Eden Energy Ltd

ACN 109 200 900

First and Final Report

Bollards Lagoon Project
GEL 169

HELD BY:	Eden Energy Ltd
MANAGER & OPERATOR:	Eden Energy Ltd
AUTHOR(s):	Graham M. Jeffress
SUBMITTED TO:	Greg Solomon
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CONTENTS

List of Figures

1 Introduction

1.1 Background

GEL169 is located south of Moomba in the Eromanga Basin on features related to the Cooper Basin model developed by Geodynamics Pty Ltd. Although it is outside the Cooper Basin depo-centre there are significant sediment sections in the Tennapera Trough providing good thermal insulation for basement granites. In addition there is some evidence for regional lineaments providing a focus for fracturing and aquifer development in basement sections.

Two main components are required for a heat reservoir within the earth's crust to achieve the required temperature for commercial power generation:

(a) Primary heat production within the reservoir

The primary heat production from within a buried body results largely from radioactive decay of minerals within the body. Hence, large bodies which are relatively rich in such minerals will have the ability to generate anomalously large amounts of heat. In particular large, late stage granite plutons or large mineralised systems rich in radioactive minerals are potential targets. In addition, the temperature of such reservoirs would be enhanced if they are located in an area of anomalous heat flow within the crust, such as the fairly well defined area occupying a large portion of northeastern South Australia.

(b) Insulation of the heat reservoir

It is essential that the heat generated within the reservoir be trapped effectively, and the most efficient natural insulators are fine grained sediments, in particular carbonaceous shales and coal seams. Modelling by others indicates that around four to five kilometres of sedimentary cover would be required to blanket a granitic heat reservoir to ensure sufficient heat was retained. Large mineralised systems rich in radioactive minerals may require less sedimentary cover, possibly as little as 2-3 km.

1.2 Licence Data

Geothermal Exploration Licence 169 (GEL169) was granted on 9th May 2005 with an initial term of five years over an area of 498km^2.

Figure 1 shows the licence location.

1.3 Period

In accordance with Section 33 of the Petroleum Regulations 2000, this report details work conducted during the first permit year of GEL 169.

2 Work Requirements

The Year 1 work programme negotiated by Eden with PIRSA for GEL 169 comprised:

- Geological and geophysical review;
- Seismic reprocessing; and
- Logging and petrographic investigations.

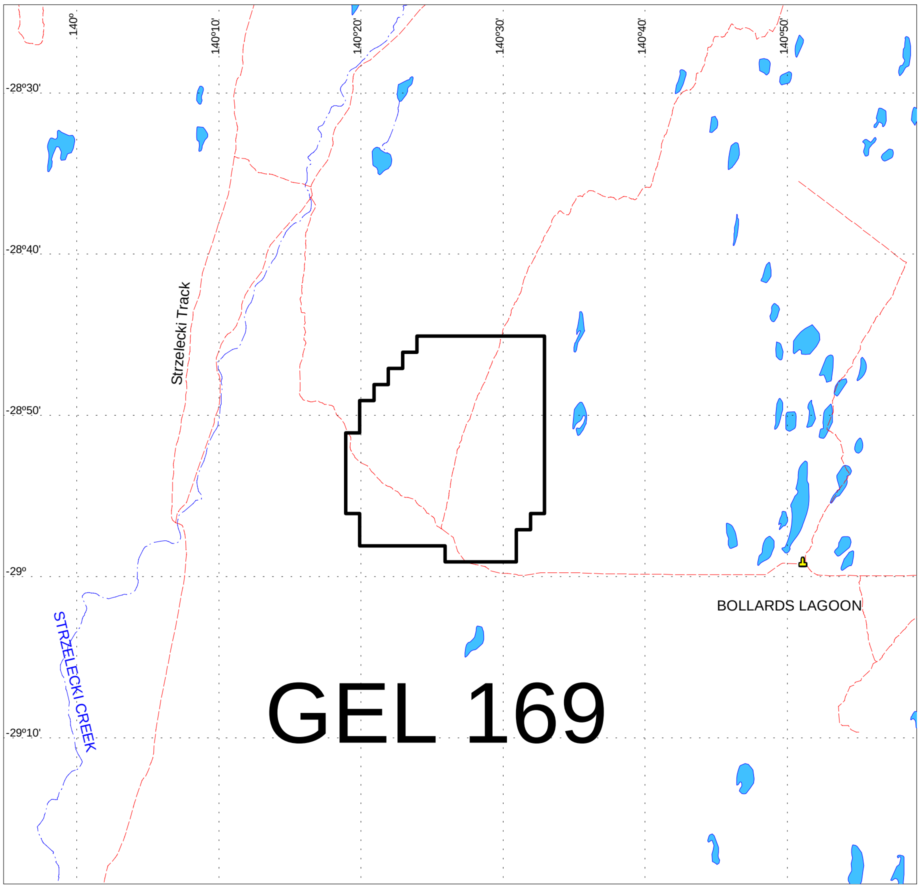

Figure 1: Location of GEL169

3 Work Conducted

During the first year of the licences Eden concentrated on reviewing all the available data for the area and assessing the validity of its initial rationale for the tenement application.

3.1 Geological Review

During the first year of the licences, Eden has focussed on acquiring and reviewing all the available open file data relevant to the project area.

A review of the published literature on the geology of the region was undertaken.

Relevant features of the geological evolution in the Bollards Lagoon area are summarised by Thornton (1979). GEL169 is located on the southern margins of the Cooper/Eromanga Basin in close proximity to the Tennapera Trough which may provide geothermal prospects with deep sediment cover comparable to the Moomba region (Figure 2 and Figure 3).

The Eromanga Basin is part of the trans-Australian platform cover. It is a large depression with a north-east to south-west trend and, in Queensland, a general dip towards the south and south-west. To the north, the upper part of the sequence is continuous with the Carpentaria Basin over the Euroka Arch, and to the south-east with the Surat Basin over the Nebine Ridge. In the far northeast and northwest it abuts Pre-Cambrian rocks of the Georgetown and Mount Isa Inliers respectively. At least 50% of the Eromanga Basin is underlain by older basins. These include the Georgina Basin, the Galilee Basin which in turn is underlain in part by the Drummond and Adavale Basins, and the Cooper Basin and underlying Warrabin Trough. The Simpson Basin underlies a small part of the Eromanga Basin in Queensland in the west near Poeppel Corner. The Maneroo Platform in the central part of the basin and the Thargomindah and Cheepie Shelves in the south are main areas of Eromanga Basin sedimentation directly overlying basement.

The Eromanga Basin succession reaches a maximum thickness of at least 2600m in the central to south-western part of the basin overlying the Cooper Basin.

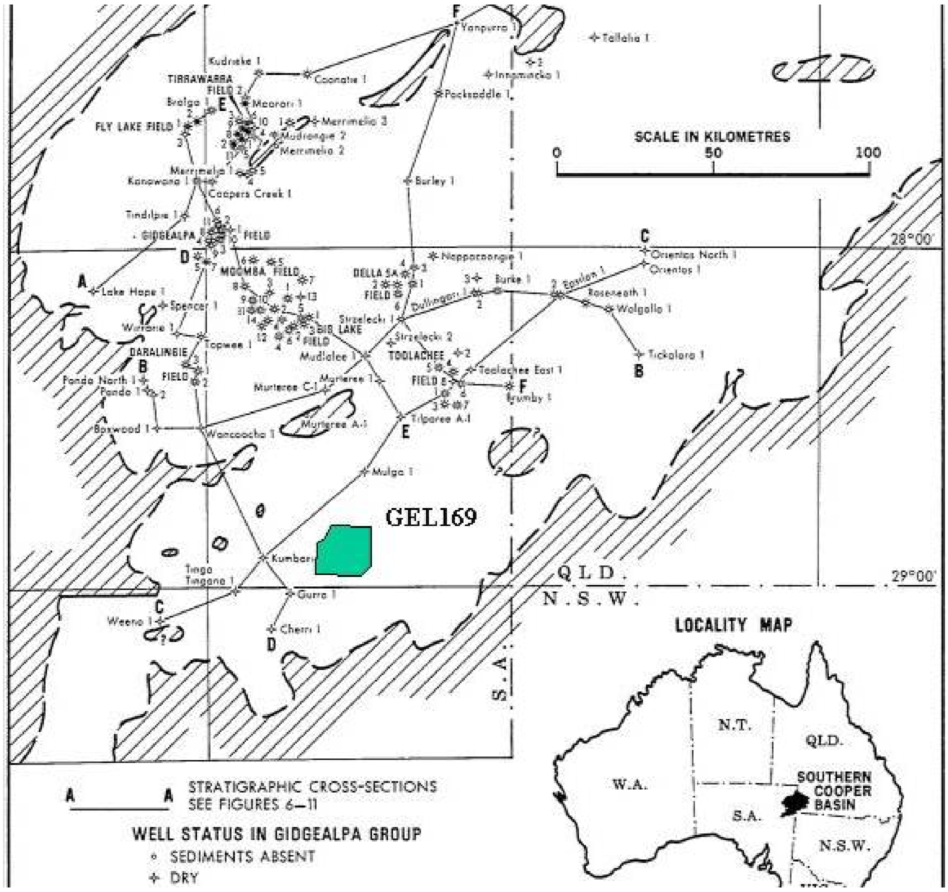

Figure 2: GEL169 - Bollards Lagoon and relevant oil well locations.

