DEPARTMENT OF MINES AND ENERGY

GEOLOGICAL SURVEY

SOUTH AUSTRALIA

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REVIEW OF HEAVY MINERAL SAND EXPLORATION IN SOUTH AUSTRALIA - THE MURRAY BASIN

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REVIEW OF HEAVY MINERAL SAND EXPLORATION IN SOUTH AUSTRALIA - THE MURRAY BASIN

The Cainozoic and Quaternary sands within the Murray Basin have been the focus of recent exploration for heavy mineral sands. Exploration in the South Australian part of the Murray Basin has been dominated by Aberfoyle Resources Ltd. The best prospects outlined were Mindarie and Perponda, with inferred resources of 56 and 27 million tonnes of >2.0% heavy minerals respectively. The heavy mineral fraction was dominated by non-economic iron oxides, which record weathering and reworking of the ferruginous Karoonda Surface, within the top layers of the Pliocene Parilla Sand. Heavy mineral accumulations are currently being formed by beach and aeolian processes in the Lake Alexandrina area, but the mineral assemblage is dominated by non-economic heavy minerals including garnet, tourmaline, staurolite, andalusite and sphene sourced from nearby outcrops of Kanmantoo Group metasediments. Future exploration for mineral sands within the Murray Basin should concentrate on a greater understanding of the stratigraphic distribution of the Pliocene Parilla Sand and other geological and geomorphic factors which would have influenced the location, grade and mineral assemblage of heavy mineral sand accumulations. This may require increased target drill depth. A program of drill holes along existing roads and tracks within Danggali Conservation Park is strongly recommended.

INTRODUCTION

Australia is the major producer of heavy mineral sands, rutile, zircon, ilmenite and monazite. Improved demand and prices for mineral sand products during the 1980's, resulted in increased exploration for new deposits. Increased environmental restrictions on mining of East Coast deposits focussed attention on inland basins including the Murray and Eucla Basins. A detailed stratigraphic study by the Bureau of Mineral Resources (BMR), South Australian Department of Mines and Energy (DME) and the Department of Marine Geology, Flinders University, reported heavy mineral sand accumulations within an extensive strand-plain environment of prograding beach ridges in the Murray Basin (Colwell, 1979). This strand-plain environment has been the focus of exploration activity within the Murray Basin. The discovery by CRA of WIM 150, near Horsham, Victoria in 1984 was the stimulus for intensive exploration for heavy mineral sands within the South Australian portion of the Murray Basin.

GEOLOGICAL SETTING

The Murray Basin is an intracratonic basin of Tertiary fluvial and shallow marine sediments covering an area of approximately 320 000 km (Brown, 1985), incorporating parts of southeast South Australia, northwest Victoria and southwest New South Wales (Fig. 1). Basement geology has been interpreted from regional gravity and aeromagnetic trends and comprises an extensive area of tectonically deformed basement crust (Brown & Stephenson, 1991). The basin is flanked by Proterozoic and Palaeozoic fold belts including the Adelaide Fold Belt, the Willyama Basement Block and the Kanmantoo Fold Belt in South

Australia (Parkin, 1969; Brown, 1985). Further east, the basin overlies folded sediments and basic to intermediate volcanics of the Cambrian to Lower Carboniferous Lachlan Fold Belt (Brown, 1985). The bedrock geology of the western part of the Murray Basin is shown in Fig. 2 (Belperio & Bluck, 1988).

A thin Cainozoic succession covering the Padthaway Ridge marks the southwest boundary of the basin where it thickens considerably into the Gambier Embayment. During the Cainozoic, a relatively thin veneer of fluvial, marginal marine and marine sediments were deposited in the Murray Basin, with up to 600m deposited in the west-central area, and generally <200-300m deposited in the northern, eastern and southern areas (Brown, 1985). Deposition of the Norwest Bend Formation and the Parilla Sand during Pliocene times marked the end of Tertiary sedimentation (Firman, 1969). Following the Pliocene regression, weathering and soil development resulted in a widespread weathering surface (ferruginous and siliceous layer) developed on the surface of the Parilla Sand (Karoonda Surface). The Karoonda Surface comprises mainly small limonite-cemented pebbles and pisolites of sand (Brown & Stephenson, 1991). Macumber (1983) reports that some ferricrete surfaces may be the result of mobilisation of iron via groundwater, forming ferruginised sands cemented by iron oxides.

During the Quaternary, fluvio-lacustrine sediments were deposited in the east forming the Riverine Plain (Brown, 1985). Eustatic sea level fluctuations during the Pleistocene produced a series of predominantly calcareous, stranded coastal ridges (parallel dunes) in the western part of the basin. Inland, widespread, thin fluvio-lacustrine sandy clay and limestone were deposited on the Tertiary succession (Firman, 1973).

Crystalline basement rocks around the northern and western margins of the Murray Basin were suitable provenance areas for the formation of heavy mineral deposits. Possible source areas are outlined in Belperio and Bluck (1988) and include:

- Mt. Lofty Ranges (ilmenite, rutile, zircon, monazite, tourmaline, staurolite, sillimanite and kyanite),
- Kanmantoo Group metasediments (garnet, sillimanite, kyanite, zircon, tourmaline, ilmenite, magnetite, rutile, sphene, epidote and actinolite),
- Cambro-Ordovician granites and acid volcanics in the Naracoorte to Tailem Bend, and Mannum areas (hornblende, epidote, sphene, apatite, magnetite, ilmenite, fluorite, monazite, zircon and tourmaline),
- Subsurface Cambro-Ordovician mafic volcanics, basic and ultrabasic intrusives (magnetite, maghemite, zircon, apatite, sphene and leucoxene), and
- Felsic norite and gabbro complex between Mannum and Blanchetown (ilmenite, magnetite and accessory sulphides).

STRATIGRAPHY

The stratigraphy of the Murray Basin is outlined in Fig. 3 (Brown & Stephenson, 1991). Tertiary sedimentation within the Murray Basin occurred in three major cycles. The earliest sequence spans the Palaeocene to Eocene, the second from the Oligocene to Mid-Miocene, and a final stage of sediment accumulation during the late Miocene to late Pliocene (Clough & Rankin, 1991).

Sedimentation commenced in the Murray Basin during the early Tertiary with the deposition of fluvial-lacustrine, dark grey carbonaceous sand and sandy clay Renmark Beds (Rogers, 1980). Transition to a marine environment during the late Eocene - early Miocene resulted in the deposition of the Buccleuch Beds/Compton Conglomerate, Ettrick Formation and Gambier Limestone equivalents.

Disconformably overlying the Miocene marine carbonates are the early Pliocene glauconitic Bookpurnong Beds, which record the first of three brief, late Tertiary regressive events (Rogers, 1980). Marine transgression during the Pliocene resulted in the deposition of the fluvial to marginal marine Loxton and Parilla Sand. Early Pliocene Loxton Sand is a fluviatile and estuarine, fine to coarse micaceous sand (Rogers, 1978). The Parilla Sand is a slightly micaceous, fine to medium-grained quartz sand and clayey quartz sand (Firman, 1966). Palaeogeographic reconstructions show that the Loxton-Parilla Sand was deposited during a regressive phase of a brief marine incursion by a shallow epeiric sea in the western Murray Basin (Brown & Stephenson, 1991). The Loxton-Parilla Sand was deposited over a widespread area (Fig. 4) and is represented by a series of northwest/southeast striking, curvilinear sand ridges covered in part by a thin veneer of Quaternary sediments. These strand lines are readily recognisable on LANDSAT images (see Fig. 93, Brown & Stephenson, 1991) and topographic maps. The Marmon-Jabuk Scarp marks the southwest boundary of the Pliocene sand ridges (Belperio & Bluck, 1988).

The estuarine Northwest Bend Formation (equivalent in age to the Parilla Sand) cross cuts the strand-plain in the west of the basin, in an area confined to the course of the ancestral Murray River.

The dominantly aeolian nature of the Pleistocene Bridgewater Formation and Holocene Molineaux Sand reflects sea level fluctuations of the late Quaternary and the migration of the coastline to its present position. The calcareous nature of these sediments reflects the decreasing siliclastic content of sediments. A detailed description of the stratigraphy of the Murray Basin is presented in Brown (1985) and Brown & Stephenson (1991). Fig. 5 outlines the Tertiary palaeogeography of the Murray Basin (Brown & Stephenson, 1991).

DEPOSITIONAL REGIMES - HEAVY MINERAL SANDS

Heavy minerals are chemically and physically resistant minerals with an SG > 2.96 (the SG of bromoform) and include magnetite, rutile, ilmenite, zircon, leucoxene and monazite. Heavy minerals occur in two major environments, hard rock deposits and beach placer deposits. In Australia, all economic deposits are placer deposits.

Heavy minerals derived from weathering of crystalline basement rocks within a drainage basin are transported and deposited in the ocean and together with sediments derived from coastal erosion, are preferentially sorted by ocean waves and concentrated in the backshore environment (Evans, 1987). The most efficient sedimentary environment for the deposition of heavy mineral sands is the littoral zone, which is characterised by oscillating wave energy. Sediments are transported up the beach by incoming waves, with heavy minerals deposited at the rear of the backshore area and the lighter quartzose fraction returned within the backswash (Harben, 1990). The efficiency of this concentrating mechanism is dependent on the wave energy, which in turn, is reliant on prevailing climatic conditions.

A similar oscillatory hydraulic process can account for the accumulation of heavy minerals in sandbars. The annual cycle of erosion and regression on beaches also influences the distribution of heavy mineral sands. During periods of beach erosion, heavy minerals become concentrated towards the backshore (Rao, 1957). Coastal islands cause wave refraction and flow separation in their lee, resulting in deposition of heavy minerals from suspension (Belperio & Bluck, 1988), and the formation of a tombola (Cuchlaine & King, 1959). Winds may also be an important factor in producing accumulations of heavy minerals (ie: Stradbroke Island) by winnowing the lighter fraction and thus concentrating heavy minerals. Storms may also be an important concentrating mechanism.

Formation of coastal heavy mineral deposits requires (Harben, 1990):

- source rocks containing heavy minerals
- period of deep weathering
- uplift
- erosion, transportation and deposition in the sea, and
- an emergent coastline with longshore drift and high-energy wave and wind action during shore line straightening.

Heavy minerals accumulate on present day beaches, but are rarely preserved because of erosion and reworking by waves and wind. The preservation of heavy mineral accumulations requires that deposits be removed from the influence of wave activity by either shoreline progradation or a decrease in sea level.

Belperio & Bluck (1988) defined four major environments for possible deposition and preservation of Pliocene heavy mineral sands in the Murray Basin (Fig. 6):

- the southeast (downdrift) end of elongate or curvilinear dune systems in an area adjacent to the palaeo-swash zone,
- lag deposits at the windward side of easterly migrating transgressive dune systems,
- the northwest side, landward end of islands which were in close proximity to a palaeo-shoreline (tombola facies), and
- the foreshore zone (sandbars).

These provide an initial framework for heavy mineral exploration within the Murray Basin.

EXPLORATION ACTIVITY

Mining of mineral sands in South Australia has been restricted to one location, Morrison Bay, Kangaroo Island, where approximately 1200 tonnes of rutile and 190 tonnes of zircon were mined between 1971-1976 (Morris, 1978; 1986). Other occurrences of heavy minerals are outlined in Farrell (1968), Hillwood (1960), McCallum & Morris (1978) and McCallum (1981).

Initial exploration for heavy mineral sands within the Murray Basin concentrated on the extensive beach and dunal sand ridges deposited during the Pleistocene. These "stranded coastal dunes" developed at various eustatic levels related to glacial and interglacial periods (Sprigg, 1952). Later exploration was concentrated on the series of Pliocene strandlines outlined by the BMR. Heavy mineral sand exploration in the South Australian portion of the Murray Basin was dominated by Aberfoyle Resources Ltd, with several deposits of heavy mineral sands outlined. Table 1 summarises company exploration in the Murray Basin, and the location of previous EL's is given in Fig. 7. Summary data sheets of company exploration are presented in Appendix A and a reference list of map/drillhole/envelope is presented in Appendix B.

PLIOCENE UNITS

Exploration in the Victorian portion of the Murray Basin outlined 2 potential deposits. CRA delineated a large accumulation of Pliocene heavy mineral sands east of Horsham, Victoria. The WIM 150 (Fig. 1) deposit formed offshore and the presence of hummocky cross stratification suggests deposition below fair weather wave base (Williams, 1990). The deposit comprises approximately 4900 million tonnes of mineralised sand averaging approximately 2.8% heavy minerals (Williams, 1990). The mineral assemblage associated with WIM 150 is (Bluck, 1988):

• rutile and anatase	0.34%,
• leucoxene	0.46%,
• ilmenite	1.25%,
• zircon	0.51%,
• monazite	0.06% and
• xenotime	0.02%.

However, the deposit remains undeveloped due to predicted low prices (Huggan, 1993).

