producing a thin capping of gypsite (flour gypsum). During summer, the subaerially exposed gypsite and gypsarenite are eroded from the lake surfaces and accreted as lunettes and spreads of gypsum (Qg), typically on eastern shorelines.

To the east of the modern lakes are scattered depressions at ~50 m above mean sea level which contain gypsite, aragonite and clay reworked by both aeolian and pedogenic processes. These sediments are stabilised by an established vegetation cover. Other minor gypsiferous coastal salinas occur north of Point De Mole.

A large complex of inland continental playa lakes coincides with the Corrobinnie Depression and extends northwesterly from near Mount Sturt on YARDEA to the Pinjarra Dam area. These lakes have formed under a different hydrogeological regime to the coastal salinas, with the playas commonly underlain by aquiclude Tertiary clay of either sedimentary origin or of kaolinitic weathered profiles. The lakes derive their water from meteoric seepage through surrounding dunes. The sediments comprise clay and silt with precipitated gypsum, halite and minor aragonite. Gypsum is typically gypsarenite and gypsite; selenite is rare. With a high amount of subaerial exposure, gypsum has been worked into dunes and gypsum clay spreads. As there is very little rainfall in the modern climate, Warren (1982) has suggested that these lakes are most likely of early Holocene-Late Pleistocene age. The continental gypsiferous salinas are equivalent to Yamba Formation and the coastal salinas are equivalent to Le Hunte Formation of Firman (1974).

Sand (Qs)

The continental lakes are generally surrounded by fine to medium-grained brown and yellowish brown quartz sand (Qs). The sand intertongues with the aeolian gypsum deposits, commonly either overlying the gypsum as a thin (<2 m) cap or being overlain by gypsite dunes. The relationships suggest complex, episodic mobilisation of both quartz and gypsum sediments with the aeolian quartz sand representing a facies equivalent to the lacustrine sediments.

Playa Lake Clay (Qhl)

Small continental lake depressions containing only rare or no evaporitic sediments occur in several localities on STREAKY BAY. Interdunal depressions north and east of Ceduna contain claypans comprising red-brown silt and clay.

STRUCTURE AND TECTONIC DEVELOPMENT

STREAKY BAY straddles three major tectonic subdivisions of the Gawler Craton — the Coulta, Nuyts and Gawler Ranges Subdomains.

The Coulta Subdomain consists largely of Late Archaean to earliest Proterozoic granitoids, gneisses, amphibolites and metasediments of the Sleaford Complex (Parker *et al.*, 1988) with small isolated Palaeo- and Mesoproterozoic intrusives. It is poorly exposed on western Eyre Peninsula but is interpreted from geophysical and limited drillhole data to extend onto STREAKY BAY.

Palaeoproterozoic sediments in the Cleve Subdomain are interpreted to have been sourced from exposed Sleaford Complex. Palaeoproterozoic metasediments have not been recognised on STREAKY BAY, although it is possible that weathered schist, correlated tentatively with the Sleaford Complex, may be or include unrecognised Hutchison Group. The nearest known outcrop of Hutchison Group is adjacent to Peter Pan Dam on YARDEA.

Interpreted Archaean-Palaeoproterozoic rocks in the northwest of STREAKY BAY may represent Mulgathing Complex of the Wilgena Subdomain of the northwest Gawler Craton rather than the Coulta Subdomain. However, the boundary between those two subdomains is masked by the Nuyts Subdomain, which is characterised by extensive granitoids of the Lincoln Complex and Mesoproterozoic Hiltaba Suite.

Lincoln Complex granitoids represent a complex suite(s) of plutons and batholiths intruded at probable middle-crustal levels. The difference in intensity of foliation between $\text{P}\gamma_1$ and the comagmatic granitoids of the St Peter Suite suggests a time gap between the two phases of plutonism, allowing an intense deformational fabric to overprint $\text{P}\gamma_1$. However, similarity in orientation of the fabric in $\text{P}\gamma_1$, the fabric in the comagmatic granitoids and the orientation of granodiorite and diorite dykes (all ~350°-010°) suggest that either the hiatus between intrusive pulses was small or similar stress regimes operated over a broad time interval. Foliation within the granitoids was possibly formed, in part, whilst the magma was cooling and crystallising, suggesting that the granitoids may have been injected during a deformational phase of the Kimban Orogeny.

The comagmatic phases of the St Peter Suite exhibit identical textures and contact relationships to similar rocks from diorite terrains elsewhere in the world, including composite intrusions at Mount Desert Island, Maine (Taylor *et al.*, 1980), Channel Island, UK (Blake *et al.*, 1965; Topley *et al.*, 1982) and Stewart Island, NZ (Cook, 1988). The development of disrupted diorite dykes and agmatitic diorite/granitoid zones within the plutons on STREAKY BAY are the result of both mixing of magmas, forming a geochemically composite lithology, and physical mingling of immiscible mafic and felsic magmas. Intrusion and crystallisation of the St Peter Suite occurred at 1620±4 Ma (Flint *et al.*, 1990).

The tectonic setting for intrusion of the Lincoln Complex in the Nuyts Subdomain is uncertain, although geochemical evidence (Berry and Flint, 1988; Rankin and Flint, 1989) suggests that the suite is similar to I-type granitoids of White and Chappell (1983), with affinities to the Caledonian-style I-type post-kinematic orogenic granitoids of Pitcher (1982).

Broadly synchronous, but probably marginally younger than intrusion of the St Peter Suite, is a subaerial sequence of rhyolites, porphyritic rhyolites and rhyolitic agglomerates of the Nuyts Volcanics. Volcanism has been dated by U-Pb zircon geochronology at 1627±2 Ma (Rankin *et al.*, 1990), whereas on NUYTS the age of volcanism is indistinguishable at 1631±3 Ma (Rosier, 1982; Cooper *et al.*, 1985) and was accompanied by granitic plutonism. Intruding the Nuyts Volcanics are dioritic to gabbroic dykes and plugs ($\text{P}\beta_3$), collectively indicating a waning phase of felsic volcanism and associated mafic and acid plutonism during the latter stage of the Palaeoproterozoic. The mechanism for the volcano-plutonic episode was possible localised remelting of an already variably depleted lower crust in response to uplift associated with post-orogenic tensional relaxation of the crust.

Deformational fabrics within both the St Peter Suite and Nuyts Volcanics are interpreted as resulting from a waning phase of the Kimban Orogeny, and with the mylonite shear zones indicating renewed uplift and erosion immediately prior to extrusion of the Gawler Range Volcanics.

The felsic Gawler Range Volcanics formed from relatively hot, dry magmas, and represent anorogenic, intracratonic volcanism. Giles (1988) considered the volcanics to be sourced by partial melting of a refractory mafic-intermediate granulitic sialic crust, triggered by diapiric mantle underplating. Despite the great thickness of volcanics, extrusion occurred over a very short period of approximately 2 million years, which may account for the apparent absence of interbedded sediments.

The volcanics and surrounding basement were intruded by large volumes of anorogenic granites of the Hiltaba Suite. Magmatism for this event is interpreted as broadly contemporaneous with the Gawler Range Volcanics but U-Pb geochronology from the eastern Gawler Craton suggests that the granites were emplaced slightly later at about 1585 Ma (Fanning *et al.*, 1988). This marks the last known major phase of either tectonic or magmatic activity in this region of the Gawler Craton prior to cratonisation.

The predominantly northeast-southwest, northwest-southeast and north-south faults interpreted from regional magnetic data most likely had an episodic history of activation and reactivation through to at least the Mesoproterozoic.

From Mesoproterozoic to the Cainozoic, the area was relatively stable with only regional uplift and erosion. There is no evidence of Neoproterozoic, Cambrian or Permian tectonism as evident in marginal regions of the Gawler Craton, and Mesozoic tectonics seen to the south in the Polda Basin which were triggered by rifting of Antarctica and Australia have no apparent expression on STREAKY BAY.

During the Tertiary, block faulting along ?reactivated Precambrian fault systems controlled the location of palaeodrainage channels, particularly the Narlaby Palaeochannel. The Gawler Ranges and exposed inselbergs and hills of Hiltaba Suite were the main source of detritus for the Tertiary sediments, but continued erosion of Archaean to Neoproterozoic rocks also contributed.

Tectonism during the Quaternary has been particularly subdued. Sea-level changes have resulted in considerable accumulation of coastal sediments and have been responsible for marine transgressions and regressions. The Middle to Late Pleistocene Bridgewater Formation was deposited during fluctuating sea levels across the continental shelf (Cook *et al.*, 1977), with sea level reaching a high during deposition of the intertidal Glanville Formation. Sea levels continued to fluctuate until they reached their present level approximately 6 000 years ago.

ECONOMIC GEOLOGY

The STREAKY BAY area has been explored for numerous commodities since the early 1900s. The mineral and hydrogeological potential of the Murat Bay and Streaky Bay areas was assessed by Hiern (1970, 1980) and Thomson and Horn (1981). A regional assessment of the mineral potential of the Gawler Craton by Parker (1990) included the STREAKY BAY area.

Metallic Exploration Index Series maps at 1:500 000 scale covering STREAKY BAY, NUYTS and ELLISTON summarise uranium and mineral occurrences, geological and drilling projects, and geochemical and geophysical surveys (SADME, 1979).

The following is a discussion of all known subeconomic mineral occurrences and exploration programs as at January 1990. The data are summarised in Table 1, and locations of tenement areas are shown on Figure 7.

Uranium

Exploration for uranium has been conducted on STREAKY BAY since 1968, with two main targets:

- primary mineralisation within basement granites
- secondary mineralisation within Tertiary fluviatile sediments.