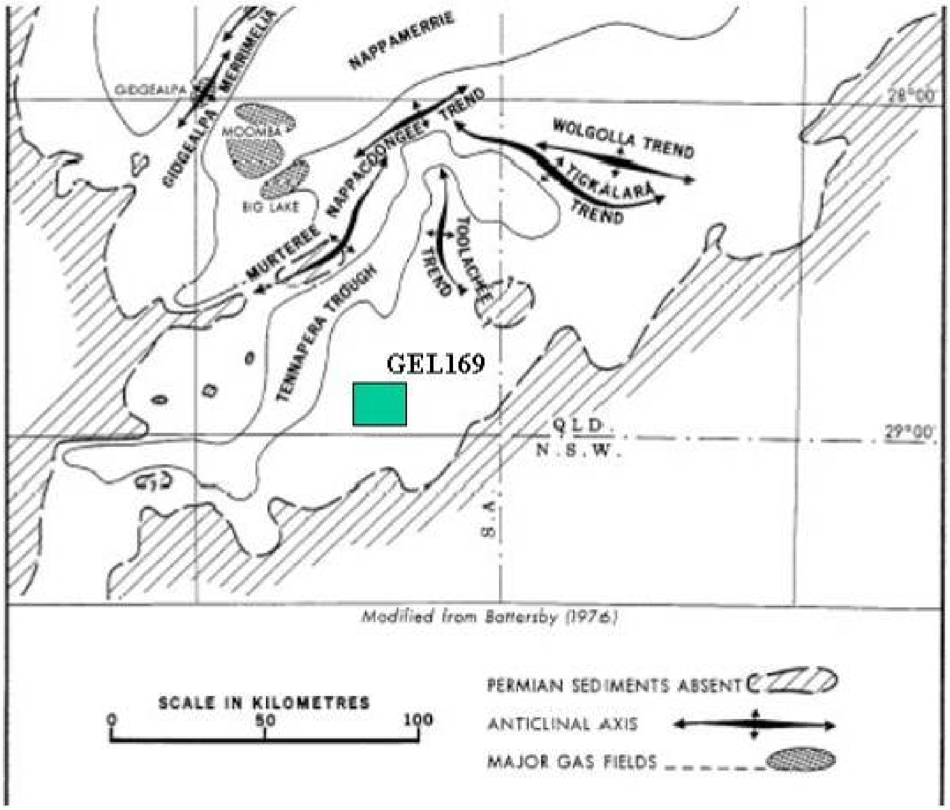

Figure 3: GEL169 - Structural elements in the Cooper/Eromanga Basin and location of Tennapera Trough

The lower part, of Jurassic age, is composed mainly of continental fluvial and lacustrine quartzose sandstone interbedded with lesser siltstone and mudstone (carbonaceous in part) and very minor coal. The overlying Early Cretaceous succession is firstly fluviatile, followed by transgressive shallow marine consisting of siltstone, mudstone, claystone and labile sandstone. A regressive phase follows and the Late Cretaceous succession was deposited under paralic, lacustrine and fluvial conditions. After the Cenomanian, the basin was virtually filled. The north-eastern part was exposed because of a fall in sea-level and since then, has been subjected to deep weathering and erosion. The south-western part of the basin underwent continuing, intermittent sedimentation until recent times.

Permian coal measures and shales are the principal hydrocarbon source rocks in the region and are dominated by Type III kerogens derived from higher plant assemblages. Oils and condensates are typically medium to light (30– 60º API) and paraffinic, with low to high wax contents. Most Permian oils in Permian reservoirs contain significant dissolved gas and show no evidence of water washing. Gas composition is closely related to maturity/depth with drier gas occurring towards basin depocentres although there is strong geological control on hydrocarbon composition. The Patchawarra Trough contains the bulk of the oil and wet gas reserves consistent with local source rocks being in the 'oil window', while the hot Nappamerri Trough (40–50ºC/km), underlain in part by granite, is over mature and contains mainly dry gas. Thin, laterally discontinuous coals represent the best source rocks of the upper Nappamerri Group, whilst shales tend to be organically lean. The lower Nappamerri Group is coal-poor, contains kerogen that tends to be oxidised, and any source rocks are humic-rich and gas-prone.

The Cooper-Eromanga Basin sediments have been subjected to several tectonic movements that began with periods of extension during the Permian. Later wrench-induced NE-SW compressional stress caused basin wide folding and faulting during the Triassic with reactivation of palaeofaults and structural contacts. Following reactivation in the Early Cretaceous the Eromanga Basin suffered maximum sudsidence under marine conditions. Late Miocene crustal shortening imparted a period of east-west compression on the Basin resulting in widespread folding, transcurrent faulting and reverse faulting. These periods of reactivation have produced a significant number of major structural traps providing a focus for hydrocarbon exploration in the Moomba region particularly in the Nappamerri and Patchawarra Troughs along with their adjacent structural ridges.

There are two distinct structural trends, north-easterly to south-westerly and north-westerly to south-easterly. The former orientation defines the present trend of the northern Cooper Basin and is in accord with the majority of trends in the southern Cooper Basin, especially in South Australia. The north-easterly to south-westerly orientation is shown by the Tanbar, Gilpeppee, Morney, Curalle and Betoota Anticlines/Trends. The north-westerly to south-easterly orientation is shown by the Galway-Ingella, Hammond and Steward Anticlines/Trends. These two distinct structural trends were influenced by much earlier faults which were reactivated a number of times between the Permian and the Tertiary. Similar trends are observed in the regional magnetics and regional gravity data which reflect the underlying basement topography and reveal major lateral contacts (see Figure 4 and Figure 5).

3.2 Modelling & Interpretation of Geophysical Data

Public domain magnetic and gravity data were compiled and re-processed.

