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EL 1425

BORDERTOWN

PROGRESS AND FINAL REPORTS TO LICENCE EXPIRY/SURRENDER FOR THE PERIOD 21/8/1987 TO 20/2/1990

Submitted by
Burmine Ltd
1989

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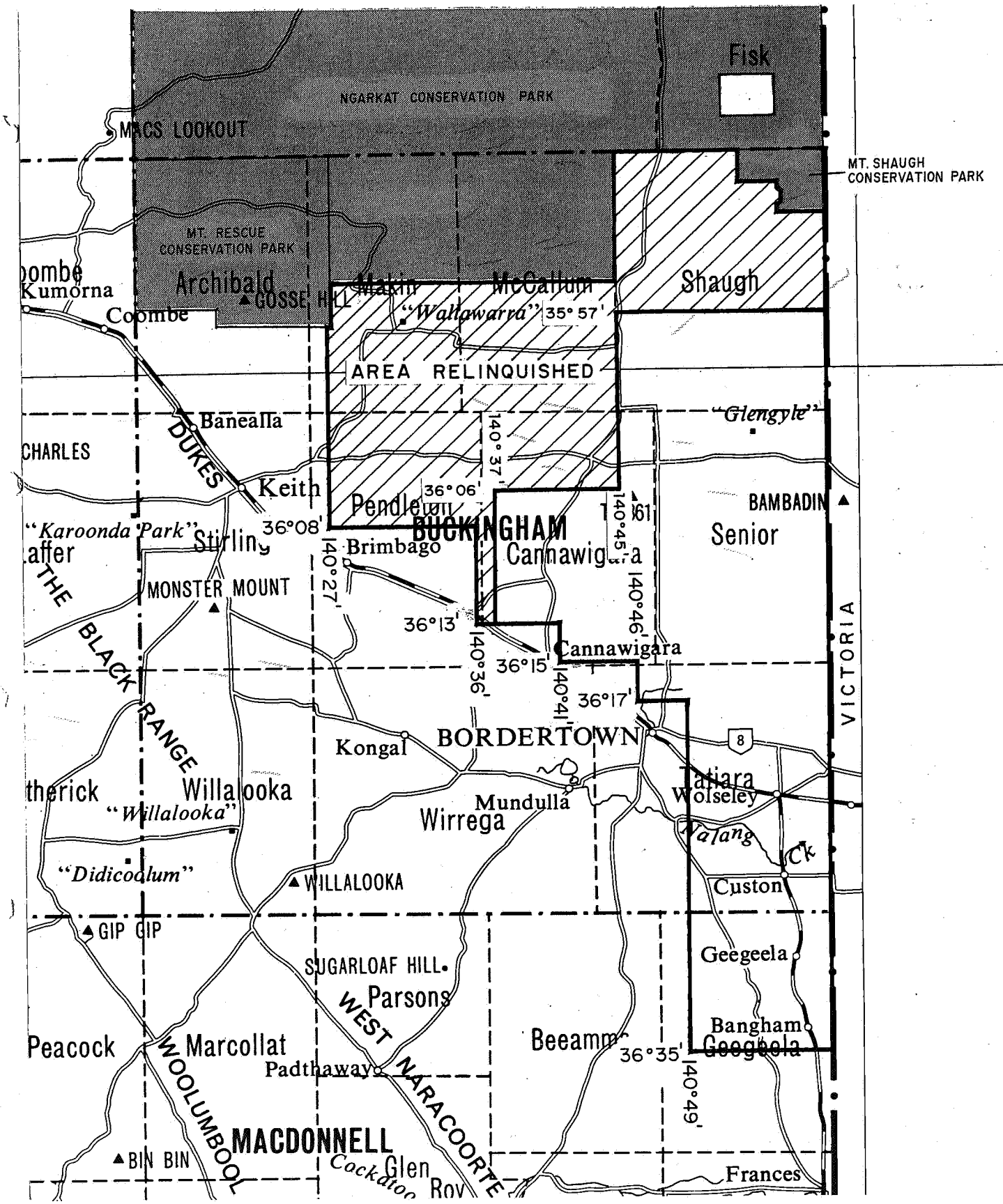
Government of South Australia
Primary Industries and Resources SA

SCHEDULE A



SCALE 1:500,000

KILOMETRES 10 0 10 20 30 40 50 KILOMETRES

EXPIRED

APPLICANT: BURMINE LIMITED & T.C. PACIFIC RESOURCES PTY. LTD.

DME 49/87

AREA: ~~2175~~ 1355 square kilometres (approx.)

1:250000 PLANS: PINNAROO NARACOORTE

LOCALITY: BORDERTOWN AREA

DATE GRANTED: 21-8-87

DATE EXPIRED: ~~20-8-88~~ ~~20-8-89~~ 20.2.90 ~~20-2-89~~ 20.2.89

EL No: 1425

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TENEMENT HOLDER: Burmine Limited and T.C. Pacific Resources Pty Ltd.

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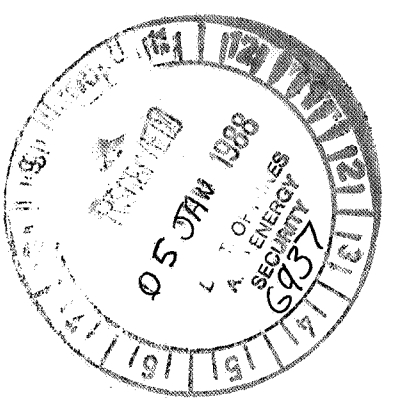
EXPLORATION LICENCE 1425.

FIRST QUARTERLY REPORT.
21 August to 21 November, 1987.

BURMINE LIMITED.
TC PACIFIC RESOURCES LIMITED.



December, 1987.

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4. Expenditure.

FIGURES.

Geography of EL 1425.

Tenure and Geology.

Total magnetic intensity contours.

1 LOCATION AND TENURE.

Exploration Licence 1425 was granted to Burmine Limited and TC Pacific Resources Limited on 2 October, 1987, with an effective term date of 21 August, 1987. The title covers an area of 2,175 square kilometres and lies on part of the Pinnaroo and Naracoorte 1:250,000 map sheet areas.

Exploration Licence 1425 is located along the South Australian - Victorian border immediately northeast of Bordertown and south of the Ngarkat Conservation Park. The area is well settled with extensive areas of dryland cropping and improved pastures.

No searches to determine the underlying title to any specific areas have been carried out.

2 EXPLORATION MODELS.

The Exploration Licence is one of five applied for along the southeastern margin of the Murray Basin in both South Australia and Victoria. The intention is to assess the area as a whole and the exploration programmes are, as far as possible, to be carried out across the whole environment until specific targets have been identified.

The analysis of the available data carried out during the area selection phase is presented on the attached summary maps. In brief, during Pliocene times the Murray Basin was closed off to the southeast of Horsham by a basement complex consisting of sediments and granites of the Lachlan Geosyncline, to the west by the Adelaide Geosyncline, and appears to have been separated from the present coastline to the southwest by a composite basement high of granitic and volcanic rocks.

The area applied for in South Australia by the Joint Venture is to be explored for postulated Parilla strandlines paralleling the southwestern basement high, and for possible back-dune environments between strandlines and basement highs. Additional targets may be located about "offshore" basement highs if there was a component of longshore drift during Parilla sedimentation.

Assuming that the major portion of the heavy mineral content is derived from local basement as indicated by previous work carried out by the BMR, then targets within the title area can be expected to contain a similar assemblage to that found along the coastal fall of the southwestern basement high. From the limited data available the heavy mineral fraction in the area could comprise approximately 8% rutile, 15% zircon and 38% ilmenite/leucoxene.

3 WORK COMPLETED AND PROPOSED PROGRAMME.

An assessment of the southeastern margin of the Murray Basin was carried out and exploration title obtained over contiguous prospective areas in South Australia and Victoria. The initial data analysis is summarised in the attached maps. A road based reconnaissance of the region was carried out to confirm the

prospectivity of the area and located heavy mineral sands in Victoria associated with strand lines which are mapped as extending into South Australia.

Bryce Russell and Associates have been retained to design, cost and conduct an evaluation of the areas with the objective of defining targets for systematic drill testing. The programme proposed will consist of;

1. Literature survey.
2. Examination of water bore logs.
3. Topographic and geological map interpretation.
4. Satellite image interpretation.
5. Air-photo interpretation.

A preliminary examination of the available satellite imagry has been carried out and a decision made to move to a more sophisticated analysis.

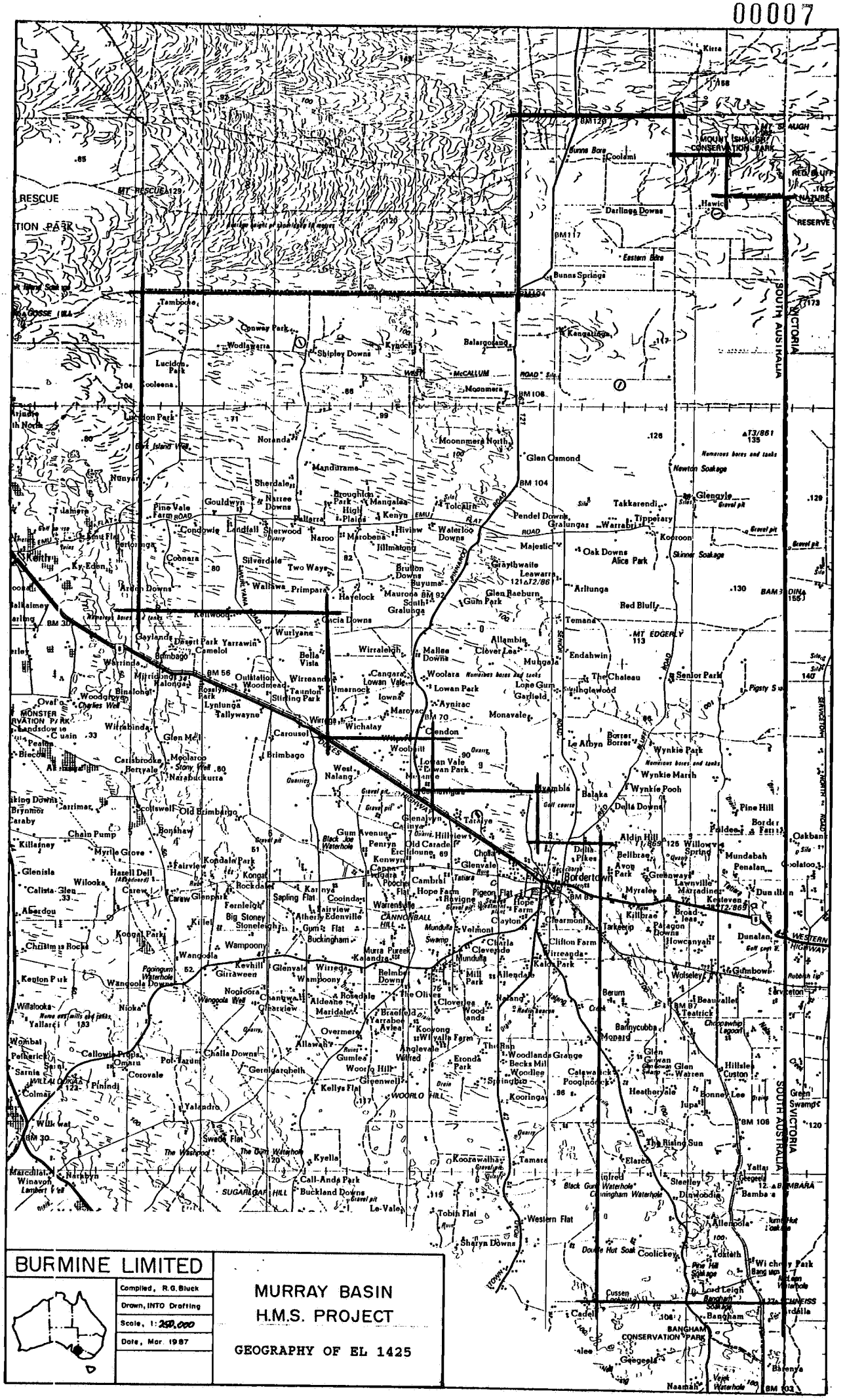
The expenditure estimates for the next quarter are;

Literature survey and examination of water bore logs	$ 2,333
Acquisition of geological and topographic maps, satellite image scenes and associated interpretation	$10,000
Titles consultants, land searches, compensation agreements	$ 6,666
	$19,000

4 EXPENDITURE.

The following schedule of expenditure does not fully account for the costs associated with the project generation, and does not include tenure costs.

Geology		$ 1,200
Ancillary technical		$ 210
Salaries and wages		$ 300
Exploration operations		$ 211
Overheads		$ 384
	Total	$ 2,305



BURMINE LIMITED	
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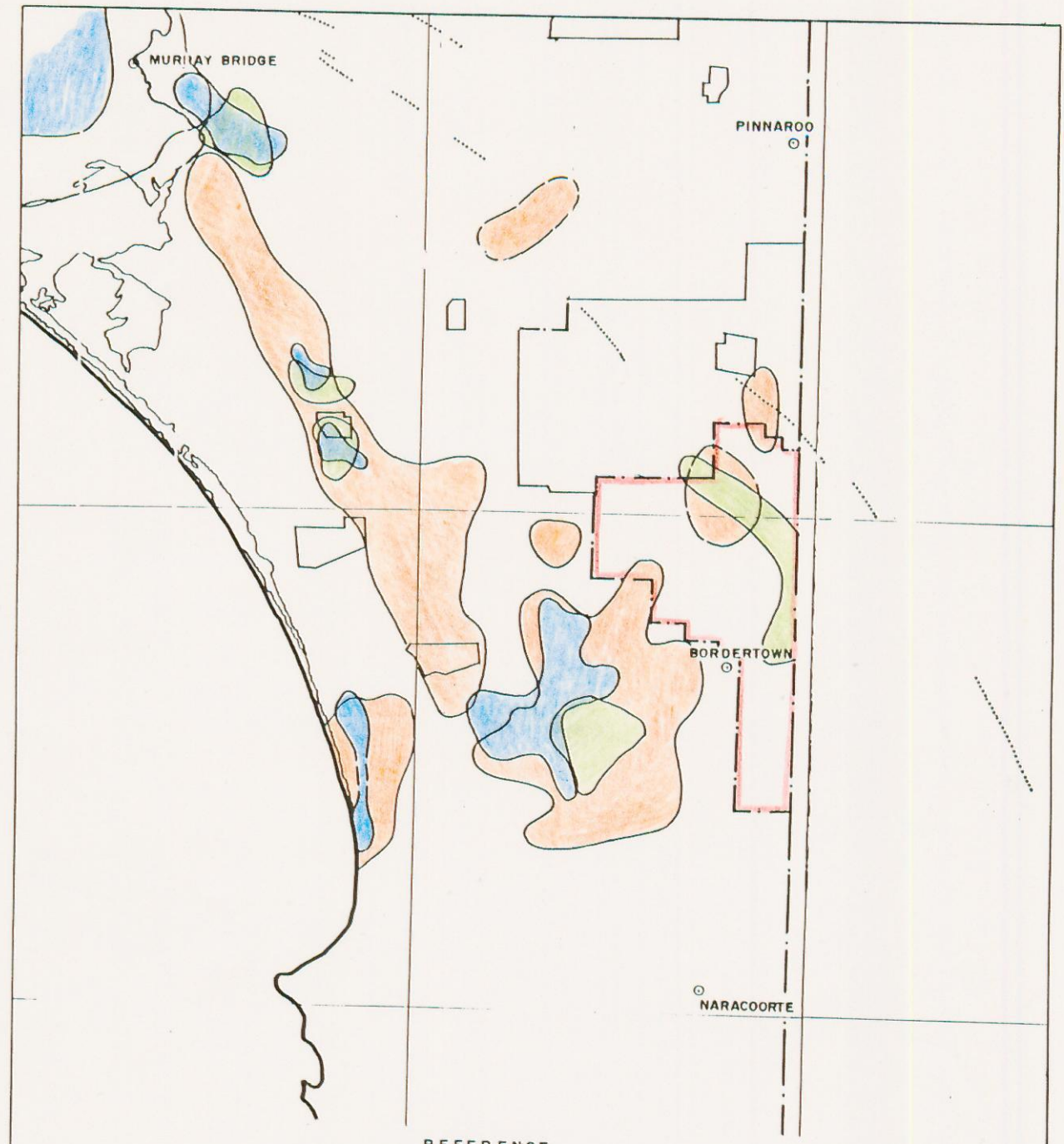
MURRAY BASIN
H.M.S. PROJECT

GEOGRAPHY OF EL 1425



REFERENCE

GEOLOGY

- Outcrop limits of Pre-Tertiary sequences.
- Magnetic Basement: interpreted area above sea level
- Basement highs: from Tectonic Map of South Australia
- Mapped and inferred Cainozoic strand lines.

TENURE

- Conservation Parks etc
- Burmine — T.C. Pacific Resources

BURMINE LIMITED

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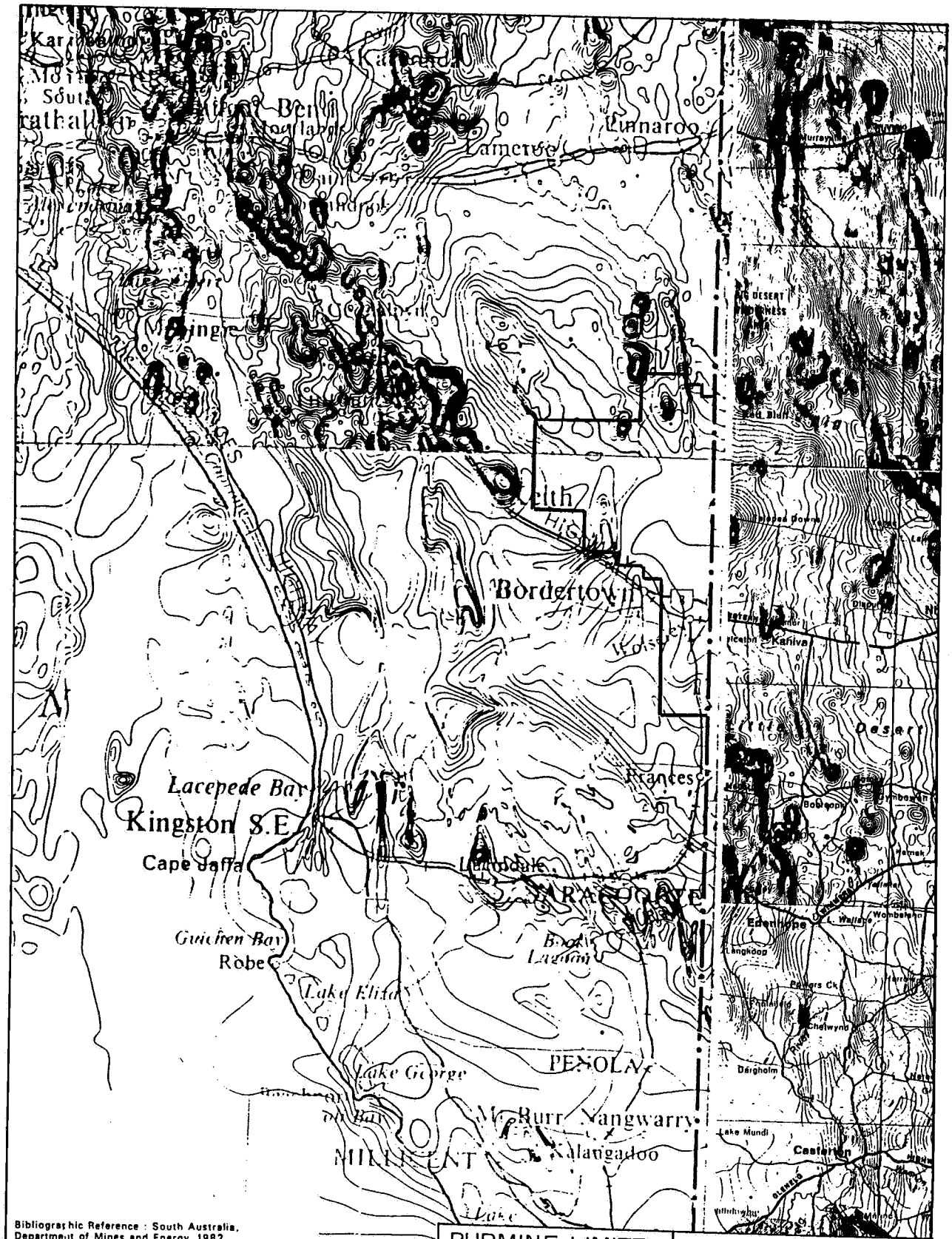
MURRAY BASIN
H.M.S. PROJECT

TENURE & GEOLOGY



Bibliographic Reference : South Australia, Department of Mines and Energy. 1982. Total Magnetic Intensity Map South Australia. 1:2 000 000 scale. S. Aust. Dept. Mines and Energy.

BURMINE LIMITED

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Date, May 1987	

MURRAY BASIN
H.M.S. PROJECT
TOTAL MAGNETIC
INTENSITY CONTOURS

BURMINE LTD
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EXPLORATION LICENCE 1425

SECOND QUARTERLY REPORT.

21 NOVEMBER 1987 TO 21 FEBRUARY 1988

BURMINE LIMITED
&
T.C. PACIFIC RESOURCES PTY. LTD.

MARCH 1988

PETER H. STITT & ASSOCIATES PTY. LTD.
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TECHNICAL NOTE NO. 2/88

Second Quarterly Report - EL 1425
21 November, 1987 to 21 February, 1988

Prepared for:

Burmine Limited
T.C. Pacific Resources Limited

C. Charlesworth
February, 1988

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Figure 3	Distribution of the Loxton Sand and Parilla Sands

1. INTRODUCTION

The exploration licence was granted to Burmine Limited and T.C. Pacific Resources Limited on 2nd October, 1987, effective from 21st August, 1987.

The Joint Venture has formed an operating committee to manage the project.

2. LOCATION

Exploration Licence 1425 is located along the South Australian-Victorian border, immediately northeast of Bordertown and south of the Ngarkat Conservation Park (Figure 1). The title covers an area of 2, 175 square kilometres and lies on part of the Pinnaroo and Naracoorte 1:250 000 map sheet areas.

The area is well settled with extensive areas of dryland cropping and improved pastures.

3. STRATIGRAPHY AND REGIONAL GEOLOGY

The area of exploration covers a small region of the Murray Basin, which occupies parts of N.S.W., Victoria and South Australia (Fig. 2).

Buried beneath the Tertiary strata are metamorphics of probable Cambrian age. Rock types include shale, slate, phyllite and sericite schist. Intruding these metasediments are granite bodies and quartz veins. Sediments of Lower Permian and Cretaceous age have also been penetrated in drilling.

Tertiary sediments are present from Paleocene/Eocene through to Pliocene ages and they include clay, silt, sand, gravel, calcareous

clay (marl), limestone, lignite and glauconitic sediments. Generally, the beds dip very gently and thicken towards the northwestern corner of Victoria.

Tertiary strata outcrop poorly due to a thin cover of Quaternary sediments, and are known largely from subsurface information.

At the base of the Tertiary succession lies the medium to coarse grained quartz sand of the Lower Renmark Beds (Knight Group of Ludbrook, 1961). Available evidence suggests the age of this unit is Paleocene to Eocene. It is in turn overlain by a much more widely distributed blanket of unconsolidated, thinly bedded carbonaceous sand, silt, clay and peaty coal; the Upper Renmark Beds. This unit thins out over the Padthaway Ridge, where the highly carbonaceous beds of the Moorlands Lignite Member are developed in areas of bedrock highs.

In the Upper Eocene, marine conditions existed over a limited area in the northwest of the Murray Basin. The Buccleuch Beds (Ludbrook 1957) consisting of limestones and sands interbedded with carbonaceous clays were laid down in this shallow marine environment.

A major change in the sedimentation pattern of the western Murray Basin, accompanied a relative rise in sea level in the Oligocene This change in sea level can be correlated with the deposition of formations within the Murray Group - Ettrick Formation, Gambier Limestone, Mannum Formation, Duddo Limestone, Morgan Limestone, Geera Clay, Pata Limestone and the Winnambool Formation.

Reconstructions suggest that a shallow-marine platform in the southwest was flanked to the east and north by a narrow zone of

restricted marine and lagoonal environments. These were in turn bordered by a marginal marine zone - further giving way to peat forming swamps, deltas and fluvial environments.

Deposition of the Murray Group sequence was terminated by a period of non-deposition caused by a regression of the Tertiary sea.

The final depositional sequence in the Tertiary commenced in the Late Miocene. Current information suggests that a fluvial flood plain in the east and north was flanked to the south and west by an extensive strand-plain of beach ridges. In the west, the flood plain was connected to the southern ocean by a river and estuary system that roughly coincided with the present day course of the River Murray.

The initial result of the marine transgression was the deposition of the Loxton Sands, Bookpurnong Beds and Parilla Sand. The Loxton Sands of South Australia includes the Parilla Sand of Victoria.

As the sea retreated from the basin a series of sub-parallel stranded beach ridges were formed on the surface of the Parilla Sand. The medium to high energy environment provided by fair weather and storm waves may have acted as a concentrating mechanism for stable minerals of relatively high specific gravity. If this were the case, the stranded ridges represent current exploration targets for accumulations of heavy mineral sands.

4. THE PARILLA SAND

The Parilla Sand was first named by Firman (1965) after he identified it in a bore near Parilla, South Australia. The Upper Loxton sands of S.A. and Parilla Sand of Victoria are considered to be equivalent by most writers.

The Parilla Sand occurs as an extensive and continuous unit over the western part of the basin in S.A., N.S.W. and Victoria (Figure 3). It outcrops only rarely, due to a thin covering of Quaternary sediments, but its alternating ridge-valley morphology is a prominent feature of the landscape. The sand is a well sorted quartzose sand in general. It may be either a silt or a sand, mostly fine to coarse grained, or, where cemented, a siltstone or sandstone. The quartz grains are usually of equal size and are rounded to sub-rounded. The rest of the sand and silt-sized grains are made up of the stable minerals zircon, tourmaline, ilmenite and rutile. It is these minerals, especially the rutile and zircon, which are of economic interest.

Drilling has shown the weathered zone (or pedoderm) of the Parilla Sand to persist to a depth of 17m., irrespective of the landscape or the thickness of the overlying deposits. Sections of the cemented zone are exposed in quarries near the southern part of the Murray Basin, in river sections, especially along the Murray, and in exposures along the southern or western side of lakes e.g. Lake Tyrell.

The soil developed on the Parilla Sand has been described as lateritic, and is often used to map the occurrence of the sand. Its distinctive red colouring, along with information from water bores and evidence of topographic high spots or ridges, has been utilised by geologists to locate and map the unit. Often the Parilla Sand is covered by a calcareous earth of aeolian origin which has been given the name "parna" (Butler 1956). This unit is an earthy, homogenous calcareous substance, without stratification and occurs as an extensive, nearly uniform sheet. It can contain up to 70% clay and is usually between 1 and 2 metres thick.

The cemented zone of the Parilla Sand is characterised by jointing. This is regarded to be the result of stress, not tectonics, due to the relatively thin layer of sandstone being underlain by loose and unconsolidated sediments. Primary structures are often obscured within the cemented zone, but there are exceptions. In a quarry section west of Kerang, Macumber (1969) described fossiliferous silts and sandstone displaying cross bedding which he interpreted to include offshore and possibly beach deposition. In river bank sections on the northern side of the Murray River east of Mildura, silts belonging to the Parilla Sand have a laminated bedding, disrupted by numerous worm burrows which are taken to be indicative of shallow marine conditions (Lawrence, 1975).

Beneath the cemented zone there is little kaolinite or limonite to bond the quartz grains together and the formation is generally represnted by loose silt or sand. In the centre of the basin, there is a general decrease of grain size with depth, with an

accompanying increase in clay content. Towards the outer boundary of the Parilla Sand, this trend is reversed and the boundary with the underlying Bookpurnong Beds is sharp and often disconformable. Where this coarse grained unit is well developed it is distinguished as Calivil Sand.

The Parilla Sand is a continuous unit for the western part of the basin and is often topographically expressed as alternating ridges and valleys. These ridges were first mapped by Hills in 1939, but have since been mapped in greater detail by a number of authors. They may be up to 50m. high and several kilometres across. Generally, the structure contours of the base do not reflect the upper surface and the base of the Parilla Sand is relatively planar.

Several theories have been put forward to explain the occurrence of these parallel ridges. Blackburn (1962) proposed the stranded coastal dune hypothesis, in which he suggested that the ridges represent former coastlines of the Murravian Gulf. Lawrence (1966) supported this hypothesis, pointing out the association of the Parilla Sand with the underlying Tertiary marine sediments. Subsequent authors (Macumber 1969) consider that the fossils, bedding and texture of the Parilla Sand exhibited on the Gredgwin Ridge, Victoria, are indicative of littoral and near shore conditions. The present day opinion probably coincides with that of Brown (1985), who regards the ridges as prograding beach ridges, formed as the result of a marine regression in the Late Tertiary.

5. EXPLORATION ACTIVITIES

Exploration currently being undertaken is aimed primarily at becoming familiar with the area covered by the EL and understanding how it fits into the theories on heavy minerals in the Murray Basin. To this end, the following have been completed.

- Purchase of relevant topographic and geological map coverage.
- Purchase of satellite imagery.
- Purchase of available publications.
- Visit to EL region, including overflying the EL and a brief, road based reconnaissance.
- Purchase of a literature survey from Technical and Field Surveys on Heavy Mineral Sand exploration in the Murray Basin.

Work currently under way includes:

- Detailed study of all available information including maps, imagery and publications. This exercise is designed to formulate ideas on the deposition of heavy minerals within the Murray Basin, and to delineate regions of most promise within EL 1425. This study is largely complete, with only a detailed inspection of the satellite imagery outstanding.

Exploration planned for the future involves another visit to EL 1425, to carry out a more extensive road based traverse. It is expected that this inspection coupled with the results from the present study will be used to determine drilling targets.

EXPENDITURE EL 1425

	$
Consultants' fees	1,926.00
Travel & Accommodation	68.00
Motor Vehicle	101.00
Geologist	351.00
Maps etc.	307.00
Administration	78.00
	2,831.00

6. REFERENCES

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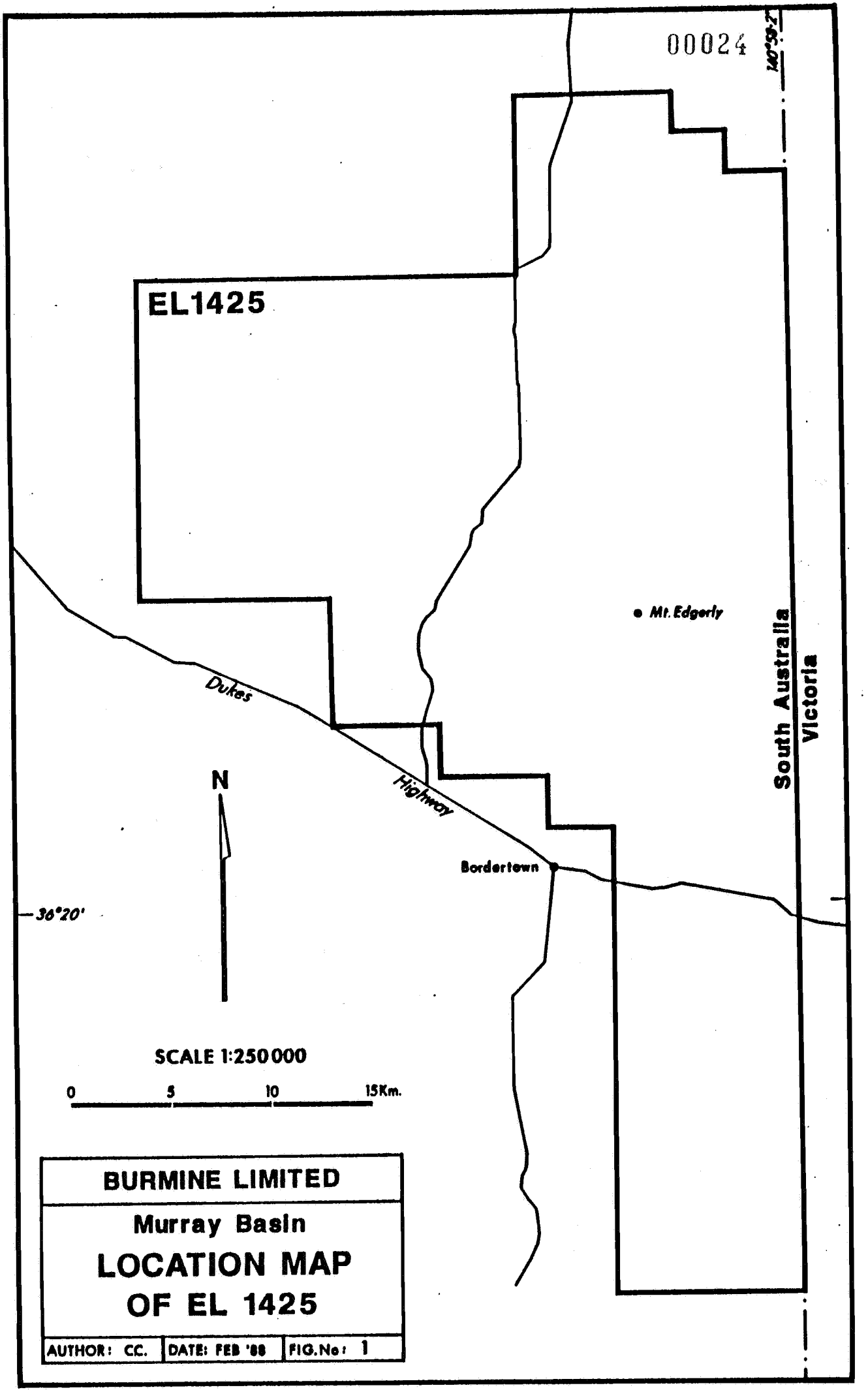

BURMINE LIMITED

Murray Basin

LOCATION MAP OF EL 1425

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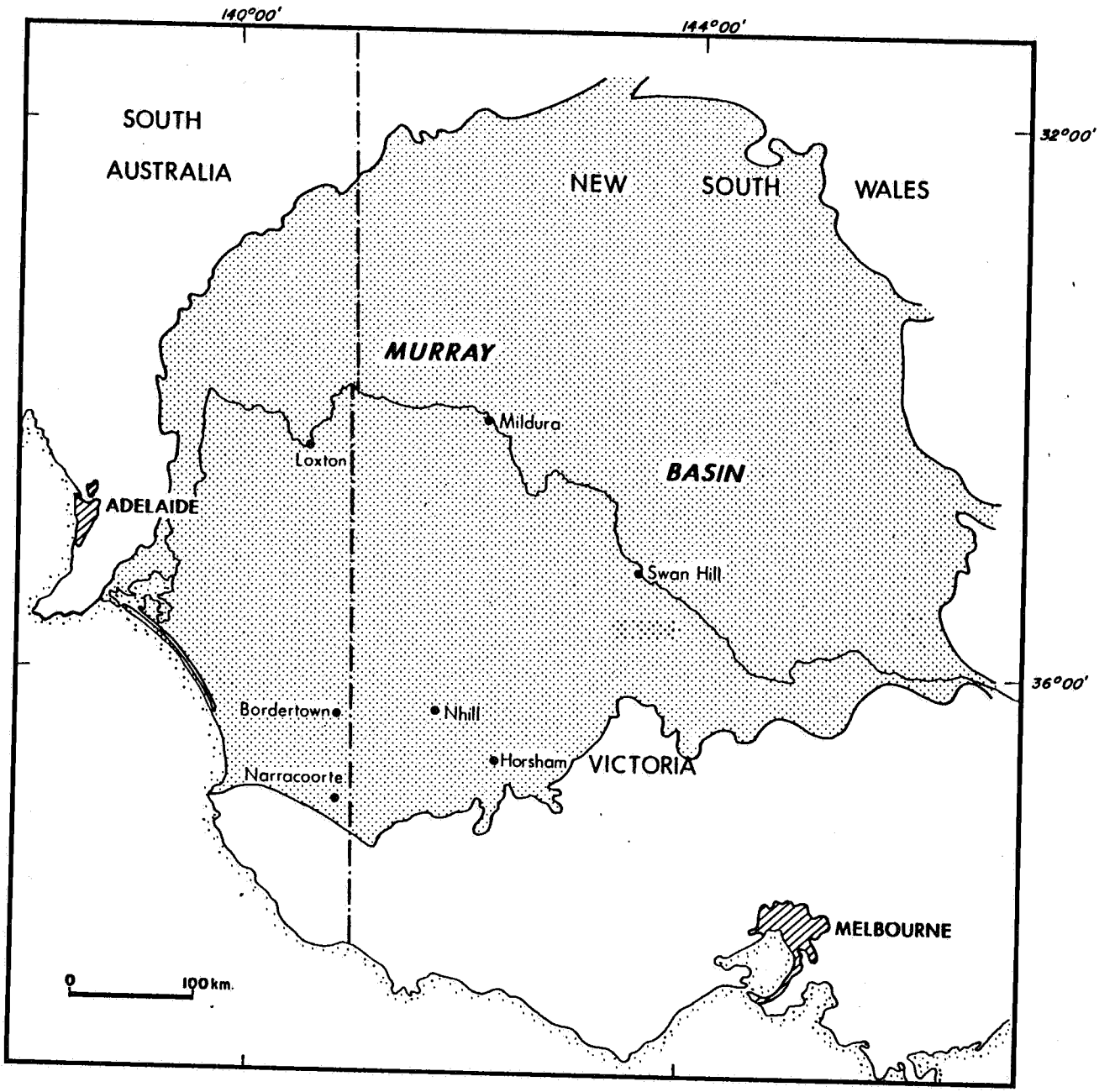
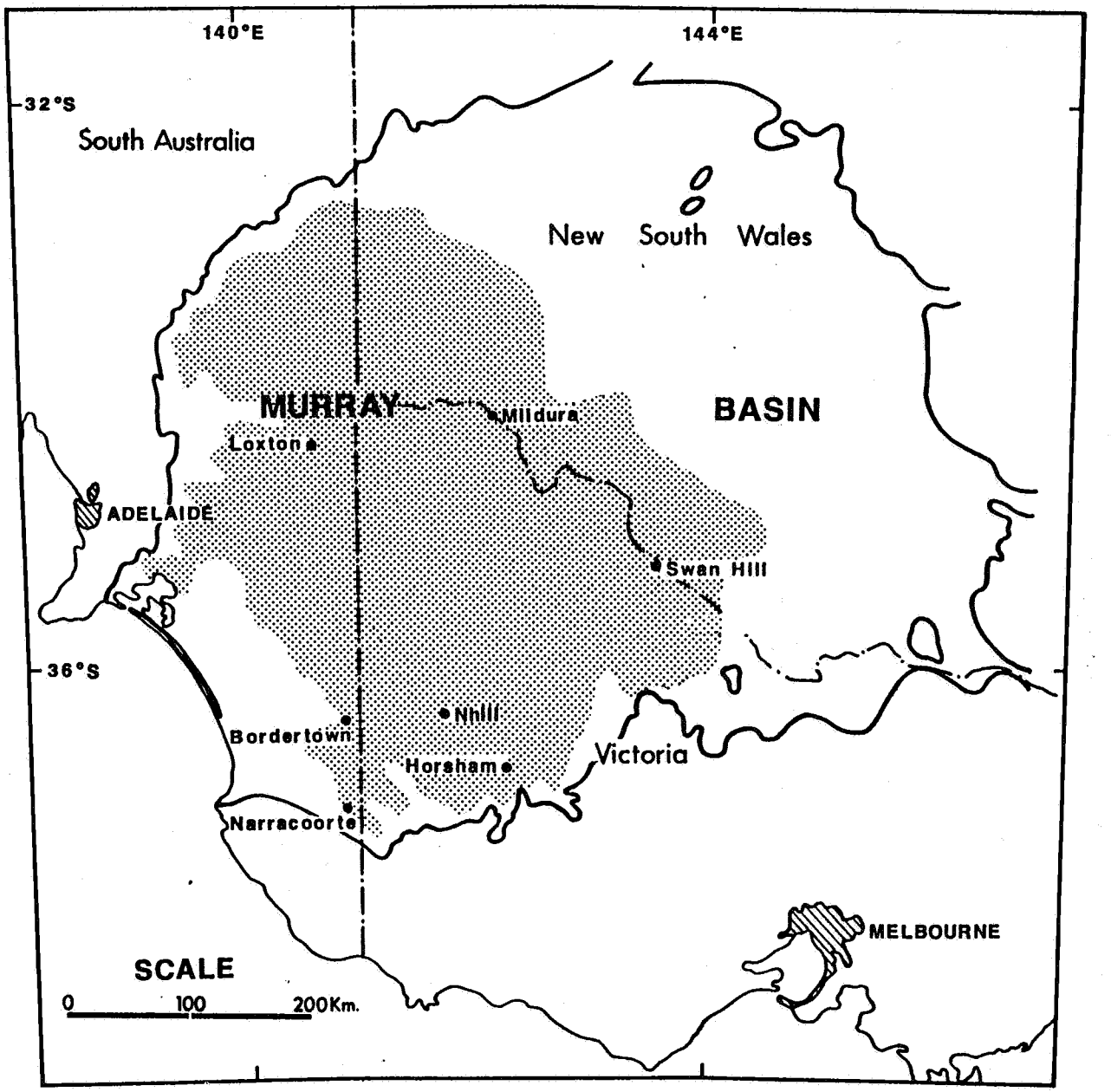


MURRAY BASIN PROJECT		
LOCATION MAP MURRAY BASIN		
Author: C. Charlesworth	Date: Feb '88	Fig. No. 2



MURRAY BASIN PROJECT		
DISTRIBUTION OF THE LOXTON SANDS & PARILLA SANDS		
Author: C.C.	Date: Feb '88	Fig. No.: 3

BURMINE

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00027

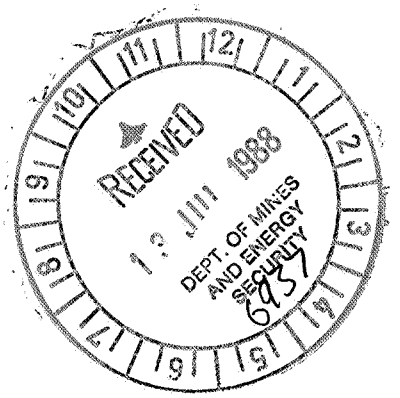
EXPLORATION LICENCE 1425

THIRD QUARTERLY REPORT.