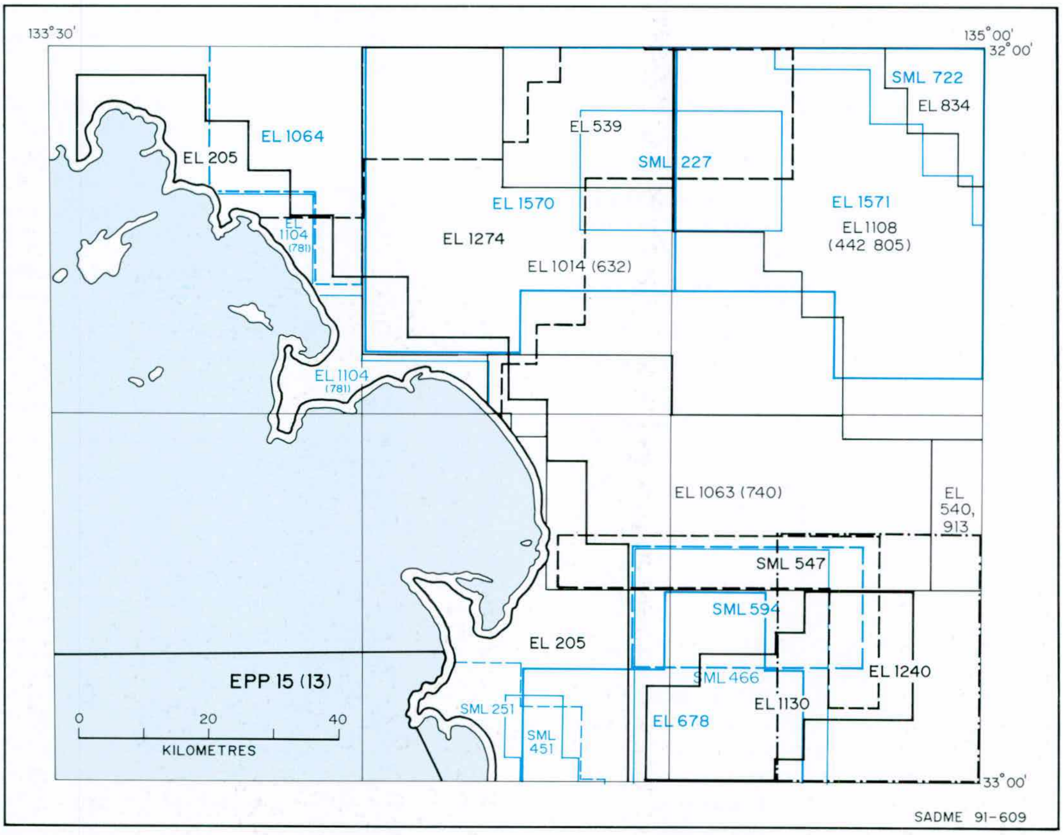


Fig. 7 Mineral and petroleum exploration licences, STREAKY BAY.

Table 1 Summary data for company exploration on STREAKY BAY (see Fig. 7 for locations).

Period	Tenement*	Company	SADME Envelope	Target	Methods	Geochemistry	Comments
1966-69	OEL 38 EPP 15	Outback Oil Co. NL, Shell Development (Aust.) Pty Ltd	648	Oil	h	—	Offshore section of Polda Basin outlined on ELLISTON. No further work on STREAKY BAY.
1968	SML 227	ACI Technical Centre Pty Ltd	1067	U	i,n,r	—	—
1969	251	Elcor Chemical Corporation	1057	Gypsum	q	$CaSO_4$	Reserves of gypsum calculated for lakes near Streaky Bay.
1970	116?	Peninsula Prospecting and Mining Pty Ltd	1274	—	—	—	Engineering study of production of sulphur and soda ash from gypsum.
1970	451	Murumba Minerals NL	1455	Gypsum	—	$CaSO_4$	Discussion of mining feasibility. Estimated 30 Mt at 90%.
1970-71	466	Central Pacific Minerals NL	1506	U — primary deposits in basement and secondary in Tertiary sediments	i,s	Cu,U	Best values 240 ppb U 8.6 ppm Cu
1971	547	Endeavour Oil Co. NL	1609	U — Tertiary sediment-hosted	s	U	Best value 25 ppb U
1970-71	EPP 13	Target Exploration Pty Ltd and Bridge Oil	1726	Oil	v	—	Three offshore seismic surveys of the Polda Basin and environs outlined basin morphology, but no drilling was undertaken.
1972	SML 722	CRA Exploration Pty Ltd	2127	U — primary in basement granites and secondary in Tertiary sediments	c,d,e, m_1,s	Cu,Eu,Ga,Ge,Pb, Sc,Th,U,Y,Zn	'Hiltaba' area. Best values 18 ppm U 106 ppm Zn 20 ppm Pb 10 ppm Cu
1972	594	Endeavour Oil Co. NL	1706	U — Tertiary sediment-hosted	d,o,q	U	Best values 40 ppb U_3O_8 (water sample) 13 ppm U_3O_8 (drillhole EOC R 2).
1975-81	EPP 15	Outback Oil NL, Australian Occidental Pty Ltd	3988	Oil	km,lm,v	—	STREAKY BAY section of seismic, gravity and magnetic survey indicated shallow basement.
1976	EL 205	Australian Anglo American Ventures Ltd	2654	Heavy-mineral beach sand	c,d,e,g,r	—	Identified three minor raised beaches — not prospective for heavy minerals. Best modern deposit sample 10.9% heavy minerals.

1979-83	781 912 (539) 913 (540) 1014 (632) 1063 (740) 1064 1108 (442, 805)	Carpentaria Exploration Pty Ltd, Mount Isa Mines Ltd	3420 3715 3882 4010	U — Tertiary sediment-hosted: associatedwith redox fronts Heavy-mineral sand Base metals (Narlaby Palaeochannel)	b,c,d,g, h,i,k,m, m_1,q,r, s,v	Ag,As,Au, Ce,Co,Cu, La,Mo,Pb, Ra,Sn,Th, U,V,W,Zn	560 holes drilled on STREAKY BAY delineated low-grade U mineralisation. Yarranna 1 prospect — 100-200 ppm U_3O_8 over 3 km^2.
1980-82	EL 678	CRA Exploration Pty Ltd	4049	U — Tertiary sandstone-hosted Coal	b,c,o,q,s	Au,Cu,K, Pb,Sn,Ta, Th,U,W,Zn	Delineated two palaeochannels. Best values 10 ppm U 30 ppm W 20 ppm Ta Best kaolin intersection 20 m (80 RBRM 15).
1981-83	834	Stockdale Prospecting Ltd	4267 4747	Diamonds	a,e,h	Al,Cu,Fe,Zn, Nb,Ni,Ti,Y,Zr	21 stream-sediment samples collected on STREAKY BAY. Results discouraging.
1983-84	1130 1240	Oilmin NL, Western Nuclear Australia Ltd, Petromin NL, Transoil NL	5146 5450	Base metals Kaolin	i,q	Ag,Au,Bi,Co, Cu,Mo,Ni,Pb,Zn	Best intersection: 48 m of kaolinitic clay in WOPT KC 2. Best values 2 ppm Ag (WOPT YD 2) 105 ppm Cu (WOPT YD 1) 105 ppm Zn (WOPT YD 2)
1985-86	1274	Carpentaria Exploration Pty Ltd, Mount Isa Mines Ltd	6089	U — Tertiary sandstone-hosted Kaolin	q,u	U	Intersected Tertiary sediments—no mineralisation encountered.
1989	1570 1571	CRA Exploration Pty Ltd	8153	Heavy minerals	o,q	—	50 holes drilled (total 1 213 m). No opaque heavy minerals found; trace zircon recorded.

*SML	Special Mining Lease (to 2/7/72)	i	Interpretation of aeromagnetic surveys	p	Diamond drilling and sampling
EL	Exploration Licence (3/7/72-1/1/90)	j	Airborne radiometric survey	q	Rotary-percussion drilling and sampling
a	Photogeology	j_1	Airborne EM survey	r	Auger drilling and sampling
a_1	ERTS/LANDSAT interpretation	k	Ground magnetic survey	s	Groundwater sampling
b	Geological reconnaissance	km	Marine magnetic survey	t	Palynology
c	Geological mapping	l	Ground gravity survey	u	Thermoluminescence
d	Rock sampling	lm	Marine magnetic survey	v	Seismic survey
e	Stream-sediment sampling	m	Ground resistivity survey	w	Costeaning and sampling
f	Soil sampling	m_1	SIROTEM survey	x	Engineering analysis
g	Petrological studies	n	Ground radiometric survey	y	Coal analysis
h	Aeromagnetic survey	o	Geophysical borehole logging		

ACI Technical Centre Pty Ltd (1969) conducted ground scintillometer traverses near Pimbaacla in an attempt to delineate a radiometric anomaly recorded during the 1958 BMR airborne radiometric survey. No uranium anomaly was located.

Central Pacific Minerals NL (1971) explored for uranium within both basement granites and Tertiary sediments near Streaky Bay. Water bore samples were analysed and found to have an average value of 5 ppb U_3O_8 and a best value of 240 ppb. Rock-chip sampling of granite outcrops and kaolinised granite failed to find any mineralisation.

Endeavour Oil Co. NL (1971) examined water bore samples in the Streaky Bay-Poochera area, and conducted exploration near Medlingie Hill (Endeavour Oil Co. NL, 1972). Drilling did not reveal any mineralisation but indicated the existence of a buried palaeochannel with a suitable environment for uranium mineralisation associated with redox fronts between oxidised Pliocene sand (Garford Formation) and underlying Eocene carbonaceous sand and clay (Pidinga Formation).

CRA Exploration Pty Ltd (1972) explored for primary uranium mineralisation within Hiltaba Suite granite in the southwestern Gawler Craton. Exploration included an airborne radiometric survey, water-bore analyses and rock-chip sampling. The results were discouraging and consequently the Hiltaba Suite granite was considered unprospective and the chance of secondary mineralisation occurring in surrounding Tertiary sediments was also considered slight.