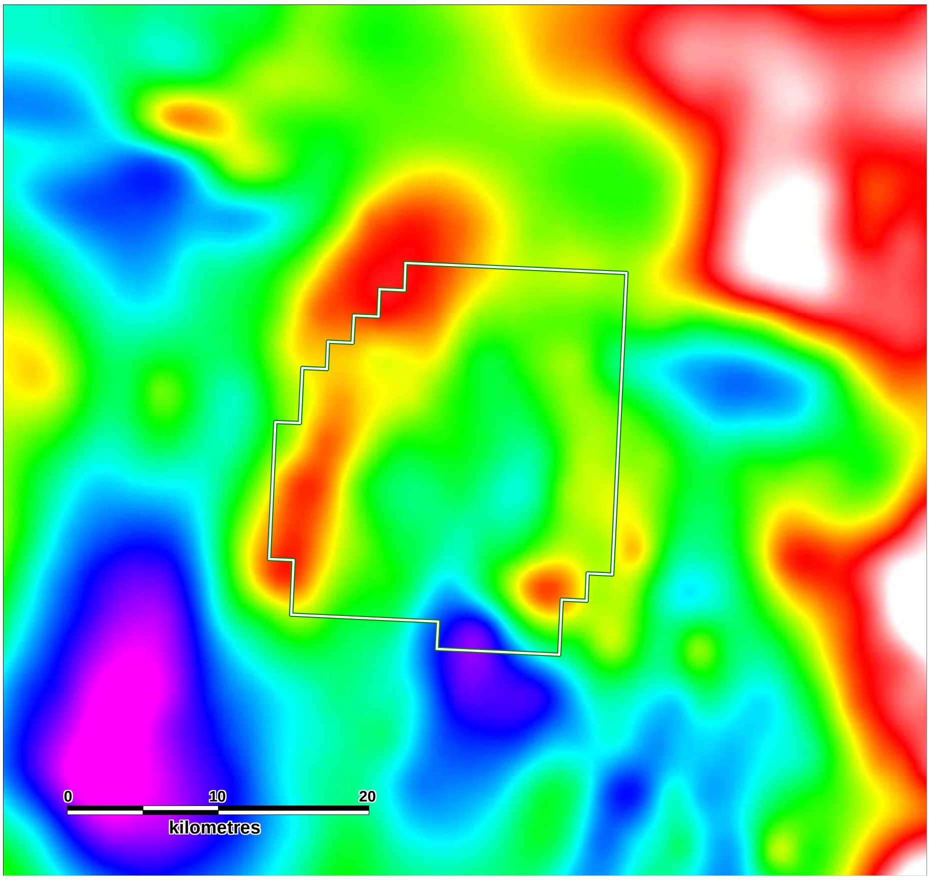

Figure 4: GEL 169 - Reprocessed TMI

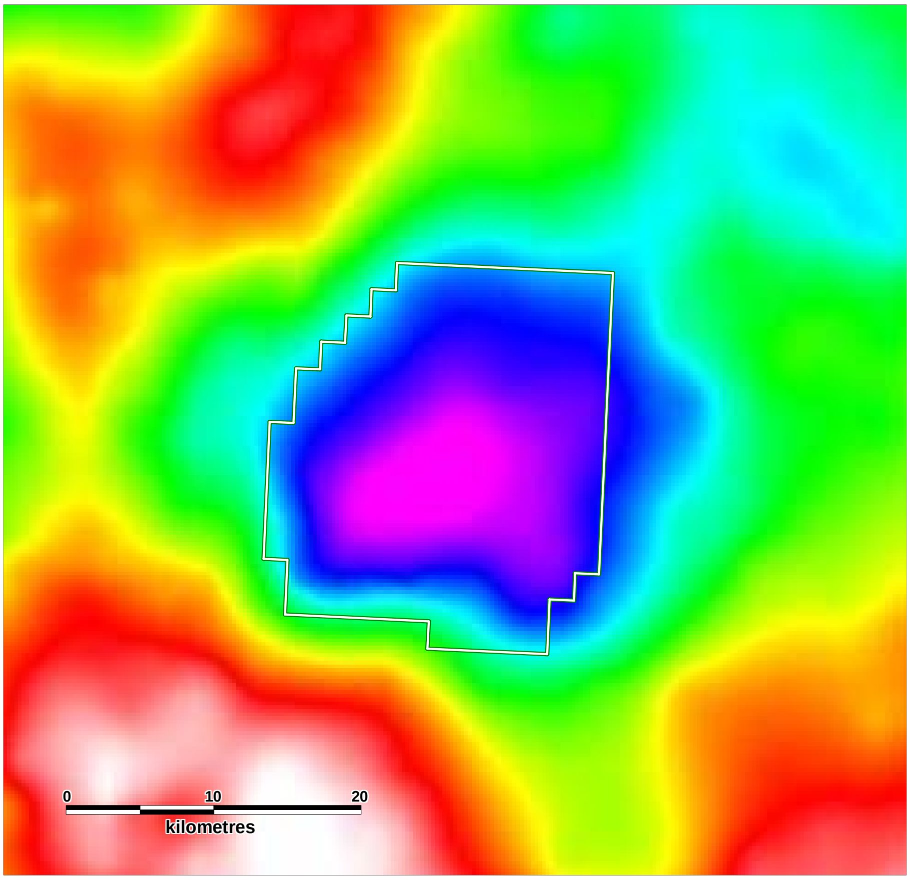

Figure 5: GEL 169 - Reprocessed Bouguer Gravity image

3.3 Thermal Data Review

Professor James Cull from Monash University reviewed geothermal constraints for the area and undertook preliminary modelling of thermal parameters.

3.3.1 Model Data

There are multiple seismic sections available in the area and the subsurface structure is relatively well known from extensive programs of oil exploration. Similarly several deep wells have been drilled on the margins of GEL169, and Beach Petroleum have recently completed Noarlunga 1 near the centre of GEL169. However most of these previous studies have been directed towards an understanding of oil maturation in the Tenappera Trough and do not directly image the site of Bollards Lagoon. Consequently estimates of temperature and stratigraphy require significant extrapolation and interpretations of the basement configuration. Only a single temperature was collected in Noarlunga 1 limiting its usefulness, though the stratigraphic information was useful.

Some relevant information can be obtained from images of gravity and magnetic data also published by PIRSA (see Figure 6and Figure 7). These confirm the major structural elements of the Tenappera Trough margins and support previous indications of orthogonal trend lines running NE and NW. Possible faulting or stress associated with these lineaments may provide zones of deep fracturing along the margins of the tenement suitable for the location and propagation of deep high-yield aquifers.

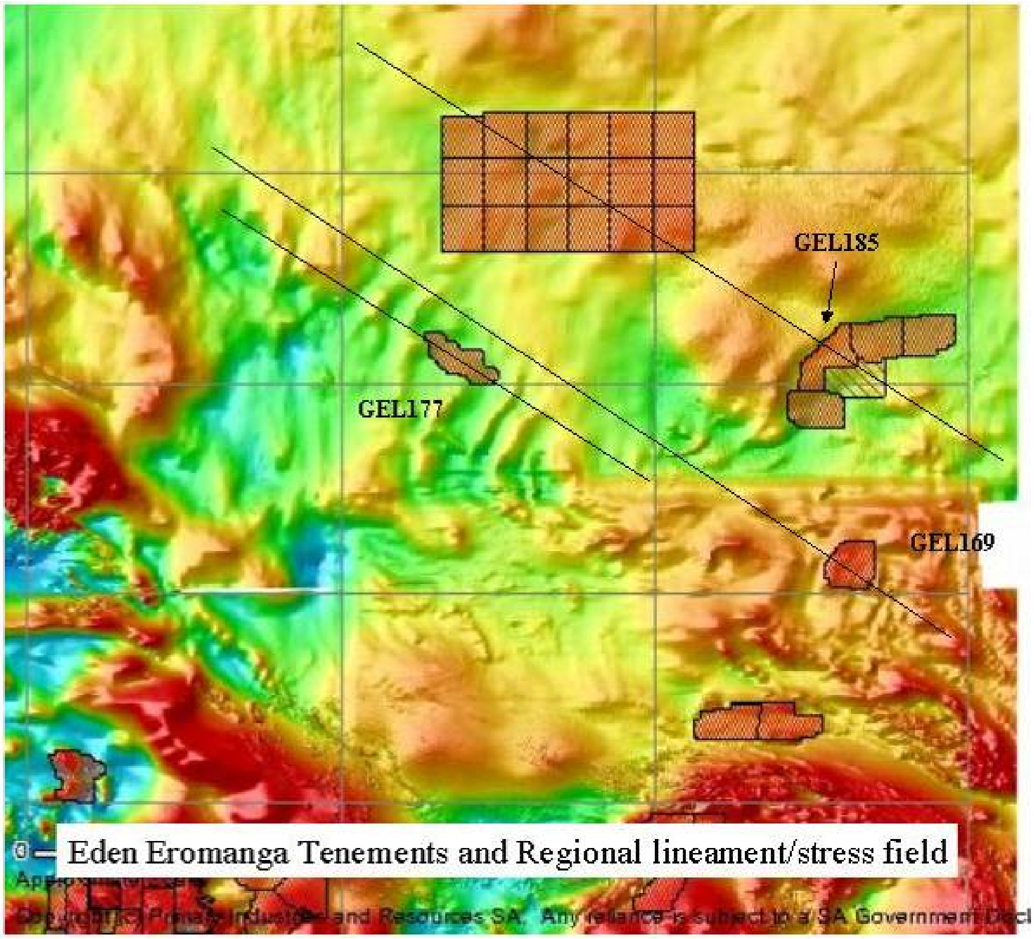

Figure 6: GEL 169 - regional TMI magnetics and structural trends / lineaments (Cull 2005).