21 FEBRUARY 1988 TO 21 MAY 1988

BURMINE LIMITED
&
T.C. PACIFIC RESOURCES PTY. LTD.

JUNE, 1988



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TECHNICAL NOTE NO. 7/88

Third Quarterly Report - EL 1425

21 February, 1988 to 21 May, 1988

Prepared for:

Burmine Limited

T C Pacific Resources Limited

C. Charlesworth
P. Hesp
June, 1988

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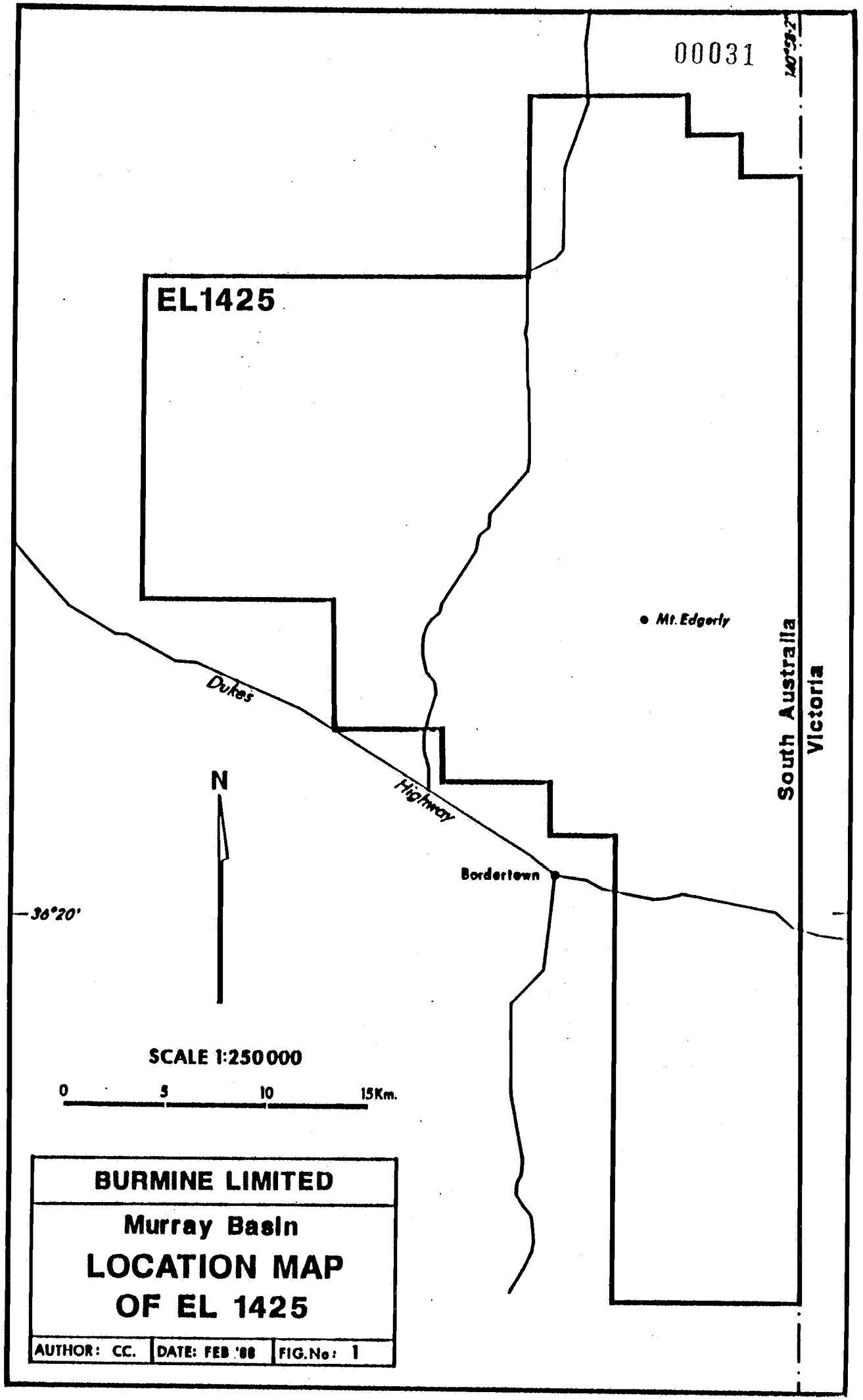
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Dukes
Highway
Bordertown
South Australia
Victoria
N
36°20'
SCALE 1:250000
0 5 10 15Km.
BURMINE LIMITED
Murray Basin
LOCATION MAP
OF EL 1425
AUTHOR: CC.
DATE: FEB '88
FIG.No: 1

1. INTRODUCTION

The exploration licence was granted to Burmine Limited and T.C. Pacific Resources Limited on 2nd October, 1987, effective from 21st August, 1987.

The Joint Venture has formed an operating committee to manage the project.

2. LOCATION

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The area is well settled with extensive areas of dryland cropping and improved pastures.

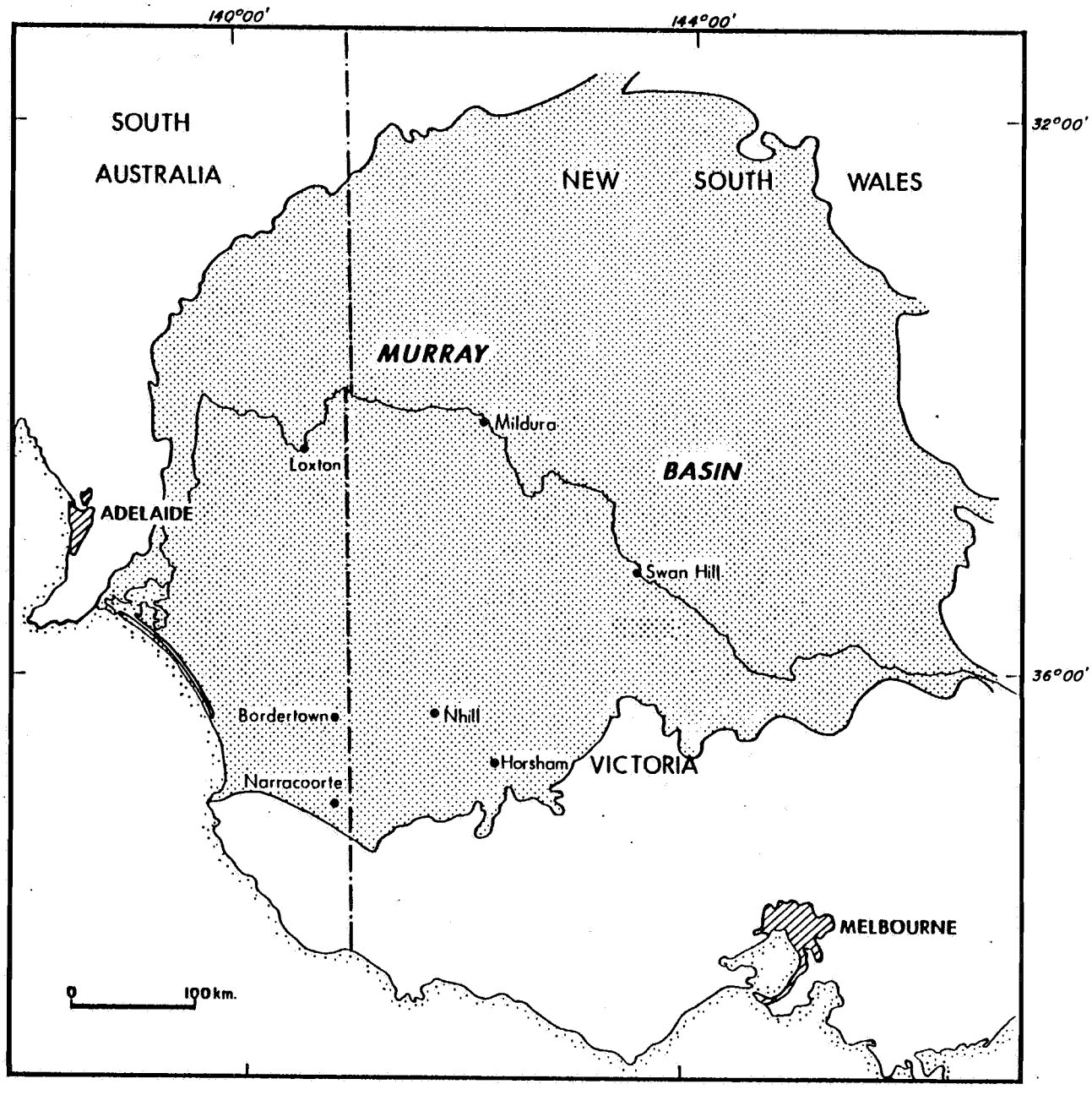
3. STRATIGRAPHY AND REGIONAL GEOLOGY

The area of exploration covers a small region of the Murray Basin, which occupies parts of N.S.W., Victoria and South Australia (Fig. 2).

Buried beneath the Tertiary strata are metamorphics of probable Cambrian age. Rock types include shale, slate, phyllite and sericite schist. Intruding these metasediments are granite bodies and quartz veins. Sediments of Lower Permian and Cretaceous age have also been penetrated in drilling.

Tertiary sediments are present from Paleocene/Eocene through to Pliocene ages and they include clay, silt, sand, gravel, calcareous clay (marl), limestone, lignite and glauconitic sediments. Generally, the beds dip very gently and thicken towards the northwestern corner of Victoria.

Tertiary strata outcrop poorly due to a thin cover of Quaternary sediments, and are known largely from subsurface information.



MURRAY BASIN PROJECT		
LOCATION MAP MURRAY BASIN		
Author: C. Charlesworth	Date: Feb '88	Fig. No. 2

At the base of the Tertiary succession lies the medium to coarse grained quartz sand of the Lower Renmark Beds (Knight Group of Ludbrook, 1961). Available evidence suggests the age of this unit is Paleocene to Eocene. It is in turn overlain by a much more widely distributed blanket of unconsolidated, thinly bedded carbonaceous sand, silt, clay and peaty coal; the Upper Renmark Beds. This unit thins out over the Padthaway Ridge, where the highly carbonaceous beds of the Morrlands Lignite Member are developed in areas of bedrock highs.

In the Upper Eocene, marine conditions existed over a limited area in the northwest of the Murray Basin. The Buccleuch Beds (Ludbrook 1957) consisting of limestones and sands interbedded with carbonaceous clays were laid down in this shallow marine environment.

A major change in the sedimentation pattern of the western Murray Basin, accompanied a relative rise in sea level in the Oligocene. This change in sea level can be correlated with the deposition of formations within the Murray Group - Ettrick Formation, Gambier Limestone, Mannum Formation, Duddo Limestone, Morgan Limestone, Geera Clay, Pata Limestone and the Winnambool Formation.

Reconstructions suggest that a shallow-marine platform in the southwest was flanked to the east and north by a narrow zone of restricted marine and lagoonal environments. These were in turn bordered by a marginal marine zone - further giving way to peat forming swamps deltas and fluvial environments.

Deposition of the Murray Group sequence was terminated by a period of non-deposition caused by a regression of the Tertiary sea.

The final depositional sequence in the Tertiary commenced in the Late Miocene. Current information suggests that a fluvial flood plain in the east and north was flanked to the south and west by an extensive strand-plain of beach ridges. In the west, the flood plain was connected to the southern ocean by a river and

estuary system that roughly coincided with the present day course of the River Murray.

The initial result of the marine transgression was the deposition of the Loxton Sands, Bookpurnong Beds and Parilla Sand. The Loxton Sands of South Australia includes the Parilla Sand of Victoria.

As the sea retreated from the basin a series of sub-parallel stranded beach ridges were formed on the surface of the Parilla Sand. The medium to high energy environment provided by fair weather and storm waves may have acted as a concentrating mechanism for stable minerals of relatively high specific gravity. If this were the case, the stranded ridges represent current exploration targets for accumulations of heavy mineral sands.

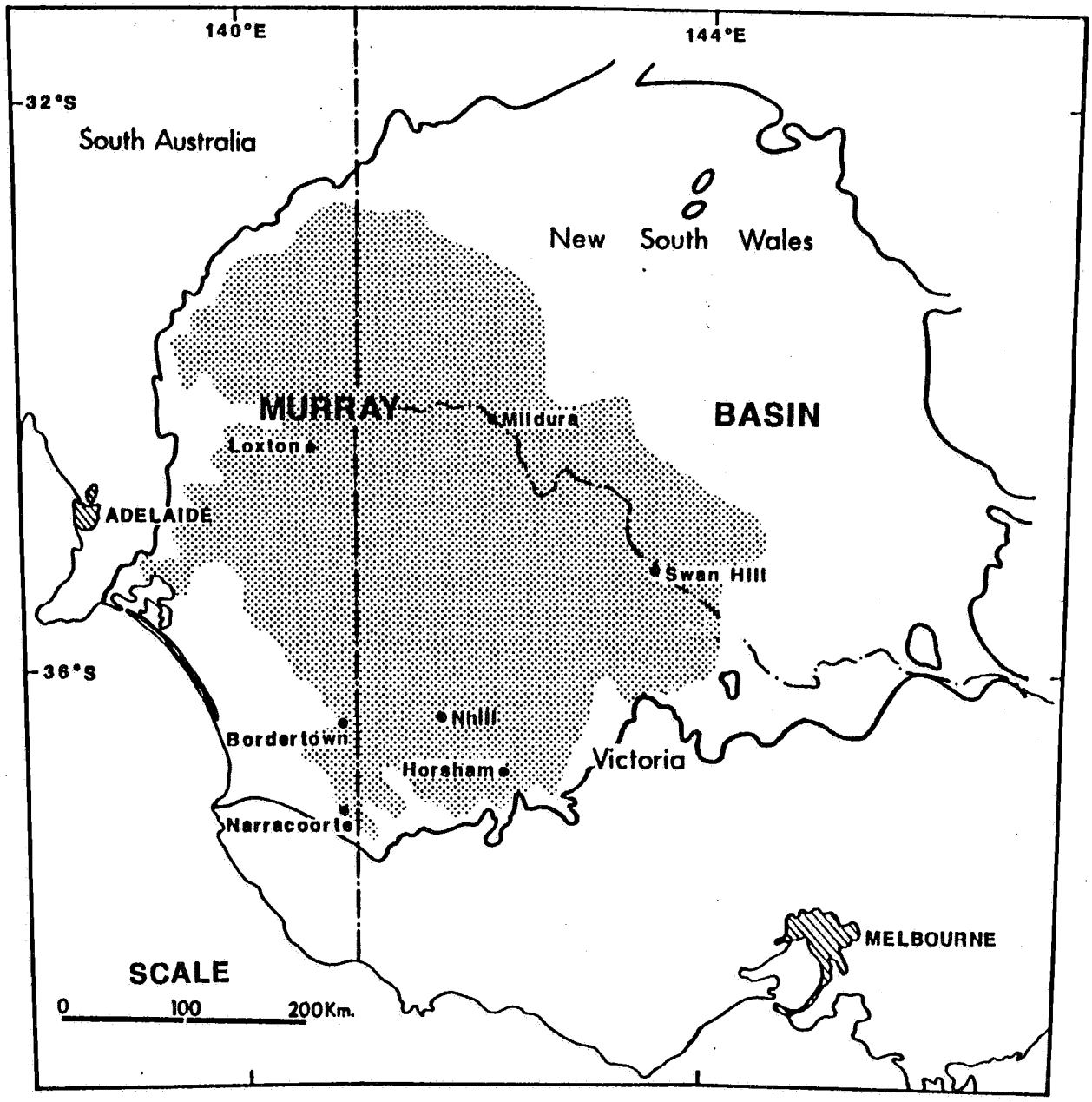
4. THE PARILLA SAND

The Parilla Sand was first named by Firman (1965) after he identified it in a bore near Parilla, South Australia. The Upper Loxton Sands of S.A. and Parilla Sand of Victoria are considered to be equivalent by most writers.

The Parilla Sand occurs as an extensive and continuous unit over the western part of the basin in S.A., N.S.W. and Victoria (Figure 3). It outcrops only rarely, due to a thin covering of Quaternary sediments, but its alternating ridge-valley morphology is a prominent feature of the landscape. The sand is a well sorted quartzose sand in general. It may be either a silt or a sand, mostly fine to coarse grained, or, where cemented, a siltstone or sandstone. The quartz grains are usually of equal size and are rounded to sub-rounded. The rest of the sand and silt-sized grains are made up of the stable minerals zircon, tourmaline, ilmenite and rutile. It is these minerals, especially the rutile and zircon, which are of economic interest.

Drilling has shown the weathered zone of the Parilla Sand to persist to a depth of 17 m., irrespective of the landscape or the thickness of the overlying deposits. Sections of the cemented zone are exposed in quarries near the southern part of the Murray Basin, in river sections, especially along the Murray, and in exposures along the southern or western side of lakes e.g. Lake Tyrell.

The soil developed on the Parilla Sand has been described as lateritic, and is often used to map the occurrence of the sand. Its distinctive red colouring, along with information from water bores and evidence of topographic high spots or ridges, has been utilised by geologists to locate and map the unit. Often the Parilla Sand is covered by a calcareous earth of aeolian origin which has been given the name "parna" (Butler 1956). This unit is an earthy, homogenous calcareous substance, without stratification and occurs as an extensive, nearly uniform sheet. It can contain up to 70% clay and is usually between 1 and 2



SAND

N

MURRAY BASIN PROJECT

DISTRIBUTION OF THE LOXTON SANDS & PARILLA SANDS

Author: C.C.	Date: Feb '88	Fig. No.: 3

metres thick.

The cemented zone of the Parilla Sand is characterised by jointing. This is regarded to be the result of stress, not tectonics, due to the relatively thin layer of sandstone being underlain by loose and unconsolidated sediments. Primary structures are often obscured within the cemented zone, but there are exceptions. In a quarry section west of Kerang, Macumber (1969) described fossiliferous silts and sandstones displaying cross bedding which he interpreted to include offshore and possibly beach deposition. In river bank sections on the northern side of the Murray River east of Mildura, silts belonging to Parilla Sand have a laminated bedding, disrupted by numerous worm burrows which are taken to be indicative of shallow marine conditions (Lawrence, 1975).

Beneath the cemented zone there is little kaolinite or limonite to bond the quartz grains together and the formation is generally represented by loose silt or sand. In the centre of the basin, there is a general decrease of grain size with depth, with an accompanying increase in clay content. Towards the outer boundary of the Parilla Sand, this trend is reversed and the boundary with the underlying Bookpurnong Beds is sharp and often disconformable. Where this coarse grained unit is well developed it is distinguished as Calivil Sand.

The Parilla Sand is a continuous unit for the western part of the basin and is often topographically expressed as alternating ridges and valleys. These ridges were first mapped by Hills in 1939, but have since been mapped in greater detail by a number of authors. They may be up to 50 m. high and several kilometres across. Generally, the structure contours of the base do not reflect the upper surface and the base of the Parilla Sand is relatively planar.

Several theories have been put forward to explain the occurrence of these parallel ridges. Blackburn (1962) proposed the stranded coastal dune hypothesis, in which he suggested that the ridges represent former coastlines of the

Murravian Gulf. Lawrence (1966) supported this hypothesis, pointing out the association of the Parilla Sand with the underlying tertiary marine sediments. Subsequent authors (Macumber 1969) consider that the fossils, bedding and texture of the Parilla Sand exhibited on the Gredgwin Ridge, Victoria, are indicative of littoral and near shore conditions. The present day opinion probably coincides with that of Brown (1985), who regards the ridges as prograding beach ridges, formed as the result of a marine regression in the Late Tertiary.

5. PREVIOUS EXPLORATION

The studies undertaken during the past months include:

- Literature Survey - A review of all the published geological data for the Murray Basin in (mainly) South Australia and Victoria, was undertaken. This work is now largely complete, with only the examination of unpublished reports and water bore logs outstanding. This study will begin in the next period, but is expected to continue into the second year of operation.

  A summary of exploration reports was also purchased from Technical Field Surveys, covering the entire Murray Basin. This data essentially served to confirm the view that very little exploration for heavy minerals has been carried out in the region.

- Satellite Imagery Analysis - Satellite Imagery was examined for lineations and strandline features which could be located or projected into the EL. Some features were highlighted this way, but further systematic work is necessary and will constitute part of the conceptual study.

- Murray Basin Visit - This trip took place in late March. The itinerary covered a wide area of the Murray Basin, including the general region around CRA's HMS project, EL 1425, and the Little Desert. Much of the travel was by light aircraft, from which observation of large areas in a short time span could be made. A limited amount of road traversing was also undertaken to ground-truth the aerial observations. Several points noted on this trip led to the decision to undertake an aerial photograph mapping exercise, incorporating geomorphological information, of EL 1425. The suggested programme for this is outlined in Section 7.1.

- Geological Model - A preliminary geological model has been advanced but it is expected that this will be modified in the course of the conceptual study.

The conceptual study is intended to provide a foundation on which further observations and data can be built into a comprehensive and authoritative theory.

6. MURRAY BASIN - REGIONAL STUDY

6.1 Introduction

Mineral sands exploration in the Murray Basin is a relatively recent activity. A handful of companies are involved at this stage, but the mechanisms which produce the heavy mineral accumulations have yet to be definitely identified.

The author and others involved in the Burmine HMS project have spent the past several months attempting to put together the various pieces of information available to form a consolidated theory of HMS placer formation in the Murray Basin.

The outcome of the studies undertaken are reproduced herein, along with observations made on a visit to the Murray Basin. A number of suggestions for further action have come out of this visit and are presently being pursued. Future exploration will be based on the results of an integrated study of the evolution of this part of the Murray Basin.

6.2 Theory of Beach Placer Formation

Beach placers are formed when heavy minerals derived from erosion of the land are redistributed along the continental shelf. The movement of the sea gradually sorts the sediments, directing the finer materials into deep water, and the coarser material towards the shore. The action of storms can be an important concentrating mechanism. The valuable minerals are both resistent to weathering and have a high S.G. relative to quartz and therefore become concentrated with the coarser grained sediments. The final distribution of the minerals is affected by the overall sedimentation properties of the particles (specific gravity, diameter, settling velocity) and the strength and direction of the wind and ocean currents.

The most commercially important placers develop at the base of frontal dunes

on open beaches and in the natural traps formed by headlands and other barriers to the free passage of longshore currents (Fig. 5). Fossil beaches are often referred to as strandlines. Beach deposits are characteristically lenticular in cross section and may vary in size up to several kilometres in length and a couple of metres in thickness.

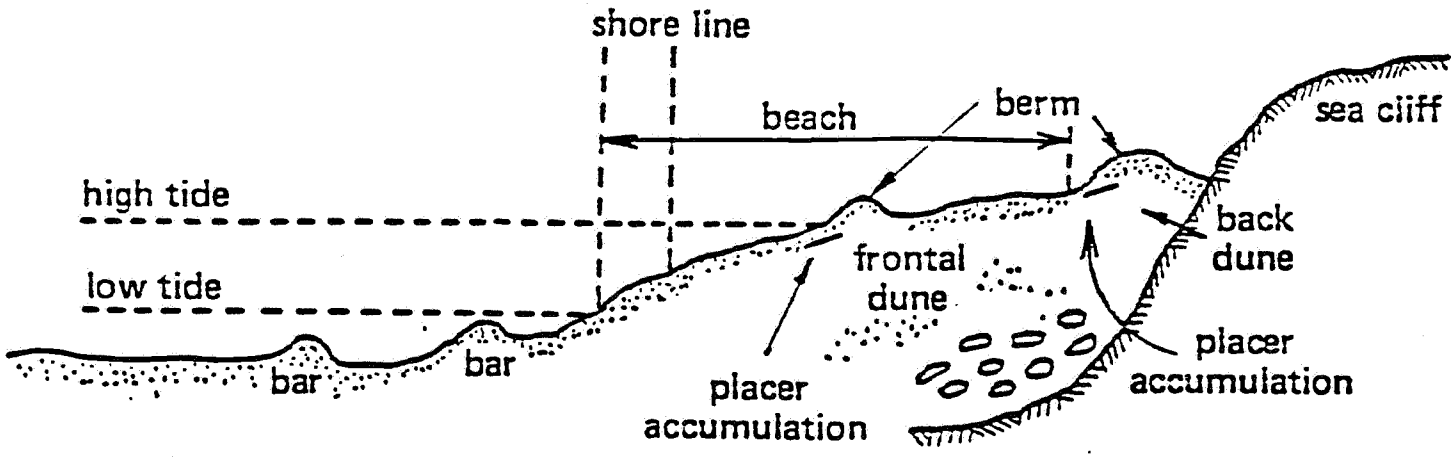
Periods of upward warping of coastal areas, variations in sea level and the migration of windblown sand dunes may cause changes to the location of the coastline. Consequently strandlines and beach placers can occur at considerable distances inland from the present coastline. Some well developed strandline/coastal ridge features can be identified by remote methods such as aerial and satellite photography.

Aeolian placers may be formed in conditions where large areas of beach sand are exposed to the action of the wind. A third type of placer is found in the underwater bars of sediments which parallel the shoreline. Some of these bar accumulations may be submerged beach placers, others have resulted from the sorting action of waves and ocean currents.

6.3 Satellite Imagery Analysis

Enhanced Landsat imagery was obtained for the entire Murray Basin. The reasoning behind this was the need to build up a regional picture of the processes which have shaped the stratigraphy of the basin, and resulted in accumulations of heavy minerals. It was hoped that trends observed might be related back to the ground held, and act as a first stage in delineating targets.

Stranded features show up quite readily on the images, allowing them to be traced and hopefully projected into the EL. These features were examined and recorded for a considerable area surround the the EL's in order to examine such things as the trend of the lineations (if any), the effect



Showing typical beach pattern with offshore bars. Lenses of mineral accumulations have formed placer deposits in dunal systems.

FIGURE 5

of basement highs and so on.

The resulting map has been reproduced as Figure 4. Inspection of this figure and indeed the imagery, reveals a relative dearth of macro-stranded features within the EL, when compared to surrounding areas, for example to the north.

This outcome makes the delineation of targets by systematic methods just that much more difficult. Whilst it was not intended to rely totally on this investigtion, it was hoped that it would point out the most prospective areas of the EL, allowing closer study on the ground.

The stranded features which the imagery picked up should be looked at on the ground and perhaps examined in air photos. The results of the satellite imagery study are a little disappointing, but they do provide some indication of regions where stranded features occur. Whether these exist in the Tertiary or more recent sediments will need to be field checked and form the basis for further on-site traverses.

6.4 Some Observations

- Past HMS exploration in the Murray Basin appears to have been mainly directed towards topographic highs in the form of ridges, which may represent previous shorelines.

- The recently announced resource of heavy minerals at WIM 150 in Victoria does not, on the surface, seem to fit into this category.

- Most mineral sands operations on the east and west of Australia are involved with deposits of much more recent origin than the Tertiary age suggested for the Victorian heavy mineral occurrences. This is significant because it means that the Parilla sand unit which hosts the heavy minerals, may be covered with a deep cover of younger sediments,

and is often present as a sandstone at the shallow depths amenable to mining.

- The first of these factors has a bearing on both the exploration and successful exploitation of the heavy minerals. The thick sequence of (usually) Quaternary cover presents a significant barrier to exploration, especially by remote and surface geophysical means. Assuming a resource is located, an economic assessment of the prospect must take into account the extra cost of overburden removal.

- The fact that the Parilla is most usually represented by a sandstone plays a part in the actual mining operation. Many large mineral sands mining operations employ a dredge as the most cost effective means of recovering the mineralised sands. Clearly, a conventional operation of this sort would be made extremely difficult, if not impossible, by the presence of large amounts of hard material. The cost of developing an open pit or modifying and developing conventional dredging techniques to suit these conditions may be prohibitive.

- The nature and suites of the heavy minerals on the east and west coasts have been established through many years of operational experience. Suitable beneficiation techniques have been developed. There have been some suggestions that the Murray Basin heavy minerals range from being slightly finer to very much finer than those found on our present coasts. If this is the case, new separation technology may have to be developed to beneficiate the very fine mineral. The mineral suites encountered in the Murray Basin are almost certain to be different to east or west coast occurrences.

At least one important fact was noted from the air during the visit to the Murray Basin. Areas with a pinkish hue were noted, and it was hypothesised that this may represent Parilla Sand (often red/orange near the surface) showing up at a shallow depth beneath the Quaternary cover (light yellow-white). Reference back to geological sheets confirmed that the patch was in fact Parilla Sand. A search for other similar spots drew the same result. Although this phenomenon was discovered for areas outside EL 1425, it follows that examination of aerial photographs of the EL may reveal similar localities, which would then form exploration targets by allowing dunes to be traced under thin Aeolian cover. Plate 1 is a photograph taken from the aircraft showing the pinkish hue visible.

6.5 Geological Model

A geological model is suggested for the Murray Basin based on experience elsewhere; especially the east coast of Australia. It is suggested that this model be used as a basis for further exploration by the Joint Venture. It is further suggested that the model be viewed with an open mind, and to be subject to revision should the field evidence indicate that this be necessary.

The model also attempts to account for observations made elsewhere in this report:

i) Heavy mineral concentrations in the Murray Basin probably resulted from relatively high energy wave action on shore lines.

ii) As the ocean has retreated through Tertiary and Quaternary time successive shore lines were established younging south-west towards Koorong.

iii) Each shore line is a potential exploration target although some of the newer calcite rich strandlines closer to the current shore line should be down-graded somewhat on current data.

iv) The most likely location for mineral concentration is on the seaward side of strandlines.

v) It is likely that any ocean set will have transported mineral along shorelines. Where there was any natural barrier such as a headland, this may have resulted in a concentration of mineral over a large area. This type of mechanism may well be responsible for the observed mineralisation at Drung South (WIM 150).

vi) Similarly any ocean set may have transported mineral along shorelines from major paleo rivers.

vii) It therefore follows that when exploring for mineralisation, localities where strandlines (or the projection of strandlines) come up against features which would have formed barriers against the set of the Tertiary sea, should be prime exploration targets. Similarly, exploring shorelines down-set from the outlets of major paleo rivers, should improve the chance of success.

viii) Current experience indicates that the high grade deposits occur on the higher RL strandlines or where the projection of such strandlines impinge on headland features.

ix) Emphasis should therefore be given to higher strandline features; however cognizance should be taken of the fact that block faulting and/or warping may have affected relevant elevations (example, the Tyrell Ridge v. the strandlines running through Nhill, in Victoria).

x) Tertiary shoreline features may well be obscured by Quaternary cover.

7. PROPOSED EXPLORATION ACTIVITIES

7.1 Introduction

In keeping with the general philosophy of trying to understand the processes which have moulded the basin, a geomorphological study has been commissioned to describe and interpret the present day landforms. It is intended to identify regions where Aeolian overburden is at a minimum. Conversely, regions where cover is extensive or thick, will be down-graded as exploration targets and may be dropped from the EL.

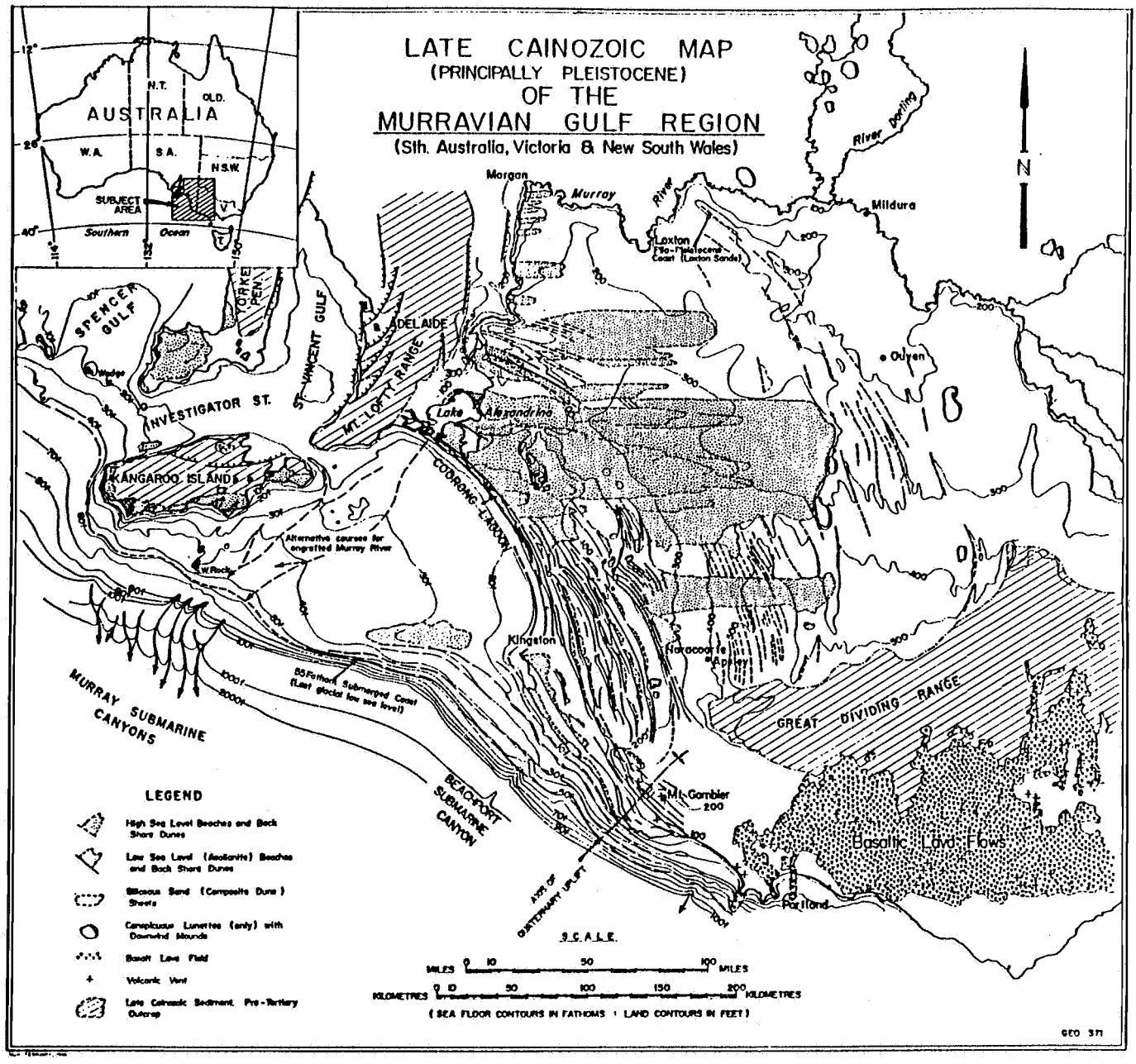
Initially the study will involve detail mapping by aerial photography. This is to be followed up on the ground by detailed field traverses.

Dr. Patrick Hesp has been retained to undertake the study and his summary of proposed activities is contained herein:

- General

  The region is dominated by a large coastal plain composed almost entirely of re-worked marine sediments. The plain extends over 250 km. inland and is composed of siliceous sediments delivered by the Murray River and re-worked on-shore by wave and wind actions, and carbonate sediments derived from the broad continental shelf and moved shoreward with each sea level transgression. The abundant sediments and energetic wave regime have succeeded in largely filling the Murravian Gulf with Tertiary Parilla Sand and Pliocene-Pleistocene barrier systems, which stretch from the present coast to beyond Ouyen. This Pleistocene to Tertiary sequence is complicated by widespread Aeolian re-working during glacial periods (Sprigg 1978, Fig. 6).

  Between Lake Alexandrina and just north of Keith, a series of Aeolian sand drifts over and underlie Pleistocene and pre-Pleistocene barriers.



Distribution of "stranded" sea beaches of late Cainozoic Age, coastal margin of the Murravian Gulf. Note the pronounced easterly drift of sands associated with the low-level aeolianite beaches.

FIGURE 6

The sediments of these loessial lime dust Aeolian sheets have been derived from sands deposited in a multiplicity of coalescing delta formations of the Murray River. Over-deposition of these sands in a notably restricted westerly sub-coastal zone, has meant that during low sea level periods, when a more peri-glacial climate prevailed, widespread Aeolian sheet distribution occurred down-wind to the east (Sprigg 1978).

Geomorphic Mapping

Figure 6 illustrates the extent of Aeolian sands which blanket a considerable portion of the EL. The dune field is principally composed of parabolic dunes (upsiloidal or U-shaped dunes) and a few other dune types (short longitudinal and barchanoidal dunes). The thickness of these sands is highly variable over the Parilla sand, ranging from little to considerable thicknesses (several metres). Since the Company has targeted an overburden limit of approximately 4 metres it is critical that detailed mapping of the surface topography and thickness of principally Aeolian overburden is undertaken.