Extensive exploration was conducted by Carpentaria Exploration Co. Pty Ltd (1979, 1980, 1981a,b, 1984) for uranium mineralisation within Tertiary sediments. A total of 1 503 rotary holes, including 560 on STREAKY BAY, were drilled within the Narlaby Palaeochannel. The program delineated four prospects (Yarranna 1-4) of subeconomic uranium mineralisation within clay and sand of the Pidinga Formation (Fig. 5). Mineralisation is associated with redox fronts near the contact of the carbonaceous, variably reduced to oxidised Pidinga Formation and the overlying oxidised sand of the Pliocene Garford Formation. Mineralisation appears to be better developed in areas where the Pidinga Formation occurs as erosional remnants or 'mesas' surrounded by Garford Formation (Binks and Hooper, 1984).

The best prospect (Yarranna 1) covers an area of 3 km^2 of low-grade mineralisation (average 100 to 200 ppm U_3O_8). Best values recorded over 1 m intervals were 3 550 ppm in clay and 1 275 ppm U_3O_8 in sand. Minor mineralisation also occurs in the southwestern extension of the palaeochannel in the Nunjikompita area. Binks and Hooper (1984) concluded that high acidity of groundwater in the Yarranna prospects inhibited deposition of economic grades of mineralisation.

Five holes were drilled (for kaolin) by Carpentaria Exploration Co. Pty Ltd on behalf of Mount Isa Mines Ltd (1986) near Dunn Hill but no uranium mineralisation was detected.

CRA Exploration Pty Ltd (1982) explored for similar Tertiary sandstone-hosted uranium mineralisation in the region east of Streaky Bay. Water bores were sampled and 19 rotary holes drilled and geophysically logged. Drilling broadly defined a wide topographic basement depression with two possible southwest-trending palaeochannels containing carbonaceous sand of the Pidinga Formation. The best values were 10 ppm U_3O_8 in holes CRAE 80 RBRM 11, 14 and 19.

Base Metals

Central Pacific Minerals NL (1971) analysed water bore samples for copper in conjunction with uranium exploration. The regional background value was found to be low, averaging about 0.05 ppm copper; the best value was 8.6 ppm copper. The lease was considered unfavourable for either uranium or copper, and was relinquished.

Base-metal assays of 36 rock-chip samples of Hiltaba Suite granite were determined by CRA Exploration Pty Ltd (1972) in conjunction with uranium. The best values recorded were 20 ppm lead, 10 ppm copper and 106 ppm zinc.

Base-metal assays were determined routinely by Carpentaria Exploration Co. Pty Ltd (1979, 1980, 1981a,b, 1984) during uranium exploration within the Narlaby Palaeochannel. Base-metal values were typically low, with the best value being 410 ppm zinc.

CRA Exploration Pty Ltd (1982) assayed for base metals in the region east of Streaky Bay but no significant anomalies were found; the best values were 145 ppm copper, 50 ppm lead and 95 ppm zinc.

Samples of Hiltaba Suite granite taken from Kattata Mine south of Poochera were submitted for geochemical analysis by Barnes and Flint (1984); the best base-metal values were 4 ppm copper, 4 ppm lead and 20 ppm zinc.

Oilmin NL (1984, 1985) explored for base metals and kaolin in the Karcultaby and Yandra areas. Exploration included ground geophysical traverses and drilling of six percussion holes. No significant values were recorded.

Gold

The first record of gold on STREAKY BAY was by Jack (1912) who reported on a gold-bearing quartz specimen found east of Wurkagie Well, 31 km southwest of Poochera. No other information is available.

Records for the Kattata Mine, 18 km south of Poochera, are incomplete and there is no recorded mineral production, but Barnes and Flint (1984) surmised that the original target was gold. Analysis by Barnes and Flint of Hiltaba Suite granite from the mine returned a best value of 0.05 ppm gold.

Gold analyses were determined by Carpentaria Exploration Co. Pty Ltd (1980, 1981a,b, 1984) for samples from the Narlaby Palaeochannel collected during the uranium exploration program; the best value recorded was 0.2 ppm gold.

CRA Exploration Pty Ltd (1982) analysed Tertiary sediments for placer concentrations of gold, tin, tungsten and tantalum. Concentrations were typically below detection limits, with the best values being 30 ppm tungsten in CRAE 80 RBRM 16 and 20 ppm tantalum in CRAE 80 RBRM 11 and 15.

Gold analyses of drillhole samples by Oilmin NL (1984, 1985) provided no results above detection limits.

Although no mineralisation was discovered by Carpentaria Exploration Co. Pty Ltd within the Narlaby Palaeochannel, this area remains prospective for placer gold deposits. The palaeochannel drained a large area of both Gawler Range Volcanics and Hiltaba Suite granite, and has a complex channel morphology which could provide sites for gold accumulation. The potential for volcanogenic gold mineralisation within the Gawler Range Volcanics, and/or epithermal/hydrothermal mineralisation associated with Hiltaba Suite granite in the southern Gawler Ranges, has not been evaluated. It is worth noting that Hiltaba Suite granite has been mined for gold in the Tarcoola Goldfield (TARCOOLA; Daly, 1985), with a production of over 129 kg. Over 2t of gold have also been produced from quartz-vein mineralisation (hosted by the Tarcoola Formation) believed to be associated with Hiltaba Suite granite in the Tarcoola area (Daly *et al.*, 1990). The Olympic Dam orebody, which contains substantial quantities of gold, occurs in brecciated Hiltaba Suite granite and was possibly formed during the same tectono-thermal event that produced the Gawler Range Volcanics and Hiltaba Suite.

Heavy-Mineral Sand

A reconnaissance heavy-mineral-sand survey of the west coast of Eyre Peninsula by Hillwood (1960) included beaches on STREAKY BAY. Most were considered unfavourable for heavy-mineral accumulation, with only minor deposits of garnet and pyroxene being found along the beach between Smoky Bay and Streaky Bay, and at Point Bell.

Australian Anglo American Ventures Ltd (1976) conducted a reconnaissance survey of the west coast area, sampling modern and raised Pleistocene beaches and rock-chip sampling potential basement source rocks. Three raised beaches were recognised but contained little or no heavy-mineral accumulations. The best modern beach accumulations at Point Brown and Slade Point were of patchy thickness and distribution, averaging 0.5 m thick with 0.76% heavy minerals. The best sample contained 10.9% heavy minerals, which included epidote, garnet, magnetite, hornblende, zircon, rutile and ilmenite.

The coastline was re-examined for heavy-mineral deposits by Morris (1977, 1980) who summarised previous work and sampled both beach sand and potential source rocks.

Samples of Tertiary sand from the Narlaby Palaeochannel were analysed for heavy-mineral content by Carpentaria Exploration Co. Pty Ltd (1979, 1980, 1981a,b, 1984). Although results were discouraging since the best sample contained only 0.39 wt% heavy minerals, this program concentrated only on fluviatile channel sand. The Narlaby Palaeochannel was again explored for heavy-mineral sand in 1989 by CRA Exploration Pty Ltd (1989). Fifty drillholes (total 1 213 m) were drilled to an average depth of 30 m within Garford and Pidinga Formation sediments. No opaque heavy minerals were found and only minor traces of zircon were recorded from several holes. A more prospective target may be the concealed mouth of the palaeochannel, possibly near Smoky Bay, where heavy-mineral sand could have been concentrated and reworked in a higher energy beach environment.

Accumulations of heavy-mineral sand, sourced from weathered diorite ($\text{Ⓟ}\beta_3$), occur within beach sand at several localities on St Peter Island. One sample examined by Rankin and Flint (1989) assayed 26.8% heavy-minerals, comprising ilmenite (50-55%), magnetite (30-40%), and pyroxene, garnet, monazite, spinel, tourmaline and Mn-andalusite (8-10%).

Kaolin

Extensive uranium exploration by Central Pacific Minerals NL (1971), Endeavour Oil Co. NL (1971, 1972) and Carpentaria Exploration Co. Pty Ltd (1984) indicated that crystalline basement to the Tertiary palaeochannels was heavily weathered, with development of thick kaolinitic profiles.

CRA Exploration Pty Ltd (1982) included kaolin as a target commodity during their exploration program in the region east of Streaky Bay. The weathered basement profile in the Moorkitabie area was found to vary from 1 to 22 m thick, comprising medium to coarse-grained kaolinitic clay. Relatively clean kaolin was intersected in CRAE 80 RBRM 16 (16-26 m), 15 (18-38 m) and 6 (16-18 m). Samples tested indicate that the kaolin is suitable for commercial brick production but is not of sufficient quality for paper coating or filling.

Oilmin NL (1984, 1985) explored for kaolin in conjunction with base-metal exploration near Karcultaby. Kaolin intersections in drillholes were up to 48 m thick (WOPT KC 2), with a brightness of 86-91% and a -2 micron yield of 23-40%. Although viscosity tests of the kaolin indicated that it was unsuitable for paper coating, this deposit shows potential in both size and quality for development.

Kaolin of paper-coating quality was also sought by Carpentaria Exploration Co. Pty Ltd (1986) during uranium exploration for Mount Isa Mines Ltd (1986). Five rotary holes were drilled in the Dunn Hill area, with three holes intersecting up to 12 m of kaolin, but tests indicated that the kaolin viscosity was too high for paper coating.

Gypsum

The first reference to gypsum as a potential economic commodity on STREAKY BAY was made by Jack (1912), who commented on the presence of gypsum dunes, and the use of gypsum for plaster and as a topsoil dressing for agriculture.

Mapping south of Streaky Bay by Segnit and Dridan (1938) indicated the presence of gypsiferous sandy marl in a low-lying swamp 1 km south of Toorna Well.

