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

by

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Mineral Resources

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Review of heavy mineral sand exploration in South Australia - the Eucla Basin

G M FERRIS

The Cainozoic Eucla Basin has been the focus of recent heavy mineral exploration due to the recognition of Tertiary coastal features including the Ooldea Range. Hypsometric and Landsat, data together with detailed work on the Tertiary stratigraphy of the Basin and surrounding palaeodrainage channels and palaeogeographic setting has greatly enhanced the search for heavy minerals. Terrigenous sediments of the Immarna Group occur along the eastern margin of the Basin, with the Ooldea Sand and Hampton Sandstone being the main stratigraphic units which host mineralisation.

Two heavy mineral strandlines within the Hampton Sandstone were outlined at Immarna by Geopeko. Metallurgical testing showed the deposit comprised predominantly ilmenite which gave an average TiO_2 assay between 61 - 62.1%. Numerous low grade anomalous zones were outlined throughout the Basin, but most drilling was at 1 km intervals and consequently narrow high grade zones may have been missed.

Most exploration focussed on the Ooldea Range and other coastal features including headlands, embayments, strandline beaches, islands and linear shorelines outlined by photogeomorphic mapping. Future exploration for heavy minerals within the Eucla Basin should concentrate on a greater understanding of the stratigraphic distribution of the Eocene Ooldea Sand and Hampton Sandstone and a greater emphasis on geomorphic factors including possible provenance areas and detailed analysis of sediments within palaeodrainage channels to determine flow rates and other factors which influence the transport and concentration of heavy minerals.

Potential still exists in areas north and south of the Ooldea Range where the Hampton Sandstone may be closer to the surface and within the Barton Range. Only limited exploration has been undertaken in the Barton Range. The current market for heavy minerals is depressed with prices reflecting reduced demand and oversupply. However, the market is predicted to improve towards the end of the decade, so the current period is the perfect time to explore for heavy minerals within underexplored areas of the Eucla Basin. With the release of new aeromagnetic data for the northwestern Gawler Craton offering new exploration potential, exploration companies should incorporate heavy mineral exploration within future drilling programs in the Eucla Basin.

INTRODUCTION

This report is the second in a series prepared to summarise and assist exploration for heavy mineral sands in South Australia. Regional mapping by Mines and Energy, South Australia (MESA) delineated Tertiary coastal dunes on the eastern margin of the Eucla Basin (Fig. 1) and reported on

their heavy mineral potential (Benbow, 1983, 1986 and 1990a).

The Eucla Basin, together with the Murray Basin were major Tertiary depocentres and the dune systems record a number of transgression/regression events, which provided ideal conditions for the formation of heavy mineral deposits. Recent company exploration focussed on the Ooldea Range, a 650 km long coastal dune, but the Barton and Paling Ranges remain under explored and may have potential for heavy minerals.

GEOLOGICAL SETTING

The South Australian portion of the Eucla Basin is located on parts of the 1:250 000 map sheet areas of WYOLA, MAURICE, TALLARINGA, COOK, OOLDEA, BARTON, COOMPANA, NULLARBOR, NUYTS, FOWLER, CHILDARA, STREAKY BAY, YARDEA, ELLISTON, KIMBA and LINCOLN.

Cainozoic sediments within the Eucla Basin unconformably overly Neoproterozoic - Palaeozoic Officer Basin rocks and Mesozoic sediments of the Bight Basin (Rankin & Benbow, 1992). The Eucla Basin is also underlain and rimmed by Archaean to Middle Proterozoic crystalline basement rocks of the Gawler Craton, which include granites, gneisses, mafic/ultramafic intrusives and the Gawler Range Volcanics. These rocks, together with rocks from the Palaeoproterozoic Musgrave Block were suitable provenance for the formation of heavy mineral deposits. Fig. 2 outlines the Archaean to Early Proterozoic tectonic provinces of South Australia.

The Eucla Basin formed in response to the separation of Australia and Antarctica during Tertiary times (Falvey, 1974; Benbow, 1993). Recent mapping by MESA has extended the basin margins to include an inner platform belt of terrigenous sediments (Immarna Group) along the northeastern margin and Tertiary sediments within the Polda, Uley and Wanilla Basins along the west coast of Eyre Peninsula (Benbow, *et al*., in prep).

Global sea level fluctuations during the Early Tertiary resulted in extensive deposition of marine temperate water limestone along the continents newly formed southern margin producing the Bunda Plateau (Rankin & Benbow, 1992). Marine transgression during the Late Eocene or Early Oligocene was the major period of dune building, forming the Ooldea, Barton and Paling Ranges from sediments deposited by the rivers around the basin.

During the Middle Miocene, the last major transgression resulted in the deposition of the Nullarbor Limestone over broad areas of the basin (Benbow, 1992). Benbow (1990a) reports that the Nullarbor Plain represents the former sea floor. The transgression did not extend beyond the Ooldea Range, resulting in the formation of a series of freshwater lakes between the Ooldea and Barton Ranges (Benbow, 1990; 1992)

Since the Middle Miocene, the climate has been predominantly semi-arid to arid, a factor which aided the preservation of these ancient landforms. Minor wetter periods during the Pliocene resulted in re-activation of palaeodrainage and subsequent deposition of fluvial and lacustrine Garford and Narlaby Formations.

During the Quaternary, vast quantities of quartz sand was blown inland blanketing the land surface forming a series of longitudinal dunes termed the Great Victoria Desert. These dunes were subsequently fixed by vegetation and now dominate the northern part of the Basin. In the southeastern Eucla Basin, calcareous sediments were blown inland during the Quaternary forming dunes as well as being incorporated into the soil.

GEOMORPHOLOGY

The geomorphology of the Eucla Basin reflects Australia's predominantly arid climate since Tertiary times. Recent hypsometric data (Benbow & Crooks, 1988) covering much of the Eucla Basin resulted in the production of regional topo-contour maps which clearly show many landforms including the Bunda Plateau, Nullarbor Plain, the Ooldea, Barton and Paling Ranges together with some unnamed dunes which possibly represent former coastal dunes and prominent palaeodrainage channels (Fig. 3).

The oldest landforms of the Eucla Basin are the coastal dunes of Late Eocene or Early Oligocene age, the Ooldea, Barton and Paling Ranges. Benbow

(1990a) reports that the Barton, Paling and Ooldea Ranges formed initially as spits and barrier islands during the period of maximum transgression at the end of the Eocene. These dunes are comprised of a core of marine and fluvial Eocene Hampton Sandstone, overlain by aeolian Ooldea Sand (Benbow, 1990a). The Ooldea Range was originally thought to be a shallow remnant basement high, but stratigraphic drilling by MESA confirmed the coastal origin of the Range (Benbow, 1990a).

The Ooldea Range is approximately 650 km in length and dune height varies between 40 - 150m above the surrounding terrain (Benbow, 1990a; Rankin & Benbow, 1992). The Ooldea Range is clearly recognisable on topo-contour maps (Fig. 3) and is composed of different morphological components (see Benbow, 1990a). Also clearly recognisable on topo-contour maps of the region are headlands and embayments (Fig. 3), which are important areas of heavy mineral accumulation. A number of other possible coastal dunes were outlined by Benbow and Crooks (1988), and Benbow (1990a) and are visible on topo-contour maps (Fig. 3).

The major landform of the western Eucla Basin is the Bunda Plateau (Tate, 1879) which is one of the worlds largest arid/semi arid karst terrains (Benbow *et al*., 1994) and includes the Nullarbor Plain (Fig. 3).

Around the Basin are palaeodrainage networks which drained areas of crystalline basement and supplied vast quantities of sediments to the Basin (Fig. 3). Rankin & Benbow (1992) suggest the palaeodrainage network may have formed in the Jurassic and drained the Musgrave Block, Stuart Range and the Gawler Ranges (Benbow *et al*., 1995). Sediments within palaeochannels are important indicators to provenance areas and reflect energy conditions, thereby aiding palaeogeographic reconstructions.

Twidale and Campbell (1985) report that the oldest landforms on Eyre Peninsula are the laterite plateau which formed on many basement blocks including the Lincoln Uplands and may be correlated with a similar laterite capping on Fleurieu Peninsula and Kangaroo Island, which is older than the Middle Jurassic.

Minor landforms within the Basin includes strings of playa lakes and lunettes developed in low lying areas and interdune corridors (Fig. 3). The Tietkens Plain (Fig. 3) displays similar karst features to the Nullarbor Plain and was developed on Garford Formation freshwater dolomite (Benbow, 1992).

The landscape over much of western Eyre Peninsula is relatively flat with a number of plains developed at various levels (Poochera Peneplain, Chandada Plain). During Tertiary times, silcrete was widely developed forming plains which were later dissected by rejuvenated streams (Twidale & Campbell, 1985). Scattered inselbergs of Crystalline basement rocks including Mount Wudinna, Mount Hall and Mount Cooper are found throughout the Eyre Peninsula. These inselbergs display platforms preserved on and near the summits which may be remnants of former higher plains (Twidale & Campbell, 1985).

Climatic oscillations of the last 2 million years have influenced the development of the present landscape. Longitudinal dunes of the Great Victoria Desert dominate the northern part of the Basin and formed during the late Quaternary from pre-existing Immarna Group sediments (Rankin & Benbow, 1992). Along the West Coast of Eyre Peninsula, Quaternary Bridgewater Formation calcarenite is widespread and represents former coastal dune deposits built up during periods of lower sea level. Episodes of sediment accumulation were interspersed with periods of erosion and arid pedogenesis producing multiple horizons of sheet, nodular and massive calcrete plus carbonate soils (Flint, 1990). Rising sea level has drowned and eroded Bridgewater Formation dunes to form the spectacular coastal cliffs along much of western Eyre Peninsula.

STRATIGRAPHY

During the Cainozoic, marine limestone of the Eucla Group was deposited over much of the Basin and terrigenous sediments of the Immarna Group were deposited around the northeastern basin margin and in palaeochannels which flowed into the Basin. The Immarna Group comprises the Pidinga Formation, Hampton Sandstone, Ooldea Sand, Yarle Sandstone, Garford Formation, Ilkina Formation, and Munjena Formation. Tertiary stratigraphy of the Eucla Basin is outlined in Fig. 4.

Seismic traverses across the Basin record an extensive seismic reflector (Fraser & Tilbury, 1979) which Benbow *et al*. (1995) suggest may be the base of the Tertiary sequence.

Benbow *et al.* (1995) report that sedimentation in the Eucla Basin may have commenced during the Palaeocene-Eocene with undifferentiated fluvial to marginal marine clastics.

Deposition was greatest during the Middle to Late Eocene with 4 major units deposited;

- Pidinga Formation
- Hampton Sandstone
- Ooldea Sand
- Wilson Bluff Limestone

The Pidinga Formation (Lindsay, 1966; Lindsay & Harris, 1975) comprises marine and non marine lignitic and pyritic sands, clay and silts deposited during reactivation of palaeorivers and unconformably overlies Officer Basin sediments and Archaean to Middle Proterozoic crystalline basement.

Deposition of the Pidinga Formation was widespread and occurred in a range of environments including fluvial, lacustrine, estuarine and marine (Rankin & Benbow, 1992). Sediments correlated with the Pidinga Formation occur in the Polda (Poelpana Formation) and the Cummins-Uley-Wanilla groundwater basins (Wanilla Formation).

On Eyre Peninsula and in the Narlaby and Yaninee Palaeochannels, marine sands of the Pidinga Formation were found to contain trace heavy minerals (Binks & Hooper, 1980; Marinelli, 1989).

Alley & Benbow (1989) summarise transgressive phases within the Pidinga Formation including the Tortachilla Transgression (McGowran, 1989), the Wilson Bluff Transgression (Lindsay & Harris, 1975; McGowran, 1989) and the Aldinga Transgression (Benbow *et al*., 1982; McGowran, 1989). These transgressive phases explain the vertical and lateral lithological variations observed in drill hole samples across the Basin.

Conformably overlying the Pidinga Formation are fluvial, estuarine and marine quartz sands of the Hampton Sandstone deposited during the Middle Eocene Wilson Bluff transgression (Rankin & Benbow, 1992). The Hampton Sandstone ranges from 20-50m thick and comprises very fine-coarse grained, well sorted sand containing trace heavy minerals (Benbow, 1990a). Rankin and Benbow (1992) report that deposition of the Hampton Sandstone occurred in energetic uppershore face and beach environments in the Ooldea and Barton Ranges, thereby providing excellent conditions for heavy mineral concentration.

The aeolian Ooldea Sand conformably overlies the Hampton Sandstone and comprises pale grey to off-white to pale brown, very fine to medium grained, moderately well to well sorted quartz sand, up to 112m thick and forms the Late Eocene - Early Oligocene Ooldea, Barton and Paling Ranges (Benbow, 1990a, 1993; Rankin & Benbow, 1992). The Ooldea Sand contains trace amounts of heavy minerals and is distinguished from the Hampton Sandstone by its more uniform grain size and common frosting of quartz grains (Benbow, 1990a).

During the Middle Eocene, platform carbonate deposition commenced. The Wilson Bluff Limestone is a temperate water limestone comprising white to grey wackestone and skeletal mudstone deposited over broad areas, which conformably overlies the Pidinga Formation and Hampton Sandstone (Benbow *et al*., 1995). The formation intertongues with the Pidinga Formation and Hampton Sandstone which may indicate time(s) of maximum transgression (Rankin & Benbow, 1992).

During the Middle Miocene, a narrow coastal terrigenous belt of sandstones was deposited along the northeastern margin of the Nullarbor Plain, adjacent to the Ooldea Range. These are referred to as the Yarle Sandstone (Benbow, 1990b). The Yarle Sandstone is a fine to medium grained quartz sand which may contain minor bioclastic sediments (Benbow, 1990b). Rankin & Benbow (1992) report that the Yarle Sandstone is laterally equivalent to the Nullarbor Limestone and was deposited in a moderate energy strandline.

During the Middle Miocene, the Nullarbor Limestone (Lindsay & Harris, 1975) was deposited over a broad area. The Nullarbor Limestone comprises indurated bioclastic limestone with a

primary micrite mud matrix (Rankin & Benbow, 1992).

Unconformably overlying the Pidinga Formation and Hampton Sandstone is the Miocene to Pliocene Garford Formation (Rankin & Benbow, 1992). The Garford Formation (Benbow & Pitt, 1978) comprises argillaceous green to grey muds, carbonate muds and mudstones deposited in depressed areas between the Ooldea and Barton Ranges, Wilkinson Lakes area, and within palaeodrainage channels (Rankin & Benbow, 1992; Benbow *et al*., 1995). Within the Narlaby Palaeochannel, the Garford Formation is overlain by the Narlaby Formation, a sequence up to 60m thick comprising fluvial to estuarine, fine to medium grained, moderately to well sorted sand with minor clay (Benbow *et al.*, 1995).

During the Late Pliocene or Early Pleistocene, the Ilkina Formation was deposited within palaeochannels including the Narlaby Palaeochannel and within some playa lakes such as Ifould Lake (Benbow *et al*., 1995). The Ilkina Formation comprises clay, silt and sand up to 5m thick (Benbow *et al.*, 1995).

Around the margin of the Eucla Basin within bedrock interfluves and palaeochannels, the Munjena Formation was deposited (Benbow, 1993; Benbow *et al*., 1995). The Munjena Formation comprises a sand rich sediment which may contain local reworked quartz pebbles from underlying Palaeozoic and Mesozoic sediments (Benbow *et al*., 1995; Rankin & Benbow, 1992).

The present landscape is dominated by extensive tracts of Quaternary deposits. In the northern Eucla Basin, aeolian sand of the Wintrena Formation is the dominant dune forming unit of the Great Victoria Desert. The Wintrena Formation comprises very fine to medium, red brown to orange brown, moderately sorted calcareous sand. During periods of low sea level, fine calcareous material was blown inland forming a series of coastal foredunes and sief dunes as well as being incorporated into the soil over much of the southeastern portion of the Basin. Calcareous sediments belong to the Bridgewater Formation.

COMPANY EXPLORATION

Active exploration for heavy minerals in the Cainozoic Eucla and Murray Basins commenced during the 1980's as a result of increased environmental restrictions on East Coast deposits, high prices and improved demand. Previous mineral exploration in the Eucla Basin had focussed on sedimentary uranium and coal deposits. CRA Exploration Pty Ltd in the search for uranium reported heavy minerals up to 8.27%, but the mineral assemblage comprised predominantly ilmenite (37%) and goethite (41%), with lesser amounts of zircon and rutile (Close, 1973). BP Mining Development Australia Pty Ltd in the search for uranium mineralisation reported that crystalline basement rocks from the Wilkinson Lakes area contained minor zircon, leucoxene and rutile (Weber, 1979).

PNC Exploration (Australia) Pty Ltd (1983) in the search for sedimentary uranium in the Tarcoola area reported several intersections of heavy minerals in carbonaceous (?Garford Formation) sediments within palaeochannels. The best intersection was 10% black heavy minerals in hole EE15. However, no samples were forwarded to MESA. This suggests that crystalline basement rocks around the Eucla Basin were suitable provenance areas for heavy minerals and the surrounding palaeodrainage channels transported these heavy minerals to the coast.

The recognition of stranded Tertiary coastal dunes by Benbow (1983, 1986 & 1990a) stimulated exploration during the 1980's for heavy mineral sands within the Eucla Basin. Table 1 summarises company exploration for mineral sands in the Eucla Basin with the location of previous EL's shown on Fig. 5. Summary data sheets of company exploration are presented in Appendix A.

AUSTRALIAN ANGLO AMERICAN LTD

Australian Anglo American Ltd explored for heavy mineral sands on EL 205, located along the west coast of Eyre Peninsula (Fig. 6). Exploration comprised regional mapping to delineate stranded Tertiary and Pleistocene beach deposits and their foredune systems (Hoyle, 1976). Target units were the Pidinga Formation equivalent Poelpana and Wanilla Formations as well as recent beach sands of the St. Kilda Formation and Semaphore Sand.

Samples from stranded beach and present day beaches together with basement samples were analysed for heavy minerals. Results were disappointing with only 27 of 156 samples showing heavy mineral concentrations >1%. The mineral assemblage was dominated by non-economic heavy minerals (ie: hornblende, biotite, goethite, magnetite, amphibole and epidote).

Hoyle (1976) reports that the stranded beach samples contained no significant heavy minerals and heavy mineral sands on present day beaches comprised predominantly magnetite associated with the weathering profile developed on the crystalline basement. Samples from Point Brown and Slade Point recorded high concentrations of heavy minerals up to 10.92%, however, the mineral suite comprised predominantly non-economic epidote, magnetite, hornblende and garnet (Hoyle, 1976).

Results show that crystalline basement rocks along the west coast of Eyre Peninsula are unsuitable provenance areas for economic heavy minerals, particularly rutile (Hoyle, 1976). The licence was subsequently relinquished.

BHP MINERALS LTD

BHP Minerals Ltd was a major explorer for heavy mineral sands within the Eucla Basin. Previous soil sampling for diamond indicator minerals on EL 1264 and 1265 reported trace ilmenite, zircon and rutile (BHP, 1985). EL's 1353, 1354 and 1355 were granted on 20 August 1986 to search for heavy minerals within the Ooldea Range. Target units were the Hampton Sandstone and Ooldea Sand.

During November 1986, a total of 169 holes (OL1-169) were drilled for 2930.8m along 9 traverses (Figs. 7-9) (Taylor & Tedder, 1987a, b). Drilling was designed to test possible coastal features delineated from regional topo-contour maps of the area. Drilling outlined several areas of low grade mineralisation. Significant intersections (>1% HM) are shown in Appendix B.

Mineralisation was confined to relatively narrow bands and the mineral assemblage was dominated by non-economic heavy minerals with only trace amounts of rutile. Due to the poor mineral assemblage and depth to mineralisation EL 1353 and 1354 were allowed to expire.

EL 1355 was extended and incorporated into a regional exploration program centred on the Ooldea Range which included EL's 1653, 1654 and 1655. Between 12 October and 11 November, 1990, 229 holes for 6447m were drilled within the 4 EL's (Figs. 10-12).