Geomorphic mapping for the entire EL will be carried out at a scale of 1:40,000 from colour aerial photography. As the parabolic dunes evolve by upwind deflation, formation of trailing lateral ridges and formation and migration downwind of terminal dune sheets, it will be necessary to map in detail individual deflation basins and flats within the parabolic dunes. In some cases, deflation may have taken place within the underlying Parilla sand as well, thus reducing the overburden to an absolute minimum.

Elsewhere in the EL, where Aeolian cover sands are absent, Tertiary and Pliocene-Pleistocene barrier ridges, inter-barrier flats and depressions and sand plains will be mapped.

This mapping will allow the identification of sites where overburden sediments are too extensive or thick, and these can then be excised from the EL.

The geomorphic mapping will be followed by a detailed field survey to ground-truth the mapping and identify sites with the greatest potential for mineral exploration.

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Expenditure on EL 1425

21/2/88 - 21/5/88

	$
Consultants' Fees	27,389.00
Travel and Accommodation	2,489.00
Maps	1,270.00
Aerial Photographs	1,077.00
Sundry Expenses	687.00
Administration	4,937.00
Total	$38,209.00

PLATE 1

An aerial view of the Little Desert, showing the regions of pinkish-red where the Parilla Sand is covered by a thin sequence of Quaternary sediments.

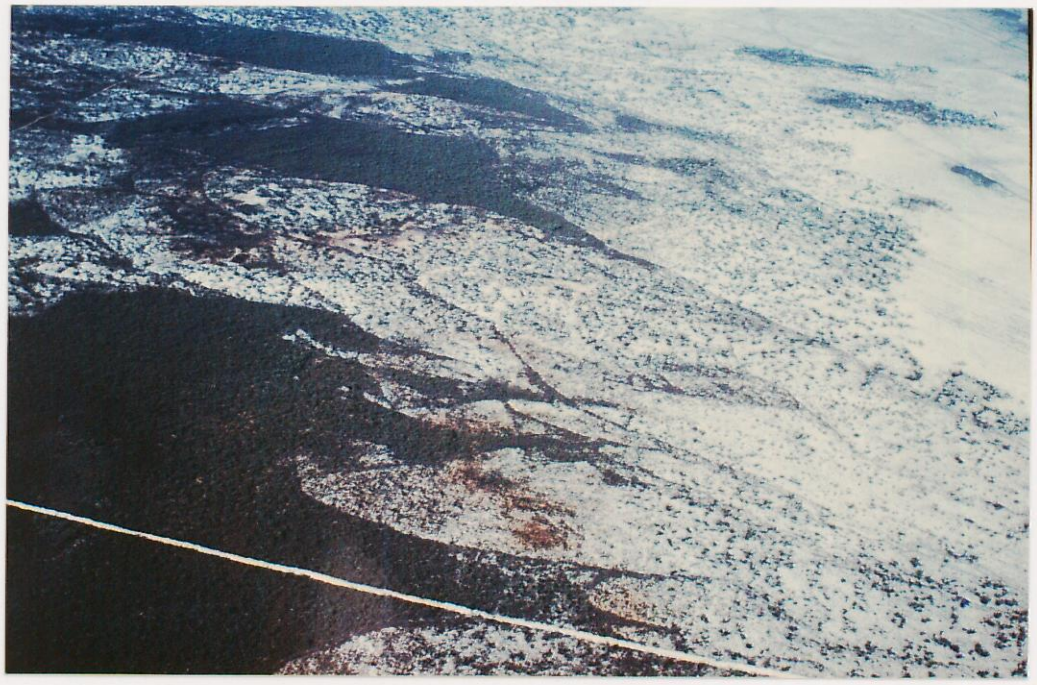

PLATE 2

A section of a pit in the Parilla sand, exhibiting its characteristic iron-stained hue. Notice that the unit is a competent sandstone at the surface.

PLATE 3

Dark grains of heavy mineral, found in a pit sunk in Parilla sand. The grains had probably been concentrated by wind and recent rain.

PLATE 4

An aerial view along the Naracoorte range, which is present as a prominent ridge to the south of EL 1425. This feature shows up clearly on Landsat Imagery.

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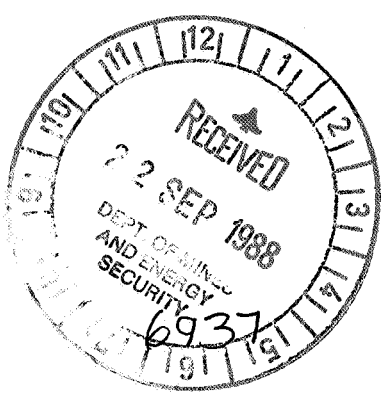
EXPLORATION LICENCE 1425

FOURTH QUARTERLY REPORT.

21 MAY 1988 TO 21 AUGUST 1988

BURMINE LIMITED
&
T.C. PACIFIC RESOURCES PTY. LTD.

SEPTEMBER, 1988



1ST copy of 6

FOURTH QUARTERLY REPORT - EL 1425

21 MAY, 1988 - 21 AUGUST, 1988

Prepared for:

Burmine Limited.

T.C. Pacific Resources Limited.

Euraust Minerals Exploration Limited.

R.A. Creelman

September, 1988

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LIST OF FIGURES

FIGURE 1. Location Map EL 1425

FIGURE 2. Distribution of Parilla and Loxton Sands

1. INTRODUCTION

The consortium of Burmine Limited, T.C. Pacific Resources and Euraust Minerals Exploration Pty Ltd has successfully negotiated a joint venture agreement with Fidunu Pty Ltd, a fully owned subsidiary of Denison Australia Pty Ltd, to explore EL 1425 in South Australia, and when granted, similar leases in Victoria. The agreement was signed in mid-July and work began immediately on the South Australian lease.

Following discussions with the South Australian Department of Mines and Energy, Burmine made application to have the lease extended for a period of six months. This request was granted in August with the requirement that the shortfall of expenditure for 1987/1988 be made up in the period September 1988 - February 1989 in addition to expenditure required for the six month extension.

The joint venture has formed a technical committee to manage the project, chaired by Dr. R. A. Creelman of Denison Australia and with members from all parties involved. Mr Peter Stitt has been retained by Denison Australia to advise the joint venture.

Work began in late July and has continued through August. It is proposed to present in this report an outline only of the exploration programme but report in detail on results at hand in the November Quarterly Report.

2. LOCATION AND REGIONAL GEOLOGY

Exploration Licence EL 1425 is located along the South Australian - Victorian border. Figure 1 shows the extent of the licence. The title covers an area of 2 175 square kilometres.

An outline of the regional geology has been presented in previous quarterly reports, especially the third report submitted in June 1988.

The major target units for exploration of Heavy Mineral Sands are the Parilla and Loxton Sands, in particular the beach and marine sequences that are the bottom sequence of the largely regressive sequence. The areal extent of the Parilla and Loxton Sands is shown in Figure 2.

A major Quaternary aeolian sequence covers the Parilla/ Loxton Sands in many parts of EL 1425. The major unit of this ssequence is the Molineaux Sand, and where thick, renders the economics of extracting Heavy Mineral Sands uneconomic. Consequently, it is necessary to clearly identify such areas and exclude them from the exploration programme at this stage.

3. EXPLORATION

3.1. Introduction

It is considered that success in exploring the Murray Basin for Heavy Mineral Sands will be greatly enhanced by understanding the evolution of the Basin during the course of the regression of the sea from the shelf.

This is accomplished by:

* establishing the stratigraphy that exists within the bounds of EL 1425.

* examining the geometry of the various sedimentary units, and from this data, establishing which environment best suits the beach/dune model that host the Heavy Mineral Sands placer accumulations.

* producing a geomorphic map of the area which shows distribution of aeolian and marine/dunal systems.

* Stratigraphic and target drilling.

3.2. Stratigraphy and Sedimentary Environments

A total of thirteen working days were spent at the South Australian Department of Mines and Energy viewing and collecting information from the numerous water bores drilled throughout EL 1425.

Initially it was necessary to generate a list of bores by

map sheet and number. A specific bore is identifed by a sequence of digits that uniquely identify the bore. This results in acode that consists of eight digits formatted in two groups of four (eg: 7025 1234).

The microfiche database at D.M.E. then identified those bores that have drillers and/or geological logs on file. A systematic search of the logs then showed which were suited to be listed in a computer database. All suitable boreholes were firstly compiled onto an index card file in a suitable format and then accumulated in a computer database. The format for each bore lists map sheet number, hole number, grid reference, relative level and depth of hole.

The geological and drillers logs were of variable quality. Some enabled good stratigraphy to be established but others were inadequate. A problem exists with the definition of the Parilla Sand from the Loxton Sands, in that a number of bore logs do not distinguish between the two. In some, the description allows a recognition of the boundary. It will be necessary to investigate this problem and resolve the position of the Parilla/Loxton contact during the preiod of field proving.

The various geological logs enable a simple stratigraphic system to be adopted at this time, consisting of:

Undifferentiated Quaternary

Parilla Sand

Loxton Sands

Undifferentiated Limestone and Calcrete

Undifferentiated Quaternary. The Quaternary units consist of siliceous and calcareous aeolian units. The most widespread of these is the Holocene - Recent Molineaux Sand, described on the Naracoorte and Pinnaroo geological sheets (SJ 54-2 and SJ 54-14) as pale yellow , unconsolidated quartz in sand sheets and E-S-E trending dunes. A system of more calcareous dunes occur to the south and west of the licence area. The Quaternary sands are differentiated from the underlying Parilla on the basis of colour, grain size and the presence of calcareous material.

Parilla Sand. The Parilla Sand consists of a single unit, and is widespread in the lease area. It is a pale yellow-brown to red-brown, fine to medium grained quartz sand, with some clay cement. Mottling is common. The Parilla Sand is thought to be late Pliocene.

Loxton Sands. The Loxton Sands underlie the Parilla Sand and are differentiated from it by an increase in grain size, an increase in mica content and, in some areas, fossiliferous material (Ludbrook, 1957).

Underlying the Loxton Sands is an undifferentiated sequence of pre-Pliocene calcretes and limestones which include Pata Limestone, Morgan Limestone, Mannum Formation and Gambier Limestone.

3.3. Airphoto Interpretation

On the advice of Dr. P. Hesp, Macquarie University, a programme of geomorphic mapping of the lease area has begun. The first part of this programme, airphoto interpretation, is well advanced and field proving is planned to begin in early October.

The aim of the airphoto exercise is to map the distribution of the major units recognised on the basis of morphology and to compare these units with those used on the 1:250 000 geological maps. The airphoto mapping is being done at 1:40 000 scale. Five major units are recognised:

1. Areas with no Quaternary sand cover. These are in the main Parilla Sand outcrop.
2. Areas with small to negligible Quaternary Sand cover. On texture and colour these areas are Parilla Sand subcrop and represent areas that will be explored because the overburden is thin.
3. Areas with sub-longitudinal and elongate long-walled parabolic dunes.
4. Areas with small fishscale parabolic dunes.
5. Areas with imbricate massive parabolic dunes.

Other features identified and mapped include stranded beach ridges of the Bridgewater Formation and inter-barrier and back-barrier depressions and flats associated with these forms. Areas of deflation and thinning of the Quaternary cover, basement highs, and a number of other features suggest that there are windows through to the Parilla Sand in a number of areas that will be investigated on the ground. It is hoped that beach dune features can be traced under the thin Quaternary cover.

A full geomorphic map of the lease area will be produced and field proving will be conducted in October 1988. The merging of the water bore information and the geomorphic mapping will provide the basis for drilling.

3.4. Drilling

The drilling programme, planned for October - November is divided into two parts:

(i) A short programme of stratigraphic drilling, employing a small GEMCO trailer mounted rig to test the thickness of the Quaternary cover over areas where the geomorphic mapping indicates thin cover. This programme is part of the proving exercise necessary to verify the geomorphic mapping.

(ii) A programme to test and sample the prime sites identified from the previous mapping and stratigraphy. Drilling for mineral sands has a number of problems that must be recognised and accounted for, especially in sampling.

The drilling programme is planned to finish at the end of November. In the period December 1988 - January 1989 results will be assessed, maps prepared and if necessary, a period of supplementary drilling completed by the end of February. At that time decisions will be taken to drop areas of low prospectivity.

4. REFERENCES

Bluck, R. C. 1987, First Quarterly Report, Exploration Licence 1425.

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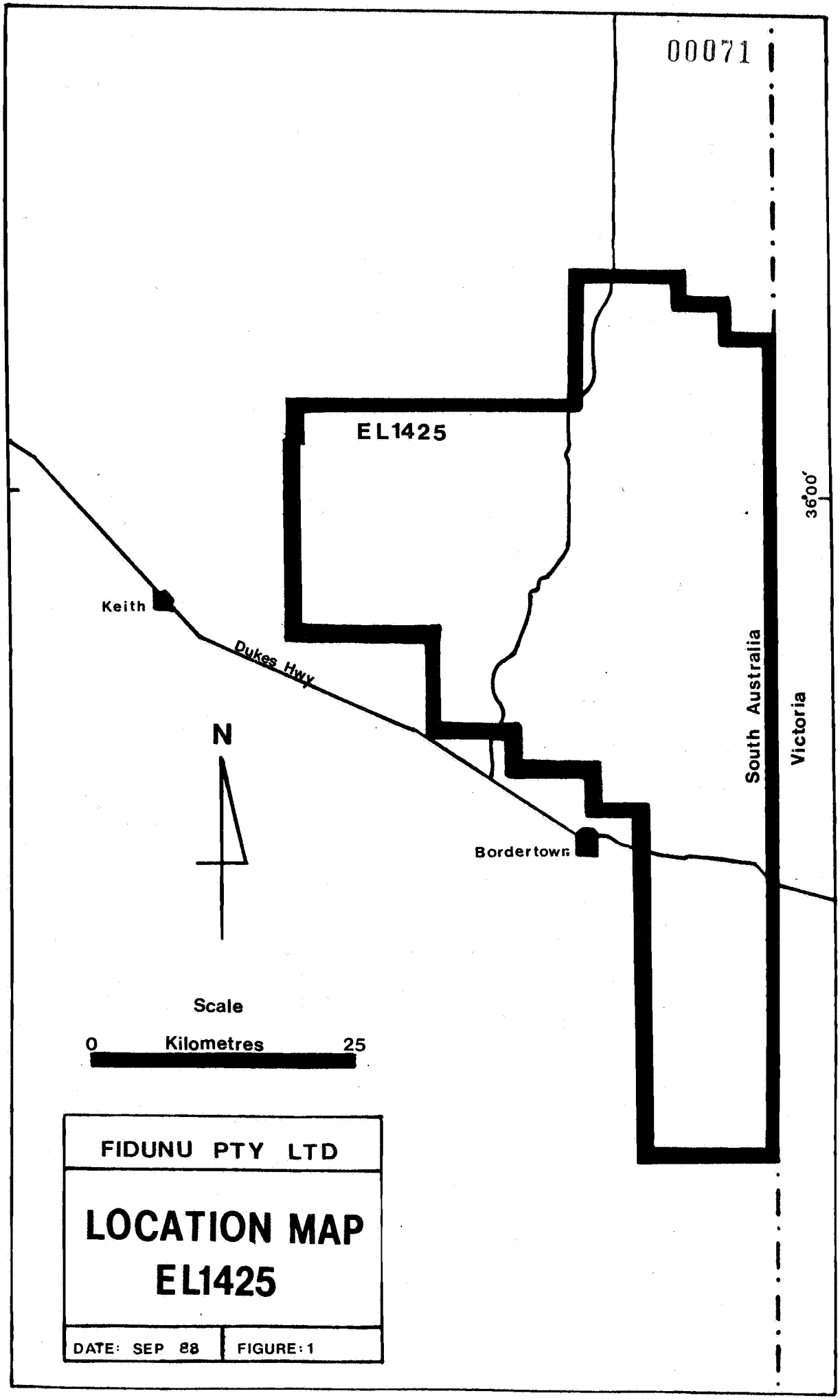
Geological Survey of South Australia, 1969, SJ 54-2 Naracoorte 1:250 000 Geological Sheet.

- 1979, SJ 54-14 Pinnaroo 1:250 000 Geological Sheet.

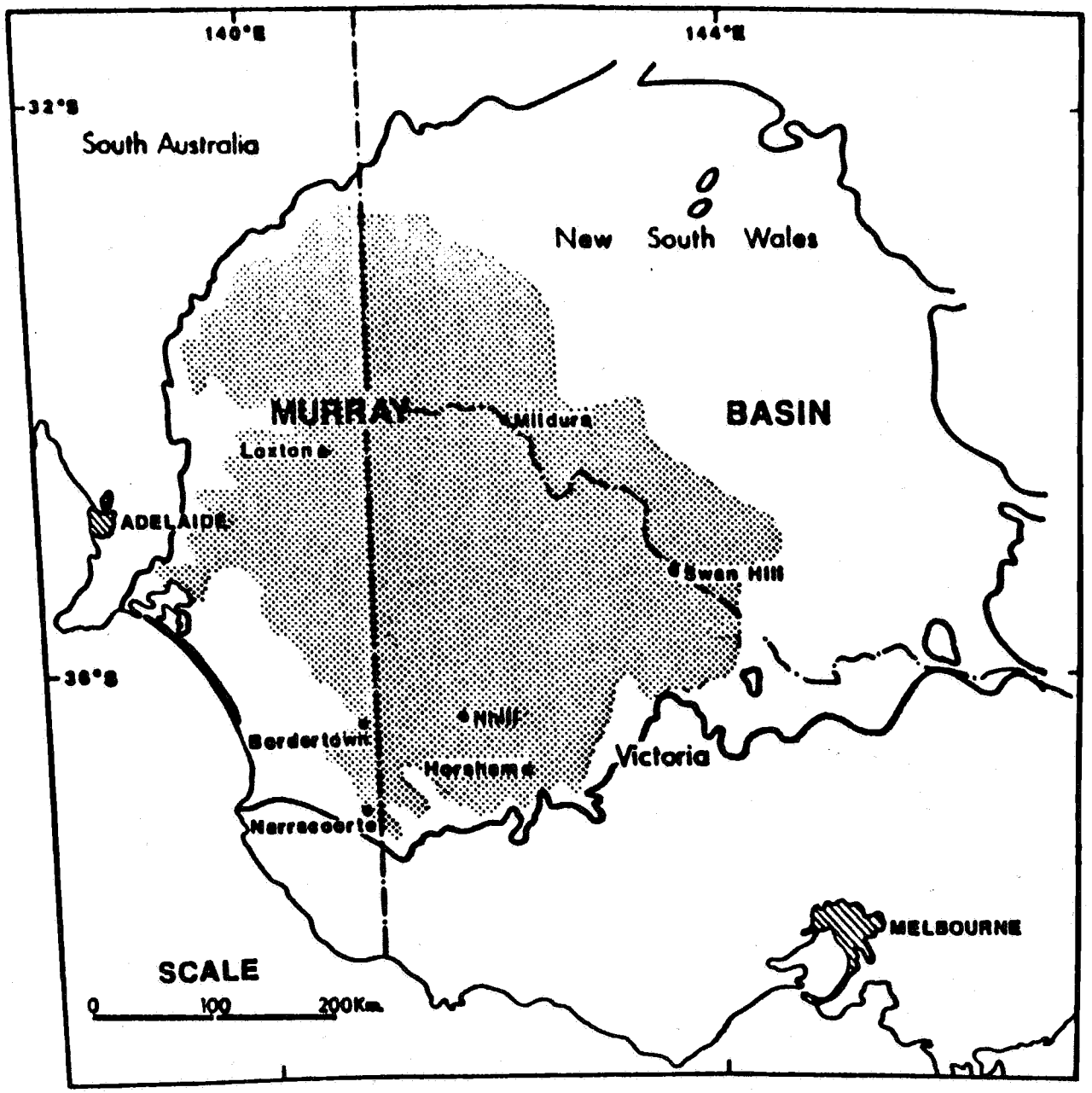
Ludbrook, N. H. 1957, The Murray Basin in South Australia. Journal of the Geological Society of Australia. Vol 5, Pt 2.



FIDUNU PTY LTD

LOCATION MAP EL1425

DATE: SEP 88 | FIGURE: 1



FIDUNU PTY LTD	
DISTRIBUTION OF PARILLA AND LOXTON SANDS	
DATE: SEP '88	FIGURE: 2

Expenditure on EL 1425

21/5/88 - 21/8/88

Consultants fees		$15,052
Computer services		$ 3,682
Travel and accommodation		$ 2,628
Sundry expenses/consumables		$ 585
	TOTAL	$21,947

00074

FIFTH QUARTERLY REPORT - EL 1425

21 AUGUST, 1988 TO 21 NOVEMBER, 1988

Prepared for:

Burmine Limited

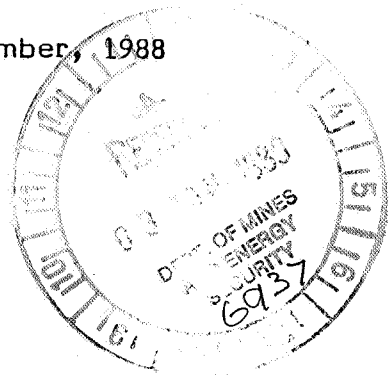
Euraust Minerals Exploration Limited

T.C. Pacific Resources Limited

R. Creelman

R.A. Creelman

December, 1988



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1.0 INTRODUCTION

Exploration licence EL 1425, situated along the South Australian -Victorian border, approximately 300km east of Adelaide, covers an area of 2175 square kilometres. (Figure 1).

An outline of the regional geology and a discussion of target units and overlying stratigraphy have been presented in previous Quarterly Reports (Charlesworth and Hesp, 1988, Creelman, 1988).

The prime objective during this quarter was to delineate target areas for drilling on the basis of overburden thickness and structural elements. In addition, reconnaisance mapping was completed during November, and the results have been used to site a series of stratigraphic drill holes. The drilling program, which commenced on 21 November 1988, will be presented in outline only. A detailed report will be presented in February 1989 Quarterly Report.

2.0 CONCLUSIONS

1. A programme of air photo interpretation and field verification over EL1425 has produced a detailed geomorphic map of Quaternary and Tertiary sedimentary/landform units.

2. The Tertiary units (the Parilla Sand) are a series of barrier ridges the trend NNW-SSE where observed. The Quaternary units (Molineaux Sand) consist of surficial clays and parabolic dunes.

3. The Tertiary units are well exposed in the central part of the lease, east and south of Bordertown, which makes these areas the most prospective in the lease. The southernmost portion of the lease, and the western portions are the least prospective due to thick Quaternary cover. The western area is covered by calcareous sands, heavily indurated to calcrete, and the southern area covered by aeolian dunes and clays.

4. Areas in the NE portion of the lease are less prospective in that there is a thin cover of Quaternary Sand in places less than 1m, but due to the sand cover, the barrier systems cannot be defined.

5. Field observations and hand/power augering of the Parilla Sand show that heavy minerals are present.

3.0 RECOMMENDATIONS

1. A drilling programme is recommended to test the Parilla Sand for heavy minerals and establish a more detailed strategraphic model for the region.

2. Drill sites recommended are the Parilla Sand barrier systems immediately east of Bordertown.

3. At the end of the lease period, 20th February 1989, it is recommended that the southernmost portion and selected parts of the northwestern area be dropped. A detailed map showing non-prospective areas is to be prepared.

4.0 EXPLORATION

4.1 INTRODUCTION

Following the development of a geological model, (Charlesworth and Hesp, 1988) exploration was conducted in 4 phases.

Phase 1. Interpretation of hydrogeological data obtained from the South Australian Department of Mines and Energy.

Phase 2. Air photo interpretation and geomorphic mapping. Phases 1 and 2 were conducted concurrently.

Phase 3. Field checking the geomorphic map and reconnaisance sampling of the lease.

Phase 4. Outline of the stratigraphic drilling programme.

4.2 DISCUSSION

4.21 Phase 1: Data Interpretation

Phase 1 involved the production of cross-sections and isopach maps from bore hole date obtained during the previous quarter. The location of these bore holes is shown in Figure 2 and the cross-sections from Figures 3 - 6.

The bore holes in this area are widely spaced. Consequently the geological information based on these logs has to be extrapolated over substantial distances to the section lines. Thus, the bore holes provide broad stratigraphic information, but fail to give the detail required at the scale of the survey.

Isopach maps were produced for the Parilla Sand (Figure 7) and the Undifferentiated Quaternary unit (Figure 8). The isopach map of the Parilla Sand provides only a broad indication of their extent and thickness due to the difficulty in identifying stratigraphic boundaries between the Parilla Sand and underlying Loxton Sands. The isopach map of the Undifferentiated Quaternary unit proved useful in delineating broad target areas for field checking during Phase 3. These target areas are regions of Parilla Sand overlain by minimal thicknesses of the Undifferentiated Quaternary overburden.

4.22 Phase 2: Air Photo Interpretation and Geomorphic Mapping

The geomorphic mapping was directed towards recognition of ridges of Pliocene marine/lacustrine/aeolian sands (Parilla) and delineating the distribution of the overlying Quaternary (Molineaux) cover sands and the carbonate dominated barrier sequences within EL 1425.

Mapping units, initially defined using the presence/absence of Quaternary cover sands, were mapped using stereo aerial photographic analyses. Individual landform and sub-landform units, which could be discretely recognised and had definable boundaries (eg. Quaternary barriers and interbarrier depressions), were mapped at a scale of 1:40 000.

Portions of the lease with an absence or minimal coverage of Quaternary sands were considered the most important. In these areas Pliocene sands would be outcropping or close to the surface. A minimum thickness of Quaternary overburden combined with recognition of the Tertiary barrier morphology indicates that these sites should provide potentially economic localities for heavy mineral exploration.

Within the Parilla landscape four separate landform units were recognised and mapped. These are listed below in Table 1. Since a significant portion of the lease is covered by varying thicknesses of Quaternary sands, much of the mapping was

directed towards identification of dune types. It was considered that variations in dune morphology may be related to Molineaux cover sand thickness and therefore the depth to Parilla Sand. Two major and one minor type of dune were recognised. Major dune types covered large areas of the lease while the minor variety was restricted to smaller, less continuous patches. The dune types are listed in Table 2 in the suspected order of increasing cover sand thickness.

The landform units described (Tables 1,2) were initially mapped onto the aerial photographs at a scale of 1:40 000. Geomorphic boundaries were then traced directly onto overlay strip maps which had been enlarged to the same scale as the photographs. This allowed mapped boundaries to be located accurately in relation to roads, buildings and the contour pattern. The base map was then checked and amended during the field verification phase of the survey. The field corrected map is shown in Figure 9, sheets i, ii and iii.

4.23 Phase 3: Field Verification

A detailed programme of field verification and reconnaisance sampling over the exploration lease was conducted from the 14/10/88 to the 26/10/88. This was undertaken to check the correspondence between geomorphic units mapped off the aerial photographs, and described in the previous section, and their landform and sedimentary signatures in the field.

The stratigraphic units present in the EL were investigated employing stratigraphic relationships observed in the sidewalls of quarries, pits and roadcuttings (Plates 1 and 2). Sediments in these exposures were correlated with the stratigraphic units of the Quaternary and Pliocene sediments described on the Pinnaroo and Naracoorte 1: 250 000 geological sheets. Heavy minerals were found to be present in the storm runnels in some of these quarries (Plate 6).

TABLE 1.

Areas of Pliocene Sand.

TP: Areas with very little or no Quaternary sand cover are thought to represent Pliocene sands overlain by varying thicknesses of late Quaternary clays (Plates 1 and 2).

TP1: Areas of TP with a minimum cover of Quaternary sands. These sands tend to occur as thin sheets or non-continuous sub-longitudinal parabolic dunes (Plate 3).

TPR: Elongate NNW-SSE trending ridges thought to represent stranded Pliocene barriers.

TPV: Interbarrier depressions separating the NNW-SSE ridges of TPR.

TABLE 2

Dune types recognised within the lease

P1: Sub-longitudinal and elongate long walled parabolic dunes (major) (Plate 4).

P2: Small fish scale parabolic dunes (minor).

P3: Imbricate massive parabolic dunes (major) (Plate 5).

Extensive road traversing and augering (hand and power) was carried out to test the consistency of the mapping units and the accuracy of the mapped boundaries. A total of 44 sites were sampled in which the thickness of Quaternary sand, late Quaternary clay and depth to Pliocene sand was recorded. The results of this field testing and a summary of the stratigraphy are presented in Appendix I. The locations of sample sites are shown on the 1:40 000 geomorphic map (Figure 9, sheets i, ii and iii).

In general, field verification supported the geomorphic mapping. There was a high degree of correlation between the mapping units and the stratigraphic thicknesses at sites within the same landscape unit. In the majority of cases the dune types listed in Table 2 were thickest for P3 dunes and thinnest for P1 dunes. However, in some cases (eg. Sample Site 30) the cover sands are deeper than they appear on the aerial photographs. This may be because the dunes infilled former topographic depressions, swales or valleys with considerable quantities of sand.

Field checking of areas mapped as Parilla Sand (TP) and Parilla Sand with minimal Quaternary cover (TP1) showed that Quaternary clays and Pliocene sands could only be diffferentiated in the field. For this reason, these two stratigraphic units have to be considered as a single complex mapping unit during air photo interpretation. Consequently, the general thickness and topographic variability of the Quaternary clay was determined from exposures and augering.

4.24 Phase 4: Drilling Program

The drilling program has been designed:

* to test the accuracy of the geological model discussed in the Third Quarterly Report (Charlesworth and Hesp, 1988)
* to verify the stratigraphy, and
* to sample the Parilla Sand for concentrations of heavy mineral sands.

The first stage of stratigraphic drilling will be conducted along two transects, traversing two Pliocene barrier ridges and the intervening interbarrier depressions (Figure 10). The spacing between the drill holes will vary according to their position on the barrier ridge. Holes on the seaward side of the ridge will be drilled on an 80m spacing; those on the back of ridges on a 160m spacing.

Continuous sampling over two metre intervals has been proposed, with each sample being split twice. One sample will be sent to the laboratory for analysis; the second to the SADME Core Library; the third will be kept by the Joint Venture for reference and the fourth will be used in the field for logging and panning.

Wallis Drilling Pty. Ltd. have been retained as the drilling contractor. They intend to use an NQ reverse circulation air core drill rig. Approximately 800-1000 metres of drilling have been contracted.

5.0 EXPENDITURE

Administrative Overheads		
Expenses related to Joint Venture Meeting	$1,600.00	
General office overheads	$1,226.58	
		$2,826.58
Travel and Accommodation		
Total travel and accommodation 3/10/88 - 1/12/88		$6,423.25
Vehicle Expenses		
Leasing costs of 4WD Toyota	$1,882.16	
Fuel costs	$1,155.00	
Service costs	$175.00	
		$3,212.16
Consultants/Professional Staff		
Professional staff 3 Geologists	$17,230.00	
Consultants P.H. Stitt & Associates	$5,611.64	
Consultant Dr P. Hesp	$3,351.24	
Consultant O.J.W. Bowering	$702.00	
Supervision of Professional Staff (R. Creelman)	$7,500.00	
		$34,394.88
Field Equipment/Expenses		
Hire of Gemco Drilling Rig	$2,000.00	
Bits for Gemco Rig	$1,056.33	
Topographic Maps	$46.08	
Field Supplies	$2,219.40	
		$5,321.81
Services/Field Support		
Plan Printing/Draughting	$546.29	
Courier Charges	$83.40	
Micromine Servicing & Update to handle bore hole data (Computing)	$3,875.00	
		$4,504.69
Total for Quarter		$56,683.37

Note: Drilling expenses were incurred in the latter part of the period, but these charges will be listed as part of the final report due in February 1989.

6.0 REFERENCE

Bluck, R.C. 1987, First Quarterly Report, Exploration Licence 1425. **(Unpublished)**

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Creelman, R.A. 1988, Fourth Quarterly Report, Exploration Licence 1425. **(Unpublished)**

Geological Survey of South Australia, 1969, SJ 54-2 Naracoorte 1:250 00 Geological Sheet.

- 1979, SJ 54-14 Pinnaroo 1:250 000 Geological Sheet.

PLATE 1.

Sediments exposed in a quarry at site (27) with Quaternary clays (red) overlying the yellow-white mottled Pliocene (Parilla) sands.

PLATE 2.

A thick sequency of quatenary clays overlying Parilla Sand at site (28).

PLATE 3.

An area mapped as TP1 with non-continuous sub-longitudinal parabolic dunes overlying late Quaternary clays and Pliocene sands.

PLATE 4.

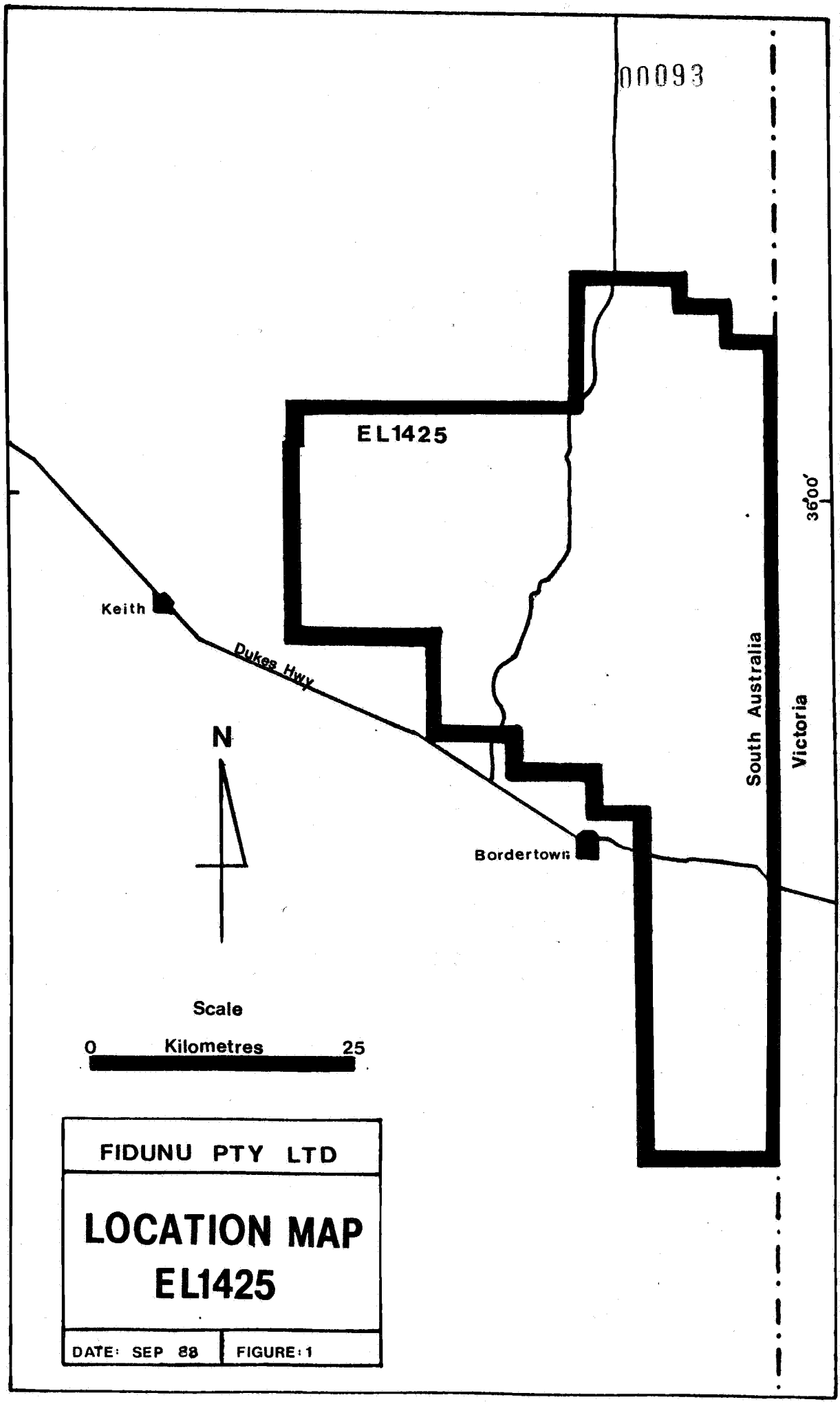
The geomorphic mapping unit P1 showing sub-longitudinal elongate long walled parabolic dune.

PLATE 5.

An imbricate massive P3 parabolic dune.

PLATE 6.

A trace of heavy minerals concentrated in storm runoff rills in a quarry at site (28).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EL1425
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Dukes Hwy
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Bordertown
South Australia
Victoria
Scale
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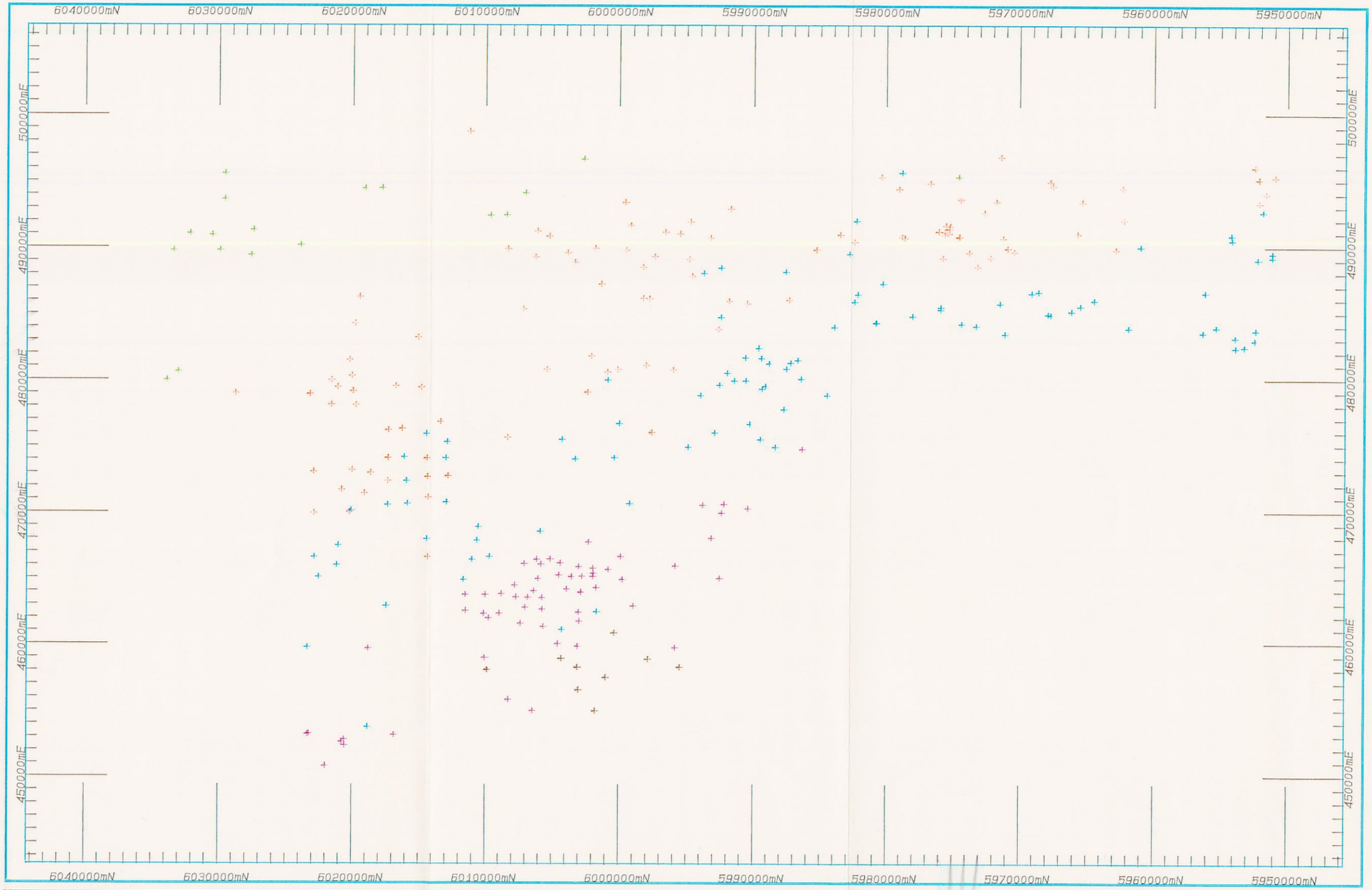
LOCATION MAP
EL1425
DATE: SEP 88
FIGURE: 1



NOTES :
Collar locations colour coded by R.L. See key.