Forbes (1960) examined gypsum deposits within lakes southeast of Streaky Bay. Gypsum occurs as grey sand (gypsarenite) with a capping of flour gypsum (gypsite) which is typically blown into elongate and luniform dunes on the eastern margins of lakes. Drilling of 78 boreholes indicated a probable 30 Mt of gypsum sand grading +90% purity, with the major impurity (6%) being calcite. Reserves within the dunes were estimated at 528 400 t. Gypsum sand occurs over 14 km^2 to an average depth of 1.8 m.

An occurrence of gypsum within a coastal lake at Point De Mole was also examined by Forbes (1960), who recorded minor gypsum with a purity of up to 82%.

The grey colour of gypsum and calcite impurities in the Streaky Bay deposits was considered as deleterious. Beneficiation by washing, investigated by Ashton and Moffitt (1961), yielded 97.3% recovery of 94.2% pure gypsum on test samples from Departmental drillholes. Hosking and Moffitt (1960) estimated that 5 640 L of water were required to beneficiate 1 t of gypsum concentrate. Possible mining methods, transport costings and on-site washing were discussed by Mansfield (1961). Five different mining procedures were proposed, using either dragline or suction dredge.

Elcor Australia Pty Ltd (1970) drilled 32 holes within the southern half of the lakes near Streaky Bay (see also Elcor Chemical Corp., 1969). Reserves were calculated at 15.4 Mt of 91.7% gypsum, 29.2 Mt at 88.58%, and 30.1 Mt at 84.47%. The presence of calcite, high watertable and grey colour of the gypsum again discouraged development.

Murumba Minerals NL (1970) also examined the economics of mining, transport and treatment of the deposit, concluding that the gypsum was unsuitable for all major uses unless washed. This was considered a major problem due to the shortage of suitable fresh groundwater and low rainfall in the Streaky Bay region. Aminco and Associates Pty Ltd (1984) conducted limited reconnaissance and photogeological interpretation over the same area. A detailed report by Bay Gypsum Pty Ltd (1985) on the logistics and economics of mining the deposit included submissions to State Government supporting the development of a deep-sea port at Sceale Bay for bulk transport.

The continued interest in the Streaky Bay gypsum deposits prompted a re-evaluation of resources by Olliver *et al.* (1985). This report contains a detailed summary of all SADME and company investigations, as well as revised estimates of proven and probable resources for Lake Purdilla and Lake Toorna (see Table 2).

Petroleum

In the early 1900s, the presence of black mud associated with the saline and gypsiferous lake deposits southeast of Streaky Bay was commonly thought to indicate a potential hydrocarbon source.

Table 2 Gypsum reserves and grades for lakes near Streaky Bay (adapted from tables 5 and 6 of Olliver *et al.*, 1985).

Lacustrine Gypsum	**Lake Purdillo**		**Lake Toorna**		**Dune Gypsarenite**	**Lake Purdillo**	**Lake Toorna**
	Proven	Probable	Proven	Probable			
No. of drillholes	98	11.3	15	17	No. of samples	6	2
Area (km^2)	15	22.7	2.6	9.6	Volume (m^3 x10^6)	0.4	0.13
Av. thickness (m)	2.51	2.28	2.08	1.94			
Tonnes (x10^6)	44	48	6	10	Tonnes (x10^6)	0.5	0.17
Grade (% gypsum)	88.4	87.8	85.9	85.9	Grade (% gypsum)	96.4	96.4
Insolubles (%)	0.5	0.6	0.53	0.5	Insolubles (%)	0.4	0.06
$CaCO_3$ (%)	8.30	8.70	10.64	10.66	$CaCO_3$ (%)	1.45	2.80
NaCl (%)	2.08	2.13	2.34	2.31	NaCl (%)	1.35	0.65

This notion was refuted by Wade (1915) and Ward (1944).

During 1966-69, Outback Oil Co. NL and Shell Development (Aust.) Pty Ltd (1966) conducted a regional aeromagnetic survey over OEL 38 (later EPP 15) during a program of evaluation of the potential for offshore oil deposits in South Australia. No further work was conducted.

During oil exploration over the offshore extension of the Polda Basin in EPP 13, Target Exploration Pty Ltd (1971) and Bridge Oil ran 58 km of seismic refraction survey on the Collinson 1:100 000 map sheet southwest of Ceduna. The survey indicated that basement in this area is shallow, with little likelihood of oil-bearing sediments and structures.

Investigations offshore on EPP 15 were again conducted by Australian Occidental Pty Ltd (1981) and Outback Oil NL, who profiled 125 km of seismic on STREAKY BAY; shallow basement with no potential for oil was indicated.

Coal

Carbonaceous and lignitic sand and clay within Tertiary fluviatile sediments were intersected by Central Pacific Minerals NL (1971) and Endeavour Oil Co. NL (1971, 1972) during uranium exploration drilling in the region east of Streaky Bay.

Drilling by Carpentaria Exploration Co. Pty Ltd (1980, 1981a,b, 1984) also revealed extensive carbonaceous sediments and some lignite in the Eocene Pidinga Formation within the Narlaby Palaeochannel. Within CEC IR 385, 18 m of clayey sand and coal beds of various thicknesses were intersected.

CRA Exploration Pty Ltd (1982) also explored for lignite in conjunction with uranium exploration on southeastern STREAKY BAY. Five holes intersected carbonaceous sand within the Pidinga Formation in a northeast-southwest trending palaeochannel. No major lignite deposits were found.

Diamonds

Stockdale Prospecting Ltd (1982, 1984) explored for diamonds over most of the Gawler Ranges, including the Toondulya Bluff area on STREAKY BAY (EL 834). Reconnaissance heavy-mineral sampling and geochemical analysis proved negative and the lease was relinquished. Nevertheless, there is still potential within concealed basement rocks for small kimberlite/lamprophyre dykes or pipes.

Lime Sand

Johns (1968) conducted a reconnaissance survey of unconsolidated lime sand deposits on Eyre Peninsula between Coffin Bay and Fowlers Bay. Thin spreads and low dunes of limited extent were reported. Dune sand was sampled at Sceale Bay; analyses are shown in Table 3.

The deposits at Sceale Bay, Port Le Hunte and Fowlers Bay were considered by Flint (1986) to contain large reserves but of an inferior grade to those at Coffin Bay which are used as a source of flux for BHP steelworks at Whyalla. A port with bulk handling facilities near the deposits was also lacking, making the sand subeconomic due to transportation costs.

Salt

Although no salt has been extracted from the gypsiferous lakes southeast of Streaky Bay, Thompson and Horn (1981) considered that there is potential for salt production by solar evaporation of brine on the lake beds similar to the operations at Lake MacDonnell (South Australian State Planning Authority, 1974).

Aggregate

At a request from the South Australian Railways, investigations were conducted by SADME to establish a source of 62 000 m^3 of hard nodular calcrete for use as rail ballast on the Ceduna-Kevin railway (Shackleton and Robinson, 1964). A total of 20 diamond-drillholes over a potential deposit in section 25, Hundred of Moule, indicated an estimated reserve of 250 000 m^3 of hard, compact nodular calcrete in a sheet averaging 1 m thick over an area of 366 by 488 m, with an average overburden of 0.6-1 m. The deposit was subsequently quarried by Quarry Industries. Six further drillholes confirmed an additional 92 000 m^3 of calcrete suitable for rail ballast, with 42 000 m^3 of overburden (Russ, 1967a).

Mineral leases were applied for by the South Australian Railways in 1967 over a possible second deposit of calcrete for rail ballast. Eight diamond-drillholes indicated that the calcrete was too thin to exploit (Russ, 1967b).

Hard nodular calcrete, extracted from numerous borrow pits, was used as road aggregate during construction of the Flinders and Eyre Highways. Shallow seismic refraction surveys were conducted by SADME (Dixon and Nelson, 1972) to determine a scale of seismic velocity relative to the rippability of the calcrete by bulldozer. The data were re-examined by McPharlin (1974) and Nelson (1972). A summary of the final results of the excavation work and a correlation to the seismic refraction surveys was presented by Selby (1976).

Thompson and Horn (1981) reported that suitable sources of aggregate for road and railway construction, and cement production, could be obtained from limited basement outcrops and widespread calcrete in the Streaky Bay area. Calcrete was suggested as the most suitable material for local Council works and road maintenance.

Granite

Hiltaba Suite granite outcrops on Eyre Peninsula are being investigated following an Australia-wide interest in building stones during 1988 and 1989; outcrops on STREAKY BAY may have potential as building and ornamental stones. Hiltaba Suite granites are being quarried for building stone (dimension stone) at Calca (ELLISTON) and Minnipa (YARDEA).

Groundwater

Pastoral properties on STREAKY BAY rely on drains, boreholes and windmill-equipped wells to augment the low annual rainfall. Groundwater is obtained from aquifers within both the Bridgewater Formation and underlying Tertiary sediments, with limited recharge from local winter

Table 3 Analyses of lime sand from Sceale Bay, collected by Johns (1968).

	Sceale Bay Average %			Coffin Bay* Average %	Blast furnace specifications** %
	SB1-3	SB4-6	SB7-9		
$CaCO_3$	86.2	86.5	86.5	90.7	89.2 min
$MgCO_3$	6.3	6.3	6.3	5.8	8.4 max
SiO_2	4.1	4.0	4.0	0.5	5.0 max
Al_2O_3	0.7	0.45	0.4		1.0 max
Fe	0.15	0.15	0.10		
P	0.05	0.04	0.04		
SO_3	0.46	0.46	0.46		

SB Bulk samples
* Johns (1963)
** Johns (1961)

rainfall. Groundwater on STREAKY BAY is generally saline and, in the Narlaby Palaeochannel area, is also acidic (Binks and Hooper, 1984).