14 anomalous zones were outlined with the best zone being at the northern end of traverse 2 (M36 & M37) and the northern end of traverses 11 and 12 (M143-M148 & M169) (Darby, 1991a). Analytical results showed that the mineral assemblage ranged from moderately good to poor with the best mineral assemblage recorded for Anomalies 1, 2, 3, 10 and 11 (see Appendix B).

BHP sampled 7 company drill holes held at MESA Core Library for heavy mineral content. Results were disappointing with only 5 out of 29 samples recording >1% HM and the mineral assemblage was dominated by non-economic heavy minerals. Rutile contents were low averaging ~ 2%, with the highest rutile contents from 2 holes within the Barton Range (SAMP-5 & SAMP-6) (Darby, 1991b).

Darby (1991b) reported that the Ooldea Sand was barren with all mineralisation located within the Hampton Sandstone, usually at depth (av. 20-30m). Darby (1991a) reported that the Ooldea Range was unlikely to host an economic deposit due to the poor mineral assemblage and depth to mineralisation, but considered the area between the Ooldea Range and the Nullarbor Plain (seaward flank of the Ooldea Range) to be prospective, but access difficulties prevented exploration. The licences were subsequently relinquished.

Between October 1989 and March 1991, 212 holes totalling 5132m were drilled on EL's 1605, 1647, 1671, 1672 and 1703 in the search for heavy minerals within Tertiary Pidinga and Garford Formation sands on northwest Eyre Peninsula. Darby (1991c) reports that the Precambrian granitoids and Gawler Range Volcanics may be suitable provenances for heavy minerals which were transported to the coast by rivers during the Tertiary and may have been concentrated along palaeoshorelines at the eastern edge of the Eucla

Basin.

MESA aeromagnetic/radiometric data revealed 3 possible marine embayments along the northern margin of the Polda Basin (Benn, 1990). Drilling confirmed the presence of heavy minerals in embayment number 2 (Benn, 1990).

Results for the EL's revealed four zones of anomalous (low grade) mineralisation (see Appendix B). Mineralisation was confined to the Pidinga Formation, however, these anomalous zones were overlain by at least 10m of Quaternary sands which contain calcrete layers. Drill holes are shown on Figs. 13a and 13b.

Several suitable depositional environments were outlined but the mineralogy of heavy minerals was disappointing. From palaeogeographic reconstructions, it appears that the Gawler Range Volcanics was the main provenance for the Narlaby Palaeochannel which explains the high zircon content (Darby, 1991c). A possible Eocene palaeochannel southwest of Port Lincoln which may drain granulite grade rocks near Cummins is a possible exploration target (Darby, 1991c). Darby (1991c) concluded that the northwest Eyre Peninsula was unlikely to host a high grade deposit (>10% rutile) and any deposit would be a ilmenite and zircon deposit.

ABERFOYLE RESOURCES LTD

Aberfoyle Resources Ltd were a major explorer for mineral sands within the Murray Basin (Ferris & Hayball, 1993). Drilling on EL's 1520 and 1521 within the Eucla Basin failed to intersect the target Eocene Hampton Sandstone (Painter, 1990). Only trace heavy minerals were observed and the Licences were subsequently released. Drill hole locations are shown on Fig. 14.

CRA EXPLORATION PTY LTD

CRA Exploration Pty Ltd were granted 3 EL's (1570, 1571 & 1572) to explore for heavy minerals within the Narlaby Palaeochannel. Target units were the Eocene Pidinga Formation and the Miocene to Pliocene Garford Formation. Fifty holes were drilled across the palaeochannel, but only trace heavy minerals were observed in panned samples (Marinelli, 1989). Particle size and specific gravity analysis confirmed the lack of heavy minerals (Marinelli, 1989).

NATIONAL MINERAL SANDS, SWAN REACH NL & PEKO EXPLORATION LTD

National Mineral Sands (NMS), Swan Reach NL and Geopeko under the Joint Venture Ceduna Heavy Minerals Project were the major explorers for mineral sands within the eastern margin of the Eucla Basin. Exploration centred on the Eocene Ooldea Range and other possible Eocene Coastal features which may contain heavy minerals. Target units were the Eocene Hampton Sandstone and Ooldea Sand. EL's 1597-1602, 1631, 1632 and 1633 were registered to National Mineral Sands (SA) NL and Swan Reach NL. EL's 1717, 1721 and 1722 were registered to Peko Exploration Ltd.

Between August 1989 and December 1991, 1017 holes, totalling 19 161.2m were drilled on the 12 EL's. Initial exploration by NMS comprised a regional air and ground survey to identify possible geomorphological features of interest. Samples from a bulldozer cut and a shallow hand auger hole in the Immarna area (EL 1602) recorded minor heavy minerals ranging from 0.16-1.59% HM (Besley & Olliver, 1990). The mineral suite comprised 65-85% altered ilmenite, 10-20% zircon, trace rutile and leucoxene (Besley & Olliver, 1990).

Australian Photogeologic Consultants undertook a photogeologic study of the eastern margin of the Eucla Basin and delineated a number of possible Eocene coastal landforms including large shoreline dunes, strandline beaches, islands, headlands, embayments, linear shorelines and 2 palaeodrainage networks which source crystalline basement rocks to the north and west (Besley & Olliver, 1990).

The first drilling program comprised 110 holes (EB001-110) on EL's 1597-1602 (Figure 15a). The best results were from Traverse 1 (EL 1597) and Traverse 3 (EL 1602), with all significant intersections of heavy minerals (>1% HM) tabled in Appendix C. The heavy mineral assemblage comprised 50-75% ilmenite, 12-34% zircon and approximately 5% rutile and Leucoxene (Besley & Olliver, 1990).

The second drilling program comprised 348 holes (EB111-458) (Figure 15b). Results were encouraging with the best intersections from the Immarna area (EL 1602) on traverses I-D, 14 Ext and 3. The best intersection was 27.2% HM in EB119 (38-40m) with the mineral suite comprising 51% zircon, 43% ilmenite/altered ilmenite and 3% rutile (Jurica & Rothnie, 1990). Microprobe analysis of the ilmenite returned an average TiO_2 content of 66.2% (Jurica & Rothnie, 1990). Traverse 14 Ext showed a number of anomalous intersections, but mineralisation was localised and lacked lateral continuity (Jurica & Rothnie, 1990). Significant intersections are shown in Appendix C.

Jurica and Rothnie (1990) suggest that an upper layer of fine to medium sand on traverse I-D may be Colville Sandstone. However, Benbow (pers. comm.) suggests that the unit is more likely to represent the Ooldea Sand.

Drilling on EL's 1598, 1631, 1632 and 1633 (EB 459-549) (Figure 15c) during October-November 1990 was disappointing, with only 14 of the 1025 logging samples containing visible anomalous concentrations of heavy minerals (Morris & McInnes, 1991). The majority of samples were from Line 12 and mineralisation was predominantly magnetite derived from the weathering of basic rocks (Morris & McInnes, 1991). The abundance of indurated sand and silcrete horizons in these areas presented difficult drilling conditions further downgrading these prospects.

Between May - June 1991, 290 holes (EB550 - 839) (Figure 15d) were drilled along 14 lines on EL 1602 to delineate mineralisation discovered by previous drilling (Jurica, 1991). Two highly anomalous heavy mineral zones were outlined with significant intersections (>1% HM) shown in Appendix C. Ninety one soil samples were collected using a regular grid over the Immarna area to test for surface expression of below surface heavy mineral zones, which may have resulted from concentration by wind action during the period after peak Miocene transgression (Jurica, 1991). Soil sampling on EL 1717 located a minor anomalous zone approximately 4 km east of Barton (Jurica, 1991).

Jurica (1991) reports that interpretation of drill hole logs suggests that mineralisation occurs in 2 distinct horizons of different age, grain size and mineral assemblage. Type 1 was a Late Eocene/Oligocene fine grained (~ 0.08mm) sand with the heavy mineral fraction comprising 25-50% zircon and up to 70% ilmenite and leucoxene (Jurica, 1991). Type 2 was a coarse grained (~ 0.17mm), Middle Miocene sand comprising predominantly ilmenite and leucoxene (up to 85% of the heavy fraction) with minor zircon (Jurica, 1991). However, reviewing limited drill hole samples and sections, the fine grained sand probably represents Ooldea Sand and the coarser sand represents the Hampton Sandstone. This may indicate possible reworking of deposits during successive regression/transgression events.

Between November - December 1991, 123 holes (EB840 - 962) were drilled at Immarna (EL 1602) to test the southern extent of mineralisation (Jurica, 1992). Results were disappointing with 2 weak anomalous zones outlined, but the thick Quaternary cover renders this area uneconomic (Jurica, 1992).

A total of 55 holes were drilled on EL 1717 to test the anomalous zone outlined by previous soil sampling. Results were disappointing with only 6 logging samples recording >1%HM (Jurica, 1992).

No further exploration for heavy minerals was carried out and EL's 1598, 1599, 1600, 1601, 1631, 1632, 1633, 1717, 1721 and 1722 were allowed to expire. EL 1597 and 1602 are currently held by Peko-Wallsend Operations Ltd.

SOUTHERN VENTURES NL

EL 1614 was granted on 4 October 1989 to explore for possible Tertiary coastal dunes west of the Lincoln Uplands. Analysis of water bores showed minor heavy minerals (1.41% TiO_2 and 0.28% ZrO_2 recorded in hole Bore General File No. 887 from 40-46.5m). Geomorphological mapping and drilling revealed the Central Basin comprised estuarine sediments.

Drilling outlined an low grade anomalous zone approximately 800m wide by 15 km long within the Wanilla Channel (Ward, 1990). The Wanilla Channel is located between the Lincoln Uplands and a NNE oriented line of basement highs which were provenance areas for heavy minerals. Heavy minerals were confined to a very fine to coarse,

angular, poorly sorted sand unit, most probably representing the Poelpena Formation.

Follow-up drilling failed to locate a high grade deposit and mineral sand exploration ceased in mid 1990 and the base metal potential of the was investigated.

MESA DRILLING

During March - April, 1986, 9 holes (OR-1 - OR-9) totalling 343.5m were drilled within the Ooldea Range along the railway line west of Barton. Holes ranged in depth from 14.5m to 93m. The aim of the drilling program was to determine the origin and stratigraphy of the Ooldea Range. Drill hole samples are currently held at MESA Core Library, Glenside. Drill hole locations are shown on Fig. 10.

Between June - December 1993, 184 RC holes totalling 10 126m were drilled on BARTON. The main aim of the drilling program was to test the basement to aid aeromagnetic interpretation of the northwest Gawler Craton and to stimulate company exploration. A number of holes were drilled in the Ooldea and Barton Ranges with trace heavy minerals observed in many samples (Morris, Hill & Ferris, 1994). Seven samples were forwarded to Amdel for heavy mineral determination. Results are presented below;

D/hole	Interval (m)	HM%	Il	Z	L	R	G	Others
LBR17	16-22	0.76	56	17	15	3	tr	9
LBR24	59-61	7.90	2	2	tr	2	74	20
LBR24	62-64	5.55	2	1	tr	1	70	26
BAR29	16-18	1.56	60	12	3	2	2	20
BAR33	44-56	1.11	55	10	3	1	5	26
TAL52	28-32	0.68	56	20	10	4	-	10
TAL64	10-22	0.18	50	15	20	2	-	13

Il - ilmenite, Z - zircon, L - leucoxene, R - rutile, G - goethite

SUMMARY AND CONCLUSIONS

The Eucla Basin formed in response to the separation of Australia and Antarctica during Tertiary times. Vast quantities of sediments were deposited within the Basin by the many rivers surrounding the Basin draining areas of crystalline basement rocks. These predominantly quartzose sediments were sorted by wave action and sea level fluctuations during the Early to Middle Eocene marine transgression to produce large coastal dunes including the Barton, Paling and Ooldea Ranges. These conditions were conducive for the concentration and formation of heavy mineral deposits. Company exploration has shown the Ooldea Range contains a number of anomalous zones of heavy minerals.

Initial exploration within the Eucla Basin and surrounding palaeodrainage channels focussed on sedimentary uranium and lignite. Several significant intersections of heavy minerals were reported including 8.27% HM by CRA Exploration Pty Ltd (Close, 1973) from the Lake Anthony - Lake Bring area. Basement rocks surrounding the Eucla Basin contain leucoxene, zircon, rutile, zircon and pyrite (Weber, 1979).

The main stimulus for company exploration was the recognition of a series of coastal dunes including the Ooldea Range by Benbow (1983; 1988: Benbow & Crooks, 1988). Detailed work by Benbow (1988; 1990a; in prep) on unravelling the Tertiary stratigraphy of the Eucla Basin and palaeodrainage and palaeogeographic reconstructions has greatly enhanced the exploration potential of the area.

The Ooldea Range was the main target for exploration with several zones of anomalous mineralisation outlined. Exploration comprised detailed geomorphological mapping and followup drilling along traverses across geomorphological features.

National Mineral Sands, Swan Reach NL and Peko Exploration Ltd under the Joint Venture Ceduna Heavy Minerals Project outlined the Immarna Prospect (EL 1602) which comprised 2 heavy mineral strandlines. Mineralisation was present in 2 distinct horizons which have different characteristics (ie: grain size, composition).

Preliminary metallurgical analysis of 2 representative bulk samples from the different horizons by Ammtec gave the following results:

	%HM	Il%	TiO_2%	Zr%	ZrO_2%
upper	2.77	86.1	62.1	11	
lower	1.94	66.1	61.0	26	62.8

The TiO_2 content of both samples is very good and compares favourably to other ilmenites including Eneabba which averages 60-61% TiO_2 (Towner, 1990). Jurica and Rothnie (1990) report that the ilmenite chemistry possibly satisfies specifications for chloride route processing. Jurica and Rothnie (1990) report that impurities present within the zircon concentrate include minor Fe_2O_3 and TiO_2, which could possibly be removed to improve the ZrO_2 content to 65%. Grain size analysis suggests that the heavy minerals could be separated by conventional mineral sands treatment methods, although the different grain size between the 2 types may create problems if the heavy minerals are processed together (Jurica & Rothnie, 1990).

Drilling near Lake Ifould by the Ceduna Joint Venture showed some encouraging results with some significant intersections within the Ooldea Sand. The best intersection was 27.2%HM in EB119 (38-40m) with the mineral assemblage comprising 51% zircon, 43% ilmenite and altered ilmenite and 3% rutile (Jurica & Rothnie, 1990). Limited microprobe analysis returned an average TiO_2 assay of 66.2% (Jurica & Rothnie, 1990). Other significant intersections included 16%HM in EB115 (52-54m) and 9.4%HM in EB122 (38-40m). The depth to mineralisation greatly downgrades this prospect. Minor anomalous heavy mineral zones were also reported on traverses 4, 5/6 Extension and 21 (Jurica & Rothnie, 1990).

BHP Minerals Ltd outlined 14 anomalous heavy mineral zones within the Ooldea Range on EL's 1355, 1653, 1654 & 1655 (see Appendix B). The best zone was Anomaly No. 1 (traverse 2) centred on holes M36 (30-36m) and M37 (28-39.5m). The mineral assemblage comprised 59% ilmenite, 17% zircon, 5% leucoxene, 1% rutile and 18% non-economic heavy minerals (Benn, 1990). Drill hole M178 (Anomaly No. 10) averaged 2.85%HM over 4m (34-38m) with the mineral assemblage comprising 31% ilmenite, 47% zircon, 5% leucoxene, 2% rutile, 2% monazite and 13% non-economic heavy minerals (Benn, 1990). Generally, the mineral assemblages were dominated by non-economic heavy minerals with only Anomalies 2, 3 and 11 recording high ilmenite and zircon (see Appendix B).

BHP Minerals Ltd outlined 4 anomalous strandlines along the west coast of Eyre Peninsula (EL's 1605 & 1647). However, grades were relatively low and the mineral assemblage was dominated by ilmenite and zircon. Due to the lack of rutile, difficult drilling conditions and the depth to mineralisation, BHP Minerals Ltd subsequently abandoned heavy mineral exploration within the Eucla Basin.

A low grade anomalous zone approximately 800m wide by 15 km long was outlined by Southern Ventures NL (EL 1614) within the Wanilla Channel. Heavy minerals were confined to estuarine sediments of the Poelpena Formation possibly derived from surrounding basement highs. Other company exploration within the Eucla Basin failed to locate any significant heavy mineral zones.

RECOMMENDATIONS

1. a complete/detailed study on the stratigraphy, palaeogeography of the Eucla Basin and surrounding palaeodrainage networks to determine provenance, energy and depositional environments to accurately target possible zones of heavy mineral concentration;

2. further drilling particularly within the Barton Range and areas of shallow Hampton Sandstone. Further drilling within palaeochannels to understand flow rates and to explore for other placer minerals (ie: gold etc.) and clay minerals (ie: palygorskite) and possibly diamonds if rocks in the Abminga area are found to be diamond bearing;

3. research other exploration techniques including surface sampling (Geopeko Exploration Ltd had limited success in the Immarna and Barton areas) which may be useful and relatively inexpensive exploration methods.

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APPENDIX A

SUMMARY DATA SHEETS

EUCLA BASIN, SOUTH AUSTRALIA

COMPANY	EL	PAGE
Australian Anglo American Ltd	205	A1
BHP Minerals Ltd	1353	A2
BHP Minerals Ltd	1354	A3
BHP Minerals Ltd	1355	A4
Aberfoyle Resources Ltd	1520, 1521	A5
CRA Exploration Ltd	1570, 1571, 1572	A6
NMS, Swan Reach NL & Geopeko	1597-1602, 1631-1633, 1717, 1721-22	A7
BHP Minerals Ltd	1605, 1647, 1671, 1672, 1703	A9
Southern Ventures Nl	1614	A10
BHP Minerals Ltd	1653, 1654, 1655	A11

COMPANY:	AUSTRALIAN ANGLO AMERICAN LTD
TENEMENT:	EL 205
ENVELOPE:	2654
DURATION:	August 1975 - December 1975
1:250 000 SHEET:	STREAKY BAY, ELLISTON & KIMBA
TARGET:	Heavy mineral sands
AGE/ROCKS	Tertiary to recent sands
STRUCTURAL CONTROL:	Precambrian basement and Tertiary to recent beach and dune deposits

EXPLORATION SUMMARY: An area of approximately 3200 km^2 was mapped at 1:250 000 scale and 156 surface grab samples collected. Samples comprised 25 from raised beach and fore-dune deposits, 79 from present day beach sands, 41 from basement, Tertiary and basal Pleistocene rocks, 2 samples from hand auger holes on present day beaches and 7 samples collected near PortLincoln outside the licence area. Samples were submitted for heavy liquid separation and 27 samples with heavy mineral contents >1% were forwarded to Central Mineralogical Services for determination of the heavy mineral suite.

MINERALISATION /PROSPECTS: Mapping outlined 5 raised beach deposits but these contained no heavy minerals. Anomalous heavy mineral contents were recorded for 27 samples but the heavy mineral assemblage was dominated by uneconomic heavy minerals including goethite, Fe oxides and various metamorphic minerals. The Licence was subsequently relinquished.

COMPANY: BHP MINERALS LTD

TENEMENT: EL 1353

ENVELOPE: 6816

DURATION: August 1986 - August 1988

1:250 000 SHEET: BARTON & FOWLER

TARGET: Heavy mineral sands

AGE/ROCKS: Eocene Hampton Sandstone and Ooldea Sand

STRUCTURAL CONTROL: Tertiary strandlines containing lenses of heavy minerals on SW slopes of the Ooldea Range

EXPLORATION SUMMARY: 5 stream sediment samples showed the presence of heavy minerals with values ranging from 0.12-0.32%, with zircon>rutile. 55 RC holes were drilled along 3 traverses (2,3 & 7) for a total of 863.8m. Hole spacing varied between 400m and 200m. Each 2m sample was split on site using a Jones Splitter to produce a 3-5kg sample, from which a composite for each hole was obtained by grab samples from each 2m interval.