KEY (metres ASL)
40.0 → 60.0
60.1 → 80.0
80.1 → 100.0
100.1 → 120.0
120.1 → 200.0

SCALE	DATE	SHEET
1: 300000	07/12/88	1 of 1
	REF No. VDISP2	

0 15000m

Fig 2: EL 1425
LOCATION OF WATER BORE COLLARS

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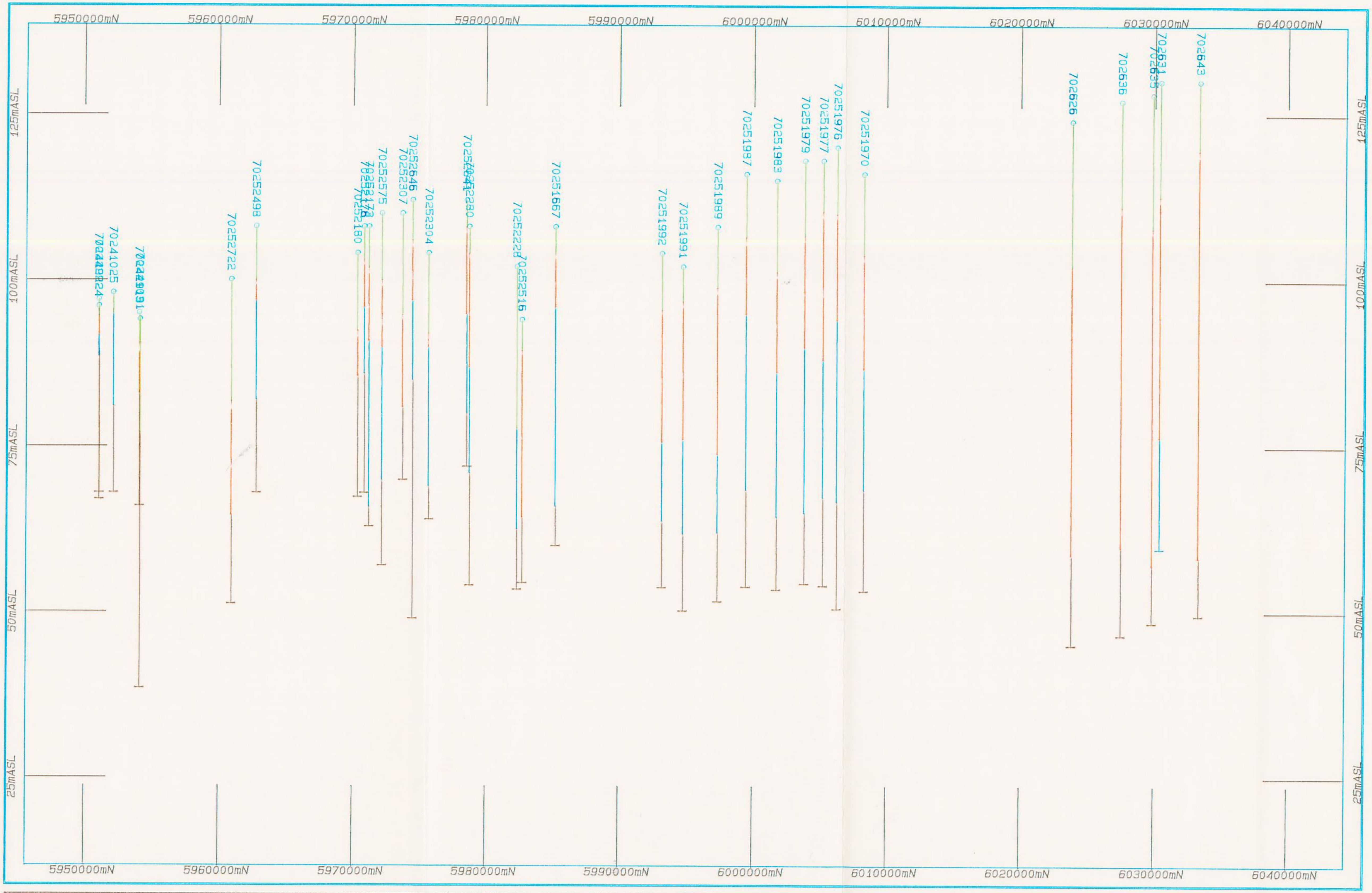
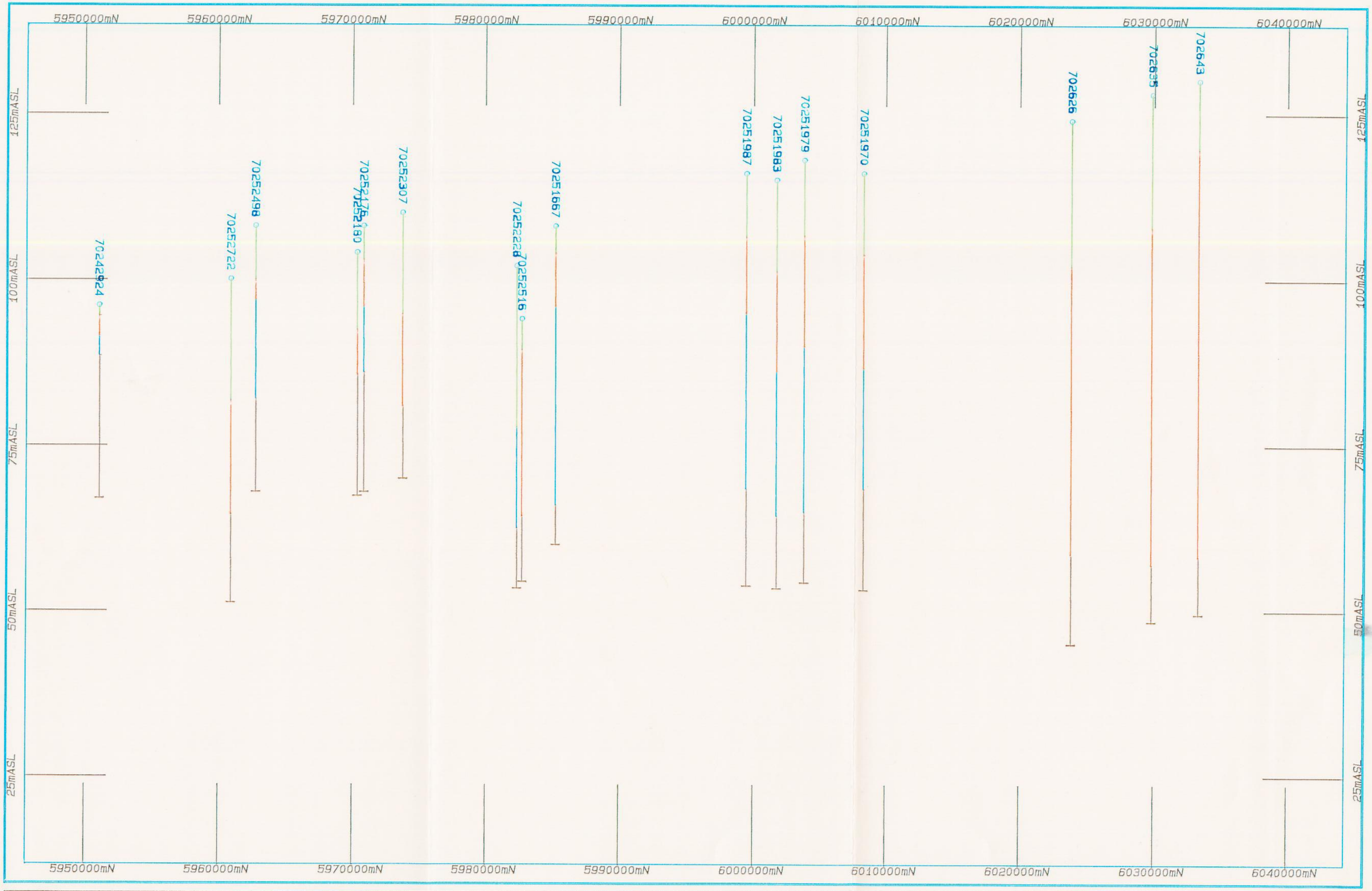


NOTES : Window 1000 metres either side of section	KEY: Undifferentiated Quaternary; Parilla Sand, Parilla/Loxton; Loxton Sands; Undifferentiated Limestone	XSCALE 1: 300000 YSCALE 1: 600	DATE 16/09/88 REF No. OSECT2	SHEET 1 of 1

Fig 3: EL 1425
CROSS-SECTION ALONG
490000E

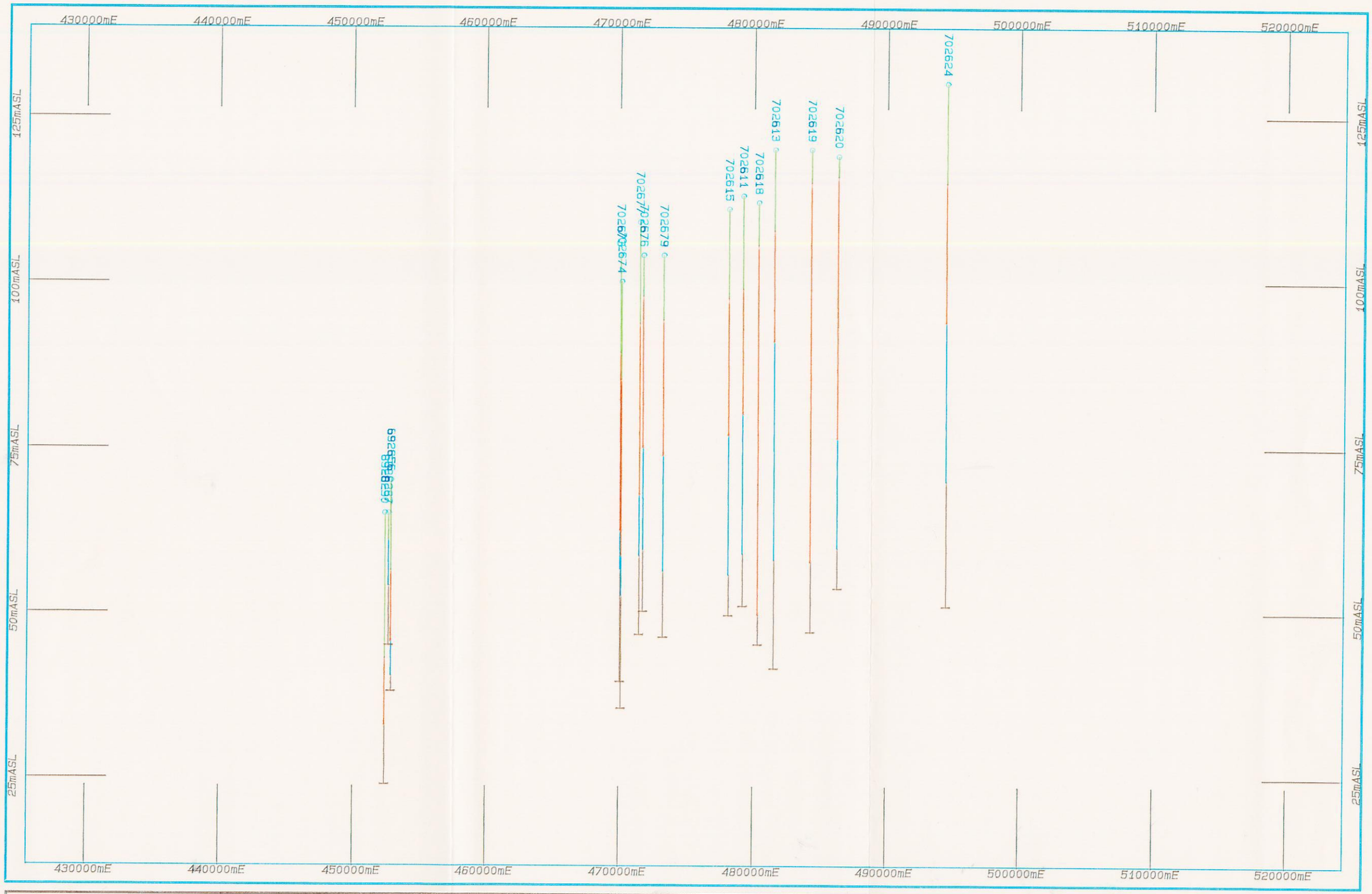
FIDUNU PTY LTD



NOTES :	KEY	XSCALE 1: 300000	DATE 16 SEP 88	SHEET 1 of 1
Window 500 metres either side of section	Undifferentiated Quaternary Parilla Sand, Parilla/Loxton Loxton Sands Undifferentiated Limestone	YSCALE 1: 600	REF No. OSECT3	

Fig 4: EL 1425
CROSS-SECTION ALONG
490000E

FIDUNU PTY LTD



NOTES :
Window 1000 metres either side of section

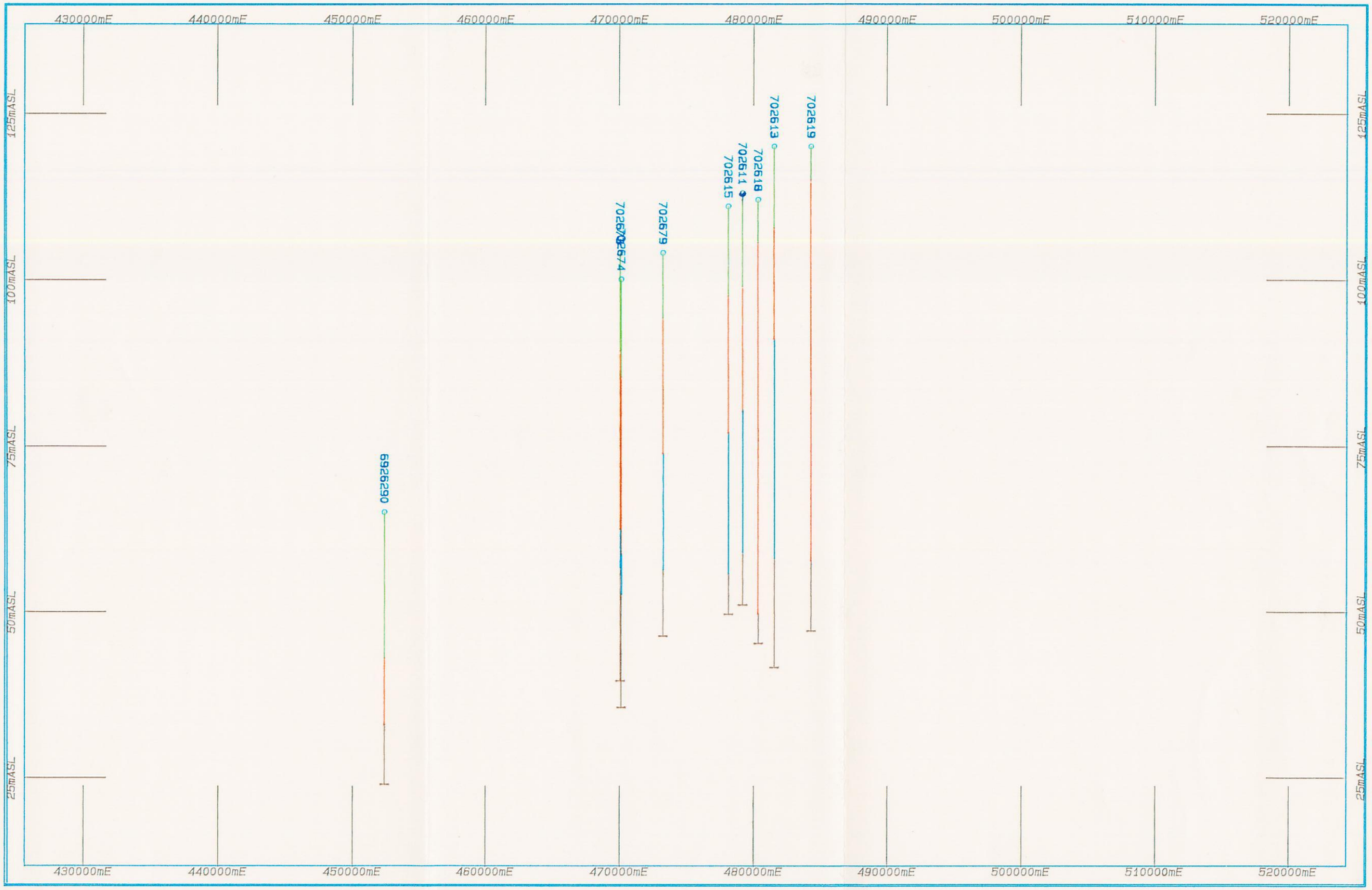
KEY
Undifferentiated Quaternary
Parilla Sand, Parilla/Loxton
Loxton Sands
Undifferentiated Limestone

XSCALE 1: 300000	DATE 16/09/88	SHEET 1 of 1
YSCALE 1: 600	REF No. OSECT11E	

Fig 5: EL 1425
CROSS SECTION ALONG
6020000N

FIDUNU PTY LTD

00098



	NOTES : Window 500 metres either side of section	KEY Undifferentiated Quaternary Parilla Sand. Parilla/Loxton Loxton Sands Undifferentiated Limestone	XSCALE 1: 300000 YSCALE 1: 600	DATE 19/09/88 REF No. DSECT14N	SHEET 1 of 1	Fig 6: EL 1425 CROSS SECTION ALONG 6020000N	FIDUNU PTY LTD

NOTES :
Search Window for data circle radius 5000m.

Contour inteval 5m.

THICKNESS (metres)
0.0 - 5.0
5.1 - 10.0
10.1 - 20.0
20.1 - 30.0
30.1 - 40.0
40.1 - 100.0

SCALE	DATE	SHEET
1:300000	15/09/88	1 of 1
	REF No. CDISP16	

0 15000m

Fig 7: EL 1425
ISOPACH MAP OF PARILLA SAND

FIDUNU PTY LTD

NOTES :
Search Window for data circle radius 3000m.

Contour inteval 2m.

THICKNESS (metres)
0.0 - 5.0
5.1 - 10.0
10.1 - 20.0
20.1 - 30.0
30.1 - 40.0
40.1 - 100.0

SCALE	DATE	SHEET
1: 300000	19/09/88	1 of 1
	REF No. CDISP15	

0 15000m

Fig 8: EL 1425
ISOPACH MAP OF
UNDIFFERENTIATED
QUATERNARY SEDIMENTS

FIDUNU PTY LTD

00101

PINNAROO 128 km

VE WE

TELOPEA DOWNS HS 27 km

FIGURE 10: PROPOSED LOCATIONS OF STRATIGRAPHIC DRILL LINES

APPENDIX 1

STRATIGRAPHIC DESCRIPTIONS FROM FIELD CHECKING

Site Number	Sample Type	Grid Reference	Depth (Metres)	Stratigraphic Unit	Soil Landscape Unit Maped
1	Quarry	04893E 60315N	0 - 2.0	Fine, well sorted yellow sands (Molineaux)	P3
			2.0 - 2.9	Mottled red/brown sandy clay Quaternary	
2	Quarry	04772E 60237N	0 - 0.8	Fine yellow sands (Molineaux)	TP
			0.8 - 5.0	Pliocene sands (Parilla)	
3	Auger	04774E 60212N	0 - 2.0	Sand (Molineaux)	P3
			2.0 - 2.4	Quaternary clays	
4	Auger	04774E 60205N	0 - 0.2	Sand (Molineaux)	P3
			0.2 - 0.4	Quaternary clays	
5	Auger	04774E 60199N	0 - 6.5	Fine yellow sand (Molineaux)	P3
			6.5 - 7.0	Red yellow sands (Parilla)	
6	Auger	04774E 60193N	0 - 0.5	Quaternary clay	TP1
7	Auger	04732E	0 - 1.5	Fine, well sorted yellow sand (Molineaux)	
			1.5 - 1.75	Plastic brown clay (Quaternary)	
8	Auger	04669E 60184N	0 - 0.2	Clay sand (Quaternary)	TP
9	Auger	04620E 60175N	0 - 1.0	Molineaux sand	TP1
			1.0 - 1.5	Red yellow mottled medium sand (Parilla)	
10	Auger	04572E 60065N	0 - 0.3	Molineaux sand	TP1
			0.3 - 0.7	Brown sandy clay (Quaternary)	
11	Auger	04539E 60079N	0 - 0.3	Molineaux Sand	TP1
			0.3 - 0.7	Parilla Sand	
12	Auger	04539E 60076N	0 - 0.3	Molineaux Sand	Edge of a barrier
			0.3 - 0.5	Red brown sandy clay (Quaternary)	
13	Power Auger	04522E 60077N	0 - 0.3	Molineaux Sand	Interbarrier depression
			0.3 - 0.7	Clayey sand (Quaternary)	
14	Quarry	04514E	0 - 2.4	Calcareous sand with calcrete clasts (Quaternary)	Barrier
15	Power Auger	04599E 60077N	0 - 0.2	Molineaux Sand	P1
			0.2 - 0.4	Sandy clay (Quaternary)	

33 Auger
6 Power
27 Hand

Site Number	Sample Type	Grid Reference	Depth (Metres)	Stratigraphic Unit	Soil Landscape Unit Maped
16	Power Auger	04628E 60074N	0 - 0.2	Fine, well sorted yellow sand (Molineaux)	Boundary TP1/P1
			0.2 - 0.3	Red clay sand (Parilla)	
17	Auger	04723E 60078N	0 - 6.0	Sand (Molineaux)	P3
			6.0 - 6.9	Blue grey clay sand	
			6.9 - 7.1	Mottled yellow red sand (Parilla)	
18	Blow out	04764E 60068N	-	Blow out in Molineaux Sand, exposing Pliocene sand (Parilla)	Deflation basin in P1
19	Auger	04808E 60052N	0 - 3.5	Sand (Molineaux)	P3
			3.5 - 4.0	Pliocene sand (Parilla)	
20	Road cutting	04808E 60009N	0 - 1.5	Sand (Molineaux)	P1
			1.5 - 2.5	Pliocene sand (Parilla)	
21	Auger	04807E 59964N	0 - 0.3	Sand (Molineaux)	Boundary TP/P1
			0.3 - 0.4	Harsh texture brown sandy clay (Quaternary)	
22	Auger	04808E 59936N	0 - 1.0	Sandy clay (Quaternary)	TP
23	Auger	04807E 59927N	0 - 0.3	Sand (Molineaux)	TP1
			0.3 - 0.8	Pliocene sand (Parilla)	
24	Auger	04805E 59908N	0 - 2.5	Sand (Molineaux)	P1
			2.5 - 2.7	Yellow clayey sand (Quaternary)	
25	Road cutting	04886E 59804N	0 - 1.5	Quaternary clay	TPR
			1.5 - 1.6	Iron indurated Pliocene sand (Parilla)	
26	Power Auger	04848E 59825N	0 - 0.3	Sand (Molineaux)	TPV
			0.3 - 5.0	Calcareous sandy clay (Loveday Soil?)	
			5.0 - 5.2	Fine sandy clay	
27	Quarry	04886E 59838N	0 - 0.8	Sand (Molineaux)	TPR
			0.8 - 4.0	Pliocene sand (Parilla)	
28	Quarry	04920E 59828N	0 - 0.4	Sand (Molineaux)	TPV/TPR
			0.4 - 0.7	Grey sandy clay (Quaternary)	
			0.7 - 1.0	Iron cemeted sands (top of Parilla)	
			1.0 - 3.9	Well sorted grey and orange quartz sands (Parilla)	
29	Auger	04937E	0 - 0.8	Red brown sandy clay (Quaternary)	TP
30	Power Auger	04799E 60007N	0 - 10.0	Fine, well sorted sand (Molineaux)	P3

Site Number	Sample Type	Grid Reference	Depth (Metres)	Stratigraphic Unit	Soil Landscape Unit Mapped
31	Power Auger	04494E 60035N	0 - 3.0	Heavy plastic brown clay (Quaternary)	Interbarrier depression
32	Power Auger	04919E 59828N	0 - 1.0 1.0 - 4.0 4.0 - 5.6	Brown Clay (Quaternary) Red brown clayey sand (Quaternary) Sandy clay (Quaternary?)	TPV
33	Road cutting	04793E 60084N	0 - 4.0	Yellow orange clay sand	Barrier
34	Auger	04797E 60086N	0 - 4.2 4.2 - 6.5	Fine, well sorted sand (Molineaux) Mottled pale orange sand (Parilla?)	Barrier
35	Road cutting	04514E 60115N	0 - 2.0 2.0 - 3.2	Sand (Molineaux) Planar calcrete (Bakara Soil?)	Barrier
36	Auger	04532E 60138N	0 - 0.1 0.1 - 0.5	Sand (Molineaux) Red yellow mottled clayey sand	P1
37	Auger	04620E 60185N	0 - 4.5 4.5 - 4.75	Sand (Molineaux) Yellow sandy clay (Quaternary)	P3
38	Auger	04903E 59520N	0 - 0.5 0.5 - 1.5	Sand (Molineaux) Red mottled clay sand	P1
39	Auger	04921E 59529N	0 - 0.5 0.5 - 0.7	Sand (Molineaux) Red brown clay (Quaternary)	P1
40	Auger	04945E 59532N	0 - 1.2 1.2 - 1.4	Molineaux Sand Clayey sand	Boundary TP & P3
41	Road cutting	04637E 59558N	0 - 2.0 2.0 - 2.7	Molineaux Sand Yellow brown sandy clay (Quaternary)	Pi3
42	Auger	04957E	0 - 0.3	Hard set blocky clay (Pliocene)	TP1
43	Auger	04882E 59813N	0 - 3.0 3.0 - 3.2	Brown plastic sandy clay (Quateernary) Pliocene sand (Parilla)	TPR
44	Auger	04352E 60245N	0 - 2.0	Molineaux sand	P2

SIXTH QUARTERLY REPORT - EL 1425

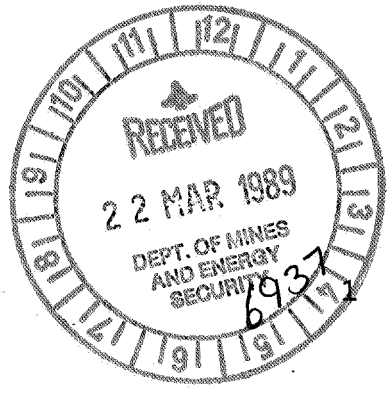
21 November, 1988 - 21 February, 1989

Prepared for:

Burmine Ltd.

R.A. Creelman

March, 1989.



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8.0 PARTIAL RELINQUISHMENT OF EL 1425

9.0 EXPENDITURES

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1.0 CONCLUSIONS

1. The drilling programme has demonstrated the presence of heavy minerals in Pliocene sand ridges of the Parilla Sand on EL 1425.

2. The dunes drilled had the marine/beach facies at a depth beyond that which is economic for the grades encountered.

3. The marine/ beach facies is thin at these sites and, in part, covered by ferricrete development.

4. In general, the model of beach/dune development guiding the exploration is valid.

2.0 RECOMMENDATIONS

1. As the site of heavy minerals is the beach/marine facies, effort will be made to identify this sequence in outcrop or to identify, from knowledge of the basement, areas where this sequence is thicker.

2. There needs to be special attention given to the sampling crews to increase their ability to visually estimate the grade from panning. One more important change will be that samples will be dried and homogenised before panning. The grab sample does not appear to be representative.

3.0 INTRODUCTION

Exploration in this quarter investigated the stratigraphic boundaries, the sediment layer relationships and the potential for heavy mineral accumulation across two Pliocene Sand ridges in EL 1425. The stratigraphy was sampled using an NQ. reverse circulation drill, with the relative concentrations of heavy minerals determined by panning. Selective assaying and heavy mineral analysis was then used to clarify the relationship between the field estimates (as seen in the pan) and the actual grades of mineralisation. The stratigraphic trends in the heavy mineral concentration were then used to refine the model of heavy mineral concentration, and to assess the potential for further drilling and exploration in this portion of the Murray Basin.

4.0 DRILLING

4.1 Location of Drilling

The drilling program was designed to identify the vertical and lateral distribution of sediments and heavy minerals across two Pliocene sand ridges. The ridges selected for sampling were located to the east of Bordertown (Figure 1). They were characterised by a well developed ridge morphology, the absence of Quaternary sand cover and a NW/SE orientation. The drill lines crossed the ridges and the inter-ridge depressions perpendicular to their long axes. The locations of the drill lines are shown in Figure 2. Sample sites were spaced at 160m intervals.

4.2 Drilling Procedure

Drilling commenced on November 21, 1988 and concluded on November 24, 1988. Wallis Drilling Pty. Ltd. were contracted and used an NQ reverse circulation air core technique. Twenty-two holes totaling 794 meters were drilled, with most holes being sunk to the limestone basement.

Sampling was conducted continuously at 2 meter intervals. When dry, the sediments could be recovered and split in the field. The split portions were weighed to give an estimate of recovery. The recoveries were in close agreement with theoretical estimates. Due to the damp and clayey nature of the majority of sediments it was necessary to inject water during drilling. The wet samples could not be split in the field. The entire sample was bagged and transported to a nearby farm for air drying prior to splitting.

All samples were logged and panned in the field. Reference samples were collected in small plastic trays for use in the office. Examination of the drill logs has allowed the stratigraphy to be subdivided into four distinct lithologic units on the basis of grain size and degree of sorting. (Table 1)

TABLE 1 Lithologic Units

UNIT	CHARACTERISTICS
1. Silty clays and /or clayey silt	Contains Fe-stone fragments. Colour variable (Brown, grey, red, red-brown, yellow).
2. Mixed quartz sands	Fine to coarse grained quartz sand. Poorly to well sorted, subangular to rounded. May contain silty and/or clayey material; becoming micaceous with depth. Colour variable (Brown, grey, yellow, grey-brown, red-brown, yellow-brown, orange-brown or red-orange). Fe-stone may be present.
3. Fine quartz sands	Very fine grained quartz sand with clayey silt or silty clay. Well sorted, subangular to rounded. Micaceous. Some lithic grains are present. Colour variable (Grey, greyish-brown, reddish-brown, yellow-brown, brown, orange.)
4. Basement	Brown calcareous quartz sandstone. Sandy bryozoal limestone. Cream bryozoal limestone. Some unconsolidated fossiliferous calcareous sand and/or sandstone.

5.0 SAMPLING

The choice of samples to be assayed was based on the visual estimates of heavy minerals obtained by field panning. The samples with the highest estimated values, along with six other control samples, were sent to Amdel Ltd. for processing. In total, 52 samples from drill lines 1 and 2 were analysed to determine the abundance of heavy minerals expressed as a weight percent. The relative proportions of the constituent heavy mineral suites were then determined for the 6 samples with the highest heavy mineral concentrations. These results are summarized in Table 2. The weight percents for all samples assayed are listed in Appendix 1.

6.0 OBSERVATIONS ON HEAVY MINERAL DISTRIBUTION

The distribution of heavy minerals intersected by drill holes along lines 1 and 2 are shown on the cross sections of Figures 3 and 4. The following features of their distribution relate to these diagrams:

1. The heavy minerals are mainly concentrated at the seaward facing (southwestern) base of the dune front. Lower concentrations, situated towards the back of the ridges, may be the result of deposition in the early stages of beach ridge formation, deposited before the development of substantial relief. Alternatively, these low concentrations may be the result of wind action, however, this is less likely.

2. The best heavy mineral grades occur where the basement is relatively flat, and a layer of ferricrete has developed on top (see stratigraphic cross sections of Figures 3&4).

3. The units containing the most heavy minerals tend to be convex in cross-section and have a lateral extent of approximately 0.5km, with a variable thickness from 5.0-20.0m (see Figure 3). This is relatively thin if it represents a marine beach facies.

4. The most prospective heavy mineral grades are situated in the sandy layer above the calcareous sandstone base, which is certainly a marine facies (Figures 3&4).

These observations generally conform with the geological model proposed by Charlesworth and Hesp in 1988 which states:

Placer heavy mineral deposits in these environments are typically lenticular in cross-section, with a large lateral extent (up to a few kilometres) and a variable thickness (1-10's of meter).

The drilling results verify this geological model which may now be used, with greater confidence, in the selection of target areas for future heavy mineral exploration.

7.0 DISCUSSION OF ASSAY RESULTS

The results from the heavy mineral assays (presented in table 2) are significant since the results conform with the previously recorded high values of 1.2%, for the Victorian Murray Basin (Colwell,1979). This suggests that suitable sedimentary processes for heavy mineral accumulation were operative during the formation of the two sampled Pliocene ridges.

A difficulty associated with the location of significant heavy mineral concentrations is that they occur within the fine sandy lithological unit, which stratigraphically overlies the calcareous sandstone basement, at substantial depths in the barrier sequence. (Figures 3A,3B,4A&4B) Consequently, the cost involved in the excavation of the increased thickness of overburden will raise the cost of mineral sand production.

The proportions of heavy minerals listed in table 1 indicates that the weight percent of the economically significant minerals rutile, zircon, ilmenite and monazite are rarely above trace values. An example of this is shown in sample 1/160 which contains 3.04 wt % heavy minerals. 75% of this is goethite, 2.0% is leucoxene, 1.0% is zircon, there is only a trace of ilmenite, while rutile and monazite are absent. The other heavy mineral weight percentages comprise 10.0-50.0% goethite, trace-5.0% magnetite, trace to 30% ilmenite, 2.0-20.0% leucoxene, 1.0-6.0% rutile, 1.0-32.0% zircon, and traces of monazite.

The results of the exploration to date have demonstrated that suitable mechanisms for the concentration of heavy minerals existed towards the base of the sampled Pliocene sand unit. The high proportion of non-prospective heavy minerals, such as goethite, magnetite and varying amounts of mica and sillimanite, may indicate that the source lithology was not rich in economic heavy minerals. Another interpretation suggests that the time or coastal processes necessary for hydraulic separation of the economic heavy mineral fraction was not achieved.

It must be noted that these interpretations are based on a limited number of assay results derived from samples crossing two ridges in a small portion of EL 1425. Further sampling is required to determine if this is a widespread or isolated phenomenon.

A potential problem is the occurrence of ferricrete. Fine iron oxides will increase the assay grade. A number of assays in

this programme were >10%, but on numerological analysis were up to 70% iron oxides. It would appear that careful panning will eliminate this problem. It is also necessary for the sample crews to be more accurate in their estimation of the heavy mineral grade from panning.

8.0 PARTIAL RELINQUISHMENT OF EL 1425

In mid-January 1989, a decision was made to relinquish a portion of EL 1425. This decision was based upon previous findings, and the thickness of the Quaternary cover (summary report, Creelman, 1989). The lease, which previously covered an area of approximately 2175 square kilometres, has been reduced to 1325 square kilometres. The new boundaries are shown in Figure 5.

Presently, there has been no notification of approval of the relinquishment application.

9.0 EXPENDITURES

Administrative Overheads

Expenses related to Joint venture meetings, communication of data.	$ 616.20	
General office overheads	$ 1081.10	
		$ 1697.30

Travel and Accomodation

Jan - Feb 1989	$ 1495.04	
		$ 1495.04

Vehicle Expenses

Leasing costs	$ 909.48	
Fuel	$ 203.00	
		$ 1112.48

Consultants/Professional Staff

Professional Staff	$ 6750.00	
		$ 6750.00

Drilling and Assaying

Wallis Drilling	$14219.00	
AMDEL, assaying	$ 4095.00	
		$18314.00

Field Equipment

Field consumables, total	$ 1523.80	
		$ 1523.80

Total for Quarter	$30,892.62

10.0 REFERENCES

Charlesworth, C. and Hesp, P. 1988, Third Quarterly Report, Exploration Licence 1425, Unpublished.

Colwell, J.B. 1979, Heavy minerals in the late Cainozoic sediments of Southeastern South Australia and Western Victoria. BMR Journal of Australian Geology and Geophysics, 4, 83-97.

Creelman, R.A. 1989, Summary Report Exploration Licence 1425, Unpublished.

11.0 LIST OF FIGURES

Figure 1. Location Map of EL 1425

Figure 2. Location of Drill Lines 1 and 2

Figure 3. Topograghic Surface, Geological Interpretation and Heavy Mineral Concentrations Along Drill Line 1

Figure 4. Topographic Surface, Geological Interpretation and Heavy Mineral Concentrations Along Drill Line 2

Figure 5. Relinquish areas of EL 1425

12.0 LIST OF TABLES

Table 1. Lithological Units

Table 2. Mineralogy of the high weight % heavy mineral concentrations.

APPENDIX

APPENDIX 1 Weight % heavy minerals.