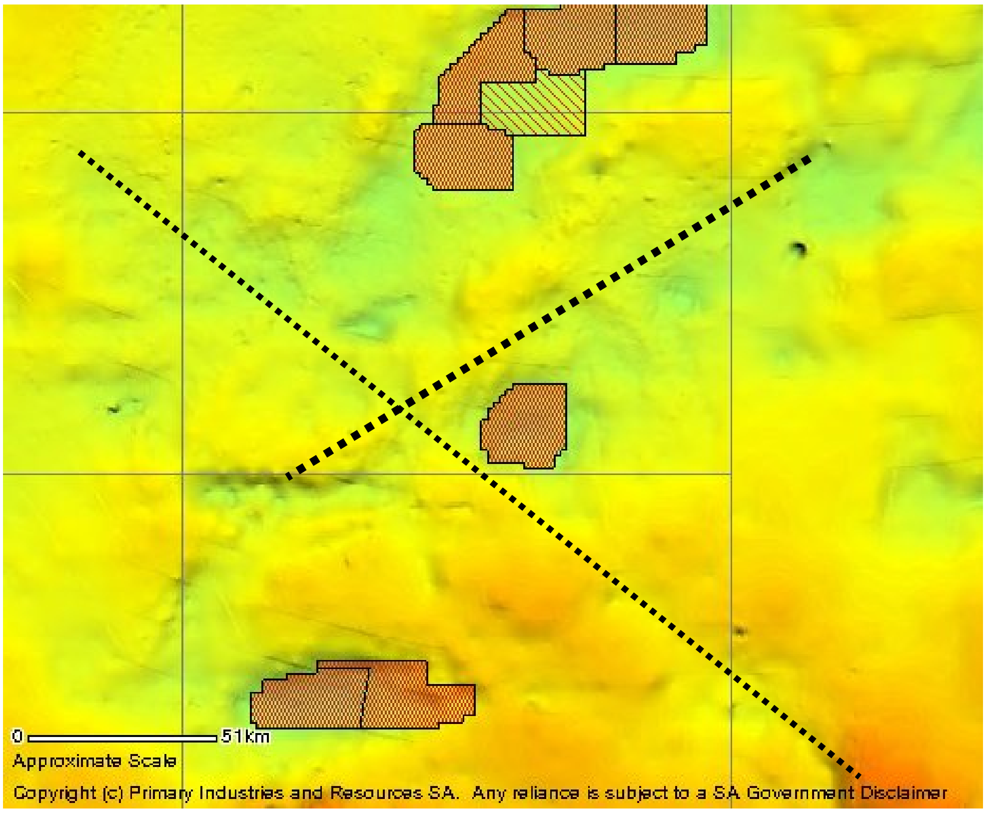

Figure 7: GEL 169 - Regional gravity data and orthogonal basement trends.

Estimates of temperature can be reasonably based on stratigraphic logs obtained for Mulga 2 immediately to the north of the tenement (see). Estimates of thermal conductivity are based on related measurements on similar units elsewhere in the Eromanga Basin and values of regional heatflow extrapolated from a 3' grid. However there are significant uncertainties in these key parameters resulting in a broad range of possible models (see Figure 8). In view of the uncertain basement structure no attempt is made to extrapolate the resulting geothermal gradient beyond 2000m depth indicated for the Tenappera Trough. The comparatively low values of temperature are consistent with previous models indicating mature or under-mature hydrocarbon content in this area (e.g. Kantsler et al. 1983).

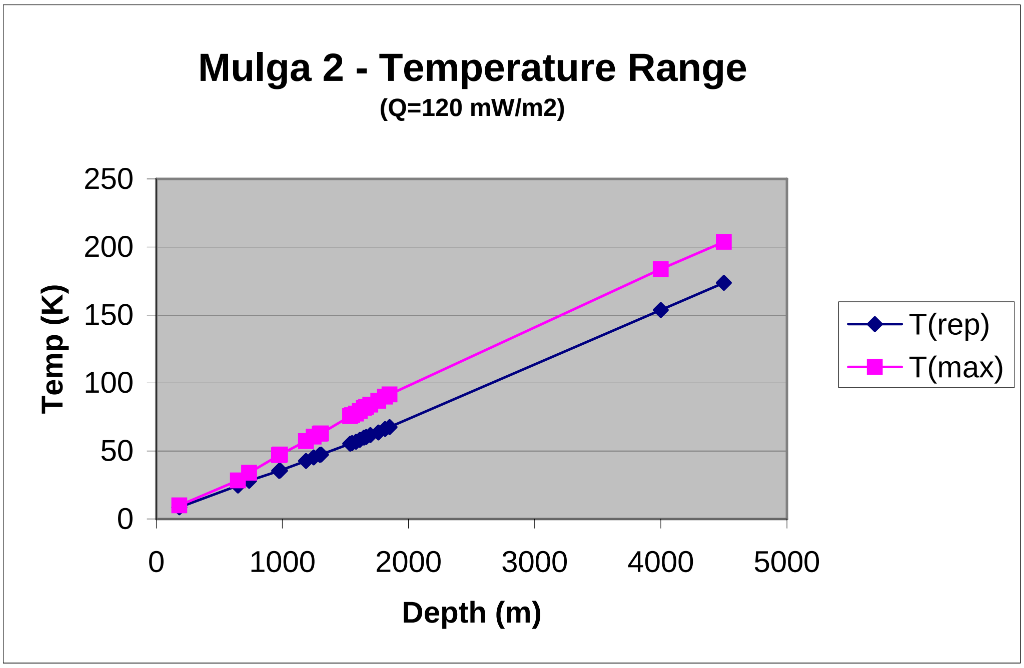

Figure 8: GEL 169 - Temperature estimates for Mulga 2 assuming no anomalous local heat production.

3.4 Recommendations from Data Review

Cull (2005) concluded that GEL169 is considered a moderate geothermal prospect. It has several features comparable to the hot Cooper Basin sections but is more limited in several key aspects. In particular while basement radiogenics may provide similar rates of heat generation the extent of thermal insulation is much more limited. Maximum cover occurs in the Tenappera Trough but that structure is located well to the north of the tenement. There are some bounding lineaments with a similar orientation to the Tenappera Trough which may indicate reasonable prospects for deep stress and local fracture systems associated with loading of the margins but there are no obvious features within the boundaries to provide a focus for further exploration.

High temperatures may be obtained on the margins of deep troughs as a result of thermal refraction. This would favour geothermal energy prospects on GEL169 since basement rocks are relatively shallow in this area. However temperatures of 200ºC are unlikely at depths less than 3500m and excess drilling costs can be expected for basement areas at depths less than 2000m. Better targeting of hot rocks or saline fluids within shear zones may be possible using magnetotelluric (MT or AMT) profiles to detect zones of anomalous electrical resistivity.

Additional estimates of heatflow are required to confirm current geothermal models based on regional data and representative values for thermal conductivity. Suitable data can be obtained from shallow holes (to 300m) or core samples can be extracted from existing PIRSA stores for thermal conductivity.

4 Year 1 Expenditure

Table 1

Commercial in Confidence

5 Year 2 Work Programme

Eden was to undertake reviews of the geology and geophysics of the Bollards Lagoon area in the first year of the licence, and if necessary, to complete some seismic reprocessing and logging and petrographic investigations.

Activities scheduled for year two are designed to secure funds for subsequent, higher cost aspects of the work program, better define the target reservoirs by conducting specific, targeted geophysical surveys (if required) and selection of a suitable initial test drill site.

6 Compliance with the Petroleum Act (Reg. 33)

6.1 Summary of the regulated activities conducted under the licence during the year

Eden has not undertaken any regulated activities as defined under the Petroleum Act in GEL 169 during the licence year.

6.2 Report for the year on compliance with the Act, these Regulations, the licence and any relevant Statement of Environmental Objectives

Given that no regulated activities were undertaken during the reporting period, many of the regulations are inapplicable at this stage and no non-compliances have been noted, with the exception of late submission of this report.

6.3 Statement concerning any action to rectify non-compliance with obligations imposed by the Act, these regulations or the licence, and to minimise the likelihood of the recurrence of any such non-compliance

Eden recognises the importance of achieving regulatory compliance and is committed to achieving appropriate practices in its management strategies, work practices and procedures. Eden is committed to operating in an environmentally and socially responsible manner.