Samples were panned on site to give a visual estimate of heavy mineral content and selected 2m samples together with all composite samples were forwarded to BHP Mineral Laboratory, Perth for heavy mineral determination.

MINERALISATION /PROSPECTS: Results from the drilling program were poor with only trace heavy minerals reported. The best intersections were;

Traverse 2
OL76 (0-6m) - 1.21% heavy minerals
OL68 (16-18m) - 0.99% "
OL69 (14-16m) - 1.01% "
Traverse7
OL111 (0-18m) - 1.20% "
OL111 (14-16m) - 1.18% "

No anomalous heavy mineral horizons were encountered on Traverse 3.

The mineral assemblage was dominated by non-economic heavies with only trace amounts of rutile.

Due to the poor mineral assemblage, depth of mineralisation and fine grain size (18 - 75μm), the Licence was relinquished.

COMPANY:	BHP MINERALS LTD
TENEMENT:	EL 1354
ENVELOPE:	6817
DURATION:	August 1986 - August 1987
1:250 000 SHEET:	FOWLER
TARGET:	Heavy mineral sands
AGE/ROCKS:	Eocene Hampton Sandstone and Ooldea Sand
STRUCTURAL CONTROL:	Tertiary strandlines adjacent to the Ooldea Range containing lenses of heavy minerals

EXPLORATION SUMMARY: Loam samples were collected near outcropping granite gneiss at Euria Well and Midgerie Rockhole. Analysis showed trace amounts of ilmenite, zircon and rutile. 43 RC holes were drilled along 2 traverses (4 & 5) for a total of 863m. Hole spacing varied between 400m and 200m.

Each 2m sample was split on site using a Jones Splitter to produce a 3-5kg sample, from which a composite for each hole was obtained by grab samples from each 2m interval.

Samples were panned on site to give a visual estimate of heavy mineral content and selected 2m samples together with all composite samples were forwarded to BHP Mineral Laboratory, Perth for heavy mineral determination.

MINERALISATION /PROSPECTS: Results from the drilling program were poor. The best intersection came from hole OL155 on Traverse 5, which recorded 1.41% heavy minerals over 10m (30-40m). However, the mineral assemblage was poor with only trace rutile and zircon. The Licence was subsequently relinquished.

COMPANY: BHP MINERALS LTD

TENEMENT: EL 1355

ENVELOPE: 6818

DURATION: September 1986 - August 1991

1:250 000 SHEET: OOLDEA

TARGET: Heavy mineral sands

AGE/ROCKS: Eocene Hampton Sandstone and Ooldea Sand

STRUCTURAL CONTROL: Tertiary strandlines adjacent to the Ooldea Range

EXPLORATION SUMMARY: RC air core drilling between 1986-1990 of 71 holes for 1204m along 4 traverses (1, 6, 8 & M) was carried out in the Licence area. Each 2m sample was split on site using a Jones Splitter to produce a 3-5kg sample, from which a composite for each hole was obtained by grab samples from each 2m interval.

Samples were panned on site to give a visual estimate of heavy mineral content and selected 2m samples together with all composite samples were forwarded to BHP Mineral Laboratory, Perth for heavy mineral determination. Samples from the M holes(M15 - M20) were forwarded to Amdel for analysis.

7 company drill holes held at MESA core library were sampled and the heavy mineral content determined by Amdel.

MINERALISATION /PROSPECTS: Heavy mineral occurrence on EL 1355 were generally low and no economic deposits were located. The best intersections were;

Traverse 1
OL9 (0-20m) - 1.61% heavy minerals

Traverse 6
OL39 (0-24m) - 1.35% "
OL39 (10-12m) - 3.06% "
OL159 (22-23m) - 1.06% "
OL160 (4-6m) - 1.05% "
OL160 (6-8m) - 0.84% "
OL160 (8-10m) - 0.96% "
OL160 (10-12m) - 1.74% "
OL160 (0-12m) - 1.00% "

No significant intersections were reported from traverse 8 and holes M15-20.

Results from company drill holes range from 0.06 - 5.40% heavy minerals but rutile content was very low and the mineral assemblage was dominated by non-economic heavy minerals.

COMPANY:	ABERFOYLE RESOURCES LTD
TENEMENT:	EL 1520 & 1521
ENVELOPE:	8104
DURATION:	September 1988 - March 1990
1:250 000 SHEET:	CHILDARA
TARGET:	Heavy mineral sands
AGE/ROCKS:	Eocene Hampton Sandstone
STRUCTURAL CONTROL:	Tertiary strandlines containing lenses of heavy minerals

EXPLORATION SUMMARY: After reviewing available literature, a study of LANDSAT data and topographic maps outlined possible palaeoshorelines. RC air core drilling was carried out along existing roads for 97 holes and a cumulative depth of 1953m. 100-150g grab samples were taken from each 2m interval. Part of the sample was bagged and a second sample was panned on site to visually assess the percentage of heavy minerals.

MINERALISATION /PROSPECTS: Drilling failed to intersect the prospective Eocene Hampton Sandstone and only trace heavy minerals were observed. No samples were submitted for analysis and the Licences were relinquished.

COMPANY:	CRA EXPLORATION PTY LTD
TENEMENT:	EL 1570, 1571 & 1572
ENVELOPE:	8153
DURATION:	February 1989 - June 1989
1:250 000 SHEET:	STREAKY BAY & YARDEA
TARGET:	Heavy mineral sands
AGE/ROCKS:	Tertiary Garford and Pidinga Formations
STRUCTURAL CONTROL:	Tertiary sediments within the Narlaby Palaeochannel

EXPLORATION SUMMARY: A total of 50 RC holes were drilled on the EL's for a total of 1 213m. Holes were drilled across the Narlaby Palaeochannel at 1km spacing and samples were collected at 1m intervals. All samples were panned on site to test for heavy minerals. Drill holes were also gamma logged. A total of 11 samples were forwarded to CRAE's Belmont Laboratory for particle size determination and specific gravity analysis.

MINERALISATION /PROSPECTS: Results were disappointing with no significant intersections of heavy minerals encountered with only trace zircon observed in some panned samples. Due to poor results and large depths to basement, the Licences were relinquished.

COMPANY:	NATIONAL MINERAL SANDS, SWAN REACH NL & PEKO EXPLORATION LTD
TENEMENT:	EL 1597, 1598,1599, 1600, 1601, 1602, 1631, 1632, 1633, 1717, 1721 & 1722
DURATION:	EL 1597, 1599, 1600, 1601 - July 1989 - January 1992 EL 1598, 1602 - July 1989 - ongoing EL 1631, 1632, 1633 - June 1989 - June 1991 EL 1717, 1722 - May 1991 - May 1992 EL 1721 - May 1991 - May 1992
ENVELOPE:	8471, 8561 & 8219 (Env 8219 Closed File)
1:250 000 SHEET:	OOLDEA, BARTON, FOWLER, CHILDARA, STREAKY BAY, ELLISTON & YARDEA
TARGET:	Heavy mineral sands
AGE/ROCK UNITS:	Eocene Hampton Sandstone and Ooldea Sand
STRUCTURAL CONTROL:	Cainozoic palaeo-strandlines and associated geomorphological features

EXPLORATION SUMMARY: Initial exploration comprised collection of samples from a bulldozer cut and 4 shallow auger holes. Geomorphic maps of the eastern margin of the Eucla Basin were generated by Australian Photogeologic consultants showing large shoreline dunes, strandline beaches, islands, headlands, embayments and linear shorelines present within the licences.

1017 RC air core holes were drilled on the 12 Licence areas for a total of 19 161.2m between 1989-1992.

Initial exploration was carried out by National Mineral Sands Pty Ltd on EL's 1597, 1598, 1600, 1601 and 1602. 110 holes (EB 001-110) were drilled along 8 traverses for 1608.8m. Samples were taken at 1.5m intervals and split on site using a cyclone-spinner attachment. Part of the sample was forwarded to Australmin Holding Ltd laboratory, NSW for heavy mineral determination, with check analyses undertaken by Amdel.

Stage 2 comprised RC air core drilling of 348 holes (EB 110-458) totalling 11 921m by Geopeko. Each 2m interval was sampled and samples split on site using a rotary splitter attached to the sample cyclone. Samples were panned on site and intervals with a visual estimate of heavy minerals >0.5% were submitted to Amdel for heavy mineral determination. Check samples were forwarded to Western Geochem Laboratories, Perth. Initial results were encouraging and 2 representative bulk samples were

prepared and submitted to Australian Metallurgical and Mineral Testing Consultants Pty Ltd (Ammtec), Perth.

Between October and November, 1990, 91 holes (EB 459-549) totalling 2020.4m were drilled on EL 1631-33 along 8 lines. Results were very disappointing with only 14 of 1025 logging samples sent for analysis.

Between 5 May - 13 June 1991, 290 holes (EB 550- 839) were drilled along 14 lines totalling 8 165m in the Immarna area. Soil sampling was carried out in the Immarna (EL 1602) and Barton areas (EL 1717) with a total of 116 samples collected.

In December 1991, 178 holes were drilled by Geopeko. 123 holes (EB 840-962) were drilled along 4 lines in the Immarna area for 2 443m. 55 holes (EB 963-1017), totalling 1 168m were drilled at Barton (EL 1717).

MINERALISATION /PROSPECTS: Initial results from reconnaissance samples showed the presence of heavy minerals with results ranging from 0.16-1.59% HM comprising predominantly altered ilmenite (65-80%) and zircon (10-20%).

2 anomalous zones were outlined during stage 1 (EB 001-110) on Traverse 1 and 3 (EL 1597 & 1602) with mineralogy predominantly altered ilmenite (50-75%) and zircon (12-34%).

During stage 2 (EB 111-458), the best intersections were from the Traverses I-D, 14 Ext and 3 in the Immarna area (EL 1602). The best intersection was 27.2%HM in EB 119 (38-40m) with the mineral assemblage comprising 51% zircon, 43% ilmenite/altered ilmenite and 3% rutile. Microprobe analysis returned average TiO_2 assay of 66.2% (range 61.7-70.5%). Many samples showed heavy mineral contents >1%, but mineralisation was relatively deep (av 40m below surface).

At Immarna, drill hole information suggests that mineralisation was present in 2 distinct horizons which differ in age, grain size and HM assemblage. 2 representative bulk samples (1 from each zone) were analysed with the HM concentration from the upper horizon being 2.77% HM comprising 86.1% altered ilmenite & leucoxene. The lower horizon recorded 1.94% HM comprising 66.1% altered ilmenite & leucoxene.

Stage 3 (EB 550-839) outlined 2 anomalous zones in the Immarna area, but grades and volumes were uneconomic.

Drill holes EB840-962 were drilled to test the extent of mineralisation at the Immarna Prospect, due due to thick Quaternary cover, the area was considered unprospective.

Holes EB963-1 017 on BARTON failed to intersect significant mineralisation with only 6 samples recording >1% HM.

See Appendix C for all drill hole samples which assayed >1% HM.

COMPANY:	BHP MINERALS LTD
TENEMENT:	EL 1605, 1647, 1671, 1672 & 1703
ENVELOPE:	8230
DURATION:	EL 1605 - August 1989 - February 1992 EL 1647 - March 1990 - March 1992 EL 1671, 1672 - August 1990 - August 1992 EL 1703 - February 1991 - February 1992
1:250 000 SHEET:	STREAKY BAY, ELLISTON, KIMBA & LINCOLN
TARGET:	Heavy mineral sands
AGE/ROCK:	Pliocene to Eocene marginal marine sands of the Pidinga and Garford Formations
STRUCTURAL CONTROL:	Pliocene to Eocene palaeo-shorelines containing lenses of heavy minerals

EXPLORATION SUMMARY: 3 regional RC air core drilling programs were undertaken on the licences comprising 212 holes for 5132m.

The first drilling program between 2-11 October 1989, comprised 71 holes for 1357m with holes spaced at intervals ranging from 1-2km. Downhole gamma logging of the first 54 holes showed no radioactive heavy minerals. Samples were taken at 2m intervals and panned on site for traces of heavy minerals. 171 composite samples were forwarded to Classic Comlabs for Ti and Zr determination by XRF.

93 holes totalling 2428m were drilled along 7 traverses (T8-T13 & traverse Tal) between 9-23 August 1990. Sampling commenced at the base of the Bridgewater Formation. Samples were collected every 2m and split on site using a Jones riffle splitter. Samples were forwarded to Classic Comlabs for heavy mineral determination and detailed mineralogy on composites samples.

Between 7-17 March 1991, 48 holes totalling 1346m were drilled along 3 traverses (8, 14 & 15). All holes were down hole gamma logged. Sampling was as above. 421 samples were submitted for heavy mineral determination and 12 composite samples were forwarded to Amdel for heavy mineral determination.

MINERALISATION /PROSPECTS: Drilling outlined 4 zones of low grade mineralisation, however the mineral assemblage was dominated by ilmenite and uneconomic heavy minerals. The Licences were relinquished due to poor mineral assemblage, low grade, high overburden (>10m) and difficult drilling conditions.

COMPANY: SOUTHERN VENTURES NL

TENEMENT: EL 1614

ENVELOPE: 8240

DURATION: October 1989 - January 1994

1:250 000 SHEET: LINCOLN

TARGET: Heavy mineral sands

AGE/ROCKS: Eocene Wanilla Formation

STRUCTURAL CONTROL: Tertiary to Pleistocene palaeoshorelines and tombola facies

EXPLORATION SUMMARY: Initial exploration comprised examination of MESA Open file Envelopes and the Bore General File in order to identify prospective targets in the licence area. A search of drill holes held at DME Core Library and 50g composite samples were forwarded to Analabs for determination of TiO_2 and ZrO_2 by XRF. A photogeological study identified a possible Pleistocene shoreline.

Regional reconnaissance air core RC drilling of 167 holes for 4049m was undertaken. Samples were collected every metre and a total of 816 samples were forwarded to Analabs for determination of TiO_2 and ZrO_2 by XRF.

MINERALISATION /PROSPECTS: Initial results were encouraging with 1.41% TiO_2 & 0.28% ZrO_2 over a 6.5m interval (40-46.5m) from hole Bore General File No. 887.

Results from drilling showed heavy mineral intersections on the licence area were prevalent with the best intersections being;

Sample	%TiO_2	ppm ZrO_2
315401	1.94	1248
315500	1.60	843
315525	2.54	558
315553	2.00	684
315643	2.13	850
315715	2.26	596

Drilling outlined a low grade anomalous zone approximately 800m wide by 15 km long within the Wanilla Channel, comprising poorly sorted, angular sand, derived from surrounding basement highs. However no economic deposit was outlined and heavy mineral exploration ceased in mid 1990.

COMPANY:	BHP MINERALS LTD
TENEMENT:	EL 1653, 1654 & 1655
ENVELOPE:	8302
DURATION:	April 1990 - April 1991
1:250 000 SHEET:	OOLDEA, WYOLA & MAURICE
TARGET:	Heavy mineral sands
AGE/ROCKS:	Eocene Ooldea Sand & Hampton Sand
STRUCTURAL CONTROL:	Palaeo-beach ridges within the Ooldea Range and adjacent areas.

EXPLORATION SUMMARY: A total of 229 holes totalling 6447m were drilled along 13 Traverses. 12 holes were gamma ray logged. Ground magnetic lines were carried out along 3 Traverses but drilling failed to locate anomalous mineralisation.

2m samples were logged and split on site to produce a 2kg sample. 679 composite samples over 10m were forwarded to Amdel for heavy mineral determination. A further 41 samples comprised of 2m intervals of 10m composites with heavy mineral contents of >0.5% were forwarded to Amdel.

MINERALISATION /PROSPECTS: Initial results suggest that the mineralisation is predominantly within the Hampton Sandstone, with the overlying Pleistocene units relatively unmineralised. Best results were from holes M169 28-30m, 8.37%, M143 36-38m, 3.64% and M37 36-38m, 3.54%. 14 anomalous zones were identified and composite samples from each were analysed. Results showed the mineral assemblages was dominated by uneconomic minerals and ilmenite with low concentrations of rutile and zircon. Although mineralisation was present within the Licences, the depth to mineralisation (22-44m) and the poor mineral assemblage downgrade the prospect of an economic deposit. The Licences were subsequently relinquished.

APPENDIX B

SIGNIFICANT RESULTS

BHP MINERALS LTD

EL 1353, 1354 & 1355

Drill hole	Interval (m)	Traverse	%HM	%R	%Z	%Il	Other
OL9	0-20	1	1.61	<1	<1	<1	
OL39	0-24	6	1.35	2	9	19	70
OL39	10-12	6	3.06	5	13	12	70
OL76	0-6	2	1.21	-	-	<1	
OL111	0-18	7	1.20	-	6	<1	
OL111	14-16	7	1.18	-	2	4	
OL155	30-40	5	1.41	-	<1	<1	
OL159	22-23	6	1.06	-	-	3	
OL160	4-6	6	1.05	<1	2	38	
OL160	10-12	6	1.74	1	2	77	20
OL160	0-12	6	1.00	<1	1	74	25

R rutile
Z zircon
Il Ilmenite

EL 1355, 1653, 1654 & 1655

Anomaly No.1 - Traverse 2

Hole	Depth(m)	%HM	Mineralogy	(%)
M36	30-36	1.79	ilmenite	59
M37	28-39.5	1.93	rutile	1
			zircon	17
			leucoxene	5
			monazite	tr
			trash	18

Anomaly No.2 - Traverse 5

Hole	Depth(m)	%HM	Mineralogy	(%)
M906	22-30	0.69	ilmenite	35
M907	26-30	0.36	rutile	1
			zircon	28
			leucoxene	8
			monazite	-
			trash	28

Anomaly No.3 - Traverse 8

Hole	Depth(m)	%HM	Mineralogy	(%)
M909	28-30	1.15	ilmenite	53
M910	30-32	0.82	rutile	tr
			zircon	14
			leucoxene	4
			monazite	-
			trash	29

Anomaly No.4 - Traverse 9

Hole	Depth(m)	%HM	Mineralogy	(%)
M103	38-42	1.46	ilmenite	1
			rutile	tr
			zircon	4
			leucoxene	3
			monazite	-
			trash	92

Anomaly No.5 - Traverse 10

Hole	Depth(m)	%HM	Mineralogy	(%)
M131	36-38	1.35	ilmenite	6
M131	30-46	0.44	rutile	tr
M134	38-41.8	1.20	zircon	12
			leucoxene	5
			monazite	-
			trash	77

Anomaly No.6 - Traverse 10

Hole	Depth(m)	%HM	Mineralogy	(%)
M138	38-44	0.88	ilmenite	7
			rutile	tr

			zircon	1
			leucoxene	8
			monazite	-
			trash	84

Anomaly No.7 - Traverse 11

Hole	Depth(m)	%HM	Mineralogy	(%)
M143	32-39	1.77	ilmenite	13
M144	34-39	0.64	rutile	1
M145	38-42	3.19	zircon	4
M146	32-36	0.73	leucoxene	9
M147	34-39	1.14	monazite	-
M172	34-42	0.51	trash	73
M173	28-38	0.88		
M174	34-39	0.74		
M175	34-44	1.30		

Anomaly No.8 - Traverse 12

Hole	Depth(m)	%HM	Mineralogy	(%)
M167	36-42	0.98	ilmenite	12
M168	30-34	0.88	rutile	tr
M169	24-28	1.00	zircon	4
			leucoxene	4
			monazite	-
			trash	80

Anomaly No.9 - Traverse 10

Hole	Depth(m)	%HM	Mineralogy	(%)
M914	34-42	0.67	ilmenite	27
			rutile	2
			zircon	8
			leucoxene	14
			monazite	tr
			trash	49

Anomaly No.10 - Traverse 11

Hole	Depth(m)	%HM	Mineralogy	(%)
M178	34-38	2.86	ilmenite	31
			rutile	2
			zircon	47
			leucoxene	5
			monazite	2
			trash	13

Anomaly No.11 - Traverse 13

Hole	Depth(m)	%HM	Mineralogy	(%)
M204	22-26	0.47	ilmenite	54
			rutile	2
			zircon	24
			leucoxene	9
			monazite	tr
			trash	11