Supplies of groundwater on STREAKY BAY were first examined by Jack (1912) during geological investigations along the west coast of Eyre Peninsula. He noted that most wells in the Wurkagee-Wittera area intersected a layer of freshwater 80 mm to approximately 1 m thick overlying saline water, and named the area the Wurkagee-Wittera Freshwater Area. Other minor occurrences were noted on or near the flanks of buried granite inselbergs, with the freshwater lens occurring on top of the regional saline watertable.

Wurkagee-Wittera and surrounding areas were investigated by Segnit (1933) in an attempt to establish a permanent supply of potable water for the township of Streaky Bay. The Wurkagee-Wittera Freshwater Area was recognised as part of a larger basin which was named the Robinson (Freshwater) Basin. This 500+ km^2 basin within Cainozoic sediments is not defined as a tectonic or sedimentary entity, but is based on the 1 000 mg/L groundwater isohaline (Shepherd, 1978).

Pumping tests from a trench southeast of Streaky Bay proved that freshwater could be extracted for the township without disturbing the underlying saline layer. A water reserve was established over the area by E&WS Department, and two trenches were supplying water by 1965 (Steel, 1966b). Water salinity initially varied from 870 mg/L in winter to 1 400 mg/L in late summer.

Problems with increasing demand and salinities prompted further investigations by SADME (Steel, 1966a,b). Six wells drilled east of the reserve intersected limited freshwater of variable quality in a zone of localised recharge. This work was summarised by Painter (1970a,b) and the Robinson Freshwater Basin was summarised by Shepherd (1967).

Five more holes were drilled to improve water supply; two were sited within the reserve and three 3 km to the east within a potential freshwater basin (Herraman and Barnett, 1979). The area east of the reserve proved unsuitable due to low supplies. A further 21 observation wells were drilled by E&WS, and a total of 50 wells were monitored in the Maryvale-Yandra area by Herraman and Barnett (1979) in an attempt to delineate additional supplies. Extraction records for the Robinson Freshwater Basin water reserves are given below (after Herraman and Barnett, 1979):

1949-56	< 100 ML/yr
1957-69	100-200 ML/yr
1970-76	200-300 ML/yr

Barnett (1980, 1982) provided a summary of SADME investigations within the Robinson Freshwater Basin. E&WS Department (1983) reviewed all aspects of the Robinson Freshwater Basin and estimated the total exploitable resource at 320 ML/year, which equalled the then extraction rate. The continuing high usage and projected increased demand implies that Streaky Bay township will experience problems with groundwater, especially during prolonged dry periods.

Hydrogeological investigations were conducted by SADME to establish water supplies for use during construction of the Eyre Highway (Shepherd, 1961, 1963).

REFERENCES

ACI Technical Centre Pty Ltd, 1969. SML 227, Pimbaacla. Progress report, 19 August 1968 to 31 December 1968. *South Australia. Department of Mines and Energy. Open file Envelope,* 1067 (unpublished).

Ambrose, G.J. and Kinsman, J.E., 1973. Reconnaissance mapping of the eastern boundary of the Bridgewater Formation on Eyre Peninsula, South Australia. *South Australia. Department of Mines and Energy. Report Book,* 73/123.

Aminco and Associates Pty Ltd, 1984. EL 1246, Pundilla Well. Quarterly report for the period ended 2 November 1984. *South Australia. Department of Mines and Energy. Open file Envelope,* 5867 (unpublished).

Ashton, B.E. and Moffitt, P.B., 1961. Beneficiation of Streaky Bay gypsum. *Mining Review, Adelaide,* 112:75-78.

Australian Anglo American Ventures Ltd, 1976. South Australian beach sands project, EL 205, final report. *South Australia. Department of Mines and Energy. Open file Envelope,* 2654 (unpublished).

Australian Occidental Pty Ltd, 1981. Marine seismic survey permit EPPSA 15. Final report. *South Australia. Department of Mines and Energy. Open file Envelope,* 3988 (unpublished).

Barnes, L.C. and Flint, R.B., 1984. Kattata Mine, section 16, Hundred Moorkitabie, Eyre Peninsula. *South Australia. Department of Mines and Energy. Report Book,* 84/4.

Barnett, S.R., 1980. Eyre Peninsula groundwater survey — bibliography of hydrogeology and engineering geology reports. *South Australia. Department of Mines and Energy. Report Book,* 80/92.

Barnett, S.R., 1982. Eyre Peninsula groundwater investigation. Progress report to January 1982. *South Australia. Department of Mines and Energy. Report Book,* 82/63.

Bay Gypsum Pty Ltd, 1985. Streaky Bay gypsum deposit: proposal to mine and feasibility study. *South Australia. Department of Mines and Energy. Open file Envelope,* 6236 (unpublished).

Belperio, A.P., 1984. Coastal sedimentation in the vicinity of the Port Wakefield Proof Range. *South Australia. Department of Mines and Energy. Report Book,* 84/77.

Belperio, A.P., 1985. The Quaternary stratigraphy between St Kilda and Outer Harbour with special reference to the excavation conditions in Barker Inlet. *South Australia. Department of Mines and Energy. Report Book,* 85/2.

Belperio, A.P., 1988a. Fowlers Bay rotary drilling report and revision of the Quaternary geology around Fowlers Bay. *South Australia. Department of Mines and Energy. Report Book,* 88/93.

Belperio, A.P., 1988b. Vincent map sheet. *South Australia. Geological Survey. Geological Atlas 1:50 000 Series,* sheet 6528-1.

Belperio, A.P., Gostin, V.A., Cann, J.H. and Murray-Wallace, C.V., 1988. Sediment-organism zonation and the evolution of Holocene tidal sequences in Southern Australia. *In:* de Boer, P.L., Van Gelder, A. and Nio, S.D. (Eds), *Tide-influenced sedimentary environments and facies.* D. Reidel Publishing Co., Dordrecht, Holland.

Belperio, A.P., Hails, J.R. and Gostin, V.A., 1983. A review of Holocene sea levels in South Australia. *In:* Hopley, D. (Ed.), Australian sea levels in the last 15 000 years: a review. *James Cook University of North Queensland. Department of Geography. Monograph Series. Occasional Paper,* 3:48-53.

Belperio, A.P., Smith, B.W., Polach, H.A., Nittrouer, C.A., DeMaster, D.J., Prescott, J.R., Hails, J.R. and Gostin, V.A., 1984. Chronological studies of the Quaternary marine sediments of northern Spencer Gulf, South Australia. *Marine Geology,* 61:265-296.

Benbow, M.C., 1986. TALLARINGA map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SH53-5.

Benbow, M.C., 1990. Tertiary coastal dunes of the Eucla Basin, Australia. *Geomorphology,* 3:9-29.

Benbow, M.C. (in prep.). Tertiary stratigraphy of the eastern Eucla Basin region. *University of Adelaide. Ph.D. thesis* (unpublished).

Benbow, M.C. and Rankin, L.R. (in prep.). BARTON map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SH53-9.

Berndt, R.F., 1985. Traditional aboriginies. *In:* Twidale, C.R., Taylor, M.J. and Davies, M. (Eds), Natural history of Eyre Peninsula. *Royal Society of South Australia. Occasional Publications,* 4:127-138.

Berry, R.F. and Flint, R.B., 1988. Magmatic banding within Proterozoic granodiorite dykes near Streaky Bay, South Australia. *Royal Society of South Australia. Transactions,* 112:63-73.

Binks, P.J. and Hooper, G.J., 1984. Uranium in Tertiary palaeochannels 'West Coast Area', South Australia. *Australasian Institute of Mining and Metallurgy. Proceedings,* 289:271-275.

Blake, D.H., Elwell, R.W.D., Gibson, I.L., Skelhorn, R.R. and Walker, G.P.L., 1965. Some relationships resulting from the intimate association of acid and basic magmas. *Geological Society of London. Quarterly Journal,* 121:31-49.

Blissett, A.H., 1975. Rock units in the Gawler Range Volcanics, South Australia. *South Australia. Geological Survey. Quarterly Geological Notes,* 55:2-14.

Blissett, A.H., 1980. CHILDARA map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SH53-14.

Blissett, A.H., 1985. GAIRDNER map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SH53-15.

Blissett, A.H., 1986. Subdivision of the Gawler Range Volcanics in the Gawler Ranges. *South Australia. Geological Survey. Quarterly Geological Notes,* 97:2-11.

Blissett, A.H., 1987. Geological setting of the Gawler Range Volcanics. *South Australia. Geological Survey. Special Map,* 1:500 000.

Blissett, A.H., Parker, A.J. and Crooks, A.F., 1988. YARDEA map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SJ53-3.

Blissett, A.H. and Radke, F., 1979. The Gawler Range Volcanics — a regional review. *In:* Parker, A.J. (Compiler), *Symposium on the Gawler Craton, Adelaide, 1979. Extended abstracts.* Geological Society of Australia (SA Division), pp.45-48.

BMR, 1986. STREAKY BAY total aeromagnetic intensity map. *Bureau of Mineral Resources, Geology and Geophysics, Australia. Geophysical Atlas 1:250 000 Series,* sheet SI53-2.

Botham, S.J., 1969. STREAKY BAY map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SI53-2.

Bourne, J.A., Twidale, C.R. and Smith, D.M., 1974. The Corrobinnie Depression, Eyre Peninsula, South Australia. *Royal Society of South Australia. Transactions,* 98:139-152.

Brown, H.Y.L., 1885. Report on geological character of country passed over from Port Augusta to Eucla. *South Australia. Parliamentary Papers,* 45.

Carpentaria Exploration Co. Pty Ltd, 1979. EL 442, Ilkina. Report for quarter ended 7/10/79. *South Australia. Department of Mines and Energy. Open file Envelope,* 3420 (unpublished).