TABLE 2 Mineralogy of the high weight % heavy mineral concentrations

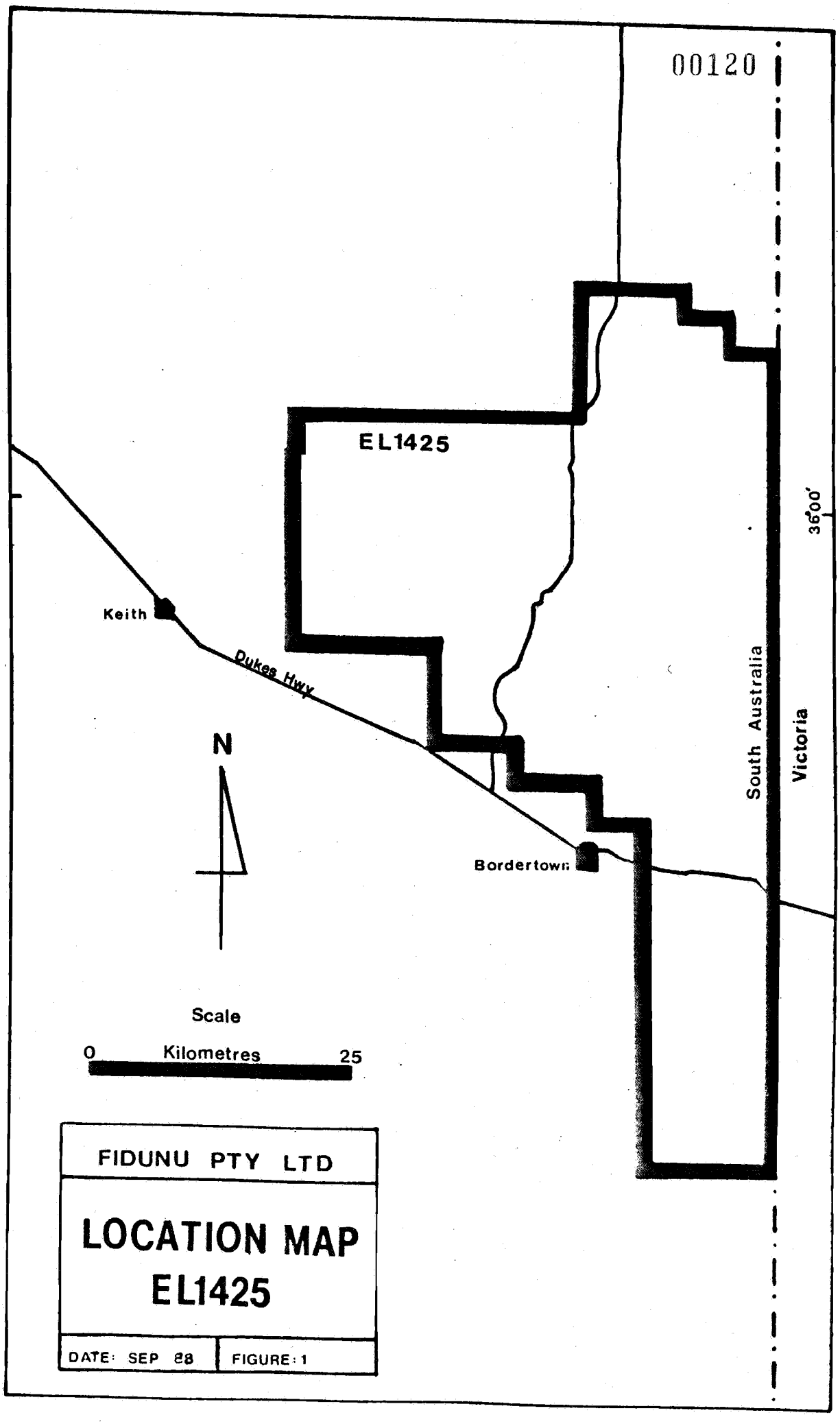
Sample No.	1/160	1/160	2/640	2/640	1/480	2/1200
Depth (m)	20–22	22–24	34–36	36–38	4–6	16–18
Wt. % Heavies	2.42	3.04	0.69	0.88	0.92	1.00
Goethite	70	75	10	10	75	50
Magnetite	–	–	5	3	Tr	4
Imenite	Tr	Tr	25	30	2	15
Leucoxene	5	2	8	20	5	4
Rutile	2	–	6	3	1	2
Zircon	2	1	32	12	3	10
Monazite	–	–	Tr	Tr	–	–
Others	21	22	14	22	4	15

Others consists of varying amounts of tourmaline, mica, Fe stained quartz?, sillimanite, etc..

APPENDIX 1 : Weight % heavy minerals

Sample Number	Depth (m)	Weight % heavies
1/00	2–4	0.28
1/00	16–18	1.63
1/00	18–20	0.75
1/160	4–6	0.06
1/160	8–10	0.23
1.160	10–12	0.19
1/160	16–18	0.10
1/160	18–20	0.53
1/160	20–22	2.42
1/160	22–24	3.04
1/320	2–4	0.17
1/320	6–8	0.13
1/320	8–10	0.12
1/320	10–12	0.25
1/320	14–16	0.19
1/320	18–20	0.07
1/320	22–24	0.81
1/320	24–26	0.20
1/320	26–28	0.25
1/480	4–6	0.92
1/480	22–24	0.16
1/630	10–12	0.13
1/630	16–18	0.18
1/630	18–20	0.17
1/630	20–22	0.18

1/630	22-24	0.20
1/630	24-26	0.20
1/630	26-28	0.14
1/1270	18-20	0.37
1/1270	20-22	0.51
1/1270	36-38	0.68
1/1440	34-36	0.76
2/1200	16-18	1.00
2/1200	18-20	0.45
2/960	32-34	0.62
2/960	34-36	0.43
2/960	36-38	0.41
2/880	28-30	0.95
2/880	32-34	0.50
2/880	34-36	0.48
2/880	38-40	0.24
2/720	12-14	0.60
2/640	12-14	0.32
2/640	24-26	0.08
2/640	34-36	0.69
2/640	36-38	0.88
2/480	20-22	0.18
2/480	22-24	0.01
2/160	8-10	0.14
2/160	10-12	0.18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LOCATION MAP
EL1425
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FIGURE: 1

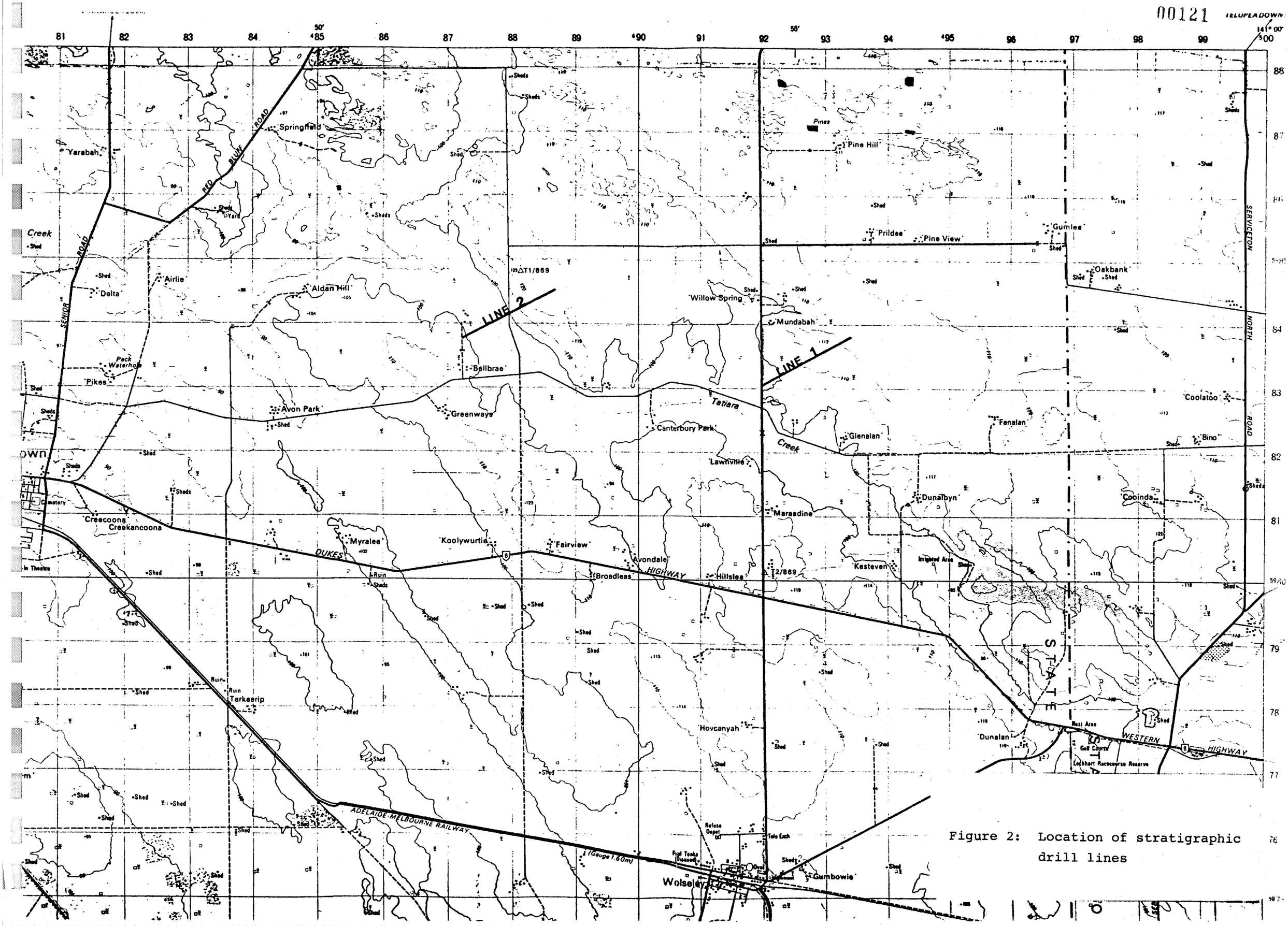
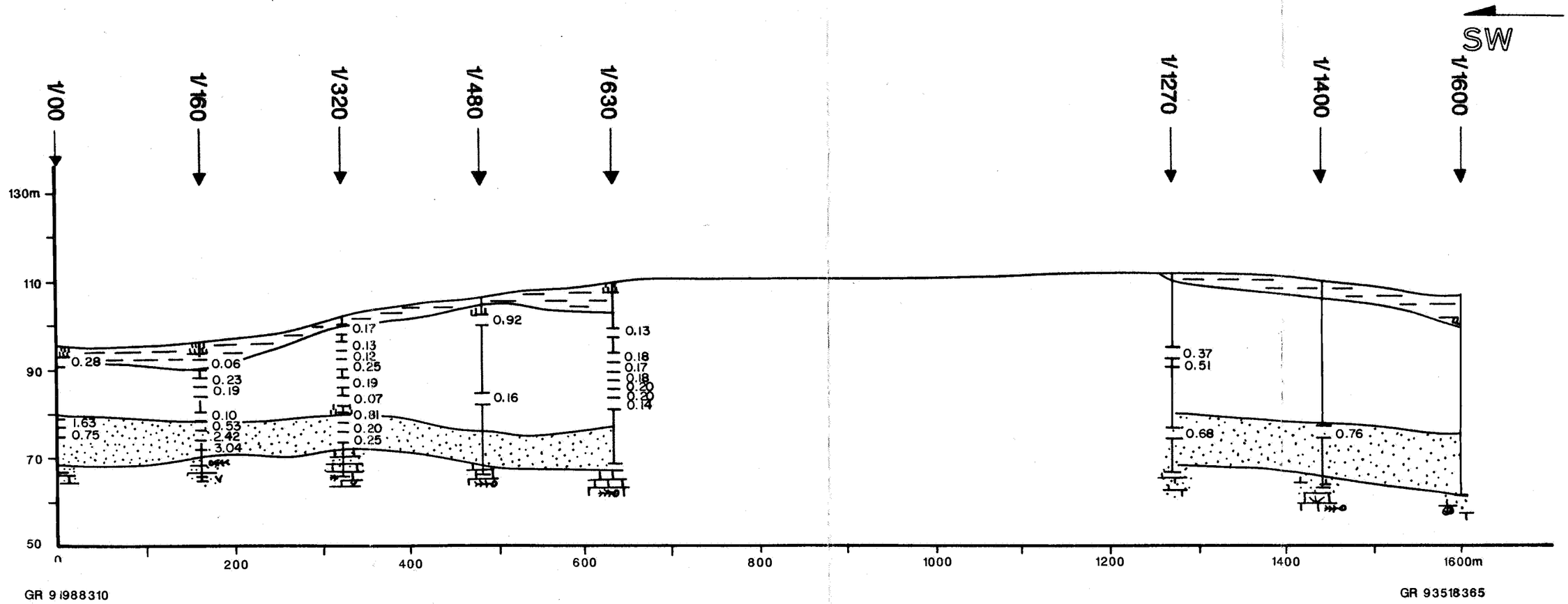


Figure 2: Location of stratigraphic drill lines

TOPOGRAPHIC SURFACE AND ESTIMATES
OF HEAVY MINERAL CONCENTRATIONS
FROM DRILL HOLES ALONG LINE I
TATIARA 1:50 000 TOPOGRAPHIC MAP
SOUTH AUSTRALIA - FIGURE 3



TOPOGRAPHIC SURFACE AND ESTIMATES OF HEAVY MINERAL CONCENTRATIONS FROM DRILL HOLES ALONG LINE 2 TATIARA 1:50 000 TOPOGRAPHIC MAP SOUTH AUSTRALIA - FIGURE 4

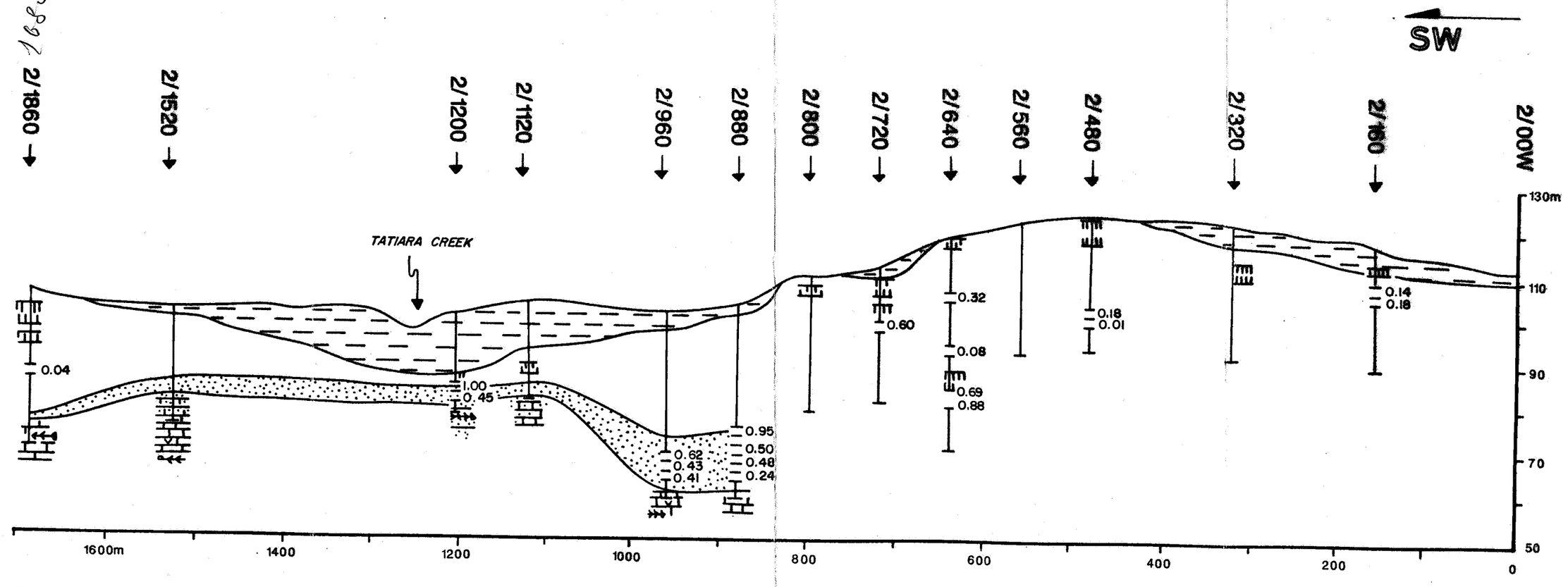
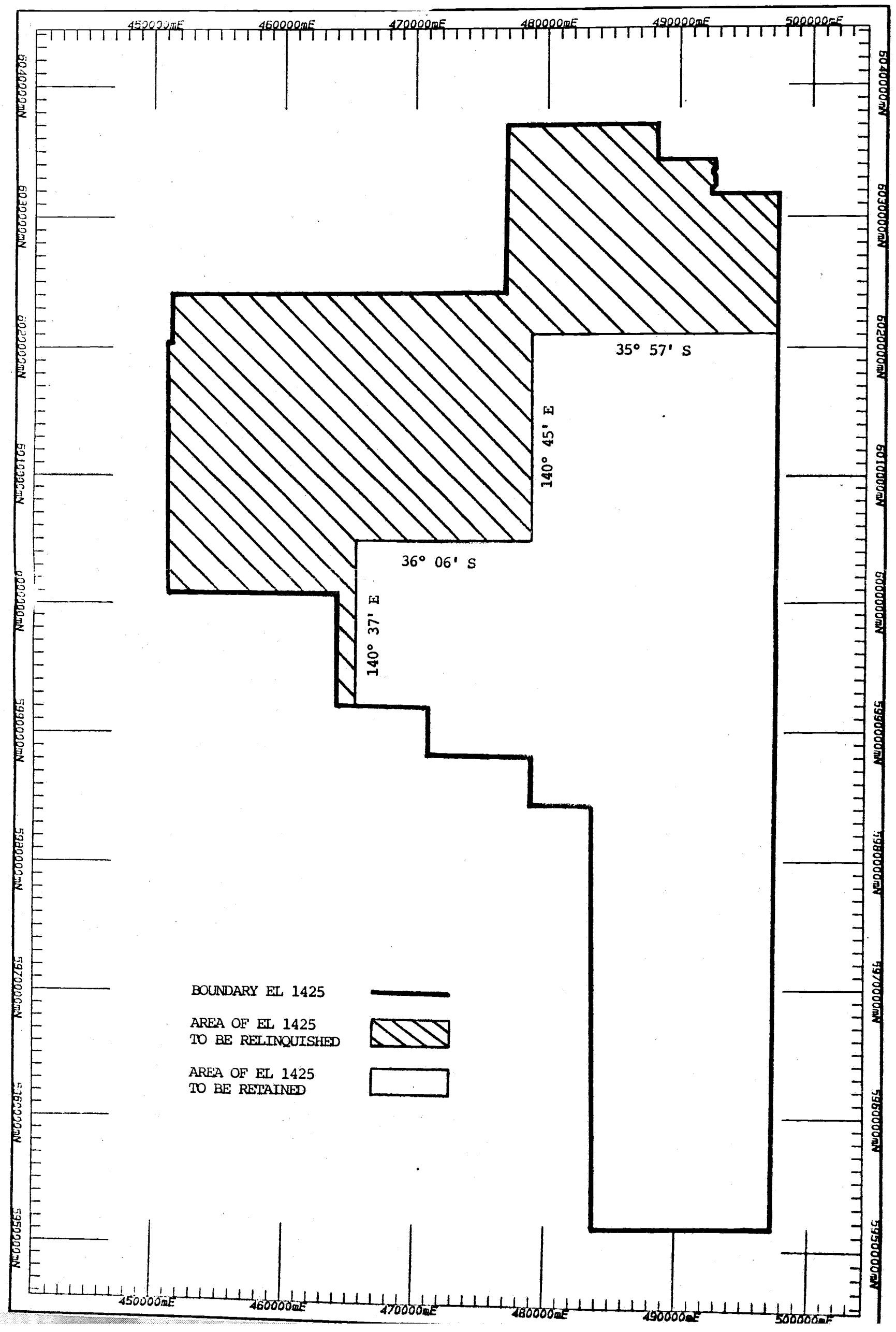


Figure 5: Relinquished areas
of EL 1425



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SEVENTH QUARTERLY REPORT - EL 1425

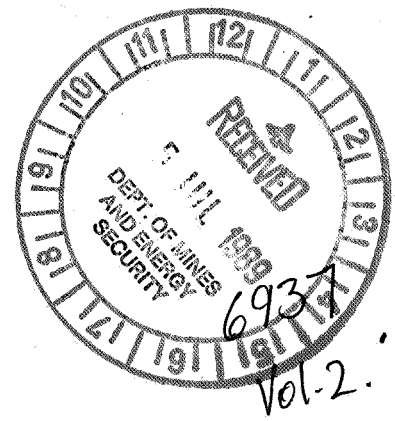
21 FEBURARY, 1989 TO 21 MAY, 1989.

Prepared for:

Burmine Ltd.

R.A.Creelman

May , 1989.



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1.0 INTRODUCTION

2.0 CONCLUSIONS

3.0 RECOMMENDATIONS

4.0 DRILLING

5.0 SAMPLING

6.0 DISCUSSION OF ASSAY RESULTS

7.0 PARTIAL RELINQUISHMENT OF EL 1425

8.0 EXPENDITURE

FIGURES :

Figure 1. Location Map of EL 1425.

Figure 2. Pliocene sand ridge orientation east of Bordertown.

Figure 3. Location of Drill Lines.

Figure 4. New boundary areas of EL 1425.

TABLES

Table 1. Lithological units.

1.0 INTRODUCTION.

Exploration licence El 1425, situated along the South Australian - Victorian border, approximately 300km east of Adelaide, covers an area of 2175 square kilometers. (Figure 1).
now 1355 " "

Exploration in this quarter concentrated on further detailed analysis of four drill holes at the western end of Line 1. The results of the analysis was then used to improve the relationship between the field estimates and actual grades of mineralization.

The second phase of drilling was planned for this quarter but had to be postponed as a result of bad weather, closing access to drill sites.

2.0 CONCLUSIONS.

1. The drilling programme has demonstrated the presence of heavy minerals in Pliocene sand ridges of the Parilla Sand on EL 1425.

2. The dunes drilled had the marine/beach facies at a depth beyond that which is economic for the grade encountered.

3. The marine/beach facies is thin at these sites and, in part, covered by ferricrete developement.

4. In general, the model of beach/dune development guiding the exploration is valid.

3.0 RECOMMENDATIONS.

1. As the major site of heavy minerals is the beach/marine facies, effort will be made to identify this sequence in outcrop or to identify, from knowledge of the basement, areas where this sequence is thicker.

2. The sample interval be reduced from 2 metres to 1 metre. This should result in more accurate estimates of grade, as the sample will not be panned until it has been dried and homogenised. The previous system of panning a grab sample does not appear to have been representative.

4.0 DRILLING.

The second phase of the drilling program was designed to extend knowledge of sediment and heavy mineral distribution within Pliocene sand ridges, east of Bordertown. (Figure 2). Ridge morphology is less well developed than the ridges which were drilled in November 1988, but are still characterised by a northwest - southeast orientation and an absence of Quaternary cover. The location of the drill lines is shown in Figure 3.

Drilling was scheduled to commence in May. Due to heavy rain and water logged soil conditions access to the sites was impossible. This caused postponement of drilling, which is now scheduled to take place in July.

5.0 SAMPLING.

Postponement of the May drilling program resulted in no further samples being obtained.

Following the essay results reported in the Sixth Quarterly report (Creelman, 1989a), a further 35 samples were analysed to determine heavy mineral content. All samples were taken from Line 1, holes 1/00, 1/160, 1/320 and 1/480. The assay results are shown in Appendix 1.

The 4 samples with the highest heavy mineral content were then to have had their respective heavy mineral suite determined. Initial examination by AMDEL laboratories showed the bulk of mineralization to be of low economic value, and no further determination was made.

6.0 DISCUSSION OF ASSAY RESULTS.

A difficult association with the location of significant heavy mineral concentrations is that they occur within the fine sandy lithological unit (see Table 1 for description of Lithological Units). This unit stratigraphically overlies the calcareous basement at substantial depths in the barrier sequence. Consequently, the cost of overburden removal will raise the cost of mineral sand production.

The economic minerals rutile, zircon, ilmenite and monazite are rarely above trace values, even where the percent total heavy minerals is high. The high proportion of non-economic minerals (such as goethite, magnetite and varying amounts of mica and silimanite) may indicate that the source lithology was not rich in economic heavy minerals. Alternatively, the time required, or coastal processes necessary, for hydraulic separation of the economic heavy mineral was not available.

TABLE 1 Lithologic Units

UNIT	CHARACTERISTICS
1. Silty clays and /or clayey silt	Contains Fe-stone fragments. Colour variable (Brown, grey, red, red-brown, yellow).
2. Mixed quartz sands	Fine to coarse grained quartz sand. Poorly to well sorted, subangular to rounded. May contain silty and/or clayey material; becoming micaceous with depth. Colour variable (Brown, grey, yellow, grey-brown, red-brown, yellow-brown, orange-brown or red-orange). Fe-stone may be present.
3. Fine quartz sands	Very fine grained quartz sand with clayey silt or silty clay. Well sorted, subangular to rounded. Micaceous. Some lithic grains are present. Colour variable (Grey, greyish-brown, reddish-brown, yellow-brown, brown, orange.)
4. Basement	Brown calcareous quartz sandstone. Sandy bryozoal limestone. Cream bryozoal limestone. Some unconsolidated fossiliferous calcareous sand and/or sandstone.

7.0 PARTIAL RELINQUISHMENT OF EL 1425.

In mid-Janurary 1989, a decision was made to relinquish a portion of the lease EL 1425. This decision was based upon previous findings and the thickness of Quarternary cover (summary report, Creelman, 1989b). The lease, which previously covered an area of approximately 2175 square kilometres, has been reduced to approximately 1325 square kilometres. The new boundaries for El 1425 is shown in Figure 4.

The summary report was returned to the company for elaboration. The expanded relinquishment report (Creelman, 1989c) has been returned to the South Australian Department of Mines and Energy. At the time of writing, there had been no notification of approval of the relinquishment application.

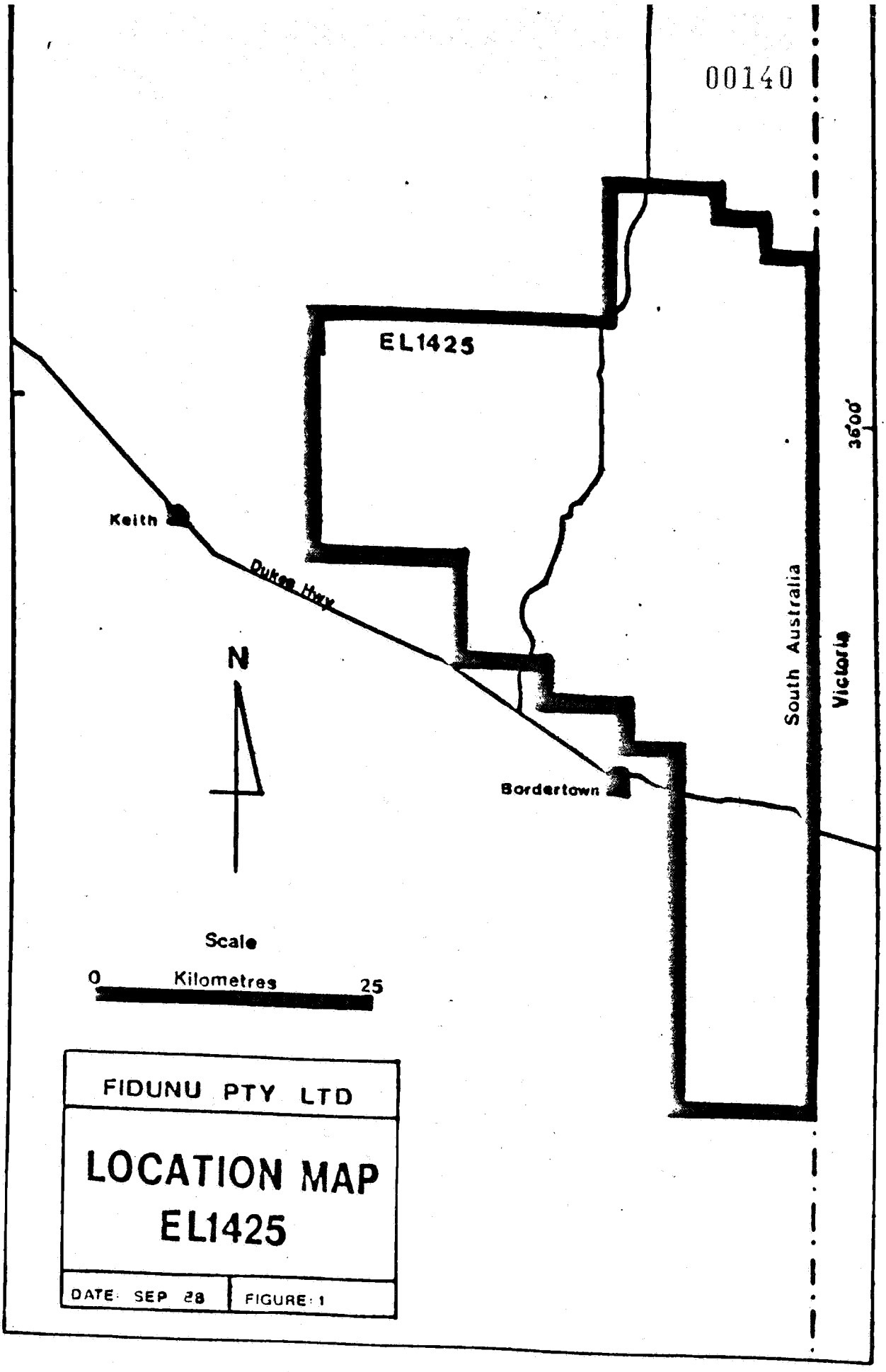
8.0 EXPENDITURES

Administrative Overheads		
General Office Overheads (Epping Office)	$1,210.00	
		$1,210.00
Travel and Accommodation		
Feb - May 1989	$1,250.00	
		$1,250.00
Vehicle Expenses		
Leasing Costs	$ 909.48	
Fuel	$ 302.00	
		$1,211.48
Consultants/Professional Staff	$4,550.00	
		$4,550.00
Field Equipment	$ 340.00	
		$ 340.00
TOTAL Seventh Quarter		$8,561.48

APPENDIX 1.

HOLE NO.	INTERVAL	TOTAL MINERAL %
1/00	4-6m	0.22
1/00	8-10m	0.16
1/00	10-12m	0.14
1/00	12-14m	0.14
1/00	14-16m	0.35
1/00	20-22m	0.55
1/00	24-26m	0.33
1/160	0-2m	0.12
1/160	6-8m	0.93
1/160	12-14m	0.14
1/160	14-16m	0.06
1/160	26-28m	----
1/160	28-30m	0.29
1/320	4-6m	----
1/320	12-14m	0.10
1/320	16-18m	1.92
1/320	20-22m	1.27
1/320	28-30m	0.47
1/320	30-32m	0.30
1/320	32-34m	0.75

HOLE NO.	INTERVAL	TOTAL MINERAL %
1/480	2-4m	0.27
1/480	6-8m	0.17
1/480	10-12m	0.17
1/480	12-14m	0.10
1/480	14-16m	0.15
1/480	16-18m	0.49
1/480	18-20m	0.16
1/480	20-22m	0.05
1/480	24-26m	0.07
1/480	26-28m	0.10
1/480	28-30m	0.39
1/480	30-32m	0.36
1/480	32-34m	0.59
1/480	34-36m	0.30
1/480	38-40m	0.96
1/320	30-32m	0.46
1/480	6-8m	0.18
1/480	32-34m	0.35
1/480	34-36m	0.40



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LOCATION MAP EL1425

DATE: SEP 28 | FIGURE: 1

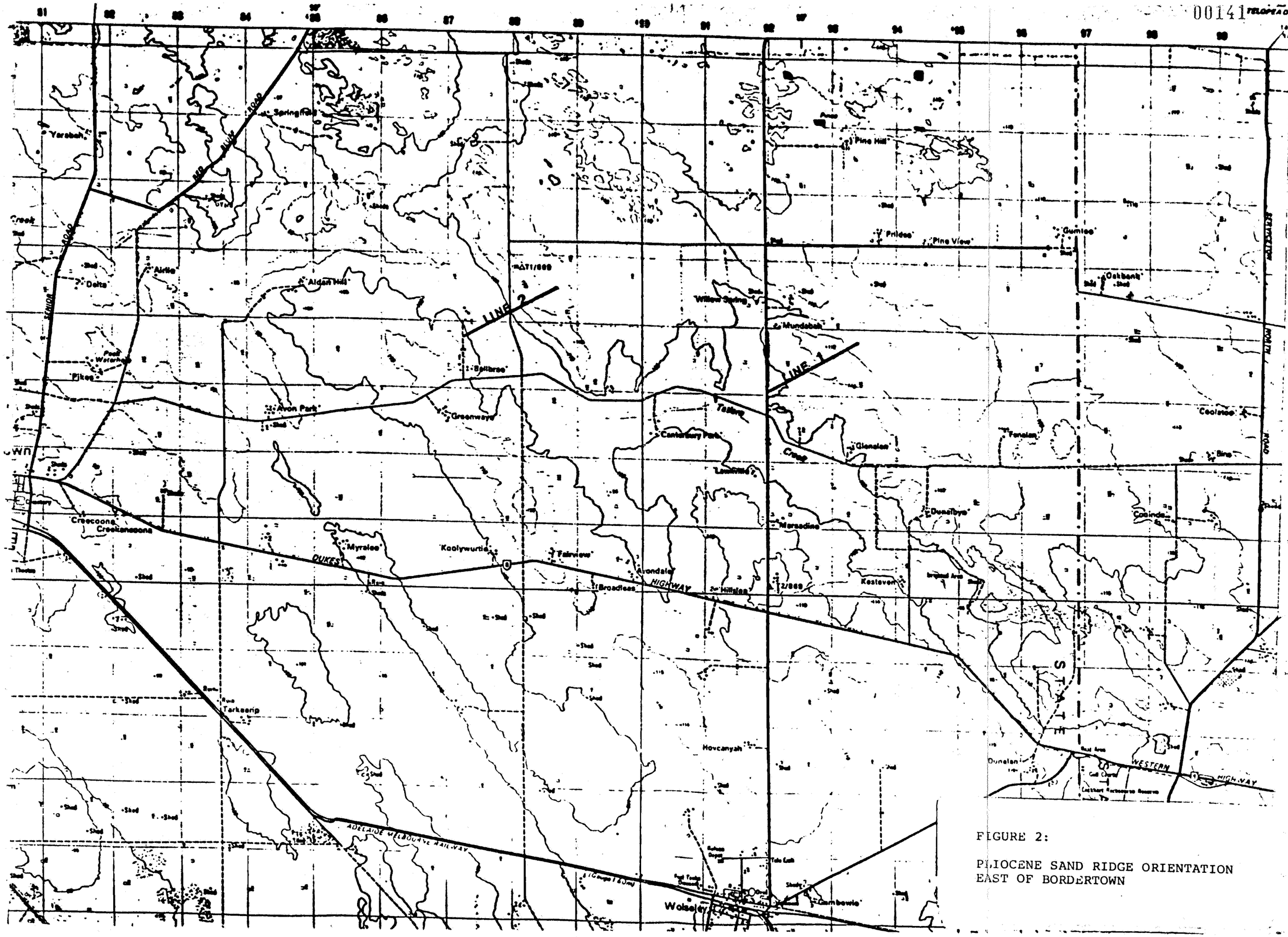


FIGURE 2:

PLIOCENE SAND RIDGE ORIENTATION
EAST OF BORDERTOWN

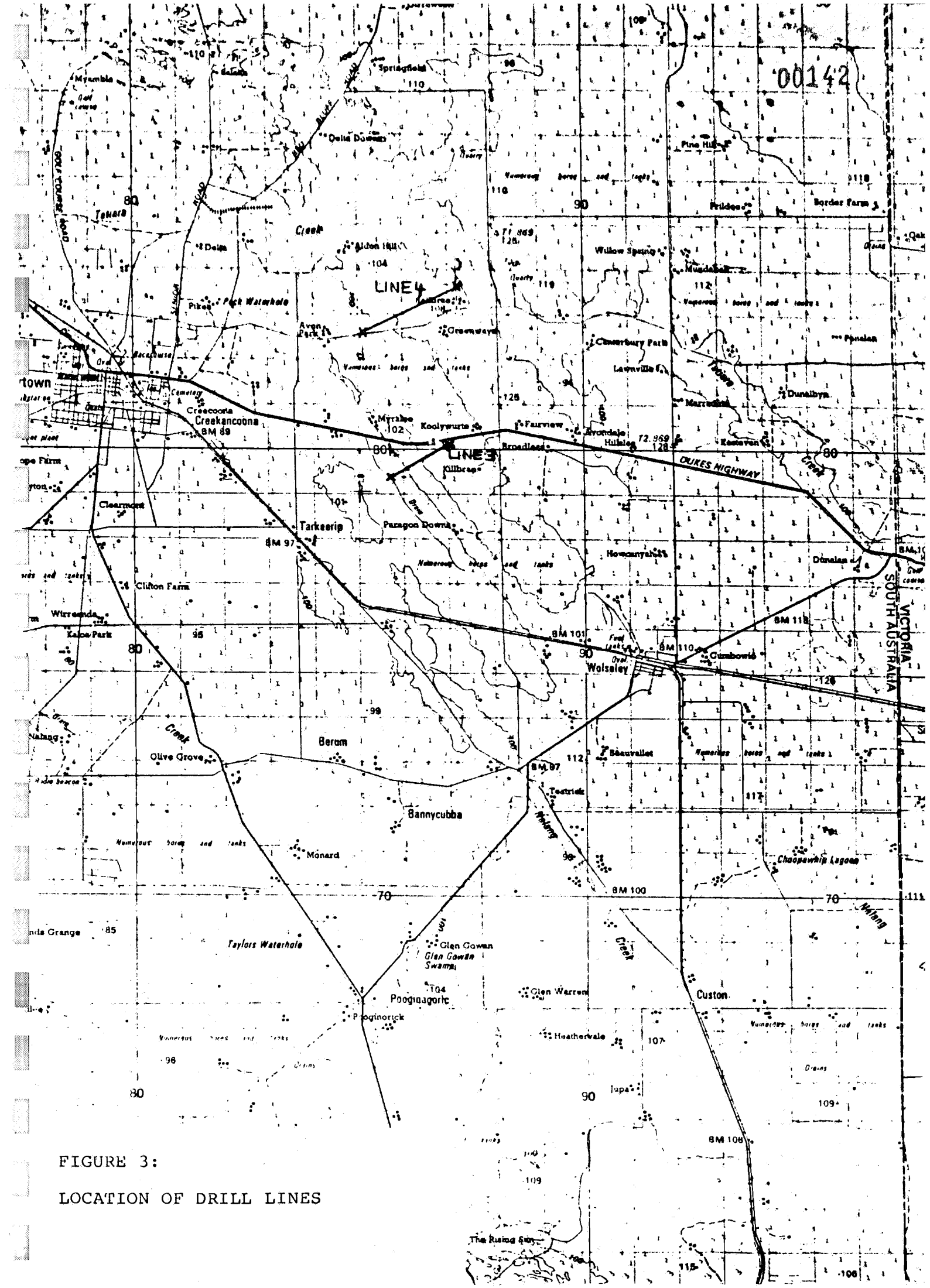
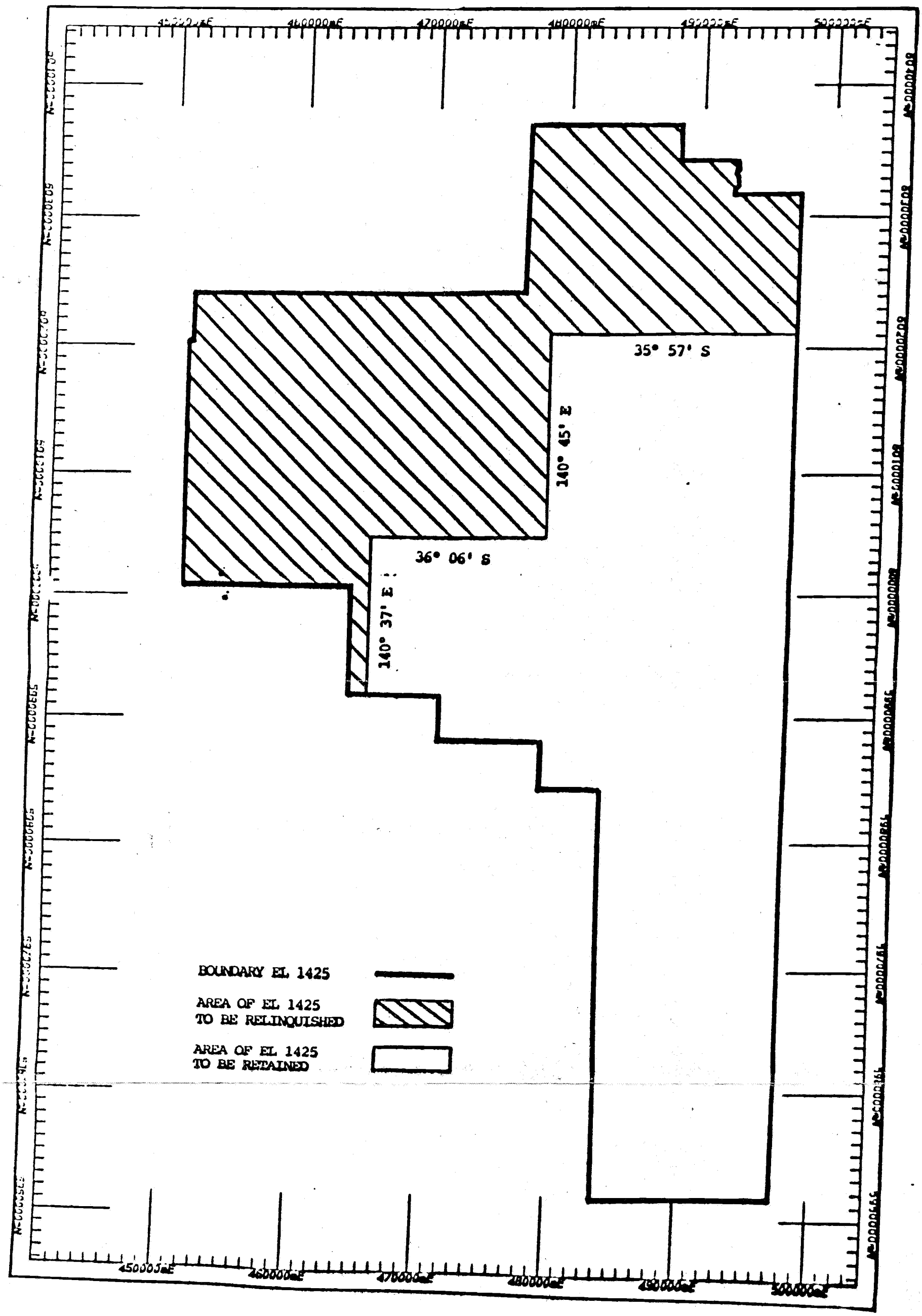


FIGURE 3:

LOCATION OF DRILL LINES

Figure 4: NEW BOUNDARY AREAS
OF EL. 1425



00144

ENV. 6937

OUTSTANDING DATA

EL 1425

As at 1/5/90 certain ~~data~~/drill samples pertaining to exploration had not been received.