Anomaly No.12 - Traverse 13

Hole	Depth(m)	%HM	Mineralogy	(%)

M204	26-28	1.40	ilmenite	8
M204	20-22	1.48	rutile	1
			zircon	4
			leucoxene	2
			monazite	tr
			trash	85

Anomaly No.13 - Traverse 11

Hole	Depth(m)	%HM	Mineralogy	(%)
M150	36-40	0.27	ilmenite	33
			rutile	4
			zircon	25
			leucoxene	16
			monazite	tr
			trash	22

Anomaly No.14 - Traverse 12

Hole	Depth(m)	%HM	Mineralogy	(%)
M154	34-36	1.83	ilmenite	26
M154	20-36	0.27	rutile	5
			zircon	30
			leucoxene	8
			monazite	1
			trash	30

EL 1605, 1647, 1671, 1672 & 1703

Strandline	Length	Width	Thickness	Overburden	Grade	Assemblage				
	(km)	(m)	(m)	(m)	%HM	Ilm	Leu	R	Z	Trash
1	34	2000	9	16	0.92	32	9	4	18	37
2	32	1000	3	20	1.11	0	1	4	13	82
3	25	3000	7	24	1.05	35	12	1	18	34
4	6	1500	6	18	0.97	41	10	1	25	23

APPENDIX C

SIGNIFICANT RESULTS (>1% HM)

CEDUNA HEAVY MINERALS PROJECT

JOINT VENTURE

NATIONAL MINERAL SANDS, SWAN REACH NL &

PEKO EXPLORATION LTD

Hole #	Sample	from	to	HM %	OS	Slimes
EB0020	100203	9.00	10.50	2.6000	18.7000	35.7000
EB0021	100215	12.00	13.50	1.7000	7.5000	13.9000
EB0024	100241	6.00	7.50	1.8000	41.2000	28.4000
EB0028	100281	6.00	7.50	0.5000	51.1000	24.8000
EB0033	100334	15.00	16.50	1.1000	2.0000	4.8000
EB0033	100337	19.50	21.00	2.0000	0.7000	24.7000
EB0040	100417	13.50	15.00	2.7000	41.9000	8.0000
EB0050	100514	9.00	9.50	1.5000	16.7000	11.5000
EB0051	100517	3.00	4.50	1.3000	6.2000	24.2000
EB0056	100564	7.50	9.00	2.0000	20.7000	13.3000
EB0064	100628	12.00	13.50	3.6000	13.5000	47.8000
EB0065	100632	3.00	4.50	1.2000	55.8000	10.5000
EB0067	100659	13.50	15.00	1.5000	8.9000	31.0000
EB0068	100664	6.00	7.50	3.1000	18.6000	22.2000
EB0068	100667	10.50	12.00	2.4000	19.6000	33.6000
EB0070	100687	10.50	12.00	1.5000	28.9000	26.2000
EB0079	100773	7.50	9.00	21.0000	51.6000	10.5000
EB0109	101066	9.00	10.50	1.3000	15.8000	22.3000
EB0112	256037	14.00	16.00	1.3200	0.1000	1.8000
EB0113	256055	12.00	18.00	1.1200	0.2000	3.6000
EB0114	256076	20.00	22.00	1.0400	6.3000	1.5000
EB0114	256080	28.00	30.00	1.0450	0.0100	5.6400
EB0114	256083	34.00	36.00	1.4400		4.1000
EB0115	256104	18.00	20.00	1.9400	44.0000	3.0000
EB0115	256112	34.00	36.00	1.4400		1.7000
EB0116	256133	18.00	20.00	2.2700	19.1000	4.3000
EB0117	256159	12.00	14.00	2.1300	0.4000	12.3000
EB0118	256190	16.00	18.00	1.0200	0.2000	3.7000
EB0118	256207	50.00	52.00	3.1700	17.1000	4.6000
EB0119	256218	14.00	16.00	1.1100	2.4000	5.6000
EB0119	256229	36.00	38.00	4.9700	2.3650	6.3550
EB0121	256280	22.00	24.00	2.7400	13.4100	2.0100
EB0122	256317	38.00	40.00	9.3800		1.6000

EB0122	256320	44.00	46.00	1.0400	1.8000	6.4000
EB0129	256486	18.00	20.00	1.6700	4.6000	3.3000
EB0130	256504	12.00	14.00	2.3300	5.4000	6.4000
EB0132	256551	32.00	34.00	1.0600	26.1000	3.9000
EB0132	256563	56.00	57.00	1.6000		4.2000
EB0133	256576	24.00	26.00	3.3400	3.5000	4.2000
EB0133	256583	38.00	40.00	1.0800		7.1000
EB0134	256606	26.00	28.00	1.2600	5.3000	2.3000
EB0134	256619	52.00	54.00	1.0100	0.1000	5.9000
EB0135	256638	32.00	34.00	1.1000		8.0000
EB0135	256643	42.00	44.00	1.9000		7.4000
EB0136	256662	22.00	24.00	1.2200	0.2000	6.1000
EB0136	256669	36.00	38.00	1.6700	0.1000	5.3000
EB0147	256853	12.00	14.00	1.4700	40.3000	1.8000
EB0149	256894	6.00	8.00	1.5000	19.1000	8.3000
EB0151	256945	24.00	26.00	1.0200	14.7000	2.1300

Hole #	Sample	from	to	HM%	OS	Slimes
EB0171	257303	50.00	52.00	6.8600	0.1050	8.6200
EB0172	257332	50.00	52.00	3.2150	1.0100	5.5100
EB0174	257387	44.00	46.00	1.0300	1.3300	4.4100
EB0176	257446	46.00	48.00	1.2900	1.8000	6.0800
EB0177	257588	40.00	42.00	0.9200	0.9100	7.2000
EB0179	257498	34.00	36.00	2.0900	1.4900	5.3900
EB0180	257536	52.00	54.00	1.5600	0.1700	8.1900
EB0183	257620	20.00	22.00	2.1900	18.2000	18.0000
EB0184	257635	26.00	28.00	1.2400	0.1000	1.0000
EB0185	257660	36.00	38.00	7.8500	18.2000	24.6000
EB0187	257730	26.00	28.00	1.8700	9.5000	17.2000
EB0188	257707	38.00	40.00	1.0850	16.2100	12.5350
EB0189	257742	16.00	18.00	1.6800	9.0000	15.4000
EB0190	257768	30.00	32.00	2.6800	9.0000	15.3000
EB0191	257796	28.00	30.00	1.3100	2.3000	17.9000
EB0195	257898	32.00	34.00	2.6000	23.2000	33.6000
EB0196	257916	32.00	34.00	1.1700	1.1750	9.4050
EB0198	257963	38.00	40.00	1.1700	4.3000	10.2000
EB0199	257974	16.00	18.00	1.4900	27.6000	3.0000
EB0202	258027	10.00	12.00	4.2100	28.2000	20.1000
EB0203	258058	14.00	16.00	2.9600	11.1000	16.7000
EB0208	258165	22.00	24.00	2.7200	14.5000	16.2000
EB0209	258182	2.00	4.00	3.3600	51.2000	8.1000
EB0209	258188	14.00	16.00	1.2800	0.6000	6.6000
EB0210	258202	12.00	14.00	2.7700	28.7000	7.2000
EB0210	258205	18.00	20.00	6.0900	30.5000	22.1000
EB0210	258209	26.00	28.00	1.1300	8.7000	6.5000
EB0211	258231	28.00	30.00	1.2700	3.7000	11.4000
EB0212	258253	24.00	26.00	1.1900	3.6000	11.2000
EB0213	258269	18.00	20.00	1.1500	1.3000	2.7000
EB0214	258285	18.00	20.00	1.4000	0.2000	2.7000
EB0214	258289	26.00	28.00	2.6300	22.3000	16.1000
EB0215	258298	14.00	16.00	2.4200	0.2800	14.4750
EB0217	258330	18.00	20.00	1.2500	0.6950	1.5850
EB0217	258335	28.00	30.00	1.0600	5.2000	4.8000
EB0219	258389	42.00	44.00	1.7000	0.5000	5.3000
EB0220	258418	42.00	44.00	1.8800	1.2000	8.7000
EB0221	258437	22.00	24.00	1.5650	3.9250	6.1000
EB0222	258452	14.00	16.00	12.2800	0.2000	6.5000
EB0223	258472	10.00	12.00	1.3500	0.1000	2.6000
EB0223	258474	14.00	16.00	1.1300	0.1000	3.3000
EB0223	258485	36.00	38.00	1.2100	29.1000	7.5000
EB0224	258507	26.00	28.00	1.6200	1.7000	5.6000
EB0224	258515	42.00	44.00	1.2700	0.4000	5.6000
EB0227	258538	2.00	4.00	1.7500	16.3000	7.6000
EB0227	258541	8.00	10.00	1.4800	35.3000	4.0000
EB0229	258552	6.00	8.00	1.0500	6.3000	6.0000
EB0231	258569	0.00	2.00	1.2600	1.9000	20.7000
EB0232	258584	6.00	8.00	1.0200	0.7000	5.5000

Hole #	sample	from	to	HM%	OS	Slimes
EB0234	258622	12.00	14.00	1.5300	0.3000	4.1000
EB0235	258628	6.00	8.00	0.9900	0.1000	3.1000
EB0235	258633	16.00	18.00	1.0300	0.6000	8.0000
EB0236	258639	8.00	10.00	2.3000	0.2000	9.1000
EB0236	258647	24.00	26.00	1.7100	3.0000	4.6000
EB0237	258663	20.00	22.00	2.1100	1.4000	6.5000
EB0238	258679	24.00	26.00	2.6900	1.2000	5.0000
EB0240	258695	24.00	26.00	3.2000	5.3000	4.0000
EB0240	258702	38.00	40.00	2.9900	0.3000	6.2000
EB0331	272024	12.00	14.00	2.7000	12.0000	34.2000
EB0365	272388	26.00	28.00	1.0400	7.2000	6.5000
EB0372	272565	30.00	32.00	1.5500	5.0900	5.3200
EB0372	272572	44.00	45.00	1.2400	27.7000	26.7700
EB0373	272585	24.00	26.00	1.0200	0.5000	7.0700
EB0374	272601	22.00	24.00	1.8600	0.3300	7.2000
EB0375	259689	20.00	22.00	1.6000	0.6350	7.1700
EB0375	272617	22.00	24.00	1.3200	3.9500	10.6600
EB0376	272639	8.00	10.00	1.3400	1.4600	7.5500
EB0377	272648	6.00	8.00	1.0200	5.4800	8.0300
EB0377	272649	8.00	10.00	1.2100	9.1700	6.6500
EB0378	259691	8.00	10.00	1.6800	2.2850	9.8750
EB0379	272669	8.00	10.00	1.9100	12.7100	8.5300
EB0379	272676	22.00	24.00	1.5200	9.0000	6.1200
EB0380	272688	6.00	8.00	1.7900	14.0200	8.1000
EB0380	272696	22.00	24.00	2.7200	7.4800	14.0700
EB0381	272717	16.00	18.00	1.1400	0.8000	4.1000
EB0381	272722	26.00	28.00	1.1600	21.3500	8.2100
EB0382	272736	24.00	26.00	1.0300	0.1000	7.1100
EB0383	259694	18.00	20.00	1.5550	1.3350	3.6300
EB0383	272758	26.00	28.00	0.6900	2.1400	5.1700
EB0384	272779	26.00	28.00	1.1200	0.2100	7.9500
EB0385	259695	22.00	24.00	2.0550	2.5300	8.0400
EB0386	272810	14.00	16.00	1.8700	0.4200	7.9200
EB0387	272816	2.00	4.00	1.0500	12.4400	17.0800
EB0388	272825	12.00	14.00	1.5900	20.3800	5.7800
EB0389	272835	8.00	10.00	1.5300	0.2900	12.0100
EB0389	272841	20.00	22.00	1.7500	0.2700	5.0200
EB0390	272853	14.00	16.00	1.9300	0.5400	5.8200
EB0391	272866	22.00	24.00	1.9100	0.1800	5.7700
EB0392	272874	6.00	8.00	1.1400	0.1300	11.0000
EB0392	272881	20.00	22.00	2.1000	0.7100	4.7700
EB0393	272892	8.00	10.00	1.6600	0.0700	12.8000
EB0393	272900	24.00	26.00	2.9400	0.3700	4.1600
EB0393	272906	36.00	37.00	1.6200	34.0600	14.6400
EB0394	272918	22.00	24.00	2.5200	0.3200	6.9600
EB0396	272937	14.00	16.00	1.0400	0.4300	5.7200
EB0396	272938	16.00	18.00	1.6900	0.0500	4.6500
EB0396	272939	18.00	20.00	1.7200	0.0100	6.3700
EB0396	272940	20.00	22.00	3.6100	0.1900	6.2700

Hole #	Sample	from	to	HM%	OS	Slimes
EB0396	272941	22.00	24.00	1.0100	0.1700	10.8600
EB0396	272943	26.00	28.00	3.3800	14.8100	10.0600
EB0397	272955	20.00	22.00	1.0000	0.0400	4.3900
EB0397	259700	22.00	24.00	1.2150	0.0350	7.7450
EB0397	272957	24.00	26.00	1.4200	1.6900	7.1300
EB0397	272958	26.00	28.00	1.5900	27.7300	9.9000
EB0398	272975	24.00	26.00	1.6300	0.0800	4.3200
EB0401	273034	22.00	24.00	2.0500	0.6200	11.2000
EB0401	259701	24.00	26.00	2.9350	8.1300	9.6300
EB0402	273047	18.00	20.00	1.0400	3.6400	8.9600
EB0402	273048	20.00	22.00	2.0000	0.1000	9.1300
EB0402	273049	22.00	24.00	2.9000	0.0800	9.1000
EB0402	273050	24.00	26.00	1.0400	9.3800	9.4500
EB0403	273065	24.00	26.00	1.2400	0.8400	10.4100
EB0403	273066	26.00	28.00	1.4300	1.3400	9.7100
EB0403	273067	28.00	30.00	2.5300	0.8500	8.6300
EB0403	273068	30.00	32.00	1.2400	12.5600	9.2900
EB0404	273080	22.00	24.00	1.3200	0.2300	9.6300
EB0404	273081	24.00	26.00	1.4700	1.0100	8.9800
EB0405	273091	12.00	14.00	1.0100	4.8200	6.7600
EB0405	273092	14.00	16.00	1.0900	0.0800	6.4800
EB0405	273093	16.00	18.00	1.5900	4.1600	6.6600
EB0405	273094	18.00	20.00	2.6800	5.1700	9.2500
EB0405	273095	20.00	22.00	1.8200	2.4600	10.3100
EB0406	259704	20.00	22.00	2.8100	0.3450	5.1750
EB0406	273111	22.00	24.00	1.3200	0.2200	6.3000
EB0407	273129	20.00	22.00	3.5300	0.7800	3.6100
EB0407	273130	22.00	24.00	1.3600	0.2900	4.2200
EB0407	273132	26.00	28.00	1.3100	0.7500	7.5300
EB0408	273142	4.00	6.00	1.3100	0.0700	5.8200
EB0408	259705	10.00	12.00	4.0800	3.9450	1.9700
EB0408	273149	18.00	20.00	3.0800	0.4400	4.1100
EB0408	273150	20.00	22.00	2.6400	0.6000	5.4800
EB0408	273152	24.00	26.00	1.6100	0.5600	9.1500
EB0408	273155	30.00	32.00	2.5400	23.3400	9.8300
EB0409	273164	12.00	14.00	1.2900	0.1900	5.8200
EB0409	273165	14.00	16.00	1.2600	0.0400	3.8000
EB0409	273168	20.00	22.00	3.1500	0.8500	4.9800
EB0410	273186	20.00	22.00	1.4000	28.3900	8.4500
EB0411	273201	18.00	20.00	1.1000	0.2700	2.6900
EB0411	273202	20.00	22.00	1.1600	5.6100	5.9600
EB0411	273203	22.00	24.00	1.2800	22.5700	7.4900
EB0412	273219	24.00	26.00	1.2000	9.6100	10.5000
EB0413	273227	10.00	12.00	1.5000	1.8000	7.0400
EB0414	273238	8.00	10.00	1.1400	3.5200	8.3200
EB0414	273239	10.00	12.00	1.6500	1.4700	3.0400
EB0414	273248	28.00	30.00	1.0300	19.9000	10.7000
EB0415	273251	4.00	6.00	1.1000	0.3400	7.1700
EB0415	273252	6.00	8.00	1.9700	7.4000	2.0600

Hole #	Sample	from	to	HM%	OS	Slimes
EB0415	273253	8.00	10.00	2.1400	0.1800	1.3400
EB0415	273254	10.00	12.00	6.7400	0.5700	5.6800
EB0415	273259	20.00	22.00	3.1100	0.3200	4.4400
EB0415	273260	22.00	24.00	2.8300	0.4000	7.4000
EB0416	259709	24.00	26.00	1.6300	0.2850	4.6400
EB0416	273277	26.00	28.00	2.4700	0.9100	5.0100
EB0417	273287	14.00	16.00	1.4400	0.0200	6.0500
EB0417	273288	16.00	18.00	2.6900	0.1400	4.7300
EB0418	273302	18.00	20.00	1.4100	7.7700	9.1800
EB0418	273303	20.00	22.00	1.8400	3.1500	9.1800
EB0418	273304	22.00	24.00	2.7800	1.7500	8.6500
EB0419	273319	24.00	26.00	2.0000	2.9900	9.7400
EB0419	273320	26.00	28.00	1.5100	3.1300	8.3000
EB0419	273322	30.00	32.00	1.6900	19.0600	9.8200
EB0420	273334	22.00	24.00	1.8800	0.1300	7.6500
EB0420	259711	26.00	28.00	2.9900	0.2750	8.4750
EB0421	273349	20.00	22.00	1.5900	0.5200	6.8500
EB0421	273350	22.00	24.00	1.0200	0.5000	8.5000
EB0421	273351	24.00	26.00	1.6400	14.1100	9.0500
EB0422	273367	28.00	30.00	1.6000	5.1600	14.5000
EB0423	273378	20.00	22.00	1.3400	0.2000	3.0500
EB0424	259713	14.00	16.00	1.4800	0.1500	5.6650
EB0424	273391	16.00	18.00	2.6400	0.2900	6.4300
EB0424	273393	20.00	22.00	1.1900	5.1700	11.2900
EB0425	273401	12.00	14.00	1.3400	0.2000	3.7100
EB0425	273402	14.00	16.00	1.7100	0.0200	2.0000
EB0425	273406	22.00	24.00	1.3200	3.0700	5.0700
EB0425	273407	24.00	26.00	3.7600	0.9700	5.5900
EB0426	273423	24.00	26.00	1.5100	1.4500	8.2500
EB0427	273433	14.00	16.00	2.2400	0.0700	4.0600
EB0427	273434	16.00	18.00	10.9000	0.0200	1.9800
EB0427	259715	18.00	20.00	17.4100	0.0250	1.7650
EB0427	273436	20.00	22.00	1.3700	0.0100	2.7200
EB0427	273438	24.00	26.00	1.7900	0.0500	4.4100
EB0427	273439	26.00	28.00	1.2500	0.3600	5.8700
EB0428	273448	8.00	10.00	1.1400	0.6100	20.7000
EB0428	273449	10.00	12.00	1.2100	0.1800	17.9800
EB0428	273450	12.00	14.00	1.0500	0.1700	8.1100
EB0428	273453	18.00	20.00	1.0300	0.1900	5.8800
EB0428	273454	20.00	22.00	1.7600	0.2900	6.2400
EB0429	273464	12.00	14.00	1.2400	3.6000	19.6000
EB0429	273465	14.00	16.00	1.6500	0.1600	15.8400
EB0429	259716	16.00	18.00	2.7500	0.1900	8.0600
EB0430	273477	16.00	18.00	1.5100	0.0700	15.0400
EB0430	273478	18.00	20.00	1.7600	0.0800	10.4700
EB0430	273479	20.00	22.00	4.2800	2.0900	4.2300
EB0430	273480	22.00	24.00	5.3200	0.0300	2.5000
EB0430	273484	30.00	32.00	2.4700	0.3500	8.8700
EB0430	273485	32.00	34.00	2.3400	0.6900	9.5200