6.4 Summary of any management system audits undertaken during the relevant licence year, including information on any failure or deficiency identified by the audit and any corrective action that has, or will be, taken

Eden is a new company and is developing appropriate systems and documentation to cover Field Operations, Environmental Management, Health and Safety issues and compliance checklists to ensure the requirements of relevant Acts and Regulations are met.

Eden's activities have been essentially desktop studies at this stage and no management system audits have been undertaken as yet.

6.5 List of all reports and data relevant to the operation of the Act generated by the licensee during the relevant licence year

Most of the work conducted during the first licence year comprised compilation of various public domain data and preparation of a number of memoranda by consultants. The contents of the memoranda have been incorporated into this report.

No new surveys or data relating to the tenement have been acquired.

6.6 Report on any Incidents reportable to the Minister under the Act and Regulations during the relevant Licence Year

No reportable incidents occurred.

6.7 Report on any reasonably foreseeable threats (other than threats previously reported on) that reasonably present, or may present, a hazard to facilities or activities under the licence, and a report on any corrective action that has, or will be, taken

No threats have been identified.

7 Key References

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Second Annual Report

Bollards Lagoon Project
GEL 169

HELD BY:	Eden Energy Ltd
MANAGER & OPERATOR:	Eden Energy Ltd
AUTHOR(s):	Graham M. Jeffress
SUBMITTED TO:	Greg Solomon
DUE DATE FOR SUBMISSION:	9th July 2007
PROSPECTS:	
COMMODITY(s):	Geothermal Energy
KEY WORDS:	Bollards Lagoon, geothermal

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Submitted by : ______________________________

Accepted by : ______________________________

CONTENTS

List of Figures

1 Introduction

1.1 Background

GEL169 is located south of Moomba in the Eromanga Basin on features related to the Cooper Basin model developed by Geodynamics Pty Ltd. Although it is outside the Cooper Basin depo-centre there are significant sediment sections in the Tennapera Trough providing good thermal insulation for basement granites. In addition there is some evidence for regional lineaments providing a focus for fracturing and aquifer development in basement sections.

Modelling of data from Open file sources predicts suitable temperature rocks at depths of 3-4km.

1.2 Licence Data

Geothermal Exploration Licence 169 (GEL169) was granted on 9th May 2005 with an initial term of five years over an area of 498km^2.

Figure 1 shows the licence location.

1.3 Period

In accordance with Section 33 of the Petroleum Regulations 2000, this report details work conducted during the second permit year of GEL 169.

2 Work Requirements

The Year 2 work programme negotiated by Eden with PIRSA for GEL 169 comprised:

- Geological and geophysical review;
- Seismic reprocessing; and
- Logging and petrographic investigations.

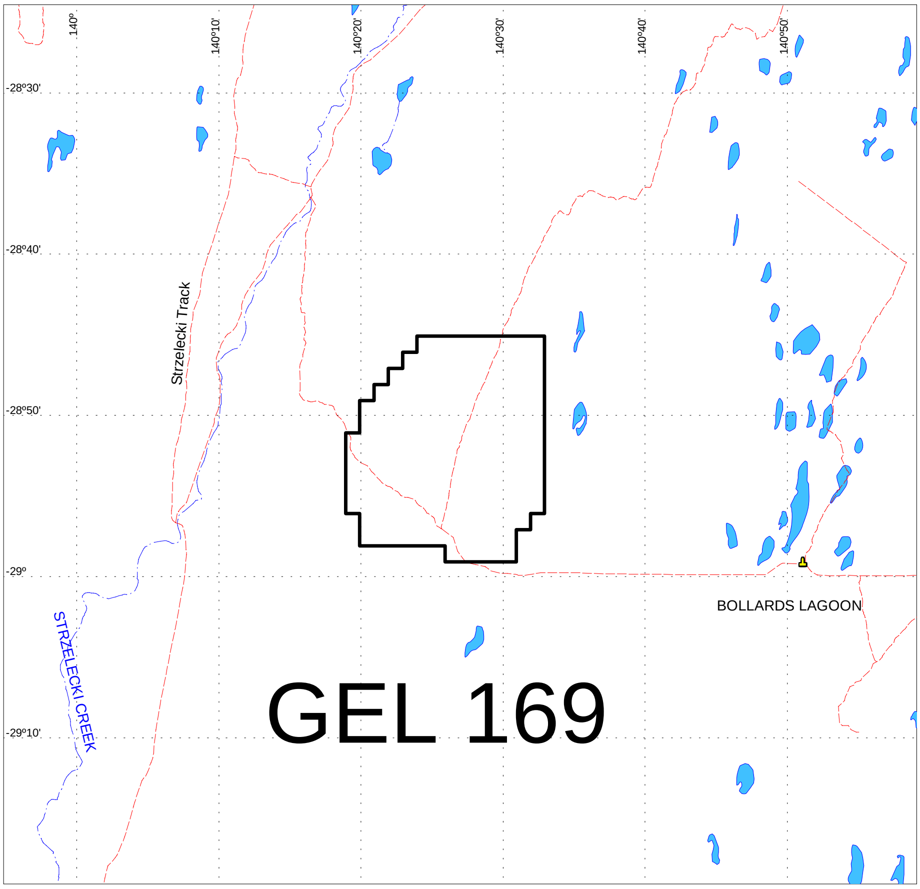

Figure 1: Location of GEL169

3 Work Conducted

Work undertaken in Year 2 consisted of acquisition of further public domain data, consolidation of existing data sets and retention of appropriate consultants to assist with the evaluation of the tenement.

Well completion reports for two wells drilled in and near to the GEL, Noarlunga 1 and Aldinga 1 were obtained and modelling of the data completed.

A review of the licence area was completed by Hot Dry Rocks Pty Ltd (HDRPL) and an improved prospectivity was identified compared to previous assessment by Eden Energy Ltd.

HDRPL concluded that the nature of the basement represents the greatest uncertainty, and therefore the greatest risk, with respect to geothermal resource development in GEL 169. Available temperature data suggest that heat flow in the area is high enough to generate attractive temperatures for an EGS geothermal development at depths less than 4000 m. This would require drilling through 2000 m of basement material, but HDRPL understands from discussions with drilling engineers that this would not pose any unusual technical problem. HDRPL will review the well completion reports for Aldinga 1 and Noarlunga 1 to determine the lithology of the basement. It is possible that the reports may not reveal granitic rocks at the base of the wells, and that the heat source may be deeper in the crust.

During the licence year, Eden has sought to arrange a magnetotelluric (MT) survey of the region, given the Eden believes this tool offers the most cost effective means to select test sites for drilling within the tenement. However, suitable contractors with the appropriate equipment, experience and availability were not able to be located. Subsequent to the licence year, a number of new possibilities were identified and Eden are hopeful of conducting an MT survey in 2007.

The inability to conduct MT work at Bollard's Lagoon has meant that Eden were unable to select a site to drill a confirmatory slimline hole to test the geothermal gradient and collect material for thermal conductivity measurement, and this work will therefore need to be postponed to later years of the licence.

4 Year 2 Expenditure

Table 1

Commercial in Confidence	
TOTAL	

1: subsequent to the reporting year

5 Year 3 Work Programme

Eden’s initial assessment of GEL169 was less than favourable, however a subsequent review by HDRPL using newly available data has increased the prospectivity of the licence area.

Eden now plans to:

- Obtain well completion reports for Aldinga 1 and Noarlunga 1;
- Attempt to determine the lithology of basement;
- Model gravity and magnetics to investigate depth and shape of potential granitic heat source;
- Use MT to refine drill targets;
- Investigate local stress fields;
- Integrate seismic interpretations with other data sets; and,
- assess the need for petrographic investigations, including acquiring new thermal conductivity data from any available core.

Using this information, plan and drill a heat flow hole above the minimum gravity point to confirm the presence of an anomalous heat source

Activities scheduled for year three are designed to secure funds for subsequent, higher cost aspects of the work program, better define the target reservoirs by conducting specific, targeted geophysical surveys (if required) and selection of a suitable initial test drill site.

6 Compliance with the Petroleum Act (Reg. 33)

6.1 Summary of the regulated activities conducted under the licence during the year

Eden has not undertaken any regulated activities as defined under the Petroleum Act in GEL 169 during the licence year.