Carpentaria Exploration Co. Pty Ltd, 1980. EL 632, Nunjikompita. Progress reports from 19/8/80 to 19/11/80. *South Australia. Department of Mines and Energy. Open file Envelope,* 3882 (unpublished).

Carpentaria Exploration Co. Pty Ltd, 1981a. EL 442, Ilkina. Progress reports from 7/4/79 to 7/1/81. *South Australia. Department of Mines and Energy. Open file Envelope,* 3420 (unpublished).

Carpentaria Exploration Co. Pty Ltd, 1981b. EL 539, Yarranna Hill. Progress reports from 24/1/80 to July 1981. *South Australia. Department of Mines and Energy. Open file Envelope,* 3715 (unpublished).

Carpentaria Exploration Co. Pty Ltd, 1984. Narlaby Palaeochannel area. Progress and final reports from 5/1/81 to 31/12/83. *South Australia. Department of Mines and Energy. Open file Envelope,* 4010 (unpublished).

Carpentaria Exploration Co. Pty Ltd, 1986. EL 1274, Dunn Hill. Progress report for quarter ended 18/8/86. *South Australia. Department of Mines and Energy. Open file Envelope,* 6089 (unpublished).

Central Pacific Minerals NL, 1971. Progress and final reports on SML 466, Robinson, SA. *South Australia. Department of Mines and Energy. Open file Envelope,* 1506 (unpublished).

Cockburn, R., 1984. *What's in a name?: nomenclature of South Australia.* Ferguson Publications, Adelaide.

Compagnie Generale de Geophysique, 1975. Marine geophysical survey of the continental margins of Australia, Gulf of Papua and the Bismark Sea, 1970-1973: operations and techniques. *Bureau of Mineral Resources, Geology and Geophysics, Australia. Record,* 1975/151.

Compston, W., Crawford, A.R. and Bofinger, V.M., 1966. A radiometric estimate of the duration of sedimentation in the Adelaide Geosyncline, South Australia. *Geological Society of Australia. Journal,* 13:229-276.

Cook, N.D.J., 1988. Diorites and associated rocks in the Anglem Complex at The Neck, northeastern Stewart Island, New Zealand: an example of magma mingling. *Lithos,* 21:247-262.

Cook, P.J., Colwel, J.B., Firman, J.B., Lindsay, J.M., Schwebel, D.A. and von der Borch, C.C., 1977. The late Cainozoic sequence of southeast South Australia and Pleistocene sea-level changes. *BMR Journal of Australian Geology and Geophysics,* 2:81-88.

Cooper, J.A., Mortimer, G.E., Rosier, C.M. and Uppill, R.K., 1985. Gawler Range magmatism — further isotopic age data. *Australian Journal of Earth Sciences,* 32:115-124.

CRA Exploration Pty Ltd, 1972. SML 722, Hiltaba, SA. Progress and final reports. *South Australia. Department of Mines and Energy. Open file Envelope,* 2127 (unpublished).

CRA Exploration Pty Ltd, 1982. EL 678, Streaky Bay, SA. Progress and final reports from 28/10/80 to 30/3/82. *South Australia. Department of Mines and Energy. Open file Envelope,* 4049 (unpublished).

CRA Exploration Pty Ltd, 1989. First quarterly report for Dunn Hill EL 1570, Wallala Hill EL 1571 and Mount Centre EL 1572, South Australia, for period ending 13 May 1989. *South Australia. Department of Mines and Energy. Open file Envelope,* 8153 (unpublished).

Creaser, R.A., 1989. The geology and petrology of Middle Proterozoic felsic magmatism of the Stuart Shelf, South Australia. *La Trobe University. Ph.D. dissertation* (unpublished).

Daly, S.J., 1985. TARCOOLA map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SH53-10.

Daly, S.J., Horn, C.M. and Fradd, W.P., 1990. Tarcoola Goldfield. *In:* Hughes, F.E. (Ed.), Geology of the mineral deposits of Australia and Papua New Guinea. *Australasian Institute of Mining and Metallurgy. Monograph Series,* 14:1049-1053.

Dixon, H.W. and Nelson, R.G., 1972. Flinders Highway No. 9. Talia-Port Kenny-Streaky Bay section, Co. Robinson. Geological investigation. *South Australia. Department of Mines. Report Book*, 72/75.

Dowling, D.R. and Moorcroft, E., 1959. Gravity and magnetic surveys over aeromagnetic anomaly, Hundred Chandada. *Mining Review, Adelaide*, 111:94-100.

Elcor Chemical Corp., 1969. SML 251, Sceale Bay. Progress reports. *South Australia. Department of Mines and Energy. Open file Envelope*, 1057 (unpublished).

Elcor Australia Pty Ltd, 1970. Geological report on gypsum in Sceale Bay district SA, SML 251. *South Australia. Department of Mines and Energy. Open file Envelope*, 1057 (unpublished).

Endeavour Oil Co. NL, 1971. SML 547, Medlingie Hill-Streaky Bay, Eyre Peninsula. Progress reports. *South Australia. Department of Mines and Energy. Open file Envelope*, 1609 (unpublished).

Endeavour Oil Co. NL, 1972. SML 594, Medlingie Hill. Progress reports. *South Australia. Department of Mines and Energy. Open file Envelope*, 1706 (unpublished).

E&WS Department, 1983. Eyre Peninsula water resources management review. *Engineering and Water Supply. Library Reference*, 83/38 (unpublished).

Eyre, E.J., 1845. *Journals of expeditions into Central Australia*, Vol. 1. Borne, London.

Fanning, C.M., Flint, R.B., Parker, A.J., Ludwig, K.R. and Blissett, A.H., 1988. Refined Proterozoic evolution of the Gawler Craton, South Australia, through U-Pb zircon geochronology. *Precambrian Research*, 40/41:363-386.

Farrand, M.G., 1988. Volcanic and sedimentary rocks from the Wirrulla region, Gawler Craton, South Australia. *South Australia. Department of Mines and Energy. Report Book*, 88/50.

Firman, J.B., 1964. The Bakara Soil and other stratigraphic units of Late Cainozoic Age in the Murray Basin, South Australia. *South Australia. Geological Survey. Quarterly Geological Notes*, 10:2-5.

Firman, J.B., 1967a. Stratigraphy of Late Cainozoic deposits in South Australia. *Royal Society of South Australia. Transactions*, 91:165-180.

Firman, J.B., 1967b. Late Cainozoic stratigraphic units in South Australia. *South Australia. Geological Survey. Quarterly Geological Notes*, 22:4-8.

Firman, J.B., 1974. Upper Cainozoic stratigraphic units of the Gawler Block and Eucla Basin in South Australia. *South Australia. Geological Survey. Quarterly Geological Notes*, 52:2-4.

Firman, J.B., 1978. FOWLER map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series*, sheet SI53-13.

Flint, R.B., 1986. NUYTS map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series*, sheet SI53-1.

Flint, R.B., 1987. NUYTS, South Australia, sheet SI53-1. *South Australia. Geological Survey. 1:250 000 Series — Explanatory Notes.*

Flint, R.B., 1989. ELLISTON map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series*, sheet SI53-6.

Flint, R.B. and Parker, A.J. (Compilers), 1982. Tectonic map of South Australia. *South Australia. Geological Survey. Maps of South Australia Series, 1:2 000 000.*

Flint, R.B., Parker, A.J., Blissett, A.H., Daly, S.J. and Thomson, B.P., 1984. Geological map of the Gawler Craton. *South Australia. Geological Survey. Special Map*, 1:1 000 000.

Flint, R.B. and Rankin, L.R., 1989. KIMBA map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series*, sheet SI53-7.

Flint, R.B., Rankin, L.R. and Fanning, C.M., 1990. Definition — the Palaeoproterozoic St Peter Suite of the western Gawler Craton. *South Australia. Geological Survey. Quarterly Geological Notes*, 114:1-8.

Forbes, B.G., 1960. Gypsum deposits near Streaky Bay and some other localities on Eyre Peninsula. *Mining Review, Adelaide*, 110:83-105.

Fraser, A.R. and Pettifer, G.R., 1980. Reconnaissance gravity surveys in WA and SA, 1969-1972. *Bureau of Mineral Resources, Geology and Geophysics, Australia. Bulletin*, 196.

Galloway, R.W. and Kemp, E.M., 1981. Late Cainozoic environments in Australia. *In:* Keast, A. (Ed.), *Ecological biogeography of Australia*. W. Junk, The Hague, pp.51-80.

Gerdes, R.A., 1975. STREAKY BAY Bouguer anomaly map. *South Australia. Geological Survey. Geophysical Atlas 1: 250 000 Series*, sheet SI53-2.

Giles, C.W., 1980. A comparative study of Archaean and Proterozoic felsic volcanic associations in southern Australia. *University of Adelaide. Ph.D. thesis* (unpublished).

Giles, C.W., 1988. Petrogenesis of the Proterozoic Gawler Range Volcanics, South Australia. *Precambrian Research*, 40/41:407-427.

Glenn, R.A., Laing, W.P., Parker, A.J. and Rutland, R.W.R., 1977. Tectonic relationships between the Proterozoic Gawler and Willyama Orogenic Domains, Australia. *Geological Society of Australia. Journal*, 24:125-150.

Gostin, V.A., Belperio, A.P. and Cann, J.H., 1988. The Holocene non-tropical coastal and shelf carbonate province of South Australia. *Sedimentary Geology*, 29:51-70.

Harris, W.K., 1979a. Palynology of selected samples from EL 442 for Carpentaria Exploration Co. Pty Ltd. Summary report. *South Australia. Department of Mines and Energy. Report Book*, 812.

Harris, W.K., 1979b. Streaky Bay town water supply: palynology of carbonaceous clay from FOR 20A. *South Australia. Department of Mines and Energy. Report Book*, 79/91.