Hole #	Sample	from	to	HM%	OS	Slimes
EB0430	273486	34.00	36.00	3.5300	0.1300	10.0100
EB0431	273496	14.00	16.00	1.0000	0.0400	16.0700
EB0431	273497	16.00	18.00	1.3100	0.0600	9.3700
EB0431	273498	18.00	20.00	1.8900	1.0300	2.9100
EB0431	273499	20.00	22.00	3.4200	1.6500	1.7100
EB0432	273524	26.00	28.00	1.5900	0.6700	3.8300
EB0432	273526	30.00	32.00	2.9400	0.3400	6.5500
EB0433	259718	28.00	30.00	1.7000	0.3850	4.5600
EB0434	273564	28.00	30.00	1.1700	2.2700	4.4600
EB0434	273565	30.00	32.00	1.7600	0.7300	4.9900
EB0434	273566	32.00	34.00	1.8400	0.2700	3.6000
EB0435	273586	30.00	32.00	2.4900	14.8600	3.3600
EB0435	259719	32.00	34.00	1.6100	0.5350	5.7450
EB0436	273600	16.00	18.00	1.0400	1.9600	23.0900
EB0436	273601	18.00	20.00	1.2800	0.1300	16.4500
EB0436	273602	20.00	22.00	1.3500	0.1500	12.5500
EB0436	273603	22.00	24.00	2.0400	0.1300	6.8400
EB0437	273617	18.00	20.00	1.4000	0.5200	6.4800
EB0437	259720	20.00	22.00	2.5750	1.1900	10.7250
EB0438	273627	12.00	14.00	1.1200	0.1900	14.4100
EB0438	273628	14.00	16.00	2.5000	0.0800	5.0400
EB0438	273629	16.00	18.00	5.6900	0.0200	1.9700
EB0438	273630	18.00	20.00	1.2000	0.0500	3.6700
EB0439	273639	10.00	12.00	1.0300	0.1200	2.8600
EB0439	273640	12.00	14.00	1.2500	1.0100	1.1500
EB0439	259721	14.00	16.00	1.1900	0.3300	1.1950
EB0439	273643	18.00	20.00	1.4100	0.0300	1.6200
EB0439	273645	22.00	24.00	1.3700	0.9700	4.3100
EB0440	273662	24.00	26.00	1.9800	0.1000	6.0000
EB0440	273663	26.00	28.00	1.9700	1.1100	6.4400
EB0441	273668	2.00	4.00	1.7300	0.3700	12.7100
EB0441	273669	4.00	6.00	1.9200	0.2100	0.8700
EB0441	273675	16.00	18.00	4.8500	1.5500	6.2400
EB0441	273676	18.00	20.00	2.6400	1.2000	6.1100
EB0441	273678	22.00	24.00	2.1000	1.7800	10.9900
EB0442	273682	4.00	6.00	2.2200	0.1800	5.4000
EB0442	273683	6.00	8.00	1.4500	0.2100	2.2500
EB0442	273689	18.00	20.00	2.2400	0.3200	8.1000
EB0443	259722	6.00	8.00	1.6450	0.5300	4.5500
EB0443	273696	8.00	10.00	1.4400	0.1700	2.0800
EB0443	273700	16.00	18.00	1.0200	0.5500	4.0600
EB0443	273701	18.00	20.00	2.4500	0.8300	3.9700
EB0444	273709	8.00	10.00	1.5700	0.8200	4.5500
EB0444	273710	10.00	12.00	2.7900	0.2500	2.3100
EB0444	273714	18.00	20.00	2.8900	1.3100	6.1100
EB0444	273715	20.00	22.00	1.2600	0.6700	6.4100
EB0445	273722	10.00	12.00	1.7200	0.0600	1.5100
EB0445	273725	16.00	18.00	3.2300	2.5200	5.1600
EB0445	273726	18.00	20.00	1.0500	26.3100	7.9800

Hole #	Sample	from	to	HM%	OS	Slimes
EB0446	273738	22.00	24.00	2.5800	0.7100	5.0200
EB0446	273739	24.00	26.00	1.6800	0.3900	6.3600
EB0447	273753	22.00	24.00	1.2800	0.3000	10.9300
EB0448	273767	22.00	24.00	1.3500	0.2200	3.3500
EB0448	273768	24.00	26.00	1.9400	0.6300	25.5000
EB0449	273781	22.00	24.00	1.2100	0.2700	3.1100
EB0449	259724	24.00	26.00	2.5400	0.5700	5.6250
EB0449	273784	28.00	30.00	1.5300	16.9300	8.6300
EB0450	273794	18.00	20.00	1.1900	0.1300	2.4400
EB0450	273796	22.00	24.00	1.7400	0.4700	3.8000
EB0450	273797	24.00	26.00	1.1300	0.7100	8.6000
EB0451	273804	10.00	12.00	2.8600	5.4200	6.9700
EB0451	259725	12.00	14.00	3.5400	0.6400	2.6050
EB0451	273806	14.00	16.00	1.1600	0.0500	2.7400
EB0451	273807	16.00	18.00	1.4500	0.5700	3.1700
EB0451	273808	18.00	20.00	1.4000	2.4500	4.4100
EB0451	273809	20.00	22.00	1.2600	1.1100	3.8900
EB0451	273810	22.00	24.00	1.4200	2.6600	5.1400
EB0452	273813	0.00	2.00	1.3000	0.2400	13.3500
EB0452	273814	2.00	4.00	1.2900	0.1300	11.8400
EB0452	273815	4.00	6.00	2.9000	0.1400	8.9400
EB0452	273816	6.00	8.00	3.2900	4.1400	4.1900
EB0452	273817	8.00	10.00	3.2000	0.2200	1.6700
EB0452	273818	10.00	12.00	14.8700	1.1800	1.8800
EB0452	273819	12.00	14.00	1.8900	0.0900	1.4900
EB0452	273821	16.00	18.00	1.0500	0.9000	3.4400
EB0452	273822	18.00	20.00	2.7200	0.1800	3.9500
EB0452	273823	20.00	22.00	2.0100	0.5900	5.4200
EB0452	273825	24.00	26.00	2.0200	1.5000	9.2600
EB0453	273836	16.00	18.00	1.2000	0.0300	2.5800
EB0453	259726	18.00	20.00	1.1025	0.0250	1.7350
EB0453	273840	24.00	26.00	2.5700	0.0900	5.2300
EB0453	273841	26.00	28.00	3.5100	0.2900	5.3600
EB0453	273843	30.00	32.00	1.3100	0.7200	9.0200
EB0454	273851	10.00	12.00	1.0100	0.1300	9.6800
EB0454	273854	16.00	18.00	1.7800	0.0700	2.3300
EB0454	273857	22.00	24.00	1.7200	0.9300	3.1800
EB0454	273858	24.00	26.00	4.9200	2.3300	5.2800
EB0454	273859	26.00	28.00	2.0200	1.0900	4.2400
EB0455	273868	10.00	12.00	1.5700	0.1400	16.0100
EB0455	273869	12.00	14.00	2.2500	0.0500	8.2400
EB0455	273870	14.00	16.00	2.6500	0.0700	2.5200
EB0455	273871	16.00	18.00	1.9900	0.0400	2.2700
EB0455	259727	18.00	20.00	4.6600	0.1650	2.0600
EB0455	273873	20.00	22.00	2.0600	0.3100	0.8200
EB0455	273876	26.00	28.00	1.0400	2.3800	3.5200
EB0455	273877	28.00	30.00	1.6200	0.7600	6.9200
EB0455	273878	30.00	32.00	3.1600	0.3600	5.2100
EB0456	273886	8.00	10.00	1.4800	0.1100	15.5600

Hole #	Sample	from	to	HM%	OS	Slimes
EB0456	273887	10.00	12.00	1.9100	0.0500	9.1600
EB0456	273888	12.00	14.00	3.4000	2.2600	3.1800
EB0456	273889	14.00	16.00	3.8300	0.1200	1.6800
EB0456	273890	16.00	18.00	2.8500	0.0600	1.4800
EB0456	273891	18.00	20.00	2.4200	0.1000	1.5100
EB0456	273892	20.00	22.00	1.2400	0.1000	1.4800
EB0456	273895	26.00	28.00	1.5700	1.4400	5.9400
EB0456	273896	28.00	30.00	2.1000	0.2900	6.7200
EB0457	273906	10.00	12.00	2.1700	0.2700	13.4500
EB0457	273907	12.00	14.00	3.0800	0.0600	5.8200
EB0457	273908	14.00	16.00	2.4400	0.0300	2.8400
EB0457	273909	16.00	18.00	4.7900	0.0300	2.3300
EB0457	273910	18.00	20.00	3.9900	0.2400	1.2600
EB0457	273911	20.00	22.00	1.2600	0.6800	1.4800
EB0457	273914	26.00	28.00	1.8800	0.7300	4.9600
EB0457	273915	28.00	30.00	3.7000	0.2000	5.6200
EB0457	273916	30.00	32.00	3.9100	0.2000	6.0300
EB0458	273924	8.00	10.00	1.1900	1.3700	17.3400
EB0458	273925	10.00	12.00	1.4100	0.0500	11.7800
EB0458	273926	12.00	14.00	1.4700	0.0500	10.2600
EB0458	273927	14.00	16.00	1.7800	0.8100	4.9600
EB0458	273928	16.00	18.00	1.9300	0.7200	3.2900
EB0458	273929	18.00	20.00	1.8900	0.3700	1.2700
EB0458	273930	20.00	22.00	1.8700	0.7600	1.4300
EB0458	273934	28.00	30.00	1.6700	0.2600	4.3600
EB0458	273935	30.00	32.00	2.3200	1.6600	3.4600
EB0458	273936	32.00	34.00	1.2000	1.5600	9.7100
EB0551	284115	4.00	6.00	1.8000	3.8400	7.6300
EB0552	284117	18.00	20.00	2.4400	0.3400	16.1700
EB0553	284119	22.00	24.00	1.0200	0.6600	12.1300
EB0554	284120	8.00	10.00	2.2200	4.1400	15.5300
EB0566	284131	20.00	22.00	1.0200	0.7000	13.9200
EB0566	284132	22.00	24.00	1.1400	0.1850	10.8800
EB0566	284133	24.00	26.00	1.1600	0.1700	6.1100
EB0566	284134	26.00	28.00	1.0200	0.0800	3.1400
EB0566	284135	28.00	30.00	1.1500	0.1400	2.5000
EB0572	284137	16.00	18.00	1.5000	0.1200	30.5100
EB0572	284138	18.00	20.00	1.9100	0.1100	20.1600
EB0572	284139	20.00	22.00	1.6800	0.1400	8.4300
EB0572	284141	28.00	30.00	1.5500	20.6400	13.4600
EB0573	284142	14.00	16.00	3.1500	0.1400	7.4000
EB0573	284143	16.00	18.00	4.7900	0.2300	5.0100
EB0573	284144	18.00	20.00	5.5000	2.4700	7.3200
EB0573	284145	20.00	22.00	4.3300	18.5500	14.9300
EB0573	284146	22.00	24.00	12.1600	58.9300	8.6200
EB0574	284147	14.00	16.00	2.4000	0.1800	14.9000
EB0574	284148	16.00	18.00	2.8400	0.2500	15.1300
EB0574	284149	18.00	20.00	3.3600	0.1500	13.1900
EB0574	284150	20.00	22.00	4.2700	0.0900	11.9900

Hole #	Sample	from	to	HM%	OS	Slimes
EB0574	284161	22.00	24.00	3.6900	0.4500	10.5600
EB0574	284162	24.00	26.00	12.5500	21.9200	10.5100
EB0574	284163	26.00	27.00	14.3500	42.5000	9.6400
EB0589	284173	24.00	26.00	1.1800	17.4100	7.5200
EB0611	284182	20.00	22.00	1.2300	0.2500	8.7000
EB0614	284183	18.00	20.00	1.1000	3.7200	10.1800
EB0656	284195	26.00	28.00	1.3200	0.6800	1.9300
EB0669	284206	28.00	30.00	4.4500	6.1700	1.7900
EB0670	284210	26.00	28.00	1.2200	2.9700	4.9900
EB0670	284211	28.00	30.00	2.6800	1.7300	2.2900
EB0671	284218	34.00	36.00	1.6500	0.8500	3.7800
EB0674	284222	24.00	26.00	1.3000	30.2000	12.8400
EB0676	284229	24.00	26.00	2.0800	6.3900	7.6100
EB0676	284230	26.00	28.00	1.0500	7.2900	6.2700
EB0682	284236	10.00	12.00	1.5000	1.6100	7.3700
EB0682	284237	12.00	14.00	2.0700	0.2000	5.1000
EB0682	284238	14.00	16.00	3.5700	0.3950	4.3000
EB0682	284239	16.00	18.00	1.2500	0.0300	5.2000
EB0682	284240	18.00	20.00	1.1100	14.6300	5.5300
EB0683	284245	10.00	12.00	1.0200	6.7000	4.2400
EB0683	284248	16.00	18.00	1.1500	0.6400	4.7900
EB0683	284249	18.00	20.00	3.9900	1.0000	4.3600
EB0684	284256	24.00	26.00	1.6500	0.2000	12.2500
EB0684	284257	26.00	28.00	2.7200	1.1800	11.9300
EB0685	284262	6.00	8.00	1.0000	12.0200	16.3000
EB0685	284263	8.00	10.00	7.0000	6.5800	6.0500
EB0685	284266	14.00	16.00	1.6300	0.9400	8.6300
EB0686	284270	18.00	20.00	1.2900	3.9650	10.7500
EB0686	284271	20.00	22.00	1.7800	3.2700	13.2900
EB0687	284276	18.00	20.00	1.1400	0.2600	11.1000
EB0688	284278	20.00	22.00	1.3600	0.8500	13.3800
EB0688	284279	22.00	24.00	1.4000	0.4900	13.2000
EB0692	284281	16.00	18.00	1.0500	8.6300	10.9200
EB0692	284284	22.00	24.00	11.0700	18.1950	10.1700
EB0697	284287	22.00	24.00	1.4400	1.1800	12.9400
EB0698	284290	24.00	26.00	1.0700	3.1800	11.6400
EB0700	284291	28.00	30.00	1.4000	14.8300	8.7200
EB0704	284297	24.00	26.00	5.7400	8.9800	6.5000
EB0704	284298	26.00	28.00	28.7300	13.6400	7.5000
EB0715	284312	30.00	32.00	1.0100	1.9100	6.6500
EB0715	284313	32.00	34.00	1.1800	2.7200	8.0600
EB0715	284314	34.00	36.00	3.4800	0.4500	7.8400
EB0716	284318	14.00	16.00	1.1200	1.0400	6.8100
EB0716	284319	16.00	18.00	2.1800	0.2100	5.3100
EB0716	284320	18.00	20.00	2.6100	1.2500	6.0300
EB0716	284321	20.00	22.00	1.6000	0.3700	7.6300
EB0717	284326	12.00	14.00	1.0700	0.5100	3.0900
EB0717	284327	14.00	16.00	1.4700	0.5700	5.3500
EB0717	284328	16.00	18.00	1.0200	0.2000	5.0000

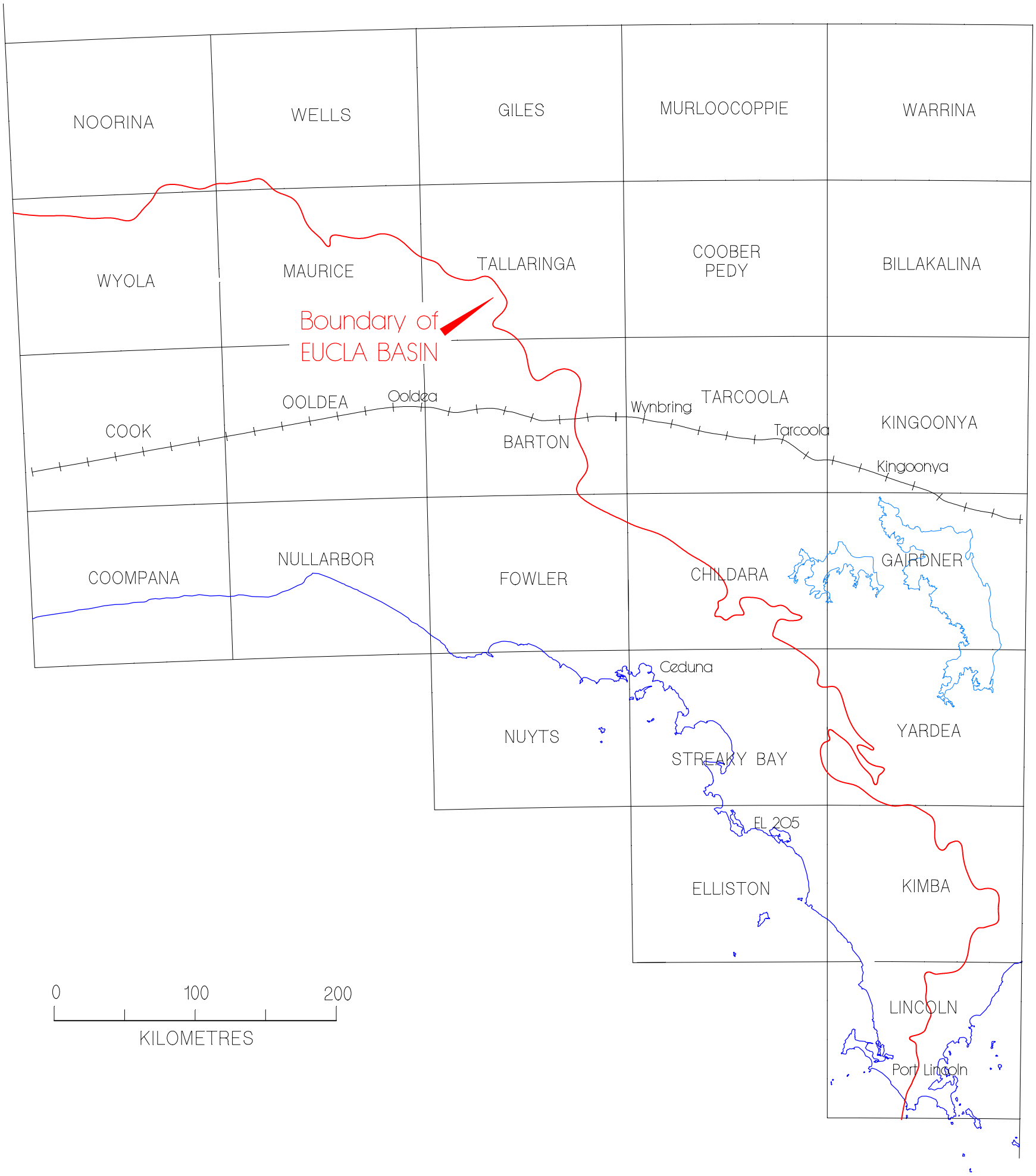
Hole #	Sample	from	to	HM%	OS	Slimes
EB0718	284329	0.00	2.00	1.2600	0.5900	5.8900
EB0718	284330	2.00	4.00	1.1350	0.3950	10.0750
EB0718	284333	8.00	10.00	2.6700	1.7100	4.8800
EB0718	284336	14.00	16.00	2.2200	1.8000	4.5200
EB0718	284337	16.00	18.00	2.4300	0.4900	6.9600
EB0718	284338	18.00	20.00	1.4700	0.2900	6.2200
EB0719	284339	0.00	2.00	1.5500	0.5200	5.0100
EB0719	284340	2.00	4.00	1.3000	0.3100	7.9700
EB0719	284341	4.00	6.00	1.0400	0.1800	9.0600
EB0719	284343	8.00	10.00	1.3800	0.4400	10.8400
EB0719	284345	12.00	14.00	3.1400	1.1550	5.1550
EB0719	284346	14.00	16.00	11.2300	0.5000	3.4700
EB0719	284347	16.00	18.00	1.1400	0.4500	3.9000
EB0719	284348	18.00	20.00	1.2300	0.1700	5.6200
EB0719	284350	26.00	28.00	2.8200	0.8500	7.4700
EB0720	284356	10.00	12.00	4.3200	3.1000	2.9400
EB0720	284357	12.00	14.00	1.4400	0.2200	1.7900
EB0720	284358	14.00	16.00	2.0300	0.1100	2.3000
EB0720	284360	18.00	20.00	1.3200	0.2600	3.0300
EB0720	284361	20.00	22.00	2.2500	0.0800	3.5500
EB0721	284370	22.00	24.00	1.8500	2.2700	4.6500
EB0721	284371	24.00	26.00	3.2800	0.4900	7.4300
EB0726	284382	20.00	22.00	1.3700	1.0100	8.5000
EB0734	284383	14.00	16.00	2.3200	0.0800	6.0700
EB0735	284385	14.00	16.00	4.2700	3.8100	7.1200
EB0740	284386	22.00	24.00	1.0400	0.8900	2.0300
EB0747	284397	22.00	24.00	1.0600	4.3600	2.5700
EB0747	284398	24.00	26.00	1.7800	13.6700	5.0500
EB0747	284399	26.00	28.00	2.1400	3.6200	3.4000
EB0747	284400	28.00	30.00	1.0100	0.0100	1.9600
EB0747	284401	30.00	32.00	2.1300	0.0200	2.8200
EB0747	284402	32.00	34.00	2.0600		2.3400
EB0748	284406	24.00	26.00	1.0500	0.0400	3.8100
EB0753	284422	20.00	22.00	2.0400	13.6200	5.9800
EB0753	284428	34.00	36.00	1.0200	0.0900	3.9700
EB0754	284433	8.00	10.00	2.2900	0.3300	3.4900
EB0754	284434	10.00	12.00	2.1400	2.5000	1.4400
EB0754	284435	12.00	14.00	2.6300	0.8800	1.5200
EB0754	284436	14.00	16.00	1.8100	0.0100	1.4400
EB0754	284437	16.00	18.00	1.8900	0.0100	1.6800
EB0754	284438	18.00	20.00	7.3000	0.1600	3.0900
EB0754	284439	20.00	22.00	2.4800	0.1400	2.4200
EB0754	284440	22.00	24.00	0.3100	0.0200	1.8200
EB0754	284441	24.00	26.00	0.6400	0.0400	2.8300
EB0754	284442	26.00	28.00	1.3100	0.0400	2.5200
EB0754	284443	28.00	30.00	1.2100	0.0500	4.2800
EB0755	284449	4.00	6.00	1.1700	0.0200	2.7900
EB0755	284450	6.00	8.00	1.2200	0.0300	3.0600
EB0755	284451	8.00	10.00	1.0300	0.0100	2.7300