6.2 Report for the year on compliance with the Act, these Regulations, the licence and any relevant Statement of Environmental Objectives

Given that no regulated activities were undertaken during the reporting period, many of the regulations are inapplicable at this stage and no non-compliances have been noted, with the exception of late submission of this report.

6.3 Statement concerning any action to rectify non-compliance with obligations imposed by the Act, these regulations or the licence, and to minimise the likelihood of the recurrence of any such non-compliance

Eden recognises the importance of achieving regulatory compliance and is committed to achieving appropriate practices in its management strategies, work practices and procedures. Eden is committed to operating in an environmentally and socially responsible manner.

6.4 Summary of any management system audits undertaken during the relevant licence year, including information on any failure or deficiency identified by the audit and any corrective action that has, or will be, taken

Eden is a new company and is developing appropriate systems and documentation to cover Field Operations, Environmental Management, Health and Safety issues and compliance checklists to ensure the requirements of relevant Acts and Regulations are met.

Eden’s activities have been essentially desktop studies at this stage and no management system audits have been undertaken as yet.

6.5 List of all reports and data relevant to the operation of the Act generated by the licensee during the relevant licence year

Most of the work conducted during the first licence year comprised compilation of various public domain data and preparation of a number of memoranda by consultants. The contents of the memoranda have been incorporated into this report.

No new surveys or data relating to the tenement have been acquired.

6.6 Report on any Incidents reportable to the Minister under the Act and Regulations during the relevant Licence Year

No reportable incidents occurred.

6.7 Report on any reasonably foreseeable threats (other than threats previously reported on) that reasonably present, or may present, a hazard to facilities or activities under the licence, and a report on any corrective action that has, or will be, taken

No threats have been identified.

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Third Annual Report
Bollards Lagoon Play
GEL 169

HELD BY: Eden Energy Ltd
MANAGER & OPERATOR: Eden Energy Ltd
AUTHOR(s):
SUBMITTED TO:
DUE DATE FOR SUBMISSION: 8th July 2008
PROSPECTS:
COMMODITY(s): Geothermal Energy
KEY WORDS: Bollards Lagoon, geothermal

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Submitted by : M Krzus M Krzus 4/7/08
Accepted by : ______________________

CONTENTS

List of Figures

1. Introduction

1.1 Background

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Modelling of data from open file sources predicts suitable temperature rocks at depths of 3-4km.

1.2 Licence Data

Geothermal Exploration Licence 169 (GEL169) was granted on 9th May 2005 with an initial term of five years over an area of 498km^2.

Figure 1 shows the licence location.

1.3 Period

In accordance with Section 33 of the Petroleum Regulations 2000, this report details work conducted during the third permit year of GEL 169.

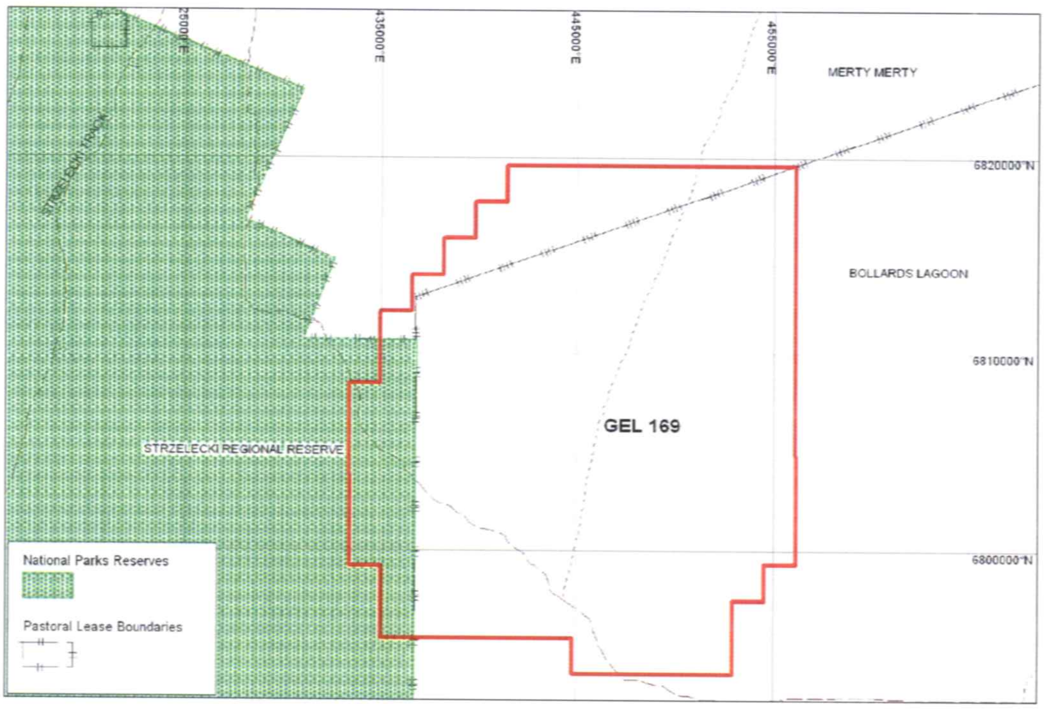

Figure 1 Location map of GEL 169

2. Work Requirements

The Year 3 work programme negotiated by Eden with PIRSA for GEL 169 comprised:

- Geological and geophysical reviews in an attempt to define basement lithology;
- Magnetotelluric survey and interpretations;
- Initial planning for preliminary exploration hole.

3. Work Conducted

Work conducted in year three consisted of acquisition of further public domain data, consolidation of existing data and retention of appropriate consultants to assist with the evaluation of the tenement. A geothermal assessment and review of open file seismic data was completed.

A Magnetotelluric (MT) survey was designed and conducted during the year, as it is believed that this geophysical method can provide a cost effective tool in working towards assessing the tenement with a view to suitable placement of drill hole(s) for heat flow assessment. The final interpretation of the MT data is still being awaited at the time of writing this report. This survey was planned to be conducted in the 2007 calendar year, however contractor delays meant that the acquisition did not occur until early 2008.

3.1 Geophysical Data Acquisition

The engagement of suitably qualified contractors to undertake the desired MT acquisition survey of GEL169 was finally achieved in early 2008. The survey was undertaken by Quantec Geoscience. A total of one line, nominally in a north-south orientation, was undertaken with a total of 13 sample locations being measured (Figure 2).

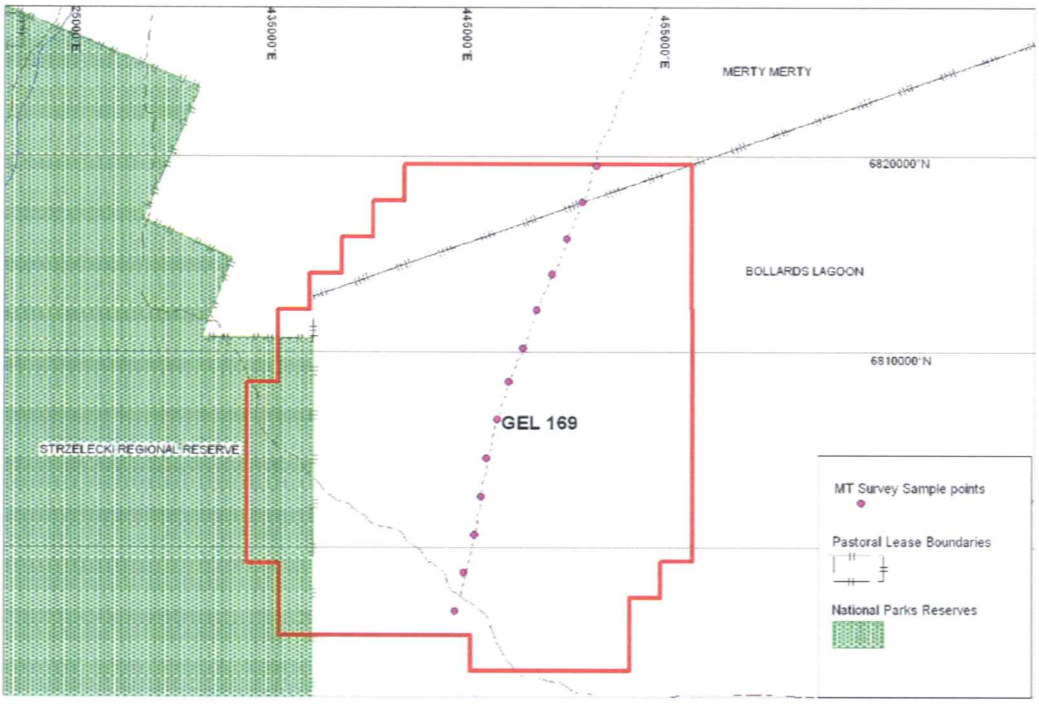

Figure 2 Location of MT sample points

3.2 Recommendations from MT Survey Results

At the time of writing this report the final interpretations have not yet been received from the geophysical contractor.