The Aberfoyle - Sandhurst Mining Joint Venture delineated a heavy mineral strandline within the "Tyrrell Ridge" (Fig. 1), north of WIM 150, comprising up to 11.6% heavy mineral content (Bluck, 1988). The mineral assemblage associated with the deposit is (Bluck, 1988):

	in-situ grade
• rutile	1.50%
• zircon	1.62%
• monazite	0.12%
• ilmenite & others	8.24%.

Peregrine Resources (Aust) NL discovered the Massidon deposit 130km south of Broken Hill, New South Wales (Fig. 1). Measured and Indicated Resources total 1170Mt at 2% heavy minerals and the mineral assemblage comprises 50% altered ilmenite, 15% leucoxene, 10% zircon, 5% rutile and 0.6% combined monazite and xenotime, ranging in size from 50-130μm (Minfo, 1991).

Several deposits of heavy minerals sands have been located in the South Australian portion of the Murray Basin.

Aberfoyle Resources Ltd

Aberfoyle Resources Ltd was a major explorer for mineral sands within the Murray Basin. Aberfoyle's exploration technique comprised study of topographic maps and satellite imagery to identify palaeoshorelines and strandline ridges followed by shallow (usually up to 18m) RAB drilling along traverse lines.

The Mindarie prospect (EL 1397 & EL 1401) located approximately 60 km northeast of the Marmon-Jabuk Range was delineated by Aberfoyle Resources Ltd. Coarse grained sands and heavy mineral sand lenses were deposited on a palaeo-beach, between 55 and 75 m above present sea level. Belperio and Bluck (1988) interpreted the palaeo sea level in the vicinity of the Marmon-Jabuk Range to have been between 30 and 50 m above present sea level. This stratigraphic distribution of littoral sediments suggests a very gently southwest dipping Pliocene strand-plain. Mineralisation occurs in three main lenses over a strike length of 12km to 20km (A -

C). Width of the lenses varies from 100 to 500m, thickness varies from 2 to >8m and overburden thickness ranges from 2 to 14m (Young, 1990). Inferred resources were estimated at 56 million tonnes and heavy mineral grades vary between 1.96% and 3.82%, with the heavy mineral fraction being fine to medium-grained (75-100μm), however, the mineral assemblage was dominated by either ilmenite and/or non-economic silicates and iron oxides.

A summary of the mineral assemblage is presented below (Young, 1990):

	HM%	Rutile	Leucoxene	Ilmenite	Zircon	Tonnes
Lens A	2.92	8	14	44	20	16M
Lens B	3.82	2.5	7.5	22	6	24M
Lens C	1.96	6	17.1	42	22	16M

Limited metallurgical work showed the sand to have a relatively high slime content (~10%) and to contain trace organics and minor cemented pebbles, however, good recoveries for ilmenite and zircon were reported (Young, 1990).

On Mercunda (EL 1401), a 700m wide lens of heavy minerals averaging 2.4% heavy minerals and averaging 4.5m thick was delineated in Line MC05 from holes 088 to 094. Other significant intersections were:

- MC05-080 2m (16-18m) at 4.27% HM
- MC01-016 2m (16-18m) at 1.13% HM
- MC01-030 2m (14-16) at 2.12% HM
- MC05-014 2m (8-10) at 2.59% HM

The mineral assemblage was dominated by ilmenite and goethite (Painter, 1990d).

A heavy mineral sand lens incorporated into the Pliocene strandline with a strike length of 5km was outlined in the Perponda prospect (EL 1356). The deposit varies between 300-1700m in width and 2-10m thickness. The lens comprises about 27 million tonnes of heavy mineral sands averaging 2% total heavy minerals. The mineral assemblage was dominated by non-economic heavy minerals. Drilling on the UpsnDowns prospect, located on EL 1356 and 1357, delineated 2 heavy mineral accumulations. A 600m long by >5m thick lens averaging 2.88% heavy minerals was located on line PK05. An irregular lens 200m long by 2m thick was located in 2 drill holes on line PK10, with heavy mineral grades of 1.13% and 1.47%. RC drilling on Line KR08 outlined a second, deeper horizon of heavy minerals below the shallower main horizon comprising a lens more than 100m wide and averaging 4m thick at 3.03% heavy minerals (Teakle, 1989b). Other significant intersections of heavy minerals from EL 1356 and 1357, and the mineral assemblage are presented in Appendix C.

Two holes on EL 1454 intersected significant mineralisation on Line BL02. Holes 064 (4-8m) and 108 (2-8m) recorded heavy mineral contents of 4.58% and 2.54% respectively, but the mineral assemblage was dominated by iron oxides and ilmenite (Teakle & Painter, 1988b).

RAB drilling on EL 1499 delineated a lens 400m long and 7m thick containing 1.39% heavy minerals between holes GP07-022 and GP07-026. Overburden thickness was between 18-26m and the mineral assemblage comprised ilmenite, leucoxene, zircon and minor rutile (Teakle, 1990).

EL 1502, located west of Danggali Conservation Park, comprised areas of significant mineralisation with intersections of up to 4.66% heavy minerals recorded (Table 2), however, the mineral assemblage was dominated by iron oxides and ilmenite (Painter, 1990a). Follow-up RC drilling outlined 4m intersections in holes LW13-010 and LW13-027 with estimated heavy mineral contents between 1 - 2.5%, and up to 3% heavy minerals in zones up to 8m thick in holes LW016-024, -026 and -032 (Painter, 1990c). Overburden thickness varied from 2m to 16m in LW12-048.

RAB drilling of lines WK03 and WK05 on EL 1503 delineated a 800m wide lens of heavy minerals extending along strike for approximately 11km. Using a 0.78% cut-off, the lens averaged 2.6m at 1.29% heavy minerals. The mineral assemblage comprised 5% rutile, 10% leucoxene, 27% ilmenite and 11% zircon (Teakle & Painter, 1989).

RAB drilling on EL 1553 delineated a heavy mineral sand lens 800m long, 2.8m thick with an average of 1.61% heavy minerals (Painter, 1990b). Follow up drilling failed to reveal any strike extension of the lens. Drilling on EL 1558 and 1560 did not intersect significant mineralisation.

Other companies

Exploration by Peregrine Resources (Aust) NL on EL 1476 and 1612, north of Danggali Conservation Park, included RC drilling and low level aeromagnetic and radiometric surveys. Significant intersections of heavy minerals were recorded in numerous drill holes. The best intersections were OK79 (6.78% - 33-34m & 4.6% - 34-35m), OK90 (5.73% - 27-28m & 3.81% - 24-25m), and OK36 (4.81% - 17-18m). Other significant intersections are tabled in Appendix D. Many drillholes recorded thick intersections of low grade mineralisation (<1%) and the Parilla Sand is relatively deep (30-40m). In many holes two or more zones of mineralisation were present (see Appendix D). The mineral assemblage comprised dominantly fine grained (106 - 45μm) ilmenite with minor zircon, rutile, leucoxene and trace monazite and xenotime (Peregrine Resources (Aust) NL, 1990). Geophysical methods were unable to delineate a heavy mineral accumulation on the tenement.

No significant mineralisation was located on EL 1510, 1511 and 1512 by Peregrine Resources (Aust) NL, with 8 holes bottoming in Norwest Bend Formation. RC drilling suggested that the target Parilla Sand was not present in the tenements. The best intersection was Hole 1 on EL 1510, which intersected 32m of mineralisation, with a maximum visual estimate of 2% heavy minerals, comprising predominantly goethite (Peregrine Resources (Aust) NL, 1989).

A joint venture between Demis Pty Ltd and Mining Corporation of Australia Ltd did not locate significant mineralisation on EL 1554 and 1555. The best intersections were 4m in hole WH2 (6-10m) averaging 1.11% heavy minerals and 6m in hole MJR-8 (28-34m) which averaged 0.74% heavy minerals. However the mineral assemblages were dominantly porous iron oxide in WH2 (Bluck, 1988b) and dominantly garnet in MJR-8 (Bluck, 1988a).

RC drilling by BHP and Utah Minerals International on EL 1445, south of Danggali Conservation Park, did not intersect significant mineralisation. The best result was 1020 ppm Zr and 6000 ppm Ti, over 2m (26-28m) in hole PT069 (Darby, 1989). However average depth of drilling was 22.4m, which may be insuffficent to penetrate the base of the Parilla Sand unit.

Exploration by Burmine and Denison Ltd, comprising geomorphologic mapping using satellite imagery and RC drilling did not intersect significant mineralisation on EL 1425. Four metres (20-24m) with an average heavy mineral grade of 2.73% on Line 1 was the best intersection, but the mineral assemblage was dominantly goethite (Creelman, 1989).

No significant intersections of heavy minerals were intersected by CRA Exploration Pty Ltd on EL 1309 (Richards, 1986) and by Placer Exploration Ltd on EL 1674 and 1675 (Placer Exploration Ltd, 1991).

PLEISTOCENE UNITS

Jennings Mining Ltd (EL 164) considered that the system of Pleistocene parallel dunes were similar to the parallel dune systems of the East Coast of Australia. Photogeologic mapping delineated possible beach strandlines of Bridgewater Formation. Reconnaissance surface sampling and shallow auger drilling showed that the predominantly calcareous nature of the sands was not conducive for the formation of heavy mineral beach sand deposits (Harrison, 1975).

The coastal strip of Pleistocene dunes was explored by Carpentaria Exploration Company Pty Ltd on EL 194. Exploration consisted of geomorphological mapping, regional magnetics, shallow auger drilling and sampling of granite outcrops which may have been a source of heavy minerals. Results were disappointing with low heavy mineral concentrations recorded (highest value - 1.16%). The mineral assemblage was dominated by opaques and other non-economic heavy minerals including tourmaline, epidote, amphibole, staurolite, sillimanite, clinopyroxene, garnet and sphene (Larson, 1974).

Demis Pty Ltd and Mining Corporation of Australia (1989) undertook a joint venture to explore the Pleistocene sand sequence adjacent to the Padthaway Ridge (EL 1557). Shallow auger drilling at Ferries-McDonald revealed low concentrations of heavy minerals (highest value - 0.55% in hole CG 13- 1.5m depth) with the mineral assemblage dominated by non-economic minerals andalusite, staurolite, and tourmaline. Sands rich in heavy minerals are currently forming in the Point Stuart area (10.8% HM in hole LA 1 - 1.5m depth), but the mineral assemblage is dominated by garnet, probably derived from Kanmantoo Group metasediments which crop out along the eastern margin of the Mount Lofty Ranges. Two shallow RC holes in the Mount Boothby area recorded low concentrations of heavy minerals.

SUMMARY AND CONCLUSIONS

Initial exploration for heavy mineral sands in the Murray Basin concentrated on the Pleistocene coastal and stranded parallel dunes. These dunes display many similar features to the coastal dunes along the east coast of Australia, where significant deposits of heavy minerals are mined. Surface sampling and shallow auger drilling of Pleistocene coastal dunes by Jennings Mining Ltd and Carpentaria Exploration Company Pty Ltd recorded low (<0.5%) concentrations of heavy minerals. Early Pleistocene sediments contained a higher content of siliclastics, but increased aridity during the Pleistocene led to a reduction in the supply of siliclastics, and together with minimal longshore drift due to the predominantly southwesterly wind, resulted in a dominantly calcareous sequence of dunes.

Buoyant market forces during the 1980's together with restricted access to coastal deposits along the East Coast of New South Wales and Queensland, resulted in increased exploration activity for mineral sands in the Murray Basin. Discoveries by CRA (WIM 150), Aberfoyle-Sandhurst (Tyrrell Ridge) and Peregrine Resources (Aust) NL (Massidon) in the Victorian and New South Wales portion of the Murray Basin stimulated exploration activity in South Australia.

The fluvial to marginal marine Pliocene Parilla Sand was the main target and was deposited over a broad area of the basin, forming a series of prominent ridges and swales, easily recognisable on aerial photography and satellite imagery. Exploration comprised preliminary geomorphic mapping using aerial photography and LANDSAT imagery, the application of aeromagnetic and radiometric geophysical methods together with RAB and RC drilling along traverse lines.

Exploration in the South Australian portion of the Murray Basin was dominated by Aberfoyle Resources Ltd. Aberfoyle's target drill depth of 18m was too shallow to penetrate the base of the Pliocene Parilla Sand, therefore, the true mineral potential of the tenements was not realised. A follow-up programme of deeper drilling is recommended for former EL's 1356, 1357, 1397, 1401, 1502 and 1503. Exploration by Peregrine Resources (Aust) NL (EL 1476 & 1612) and Burmine and Denison Ltd included deeper drilling which intersected accumulations of heavy minerals near the base of the Parilla Sand. Results from EL 1476 and 1612 also show the presence of 2 or more heavy mineral horizons.

Overall, exploration results were disappointing. Intersections of up to 7.14% heavy minerals were reported (hole T3, line T, EL 1356/1357), but the heavy mineral fraction was fine grained (<100μm) and dominated by non-economic iron oxides, mainly goethite. The goethite was most probably derived from the weathering and subsequent reworking of the ferruginous Karoonda Surface into the top layers of the Parilla Sand. Deeper drilling is recommended to locate deeper heavy mineral horizons which may not be contaminated by iron oxides.