Hole #	Sample	from	to	HM%	OS	Slimes
EB0755	284456	28.00	30.00	1.7800	0.5400	5.7200
EB0756	284458	16.00	18.00	1.3700	0.0300	2.0100
EB0758	284464	12.00	14.00	1.2600	0.2200	8.0600
EB0758	284465	14.00	16.00	1.1800	0.2900	4.9700
EB0758	284466	16.00	18.00	1.6600	0.1900	2.5500
EB0758	284467	18.00	20.00	2.3900	0.0700	1.7600
EB0758	284468	20.00	22.00	0.9600	0.0500	1.3900
EB0758	284469	22.00	24.00	0.6800	0.8300	2.0800
EB0758	284470	24.00	26.00	0.9800	0.6000	6.4200
EB0758	284471	26.00	28.00	3.1800	0.2800	5.9400
EB0759	284480	22.00	24.00	1.7500	0.3400	11.6700
EB0759	284481	24.00	26.00	1.3200	0.3300	10.0500
EB0760	284483	0.00	2.00	1.3100	2.4700	24.0900
EB0760	284484	2.00	4.00	1.6100	12.1600	18.7600
EB0760	284485	4.00	6.00	4.8300	0.6000	8.8500
EB0760	284486	6.00	8.00	11.7500	0.1000	6.2600
EB0760	284487	8.00	10.00	7.0350	0.0600	5.9800
EB0760	284488	10.00	12.00	2.8800	0.0600	6.3300
EB0760	284491	16.00	18.00	1.7300	0.2500	8.6200
EB0760	284492	18.00	20.00	4.2500	1.5500	13.2000
EB0761	284506	24.00	26.00	1.1600	1.0000	2.8600
EB0762	284508	16.00	18.00	1.0900	3.0300	4.9200
EB0762	284509	26.00	27.00	2.1500	20.0700	11.9300
EB0764	284510	16.00	18.00	2.1850	13.5200	8.6750
EB0764	284511	28.00	30.00	1.3700	0.5600	9.7300
EB0768	284518	26.00	28.00	1.2000	5.0300	12.3800
EB0769	284520	16.00	18.00	1.0900	0.9800	10.1400
EB0771	284524	10.00	12.00	1.5900	8.0200	11.5500
EB0773	284527	2.00	4.00	1.2100	1.7400	6.1600
EB0773	284528	4.00	6.00	1.0100	1.2600	6.4900
EB0799	284557	20.00	22.00	1.2100	0.2400	10.4800
EB0799	284558	22.00	24.00	1.2600	0.0400	7.4600
EB0799	284559	24.00	26.00	1.0500	0.0300	4.5100
EB0799	284564	34.00	36.00	1.1800	1.8000	5.6900
EB0812	284587	24.00	26.00	3.1700	1.4900	2.3500
EB0812	284588	26.00	28.00	1.6100	0.2200	2.0100
EB0827	284612	26.00	28.00	1.0300	0.2200	4.1300
EB0827	284613	28.00	30.00	1.0000	0.2200	2.3700
EB0870	284619	18.00	20.00	1.1200	0.1700	1.5300
EB0924	284620	10.00	12.00	1.3900	0.3900	6.3900
EB0924	284621	12.00	14.00	1.8200	0.7800	4.3200
EB0924	284622	14.00	15.00	1.3500	8.4900	2.6800
EB0925	284623	18.00	20.00	1.7900	1.7300	0.4700
EB0951	284624	2.00	3.00	1.2300	49.7000	2.4100
EB0959	284625	18.00	20.00	1.3400	0.0100	0.5600
EB0963	284626	8.00	10.00	1.4800	8.1400	1.8500
EB0984	284628	26.00	28.00	1.2350	6.8850	1.2200
EB0984	284629	28.00	30.00	2.3300	1.3200	0.9900
EB0984	284630	30.00	32.00	1.9300	4.1800	0.9600

Hole #	Sample	from	to	HM%	OS	Slimes
EB0987	284632	22.00	24.00	5.0000	6.1600	1.1600
EB0987	284633	24.00	26.00	2.6200	11.7900	1.3500
EB0799	284557	20.00	22.00	1.2100	0.2400	10.4800
EB0799	284558	22.00	24.00	1.2600	0.0400	7.4600
EB0799	284559	24.00	26.00	1.0500	0.0300	4.5100
EB0799	284564	34.00	36.00	1.1800	1.8000	5.6900
EB0812	284587	24.00	26.00	3.1700	1.4900	2.3500
EB0812	284588	26.00	28.00	1.6100	0.2200	2.0100
EB0827	284612	26.00	28.00	1.0300	0.2200	4.1300
EB0827	284613	28.00	30.00	1.0000	0.2200	2.3700
EB0870	284619	18.00	20.00	1.1200	0.1700	1.5300
EB0924	284620	10.00	12.00	1.3900	0.3900	6.3900
EB0924	284621	12.00	14.00	1.8200	0.7800	4.3200
EB0924	284622	14.00	15.00	1.3500	8.4900	2.6800
EB0925	284623	18.00	20.00	1.7900	1.7300	0.4700
EB0951	284624	2.00	3.00	1.2300	49.7000	2.4100
EB0959	284625	18.00	20.00	1.3400	0.0100	0.5600
EB0963	284626	8.00	10.00	1.4800	8.1400	1.8500
EB0984	284628	26.00	28.00	1.2350	6.8850	1.2200
EB0984	284629	28.00	30.00	2.3300	1.3200	0.9900
EB0984	284630	30.00	32.00	1.9300	4.1800	0.9600
EB0987	284632	22.00	24.00	5.0000	6.1600	1.1600
EB0987	284633	24.00	26.00	2.6200	11.7900	1.3500

TABLE 1. Summary of company exploration

EL	Company	Envelope	Date granted	Date expired	No. of drill holes	Total meterage
205	Australian Anglo American Ltd	2654	20/8/75	24/12/75	156 surface grab samples	
1353	BHP Minerals Ltd	6816	20/8/86	19/8/88	55	863.8
1354		6817	20/8/86	19/8/88	43	863
1355		6818	2/9/86	1/9/91	71	1 204
1520	Aberfoyle Resources	8104	29/9/88	29/6/89	97	1 953
1521	Ltd		29/9/88	29/6/89		
1570	CRA Exploration Pty	8153	14/2/89	29/6/89	50	1 213
1571	Ltd		14/2/89	29/6/89		
1571			14/2/89	29/6/89		
1597	National Mineral	8561 &	25/7/89	ongoing		
1598	Sands, Swan Reach	8219	25/7/89	24/1/92		
1599	NL & Peko		25/7/89	24/1/92		
1600	Exploration Ltd		25/7/89	24/1/92	895	16 503.7
1601			25/7/89	24/1/92		
1602			25/7/89	ongoing		
1605	BHP Minerals Ltd	8230	18/8/89	17/2/92	212	5 132
1647			28/3/90	27/3/92		
1671			31/8/90	30/8/92		
1672			31/8/90	30/8/92		
1703			14/2/91	13/2/92		
1614	Southern Ventures NL	8240	4/10/89	3/1/94	167	4 049
1631	National Mineral		21/12/89	20/6/91		
1632	Sands, Swan Reach		21/12/89	20/6/91	67	1 168
1632	NL & Peko Exploration Ltd		21/12/89	20/6/91		
1717	Peko Exploration Ltd		6/5/91	5/5/92	55	1 168
1721			17/5/91	16/11/92		
1722			17/5/91	16/11/92		



REVIEW OF HEAVY MINERAL SAND EXPLORATION

LOCALITY OF EUCLA BASIN

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 1

MESA 1996–0770

100336GF.DTA

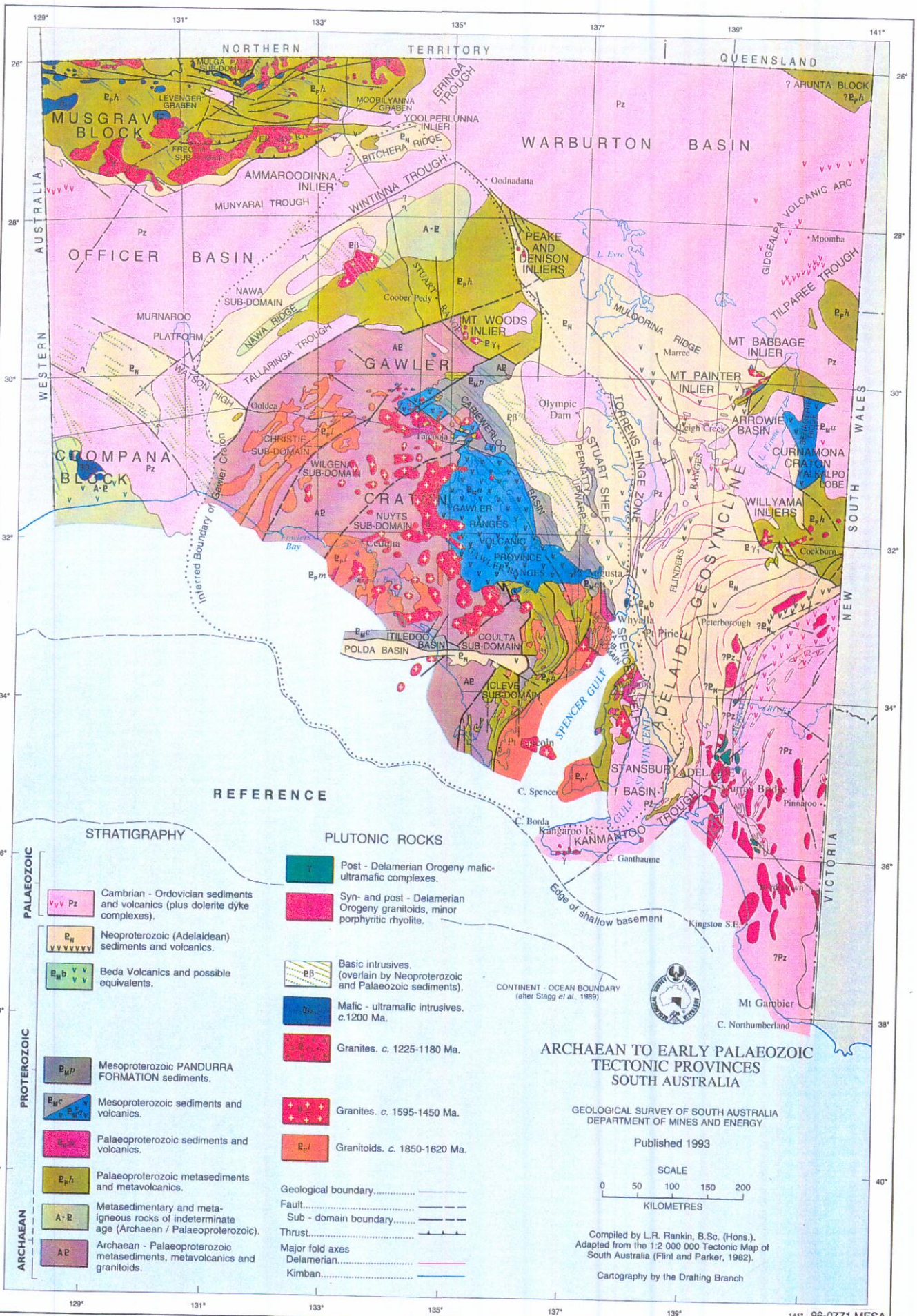
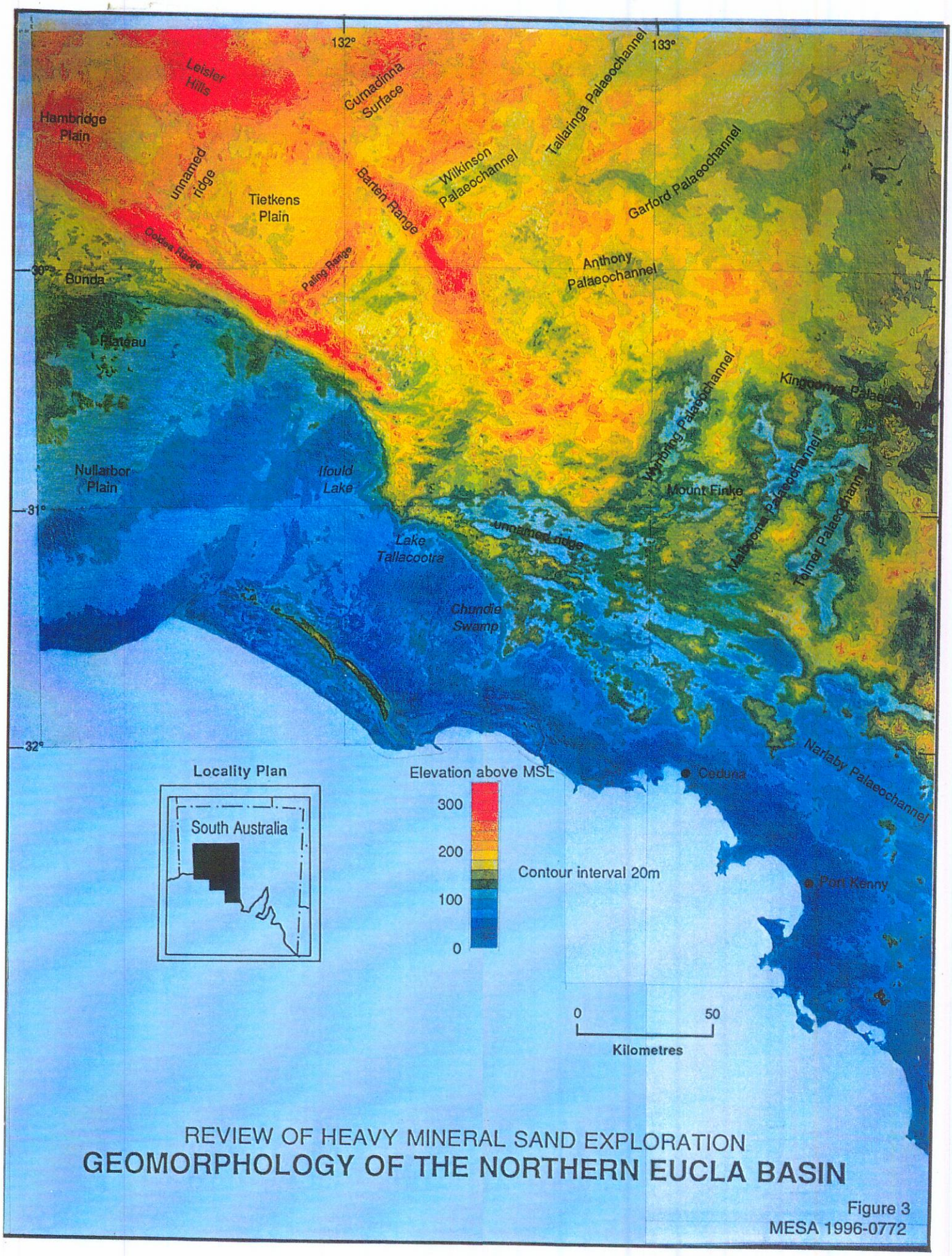