Herraman, P.D. and Barnett, S.R., 1979. Streaky Bay water supply, progress report No. 2. *South Australia. Department of Mines and Energy. Report Book*, 79/81.

Hiern, M.N., 1970. Mineral resources of the Eyre Planning Area. *Mineral Resources Review, South Australia*, 133:11-31.

Hiern, M.N., 1980. Planning policies for mineral and groundwater resources, District Council of Murat Bay. Counties Way and Dufferin. *South Australia. Department of Mines and Energy. Report Book*, 80/67.

Hillwood, E.R., 1960. Beach sand survey — west coast of Eyre Peninsula. *Mining Review, Adelaide*, 110:119-122.

Hos, D., 1978. Eocene palynology of SADME Wilkinson No. 1, Eastern Officer Basin. *South Australia. Department of Mines and Energy. Report Book*, 78/149.

Hosking, P.K. and Moffitt, P.B., 1960. Streaky Bay gypsum. Second report. Water requirements for washing. *South Australia. Department of Mines. Report Book*, 51/21.

Jack, R.L., 1912. The geology of portions of the counties of Le Hunte, Robinson and Dufferin, with special reference to underground water supplies. *South Australia. Geological Survey. Bulletin*, 1.

Jack, R.L., 1922. The iron ore resources of South Australia. *South Australia. Geological Survey. Bulletin*, 10.

Jagodzinski, E.A., 1985. The geology of the Gawler Range Volcanics in the Toondulya Bluff area, and U-Pb dating of the Yardea Dacite at Lake Acraman. *University of Adelaide. B.Sc. Honours thesis* (unpublished).

Johns, R.K., 1961. Calcareous aeolianites of South Australia. *Mining Review, Adelaide*, 111:11-17.

Johns, R.K., 1963. Limestone, dolomite and magnesite resources of South Australia. *South Australia. Geological Survey. Bulletin*, 38.

Johns, R.K., 1968. Lime sand deposits — Eyre Peninsula. *Mining Review, Adelaide*, 124:64-69.

Laut, P., Heyligers, P.C., Keig, G., Löffler, E., Margules, C., Scott, R.M. and Sullivan, M.E., 1977a. *Environments of South Australia: Province 4, Eyre and Yorke Peninsulas.* CSIRO Division of Land Use Research, Canberra.

Laut, P., Heylingers, P.C., Keig, G., Löffler, E., Margules, C., Scott, R.M. and Sullivan, M.E., 1977b. *Environments of South Australia: Province 7, Western Pastoral.* CSIRO Division of Land Use Research, Canberra.

Lowry, D.C., 1970. Geology of the Western Australian part of the Eucla Basin. *Western Australia. Geological Survey. Bulletin*, 122.

Ludbrook, N.H., 1973. Stratigraphic range of the bulmulid land snail *Bothriembryon* in the Fowlers Bay area. *South Australia. Department of Mines. Report Book*, 73/51.

Ludbrook, N.H., 1978. Quaternary molluscs of the western part of the Eucla Basin. *Western Australia. Geological Survey. Bulletin*, 125.

Ludbrook, N.H., 1984. Quaternary molluscs of South Australia. *South Australia. Department of Mines and Energy. Handbook*, 9.

Mansfield, L.L., 1961. Gypsum deposits — Streaky Bay: alternative mining methods. *Mining Review, Adelaide*, 112:65-74.

McMutrie, I.H. and Moorcroft, E., 1959. Gravity and magnetic traverses over aeromagnetic anomaly Hundred Carina. *Mining Review, Adelaide*, 110:71-77.

McPharlin, D., 1974. Examination of report by Kenneth W.G. Smith on earthworks rippability on contract Talia-Streaky Bay. *South Australia. Department of Mines. Report Book*, 74/199.

Milnes, A.R. and Ludbrock, N.H., 1986. Provenance of microfossils in aeolian calcarenites and calcretes in southern South Australia. *Australian Journal of Earth Sciences*, 33:145-160.

Morris, B.J., 1977. An investigation of the heavy mineral sands along the coast of Eyre Peninsula. *Mineral Resources Review, South Australia*, 147:51-59.

Morris, B.J., 1980. Heavy mineral sands — a resume of South Australian occurrences. *Mineral Resources Review, South Australia*, 148:26-40.

Mount Isa Mines Ltd, 1986. EL 1274, Dunn Hill. Progress report for quarter ended November 18, 1986. *South Australia. Department of Mines and Energy. Open file Envelope*, 6089 (unpublished).

Murray-Wallace, C.V. and Kimber, R.W.L., 1987. Evaluation of the amino acid racemization reaction in studies of Quaternary marine sediments in South Australia. *Australian Journal of Earth Sciences*, 34:279-292.

Murray-Wallace, C.V., Kimber, R.W.L., Belperio, A.P. and Gostin, V.A., 1988a. Aminostratigraphy of the last interglacial in southern Australia. *Search*, 19:33-36.

Murray-Wallace, C.V., Kimber, R.W.L. and Belperio, A.P., 1988b. Amino acid racemization dating of the 'Older Pleistocene Marine Beds', Redcliff, northern Spencer Gulf, South Australia. *Royal Society of South Australia. Transactions*, 112:51-55.

Murumba Minerals NL, 1970. Streaky Bay gypsum deposit — mining and treatment methods, overall economics. *South Australia. Department of Mines and Energy. Open file Envelope*, 1455 (unpublished).

Nelson, R.G., 1972. Seismic refraction survey, Eyre Peninsula, Flinders Highway — Talia to Streaky Bay, Co. Robinson. *South Australia. Department of Mines. Report Book*, 72/46.

Oilmin NL, 1984. Yandra relinquishment report. *South Australia. Department of Mines and Energy. Open file Envelope*, 5450 (unpublished).

Oilmin NL, 1985. EL 1240. Quarterly report for period ended December 4, 1984. *South Australia. Department of Mines and Energy. Open file Envelope*, 5146:29-32 (unpublished).

Olliver, J.G., Dubowski, E.A. and Barnes, L.C., 1985. Reappraisal of gypsum reserves, Streaky Bay Lakes, Eyre Peninsula. *South Australia. Department of Mines and Energy. Report Book*, 84/80.

Outback Oil Co. NL and Shell Development (Aust.) Pty Ltd, 1966. Aeromagnetic survey of offshore South Australia, OELs 33 and 38. Part 1: Operational report. *South Australia. Department of Mines and Energy. Open file Envelope*, 648 (unpublished).

Painter, J.A.C., 1970a. Groundwater resources of Eyre Peninsula (Co. Flinders, Musgrave, Robinson — summary of available data — October 1968 for E&WS Dept.). *Mineral Resources Review, South Australia*, 129:123-127.

Painter, J.A.C., 1970b. Eyre Peninsula groundwater study consolidated report No. 2 — summary of available data — June 1970. *South Australia. Department of Mines. Report Book*, 70/151.

Parker, A.J., 1990. Gawler Craton and Stuart Shelf — regional geology and mineralisation. *In:* Hughes, F.E. (Ed.), Geology of the mineral deposits of Australia and Papua New Guinea. *Australasian Institute of Mining and Metallurgy. Monograph Series*, 14:999-1008.

Parker, A.J., Fanning, C.M. and Flint, R.B., 1985. Geology. *In:* Twidale, C.R., Tyler, M.J. and Davies, M. (Eds), Natural history of Eyre Peninsula. *Royal Society of South Australia. Occasional Publications*, 5:21-45.

Parker, A.J., Fanning, C.M., Flint, R.B., Martin, A.R. and Rankin, L.R., 1988. Archaean-Early Proterozoic granitoids, metasediments and mylonites of Southern Eyre Peninsula, South Australia. *Geological Society of Australia. Specialist Group in Tectonics and Structural Geology. Field Guide Series*, 2.

Parker, A.J. and Lemon, N.M., 1982. Reconstruction of the Early Proterozoic stratigraphy of the Gawler Craton, South Australia. *Geological Society of Australia. Journal*, 29(2):221-238.

Pearce, J.A., Harris, N.B.W. and Tindale, A.G., 1984. Trace element discrimination diagrams for the tectonic interpretation of granitic rocks. *Journal of Petrology*, 25:956-983.

Pitcher, W.S., 1982. Granite type and tectonic environment. *In:* Hsu, K.J. (Ed.), *Mountain building processes*. Academic Press, London, pp.19-40.

Rankin, L.R., 1987. Eyre Peninsula field excursion notes for the Field Geology Club of South Australia, Sept. 26-Oct. 4, 1987. *South Australia. Department of Mines and Energy. Report Book*, 87/105.

Rankin, L.R. and Flint, R.B., 1989. Geology of St Peter and Goat Islands (Nuyts Archipelago) and Cape Beaufort. *South Australia. Department of Mines and Energy. Report Book*, 89/84.

Rankin, L.R., Flint, R.B. and Fanning, C.M., 1990. Palaeoproterozoic Nuyts Volcanics of the western Gawler Craton. *South Australia. Department of Mines and Energy. Report Book*, 90/60.

Rosier, C.M., 1982. The geology, geochemistry and geochronology of the northern half of Saint Francis Island, Nuyts Archipelago, South Australia. *University of Adelaide. B.Sc. Honours thesis* (unpublished).

Russ, P.J., 1967a. Report on kunkar deposit sec. 25, Hd Moule. *South Australia. Department of Mines. Report Book*, 64/23.

Russ, P.J., 1967b. Report on diamond drilling of kunkar deposit, sec. 34, Hd Wandana. *South Australia. Department of Mines. Report Book*, 64/24.