No exploration has been carried out in the Danggali Conservation Park (Fig. 1). Exploration of the surrounding areas has produced encouraging results, particularly EL 1476 and EL 1612, located north of the park (Peregrine Resources (Aust) NL, 1990). It is recommended that a drilling programme along existing roads within Danggali Conservation Park be undertaken by DME, to increase the knowledge of the stratigraphy and mineral potential of the area.

There is no current exploration for mineral sands within the South Australian portion of the Murray Basin. CRA are still evaluating the WIM 150 deposit, but the deposit remains undeveloped due to predicted low prices (Harben, 1990). Future exploration for heavy mineral sands in the Murray Basin must be based on sound sedimentological and stratigraphic understanding of the distribution processes and possible location of depositional sites of heavy minerals within the strand plains of the basin.

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TABLE 1. SUMMARY OF COMPANY EXPLORATION FOR MINERAL SANDS IN THE MURRAY BASIN, SOUTH AUSTRALIA

Company	Exploration Licence (EL)	Date granted	Date reqlinquished	Area	No of drillholes	Total metres
Aberfoyle Resources Ltd	1356	2/9/86	19/7/91	2 491km^2	12 537m*	12537
	1357	2/9/86	19/7/91	2 492km^2	6 751m*	6 751
	1397	29/4/87	3/5/91	1 489km^2	295 RAB	5 135
	1401	13/5/87	3/5/91	660km^2	146 RAB	2 442
	1399	29/4/87	23/9/87		16 RAB	279
	1417	6/8/87	5/8/88	2 219 km^2		
		5/8/88	3/5/91	465km^2	222 RAB	3 944
	1454	7/12/87	6/12/88	225km^2	345 RAB	4 776
	1499	4/7/88	3/1/91	1 742km^2	121 RAB	2 074
					55 RC	1 502
	1502	11/7/88	6/8/90	2 532km^2	375 RAB	6 147
					39 RC	975
	1503	11/7/88	10/7/89	1 845km^2	440 RAB	7 180
	1553	9/12/88	8/4/90		273 RAB	4 035
					16 RC	461
	1558	9/1/89	5/2/90	2 489km^2	55 RAB	933
	1560	19/1/89	18/1/90		49 RAB	841
Peregrine Resources (Aust) NL	1476	28/3/88	27/3/89	1 600km^2	95 RC	5 126
	1510	2/9/88	11/7/89		25 RC	956
	1511	2/9/88	11/7/89			
	1512	2/9/88	11/7/89			
BHP - UTAH	1445	15/11/87	16/11/88	1 295km^2	245 RC	3 488
Placer Exploration Ltd	1674	31/8/90	16/5/91		15 RC	586
	1675	31/8/90	16/5/91		10 RC	400
Burmine & Denison Ltd	1425	21/8/87	20/2/90	2 175km^2	16 RC	456
CRA Exploration Pty Ltd	1309	15/11/85	2/12/86	1 033km^2	19 RC	323
Carpentaria Exploration	194				17 Auger	
Jennings Mining Ltd	169	20/1/75	9/7/75	12 717km^2	23 Auger	189
Demis Pty Ltd & Mining Corp of Aust Ltd	1554	9/1/89	8/7/89	1 979km^2	11 RC	
	1555	9/1/89	8/7/89	1 428km^2	16 RC	360
	1557	9/1/89	8/7/89	1 502km^2	2 RC	21

*Includes both RAB & RC.

TABLE 2. HEAVY MINERAL INTERSECTIONS - EL 1502

Hole Numbers	Width (m)	Depth (m)	Thickness (m)	%HM
LW08-012		10 - 14	4	2.20
LW08-034-040	800		8	2.18
LW08-058		8 - 10	2	1.27
LW10-012		8 - 10	2	4.66
LW10-026		4 - 6	2	3.17
LW10-058		2 - 4	2	2.88
LW10-064		2 - 8	6	3.31
LW10-070		4 - 6	2	2.04
LW10-106		8 - 10	2	2.53
LW12-026		6 - 12	6	3.37
LW12-048-052	600		5.3	4.09
LW12-074		6 - 10	4	2.09
LW11-060		12 - 15	3	4.12