Figure 2 Archaean to Early Palaeozoic geology of South Australia



REVIEW OF HEAVY MINERAL SAND EXPLORATION

GEOMORPHOLOGY OF THE NORTHERN EUCLA BASIN

Figure 3
MESA 1996-0772

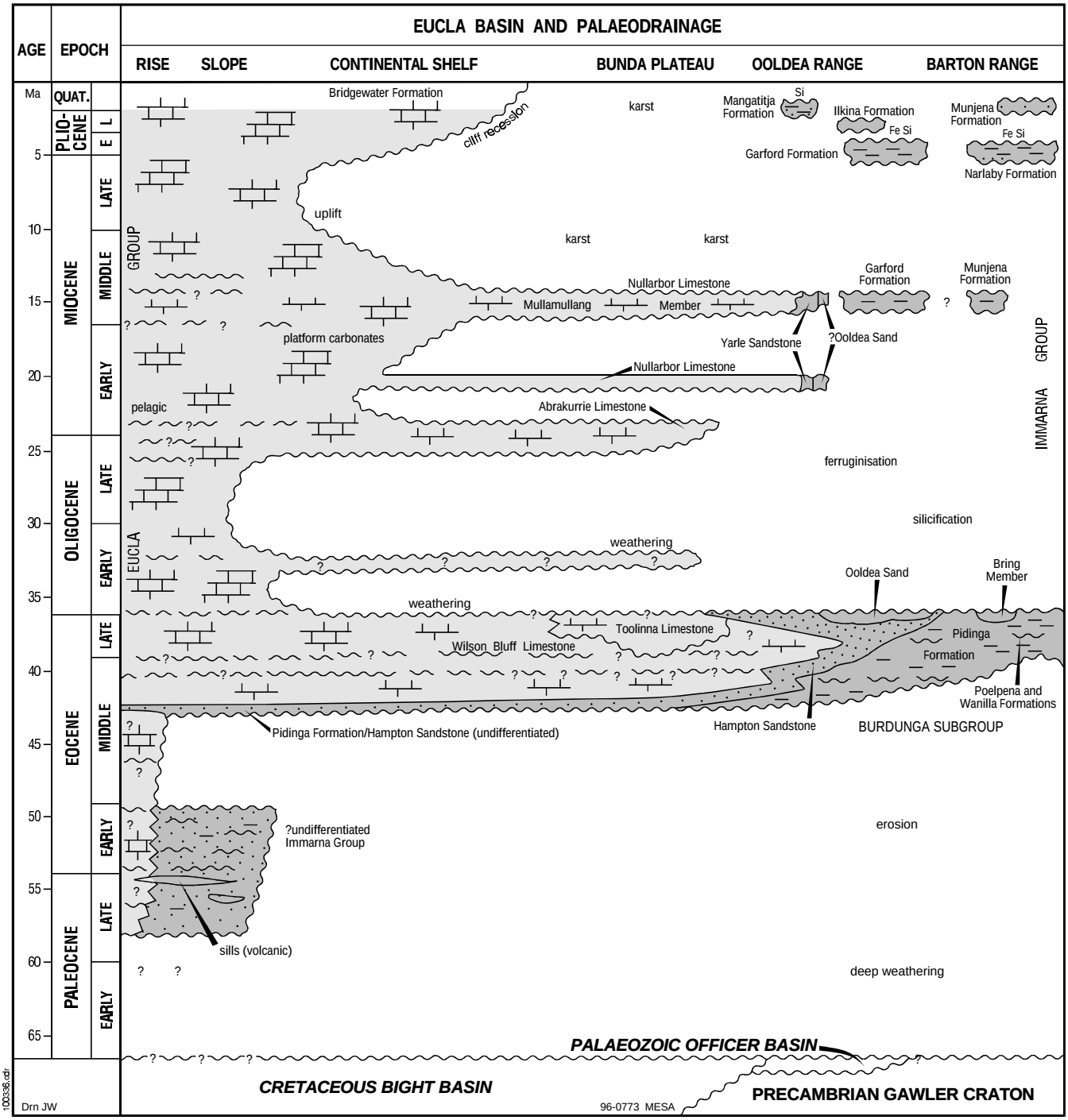
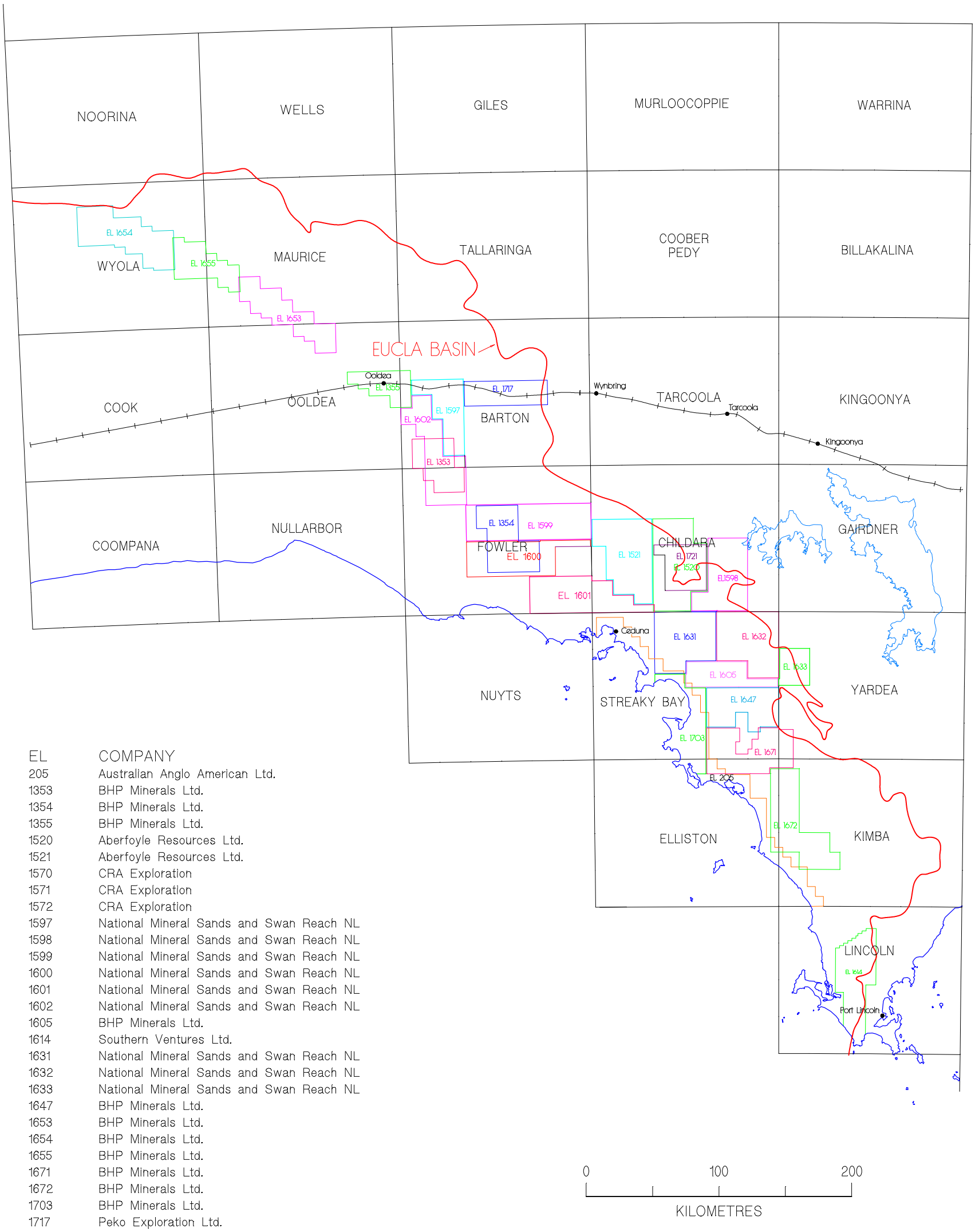


Figure 4 Stratigraphy of the Eucla Basin



EL	COMPANY
205	Australian Anglo American Ltd.
1353	BHP Minerals Ltd.
1354	BHP Minerals Ltd.
1355	BHP Minerals Ltd.
1520	Aberfoyle Resources Ltd.
1521	Aberfoyle Resources Ltd.
1570	CRA Exploration
1571	CRA Exploration
1572	CRA Exploration
1597	National Mineral Sands and Swan Reach NL
1598	National Mineral Sands and Swan Reach NL
1599	National Mineral Sands and Swan Reach NL
1600	National Mineral Sands and Swan Reach NL
1601	National Mineral Sands and Swan Reach NL
1602	National Mineral Sands and Swan Reach NL
1605	BHP Minerals Ltd.
1614	Southern Ventures Ltd.
1631	National Mineral Sands and Swan Reach NL
1632	National Mineral Sands and Swan Reach NL
1633	National Mineral Sands and Swan Reach NL
1647	BHP Minerals Ltd.
1653	BHP Minerals Ltd.
1654	BHP Minerals Ltd.
1655	BHP Minerals Ltd.
1671	BHP Minerals Ltd.
1672	BHP Minerals Ltd.
1703	BHP Minerals Ltd.
1717	Peko Exploration Ltd.
1721	Peko Exploration Ltd.
1722	Peko Exploration Ltd.

REVIEW OF HEAVY MINERAL SAND EXPLORATION

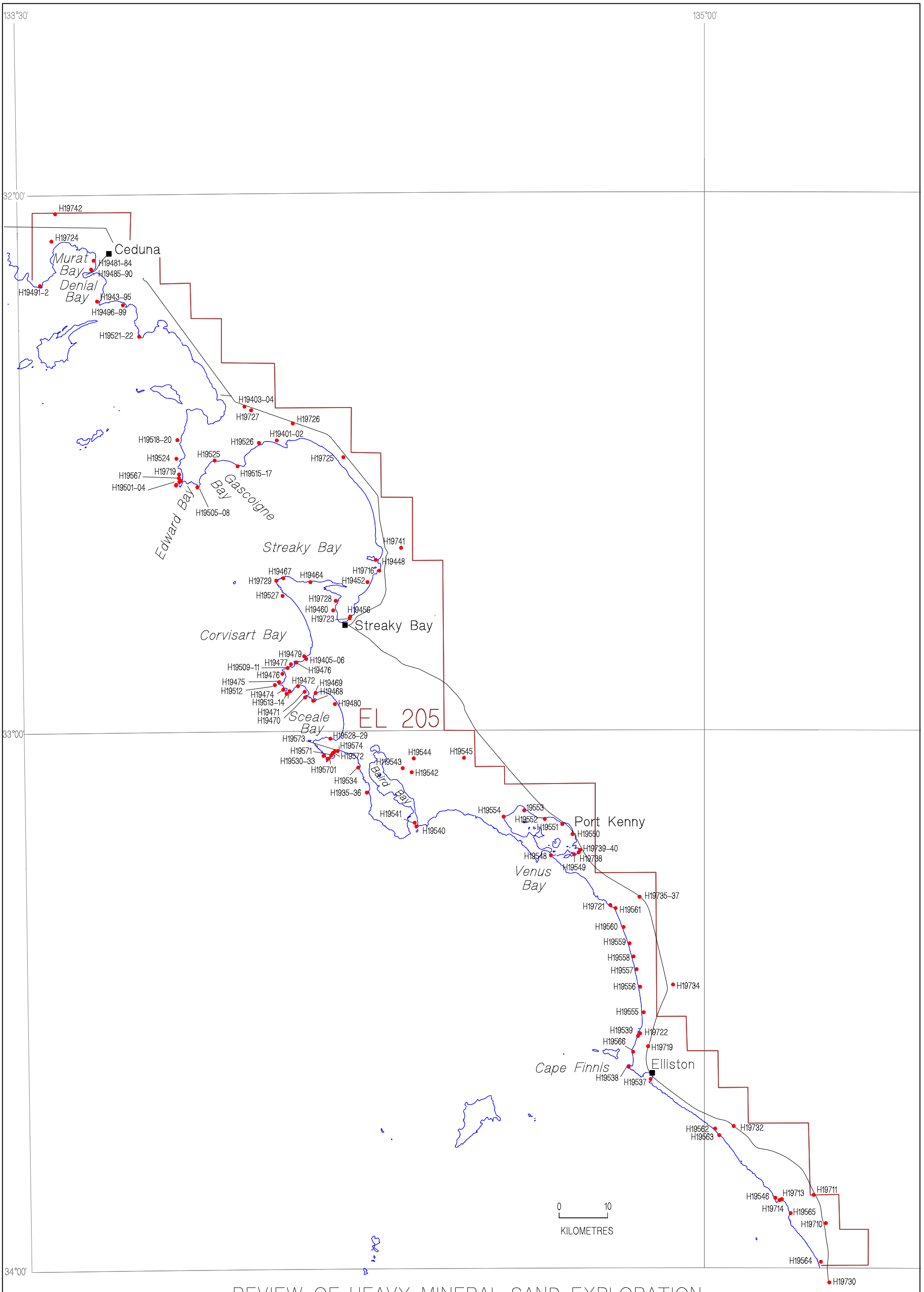
LOCATION OF PREVIOUS AND CURRENT EXPLORATION LICENCES

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 5

MESA 1996-0774

100336GF.DTA



REVIEW OF HEAVY MINERAL SAND EXPLORATION

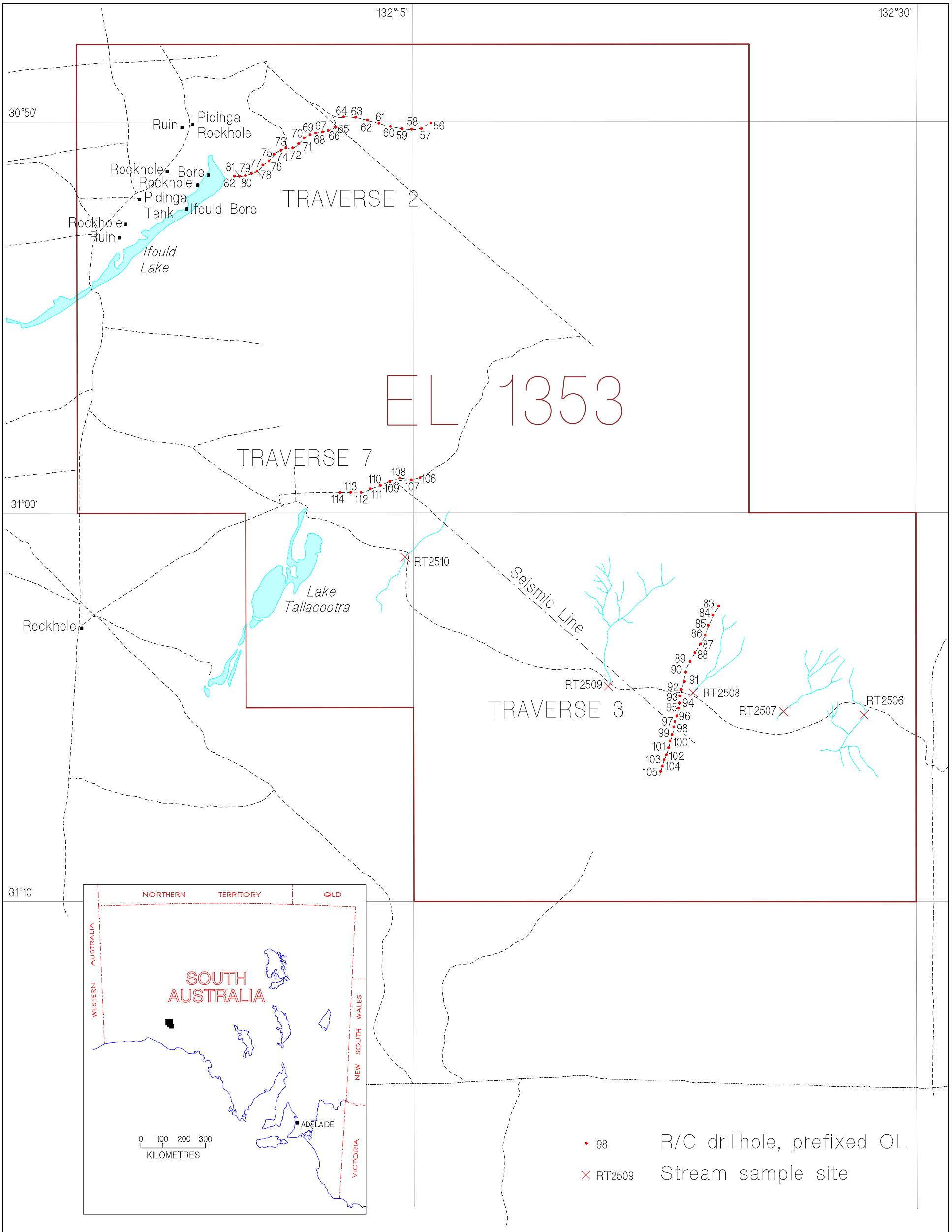
THE EUCLA BASIN

AUSTRALIAN ANGLO AMERICAN LTD. DRILLHOLE LOCATIONS
EL 205

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 6
MESA 1996–0775

100336GF.DTA



REVIEW OF HEAVY MINERAL SAND EXPLORATION

THE EUCLA BASIN

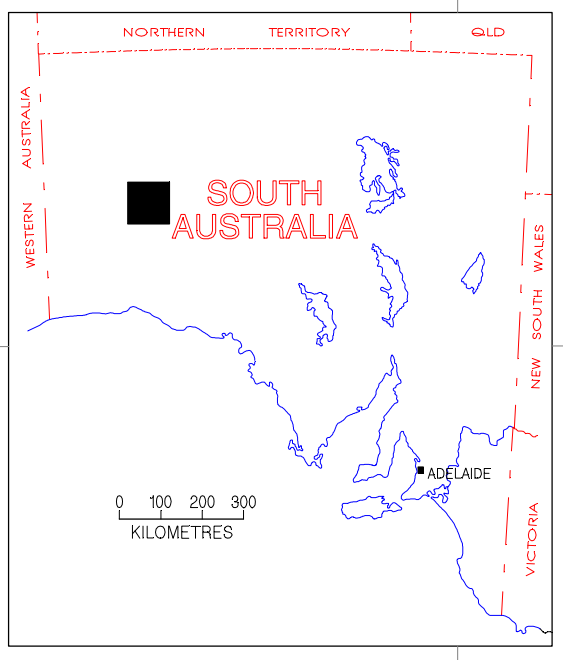
BHP MINERALS LTD DRILLHOLE LOCATIONS EL1353

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 7
MESA 1996-0776

100336GF.DTA

132°45'
133°00'
133°15'
133°30'
31°15'
31°30'



TRAVERSE 4
113
115
120
125
130
132

MYLTABIE PLAIN

TRAVERSE 5
133
135
140
145
147
150
155

Chundaria Lake

Midgerie Rockhole

Palpilba Rockhole

EL 1354

MYNG PLAIN

Euria Rockhole

Euria Well

Yangoona Rockhole

Fig Tree Corner

0 10
KILOMETRES

• 155 R/C drill hole, prefixed OL

REVIEW OF HEAVY MINERAL SAND EXPLORATION

THE EUCLA BASIN

BHP MINERALS LTD DRILLHOLE LOCATIONS
EL1354

100336GF.DTA

Figure 8
MESA 1996–0777

131°45'

132°00'

30°30'

Maralinga

Choolalie Lake

M15
M17
M16
M18
M19
M20

EL 1355

22
25
21
15
5
1
4
28
34
10
33
29
32
30
31

TRAVERSE 1

BHP
EL216–1

BHP
EL216–2

BHP
EL216–3

Ooldea Bore

Watson

Ooldea

SEE INSET

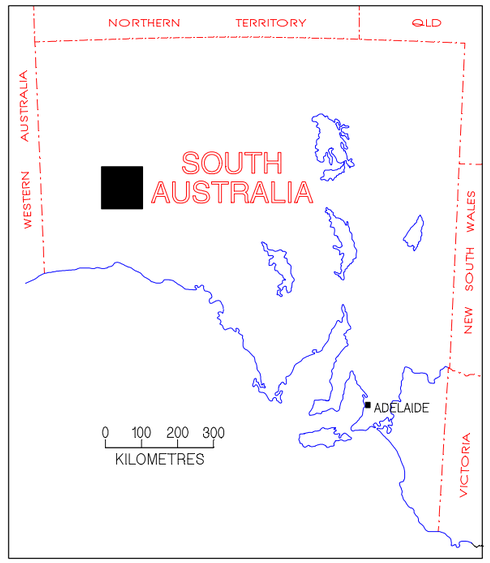
OR4
OR9
OR2
OR3
OR1

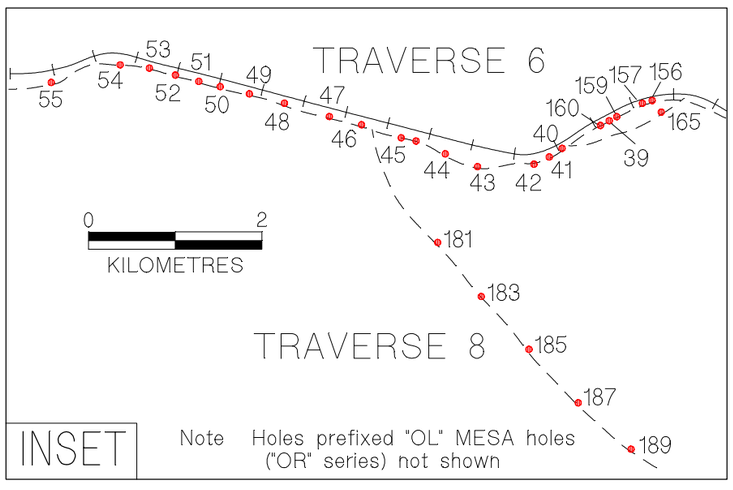
Immarna

CHEVRON PD2

CHEVRON PD1

0 5 10 15
KILOMETRES





DRILLING DETAILS

OL1–34 OL39–55 OL156–189	1986/87 Drilling
M15–20	1990 Drilling
EL216 1–3 PD1–2	Other drilling
OR1–9	MESA drilling
• 55	RC drillhole, prefixed OL

REVIEW OF HEAVY MINERAL SAND EXPLORATION

THE EUCLA BASIN

BHP MINERALS LTD DRILLHOLE LOCATIONS EL1355

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 9
MESA 1996–0778

100336GF.DTA

130°45'

131°00'

131°15'

30°00'

ANOMALY 2

905
906
907
908
68
70
75
80
81

Approximate position of edge of sand dune.