The ~~data~~/drill samples should subsequently be ~~available~~/listed in Env. 6937 ~~A.~~ ✓

G01140

00145

EIGHTH QUARTERLY REPORT - 1425

21 May,1989 to 21 August, 1989

Prepared for:

Burmine Ltd.

R. A. CREELMAN
October, 1989

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1.0 INTRODUCTION

A second drilling programme was planned for this quarter, but continued bad weather caused delays. The drilling programme will continue in the Ninth Quarter. The need to complete the drilling programme is now urgent, as it is anticipated that it may be possible to relinquish land if the results are negative.

2.0 EXPLORATION ACTIVITY. (21 May 1989 - 21 August 1989)

Access to planned drill sites was not possible during the quarter. As a contingency plan a road verge drilling programme was planned. The weather was too wet to run the road programme. Both traverses will now be drilled in the next quarter when weather permits.

3.0 EXPENDITURE

There was nil expenditure in the eighth quarter.

NINETH QUARTERLY AND RELINQUISHMENT REPORT
EXPLORATION LICENCE 1425

Prepared on behalf of the
Murray Basin Joint Venture:

Burmine Ltd

T.C. Pacific Pty Ltd

Eurast Minerals Exploration Pty Ltd

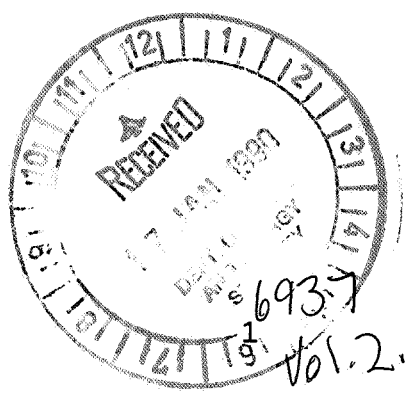
Denison Australia Pty Ltd

through

Fidunu Pty Ltd

Robert A. Creelman

Exploration Manager,
Murray Basin Joint Venture.



December 1989

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1.0 CONCLUSIONS.

1. The model of beach /dune development guiding the exploration in the Murray Basin is valid, but in the areas drilled there are no accumulations of economic grades of the valuable heavies. It would appear that the Tertiary coastal processess have not developed favourable sites for economic accumulations of heavy mineral.

2. This programme has identified the basement in the area to be the Murray Group, specifically a bryzoan rich limestone. There is no evidence of any crystalline basement. The limestone basement undulates up to 12 m along the drill lines.

3. The marine/beach facies of the Parilla Sand contains some heavy minerals, but in general the heavies that are being sought are at depth and in uneconomic grades.

4. Ferricrete development is common throughout the Parrilla, so the higher grades of mineral greater than S.G. 2.96 are goethite dominated.

2.0 RECOMMENDATION

1. Exploration Licence 1425 be relinquished on the grounds that although the areas contains a promising set of strandlines, the drilling has demonstrated that there are no significant accumulations of economic heavy minerals.

3.0 INTRODUCTION

Following exploration in previous quarters, an area to the east of Bordertown (Figure 1) has been identified as the most prospective target area for heavy minerals. In this programme drill lines were used to sample two ridges (Figure 2), bringing the total sampled to four. The stratigraphy observed in drilling to date is consistent with the dune model, but there is very little heavy mineral present.

4.0 GEOLOGY

4.1 Background

Airphoto interpretation and field proving during previous quarters were used to produce a geomorphic map (Figure 3). This mapping showed an area to the east of Bordertown to be the most prospective. A total of five well defined ridges were identified trending N40W. These ridges consist of outcropping and thinly covered sand ridges. To the north , west and south these ridges become obscured by the Quaternary to Recent cover.

4.2 Geological Model: Theory of Beach Placer Development

Beach placers are formed when heavy minerals derived from erosion of the land are redistributed along the continental shelf. The movement of the sea gradually sorts the sediments, directing the finer sediments into deep water and the coarser material shorewards. The action of storms can be an important concentrating mechanism. The valuable minerals have a high specific gravity (S.G.) relative to quartz, are resistant to weathering, and are concentrated with the coarse fraction. The final distribution of the minerals is affected by the properties of the particles (SG, diameter, settling velocity) and the strength and direction of wind and ocean currents.

The most commercially important placers develop at the base of frontal dunes on open beaches and in the natural traps formed by headlands and other barriers to the free passage of longshore currents. Fossil beaches are often referred to as strandlines. Beach deposits are characteristically lenticular in cross section and may vary in size up to several kilometres in length and a couple of metres in thickness.

Periods of upwarping of coastal areas, variations in sea level and the migration of wind blown sand dunes may cause changes to the location of the coastline. Consequently strandlines and beach placers can occur at considerable distances inland from the present coastline. Some well developed strandline/coastal ridge features can be identified by remote methods such as aerial and satellite photography.

Aeolian placers may be formed in conditions where large areas of beach sand are exposed to the action of the wind. A third type of placer is found in the underwater bars of sediments which parallel the shoreline. Some of these bar accumulations may be submerged beach placers, others have resulted from the sorting action of waves and ocean currents.

Table 1: Lithological Units

UNIT	NAME	CHARACTERISTICS
1.	Molineaux Sand	Light grey to light brown, fine to medium quartz sand.
2.	Blanchetown Clay	Light brown to grey-green clay with minor sand.
3a.	Parilla Sand	Fine to coarse grained quartz sand. Poorly to well sorted, subangular to rounded. May contain silty and /or clayey material; becoming micaceous with depth. Colour variable (Brown ,grey , yellow, grey-brown, red-brown, yellow-brown, orange -brown or red-orange). Ironstone may be present.
3b.	Parilla Sand	Very fine grained quartz sand with clayey silt or silty clay. Well sorted, subangular to rounded. Micaceous. Colour variable (grey, grey-brown, red-brown, yellow-brown, brown, orange).
4.	Murray Group	Brown calcareous quartz sandstone. Sandy bryozoal limestone. Some unconsolidated fossiliferous calcareous sand and / or sandstone.

4.3 Lithology

Five lithological units have been recognised over the exploration licence, four of which occur in the drill logs. These units are shown in Table 1.

Unit 1: Molineaux Sand This unit forms a surface cover over much of the area. Lithological units have been sub divided on the basis of sediment type, grain size and degree of sorting (Table 1). This lithology is not shown in cross sections along drill lines 3 and 4.

Unit 2: Blanchetown Clay Unit 2 is dominated by brown to grey clays with minor silt and sand. This unit occurs along lines 3 and 4. It tends to thin towards the crests of the ridges and thicken towards the interbarrier depressions (Figures 4 and 5). This unit is thought to be the Blanchetown Clay.

Unit 3: Parilla Sand Unit 3 is a very fine to coarse grained, clay and silt rich quartz sand. The sand has a distinctive yellow-brown to red-brown colouring, becoming lighter with depth. The upper surface may be indurated or contain ironstone nodules. Indurated bands may also occur within the unit. Unit 3a may become micaceous with depth. Unit 3b is micaceous, and may represent the marine sequence of the Parilla Sand. It appears to contain minor concentrations of heavy minerals.

Unit 4: Murray Group This unit underlies the Parilla Sand in most areas drilled on the EL. The unit is composed of brown calcareous quartz sandstone, sandy bryozoal limestone and some unconsolidated fossiliferous calcareous sand. The upper surface of this unit is relatively planar. The relief is generally of the order of 2-3 metres, and up to 10 metres in places. This unit represents basement.

5.0 **EXPLORATION**

5.1 Location of Drill Lines

The ridges selected for sampling were located to the east of Bordertown (Figure 1). They are not covered by later Quaternary sand and trend NNW-SSE. For ease of access the drill lines were located along the Dukes Highway (Figure 2). Drill sites were spaced at 160m intervals.

5.2 Drilling Procedure

Drilling commenced on November 17, 1989 and concluded on November 21, 1989. Wallis Drilling Pty. Ltd. were contracted and used an NQ reverse circulation air core technique. Sixteen holes totalling 456 meters were drilled, with holes being sunk to the limestone basement or to 30 metres, whichever was the least.

5.3 Sampling

Sampling was conducted continuously at 1 metre intervals. The sample was logged and bagged for transport. Due to the clayey nature of some of the samples, it was often necessary to inject water during drilling and this resulted in wet samples which had to be dried and crushed prior to processing.

Processing consists of drying, either naturally or in a drying oven, splitting and panning to give a visual estimate of heavy mineral content. The method of panning has proved accurate now that samples are no longer panned in the field.

6.0 **RESULTS**

On-site reporting of visual estimates by the site geologist indicated the ridges drilled in this programme to be of low prospectivity. This was confirmed by visual estimates of samples panned at the field camp. Estimated values after panning range from zero to minor amounts of heavy minerals (see Appendix 2). As a result of these low visual estimates, there was no further laboratory analysis of these samples.

7.0 DISCUSSION OF RESULTS.

Results from the previous and the current programme have shown the Parilla Sand to be capable of hosting heavy minerals, but the grade is low (Appendix 1). Detailed mineralogies were obtained for six samples from the 1988 programme (Table 2).

The proportion of heavy minerals listed in Table 2 indicates that the weight percent of the economically significant minerals rutile, zircon, ilmenite, and monazite are rarely above trace values. An example of this is shown in sample 1/160, 22-24m, which contained 3.04% heavy minerals. Seventy-five percent of this is goethite, 2.0% leucoxene, 1.0% zircon, with only a trace of ilmenite. Rutile and monazite are absent. These results highlight the problems caused by the presence of ferricretes.

The results of the exploration programme have demonstrated that, where suitable mechanisms for the concentrations of heavy minerals existed, it was towards the base of the Parilla Sand. This was at depths uneconomical for the recovery of the suites of heavy minerals encountered. The high proportion of non-prospective heavy minerals, such as goethite, magnetite and varying amounts of sillimanite, tourmaline etc, may indicate that the source lithology was not rich in the economic heavy minerals.

TABLE 2: Mineralogy of the Heavy Mineral Concentrates

Sample Number	1/160	1/160	2/640	2/640	1/480	2/1200
Depth (m)	20-22	22-24	34-36	36-38	4-6	16-18
Wt. % H.M.	2.42	3.04	0.69	0.88	0.92	1.00
Goethite	70	75	10	10	75	50
Magnetite	-	-	5	3	Tr	4
Ilmenite	Tr	Tr	25	30	2	15
Leucoxene	5	2	8	20	5	4
Rutile	2	-	6	3	1	2
Zircon	2	1	32	12	3	10
Monazite	-	-	Tr	Tr	-	-
Others	21	22	14	22	4	15

Others consists of varying amounts of tourmaline, mica, ?Fe stained quartz, sillimanite, etc.

8.0 **EXPENDITURES**

Expenditures in the current quarter have been as follows :

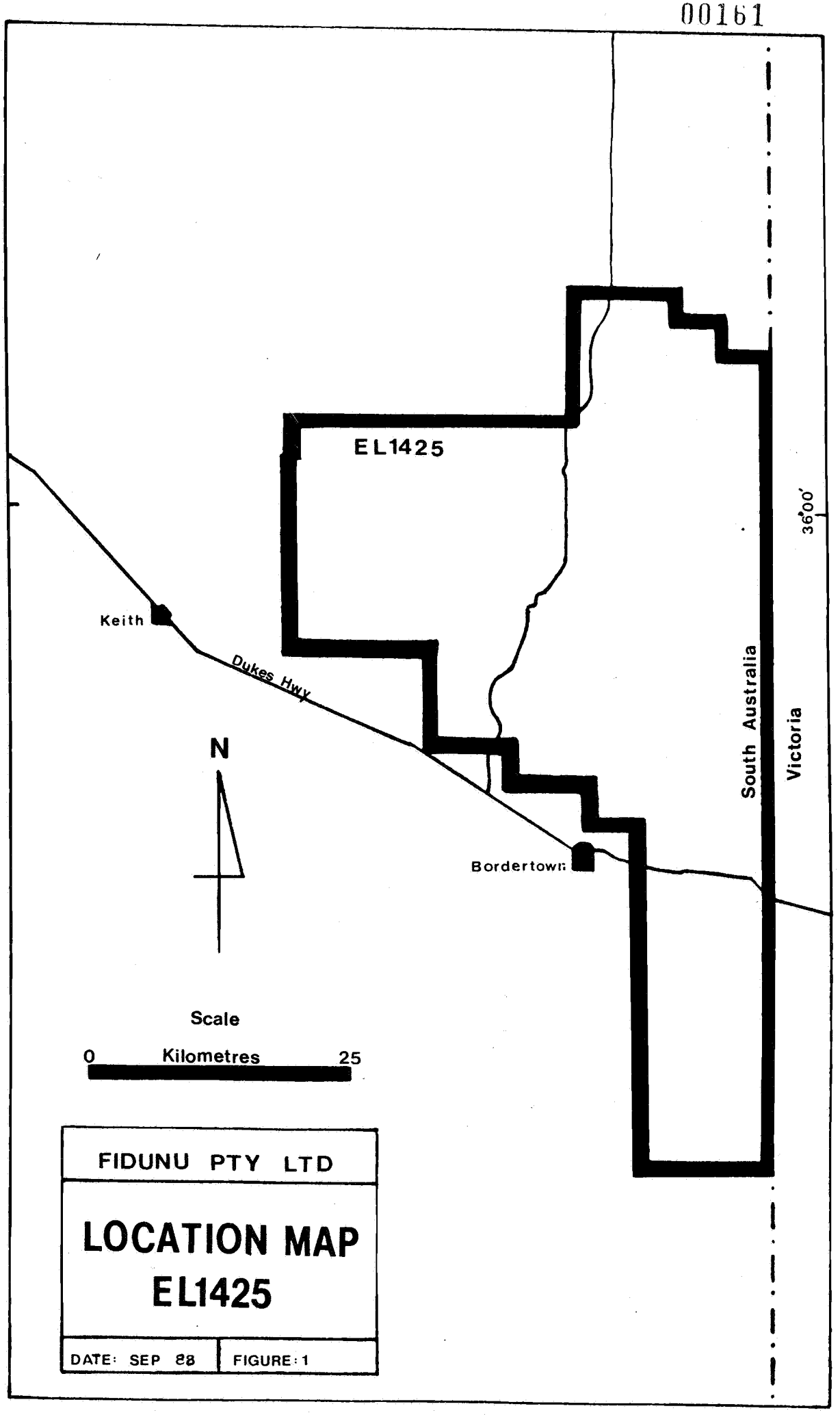
1. Drilling. 456 m		$ 11,856.00
2. Sample Processing		$ 880.00
3. Travel and Accomodation		$ 600.00
4. Vechicle Expenses.	Fuel Costs	$ 350.00
	Car Hire	$ 260.00
5. Field Consummables.		$ 400.00
6. Consulting/Professional Staff		
	Consultants	$ 900.00
	Professional Staff	$ 2,554.00
Total		$ 17,800.00

Expenditures from Previous Quarters	$161,429.47
Total Expenditures on Project	$179,229.47

9.0 REFERENCES

Creelman, R.A. 1989. Sixth Quarterly Report, Exploration Licence 1425 - South Australia. Unpublished.

Creelman, R.A. 1989. Seventh Quarterly Report, Exploration Licence 1425 - South Australia. Unpublished.



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LOCATION MAP EL1425

DATE: SEP 88 | FIGURE: 1

FIGURE 2 - LOCATION OF STRATIGRAPHIC DRILL LINES

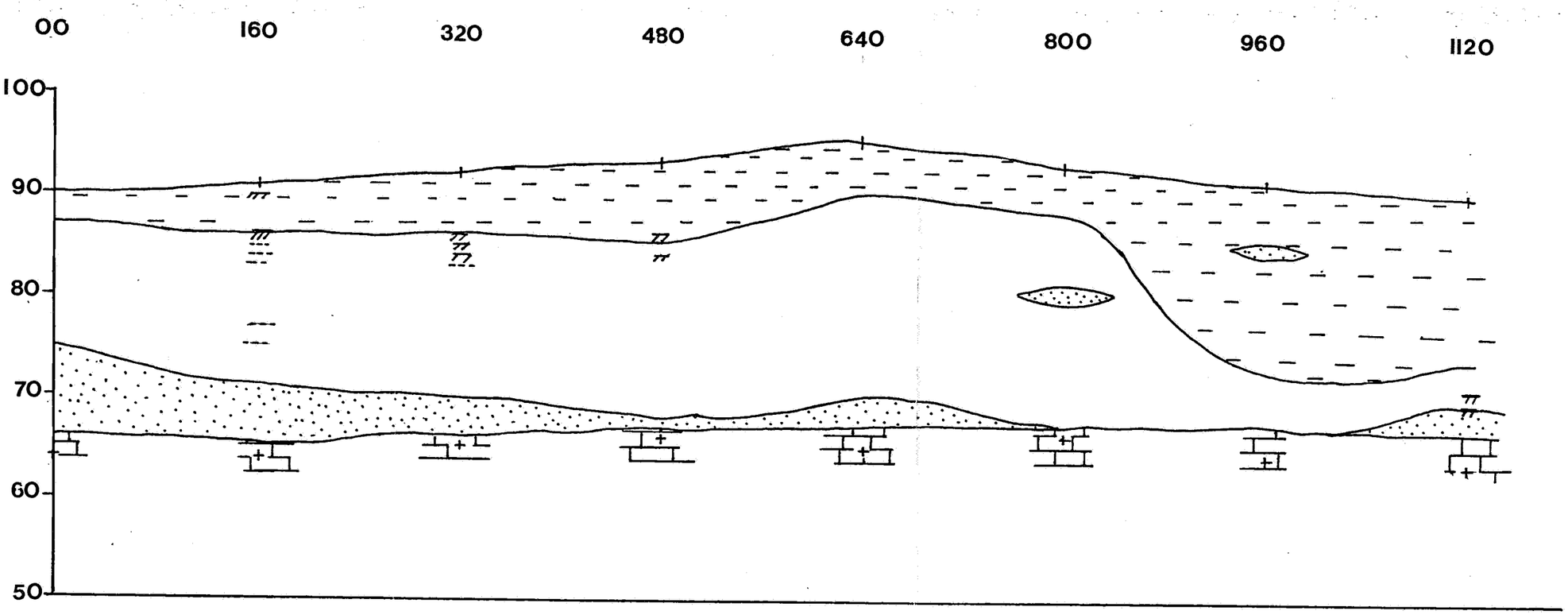
1:50 000

APPENDIX 1 : Weight % heavy minerals

Sample Number	Depth (m)	Weight % heavies
1/00	2-4	0.28
1/00	16-18	1.63
1/00	18-20	0.75
1/160	4-6	0.06
1/160	8-10	0.23
1.160	10-12	0.19
1/160	16-18	0.10
1/160	18-20	0.53
1/160	20-22	2.42
1/160	22-24	3.04
1/320	2-4	0.17
1/320	6-8	0.13
1/320	8-10	0.12
1/320	10-12	0.25
1/320	14-16	0.19
1/320	18-20	0.07
1/320	22-24	0.81
1/320	24-26	0.20
1/320	26-28	0.25
1/480	4-6	0.92
1/480	22-24	0.16
1/630	10-12	0.13
1/630	16-18	0.18
1/630	18-20	0.17
1/630	20-22	0.18

1/630	22-24	0.20
1/630	24-26	0.20
1/630	26-28	0.14
1/1270	18-20	0.37
1/1270	20-22	0.51
1/1270	36-38	0.68
1/1440	34-36	0.76
2/1200	16-18	1.00
2/1200	18-20	0.45
2/960	32-34	0.62
2/960	34-36	0.43
2/960	36-38	0.41
2/880	28-30	0.95
2/880	32-34	0.50
2/880	34-36	0.48
2/880	38-40	0.24
2/720	12-14	0.60
2/640	12-14	0.32
2/640	24-26	0.08
2/640	34-36	0.69
2/640	36-38	0.88
2/480	20-22	0.18
2/480	22-24	0.01
2/160	8-10	0.14
2/160	10-12	0.18

00165



Clayey silt and/or silty clay

Fine sand/

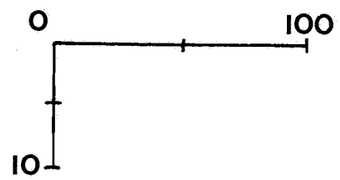
Ironstone/ferricrete

End of hole

Mixed sand (fine – coarse grained)

Limestone

Cemented bands



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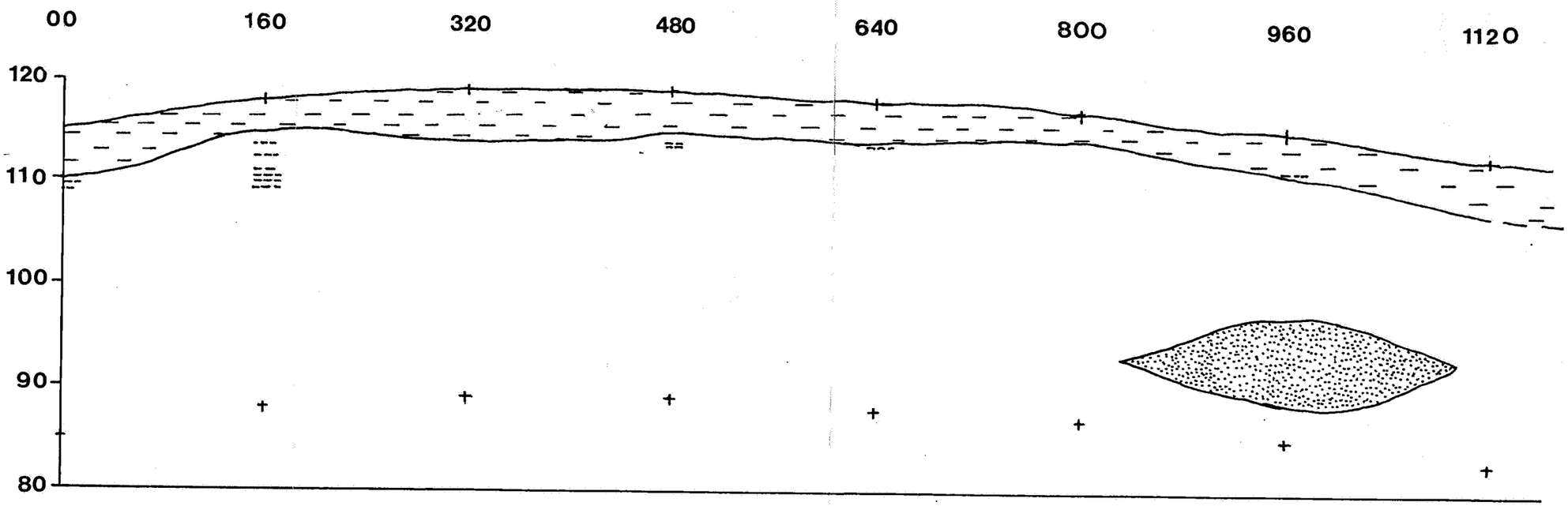
Geological Interpretation of Shallow Drill Lines. Line 3, EL 1425

Map sheet: 7025 Canawigara (1:100,000)

drawn by: PJ/RH	date: Dec.'89	figure: 4

00166



Clayey silt and/or silty clay

Mixed sand (fine – coarse grained)

Fine sand

Limestone

Ironstone/ferricrete

Cemented bands

End of hole

0 100 metres 10

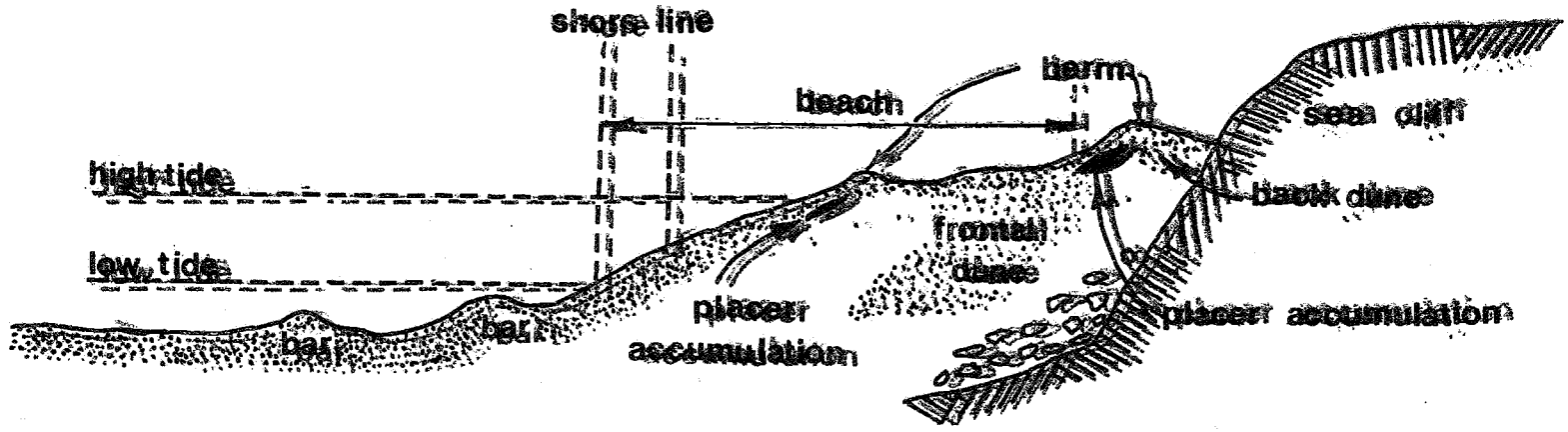
FIDUNU PTY LTD

Geological Interpretation of Shallow Drill Lines. Line 4, EL 1425

Map sheet: 7025 Cannawigara (1:100,000)

drawn by: RJ/RH	date: Dec. '89	figure: 5

00167



Typical beach pattern with offshore bars. Lenses of mineral accumulations have formed placer deposits in dunal systems.

FIGURE PTY. LTD.

Geological Model

Date: Dec. 1989 Figure: 66

APPENDIX 2: DRILL LOGS

LINE 1

LINE 2

LINE 3

LINE 4

DRILL HOLE RECORD

00169

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1:00E EL: 1425

Date: 23·11·1988 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown sandy - ironstone nodules - calcareous				
	1 - 2	CLAY: as above				
	2 - 3	CLAY: red sandy HM+1%				
	3 - 4	CLAY: as above HM+1%				
	4 - 5	SAND: fine grained, red brown, clayey, subrounded, well sorted HMT				
	5 - 6	SAND: as above HMT				
	6 - 7	SAND: medium - coarse grained, red brown, clayey, poorly sorted, angular - subrounded HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: very fine - very coarse grained, brown, clayey, poorly sorted, angular - subrounded HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: fine - very coarse grained, yellow, clayey, slightly micaceous, subangular - subrounded, poorly sorted HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: as above brown micaceous HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: very fine grained. brown. clayey, well sorted, subrounded - rounded, micaceous HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: silt - very fine grained, brown, clayey, rounded, well sorted, micaceous HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SILT: brown well sorted micaceous HMK1%				
	19 - 20	SILT: as above HMK1%				
	20 - 21	SAND: silt - very fine grained, yellow-brown, well sorted, micaceous HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: as above HMT				
	23 - 24	SAND: as above HMT				
	24 - 25	SAND: as above HMT				

00170

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HOBBES Hole No: LINE 1: 00E EL: 1425

Date: 23·11·88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25-26	SAND: as above + brown calcareous sandst HMT				
	26-27	SANDSTONE: calcareous + brown silt HMT				
	27-28	SANDSTONE: as above HMT				
		E.O.H. 28 m				

00171

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1 : 160E EL: 1425

Date: 23.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown sandy, Ironstone fragments				
	1 - 2	CLAY: 2S 2bove				
	2 - 3	SAND: fine grained, yellow-reddish brown, clayey, well sorted, subangular				
	3 - 4	SAND: 2S 2bove				
	4 - 5	CLAY: reddish brown, silty HM<1%				
	5 - 6	CLAY: 2S 2bove HM<1%				
	6 - 7	SAND: fine grained, yellow-grey-red, clayey well sorted, subrounded to rounded HMT				
	7 - 8	SAND: 2S 2bove HMT				
	8 - 9	SAND: very fine-fine grained Yellow-grey well sorted, subangular-subrounded HM>1%				
	9 - 10	SAND: 2S 2bove HM>1%				
	10 - 11	SAND: 2S 2bove yellow, clayey HM<1%				
	11 - 12	SAND: 2S 2bove HM<1%				
	12 - 13	SAND: v. fine-medium grained, orange-yellow-grey clayey, poorly sorted, subangular to rounded HMT				
	13 - 14	SAND: 2S 2bove HMT				
	14 - 15	SAND: very fine-very coarse, grey, clayey, HMT poorly sorted, some grains up to 5mm				
	15 - 16	SAND: 2S 2bove HMT				
	16 - 17	SAND: 2S 2bove subangular-subrounded brown, micaceous HMT				
	17 - 18	SAND: 2S 2bove HMT				
	18 - 19	SAND: very fine grained. Orange to brown, slightly micaceous HM<1%				
	19 - 20	SAND: 2S 2bove HM<1%				
	20 - 21	SAND: 2S 2bove clayey silt, micaceous brown HM≥1%				
	21 - 22	SAND: 2S 2bove HM≥1%				
	22 - 23	SAND: 2S 2bove Yellow brown HMT				
	23 - 24	SAND: 2S 2bove HMT				
	24 - 25	SAND: 2S 2bove HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 160E EL: 1425

Date: 23.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 2S 2BOVE HMT				
	26-27	SAND: brown silt & calcareous sand calcareous sandstone				
	27-28	SAND: 2S 2BOVE				
	28-29	SAND: 2S 2BOVE fossiliferous marine				
	29-30	SAND: 2S 2BOVE				
		E.O.H. 30.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: K. HODGES Hole No: LINE 1:320N EL: 1425

Date: 23.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown silty				
	1 - 2	CLAY: as above				
	2 - 3	SAND: fine grained, brown, clayey, very well rounded subangular - rounded HM<1%				
	3 - 4	SAND: as above HM<1%				
	4 - 5	SAND: as above yellow-brown HMT				
	5 - 6	SAND: as above HMT				
	6 - 7	SAND: very fine - fine grained, brown, clayey, well sorted, subrounded to rounded HMT-1%				
	7 - 8	SAND: as above HMT-1%				
	8 - 9	SAND: as above HM=1%				
	9 - 10	SAND: as above HM=1%				
	10 - 11	SAND: as above HM>1%				
	11 - 12	SAND: as above HM>1%				
	12 - 13	SAND: very fine fine grained, yellow-brown, clayey well sorted, subangular - subrounded HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: as above HM>1%				
	15 - 16	SAND: as above HM>1%				
	16 - 17	SAND: very fine - coarse grained, brown clayey HMT poorly sorted, subangular - rounded, slightly micaceous				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: as above HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: as above + ironstone chips HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: silt - very fine grained, brown, clayey, micaceous moderately sorted, subrounded - rounded HM=1%				
	23 - 24	SAND: as above HM=1%				
	24 - 25	SAND: as above well sorted yellow-brown HM<1%				

00174

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 320E EL: 1425

Date: 23.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 2s above HM<1%				
	26-27	SAND: 2s above subangular-subrounded HM<1%				
	27-28	SAND: 2s above HM<1%				
	28-29	CLAY: brown silty micaceous HMT				
	29-30	CLAY: 2s above HMT				
	30-31	CLAY: brown silty occ calcareous sandstone				
	31-32	CLAY: 2s above				
	32-33	SANDSTONE: brown calcareous				
	33-34	SANDSTONE: 2s above				
	34-35	LIMESTONE: light brown sandy, fossiliferous marine				
	35-36	LIMESTONE: 2s above				
		E.O.H 36.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1 : 480 E EL: 1425

Date: 23.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0 - 1	CLAY: grey-brown silty				
	1 - 2	CLAY: as above				
	2 - 3	SAND: reddish-brown, clayey, Ironstone chips				
	3 - 4	SAND: as above				
	4 - 5	SAND: fine grained, reddish brown, clayey HMT grades greyish white then to yellow, well sorted				
	5 - 6	SAND: as above subrounded-subangular HMT				
	6 - 7	SAND: fine-medium grained, Grey-yellow, clayey, moderately sorted, subrounded-rounded HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: very fine grained, yellow-brown, clayey, very well sorted, rounded HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: as above HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: as above - micaceous HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: as above very well sorted HMT subrounded-rounded				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: very fine-fine grained, Yellow-brown, clayey, HMT very well sorted, subrounded rounded, micaceous				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: as above Orange brown HMT subangular-rounded				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: very fine grained, orange-brown, well-sorted subrounded-rounded, micaceous HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: as above moderately sorted HMK% lithic fragments to 1mm				
	23 - 24	SAND: as above HMK%				
	24 - 25	SAND: very fine-coarse grained, brown, clayey poorly sorted, angular to subrounded HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 480E EL: 1425

Date: 23.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25 - 26	SAND: as above HMT				
	26 - 27	SAND: as above yellow-brown, micaceous HMT				
	27 - 28	SAND: as above HMT				
	28 - 29	SAND: as above HMT				
	29 - 30	SAND: as above HMT				
	30 - 31	SAND: very fine grained, yellow-brown, well-sorted, rounded micaceous HMT				
	31 - 32	SAND: as above HMT				
	32 - 33	SAND: as above HMT				
	33 - 34	SAND: as above HMT				
	34 - 35	SAND: silt - very fine grained, yellow-brown, well-sorted subrounded to rounded, micaceous HMT				
	35 - 36	SAND: as above HMT				
	36 - 37	CLAY: reddish brown silty micaceous HMT				
	37 - 38	CLAY: as above HMT				
	38 - 39	LIMESTONE: cream fossiliferous, brown silt				
	39 - 40	LIMESTONE: as above				
		E.O.H. 40.0m.				