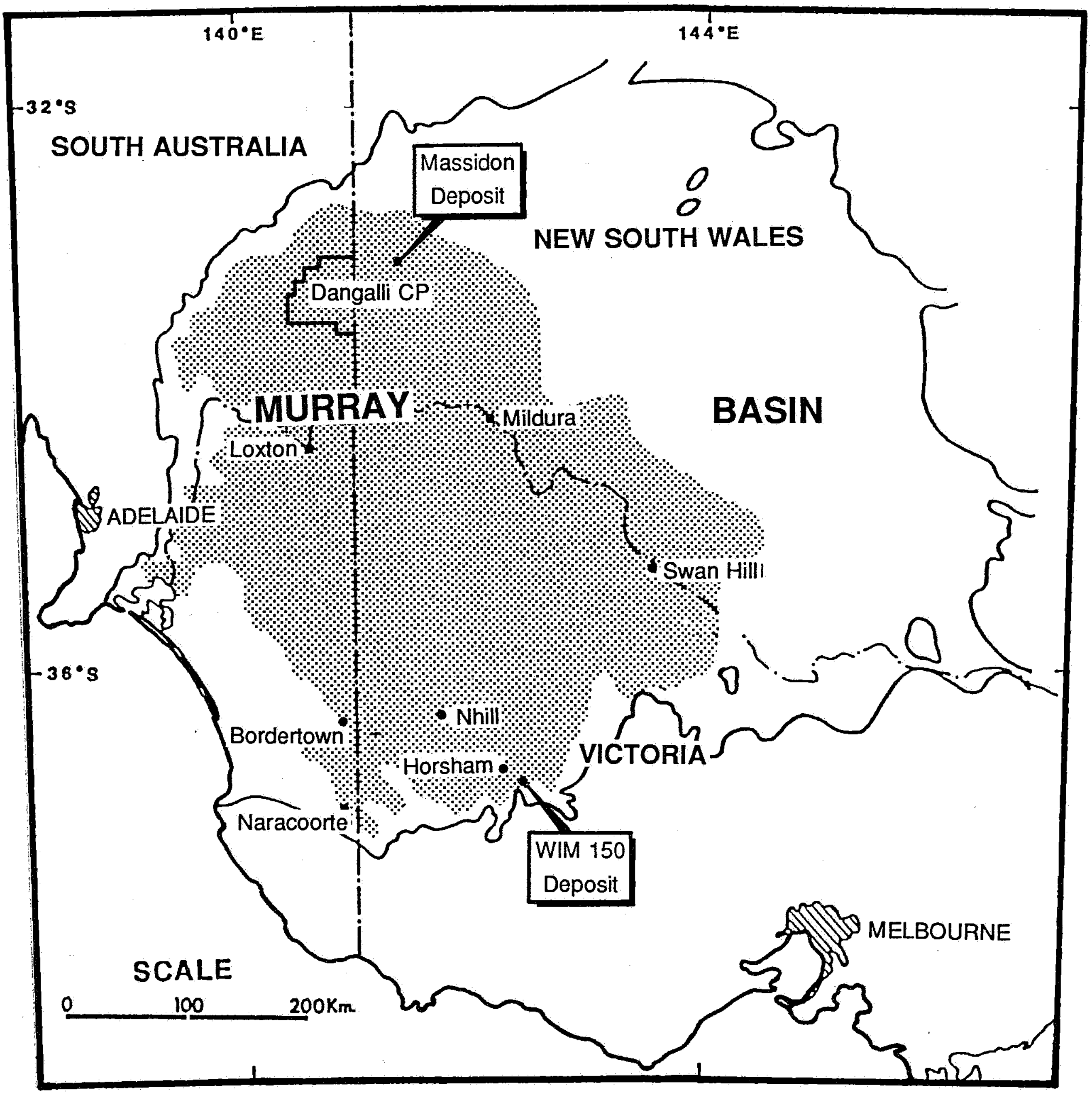


Figure 1. Murray Basin Locality plan

DME_SA 93-1287

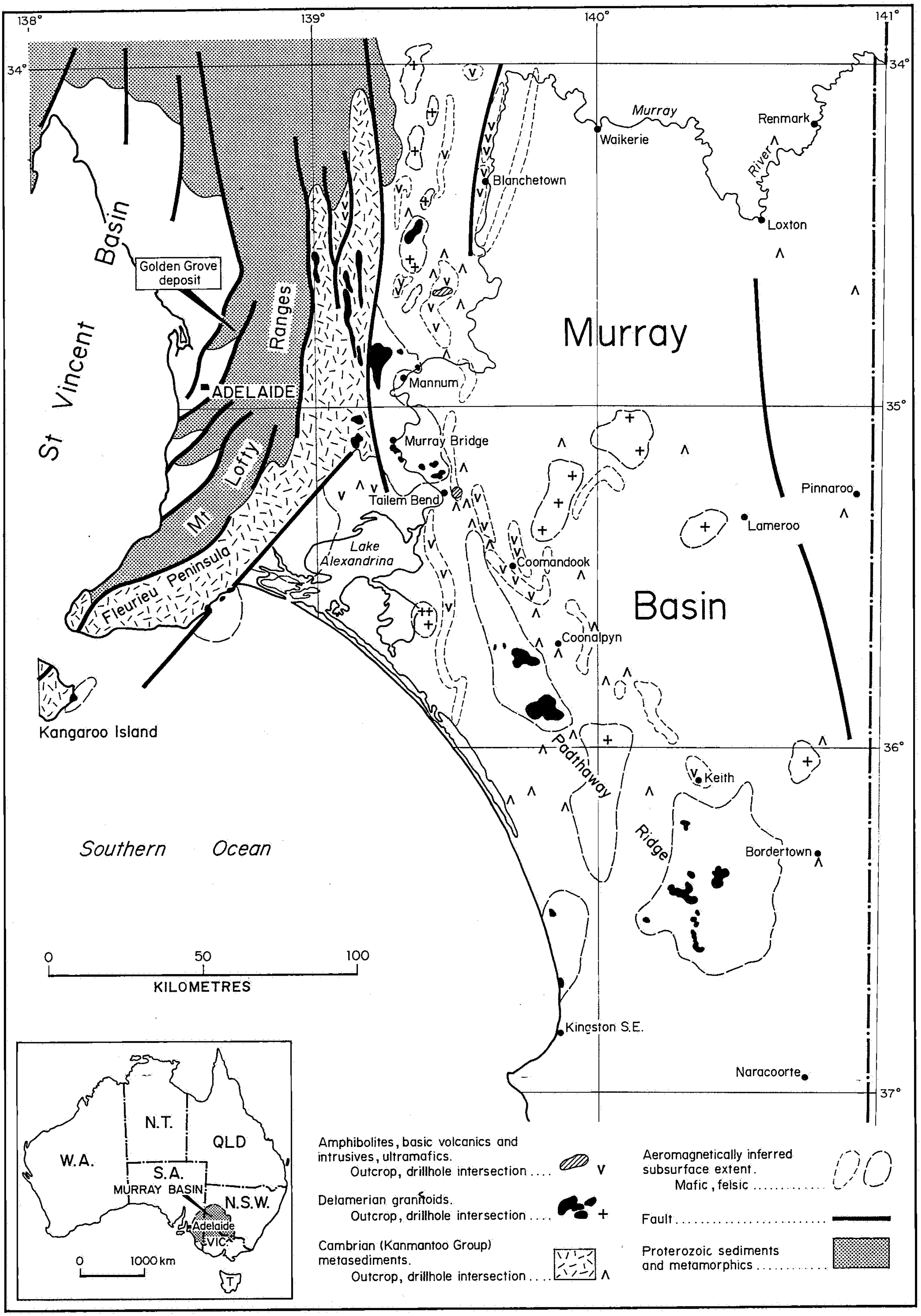


Figure 2. Bedrock geology, western Murray Basin and Fleurieu Peninsula

DME_SA 93-1288

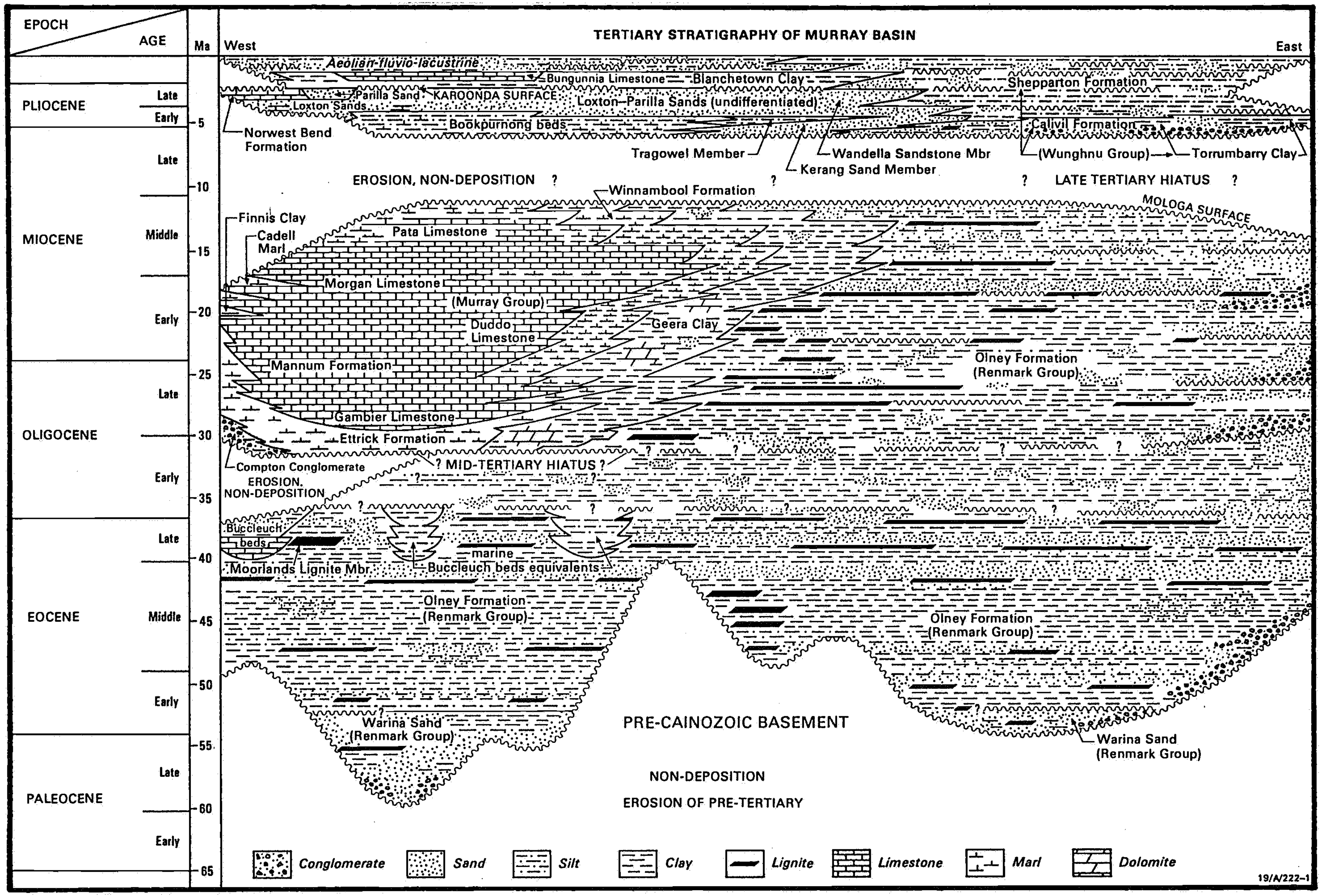


Figure 3. Cainozoic stratigraphy of the Murray Basin. (Brown and Stephenson, 1991)

DME_SA 93-1289

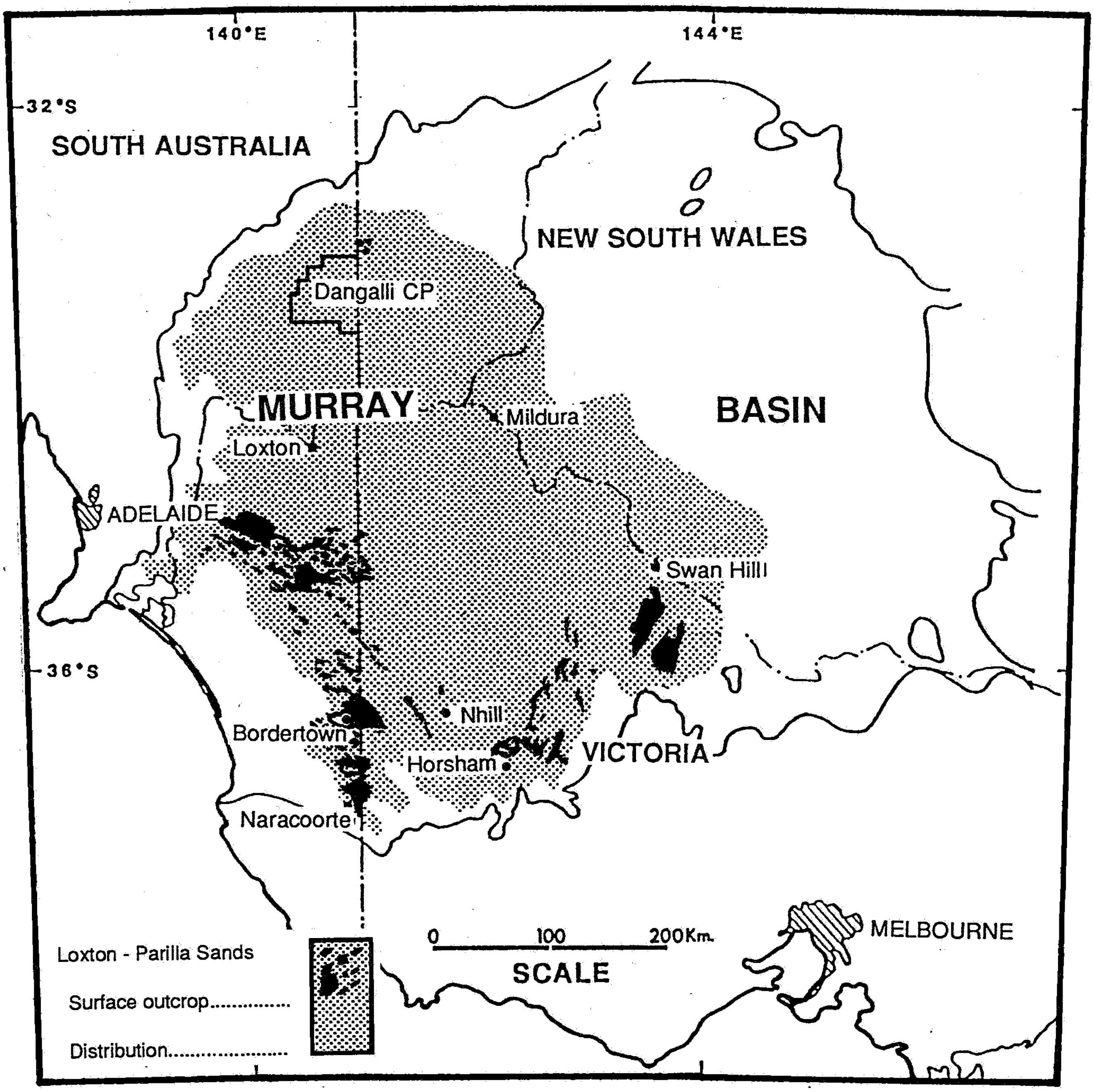


Figure 4. Distribution of Pliocene Loxton - Parilla Sand.

DME_SA 93-1290

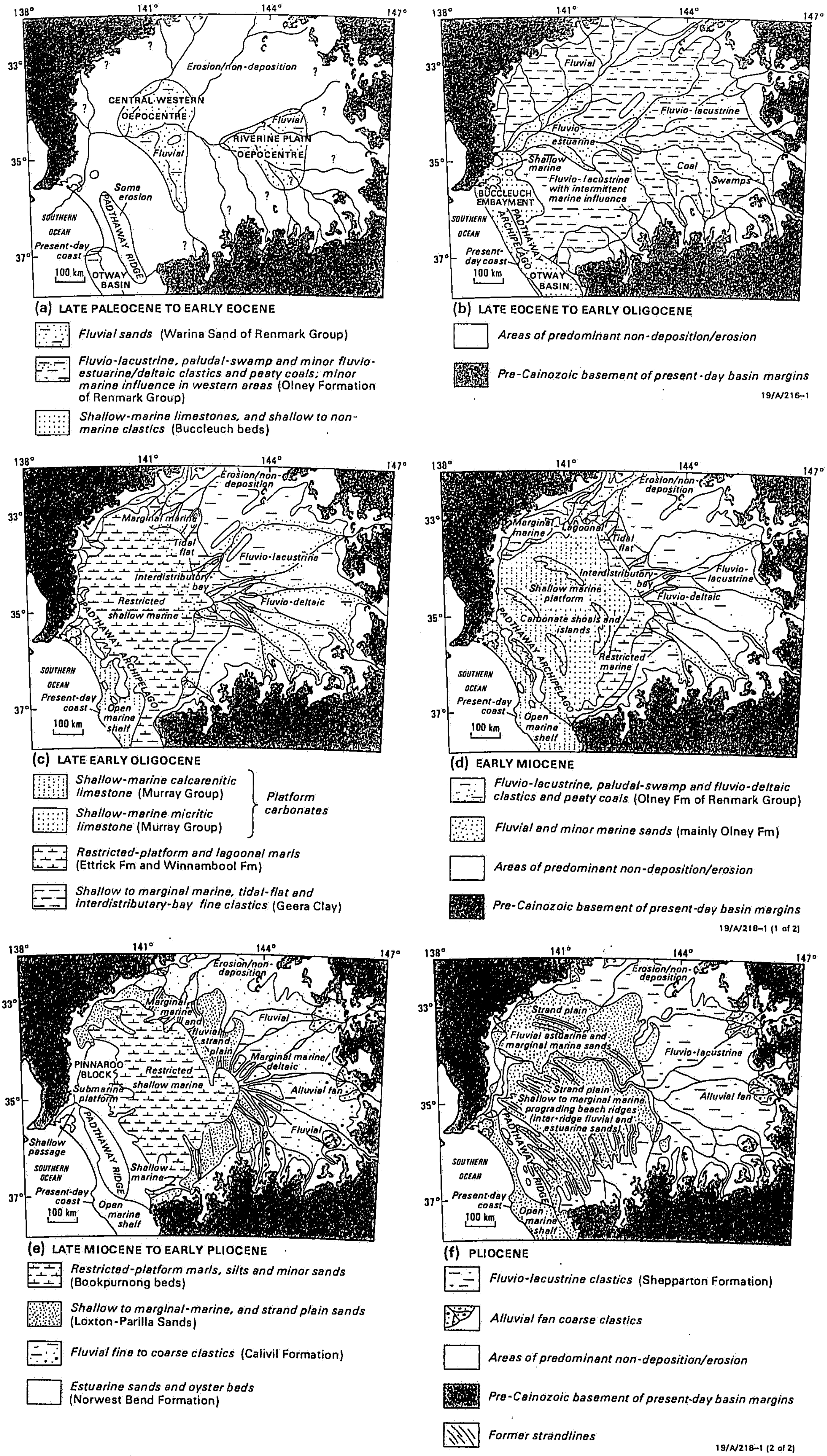


Figure 5. Tertiary palaeogeography of the Murray Basin. (Brown and Stephenson, 1991)