4. Year 3 Expenditure

5. Year Four Work Programme

Eden was to undertake reviews of the geology and geophysics of the Bollards Lagoon area in the first two years of the licence, with an aim to gaining a comprehensive understanding of the geology of the area and to plan a location for the drilling of a test hole to assess heat flow.

A revised work programme has been agreed with PIRSA. The year four work programme will involve:

- Interpretation of new MT data
- Integration of seismic interpretation and MT results;
- A preliminary feasibility study
- Planning for a deep test well for year five.

6. Compliance with the Petroleum Act (Reg. 33)

6.1 Summary of the regulated activities conducted under the licence during the year

Eden completed a Magnetotelluric survey.

6.2 Report for the year on compliance with the Act, these Regulations, the licence and any relevant Statement of Environmental Objectives

Eden has complied with all relevant sections of the Act and Regulations as they pertain to the regulated activities conducted during the year.

The relevant SEO for this activity is - *Statement of environmental objectives for ground geophysical operations (non-seismic) in South Australia.*" PIRSA August 2007.

6.3 Statement concerning any action to rectify non-compliance with obligations imposed by the Act, these regulations or the license, and to minimise the likelihood of the recurrence of any such non-compliance

Eden recognises the importance of achieving regulatory compliance and is committed to achieving appropriate practices in its management strategies, work practices and procedures. Eden is committed to operating in an environmentally and socially responsible manner.

There were no instances of non compliance for this reporting period.

6.4 Summary of any management system audits undertaken during the relevant licence year, including information on any failure or deficiency identified by the audit and any corrective action that has, or will be, taken

Eden is a new company and has developed appropriate systems and documentation to cover Field Operations, Environmental Management, Health and Safety issues and compliance checklists to ensure the requirements of relevant Acts and Regulations are met.

As these systems are newly developed and the work conducted to date has not shown any deficiencies in the systems, no management system audits have been undertaken as yet.

6.5 List of all reports and data relevant to the operation of the Act generated by the licensee during the relevant licence year

One report was generated during the year relevant to the operation of the Act:

> "Seismic Interpretation of Geothermal Licence (GEL) Areas 169, 177, 185 South Australia". *HDR Pty Ltd 2007.*

No other reports or data relating to the tenement have been received at this time.

6.6 Report on any Incidents reportable to the Minister under the Act and Regulations during the relevant Licence Year

No reportable incidents occurred.

6.7 Report on any reasonably foreseeable threats (other than threats previously reported on) that reasonably present, or may present, a hazard to facilities or activities under the licence, and a report on any corrective action that has, or will be, taken

No threats have been identified.

ACN 109 200 900

Fourth Annual Report

Bollards Lagoon Project
GEL 169

9/5/2008 – 2/5/2010
Licence Year 4

HELD BY:	Eden Energy Ltd
MANAGER & OPERATOR:	Eden Energy Ltd
AUTHOR(s):	Graham M. Jeffress
SUBMITTED TO:	Greg Solomon
DUE DATE FOR SUBMISSION:	2nd July 2010
PROSPECTS:	
COMMODITY(s):	Geothermal Energy
KEY WORDS:	Bollards Lagoon, geothermal

Distribution:

- PIRSA Petroleum
- Eden Energy Ltd

CONTENTS

List of Figures

1 Introduction

1.1 Background

GEL169 is located south of Moomba in the Eromanga Basin on features related to the Cooper Basin model developed by Geodynamics Pty Ltd. Although it is outside the Cooper Basin depo-centre there are significant sediment sections in the Tennapera Trough providing good thermal insulation for basement granites. In addition there is some evidence for regional lineaments providing a focus for fracturing and aquifer development in basement sections.

Modelling of data from Open file sources predicts suitable temperature rocks at depths of 3-4km.

1.2 Licence Data

Geothermal Exploration Licence 169 (GEL169) was granted on 9th May 2005 with an initial term of five years over an area of 498km^2.

Figure 1 shows the licence location.

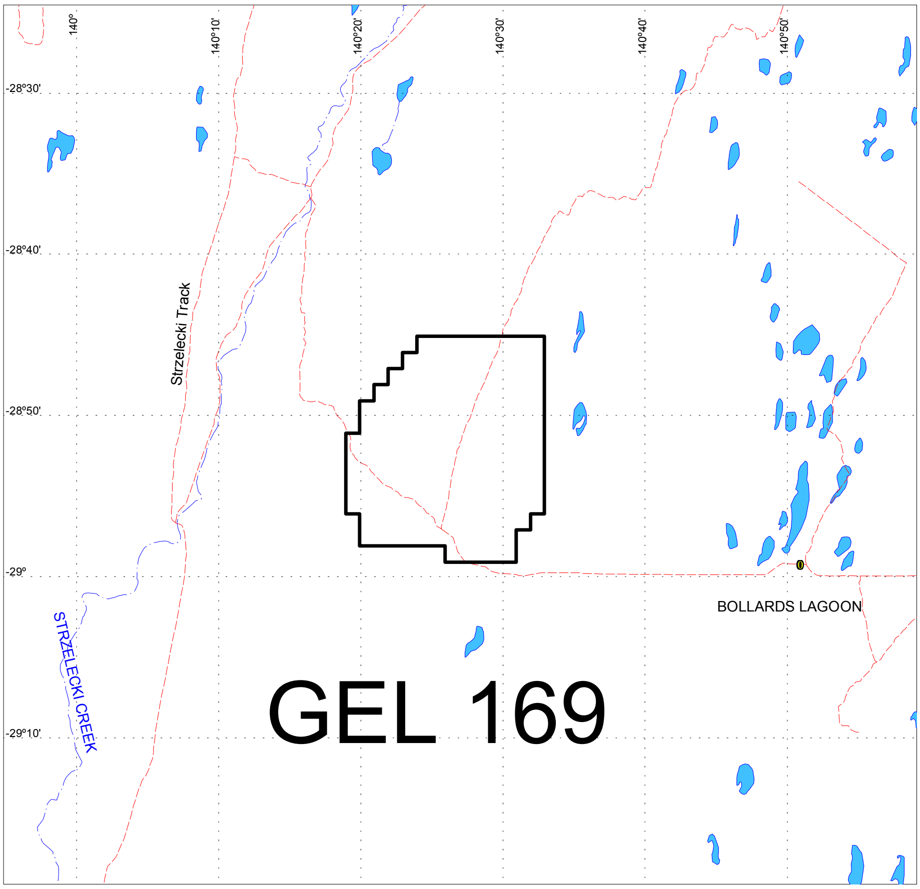

Figure 1: Location of GEL169

1.3 Period

In accordance with Section 33 of the Petroleum & Geothermal Regulations 2000, this report details work conducted during the second permit year of GEL 169.

2 Work Requirements

The original work programme for GEL169 is shown in Table 1.

Table 1: GEL 169 Original Work programme

Year of Term of Licence	Minimum Work Requirements
One	• Geological and geophysical review • Seismic reprocessing • Logging and petrographic investigations
Two	• Limited, infill geophysical surveys (if required)
Three	• Drill one test well and conduct downhole hydraulic stimulation
Four and Five	• Drill one well • Conduct circulation test

A variation to this programme, as shown in Table 2, was approved on 23rd April 2008.

Table 2: GEL 169 Varied Work Programme, April 2008

Year of Term of Licence	Minimum Work Requirements
One	• Geological and geophysical studies
Two	• Geological and geophysical studies
Three	• Acquisition and modelling of magneto-telluric data; • Geological and geophysical studies
Four and Five	• Drill one test well (3,500 to 4,000m) and conduct flow test

As reported in the Year 3 report, the revised work programme agreed with PIRSA for Year 4 of GEL169 was to comprise:

- Interpretation of the new MT data;
- Integration of the seismic interpretation with the MT interpretation;
- A preliminary feasibility study;
- Planning for a deep well for Year 5.