Rutland, R.W.R., Parker, A.J., Pitt, G.M., Preiss, W.V. and Murrell, B., 1981. The Precambrian of South Australia. *In:* Hunter, D.R. (Ed.), *Precambrian of the Southern Hemisphere*. Elsevier, Amsterdam, pp.309-360.

SADME, 1979. NUYTS, STREAKY BAY and ELLISTON geochemistry-geophysics, geology-drilling, and uranium-mineral occurrences. *South Australia. Department of Mines and Energy. Mineral Exploration Index Series, 1:500 000*.

Schwebel, D.A., 1978. Quaternary stratigraphy of the southeast of South Australia. *Flinders University (South Australia). Ph.D. thesis* (unpublished).

Schwerdtfeger, P., 1985. Climate. *In*: Twidale, C.R., Tyler, M.J. and Davies, M. (Eds), Natural history of Eyre Peninsula. *Royal Society of South Australia. Occasional Publications*, 4:89-100.

Segnit, R.W., 1933. Report on the Robinson Freshwater Basin with special reference to possibility of utilising its supply for the township of Streaky Bay. *South Australia. Department of Mines. Report Book*, 13/251.

Segnit, R.W. and Dridan, J.R., 1938. Geology and development of ground water in the Robinson Fresh Water Basin, Eyre's Peninsula. *South Australia. Geological Survey. Bulletin*, 17.

Selby, J., 1976. Flinders Highway — Talia to Streaky Bay section — summary of excavation experience. *South Australia. Department of Mines. Report Book*, 76/62.

Shackleton, N.J. and Kennett, J.P., 1975. Palaeotemperature history of the Cenozoic and the initiation of Antarctic glaciation: oxygen and carbon isotope analyses in DSDP sites 277, 279 and 281. *In:* White, S.M. (Ed.), *Initial reports of the Deep Sea Drilling Project*, 29:743-755.

Shackleton, W.G. and Robinson, W.B., 1964. Exploration for kunkar ballast. Section 25, Hundred Moule. N.W. Eyre Peninsula. *South Australia. Department of Mines. Report Book*, 59/59.

Shepherd, R.G., 1961. Report on groundwater prospects, Eyre Highway. Part IV. Minnipa-Poochera section. *South Australia. Department of Mines. Report Book*, 53/91.

Shepherd, R.G., 1963. Report on groundwater prospects, Eyre Highway. Part VII. Poochera-Ceduna section. *South Australia. Department of Mines. Report Book*, 57/22.

Shepherd, R.G., 1967. Groundwater investigation on Eyre Peninsula 1956-65, summary report. *Mining Review, Adelaide*, 123:131-137.

Shepherd, R.G., 1978. Underground water resources of South Australia. *South Australia. Geological Survey. Bulletin*, 48.

Smith, M., 1843. The country westward of Port Lincoln. *Southern Australia*, 22.xii.

South Australian State Planning Authority, 1974. *Eyre planning area development plan*. Government Printer, Adelaide.

Stearns, C.E., 1984. Uranium-series dating and the history of sea level. *In*: Mahaney, W.C. (Ed.), Quaternary dating methods. *Developments in Palaeontology and Stratigraphy*, 7. Elsevier, Armsterdam, pp.53-65.

Steel, T.M., 1966a. Groundwater prospects, sections 29, 32-34 and 46, Hd. Haslam. *South Australia. Department of Mines. Report Book*, 62/77.

Steel, T.M., 1966b. Progress report No. 1, Robinson Basin. *South Australia. Department of Mines. Report Book*, 63/104.

Steveson, B.G., 1974. Petrography of the continental shelf islands of S.A. Progress reports 1, 3, 4, 7, 8, 9, 10. Amdel project MP 1/1/160. *South Australia. Department of Mines and Energy. Open file Envelope*, 2394 (unpublished).

Stockdale Prospecting Pty Ltd, 1982. Progress reports for ELs 827, 834, 841-844, August 1981 to August 1982. *South Australia. Department of Mines and Energy. Open file Envelope*, 4267 (unpublished).

Stockdale Prospecting Ltd, 1984. Gawler Ranges relinquishment report. *South Australia. Department of Mines and Energy. Open file Envelope*, 4747 (unpublished).

Target Exploration Pty Ltd, 1971. Polda Basin second marine seismic survey EPP13 — South Australia. *South Australia. Department of Mines and Energy. Open file Envelope*, 1726 (unpublished).

Taylor, T.R., Vogel, T.A. and Wilband, J.T., 1980. The composite dikes at Mount Desert Island, Maine: an example of coexisting acid and basic magmas. *Journal of Geology*, 88:433-444.

Thompson, B.G. and Horn, C.M., 1981. District council of Streaky Bay planning policies for mineral and groundwater resources. *South Australia. Department of Mines and Energy. Report Book*, 81/118.

Thomson, B.P., 1970. A review of the Precambrian and Lower Palaeozoic tectonics of South Australia. *Royal Society of South Australia. Transactions*, 94:193-221.

Topley, C.G., Brown, M. and Power, G.M., 1982. Interpretation of the field relationships of diorites and associated rocks with particular reference to northwest Guernsey, Channel Islands. *Geological Journal*, 17:322-343.

Truswell, E.M. and Harris, W.K., 1982. The Cainozoic palaeobotanical record in arid Australia: fossil evidence for the origins of an arid-adapted flora. *In*: Barker, W.R. and Greenslade, P.J.M. (Eds), *Evolution of the flora and fauna of arid Australia*. Peacock Publications, Adelaide, pp.67-76.

Twidale, C.R., Bourne, J.A. and Smith, D.M., 1976. Age and origin of palaeosurfaces on Eyre Peninsula and in the southern Gawler Ranges, South Australia. *Zeitschrift Für Geomorphologie*, 20:28-55.

Twidale, C.R., Bourne, J.A. and Twidale, N., 1977. Shore platforms and sea level changes in the Gulfs region of South Australia. *Royal Society of South Australia. Transactions*, 101:63-74.

Twidale, C.R. and Campbell, E.M., 1985a. History of exploration and settlement. *In*: Twidale, C.R., Tyler, M.J. and Davies, M. (Eds), Natural history of Eyre Peninsula. *Royal Society of South Australia. Occasional Publications*, 4:1-19.

Twidale, C.R. and Campbell, E.M., 1985b. The form of the land surface. *In*: Twidale, C.R., Tyler, M.J. and Davies, M. (Eds), Natural history of Eyre Peninsula. *Royal Society of South Australia. Occasional Publications*, 4:57-76.

Twidale, C.R., Campbell, E.M. and Foale, M.R., 1987. *Landforms of the Streaky Bay area*. E.L. Beck, Streaky Bay (University of Adelaide Printers).

Wade, A., 1915. The supposed oil-bearing areas of South Australia. *South Australia. Geological Survey. Bulletin*, 4.

Walker, N.C. and Botham, S.J., 1969. Reconnaissance geological survey of the STREAKY BAY and NUYTS 1:250 000 areas. *South Australia. Department of Mines. Report Book*, 68/25.

Wallace, M. and Pring, A., 1991. The Streaky Bay meteorite, a new L4 chondrite from South Australia. *Australian Journal of Earth Sciences*, 38:247-248.

Ward, L.K., 1944. The search for oil in South Australia. *South Australia. Geological Survey. Bulletin*, 22.

Warren, J.K., 1980. Late Quaternary evaporite-carbonate depositional environments in South Australia — their palaeohydrological implications and application. *Flinders University (South Australia). Ph.D. thesis* (unpublished).

Warren, J.K., 1982. The hydrogeological setting, occurrence and significance of gypsum in late Quaternary salt lakes in South Australia. *Sedimentology*, 29:609-637.

Watkins, N. and Flint, R.B., 1983. Proterozoic intrusives, Streaky Bay area. *South Australia. Department of Mines and Energy. Report Book*, 83/82.

Webb, A.W., Thomson, B.P., Blissett, A.H., Daly, S.J., Flint, R.B. and Parker, A.J., 1982. Geochronology of the Gawler Craton, South Australia. *South Australia. Department of Mines and Energy. Report Book*, 82/86.

Webb, A.W., Thomson, B.P., Blissett, A.H., Daly, S.J., Flint, R.B. and Parker, A.J., 1986. Geochronology of the Gawler Craton, South Australia. *Australian Journal of Earth Sciences*, 33:119-143.

Webb, J.E., 1961. Gravity and magnetic surveys over aeromagnetic anomaly, Hundred of Ripon, County Robinson, Eyre Peninsula. *South Australia. Department of Mines. Report Book*, 52/22.

Webb, J.E., 1965. STREAKY BAY aeromagnetic map of total intensity. *South Australia. Geological Survey. Geophysical Atlas 1:250 000 Series*, sheet SI53-2.

Wells, R.T. and Callen, R.A. (Eds), 1986. The Lake Eyre Basin — Cainozoic sediments, fossil vertebrates and plants, landforms, silcretes and climatic implications. *Geological Society of Australia. Australasian Sedimentologists Group. Field Guide Series*, 4.

White, A.J.R. and Chappell, B.W., 1983. Granitoid types and their distribution in the Lachlan Fold Belt, southeastern Australia. *In:* Roddick, J.A. (Ed.), Circum-pacific plutonic terranes. *Geological Society of America. Memoirs*, 159:21-34.

Whitten, G.F., 1960. The investigation of aeromagnetic anomalies on Eyre Peninsula and the search for iron ore there. *South Australia. Department of Mines. Report Book*, 50/173.

Whitten, G.F., 1963. Investigation of aeromagnetic anomalies, Hundreds Carina, Chandada and Ripon, western Eyre Peninsula. *South Australia. Geological Survey. Report of Investigations*, 23.

Zorpi, M.J., Coulon, C., Orsini, J.B. and Cocirta, C., 1989. Magma mingling, zoning and emplacement in calc-alkaline granitoid plutons. *Tectonophysics*, 157:315-329.