DME_SA 93-1291

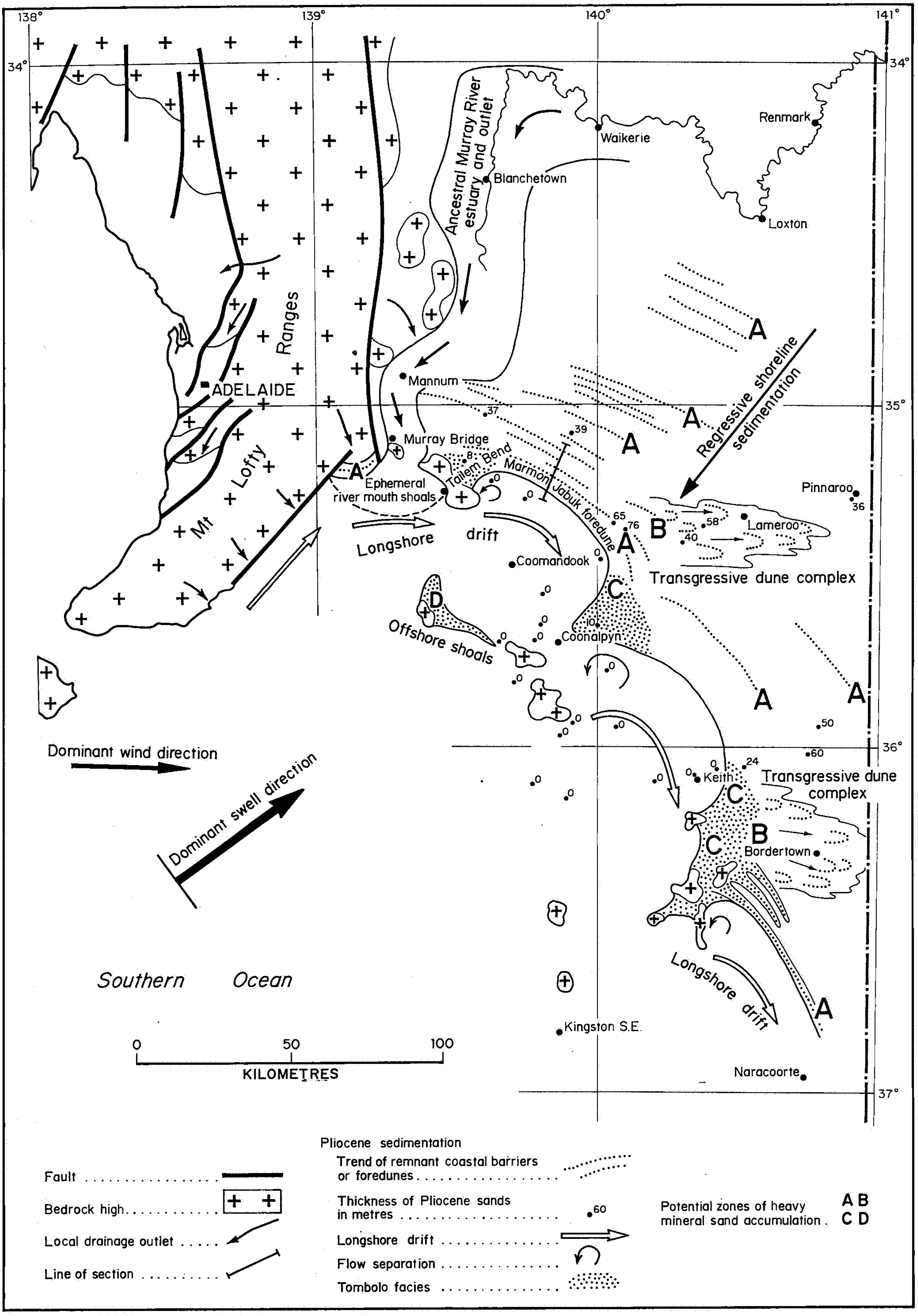
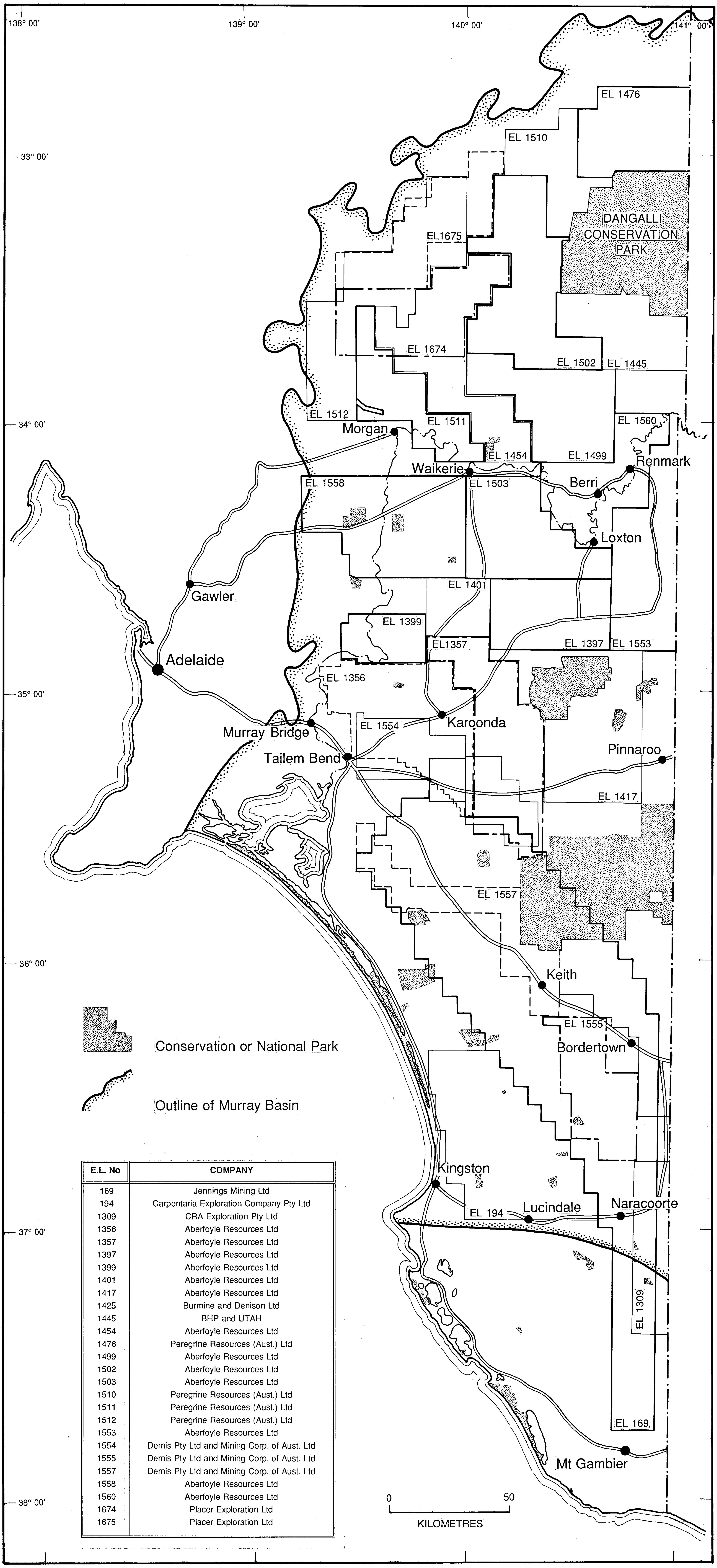


Figure 6. Location of possible sites of deposition and preservation of Pliocene heavy minerals

DME_SA 93-1292



E.L. No	COMPANY
169	Jennings Mining Ltd
194	Carpentaria Exploration Company Pty Ltd
1309	CRA Exploration Pty Ltd
1356	Aberfoyle Resources Ltd
1357	Aberfoyle Resources Ltd
1397	Aberfoyle Resources Ltd
1399	Aberfoyle Resources Ltd
1401	Aberfoyle Resources Ltd
1417	Aberfoyle Resources Ltd
1425	Burmine and Denison Ltd
1445	BHP and UTAH
1454	Aberfoyle Resources Ltd
1476	Peregrine Resources (Aust.) Ltd
1499	Aberfoyle Resources Ltd
1502	Aberfoyle Resources Ltd
1503	Aberfoyle Resources Ltd
1510	Peregrine Resources (Aust.) Ltd
1511	Peregrine Resources (Aust.) Ltd
1512	Peregrine Resources (Aust.) Ltd
1553	Aberfoyle Resources Ltd
1554	Demis Pty Ltd and Mining Corp. of Aust. Ltd
1555	Demis Pty Ltd and Mining Corp. of Aust. Ltd
1557	Demis Pty Ltd and Mining Corp. of Aust. Ltd
1558	Aberfoyle Resources Ltd
1560	Aberfoyle Resources Ltd
1674	Placer Exploration Ltd
1675	Placer Exploration Ltd

5814

Figure 7. Location of Exploration Licences within the Murray Basin

DME_SA 93-1293

APPENDIX A

SUMMARY DATA SHEETS

MURRAY BASIN, SOUTH AUSTRALIA

INDEX TO SUMMARY DATA SHEETS

COMPANY:	JENNINGS MINING LTD.
TENEMENT:	EL 169
ENVELOPE:	2518
1:250 000 SHEET:	NARACOORTE/PENOLA/PINNAROO
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pleistocene ?Bridgewater Formation and Holocene Molineaux Sand
STRUCTURAL CONTROL:	Pleistocene strandlines

EXPLORATION SUMMARY:

A photo-interpretive geological study of the area was undertaken in order to delineate heavy mineral targets in the Murray Basin. A reconnaissance surface sampling program was undertaken and 252 samples were collected. 144 of these samples were examined under the microscope to determine their heavy mineral composition. 23 auger holes were completed for a cumulative depth of 189 m and 126 incremented 1.5 m samples collected during drilling. 2 drill samples and 5 surface samples were submitted to AMDEL for heavy mineral determination. Water Bore data were also examined.

MINERALISATION /PROSPECTS:

No economic deposits of heavy minerals were encountered during exploration of the licence area. All 7 samples submitted to AMDEL for heavy mineral determination returned values of <1.0%.

COMPANY:	CARPENTARIA EXPLORATION CO. PTY LTD
TENEMENT:	EL 194
ENVELOPE:	2577
1:250 000 SHEET:	NARACOORTE
TARGET:	Heavy Mineral Sands
AGE/ROCK UNIT:	Pleistocene Bridgewater Formation
STRUCTURAL CONTROL:	Pleistocene strandlines
EXPLORATION SUMMARY:	Exploration comprised a geomorphological study of the coastal dunes together with magnetic intensity maps to delineate basement contours and possible location of beach placer deposits. Initial sampling comprised a programme of 17 hand auger holes between 1.5m and 4.5m deep. Samples were collected at 1.5m intervals and 56 samples were forwarded to Amdel for heavy mineral determination. Further sampling comprised collection of sand samples from road and drain cuttings and rock samples from igneous rocks. Nineteen sand samples and 8 rock samples were forwarded to Amdel.
MINERALISATION /PROSPECTS:	heavy mineral contents of the auger samples were low ranging from 0.04-1.16% and comprised predominantly non-economic heavy minerals. Heavy mineral contents of the 19 surface samples ranged from 0.04-0.26%.

COMPANY:	CRA EXPLORATION PTY. LTD.
TENEMENT:	EL 1309
ENVELOPE:	6509
1:250 000 SHEET:	NARACOORTE / PENOLA
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene sheet sands and strandlines incorporating lenses of heavy minerals.
EXPLORATION SUMMARY:	Regional aeromagnetic and gravity data were examined to define a secondary target for the drilling program. RC drilling consisted of 19 holes along 2, approximately north-south lines for a total depth of 323 m. Samples were collected from each one metre interval and logged for lithology and heavy mineral occurrence. In addition, each sample was measured with a scintillometer. If heavy minerals were visible and/or the scintillometer reading was twice background, a composite was made from the entire one metre and preceding one meter interval. A split was retained for heavy mineral separation and a 100 gram split kept for geochemical analysis.
MINERALISATION /PROSPECTS:	No economic accumulation of heavy minerals was encountered during drilling. The Parilla sand was generally more clayey than expected and this has been interpreted as a more distal deposit of the formation. The area was subsequently relinquished.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1356,1357
ENVELOPE:	6919,6762
1:250 000 SHEET:	ADELAIDE/PINNAROO/RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene, Loxton and Parilla Sands.
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals.

EXPLORATION SUMMARY:

RAB drilling was carried out along 10 traverse lines on EL 1356 and along 12 traverse lines on EL 1357 for a total of 12 537 and 6751 metres respectively. Hole spacing varied between 100 m and 400 m while traverse lengths ranged between 0.5 and 13.6 km. Some RC drilling was undertaken to substantiate the RAB drilling results. Grab samples of 100-150 grams were collected from each 2 metre interval. Samples were panned on site and when visually deemed to contain >0.5% heavy minerals, they were submitted to AMDEL for heavy liquid separation. Mineralogical examination was carried out on the heavy mineral fraction of the samples.

MINERALISATION /PROSPECTS:

The Perponda prospect on EL 1356 is a lens of heavy mineral sand more than 10 km long, averaging 500 m wide and 6 m thick with an average of 2% heavy minerals. Grid drilling on the prospect on Line KR02 encountered a lens of heavy minerals more than 800 m wide, 4-6+ m thick at an average grade of 1.93% heavy minerals. Line KR07 intersected a lens more than 400 m wide and 6-10+ m thick with an average grade of 2.3% heavy minerals. Lines KR01, 05 and 06 are located at the south-eastern limit of the grid drilling base line. A lens more than 300 m wide, 2-6+ m thick at an average grade of 2.59% heavy minerals was encountered together with an adjacent lens 100 m wide, 2-4 m thick at 1.60% heavy minerals.

In total the Perponda prospect is a lens of heavy minerals extending 5 km along strike from Line Perponda to Line KR01, varying in width from 1700 m to 300m and in thickness from 2-10+ m. The lens is estimated to contain 27 million tonnes of sand averaging 2% heavy minerals.