00177

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES. Hole No: LINE 1: 630E EL: 1425

Date: 23.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown, sandy, ironstone fragments & lithic fragments				
	1 - 2	CLAY: as above				
	2 - 3	CLAY: light brown, sandy				
	3 - 4	CLAY: brown and grey				
	4 - 5	CLAY: reddish brown fine sandy ironstone frag. to 10mm				
	5 - 6	CLAY: as above				
	6 - 7	SAND: very fine to medium grained, yellow brown, clayey HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: silt - very fine grained, yellow brown, clayey well sorted, subrounded - rounded HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: very fine grained, grey-white, clayey, well-sorted, subrounded - rounded HMS1%				
	11 - 12	SAND: as above HMS1%				
	12 - 13	SAND: fine to very fine, grey-yellow, well sorted subrounded - rounded slightly micaceous HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: silt - very fine grained, yellow, well sorted rounded, micaceous HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: as above HMS1%				
	17 - 18	SAND: as above HMS1%				
	18 - 19	SAND: as above HMS1%				
	19 - 20	SAND: as above HMS1%				
	20 - 21	SAND: as above yellow - brown HM2%				
	21 - 22	SAND: as above HM2%				
	22 - 23	SAND: as above brown HM2%				
	23 - 24	SAND: as above HM2%				
	24 - 25	SAND: very fine to medium grained, poorly sorted subrounded - subangular micaceous brown	HM7%			

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 630E EL: 1425

Date: 23/11/89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: as above HM >1%				
	26-27	SAND: very fine - coarse grained, orange brown, HMT poorly sorted, subrounded - angular, micaceous 1%				
	27-28	SAND: as above HMT 1%				
	28-29	SAND: as above angular to rounded HMT				
	29-30	SAND: as above HMT				
	30-31	SAND: silt - very coarse grained, greyish-brown, clayey, micaceous angular - well rounded, very poorly sorted HMT				
	31-32	SAND: as above HMT				
	32-33	SAND: silt - very fine grained, poorly sorted, micaceous lithic fragments > 3mm, brown HMT				
	33-34	SAND: as above HMT				
	34-35	SAND: silt - very fine, brown, well sorted, rounded micaceous HM<1%				
	35-36	SAND: as above HM<1%				
	36-37	SAND: very fine grained, greyish brown, clayey, rounded, well sorted, micaceous HMT				
	37-38	SAND: as above HMT				
	38-39	SILT: Yellow, poorly sorted, with lithic and quartz grains to 3mm.				
	39-40	SILT: as above				
	40-41	SILT: as above				
	41-42	SILT. as above hit fossiliferous limstone in last 20cm				
		E.O.H 42.0m.				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 1270E EL: 1425

Date: 24.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: grey and brown. silty. Some lithic (Ironstone) fragments to 5mm.				
	1 - 2	CLAY: as above				
	2 - 3	SAND: very fine-medium grained, red, clayey, moderately sorted, subrounded. HMT				
	3 - 4	SAND: as above HMT				
	4 - 5	SAND: very fine grained, orange red, clayey, moderately sorted, subangular to rounded HMT				
	5 - 6	SAND: as above HMT				
	6 - 7	SAND: fine-very fine grained, red-brown, clayey HMT moderately sorted, subangular-rounded				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: as above HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: fine-very fine grained, yellow-brown clayey well sorted, subangular-subrounded HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: very fine-fine grained, reddish-grey clayey, well sorted, subrounded-rounded HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: silt to very fine grained, yellow-brown, clayey, moderately sorted subrounded to rounded HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: very fine-fine grained, brown, clayey, well sorted, subrounded to rounded HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: silt to very fine grained, yellow-brown, very well sorted, subrounded-rounded HMT	1%			
	19 - 20	SAND: as above HM<1%				
	20 - 21	SAND: as above micaceous yellow, clayey, rounded HM>1%				
	21 - 22	SAND: as above HM>1%				
	22 - 23	SAND: as above HMT				
	23 - 24	SAND: as above HMT				
	24 - 25	SAND: very fine grained, grey-yellow, clayey, micaceous				

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hodges Hole No: Line 1 1270E EL: 1425

Date: 24:11:89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 2S above HMT				
	26-27	SAND: silt - very fine grained, grey-yellow, clayey, well sorted, rounded, micaceous HMT				
	27-28	SAND: 2S above HMT				
	28-29	SAND: 2S above grey-brown HMT				
	29-30	SAND: 2S above HMT				
	30-31	SAND: fine-coarse grained brown clayey very micaceous poorly sorted subangular to round HMT				
	31-32	SAND: 2S above HMT				
	32-33	SAND: very fine grained, brown, clayey, very well sorted subrounded-rounded, very micaceous HMT				
	33-34	SAND: 2S above HMT				
	34-35	SAND: silt - very fine grained, greyish-brown, clayey very well sorted, micaceous. HMT				
	35-36	SAND: 2S above HMT				
	36-37	SAND: 2S above yellow-brown HMT 1%				
	37-38	SAND: 2S above HMT 1%				
	38-39	SILT: silt, clayey, grey-brown, micaceous HMT				
	39-40	SILT: 2S above HMT				
	40-41	CLAY: silty, grey-white, micaceous HMT				
	41-42	CLAY: 2S above HMT				
	42-43	CLAY: 2S above reddish-grey HMT				
	43-44	CLAY: 2S above HMT				
	44-45	CALCAREOUS SANDSTONE: + brown silt HMT				
	45-46	CALCAREOUS SANDSTONE: + brown silt HMT				
		E.O.H. 46.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 1440E EL: 1425

Date: 24.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown, silty				
	1 - 2	CLAY: as above				
	2 - 3	CLAY: as above red & grey HMT				
	3 - 4	CLAY: as above HMT				
	4 - 5	SAND: fine-medium grained, yellow-orange, clayey subangular-rounded, poorly sorted HMT				
	5 - 6	SAND: as above HMT				
	6 - 7	SAND: very fine-medium grained, red orange, clayey, poorly sorted, subangular-rounded HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: very fine-fine grained, red-orange, clayey, poorly sorted, subangular-subrounded HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: very fine-medium grained, yellow-orange, clayey subangular-subrounded, poorly sorted HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: as above yellow-brown HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: very fine-medium grained, reddish brown clayey moderately sorted, angular-subrounded HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: silt-very fine grained red-yellow brown clayey, well sorted, subrounded-rounded, micaceous HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: as above grey-brown HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SILT: light grey-brown clayey micaceous HMT				
	21 - 22	SILT: as above HMT				
	22 - 23	SILT: as above HMT				
	23 - 24	SILT: as above HMT				
	24 - 25	SAND: silt-very fine grained, yellow-grey, clayey, well sorted, subrounded, micaceous HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1:1440E EL: 1425

Date: 24:11:89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 2S 2ABOVE HMT				
	26-27	SAND: 2S 2ABOVE HMT				
	27-28	SAND: 2S 2ABOVE HMT				
	28-29	SAND: 2S 2ABOVE -GREY HMT				
	29-30	SAND: 2S 2ABOVE HMT				
	30-31	SAND: very fine-medium grained, grey, clayey, micaceous moderately sorted, subangular to subrounded HMT				
	31-32	SAND: 2S 2ABOVE HMT				
	32-33	SAND: silt-very fine grained, grey-brown, clayey, HMT well sorted, subranded-rounded, micaceous				
	33-34	SAND: 2S 2ABOVE HMT				
	34-35	SAND: 2S 2ABOVE HM<1%				
	35-36	SAND: 2S 2ABOVE HM<1%				
	36-37	SAND: 2S 2ABOVE HMT				
	37-38	SAND: 2S 2ABOVE HMT				
	38-39	CLAY: grey, silty, micaceous HMT				
	39-40	CLAY: 2S 2ABOVE HMT				
	40-41	CLAY: 2S 2ABOVE grey & brown HMT				
	41-42	CLAY: 2S 2ABOVE HMT				
	42-43	SILT: reddish brown-brown, well sorted HMT				
	43-44	SILT: 2S 2ABOVE HMT				
	44-45	SILT: red-brown, brown calcareous sandstone, fossiliferous limestone				
	45-46	SILT: 2S 2ABOVE				
	46-47	LIMESTONE: cream fossiliferous + brown silt fossiliferous sand				
	47-48	LIMESTONE: 2S 2ABOVE.				
		E.O.H 48.0m.				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 1: 1600E EL: 1425

Date: 24.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY: brown calcareous sandy				
	1-2	CLAY: as above				
	2-3	CLAY: reddish-brown sandy				
	3-4	CLAY: as above HMT				
	4-5	CLAY: as above brown ironstone frag. HMT				
	5-6	CLAY: as above HMT				
	6-7	SAND: very fine-fine grained, Grey, clayey, subangular-subrounded, brown sandy clay HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: silt fine grained, pinkish-grey, clayey, moderately sorted, subangular-subrounded HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: very fine fine grained, light grey, well sorted subangular-subrounded HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above grey-yellow, clayey HMT				
	13-14	SAND: as above HMT				
	14-15	SAND: silt-very fine grained, grey, clayey, well sorted HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: as above grey-yellow brown HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: as above grey-pink brown micaceous HMT				
	19-20	SAND: as above HMT				
	20-21	SAND: as above grey				
	21-22	SAND: as above				
	22-23	SAND: as above HMT				
	23-24	SAND: as above HMT				
	24-25	SAND: very fine grained, grey-yellow brown, clayey well sorted, angular-subrounded, micaceous HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: K HODGES Hole No: LINE 1: 1600E EL: 1425

Date: 24.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 2S 2ABOVE HMT				
	26-27	SAND: fine grained, grey, clayey, well sorted, micaceous angular - subrounded HMT				
	27-28	SAND: 2S 2ABOVE HMT				
	28-29	SAND: very fine-medium grained, greyish-brown, clayey poorly sorted, angular - subrounded, very micaceous HMT				
	29-30	SAND: 2S 2ABOVE HMT				
	30-31	SAND: silt - very fine grained, greyish-brown, clayey well sorted, micaceous HMT				
	31-32	SAND: 2S 2ABOVE HMT				
	32-33	CLAY: greyish brown silty, very well sorted, micaceous HMT				
	33-34	CLAY: 2S 2ABOVE HMT				
	34-35	SAND: silt - very fine grained, greyish, brown, clayey, very well sorted, micaceous HMT				
	35-36	SAND: 2S 2ABOVE HMT				
	36-37	SAND: 2S 2ABOVE grey HMT				
	37-38	SAND: 2S 2ABOVE HMT				
	38-39	CLAY: grey silty well sorted micaceous HMT				
	39-40	CLAY: 2S 2ABOVE HMT				
	40-41	CLAY: 2S 2ABOVE greyish-brown HMT				
	41-42	CLAY: 2S 2ABOVE HMT				
	42-43	CLAY: 2S 2ABOVE yellow-brown HMT				
	43-44	CLAY: 2S 2ABOVE HMT				
	44-45	SILT: BROWN CALCAREOUS SANDSTONE: WHITE FOSSILIFEROUS -				
	45-46	SILT: - LIMESTONE (MARLINE)				
		E.O.H 46.0m				

00185

DRILL HOLE RECORD

Project: LUKAN BASIN Logged By: N. HODGES Hole No: LINE 2:00W EL: 1425

Date: 21.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0 - 1	CLAY: yellow-grey, medium grained sandy, contains charcoal, some mottling.				
	1 - 2	CLAY: as above				
	2 - 3	SAND: red-orange, medium grained, clay rich				
	3 - 4	SAND: as above				
	4 - 5	SAND: as above				
	5 - 6	SAND: as above				
	6 - 7	SAND: as above				
	7 - 8	SAND: as above				
	8 - 9	SAND: fine-medium grained, yellow red, clayey, poorly sorted, subrounded-subangular HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: as above HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: fine-medium grained, red, clayey, well sorted, subrounded HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: fine-medium grained, red, clayey, moderately sorted, subrounded HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: as above poorly sorted, red-yellow HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: fine-medium grained, pale yellow, clayey, subrounded some fe staining HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: as above HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: as above yellow-red				
	23 - 24	SAND: as above				
	24 - 25	SAND: medium-coarse grained, yellow, clayey, poorly sorted, sub angular-subrounded, some fe staining, calcareous				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: K. HODGES Hole No: LINE 2:00W EL: 1425

Date: 21.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: as above.				
		E.O.H 26.0m				

00187

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HOGGS Hole No: LINE 2: 160W EL: 1425

Date: 21:11:88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown fine grained sandy				
	1 - 2	CLAY: as above				
	2 - 3	CLAY: as above brown & grey				
	3 - 4	CLAY: as above				
	4 - 5	CLAY: as above HMT				
	5 - 6	SAND: fine - medium grained, red-yellow, well sorted, subrounded - rounded, some ironstone nodules at top of sand HMT				
	6 - 7	SAND: fine - coarse grained, reddish - yellow, clayey, HMT poorly sorted, subangular - subrounded some fe staining of quartz				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: fine - medium grained, yellow-red - some mottling, clayey, subrounded. subangular, fe staining of quartz HMS 1%				
	9 - 10	SAND: as above HMS 1%				
	10 - 11	SAND: very fine - medium grained, brownish red clayey, poorly sorted, subrounded HMS 1%				
	11 - 12	SAND: as above HM < 1%				
	12 - 13	SAND: fine - medium grained, brownish red, clayey, subrounded, some fe staining HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: as above HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: as above HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: as above yellow no fe staining HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: as above yellow-brown ironstone pebbles 2-10mm HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: as above no ironstone pebbles HMT				
	23 - 24	SAND: as above HMT				
	24 - 25	SAND: fine - medium grained, yellow, clayey, subrounded HMT				

00188

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 160W EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: as above HMTT				
	26-27	SAND: as above HMTT				
	27-28	SAND: as above HMTT				
		E.O.H. 28.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 320W EL: 1425

Date: 21.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	SAND: white, fine grained				
	1 - 2	CLAY: brown mottled, sandy				
	2 - 3	CLAY: brown mottled grey, sandy				
	3 - 4	CLAY: as above				
	4 - 5	CLAY: as above HMT				
	5 - 6	SAND: fine-medium grained, yellow mottled red, clayey, subrounded HMT				
	6 - 7	SAND: as above subangular-angular orange red HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: fine-medium grained, yellow orange, clayey HMT some fe staining of quartz, ironstone pebbles to 10mm				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: as above orange ironstone pebbles HMT to 5mm				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: fine-medium grained, orange-red, clayey, HMT some fe staining				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: as above HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: as above red-brown, subrounded HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: as above HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: as above HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: as above HMT				
	23 - 24	SAND: as above HMT				
	24 - 25	SAND: as above HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HOGGES Hole No: LINE 2: 320W EL: 1425

Date: 21.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: fine-medium grained, red brown, clayey, subrounded some fe staining HMT				
	26-27	SAND: very fine medium grained, red brown, clayey, poorly sorted, subangular - subrounded HMT				
	27-28	SAND: as above HMT				
	28-29	SAND: as above HMT				
	29-30	SAND: as above HMT				
		E.O.H. 30.0m				

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hodges Hole No: Line 2: 480W EL: 12±25

Date: 21.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown with very fine grained grey sand HMT				
	1 - 2	SAND: yellow-brown clayey with brown mottling Ironstone chips - 10mm HMT				
	2 - 3	SAND: fine grained, yellow-red, clayey, subrounded-rounded some fe staining of grains, ironstone pebbles to 10mm HMT	HMT			
	3 - 4	SAND: as above HMT				
	4 - 5	SAND: fine grained, red-brown, clayey, subrounded-rounded. Ironstones to 10mm HMT				
	5 - 6	SAND: as above HMT				
	6 - 7	SAND: fine-medium grained, orange-red, clayey, well sorted subrounded. Some fe staining of quartz grains HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: as above red-orange HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: fine-medium grained, red, clayey, some fe staining HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: as above subangular-subrounded HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: very fine-fine grained, red, clayey, subrounded some fe staining HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: fine-medium grained, red, clayey, subrounded, some fe staining HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: as above HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: as above red brown, fe stained HM < 1%				
	21 - 22	SAND: as above HM < 1%				
	22 - 23	SAND: fine-medium grained, red brown, clayey, poorly sorted subangular-subrounded some fe staining HM < 1%	HM < 1%			
	23 - 24	SAND: as above HM < 1%				
	24 - 25	SAND: very fine-medium grained, red brown, clayey subrounded-rounded, some fe staining HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 480W EL: 1425

Date: 21.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 25 2bar HMT				
	26-27	SAND: 25 2bar reddish-brown HMT				
	27-28	SAND: 25 2bar HMT				
	28-29	SAND: 25 2bar HMT				
	29-30	SAND: 25 2bar HMT				
		E.O.H 30.0m				

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hodges Hole No: Line 2: 560W EL: 1425

Date: 22:11:88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown & grey. sandy / white fine quartz sand HMT				
	1 - 2	SAND: very fine-medium grained, reddish brown, clayey, subrounded, some fe staining HMT				
	2 - 3	SAND: fine-medium grained, yellow-red, clayey, subrounded some fe staining HMT				
	3 - 4	SAND: as above HMT				
	4 - 5	SAND: very fine-medium grained, reddish-orange, clayey, subrounded, fe staining common HMT				
	5 - 6	SAND: as above HMT				
	6 - 7	SAND: very fine-fine grained, reddish-brown, clayey subrounded-rounded, some fe staining HMT				
	7 - 8	SAND: as above HMT				
	8 - 9	SAND: as above HMT				
	9 - 10	SAND: as above HMT				
	10 - 11	SAND: as above HMT				
	11 - 12	SAND: as above HMT				
	12 - 13	SAND: very fine-medium grained, reddish brown, clayey, subrounded-rounded, some fe staining HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: as above HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: very fine grained, brown, clayey, subrounded - rounded, some fe staining HMT				
	17 - 18	SAND: as above HMT				
	18 - 19	SAND: very fine-fine grained, reddish-brown, clayey, subrounded-rounded HMT				
	19 - 20	SAND: as above HMT				
	20 - 21	SAND: as above brown well sorted HMT				
	21 - 22	SAND: as above HMT				
	22 - 23	SAND: very fine-medium grained, brown, clayey, subrounded - rounded HMT				
	23 - 24	SAND: as above HMT				
	24 - 25	SAND: as above HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HOSKIES Hole No: LINE 2 : 560W EL: 1425

Date: 22.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 2S 2ABOVE HMT				
	26-27	SAND: fine-medium grained, brown, clayey, well sorted subangular - angular HMT				
	27-28	SAND: 2S 2ABOVE HMT				
	28-29	SAND: very fine - fine grained, reddish brown, clayey subangular HMT				
	29-30	SAND: 2S 2ABOVE HMT				
		E.O.H. 30.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HOSKES Hole No: LINE 2: 64KM EL: 1425

Date: 22.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	SAND: very fine-fine grained white-grey yellow HMT				
	1-2	SAND: very fine-medium grained, reddish brown clayey subangular-subrounded, ironstone chips to 15mm HMT				
	2-3	SAND: very fine-medium grained, yellow-red, clayey subangular-angular >50% Fe staining HMT				
	3-4	SAND: as above HMT				
	4-5	SAND: as above orange-red HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: as above reddish-brown poorly sorted HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: as above HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: very fine-fine grained, red-brown, clayey, some Fe staining, some sandy clay nodules in sand, subrounded HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above well sorted subangular-sub rounded HMK1%				
	13-14	SAND: as above HMK1%				
	14-15	SAND: as above HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: very fine, red-brown, clayey, well sorted, subrounded, HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: very fine-fine grained, brown, clayey, well sorted subrounded-rounded HMT				
	19-20	SAND: as above HMT				
	20-21	SAND: as above HMT				
	21-22	SAND: as above HMT				
	22-23	SAND: as above moderately sorted HMT				
	23-24	SAND: as above HMT				
	24-25	SAND: very fine-medium grained, red brown, clayey, subangular-subrounded, poorly sorted HMK<1%				

DRILL HOLE RECORD

Project: MUKKAY BASIN Logged By: R. HODGES Hole No: LINE 2: 640N EL: 1425

Date: 22:11:08 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: as above HM<1%				
	26-27	SAND: very fine - fine grained, brown, clayey, poorly sorted, subangular - subrounded HMT				
	27-28	SAND: as above HMT				
	28-29	SAND: very fine - medium grained, brown, clayey, poorly sorted, subangular - subrounded HMT				
	29-30	SAND: as above HMT				
	30-31	SAND: medium-coarse grained, orange brown, clayey, moderately sorted, some iron induration HMT				
	31-32	SAND: as above HMT				
	32-33	SAND: medium-very coarse grained, orange brown, poorly sorted, angular - rounded, clay matrix, white mica, rhyolitic ironstone fragments	HMT			
	33-34	SAND: as above HMT				
	34-35	SAND: very fine - fine grained orange brown well sorted subangular - rounded, clay matrix, some white mica. HM>1%				
	35-36	SAND: as above HM>1%				
	36-37	SAND: as above HM>1%				
	37-38	SAND: as above HM>1%				
	38-39	SAND: as above HMT				
	39-40	SAND: as above HMT				
	40-41	SAND: fine-medium grained, orange-brown, micaceous poorly sorted, subangular - rounded, clay matrix, quartz grains to 5mm	HMT			
	41-42	SAND: as above HMT				
	42-43	SAND: coarse grained brown with orange brown clay, white mica HM>1%				
	43-44	SAND: as above HM>1%				
	44-45	SAND: as above brown clay HMT				
	45-46	SAND: as above HMT				
	46-47	SAND: as above HMT				
	47-48	SAND: as above HMT				
		E.O.H. 48.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 720W EL: 1425

Date: 22.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY: brown-red mottled, slightly sandy HMT				
	1-2	SAND: very fine grained, red-brown, subangular-subrounded HMT				
	2-3	SAND: very fine-medium grained, orange-red, clayey subangular-subrounded, poorly sorted Ironstone chips HMT				
	3-4	SAND: as above HMT				
	4-5	SAND: as above HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: very fine grained, red brown, clayey, well sorted subrounded-rounded HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: as above Ironstone chips HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: as above subangular-subrounded HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: very fine grained, red brown, clayey, well sorted subrounded-rounded HM<1%				
	13-14	SAND: as above HM<1%				
	14-15	SAND: as above brown HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: as above HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: as above subangular-subrounded HMT				
	19-20	SAND: as above HMT				
	20-21	SAND: as above HMT				
	21-22	SAND: as above HMT				
	22-23	SAND: very fine-fine grained, red brown, clayey, subrounded-rounded HMT				
	23-24	SAND: as above HMT				
	24-25	SAND: very fine-very coarse grained, brown, clayey, poorly sorted, angular-subrounded HMT				

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hodges Hole No: Line 2: 720N EL: 1425

Date: 22:11:88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: 25 above HMT				
	26-27	SAND: 25 above pebbles-15mm micaceous HMT				
	27-28	SAND: 25 above HMT				
	28-29	SAND: 25 above HMT				
	29-30	SAND: 25 above HMT				
		E.O.H. 30.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 800N EL: 1425

Date: 22.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0-1	SAND: very fine-fine grained, red-brown, clayey, well sorted, subrounded HMT				
	1-2	SAND: as above HMT				
	2-3	SAND: as above Ironstone chips, brown HMT				
	3-4	SAND: as above HMT				
	4-5	SAND: as above red brown (no ironstone) HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: as above some fe staining HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: very fine-medium grained, red-brown, some fe staining, clayey, moderately sorted subangular-subrounded HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: as above poorly sorted HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above no fe staining moderately sorted HMT				
	13-14	SAND: as above HMT				
	14-15	SAND: as above some fe staining HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: as above red brown grades to yellow brown clayey HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: as above red brown HMT				
	19-20	SAND: as above HMT				
	20-21	SAND: very fine-fine grained red-brown, clayey, well sorted subangular-rounded HMT				
	21-22	SAND: as above HMT				
	22-23	SAND: as above brown subrounded-rounded HMT				
	23-24	SAND: as above HMT				
	24-25	SAND: very fine-medium grained, brown, clayey, poorly sorted subangular-rounded HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 800W EL: 1425

Date: 22.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	SAND: very fine-fine grained, red-brown, clayey, well sorted, subrounded HMT				
	1-2	SAND: 2S 2bove HMT				
	2-3	SAND: 2S 2bove Ironstone chips, brown HMT				
	3-4	SAND: 2S 2bove HMT				
	4-5	SAND: 2S 2bove red brown (no ironstone) HMT				
	5-6	SAND: 2S 2bove HMT				
	6-7	SAND: 2S 2bove some fe staining HMT				
	7-8	SAND: 2S 2bove HMT				
	8-9	SAND: very fine-medium grained, red-brown, some fe staining clayey, moderately sorted subangular-subrounded HMT				
	9-10	SAND: 2S 2bove HMT				
	10-11	SAND: 2S 2bove poorly sorted HMT				
	11-12	SAND: 2S 2bove HMT				
	12-13	SAND: 2S 2bove no fe staining moderately sorted HMT				
	13-14	SAND: 2S 2bove HMT				
	14-15	SAND: 2S 2bove some fe staining HMT				
	15-16	SAND: 2S 2bove HMT				
	16-17	SAND: 2S 2bove red brown grades to yellow brown clayey HMT				
	17-18	SAND: 2S 2bove HMT				
	18-19	SAND: 2S 2bove red brown HMT				
	19-20	SAND: 2S 2bove HMT				
	20-21	SAND: very fine-fine grained red-brown, clayey, well sorted subangular-rounded HMT				
	21-22	SAND: 2S 2bove HMT				
	22-23	SAND: 2S 2bove brown subrounded-rounded HMT				
	23-24	SAND: 2S 2bove HMT				
	24-25	SAND: very fine-medium grained, brown, clayey, poorly sorted subangular-rounded HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 800W EL: 1425

Date: 22.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25-26	SAND: 2S 2bove HMT				
	26-27	SAND: very fine fine grained, brown, clayey, poorly sorted subangular -subrounded HMT				
	27-28	SAND: 2S 2bove HMT				
	28-29	SAND: very fine-medium grained, brown, clayey, poorly sorted, angular -subrounded HMT				
	29-30	SAND: 2S 2bove HMT				
		E.O.H. 30.0m				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 880W EL: 1425

Date: 23.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY: brown sandy				
	1-2	CLAY: as above				
	2-3	SAND: very fine-fine grained, red-brown, moderately sorted. subangular-subrounded HMT				
	3-4	SAND: as above HMT				
	4-5	SAND: very fine-medium grained, yellow-red, poorly sorted subangular-subrounded grey brown mottled clayey HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: as above red moderately sorted HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: as above red brown smaller quantity of clay chips present HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: very fine fine grained, red brown, clayey, moderately sorted, subangular-subrounded HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above HMT				
	13-14	SAND: as above HMT				
	14-15	SAND: as above brown well sorted HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: as above HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: very fine-medium grained, brown, clayey HMT				
	19-20	SAND: as above HMT				
	20-21	SAND: very fine grained, Grey brown HMT				
	21-22	CLAY: dark grey-dark brown HMT				
	22-23	CLAY: dark chocolate brown silty HMT				
	23-24	CLAY: as above HMT				
	24-25	SAND: very fine-fine grained, yellow, poorly sorted HMT				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2 : 880N EL : 1425

Date: 23.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: silty - very fine, grey brown, well sorted, grained HMT				
	26-27	SAND: very fine - coarse grained, yellow, clayey, poorly sorted angular - subrounded HMT				
	27-28	SAND: 2S 2bove HMT				
	28-29	SAND: very fine grained, grey-yellow, well sorted, subrounded - rounded, micaceous HM~1%				
	29-30	SAND: 2S 2bove HM~1%				
	30-31	SAND: 2S 2bove clayey moderately sorted grains - 3mm subangular HM~1%				
	31-32	SAND: 2S 2bove HM>1%				
	32-33	CLAY: grey yellow, silty HM>1%				
	33-34	CLAY: 2S 2bove HM>1%				
	34-35	SILT: grey yellow, clayey, moderately sorted micaceous (grains - 3mm) HM~1%				
	35-36	SILT: 2S 2bove HM~1%				
	36-37	CLAY: yellow-brown silty micaceous HMT				
	37-38	CLAY: 2S 2bove HMT				
	38-39	CLAY: 2S 2bove HM<1%				
	39-40	CLAY: 2S 2bove HM<1%				
	40-41	CLAY: 2S 2bove dark brown calcareous clay chips				
	41-42	CLAY: 2S 2bove				
	42-43	LIMESTONE: + calcareous silt				
	43-44	LIMESTONE: 2S 2bove				
		E.O.H 44.0m.				

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2: 960N EL: 1425

Date: 22·11·88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY: brown & grey sandy				
	1-2	CLAY: as above				
	2-3	CLAY: as above increasingly sandy				
	3-4	CLAY: as above				
	4-5	SAND: fine-medium grained, red brown, clayey, moderately sorted subangular-subrounded brown/grey, clays HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: very fine-fine grained, brown clayey, moderately sorted, subrounded-rounded HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: very fine-medium grained, cream-white, clayey poorly sorted, angular-subrounded HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: as above moderately sorted HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above cream-grey				
	13-14	SAND: as above				
	14-15	SAND: very fine-fine grained, grey, clayey, well sorted subrounded-rounded				
	15-16	SAND: as above				
	16-17	SAND: very fine-medium grained, grey, clayey, moderately sorted, subangular-subrounded				
	17-18	SAND: as above				
	18-19	SAND: as above cream-grey				
	19-20	SAND: as above				
	20-21	SAND: as above				
	21-22	SAND: as above				
	22-23	SAND: as above grey				
	23-24	SAND: as above				
	24-25	SAND: as above				

00205

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hodges Hole No: Line 2: 960N EL: 1425

Date: 22:11:88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: as above				
	26-27	SAND: very fine - very coarse grained, grey yellow, clayey poorly sorted, grains - 10mm, subangular - subrounded				
	27-28	SAND: as above				
	28-29	SAND: silt-very fine grained, grey, clayey, very well sorted				
	29-30	SAND: as above				
	30-31	SILT: grey, clayey, well sorted, slightly micaceous				
	31-32	SILT: as above				
	32-33	SILT: as above HM<1%				
	33-34	SILT: as above HM<1%				
	34-35	SILT: as above HM<1%				
	35-36	SILT: as above HM<1%				
	36-37	CLAY: yellow, very fine, sandy HM<1%				
	37-38	CLAY: as above HM<1%				
	38-39	CLAY: yellow sandy clay. grey sandy clay				
	39-40	CLAY: as above				
	40-41	LIMESTONE fossiliferous, cream, yellow calcareous sand				
	41-42	LIMESTONE: as above				
		E.O.H. 42.0m.				

00206

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. + BOGGS Hole No: LINE 2: 112mN EL: 1425

Date: 22.11.88 Sheet 1 of 1

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0 - 1	CLAY: brown-grey sandy				
	1 - 2	CLAY: as above				
	2 - 3	CLAY: as above				
	3 - 4	CLAY: as above				
	4 - 5	CLAY: as above				
	5 - 6	CLAY: grey sandy				
	6 - 7	CLAY: as above				
	7 - 8	CLAY: as above				
	8 - 9	CLAY: as above				
	9 - 10	CLAY: as above				
	10 - 11	SAND: orange, brown clayey				
	11 - 12	SAND: as above				
	12 - 13	SAND: as above grey HMT				
	13 - 14	SAND: as above HMT				
	14 - 15	SAND: orange, clayey, containing coarse grains and pebbles of iron cemented bands HMT				
	15 - 16	SAND: as above HMT				
	16 - 17	SAND: very fine silt - occasional coarse grained, white mica HMK1%				
	17 - 18	SAND: as above HMK1%				
	18 - 19	SAND: yellow brown clayey very well sorted HMK1%				
	19 - 20	SAND: as above HMK1%				
	20 - 21	SAND: as above containing shelley fragments				
	21 - 22	SAND: as above				
		E.O.H. 22.0m				

00207

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hoggs Hole No: Line 2: 1200W EL: 1425

Date: 23:11:89 Sheet 1 of 1

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY: grey-brown fine silty				
	1-2	CLAY: as above				
	2-3	CLAY: as above				
	3-4	CLAY: as above				
	4-5	CLAY: as above to very fine sandy clay				
	5-6	CLAY: as above				
	6-7	CLAY: as above grey				
	7-8	CLAY: as above				
	8-9	CLAY: grey calcareous				
	9-10	CLAY: as above				
	10-11	CLAY: grey, fine sandy, slightly calcareous				
	11-12	CLAY: as above				
	12-13	CLAY: fine-coarse grained, orange brown, sandy HMT				
	13-14	CLAY: as above HMT				
	14-15	SAND: fine-coarse grained, red brown, clayey, poorly sorted subangular-subrounded ironstone chips HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: very fine-fine grained, grey orange brown clayey, subrounded, moderately sorted, grains to 3mm, Micaceous HM<1%				
	17-18	SAND: as above HM<1%				
	18-19	SAND: very fine grained, orange brown, clayey, well sorted subrounded-rounded HM<1%				
	19-20	SAND: as above HM<1%				
	20-21	SAND: fossiliferous clayey calcareous				
	21-22	SAND: as above				
		E.O.H 22-0m				

00208

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LINE 2 : 152W EL: 1425

Date: 24:11:88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY: reddish brown, silty, ironstone fragments to 5mm				
	1-2	CLAY: as above				
	2-3	SAND:				
	3-4	SAND: as above				
	4-5	SAND: very fine grained, yellow orange brown, clayey well sorted subrounded to rounded HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: very fine - coarse grained, orange brown, poorly sorted, angular to subrounded, micaceous HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: as above brown HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: as above yellow brown HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above subangular - rounded grey orange brown HMT				
	13-14	SAND: as above HMT				
	14-15	SAND: as above brown HMT				
	15-16	SAND: as above HMT				
	16-17	SAND: silt - very fine grained, brown, clayey, well sorted micaceous HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: as above moderately sorted HMT				
	19-20	SAND: as above HMT				
	20-21	SILT: brown calcareous sands, limestone, calcareous sandstone				
	21-22	SILT: as above				
	22-23	SILT: as above (no limestone) HMT				
	23-24	SILT: as above HMT				
	24-25	SILT: brown silt. fossiliferous limestone, calcareous sand				

DRILL HOLE RECORD

Project: Murray Basin Logged By: R. Hodges Hole No: Line 2: 1520 E EL: 1425

Date: 24.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25-26	Silt	as above			
		E.O.H 26.0m				

00210

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HOARES Hole No: LINE 2: 1680W EL: 1425

Date: 24.11.88 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	SAND: very fine-medium grained, brown, clayey, poorly sorted subangular-subrounded, slightly calcareous				
	1-2	SAND: as above				
	2-3	SAND: as above (not calcareous) HMT				
	3-4	SAND: as above HMT				
	4-5	SAND: very fine-fine grained, orange, brown clayey, well sorted, subangular-subrounded ironstone chips (to 10mm) HMT				
	5-6	SAND: as above HMT				
	6-7	SAND: as above brown moderately sorted HMT				
	7-8	SAND: as above HMT				
	8-9	SAND: silt-very fine grained, reddish brown, clayey, well sorted HMT				
	9-10	SAND: as above HMT				
	10-11	SAND: very fine grained, yellow brown, clayey, well sorted, ironstone chips to 7mm HMT				
	11-12	SAND: as above HMT				
	12-13	SAND: as above some ironstone chips micaceous HMT				
	13-14	SAND: as above HMT				
	14-15	CLAY: as above grey brown HMT				
	15-16	CLAY: as above HMT				
	16-17	SAND: silt-very fine grained, yellow brown, clayey micaceous, moderately sorted, subrounded-rounded HMT				
	17-18	SAND: as above HMT				
	18-19	SAND: very fine-coarse grained, brown, clayey, poorly sorted, subangular-well rounded, lithic fragments -1mm micaceous				
	19-20	SAND: as above				
	20-21	SAND: as above HMT				
	21-22	SAND: as above HMT				
	22-23	SAND: very fine-coarse grained, grey brown, clayey, poorly sorted, angular-rounded, micaceous HMT				
	23-24	SAND: as above HMT				
	24-25	SAND: as above brown HMT				

00211

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: R. HODGES Hole No: LWR 2: 1680W EL: 1425

Date: 24.11.88 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: as above HMT				
	26-27	SAND: silt - very coarse grained, brown, poorly sorted, subrounded-rounded, micaceous HMT				
	27-28	SAND: as above HMT				
	28-29	SILT: brown, clayey, well sorted, micaceous HMT				
	29-30	SILT: as above HMT				
	30-31	SILT: brown and calcareous sandstone				
	31-32	SILT: as above				
	32-33	CLAY: brown silty calcareous sandstone				
	33-34	CLAY: as above				
	34-35	SILT: brown clayey, fossiliferous sand				
	35-36	LIMESTONE: White				
		E.O.H. 36.0m				

DRILL HOLE RECORD

Project: SOUTH AUSTRALIA Logged By: A. DOVE Hole No: Line 3:00 EL: 1425

Date: 21.11.89 Sheet 1 of 1

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	1-2	CLAY, brown and minor sand				
	2-3	CLAY and SAND, orange brown.				
	3-4	SAND, fine grained, orange brown, abundant clay.				
	4-5	AS ABOVE, clay decreasing with depth, H.M. trace.				
	5-6	SAND, fine grained, amber. H.M. <1%.				
	6-7	SAND, fine to medium grained, light grey, clay rich, H.M. <1%.				
	7-8	AS ABOVE, grades to amber. H.M. trace.				
	8-9	SAND, fine to medium grained, orange brown, clay rich, H.M. <1%.				
	9-10	AS ABOVE. H.M. trace.				
	10-11	AS ABOVE. H.M. ≈ 1%.				
	11-12	SAND, fine to medium grained, orange brown to yellow brown, minor clay, occasional coarse to very coarse grains. H.M. <1%.				
	12-13	SAND, fine to medium grained, orange brown, minor clay, abundant coarse to very coarse grains. H.M. <1%.				
	13-14	AS ABOVE then hit very coarse grained gravel, light grey. H.M. trace.				
	14-15	SAND, fine to medium grained, brown to yellow brown, minor clay, abundant coarse to very coarse grains. H.M. trace.				
	15-16	SAND, fine grained, light yellow, minor clay and mica. H.M. trace.				
	16-17	SAND, fine grained, orange brown, minor clay. H.M. <1%.				
	17-18	AS ABOVE, H.M. ≈ 1%.				
	18-19	AS ABOVE, clay rich. H.M. <1%.				
	19-20	SAND, fine grained, orange brown, minor clay and mica rich. H.M. trace.				
	20-21	SAND, fine grained, brown, abundant clay, mica rich.				
	21-22	AS ABOVE, hit grey clay then, sandy limestone				
	22-23	SANDY LIMESTONE				
	23-24	SANDY LIMESTONE				
		E.O.H. 24.0m.				

DRILL HOLE RECORD

Project: Murray Basin Logged By: Ash Kenny Hole No: 3/160 EL: 1425

Date: 17·11·89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAY HM CONTE
	0-1	CLAY : MINOR SAND CHOCOLATE BROWN				
	1-2	CLAY : MINOR SAND BROWN IRONSTONE PRESENT				
	2-3	CLAY : SAND RICH RED-BROWN . IRONSTONE FRAGMENTS.				
	3-4	CLAY : SAND RICH IRONSTONE FRAGMENTS RED/GRAY BROWN.				
	4-5	CLAY : SAND RICH IRONSTONE FRAGMENTS RED-BROWN.				
	5-6	SAND : MEDIUM GRAINED , CLAY RICH YELLOW-BROWN				
	6-7	SAND : MEDIUM GRAINED , CLAY RICH , CEMENTED BANDS ENCOUNTERED YELLOW-BROWN				
	7-8	SAND : FINE-MEDIUM GRAINED , CLAY RICH, CEMENTED BANDS . YELLOW-BROWN				
	8-9	SAND : FINE-MEDIUM GRAINED, CLAY RICH , GRAY BROWN -YELLOW BROWN				
	9-10	SAND : MEDIUM GRAINED, CLAY RICH , YELLOW-BROWN				
	10-11	SAND : MEDIUM GRAINED CLAY RICH BROWN				
	11-12	SAND : MEDIUM GRAINED , CLAY RICH KHAKI-YELLOW BROWN				
	12-13	SAND : MEDIUM GRAINED, CLAY RICH . GRAY.				
	13-14	SAND : MEDIUM-COARSE GRAINED CLAY RICH , GRAY .				
	14-15	SAND : COARSE GRAINED CLAY RICH IRONSTONE PIECES GRAY				
	15-16	SAND : COARSE-V.COARSE GRAINED CLAY RICH IRONSTONE FRAGMENTS GRAY.				
	16-17	SAND : MEDIUM-COARSE GRAINED CLAY RICH GRAY-YELLOW				
	17-18	SAND : AS ABOVE				
	18-19	SAND : AS ABOVE . OCCASSIONAL COARSE GRAINS				
	19-20	SAND : MEDIUM GRAINED CLAY RICH GRAY/YELLOW				
	20-21	SAND : FINE-V.FINE CLAY RICH YELLOW-BROWN				
	21-22	SAND : FINE-V.FINE MODERATELY CLAYEY YELLOW-BROWN				
	22-23	SAND : FINE-V.FINE MODERATELY CLAYEY KHAKI-GRAY				
	23-24	SAND : V.FINE GRAINED CLAYEY MICACEOUS KHAKI-YELLOW				
	24-25	SAND : FINE-MEDIUM GRAINED CLAY RICH , OCCASSIONAL COARSE GRAINS MICACEOUS KHAKI-BROWN				

00214

DRILL HOLE RECORD

Project: Murray Basin Logged By: Ash Kenny Hole No: 3/160 EL: 1425

Date: 17·11·89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND: FINE- MEDIUM GRAINED CLAYEY, LIMESTONE FRAGMENTS YELLOW·BROWN.				
	26-27	LIMESTONE: FOSSILIFEROUS [SHELL FRAGMENTS BRYZOAL STEMS FORAMINOID PLATES] WHITE-CREME				
		E.O.H.				

00215

DRILL HOLE RECORD

Project: Murray Basin Logged By: Paul Jones Hole No: 3/320 EL: 1425

Date: 17·11·89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAY HM CONTE
	0-1	CLAY: BROWN				
	1-2	CLAY: AS ABOVE ; MINOR COARSE SAND				
	2-3	CLAY: GRAY ; YELLOW SAND				
	3-4	CLAY: AS ABOVE				
	4-5	CLAY: MINOR SAND ; RED - GRAY				
	5-6	CLAY: VERY SANDY ; RED				
	6-7	SAND: MEDIUM - COARSE GRAINED SUB ROUNDED - POORLY SORTED INDURATED (IRONSTONE) LAYER . RED				
	7-8	SAND: AS ABOVE . NOT INDURATED , VERY CLAYEY RED-GRAY				
	8-9	SAND: MEDIUM - COARSE GRAINED POORLY SORTED , CEMENTED AND SLIGHTLY INDURATED . VERY CLAYEY				
	9-10	SAND: MEDIUM - FINE GRAINED VERY CLAYEY YELLOW - GRAY.				
	10-11	SAND: MEDIUM - COARSE GRAINED SUB ANGULAR - SUB ROUNDED POORLY SORTED , CLAYEY .				
	11-12	SAND: AS ABOVE				
	12-13	SAND: AS ABOVE RED - GRAY				
	13-14	SAND: COARSE - V. COARSE SUB ANGULAR POORLY SORTED . SOME LARGE QTZ PEBBLES (+5mm) GRAY				
	14-15	SAND: MEDIUM - V. COARSE GRAINED SUB ANGULAR - SUB ROUNDED POORLY SORTED SLIGHTLY CLAYEY . GRAY				
	15-16	SAND: MEDIUM - FINE GRAINED WITH COARSE GRAINED MATERIAL INTERSPERSED THROUGHOUT . SUB ROUNDED , POORLY SORTED GRAY.				
	16-17	SAND: AS ABOVE . LARGE VARIATION IN GRAIN SIZE.				
	17-18	SAND: AS ABOVE . QUITE CLAYEY				
	18-19	SAND: COARSE - V. COARSE SUB ANGULAR - SUB ROUNDED POORLY SORTED . VERY CLAYEY . CREME .				
	19-20	SAND: AS ABOVE				
	20-21	SAND: AS ABOVE				
	21-22	SAND: FINE - MEDIUM GRAINED , CLAY RICH GRAY YELLOW				
	22-23	SAND: FINE - V. FINE SUB ROUNDED MODERATELY SORTED MICACEOUS , CLAYEY TRACE H.M. YELLOW				
	23-24	SAND: AS ABOVE YELLOW - GRAY				
	24-25	SAND: AS ABOVE				

00216

DRILL HOLE RECORD

Project: Murray Basin Logged By: Paul Jones Hole No: 3/320 EL: 1425

Date: 17·11·89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYE H M CONTEN
	25-26	SAND: AS ABOVE . LIMESTONE FRAGMENTS				
	26-27	LIMESTONE: FOSSILIFEROUS ; MINOR SAND				
		E. O. H.				