TRAVERSE 5

904
903
CAMP

67
65
60
55
52

EL 1653

TRAVERSE 4

Lake Dey-Dey Road

901
902

ANOMALY 1

51
50
45
40
39
38
35

TRAVERSE 3

30
25
21

TRAVERSE 2

14
10
5
1

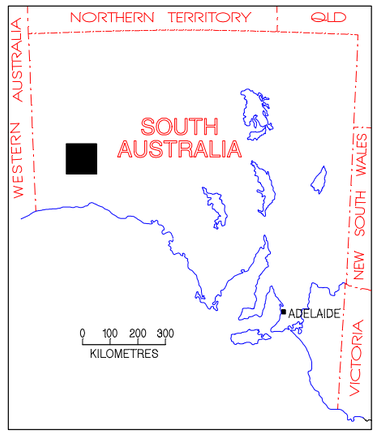
TRAVERSE 1

Boundary of Maralinga Prohibited Area

0 5 10 15
KILOMETRES

52• Drillhole location
(all hole numbers prefixed by 'M')

Maralinga



REVIEW OF HEAVY MINERAL SAND EXPLORATION

THE EUCLA BASIN

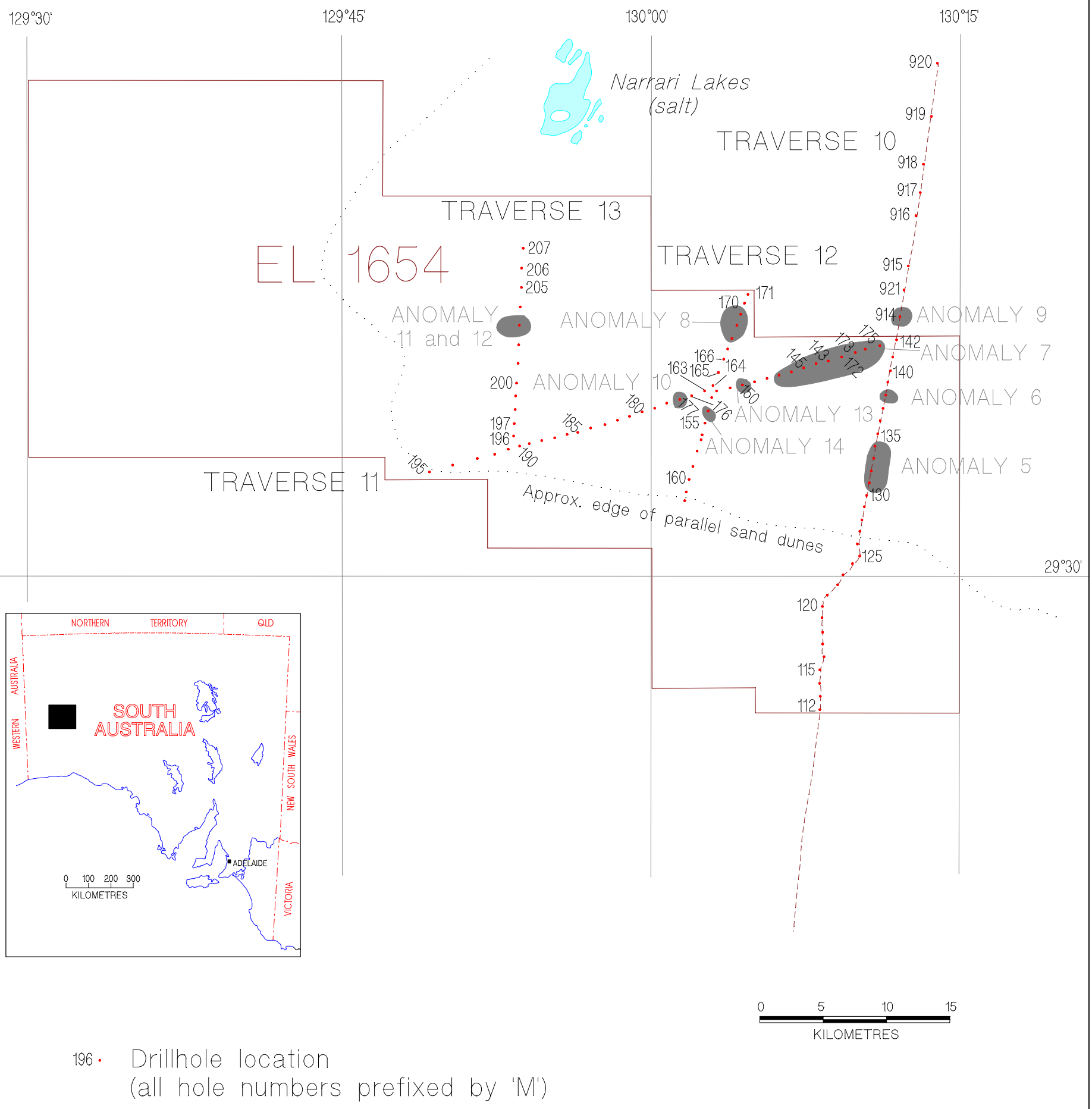
BHP MINERALS LTD DRILLHOLE LOCATIONS

EL1653

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 10
MESA 1996-0779

100336GF.DTA



196 · Drillhole location
(all hole numbers prefixed by 'M')

REVIEW OF HEAVY MINERAL SAND EXPLORATION

THE EUCLA BASIN

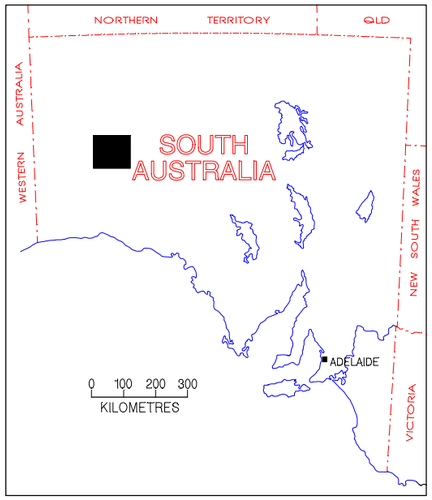
BHP MINERALS LTD DRILLHOLE LOCATIONS

EL1654

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 11
MESA 1996–0780

100336GF.DTA



130°15'
130°30'
130°45'
129°30'
Lake Dey-Dey Road
Oak Valley
Lake Maurice
ANOMALY 3
ANOMALY 4
912
913
909
910
98
100
111
110
911
82
85
105
90
101
95
97
TRAVERSE 9
TRAVERSE 8
EL 1655
Chilbinga Native Dam
Approximate edge of parallel sand dunes
101 Drillhole location
(all holes prefixed by 'M')
0 5 10 15
KILOMETRES

REVIEW OF HEAVY MINERAL SAND EXPLORATION
THE EUCLA BASIN
BHP MINERALS LTD DRILLHOLE LOCATIONS
EL1655

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 12
MESA 1996–0781

100336GF.DTA

134°15'
134°45'
32°20'
32°40'
EYRE
HIGHWAY
FLINDERS HIGHWAY
Haslam
Wirrulla
Cungena
Poochera
Streaky Bay
EL 1605
EL 1647
TRAVERSE 1
TRAVERSE 2
TRAVERSE 4
TRAVERSE 5
TRAVERSE 6
TRAVERSE 8
TRAVERSE 9
TRAVERSE 10
TRAVERSE 11
TRAVERSE 12
TRAVERSE 13
TRAVERSE 14
Zone I
Zone II
Zone III (high grade)
Zone III (low grade)
Zone IV
20 Holes
188 • Drillhole number
Zone of significant Heavy Minerals
0 5 10 15
KILOMETRES
100336GF.DTA

REVIEW OF HEAVY MINERAL SAND EXPLORATION
THE EUCLA BASIN
BHP MINERALS LTD DRILLHOLE LOCATIONS EL1605 AND EL1647

Figure 13a
MESA 1996-0782

135°00'

33°00'

Pygery

Mount Damper

Kyancutta

Kolballa Hill

"Kolballa"

"Courtabie"

Ucontitchie Hill

TA4 TA3

"Pundamulla"

TA6 TA5

Venus Bay

Pinthaput Hill

TA8 TA7

Mount Camel

TA9

TA10

TA12 TA11

TA1 TA14 TA13

Heavy mineral assemblage(%)
Ilm 31 Zir 25
Leu 17 Trash 22
Rut 5

TA2

Talia Hill

Lake Newland

"Weepra Park"

EL1672

Mount Wedge

Colton

Wedge Hill

33°30'

Polda

"Remo"

Bramfield

Elliston

"Kappawanta"

Sheringa

TA2 Drill hole and number

0 10 20 30

KILOMETRES

REVIEW OF HEAVY MINERAL SAND EXPLORATION

THE EUCLA BASIN

BHP MINERALS LTD DRILLHOLE LOCATIONS
EL1672

100336GF.DTA

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 13b
MESA 1996–0783

133°40'

134°00'

31°30'

31°45'

PL06–010
PL06–019
RPN2
PL06–028
PL06–40
PL06–057
RPN1
PL07–010
PL06–61
PL07–018
PL08–010
PL07–025
PL07–028
PL07–031
PL07–034
PL07–044
PL07–052
PL07–058
PL07–060
PL07–063
PL07–071
PL07–081
RPN11
PL07–090
PL07–098
PL07–103
PL07–108
PL07–120
PL07–116
PL07–123
PL07–128
PL07–141
PL07–145
PL07–158
PL07–148
RPN12
PL07–168

PL09–010
PL010–010
PL011–010
PL05–235
PL05–220
PL05–200
PL05–180
PL05–142
PL05–102
PL05–82
PL05–71
PL05–061
PL05–051
PL05–041
PL05–031
PL05–21
PL04–070
PL04–010
PL04–30
PL04–40
PL04–50
PL05–010
PL03–140
PL03–122
PL03–101
PL03–83
PL03–61
PL03–50
PL03–39
PL03–029
PL03–020
PL02–120
PL02–110
PL03–010
PL014–010
PL02–088
PL02–079
PL02–070
PL02–060
PL02–050
PL02–040
PL02–030
PL02–020
PL02–010
PL013–010
PL012–010
PL01–078
PL01–068
PL01–059
PL01–049
PL01–040
PL01–030
PL01–020
PL01–010

NL10–010
NL09–010
NL08–010
NL07–010
NL06–010
NL05–010
NL04–010
NL03–010
NL02–010

EL 1521

EL 1520

0 10 20 30
KILOMETRES

NORTHERN TERRITORY
QLD
WESTERN AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
ADELAIDE
0 100 200 300
KILOMETRES

PL01–040 • Aberfoyle Resources Ltd Drillhole

RPN12 ♦ Drillhole by other company

REVIEW OF HEAVY MINERAL SAND EXPLORATION
THE EUCLA BASIN
ABERFOYLE RESOURCES LTD DRILLHOLE LOCATIONS
EL 1520 and EL 1521

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

Figure 14
MESA 1996–0784

100386GF.DTA

132°00'
133°30'
135°00'
30°00'
31°00'
32°00'
33°00'

BARTON
TARCOOLA
FOWLER
CHILDARA
EYRE
NUYTS
STREAKY BAY

"Mulgathing"
"Carnes"
"Mentor"
Bates
Barton
Mungala
Mount Christie
Wynbring
Lyons
Malbooma
Tarcoola
"Wilgena"
Ferguson
Ifould Lake
Lake Tallacootra
"Colona"
Nundroo
Coorabie
"Glen Boree"
Bookabie
Penong
Fowlers Bay
Kevin
Ceduna
Merghiny
Mudamuckla
Nunjikompita
Wirrulla
Cungena
Poochera
Karcultaby
Chandada
Streaky Bay
Yanerbie
Lake Everard
Lake MacDonnell
Murat Bay
Denial Bay
Tourville Bay
Gascoigne Bay
Edward Bay
Corvisart Bay
Sceale Bay
Locke Claypans

TRANS AUSTRALIA RAILWAY
HIGHWAY

Fowlers Bay
Scott Bay
Clare Bay

0 10 20 30 40 50
KILOMETRES

EUCLA BASIN MINERAL SANDS

DRILLING PROGRAM

EB0-110

August – September, 1989.

Figure 15a
MESA 1996-0785a

10039GF01A

132°00'
133°30'
135°00'
30°00'
31°00'
32°00'
33°00'

BARTON
TARCOOLA
FOWLER
CHILDARA
EYRE
NUYTS
STREAKY BAY

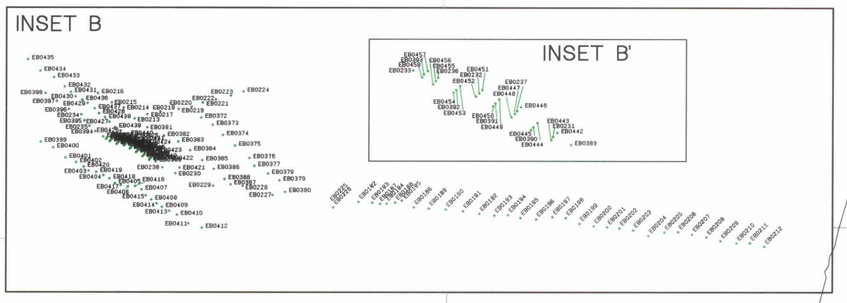
"Mulgathing"
"Carnes"
"Mentor"
Bates
Barton
Mungala
Mount Christie
Wynbring
Lyons
Malbooma
Tarcoola
"Wilgena"
Ferguson
"Colona"
Nundroo
Coorabie
"Glen Boree"
Bookabie
Penong
Fowlers Bay
Kevin
Ceduna
Merghiny
Mudamuckla
Nunjikompita
Wirrulla
Cungena
Poochera
Karcultaby
Chandada
Streaky Bay
Yanerbie

TRANS AUSTRALIA RAILWAY
EYRE HIGHWAY

See INSET B
See INSET A

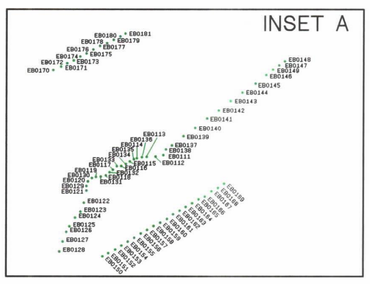
Ifould Lake
Lake Tallacootra
Lake MacDonnell
Lake Everard
Fowlers Bay
Scott Bay
Clare Bay
Murat Bay
Denial Bay
Tourville Bay
Edward Bay
Gascoigne Bay
Corvisart Bay
Sceale Bay
Locke Claypans

INSET B



INSET B'

INSET A



0 10 20 30 40 50
KILOMETRES

EUCLA BASIN MINERAL SANDS

DRILLING PROGRAM

EB111–458

5 July – 3 October, 1990.

Figure 15b
MESA 1996–0785b

100396gF.DTA

132°00'
133°30
135°00'
30°00'
31°00'
32°00'
33°00'

BARTON
TARCOOLA
FOWLER
CHILDARA
NUYTS
STREAKY BAY

"Mulgathing"
"Carnes"
"Mentor"
Bates
Barton
Mungala
Mount Christie
Wynbring
Lyons
Malbooma
Tarcoola
"Wilgena"
Ferguson
TRANS AUSTRALIA RAILWAY
Ifould Lake
Lake Tallacootra
Lake Everard
"Colona"
Nundroo
Coorabie
"Glen Boree"
Bookabie
EYRE
Penong
HIGHWAY
Fowlers Bay
Scott Bay
Clare Bay
Lake MacDonnell
Kevin
Murat Bay
Denial Bay
Tourville Bay
Ceduna
Merghiny
Mudamuckla
Nunjikompita
Wirrulla
Locke Claypans
Cungena
Edward Bay
Gascoigne Bay
Streaky Bay
Poochera
Chandada
Karcultaby
Corvisart Bay
Yanerbie
Sceale Bay

0 10 20 30 40 50
KILOMETRES

EUCLA BASIN MINERAL SANDS

DRILLING PROGRAM

EB459–549

October – November, 1990

Figure 15c
MESA 1996–0785c

10033GF.DTA

132°00'
133°30'
135°00'
30°00'
31°00'
32°00'
33°00'

BARTON

TARCOOLA

FOWLER

CHILDARA

EYRE

NUYTS

STREAKY BAY

"Mulgathing"

"Carnes"

"Mentor"

Bates

Barton

Mungala

Mount Christie

Wynbring

Lyons

Malbooma

Tarcoola

"Wilgena"

Ferguson

TRANS AUSTRALIA RAILWAY

EB0826

See INSET A

INSET A

Ilford Lake

Lake Tallacootra

Lake Everard

"Colona"

Nundroo

Coorabie

Glen Boree"

Bookabie

Penong

HIGHWAY

Fowlers Bay

Fowlers Bay

Scott Bay

Clare Bay

Lake MacDonnell

Kevin

Murat Bay

Denial Bay

Tourville Bay

Ceduna

Merghiny

Mudamuckla

Nunjikompita

Wirrulla

Locke Claypans

Gascoigne Bay

Edward Bay

Cungena

Streaky Bay

Poochera

Chandada

Karcultaby

Corvisart Bay

Streaky Bay

Yanerbie

Sceale Bay

0 10 20 30 40 50

KILOMETRES

EUCLA BASIN MINERAL SANDS

DRILLING PROGRAM

EB550–839

5 May – 13 June, 1991

Figure 15d

MESA 1996–0785d

K0339GF.DTA

132°00'
133°30'
135°00'
30°00'
31°00'
32°00'
33°00'

BARTON
TARCOOLA
FOWLER
CHILDARA
EYRE
NUYTS
STREAKY BAY

"Mulgathing"
"Carnes"
"Mentor"
Bates
Barton
Mungala
Mount Christie
Wynbring
Lyons
Malbooma
Tarcoola
"Wilgena"
Ferguson
TRANS AUSTRALIA RAILWAY

See INSET A

INSET A

Ifould Lake
Lake Tallacootra
Lake Everard

"Colona"
Nundroo
Coorabie
"Glen Boree"
Bookabie
Penong
HIGHWAY
Fowlers Bay
Fowlers Bay
Scott Bay
Clare Bay
Lake MacDonnell
Kevin
Murat Bay
Denial Bay
Tourville Bay
Ceduna
Merghiny
Mudamuckla
Nunjikompita
Wirrulla
Locke Claypans
Gascoigne Bay
Edward Bay
Cungena
Streaky Bay
Poochera
Chandada
Karcultaby
Corvisart Bay
Streaky Bay
Yanerbie
Sceale Bay

0 10 20 30 40 50
KILOMETRES

EUCLA BASIN MINERAL SANDS

DRILLING PROGRAM

EB840–962

November – December, 1991.

Figure 15e
MESA 1996–0785e

K0338A5P.DTA

132°00'
133°30'
135°00'
30°00'
31°00'
32°00'
33°00'

BARTON
TARCOOLA
FOWLER
CHILDARA
NUYTS
STREAKY BAY

Bates
Barton
Mungala
Mount Christie
Wynbring
Lyons
"Mulgathing"
"Carnes"
"Mentor"
Malbooma
Tarcoola
"Wilgena"
Ferguson

TRANS AUSTRALIA RAILWAY

Ifould Lake
Lake Tallacootra
Lake Everard

"Colona"
Nundroo
EYRE HIGHWAY
Coorabie
"Glen Boree"
Bookabie
Penong
Fowlers Bay
Fowlers Bay
Scott Bay
Clare Bay
Lake MacDonnell
Kevin
Murat Bay
Denial Bay
Tourville Bay
Ceduna
Merghiny
Mudamuckla
Nunjikompita
Wirrulla
Locke Claypans
Cungena
Poochera
Karcultaby
Chandada
Gascoigne Bay
Edward Bay
Streaky Bay
Streaky Bay
Corvisart Bay
Yanerbie
Sceale Bay

0 10 20 30 40 50
KILOMETRES

EUCLA BASIN MINERAL SANDS

DRILLING PROGRAM

EB963–1017

December, 1991.

Figure 15f

MESA 1996–0785f

K0036GF.DTA