The Upsn Downs mineralisation incorporates both EL 1356 and EL 1357 and could be the south-easterly extension of the Perponda prospect. Line PK05 located a lens 600 m long, 2-5+ m thick and an average of 2.88% heavy minerals. However, the length of intersection may represent length along strike due to the orientation of the Line. An irregular lens 200 m long was located by a 2 m intersection in two holes on Line PK10 with heavy mineral grades of 1.13% and 1.47%. Most drill holes in the area did not penetrate below 60 m elevation and thus did not intersect any strike extension of the Perponda prospect.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1397, 1401
ENVELOPE:	6869
1:250 000 SHEET:	RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals

EXPLORATION SUMMARY:

RAB drilling was undertaken along 15 traverse lines for 295 holes on EL 1393 and along 5 traverses on EL 1401 for 146 holes. The cumulative drill depth on EL 1397 and EL 1401 totalled 5135 m and 2442 m respectively. Hole depths reached between 18 and 24 m and hole spacing ranged from 25 to 400 m depending on the prospectivity of the particular area. 100- 150 g grab samples were taken from each 2 m interval. Part of the sample was bagged while the remainder was panned on-site in order to visually assess the percentage of heavy minerals. A back-up sample of 1-2 kg was collected when the sediments appeared to contain a significant amount of heavy minerals. When samples were judged to contain >0.5% heavy minerals, they were submitted to AMDEL for heavy liquid separation. Adjacent intervals to mineralised zones were also submitted to clearly define the zone of concentration. Quantitative mineralogy was performed at AMDEL on 18 samples that relate to the Mindarie prospect. Metallurgical work was carried out by Readings of Lismore on a 200 kg bulk sample from the Mindarie prospect. The work involved separating the bulk sample into rutile/leucoxene, ilmenite and zircon concentrates. Additionally, a geophysical survey was undertaken by Kevron Geophysics Pty. Ltd. to cover the entire known area of the Mindarie prospect.

MINERALISATION /PROSPECTS:

The Mindarie prospect is located predominantly on EL 1397. Mineralisation occurs broadly in three major lenses that have >1.0% heavy mineral content over a strike length of 12 to 20 km. The lenses have been assigned the abbreviations A, B and C.

Below is a summary of each lens:

Lens A: 19.6 km strike length. Open to NW and SE 100-300, m wide, 2-6 m thick, 4-14 m deep. Potential resource 16 mT. Heavy mineral grade 2.92%, Rutile factor 0.34, Rutile equivalent grade 0.99%.

Lens B: 12.4 km strike length. Open to SE, may be closed to the NW. 100-150 m wide, 2.8 m thick, 2-12m deep. Potential resource 24 mT. Heavy mineral grade 3.82%, Rutile factor 0.13 Rutile equivalent grade 0.50%

Lens C: 15.5 km strike length. Open to NW and SE, 100-300 m wide, 2-5 m thick, 2-14m deep. Potential resource 16 mT. Heavy mineral grade 1.96%, Rutile factor 0.34, Rutile equivalent grade 0.67%.

In total the Mindarie prospect retains a potential resource of approximately 56 mT. The prospect is yet to be commercially developed.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1399
ENVELOPE:	6881
1:250 000 SHEET:	RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene, Northwest Bend Formation
STRUCTURAL CONTROL:	Pliocene estuarine sediments confined to the course of the ancestral River Murray.
EXPLORATION SUMMARY:	A total of 16 RAB holes along a single traverse were completed for a cumulative depth of 279 m. The holes were spaced between 200 and 400 m. Sampling involved taking 100-150 grams of sediment from each 2 m interval. The samples were panned on-site in order to determine the heavy mineral content.
MINERALISATION /PROSPECTS:	Results from the drilling program were poor with only trace amount of heavy minerals observed. The best intersection came from hole WF1-2 which over a 16-18 m interval yielded 0.23% heavy minerals. The area was subsequently relinquished.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1417
ENVELOPE:	8065
1:250 000 SHEET:	PINNAROO
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals

EXPLORATION SUMMARY: RAB drilling was carried out along 5 traverses for a total of 222 holes and a cumulative depth of 3944 m. Hole spacing was generally every 200 m and the target depth was 18 m. Some holes had to be abandoned at <18 m due to hole collapse. Grab samples of 100-150 g were taken from each 2 m interval. Visual estimates of heavy mineral percentage were obtained by panning part of the sample. The remainder of the sample was bagged for heavy mineral determination. Heavy liquid separation was carried out on 18 samples that had a >1.0% visually estimated heavy mineral component. No mineralogical examination was carried out.

MINERALISATION /PROSPECTS: Drilling failed to locate any major heavy mineral accumulation. The best intersection was in hole PA01-52 where 0.72% heavy minerals were encountered between 6 and 8 m. The licence area was relinquished.

COMPANY:	BURMINE & DENISON LTD
TENEMENT:	EL 1425
ENVELOPE:	6937
1:250 000 SHEET:	NARACOORTE
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene shoreline containing heavy minerals

EXPLORATION SUMMARY: Geomorphic maps were generated after a photo-interpretive study and ground truthing of the area. 16 holes for a total depth of 456 m were completed along 4 traverse lines utilising an NQ RC air core technique. Samples were taken from each 1 m interval and bagged for subsequent panning. Only 6 samples were examined in detail to determine their heavy mineral composition.

MINERALISATION /PROSPECTS: No economic accumulation of heavy minerals was found in the area. The best results were obtained on Line 1 from 20-22 m and 22-24 m where the heavy mineral Wt%'s were 2.42% and 3.04% respectively. However, the heavy minerals were dominated by uneconomic goethite.

COMPANY:	BHP-UTAH MINERALS INTERNATIONAL
TENEMENT:	EL 1445
ENVELOPE:	8009
1:250 000 SHEET:	CHOWILLA
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals.
EXPLORATION SUMMARY:	RC air core drilling was undertaken along 12 traverses for a total of 245 holes and depth of 3488 m. The average depth reached was 22.4 m. A total of 2604 samples were collected using a 2 m sample interval. 315 samples were submitted to Classic Comlabs for Ti and Zr analysis by XRF. All holes were gamma ray logged and individual samples tested with a hand- held scintillometer.
MINERALISATION /PROSPECTS:	Heavy mineral occurrence on EL 1445 were generally very low and no economic deposits were located. The best interval recognised visually was in PT128 at 24-26 m where an estimated 1.5% heavy minerals occurred. The most encouraging laboratory results came from the 26-28 m interval in hole PT069. XRF revealed the sediments to contain 1020 ppm Zr and 6000 ppm Ti.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1454
ENVELOPE:	8004
1:250 000 SHEET:	CHOWILLA/RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand.
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals.
EXPLORATION SUMMARY:	RAB drilling consisted of 345 holes with a target depth of 18 m, spaced at 200 m intervals along 4 traverse lines for a total length of 69.4 km and total depth of 4776 m. Grab samples of 100-150 grams were collected from each 2 m interval. Part of the sample was panned on site to gain a visual estimate of the heavy mineral percentage and another sample retained for heavy mineral determination. Only 44 samples displayed >1.0% heavy minerals and these were submitted for heavy liquid separation. Mineralogical examination consisted of rapid in-house scanning.
MINERALISATION /PROSPECTS:	The best results came from Line BL02 where hole 64 intersected 4.58% heavy minerals over a 4 m interval. In hole 108, 2.54% heavy minerals were present over a 6 m interval. However, the heavy minerals are dominated by iron oxides and ilmenite.

COMPANY:	PEREGRINE RESOURCES (Aust) N.L.
TENEMENT:	EL 1476 & 1612
ENVELOPE:	8005
1:250 000 SHEET:	OLARY
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla and Loxton Sands
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals

EXPLORATION SUMMARY: Existing drillhole data acquired in the Western Murray Basin were examined in order to identify prospective targets in the licence area. An aeromagnetic and radiometric geophysical survey was conducted over the E.L. However this technique proved unsuccessful in delineating heavy mineral sands. 29 reconnaissance RC air core holes were completed for 1319 m. Hole depths averaged 45.5 m. RC drilling of an additional 66 holes for a total depth of 3807 m was completed in the area. The average hole depth was 36 m. Sampling was undertaken at 1 m intervals and the sands were panned on-site. When the samples were visually estimated to contain a significant percentage of heavy minerals, they were submitted to Vic Normet for heavy liquid separation. A total of 356 samples were analysed by AMDEL to verify the Vic Normet results. A spectrometer reading was taken on-site to identify any anomalous radioactivity.

MINERALISATION /PROSPECTS: Examining AMDEL results, the best hole intersections minerals were encountered in OK 79 (6.78% and 4.6%), OK90 (5.73% and 3.81%) and OK 36 (4.81% and 2.04%). Although several areas of significant mineralsiation exist in the tenement no economic resource can be delineated at this stage.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1499
ENVELOPE:	8026
1:250 000 SHEET:	CHOWILLA
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals.

EXPLORATION SUMMARY:

RAB drilling was carried out along 4 traverse lines for a total of 121 holes and a cumulative depth of 2074 m. Additionally, 4 traverses consisting of 55 RC holes were drilled for a total of 1502 m. Grab samples of 100-150 grams were taken from each 2 m interval. A sample from each interval was also retained for subsequent heavy mineral determination and another sample was panned on site for visual heavy mineral determination. When samples displayed heavy mineral percentages of >0.5% they were submitted for heavy mineral determination.

MINERALISATION /PROSPECTS:

Drillhole GP01 048 intersected a 6 m interval of 0.3% heavy minerals. Holes GP07 022-026 delineated a 400 m long, 2- 8 m thick, 2.5% heavy mineral lens. GP07 058-066 defined an 800 m long, 2 m thick, 1.5% heavy mineral lens. The mineral assemblage comprised ilmenite, leucoxene, zircon and minor rutile.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1502
ENVELOPE:	8025
1:250 000 SHEET:	CHOWILLA
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals

EXPLORATION SUMMARY:

Base maps were prepared in after the study of LANDSAT data and topographic maps. RAB drilling was undertaken along 10 traverse lines for 375 holes and a total depth of 6147 m. RC air core drilling was carried out along 5 traverses for 39 holes and a cumulative depth of 975 m. 100-150 g grab samples were taken from each 2 m interval. Part of the sample was bagged while the another was panned on-site in order to visually assess the percentage of heavy minerals. A back-up sample of 1-2 kg was collected when the sediments appeared to contain a significant amount of heavy minerals. When samples were judged to contain >0.5% heavy minerals, they were submitted to AMDEL for heavy liquid separation. Adjacent intervals to mineralised zones were also submitted to clearly define the zone of concentration. Central Mineralogical Services undertook mineralogical examination of selected samples.

MINERALISATION /PROSPECTS:

Heavy mineral intersections on the licence area were prevalent. Holes LW08 034-040 defined a lens 800 m long, 8 m thick with a heavy mineral grade of 2.18%. Holes LW12 048-052 delineated a 600 m long, 5.3 m thick, 4.09% heavy mineral lens. 1-2.5% heavy minerals were also noted in 4 m intersections in holes LW13-010 and LW13-027. However the heavy mineral assemblage was dominated by the uneconomic minerals goethite and ilmenite. The licence was subsequently allowed to expire.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1503
ENVELOPE:	8017
1:250 000 SHEET:	RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand and Northwest Bend Formation
STRUCTURAL CONTROL:	Pliocene strandlines and estuarine sediments

EXPLORATION SUMMARY:

RAB drilling was carried out along 8 traverse lines with the completion of 440 holes for a total depth of 7180 m. Target depth was 18 m, however some holes were abandoned at <18 m due to hole collapse in loose coarse sand. 100-150 g grab samples were acquired from each 2 m interval. Part of the sample was bagged while the remainder was panned on-site to visually estimate the percentage of heavy minerals present. When the sample displayed >0.5% heavy minerals, it was submitted to AMDEL for heavy liquid separation. Mineralogical examination of selected samples was carried out in-house.

MINERALISATION /PROSPECTS:

Drilling of lines WK03 and WK05 delineated an 800 m wide lens of heavy minerals extending along strike for approximately 11 km. Using a 0.78% cut-off, the lens averages 2.6 m thick at 1.29%. The mineralogy of 9 samples show the assemblage to contain 5% rutile, 10% leucoxene, 27% ilmenite and 11% zircon. Other lines only located sporadic occurrences of heavy minerals and were not examined mineralogically. Line WK01 intersected the estuarine Northwest Bend Formation.

COMPANY:	PEREGRINE RESOURCES (Aust) N.L.
TENEMENT:	EL 1510,1511 and 1512
ENVELOPE:	8059
1:250 000 SHEET:	BURRA/RENMARK/OLARY
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene, Northwest Bend Formation.
STRUCTURAL CONTROL:	Pliocene estuarine sediments confined to the course of the ancestral Murray River.
EXPLORATION SUMMARY:	Regional reconnaissance air core RC drilling of 25 holes for 956 m at depths between 10-72 m was undertaken in the licence areas. An average drilling depth of 42.5 m was attained during the programme. Samples were taken from each 1 m interval and panned on site to enable a visual estimate of heavy minerals to be entered on the log sheet. Only samples that exhibited significant heavy mineral occurrence were submitted for heavy liquid separation. A total of 8 samples were examined mineralogically at AMDEL. An aeromagnetic and radiometric survey was carried out over part of EL 1510. However, the survey only managed to reveal basement anomalies.
MINERALISATION /PROSPECTS:	Drilling failed to locate the prospective Pliocene Loxton or Parilla Sands over the exploration areas. Hole 1 on EL 1510 intersected 32 m of mineralisation which contained a maximum visual estimate of 2% heavy minerals. However, the heavy minerals were predominantly goethite. Holes 12,14,15,18 and 21-25 terminated in probable Northwest Bend Formation.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1553
ENVELOPE:	8112
1:250 000 SHEET:	CHOWILLA/RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla and Loxton Sands
STRUCTURAL CONTROL:	Pliocene strandlines containing lenses of heavy minerals.