00217

DRILL HOLE RECORD

Project: Murray Basin Logged By: Ash Kenny Hole No: 3/480 EL: 1425

Date: 17.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY : GRAY				
	1-2	CLAY : MINOR SAND ; GRAY				
	2-3	CLAY : AS ABOVE ; LIGHT GRAY				
	3-4	CLAY : AS ABOVE				
	4-5	CLAY : AS ABOVE				
	5-6	CLAY : AS ABOVE ; SAND CONTENT INCREASING				
	6-7	CLAY : SAND RICH RED-GRAY				
	7-8	CLAY : SAND RICH, CHANGES TO SANDY CLAY, RED-BROWN INDURATED BANDS?				
	8-9	SAND : MEDIUM GRAINED CLAYEY, INDURATED LAYER ORANGE-BROWN				
	9-10	SAND : MEDIUM GRAINED, VERY CLAYEY, RED-BROWN				
	10-11	SAND : MEDIUM GRAINED, CLAYEY, YELLOW BROWN				
	11-12	SAND : MEDIUM GRAINED, CLAYEY, ORANGE-YELLOW BROWN				
	12-13	SAND : FINE-MEDIUM GRAINED, CLAYEY, ORANGE-BROWN HEAVY MINERAL TRACE				
	13-14	SAND : AS ABOVE - NOT A REPRESENTATIVE SAMPLE.				
	14-15	SAND : MEDIUM GRAINED, CLAYEY, ORANGE-BROWN				
	15-16	SAND : COARSE GRAINED, CLAY RICH, ORANGE-BROWN.				
	16-17	SAND : MEDIUM-COARSE GRAINED, CLAY RICH, ORANGE-BROWN.				
	17-18	SAND : FINE-MEDIUM GRAINED, CLAY RICH, GRAY ORANGE-BROWN HEAVY MINERAL TRACE.				
	18-19	SAND : AS ABOVE				
	19-20	SAND : MEDIUM-GRAINED, CLAY RICH, ORANGE-BROWN				
	20-21	SAND : MEDIUM-COARSE GRAINED CLAY RICH, ORANGE-BROWN HEAVY MINERAL TRACE ?				
	21-22	SAND : AS ABOVE				
	22-23	SAND : FINE GRAINED-MEDIUM GRAINED CLAY RICH TRACE H.M. YELLOW-ORANGE/BROWN				
	23-24	SAND : FINE-MEDIUM GRAINED CLAY RICH, IRONSTONE FRAGMENTS (GRAVEL SIZE) TRACE H.M. KHAKI-BROWN				
	24-25	SAND : AS ABOVE				

DRILL HOLE RECORD

Project: Murray Basin Logged By: Ash Kenny Hole No: 3/480 EL: 1425

Date: 17·11·89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYE H M CONTEN
	25-26	SAND: FINE-V. FINE GRAINED; CLAY RICH YELLOW-BROWN				
	26-27	SAND + LIMESTONE: SAND AS ABOVE WITH LMST. CHIPS INTERSPERSED.				
		E.O.H.				

00219

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 3:640 EL: 1425 m

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTEN
	0-1	CLAY, grey.				
	1-2	AS ABOVE				
	2-3	AS ABOVE				
	3-4	AS ABOVE				
	4-5	CLAY, orange brown and minor sand.				
	5-6	SAND, fine to medium grained, light brown, clay rich, H.M. <1%.				
	6-7	AS ABOVE. H.M. trace.				
	7-8	AS ABOVE, grades to orange brown. H.M. trace.				
	8-9	SAND, fine to medium grained, orange brown to yellow brown, clay rich, numerous grey clay bands. H.M. trace				
	9-10	SAND, fine to medium grained, light grey, minor clay.				
	10-11	AS ABOVE				
	11-12	AS ABOVE then orange brown				
	12-13	SAND, fine to medium grained, yellow brown, abundant thin clay bands.				
	13-14	AS ABOVE, grades to light grey				
	14-15	SAND, fine to medium grained, light brown, abundant thin clay bands. Hit water.				
	15-16	SAND, fine to medium grained, light brown, clay rich.				
	16-17	AS ABOVE, grades to light grey.				
	17-18	SAND, fine to medium grained, light grey, clay rich.				
	18-19	AS ABOVE				
	19-20	AS ABOVE, minor mica. H.M. trace.				
	20-21	AS ABOVE, grades to grey. H.M. trace				
	21-22	SAND, fine to medium grained, light grey, minor coarse grains. H.M. trace.				
	22-23	AS ABOVE, grades to yellow brown, minor clay. H.M. trace				
	23-24	SAND, coarse grained, orange brown, minor mica				

00220

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. DOVE Hole No: Line 3:640 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	24-25	AS ABOVE, coarse to very coarse grained.				
	25-26	SAND, fine grained, light grey, minor mica. H.M. trace.				
	26-27	SAND, fine grained, brown, abundant light grey bands.				
	27-28	SAND, fine grained, pale yellow, minor clay bands, hit sandy limestone bands				
	28-29	SANDY LIMESTONE				
	29-30	SANDY LIMESTONE				
		E.O.H. 30.0m.				

DRILL HOLE RECORD

00221

Project: Murray Basin Logged By: A. DOVE Hole No: Line 3:800 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0-1	CLAY, dark grey.				
	1-2	CLAY, light grey.				
	2-3	AS ABOVE				
	3-4	CLAY, dark grey and minor sand.				
	4-5	CLAY, red brown and minor sand.				
	5-6	SAND, fine to medium grained, red brown, clay rich.				
	6-7	AS ABOVE, grades to brown.				
	7-8	SAND, fine to medium grained, light grey, abundant clay.				
	8-9	SAND, fine to medium grained, light grey, clay rich.				
	9-10	AS ABOVE. Hit light grey clay layer (>30 cm thick)				
	10-11	SAND, fine to medium grained, light grey, clay rich.				
	11-12	AS ABOVE. Hit grey clay layer >30 cm thick.				
	12-13	CLAY, dark grey to black.				
	13-14	CLAY, black				
	14-15	AS ABOVE				
	15-16	SAND, fine to medium grained, brown, abundant thin clay bands.				
	16-17	SAND, fine to medium grained, orange brown, minor clay.				
	17-18	AS ABOVE				
	18-19	AS ABOVE, grades to amber, minor mica.				
	19-20	SAND, fine to medium grained, light grey. H.M. trace.				
	20-21	AS ABOVE, grades to amber, minor clay. H.M. <1%.				
	21-22	SAND, fine to medium grained, light grey, minor mica. H.M. trace.				
	22-23	AS ABOVE, grades to orange brown. H.M. trace.				
	23-24	SAND, fine to medium grained, amber, minor mica. H.M. trace.				
	24-25	SAND, coarse to very coarse grained, orange brown.				

DRILL HOLE RECORD

00222

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 3:960 EL: 1425.1

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY, grey				
	1-2	CLAY, light grey				
	2-3	AS ABOVE				
	3-4	AS ABOVE				
	4-5	AS ABOVE				
	5-6	CLAY, red brown and minor sand.				
	6-7	SAND, fine to medium grained, brown, abundant clay.				
	7-8	AS ABOVE, numerous light grey clay bands.				
	8-9	CLAY, light grey				
	9-10	AS ABOVE and minor sand				
	10-11	AS ABOVE				
	11-12	CLAY, light grey				
	12-13	AS ABOVE and minor sand				
	13-14	CLAY, red brown.				
	14-15	CLAY, black.				
	15-16	AS ABOVE				
	16-17	AS ABOVE.				
	17-18	CLAY, black to dark brown				
	18-19	AS ABOVE				
	19-20	SAND, fine to medium grained, orange brown. Abundant clay				
	20-21	AS ABOVE. H.M. trace.				
	21-22	SAND, fine to medium grained, yellow brown, minor coarse grains, clay rich, minor mica.				
	22-23	SAND, coarse to very coarse grained, orange brown.				
	23-24	AS ABOVE				
	24-25	CLAY, yellow brown, minor sandy limestone chips				

00223

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. DOVE Hole No: Line 3:960 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SANDY LIMESTONE				
	26-27	SANDY LIMESTONE				
		E.O.H. 27.0m.				

DRILL HOLE RECORD

00224

Project: Murray Basin Logged By: A. DOVE Hole No: Line 3:1120 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0-1	CLAY, grey				
	1-2	AS ABOVE				
	2-3	AS ABOVE.				
	3-4	AS ABOVE.				
	4-5	AS ABOVE and brown sand.				
	5-6	SAND, fine to medium grained, brown, abundant clay.				
	6-7	CLAY, light brown and minor sand.				
	7-8	CLAY, light grey.				
	8-9	AS ABOVE				
	9-10	AS ABOVE & minor sand				
	10-11	CLAY, light grey.				
	11-12	AS ABOVE				
	12-13	CLAY, grey				
	13-14	AS ABOVE				
	14-15	CLAY, dark grey to black.				
	15-16	AS ABOVE.				
	16-17	AS ABOVE then sand, coarse tovery coarse grained, orange brown.				
	17-18	SAND, coarse to very coarse grained, yellow brown.				
	18-19	AS ABOVE, grades to orange brown.				
	19-20	AS ABOVE minor ironstone chips.				
	20-21	AS ABOVE, hit ironstone band.				
	21-22	SAND, fine to very fine grained, orange brown, silty. H.M. trace.				
	22-23	AS ABOVE. H.M. <1%.				
	23-24	AS ABOVE, H.M. <1%.				
	24-25	AS ABOVE then yellow brown clay, thin sandy limestone				

00225

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. DOVE Hole No: Line 3:1120 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SANDY LIMESTONE				
	26-27	SANDY LIMESTONE				
		E.O.H. 27.0m.				

00226

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 4:00 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0-1	CLAY, brown				
	1-2	AS ABOVE				
	2-3	AS ABOVE				
	3-4	SAND, fine to medium grained, red brown, abundant clay.				
	4-5	CLAY, orange brown, minor sand.				
	5-6	SAND, fine to medium grained, orange brown, abundant clay, minor cemented band				
	6-7	SAND, fine to medium grained, orange brown, clay rich, H.M. trace.				
	7-8	AS ABOVE, H.M. trace.				
	8-9	AS ABOVE				
	9-10	AS ABOVE				
	10-11	AS ABOVE, abundant clay. H.M. trace				
	11-12	AS ABOVE. H.M. trace.				
	12-13	AS ABOVE, H.M. trace				
	13-14	AS ABOVE				
	14-15	AS ABOVE. H.M. trace.				
	15-16	AS ABOVE. H.M. trace				
	16-17	AS ABOVE. H.M. trace				
	17-18	CLAY, light brown, minor sand				
	18-19	SAND, fine grained, light brown, abundant clay, H.M. trace.				
	19-20	AS ABOVE, H.M. trace				
	20-21	AS ABOVE, grades to off-white				
	21-22	SAND, fine to medium grained, off-white, abundant clay, H.M. trace				
	22-23	AS ABOVE, grades to light grey. H.M. trace.				
	23-24	SAND, fine to medium grained, amber. Abundant clay. H.M. trace.				
	24-25	AS ABOVE. H.M. trace.				

DRILL HOLE RECORD

00227

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 3:1120 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25-26	SANDY LIMESTONE				
	26-27	SANDY LIMESTONE				
		E.O.H. 27.0m.				

DRILL HOLE RECORD

00228

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 4:00 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25-26	AS ABOVE				
	26-27	SAND, fine to medium grained, light grey, abundant clay. H.M. trace.				
	27-28	AS ABOVE. H.M. trace.				
	28-29	AS ABOVE. H.M. trace				
	29-30	AS ABOVE, grades to light brown, minor coarse grains.				
		E.O.H. 30.0m.				

DRILL HOLE RECORD

00229

Project: Murray Basin Logged By: A. DOVE Hole No: Line 4:160 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY and SAND, light brown.				
	1-2	CLAY, brown and minor sand.				
	2-3	AS ABOVE				
	3-4	SAND, fine to medium grained, red brown, clay rich.				
	4-5	SAND, fine to medium grained, red brown, minor cemented bands				
	5-6	AS ABOVE, abundant cemented bands				
	6-7	AS ABOVE, clay rich				
	7-8	CLAY, orange brown, minor sand				
	8-9	AS ABOVE				
	9-10	SAND, fine to medium grained, orange brown, abundant clay. H.M. trace				
	10-11	AS ABOVE. H.M. trace.				
	11-12	AS ABOVE, H.M. trace.				
	12-13	AS ABOVE, H.M. trace				
	13-14	AS ABOVE, H.M. trace				
	14-15	AS ABOVE, H.M. trace.				
	15-16	AS ABOVE, H.M. trace.				
	16-17	AS ABOVE, H.M. trace.				
	17-18	AS ABOVE, H.M. trace.				
	18-19	AS ABOVE, H.M. trace.				
	19-20	AS ABOVE, grades to yellow brown. H.M. trace.				
	20-21	SAND, fine to medium grained, yellow brown, abundant clay, H.M. trace				
	21-22	AS ABOVE, occasional coarse grains. H.M. trace.				
	22-23	AS ABOVE, H.M. trace.				
	23-24	AS ABOVE, minor coarse grains, H.M. trace.				
	24-25	SAND, medium grained, amber, occasional coarse grains, clay rich. H.M. trace.				

DRILL HOLE RECORD

00230

Project: Murray Basin Logged By: A. DOVE Hole No: Line 4:160 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	25-26	AS ABOVE. H.M. trace.				
	26-27	AS ABOVE, medium to coarse grained, H.M. trace.				
	27-28	SAND, medium to coarse grained, light grey, clay rich. H.M. trace.				
	28-29	AS ABOVE. H.M. trace.				
	29-30	AS ABOVE. H.M. trace.				
		E.O.H. 30.0m.				

00231

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. DOVE Hole No: Line 4:320 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY, grey				
	1-2	AS ABOVE				
	2-3	CLAY, light grey				
	3-4	CLAY, brown and minor sand				
	4-5	AS ABOVE				
	5-6	SAND, fine to medium grained, orange brown, abundant clay.				
	6-7	AS ABOVE, H.M. trace				
	7-8	AS ABOVE, H.M. trace				
	8-9	AS ABOVE, H.M. trace.				
	9-10	AS ABOVE, H.M. trace				
	10-11	AS ABOVE, H.M. trace.				
	11-12	AS ABOVE, H.M. trace				
	12-13	AS ABOVE, H.M. trace.				
	13-14	AS ABOVE, H.M. trace				
	14-15	AS ABOVE, occasional coarse grains, H.M. trace.				
	15-16	SAND, medium to coarse grained, orange brown, abundant clay. H.M. trace.				
	16-17	AS ABOVE, H.M. trace.				
	17-18	AS ABOVE, H.M. trace.				
	18-19	AS ABOVE, grades to yellow brown, H.M. trace.				
	19-20	SAND, medium to coarse grained, yellow brown, abundant clay, H.M. trace.				
	20-21	AS ABOVE, grades to fine to medium grained. H.M. trace				
	21-22	SAND, fine to medium grained, amber, clay rich. H.M. ≈ 1%				
	22-23	AS ABOVE, grades to yellow brown, H.M. ≈ 1%.				
	23-24	SAND, fine to medium grained, yellow brown, abundant clay, occasional coarse grains. H.M. ≈ 1%.				
	24-25	AS ABOVE, grades to medium to coarse grained, H.M. trace.				

00232

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 4:320 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND, coarse grained, light grey, abundant clay.				
	26-27	AS ABOVE, grades to medium to coarse grained.				
	27-28	AS ABOVE, grades to coarse grained.				
	28-29	AS ABOVE				
	29-30	SAND, coarse to very coarse grained, light brown, abundant clay.				
		E.O.H. 30.0m.				

00233

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 4:460 EL: 1425'

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAYED H M CONTENT
	0-1	CLAY, grey				
	1-2	AS ABOVE				
	2-3	CLAY, light grey				
	3-4	AS ABOVE, grades to orange brown				
	4-5	SAND, fine to medium grained, orange brown, abundant clay				
	5-6	SAND, fine to medium grained, light grey, abundant clay, abundant cemented bands.				
	6-7	SAND, fine to medium grained, light grey, abundant clay, H.M. trace.				
	7-8	AS ABOVE, H.M. trace.				
	8-9	AS ABOVE, H.M. trace.				
	9-10	SAND, fine to medium grained, light grey, clay rich.				
	10-11	AS ABOVE, grades to orange brown.				
	11-12	SAND, fine to medium grained, yellow brown, clay rich. H.M. trace.				
	13-14	SAND, fine to medium grained, yellow brown, abundant clay, H.M. trace				
	14-15	AS ABOVE, grades to medium grained, light grey. H.M. trace.				
	15-16	SAND, medium grained, light grey, abundant clay. H.M. <1%.				
	16-17	AS ABOVE. H.M. <1%.				
	17-18	AS ABOVE. H.M. trace.				
	18-19	AS ABOVE. H.M. trace.				
	19-20	AS ABOVE, H.M. trace.				
	20-21	AS ABOVE. H.M. trace.				
	21-22	AS ABOVE, H.M. trace.				
	22-23	SAND, medium to coarse grained, pale pink, abundant clay. H.M. trace.				
	23-24	AS ABOVE. H.M. trace.				
	24-25	AS ABOVE. H.M. trace.				
	25-26	AS ABOVE				

00234

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. DOVE Hole No: Line 4:460 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	26-27	AS ABOVE, grades to medium grained, light grey.				
	27-28	SAND, medium grained, light grey, abundant clay.				
	28-29	AS ABOVE, grades to fine to medium grained, pale pink.				
	29-30	SAND, medium to coarse grained, light grey, abundant clay.				
		E.O.H. 30.0m.				

00235

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. DOVE Hole No: Line 4:640 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H.M. ESTIMATE	SAMPLE NUMBER	ASSAYED H.M. CONTEN
	0-1	CLAY, off-white				
	1-2	CLAY, light brown				
	2-3	AS ABOVE and minor sand				
	3-4	CLAY, orange brown				
	4-5	SAND, medium grained, orange brown, abundant clay, minor cemented bands.				
	5-6	AS ABOVE				
	6-7	SAND, fine to medium grained, orange brown, clay rich.				
	7-8	AS ABOVE				
	8-9	AS ABOVE				
	9-10	AS ABOVE, grades to yellow brown				
	10-11	SAND, fine to medium grained, red brown, clay rich.				
	11-12	AS ABOVE				
	12-13	SAND, fine to medium grained, orange brown, abundant clay. H.M. trace.				
	13-14	AS ABOVE, H.M. trace.				
	14=15	AS ABOVE, H.M. trace.				
	15-16	AS ABOVE, H.M. trace				
	16-17	AS ABOVE, H.M. trace				
	17-18	AS ABOVE, H.M. trace.				
	18-19	AS ABOVE, H.M. trace				
	19-20	AS ABOVE, H.M. trace				
	20-21	AS ABOVE, H.M. trace.				
	21-22	AS ABOVE				
	22-23	SAND, medium grained, yellow brown, abundant clay.				
	23-24	AS ABOVE, medium to coarse grained.				
	24-25	SAND, medium grained, light grey, abundant clay. H.M. trace.				

DRILL HOLE RECORD

00236

Project: Murray Basin Logged By: A. DOVE Hole No: Line:640 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H.M. ESTIMATE	SAMPLE NUMBER	ASSAYED H.M. CONTENT
	25-26	AS ABOVE, H.M. trace				
	26-27	SAND, medium to coarse grained, yellow brown, abundant clay. H.M. trace.				
	27-28	SAND, medium to coarse grained, light grey, clay rich. H.M. trace.				
	28-29	AS ABOVE, coarse grained.				
	29-30	AS ABOVE, coarse to very coarse grained. H.M. trace.				
		E.O.H. 30.0m.				

00237

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 4:800 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYE HM CONTEN
	0-1	CLAY, light brown.				
	1-2	AS ABOVE				
	2-3	CLAY, orange brown and minor sand				
	3-4	SAND, fine to medium grained, orange brown, abundant clay.				
	4-5	AS ABOVE				
	5-6	AS ABOVE				
	6-7	AS ABOVE, medium grained.				
	7-8	SAND, medium grained, orange brown, abundant clay.				
	8-9	AS ABOVE, fine to medium grained. H.M. trace.				
	9-10	SAND, fine to medium grained, orange brown, abundant clay, H.M. trace.				
	10-11	AS ABOVE, H.M. trace.				
	11-12	AS ABOVE, H.M. trace				
	12-13	AS ABOVE, medium grained.				
	13-14	SAND, medium to coarse grained, orange brown, abundant clay.				
	14-15	AS ABOVE				
	15-16	AS ABOVE, H.M. trace.				
	16-17	AS ABOVE, H.M. trace				
	17-18	SAND, fine to medium grained, yellow brown abundant clay				
	18-19	AS ABOVE, grades to pale pink				
	19-20	SAND, medium grained, orange brown, abundant clay.				
	20-21	AS ABOVE				
	21-22	AS ABOVE				
	22-23	SAND, coarse grained, yellow brown, abundant clay.				
	23-24	AS ABOVE				
	24-25	SAND, medium to coarse grained, pale pink, abundant clay.				

DRILL HOLE RECORD 00238

Project: MURRAY BASIN Logged By: A. DOVE Hole No: Line 4:800 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H M ESTIMATE	SAMPLE NUMBER	ASSAY H M CONTE
	25-26	AS ABOVE				
	26-27	SAND, coarse grained, light grey, abundant clay				
	27-28	SAND, coarse to very coarse grained, off-white, ~~clay rich.~~				
	28-29	AS ABOVE				
	29-30	AS ABOVE, minor gravel				
		E.O.H. 30.0m.				

00239

Project: Murray Basin Logged By: A. KENNY Hole No: LINE 4:960 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY, light brown , minor sand.				
	1-2	AS ABOVE				
	2-3	CLAY, light orange brown, minor sand.				
	3-4	CLAY, orange brown minor sand, cemented band.				
	4-5	SAND, fine to medium grained, clay rich, orange brown.				
	5-6	AS ABOVE				
	6-7	CLAY, orange brown, minor sand.				
	7-8	CLAYEY SAND, orange brown.				
	8-9	SAND, orange brown, fine to medium grained, clay rich. H.M. trace.				
	9-10	SAND, as above, medium grained H.M. trace.				
	10-11	SAND, medium grained, orange brown, abundant clay. H.M. trace.				
	11-12	SAND, as above, H.M. trace.				
	12-13	SAND, as above, H.M. trace.				
	13-14	SAND, medium to coarse grained, orange brown, abundant clay. H.M. trace.				
	14-15	SAND, as above. H.M. trace.				
	15-16	SAND, as above. H.M. trace.				
	16-17	SAND, medium grained, orange brown, abundant clay. H.M. trace.				
	17-18	SAND, fine to medium grained, orange brown, abundant clay. H.M. trace.				
	18-19	SAND, fine grained, orange brown, abundant clay. H.M. trace.				
	19-20	SAND, as above, yellow brown. H.M. ≈ 1.0%				
	20-21	SAND, fine grained, grey, abundant clay. H.M. >1%.				
	21-22	SAND, fine grained, light grey, abundant clay. H.M. > 1%.				
	22-23	SAND, as above, H.M. > 1%				
	23-24	SAND, as above. H.M. > 1%				
	24-25	SAND, as above. H.M. > 1%				

DRILL HOLE RECORD

00240

Project: Murray Basin Logged By: A. KENNY Hole No: Line 4:960 EL: 1425

Date: 21.11.89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	25-26	SAND, yellow, fine to medium grained, abundant clay. H.M. < 1%				
	26-27	SAND, yellow, medium to coarse grained H.M. < 1%				
	27-28	SAND, light grey, medium to coarse grained, abundant clay. H.M. trace.				
	28-29	SAND, light grey, coarse grained, abundant clay. H.M. trace.				
	29-30	AS ABOVE				
		E.O.H. 30.0m.				

00241

DRILL HOLE RECORD

Project: Murray Basin Logged By: A. KENNY Hole No: Line 4:1120 EL: 1425

Date: 21.11.89 Sheet 1 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED HM ESTIMATE	SAMPLE NUMBER	ASSAYED HM CONTENT
	0-1	CLAY, light brown.				
	1-2	CLAY, light brown.				
	2-3	CLAY, brown, minor sand.				
	3-4	CLAY, orange brown, sand rich.				
	4-5	CLAY, as above.				
	5-6	CLAY, orange brown, sand minor				
	6-7	SAND, medium grained, orange brown, abundant clay. H.M. trace.				
	7-8	SAND, as above. H.M. trace.				
	8-9	SAND, as above. H.M. trace.				
	9-10	SAND, medium to coarse grained, red brown, abundant clay. H.M. trace.				
	10-11	SAND, medium to coarse grained, orange brown, abundant clay. H.M. trace.				
	11-12	SAND, as above. H.M. trace.				
	12-13	SAND, as above, light brown, H.M. trace.				
	13-14	SAND, medium to coarse grained, orange brown, abundant clay. H.M. trace.				
	14-15	SAND, as above. H.M. trace.				
	15-16	SAND, medium grained, orange brown, abundant clay. H.M. trace.				
	16-17	SAND, medium to coarse grained, orange brown, abundant clay. H.M. trace.				
	17-18	SAND, as above, Fe stained, H.M. trace.				
	18-19	SAND, medium grained, red brown, abundant clay. H.M. trace.				
	19-20	SAND, fine grained, yellow, abundant clay. H.M. $\approx$ 1%.				
	20-21	SAND medium grained, light brown, abundant clay. H.M. trace.				
	21-22	SAND, fine to medium grained, light brown, abundant clay. H.M. > 0.5%.				
	22-23	SAND, fine to medium grained, light mauve, abundant clay. H.M. trace.				
	23-24	SAND, fine grained, off white, abundant clay. H.M. < 1%.				
	24-25	SAND, as above. H.M. < 1%.				

00242

DRILL HOLE RECORD

Project: MURRAY BASIN Logged By: A.KENNY Hole No: line 4;1120 EL: 1425 m

Date: 21/11/89 Sheet 2 of 2

RECOVERY	DEPTH	LITHOLOGY	WEIGHT OF SAMPLE	PANNED H.M. ESTIMATE	SAMPLE NUMBER	ASSAYED H.M. CONTENT
	25-26	SAND, as above, medium grained. H.M. trace.				
	26-27	SAND, off white/grey, fine grained, abundant clay. H.M. trace.				
	27-28	SAND, as above.				
	28-29	SAND, off white/grey, coarse grained, abundant clay. H.M. trace.				
	29-30	SAND, as above. H.M. trace.				
		E.O.H. 30.0M.				

SOUTH AUSTRALIA | VICTORIA

34°S

35°S

36°S

140°E

141°E

142°E

Murray River

DUKES HIGHWAY

BIG DESERT

LITTLE DESERT

EL 1425

Bordertown

Wimmera River

Horsham

Mt. Arapiles

Grampians

LOCALITY DIAGRAM

N

SCALE 1:1000000

0 20 40 60 80km.

6937-1

BURMINE LIMITED

SATELLITE LINEAMENT ANALYSIS

Author: C.C.	Date: JUNE '88	Fig. No.: 4

Prepared by Peter H Stitt & Associates Pty Ltd

6937-1

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SOUTH AUSTRALIA

SECOND EDITION

GEOMORPHIC MAP E.L. 1425, SHEET 1.

6937-2

KEY

TP	Parilla Sands
TP1	Parilla Sands with a minimal cover of Quaternary Sands
TPR	Parilla Barrier Ridges
TPV	Parilla Interbarrier Depressions
DP	Deflation basins on Parilla sands
B	Pliocene?/Quaternary Barriers
IB	Interbarrier depressions
	Quaternary Dunes
P1	Sub-longitudinal parabolic dunes
P2	Imbricate, massive parabolic dunes
P3	Fish-scale parabolic dunes
D	Deflation basins
S	Swamp
●	Location of drill holes

6937-2

KEY

TP	Parilla Sands
TP1	Parilla Sands with a minimal cover of Quaternary Sands
TPR	Parilla Barrier Ridges
TPV	Parilla Interbarrier Depressions
DP	Deflation basins on Parilla sands
B	Pliocene?/Quaternary Barriers
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P3	Fish-scale parabolic dunes
D	Deflation basins
S	Swamp
●	Location of drill holes

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SOUTH AUSTRALIA

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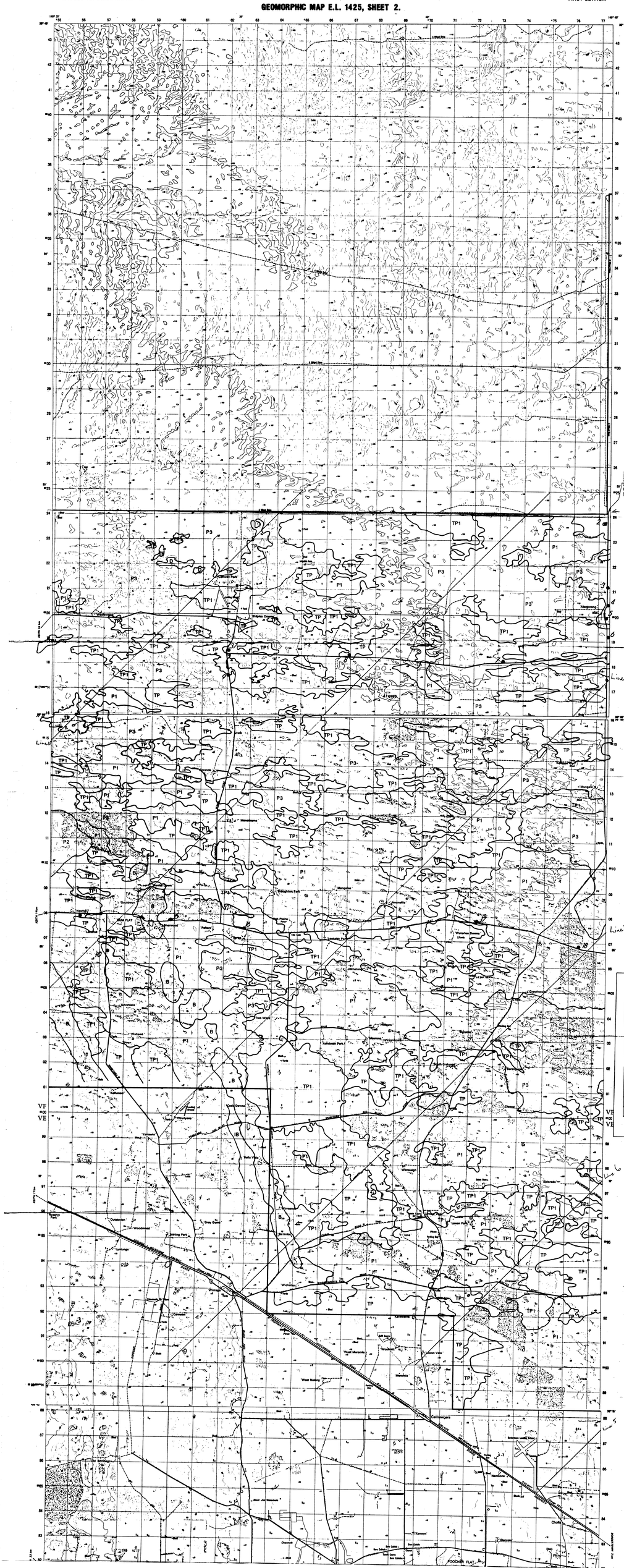
GEOMORPHIC MAP E.L. 1425, SHEET 2.

6937-3.



6937-3

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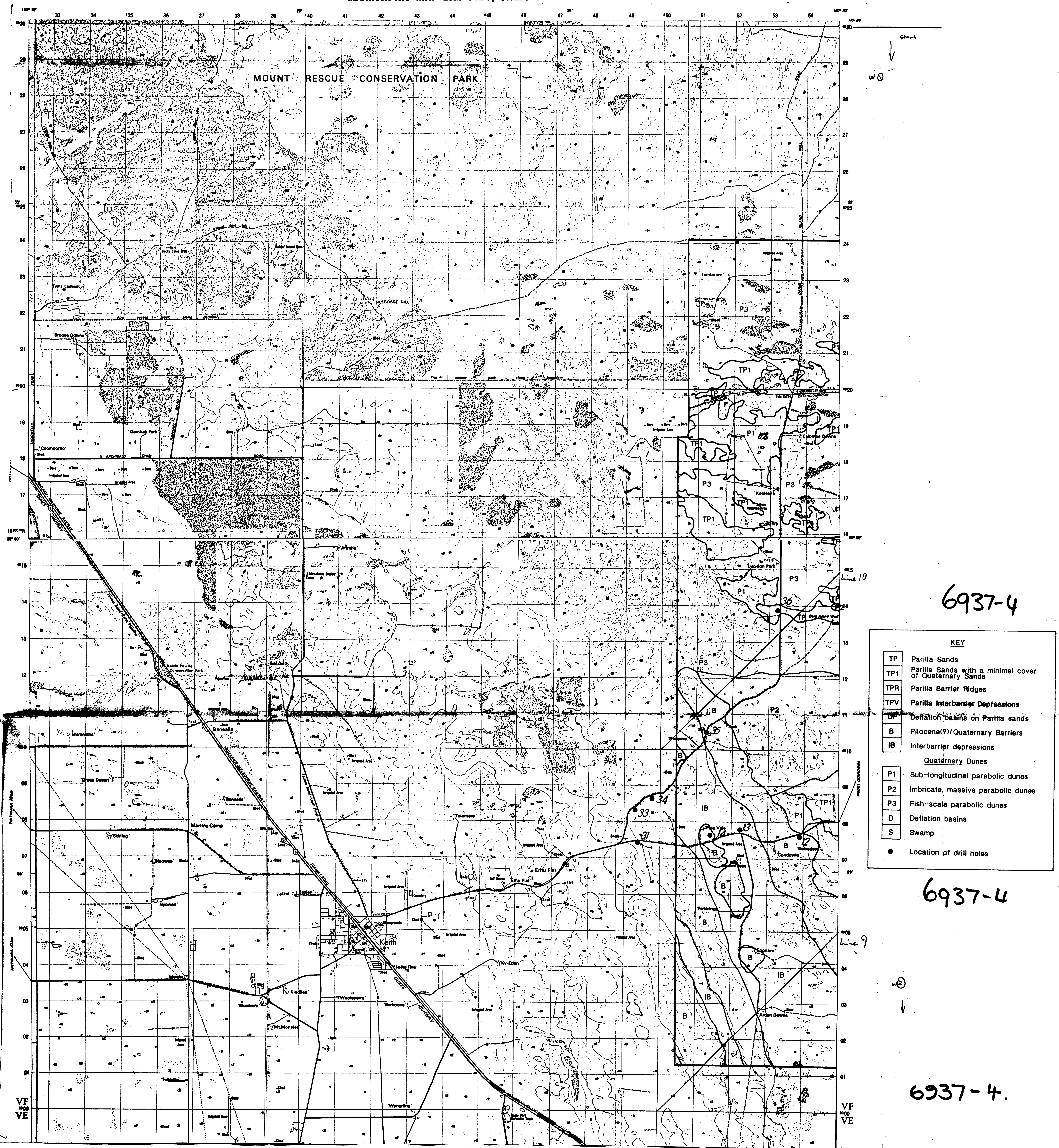
1:40 000 TOPOGRAPHIC SERIES

RESCUE

SOUTH AUSTRALIA

GEOMORPHIC MAP E.L. 1425, SHEET 3.

SECOND EDITION



6937-4

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7026-2

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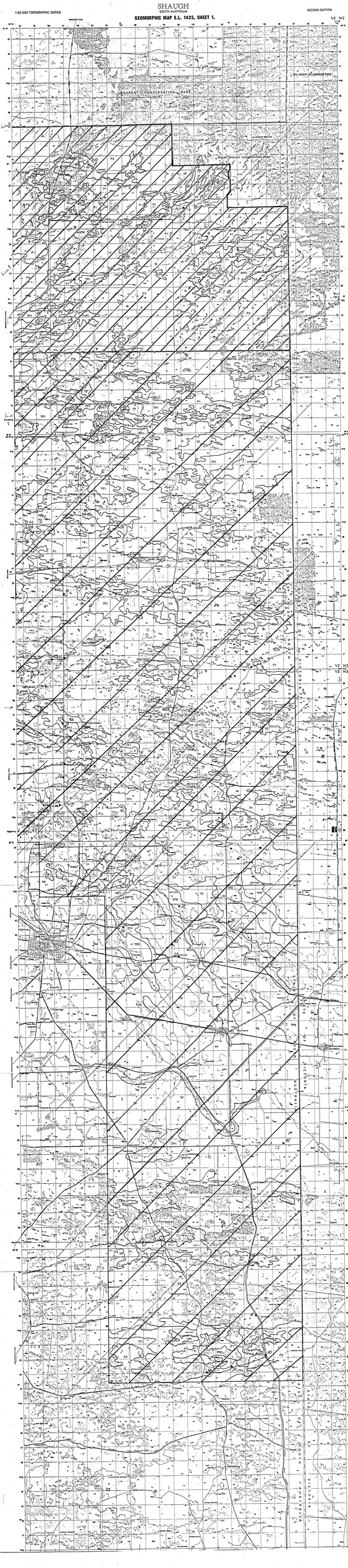
SOUTH AUSTRALIA

SECOND EDITION

GEOMORPHIC MAP E.L. 1425, SHEET 1.



7026–III

7026–III

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SOUTH AUSTRALIA

GEOMORPHIC MAP E.L. 1425, SHEET 2.

FIRST EDITION

6937-6

KEY

TP	Parilla Sands
TP1	Parilla Sands with a minimal cover of Quaternary Sands
TPR	Parilla Barrier Ridges
TPV	Parilla Interbarrier Depressions
DP	Deflation basins on Parilla sands
B	Pliocene(?)/Quaternary Barriers
IB	Interbarrier depressions

Quaternary Dunes

P1	Sub-longitudinal parabolic dunes
P2	Imbricate, massive parabolic dunes
P3	Fish-scale parabolic dunes
D	Deflation basins
S	Swamp
●	Location of drill holes

LEASE AREA TO BE RELINQUISHED.

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GEOMORPHIC MAP E.L. 1425, SHEET 3.

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