EXPLORATION SUMMARY: Initial exploration entailed the study of LANDSAT images and topographic maps in order to identify Pliocene strandlines and shorelines. Drilling comprised 273 RAB holes along 9 traverses for a cumulative depth of 4035 m. RC drilling consisted of 16 holes for a total depth of 461 m along a single traverse line. Grab samples of 100-150 grams were obtained from each 2 m interval. One sample was bagged for subsequent heavy mineral determination while another was panned on site for visual heavy mineral estimation.

MINERALISATION /PROSPECTS: Initial drilling located a heavy mineral lens 800 m long, 2.8 m thick with an average of 1.61% heavy minerals. Follow up drilling failed to locate any strike extension of the lens.

COMPANY:	Demis Pty Ltd & Mining Corp. of Aust. Ltd
TENEMENT:	EL 1554
ENVELOPE:	8172
1:250 000 SHEET:	PINNAROO
TARGET:	Heavy Mineral Sands
AGE/ROCK UNIT:	Pliocene, Loxton and Parilla Sands
STRUCTURAL CONTROL:	Pliocene tombola structures
EXPLORATION SUMMARY:	Eleven holes were completed for a cumalitive depth of 401.4m. Five composite samples were prepared on the basis of visual estimates of heavy minerals and submitted to AMDEL for heavy mineral determination. The mineralogy of 1 sample was determined.
MINERALISATION /PROSPECTS:	The best results were MJR 8 (28-34m) and MJR 11 (10-14m) which comprised 0.74% and 0.44% heavy minerals respectively. Sample MJR 8 (28-34m) comprised 47% garnet and 17% altered ilmenite.

COMPANY:	DEMIS PTY. LTD. & MINING CORP. OF AUST. LTD.
TENEMENT:	EL 1555
ENVELOPE:	8173
1:250 000 SHEET:	NARACOORTE
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines and tombola facies

EXPLORATION SUMMARY: 16 holes were drilled for a total depth of 360 m. Some intervals displayed heavy mineral occurrence and 16 samples from these intervals were submitted for heavy mineral determination by AMDEL. A further 3 samples were analysed for mineralogy.

MINERALISATION /PROSPECTS: Of the 16 slurry samples analysed by AMDEL, the best result was found in sample WH 2/6-10 which contained 1.11% total heavy minerals. 3 samples were assayed for mineralogy as a vol% of the total heavy minerals. WH 1/6-10 contained 20% tourmaline, 20% porous iron oxide and 19% leucoxene. WH 2/6-10 comprised 83% porous iron oxide. WH 5/10-18 contained 48% leucoxene and 25% tourmaline.

COMPANY:	DEMIS PTY. LTD. & MINING CORP. OF AUST. LTD.
TENEMENT:	EL 1557
ENVELOPE:	8174
1:250 000 SHEET:	PINNAROO
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Holocene ?Molineaux Sand
STRUCTURAL CONTROL:	Pleistocene strandlines and tombola facies

EXPLORATION SUMMARY: A reconnaissance field trip was conducted at Pt. Stuart on Lake Alexandrina to study the sedimentological processes that result in the deposition of heavy mineral sands. Additional field work concentrated on the Pleistocene sands found along the length of the Padthaway Ridge. Based on the above work, a reconnaissance drilling program was proposed. However, due to drilling difficulties in calcrete, only 2 holes totalling 21 m were completed near 'Bullicky Wells'.

MINERALISATION /PROSPECTS: Geological logs supplied. No sample analysis results recieved.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1558
ENVELOPE:	8127
1:250 000 SHEET:	ADELAIDE/RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene, Northwest Bend Formation.
STRUCTURAL CONTROL:	Pliocene estuarine sediments confined to the course of the ancestral Murray River.
EXPLORATION SUMMARY:	RAB drilling of 55 holes was carried out along 4 traverses for a total distance of 21.6 km and total depth of 933 m. Most holes reached 18 m but some had to be abandoned as shallow as 7 m due to indurated layers preventing penetration. Holes were spaced at 400 m intervals along the traverses. Grab samples of 100-150 grams were collected from each 2 m interval. One sample was retained for subsequent heavy mineral determination while another was panned on site for visual heavy mineral percentage estimation.
MINERALISATION /PROSPECTS:	Drilling on EL 1558 failed to locate the target Pliocene, Loxton and Parilla Sands that are known to contain heavy minerals. Drilling intersected Pleistocene sands overlying the estuarine Northwest Bend Formation which formed in the course of the ancestral Murray River. Heavy minerals were not encountered in any significant quantities with the highest visual estimate being 0.2%. No samples were submitted for analysis.

COMPANY:	ABERFOYLE RESOURCES LTD.
TENEMENT:	EL 1560
ENVELOPE:	8144
1:250 000 SHEET:	RENMARK
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pleistocene sands ?Woorinen Formation and Blanchetown Clay
STRUCTURAL CONTROL:	Pleistocene aeolian sediments

EXPLORATION SUMMARY: Preliminary work involved the study of LANDSAT images, aerial photographs and topographic maps in an effort to identify paleoshorelines on the licence area. RAB drilling was carried out along 2 traverses for 49 holes and a cumulative depth of 841 m. Grab samples of 100-150 g were taken from each 2 m interval and when visually estimated to contain >0.5% heavy minerals, they were submitted to AMDEL for heavy liquid separation.

MINERALISATION /PROSPECTS: Samples only displayed trace amounts of heavy minerals and consequently the licence was allowed to expire.

COMPANY:	PLACER EXPLORATION LTD.
TENEMENT:	EL 1674,1675
ENVELOPE:	8347
1:250 000 SHEET:	CHOWILLA
TARGET:	Heavy Mineral Sands
AGE/ROCK UNITS:	Pliocene Parilla Sand
STRUCTURAL CONTROL:	Pliocene strandlines, tombola facies and distal basinal deposits.

EXPLORATION SUMMARY: Air core drilling was carried out over the two EL's with a total of 3 lines, 25 holes and 986 m being completed. No sample assays were undertaken. However, one sample (KA4) was submitted to SADME Biostratigraphy section for age determination. The sample was judged to be Miocene in age and hence lying stratigraphically below the target Pliocene sand.

MINERALISATION /PROSPECTS: Drilling failed to locate any economic mineralisation within the identified target sands. The EL's were subsequently relinquished.

APPENDIX B

MAP/DRILLHOLE/ENVELOPE REFERENCE LIST

HEAVY MINERAL SANDS

MURRAY BASIN - SOUTH AUSTRALIA

N.B. Drill hole and drill traverse identifiers used in this reference list are the same as those found on company maps within the SADME envelope system and also on the 1:250 000 sheets accompanying this report. An 'S' suffix denotes a reconnaissance surface sample.

ADELAIDE	ENVELOPE	BARKER	ENVELOPE	BURRA	ENVELOPE
BK02	8127	352-982 S	6919	WT16	8059
BK04	8127	D	6762	WT17	8059
D	6919	E	6919	WT19	8059
DEX	6919	F	6919	WT20	8059

CHOWILLA	ENVELOPE	NARACOORTE	ENVELOPE	NARACOORTE	ENVELOPE
BL01	8004	3001/3 S	2518	3142 S	2518
BL02	8004	3004/5 S	2518	3143 S	2518
BL03	8004	3006 S	2518	3144 S	2518
BL04	8004	3007 S	2518	3145 S	2518
PT09	8009	3008 S	2518	3146 S	2518
PT10A	8009	3009/11 S	2518	3147 S	2518
PT10B	8009	3012 S	2518	3148 S	2518
PT11A	8009	3013 S	2518	3149/53 S	2518
PT11B	8009	3014/15 S	2518	3154 S	2518
PT12A	8009	3016/18 S	2518	3155 S	2518
PT12B	8009	3019 S	2518	3156 S	2518
PT22	8009	3020 S	2518	3157 S	2518
PT23	8009	3021 S	2518	3158 S	2518
PT24A	8009	3022 S	2518	3159 S	2518
PT24B	8009	3023/24 S	2518	3160 S	2518
PT26	8009	3025 S	2518	3161 S	2518
PT27	8009	3026/27 S	2518	3162 S	2518
PT28	8009	3028 S	2518	3163 S	2518
PT29A	8009	3029 S	2518	3164 S	2518
PT29B	8009	3030/32 S	2518	3165 S	2518
LW03	8025	3033 S	2518	3166 S	2518
LW04	8025	3034 S	2518	3167 S	2518
LW05	8025	3035 S	2518	3168/70 S	2518
LW06	8025	3037/38 S	2518	3171 S	2518
LW07	8025	3039/40 S	2518	3172 S	2518
LW08	8025	3041 S	2518	3173 S	2518
LW09	8025	3042 S	2518	3174 S	2518
LW10	8025	3043 S	2518	3175 S	2518
LW11	8025	3044 S	2518	3176 S	2518
LW12	8025	3045/46 S	2518	3177 S	2518
LW13	8025	3047/50 S	2518	3178/80 S	2518
LW14	8025	3051 S	2518	3181 S	2518
LW15	8025	3053/54 S	2518	3182 S	2518
LW16	8025	3055/57 S	2518	3183 S	2518
LW17	8025	3058 S	2518	3184 S	2518
GP01	8026	3059/60 S	2518	3185 S	2518
GP02	8026	3061 S	2518	3186 S	2518
GP03	8026	3062 S	2518	3187 S	2518
GP05	8026	3063/64 S	2518	KI01	6509
GP06	8026	3065 S	2518	KI02	6509
OK23	8059	3066 S	2518	KI03	6509
OK25	8059	3067 S	2518	KI04	6509
OK26	8059	3068 S	2518	KI05	6509
WT01	8059	3069 S	2518	KI16	6509

CHOWILLA	ENVELOPE	NARACOORTE		ENVELOPE	NARACOORTE	ENVELOPE
WT02	8059	3070	S	2518	KI17	6509
WT03	8059	3071/72	S	2518	KI18	6509
WT05	8059	3073	S	2518	KI19	6509
WT06	8059	3074	S	2518	LINE01	6937
WT07	8059	3075	S	2518	LINE02	6937
WT08	8059	3076	S	2518	LINE03	6937
WT09	8059	3077	S	2518	LINE04	6937
WT10	8059	3078	S	2518	KTH01	?
WT11	8059	3079	S	2518	KTH02	?
WT12	8059	3080/81	S	2518	KTH03	?
WT13	8059	3082	S	2518	KTH04	?
WT14	8059	3083	S	2518	MUN01	?
WT15	8059	3084	S	2518		
WT18	8059	3085/90	S	2518		
WT21	8059	3091/92	S	2518		
WT22	8059	3093	S	2518		
WT23	8059	3094	S	2518		
WT24	8059	3095	S	2518		
MB15	8112	3096/98	S	2518		
FA01	8347	3099	S	2518		
FA02	8347	3100	S	2518		
FA03	8347	3101	S	2518		
FA04	8347	3102	S	2518		
FA05	8347	3103	S	2518		
FA06	8347	3104/05	S	2518		
FA07	8347	3106/07	S	2518		
FA08	8347	3108	S	2518		
FA09	8347	3109/10	S	2518		
FA10	8347	3109/10	S	2518		
KA01	8347	3111	S	2518		
KA02	8347	3113	S	2518		
KA03	8347	3114	S	2518		
KA04	8347	3115	S	2518		
KA05	8347	3116	S	2518		
KA06	8347	3117	S	2518		
KA07	8347	3118	S	2518		
KA08	8347	3122	S	2518		
KA09	8347	3123	S	2518		
KA10	8347	3124	S	2518		
KA11	8347	3125	S	2518		
KA12	8347	3126	S	2518		
KA13	8347	3127	S	2518		
KA14	8347	3128	S	2518		
KA15	8347	3129	S	2518		
OK30	8005	3130	S	2518		
OK31	8005	3131	S	2518		
OK32	8005	3132	S	2518		
OK33	8005	3133	S	2518		
OK34	8005	3134	S	2518		
OK35	8005	3135	S	2518		
OK42	8005	3136	S	2518		
OK43	8005	3137/38	S	2518		

CHOWILLA	ENVELOPE
OK44	8005
OK45	8005
OK46	8005
OK47	8005
OK48	8005
OK55	8005
OK56	8005
OK57	8005
OK58	8005
OK59	8005
OK60	8005
OK61	8005
OK68	8005
OK69	8005
OK70	8005
OK71	8005
OK72	8005
OK73	8005
OK74	8005
OK84	8005
OK85	8005
OK86	8005
OK87	8005

OLARY	ENVELOPE	OLARY	ENVELOPE	PENOLA		ENVELOPE
OK01	8059	OK54	8005	3188	S	2518
OK02	8059	OK62	8005	3189	S	2518
OK03	8059	OK63	8005	3190	S	2518
OK04	8059	OK64	8005	3191	S	2518
OK05	8059	OK65	8005	3192	S	2518
OK07	8059	OK66	8005	3193	S	2518
OK08	8059	OK67	8005	.3194	S	2518
OK13	8059	OK75	8005	3195/96	S	2518
OK14	8059	OK76	8005	3197	S	2518
OK15	8059	OK77	8005	3198	S	2518
OK16	8059	OK78	8005	3199	S	2518
OK17	8059	OK79	8005	3200	S	2518
OK18	8059	OK80	8005	3201	S	2518
OK19	8059	OK81	8005	3202	S	2518
OK26	8059	OK82	8005	3203	S	2518
OK27	8059	OK83	8005	3204	S	2518
OK28	8059	OK88	8005	3205	S	2518
WT04	8059	OK89	8005	3206	S	2518
OK36	8005	OK90	8005	3207	S	2518
OK37	8005	OK91	8005	KI06		6509
OK38	8005	OK92	8005	KI07		6509
OK39	8005	OK93	8005	KI08		6509
OK40	8005	OK94	8005	KI09		6509

OLARY	ENVELOPE	OLARY	ENVELOPE	PENOLA	ENVELOPE
OK41	8005	OK95	8005	KI10	6509
OK49	8005	KI11	6509		

OLARY	ENVELOPE	OLARY	ENVELOPE	PENOLA	ENVELOPE
OK50	8005	KI12	6509		
OK51	8005	KI13	6509		
OK52	8005	KI14	6509		
OK53	8005	KI15	6509		

PINNAROO		ENVELOPE	RENMARK	ENVELOPE
3112	S	2518	A	6762
3139	S	2518	B	6762
3140	S	2518	BARJOE	6762
3141	S	2518	C	6762
3208	S	2518	GOONDOOLOO	6762
3209	S	2518	J	6762
3210	S	2518	JN	6762
3211	S	2518	JW	6762
3212	S	2518	KR04	6762
3213	S	2518	LOWALDIE	6762
3214	S	2518	PERPONDA	6762
3215	S	2518	PK01	6762
3216	S	2518	PK06	6762
3217	S	2518	PK07	6762
3218	S	2518	PK12	6762
3219	S	2518	Q	6762
3220	S	2518	QEX	6762
3221	S	2518	R	6762
3222	S	2518	AL01	6869
3223	S	2518	AL02	6869
3224	S	2518	AL03	6869
3225	S	2518	AL04	6869
3226	S	2518	AL05	6869
3227	S	2518	AL06	6869
3228	S	2518	AL07	6869
3229	S	2518	AL09	6869
3230	S	2518	AL16	6869
3231	S	2518	AL20	6869
3232	S	2518	AL25	6869
3233	S	2518	AL26	6869
3234	S	2518	AL27	6869
3235	S	2518	AL28	6869
3236	S	2518	AL30	6869
3237	S	2518	AL31	6869
3238	S	2518	AL37	6869
3239	S	2518	AL39	6869
3240	S	2518	AL40	6869
3241	S	2518	AL43	6869
3242	S	2518	AL47	6869

PINNAROO	ENVELOPE	RENMARK	ENVELOPE
3243 S	2518	AL50	6869
3244 S	2518	AL51	6869
3245 S	2518	AL60	6869
3246 S	2518	AL62	6869
3247 S	2518	AL63	6869
3248 S	2518	AL64	6869

PINNAROO	ENVELOPE	RENMARK	ENVELOPE
3249 S	2518	AL65	6869
3250 S	2518	AL66	6869
3251 S	2518	AL67	6869
3252 S	2518	MC01	6869
BARJOE	6762	MC02	6869
BARJOEW	6762	MC04	6869
FAIRWAYS	6762	MC05	6869
I	6762	MC06	6869
IJ	6762	MC61	6869
J	6762	WF1	6881
JW	6762	352-947 S	6919
KR01	6762	D	6919
KR02	6762	BL04	8004
KR03	6762	WK01	8017
KR05	6762	WK02	8017
KR06	6762	WK03	8017
KR07	6762	WK04	8017
KR10	6762	WK05	8017
LOWALDIE	6762	WK06	8017
MINDIYARRA	6762	WK07	8017
O	6762	WK09	8017
PERPONDA	6762	GP04	8026
PEX	6762	GP07	8026
PK02	6762	WT25	8059
PK03	6762	PA07	8065
PK04	6762	MB01	8112
PK05	6762	MB02	8112
PK07	6762	MB03	8112
PK08	6762	MB04	8112
PK10	6762	MB05	8112
PK11	6762	MB06	8112
PK13	6762	MB07	8112
P(S-N)	6762	MB08	8112
UPSN DOWNS	6762	MB09	8112
Y	6762	BK01	8127
352-921 S	6919	BK03	8127
352-926 S	6919	CP02	8144
352-928 S	6919	CP03	8144
352-929 S	6919		
352-930 S	6919		
352-931 S	6919		
352-934 S	6919		
352-959 S	6919		

PINNAROO	ENVELOPE
352-961 S	6919
352-963 S	6919
352-968 S	6919
352-970 S	6919
G	6919
H2	6919
HI	6919
N	6919
RR	6919
S	6919
T	6919
U	6919
V	6919
PA01	8065
PA02	8065
PA03	8065
PA04	8065
PA05	8065
MB01	8174
MB02	8174

APPENDIX C

TABLE OF SIGNIFICANT RESULTS

EL 1356 & 1357

Line	Hole No.	Interval (m)	HM%	R%	L%	I%	Z%	M%
Perp.	PP7	14-16	1.64	1	-	10	2	-
		16-18	1.91	-	2	3	6	1
		18-20	1.94	-	1	5	9	-
	PP7.5	6-8	3.26	4	7	25	10	-
		8-10	3.31	3	3	20	5	-
		10-12	0.97	1	3	23	5	-
	PP8	8-10	1.83	2	5	18	15	-
		10-12	2.39	4	5	30	10	-
	PP8.5	8-10	1.19	6	10	33	9	1
		10-12	1.24	4	5	25	9	
	PP9.5	14-16	2.09	3	3	30	9	-
		16-18	1.16	4	2	18	10	-
	PP10	12-14	1.66	2	3	20	5	-
		14-16	3.50	4	2	18	9	1
		16-18	1.20	2	2	13	10	-
JW	JW27	12-14	0.96	2	2	10	3	-
		14-16	1.01	2	3	15	5	-
		16-18	1.60	3	4	23	7	-
		18-20	1.30	2	5	13	9	-
		20-21	1.51	1	3	10	5	-
	JW28	16-18	1.82	1	5	5	5	-
		18-20	2.26	-	2	4	2	-
Upsn D	UD3		1.40	3	9	30	12	-
	UD3.5		1.40	5	8	27	10	-
	UD4		1.27	9	24	48	14	-
	UD4.5		1.27	4	10	27	11	-
P(S-N)	P(S-N)5		1.40	4	12	28	16	-
	P(S-N)6		1.10	4	13	27	13	-
	P(S-N)7		<1.0	6	16	31	17	-
KR01	009	10-14	1.35	5	15	30	20	1
	010	16-18	1.74	5	15	35	20	4
	011	14-20	3.84	6	11	27	13	-
	012	10-12	2.13	6	15	35	13	1
	014	6-10	1.73	6	13	32	12	-

Line	Hole	Interval (m)	HM%	R%	L%	I%	Z%	M%
KR05	014	12-18	1.99	2	12	15	7	-
KR06	010	6-14	1.35	1	12	10	4	-
KR01	040	16-18	3.71	7	30	30	20	2
	044	8-12	1.44	10	27	37	17	-
KR02	016	12-18	3.28	6	7	42	11	1
	017	8-12	1.84	3	8	40	14	-
	018	12-16	2.03	2	3	37	10	-
	019	12-16	1.02	1	10	33	17	1
	020	12-16	2.31	4	7	45	18	1
	021	12-18	2.64	3	12	38	14	1
	022	12-18	1.95	5	8	35	10	2
	023	10-16	1.71	4	10	38	15	1
	024	12-16	1.76	3	15	38	18	1
KR03	012	14-16	1.44	4	5	40	10	-
	018	14-18	1.15	4	21	40	23	-
		22-24	1.04	3	15	40	15	-
KR04	011	18-20	1.38	2	5	25	5	1
	016	14-18	1.23	2.5	10	30	20	-
	017	10-16	1.40	4	10	38	15	-
KR07	010	12-18	2.27	3	9	27	12	1
	011	10-16	2.10	3	8	23	8	3
	012	8-18	2.52	3	11	26	16	-
	013	12-18	2.38	4	13	23	12	-
	014	14-21	2.34	4	6	21	8	-
PK02	038	12-16	4.18	-	-	5	-	-
PK05	010	14-16	2.42	6	17	40	35	1
	013	6-8	1.88	2	15	25	27	1
	016	0-6	1.30	7	17	45	17	-
	031	12-14	1.17	1	1	1	1	-
		16-18	2.43	5	4	35	30	-
	032	16-18	2.14	1	2	17	13	-
	034	16-21	3.59	2	3	15	13	-
	037	16-18	1.91	-	1	2	2	-
	061	4-6	1.78	6	20	45	17	1
	064	12-16	0.99	6	22	30	14	-

Line	Hole	Interval (m)	HM%	R%	L%	I%	Z%	M%
PK10	020	8-10	2.51	-	2	13	1	-
	024	14-18	3.27	1	-	6	5	-
	028	6-8	1.47	-	2	5	5	-
	030	16-18	1.13	1	-	5	2	-

HM heavy minerals
R rutile
L leucoxene
I ilmenite
Z zircon
M monazite

APPENDIX D

TABLE OF SIGNIFICANT RESULTS

EL 1476 & 1612

Drillhole	Depth(m)	%HM
OK3	35-36	1.63
OK6	17-18	1.69
	18-19	3.42
	19-20	2.37
	20-21	1.4
	30-31	2.32
OK9	14-15	3.64
	16-17	3.11
	22-23	2.39
	23-24	2.79
	24-25	2.04
OK10	21-22	1.91
	24-25	1.99
	27-28	1.79
OK11	23-24	1.67
OK12	13-14	1.49
OK19	73-74	1.66
	82-83	1.62
OK20	23-24	2.08
	29-30	1.78
OK22	34-35	1.60
	35-36	1.97
	44-45	1.63
	46-47	1.73
	49-50	1.96
OK23	56-57	2.23
	57-58	2.20
OK26	56-57	1.64
OK30	40-41	1.5
	44-45	2.6
	46-47	1.9
	50-51	1.5
	51-52	2.9
	52-53	2.1
	53-54	1.8
OK34	28-29	1.8
	47-48	2.2
OK35	15-16	1.7
	33-34	2.2
OK38	34-35	3.3
	35-36	2.7
	44-45	1.5
OK42	41-42	3.1
	42-43	12.9
OK43	12-13	2.7
	28-29	1.9
	38-39	2.2

Drillhole	Depth(m)	%HM
OK44	22-23	3.8
OK45	12-13	1.7
	13-14	2.6
	28-29	2.3
	29-30	1.7
OK47	28-29	1.8
OK48	32-33	10.8
OK50	28-29	1.7
OK51	19-20	3.5
	29-3-	2.7
OK52	35-36	2.1
OK55	19-20	1.6
	41-42	2.3
	42-43	1.5
	47-48	2.4
	48-49	3.5
OK57	26-27	2.1
	27-28	2.1
OK58	12-13	2.4
	35-36	2.6
	36-37	2.1
OK59	11-12	2.7
	12-13	1.7
	31-32	1.7
	32-33	3.6
OK60	27-28	1.7
	29-30	2.2
OK61	22-23	2.2
OK62	27-28	2.3
	28-29	4.9
OK64	19-20	3.7
	22-23	2.9
	23-24	2.7
	24-25	2.1
	34-35	1.8
OK65	32-33	2.1
OK67	9-10	2.1
	27-28	5.2
	20-31	2.5
OK68	38-39	1.6
	41-42	3.1
OK70	22-23	3.3
	29-30	2.7
OK71	33-34	2.0
	40-41	2.5
	41-42	2.8
	43-44	2.4

Drillhole	Depth(m)	%HM
OK73	23-24	4.44
	34-35	2.7
	45-46	1.7
	46-47	3.0
OK74	31-32	1.9
	33-34	2.1
	47-48	1.6
OK75	25-26	1.6
	43-44	1.9
	44-45	2.0
	45-46	2.0
OK76	30-31	3.8
	46-47	2.6
OK78	34-35	3.0
OK80	20-21	3.4
OK81	22-23	1.8
OK82	19-20	5.6
	24-25	1.6
OK83	36-37	1.9
OK84	21-22	6.1
	42-43	3.0
OK86	23-24	1.7
	30-31	1.8
OK87	17-18	1.7
OK89	19-20	2.7
	22-23	3.0
	23-24	6.3
OK91	27-28	2.4
OK92	35-36	1.7
	36-37	2.6
OK94	24-25	1.5
	25-26	3.0
OK95	29-30	1.8
	33-34	4.0
	34-35	1.8