3 Work Conducted

Work undertaken in Year 4 consisted of interpretation of the MT data.

The Interpretation was based on processing as follows:

3.1 Overview of Interpretation Procedure

The magnetotelluric (MT) method is a natural source method that measures the variation of both the electric and magnetic field on the surface of the earth in order to determine the distribution at depth of the resistivity of the underlying rocks. The depth of investigation is determined primarily by the frequency of the measurement. Depth estimates from any individual sounding may easily exceed 20 km. However, the data can only be confidently interpreted to a depth that is comparable to the aperture of the array – approximately half the length of the profile. A complete review of the method is presented in Vozoff (1972)[2] and Orange (1989)[3].

The objective of the inversion of MT data is to compute a distribution of the resistivity of the subsurface that explains the variations of the MT parameters, i.e. the response of the model that fits the observed data. The solution is, however, not unique and different inversions must be performed, with different algorithms and different conditions, in order to test and compare solutions for artefacts versus the target anomaly.

For this study, inversions were performed using the “unrotated” data which assumes the strike direction is perpendicular to the profile for all sites. The TM (transverse magnetic) mode is then defined by the inline E-field (and cross-line H-field), and the TE (transverse electric) mode is defined by the cross-line E-field (and inline H-field) data. Different inversions were completed for each line.

The inversion of each dataset was first completed using the RLM algorithm, (Rodi and Mackie, 2001[4]), which is a widely used and commercially available program. The starting model for the inversion is a so-called stitched 1-D model, constructed from 1D inversions of each measured site. This solution provides a good starting model for the PW inversion (a code developed by Quantec, and based on deLugao and Wannamaker, 1996 [5]) resulting in sharper resistivity images. Only results from the PW inversions are presented as the RLM models were used as starting models.

Different data sets were used in the inversion process. The first set of inversions used only 3 components of the TM/TE impedances, i.e. the TM apparent resistivities and phases, and the TE phases. The second set of inversions used the 4 components of the TM/TE impedances, i.e. the TM and TE apparent resistivities and phases. The difference between the two datasets is the TE apparent resistivity. This parameter may reflect variation of the resistivity or structures that cannot be resolved in the 2D model because of 3D geology. In particular, small heterogeneities can cause a static shift (a distortion that shifts the apparent resistivity values by a scalar while the phase is unchanged). This 3D static shift in the TE apparent resistivity can cause serious artefacts in the 2D inversion model that do not necessarily reflect the geology below the line and station. As a result, care must be exercised when it is included in the inversion. The TE apparent resistivity is very useful, particularly for imaging deep targets as well as their depth, and because of this, both inversion models (with and with-out the TE apparent resistivity data) are usually calculated, in order to properly monitor possible artefacts.

For each line, we have 2 different PW-2D models:

- Model 1 (*PW model*)
  PW (TM –rho/phs & TE –phs) model, starting RLM (TM –rho/phs & TE –rho/phs);

- Model 2 (*PW2 model*)
  PW (TM –rho/phs & TE –rho/phs) model, starting RLM (TM –rho/phs & TE –rho/phs)

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[2] Vozoff, K., 1972. The Magnetotelluric method in the Exploration of Sedimentary basins. Geophysics, 37, 98-141.
[3] Orange, A. S, 1989. Magnetotelluric exploration for hydrocarbons: Proceedings of the IEEE, 77, 287–317.
[4] Rodi, W., and Mackie, R. L., 2001. Nonlinear conjugate gradients algorithm for 2D magnetotelluric inversions. Geophysics 66,174–187.
[5] de Lugao, P. P., and Wannamaker, P. E., 1996, Calculating the two-dimensional magnetotelluric Jacobian in finite elements using reciprocity: Geophys. J. Int., 127, 806-810.

The Spartan MT line over the Bollards Lagoon property shows a fairly constant resistivity image (see Figures 2 and 3).

Over most of the line, the depth to basement is approximately 1500m below the surface, correlating to the single well log6 (projected between stations 03 and 04) supplied for this line. The centre portion of the line, approximately between stations 06 and 08 is characterized by an increase in thickness of the sediment package, by approximately 200-300m, increasing the depth to the basement. At the southern end of the line, a similar feature can be identified, where the conductive sediments increase in thickness again. However, the less resistive feature observed continues in depth to the bottom of the model, forming a distinct boundary with the rest of the model.

Within the resistive basement, several variations in the resistivity can be observed. Below stations 02 and 03 a distinctly less resistive (20-30 Ohm m) feature is observed, which is embedded within a larger feature, from station 01 to 05, of slightly lower resistivity values (100-200 Ohm m) then the background basement values (more than 300 Ohm m). This lower resistivity feature in the basement could be related to presence of conduits for fluid flow.

The PW TM/TE phase model shows a very similar, though slightly simplified image, indicating a limited effect of 3D structures.

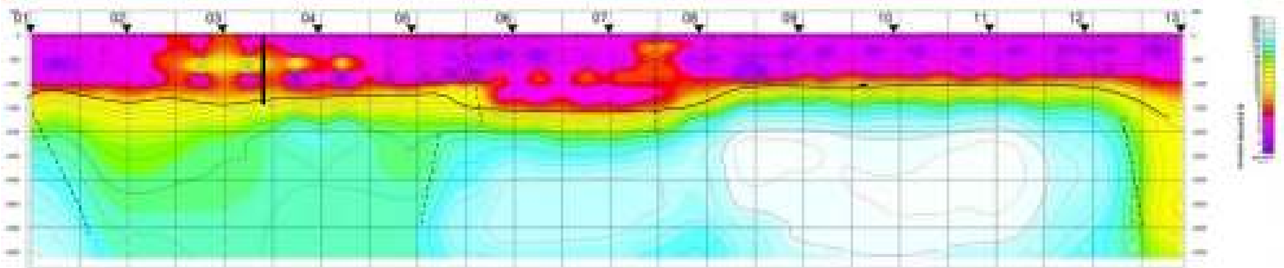

Figure 2: 2D MT inversion result GEL 169, PW inversion TM/TE model.

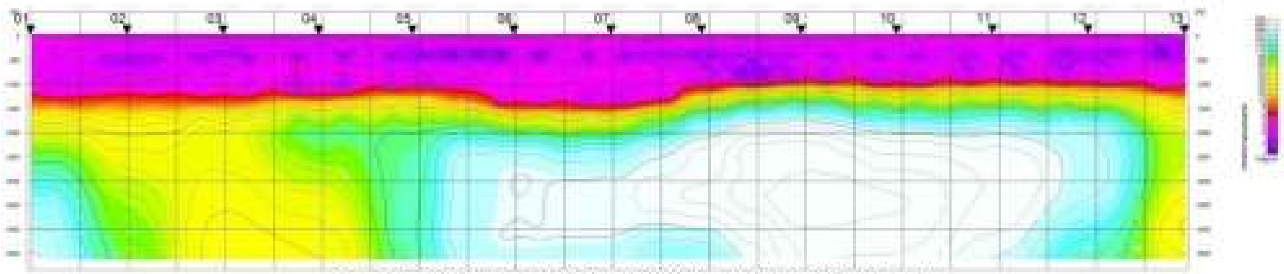

Figure 3: 2D MT inversion result GEL 169, PW inversion TM/TE phase model.

4 Year 4 Expenditure

The Year 4 expenditure summary is presented in Appendix 1.

5 Year 5 Work Programme

Activities scheduled for Year 5 are designed to secure funds for subsequent, higher cost aspects of the work program, better define the target reservoirs by conducting specific, targeted geophysical surveys (if required) and selection of a suitable initial test drill site.

Eden requested and was granted an approval to the work programme for Year 5 as shown in Table 3.

Table 3: GEL 169 Work Programme approved 1/6/2010

Year of Term of Licence	Minimum Work Requirements
One	• Geological and geophysical studies.
Two	• Geological and geophysical studies.
Three	• Acquisition and modelling of magneto-telluric data; • Geological and geophysical studies.
Four	• Geological and geophysical studies; • Conduct preliminary feasibility study.
Five	• Geological and geophysical studies.

6 Compliance with the Petroleum & Geothermal Energy Act 2000

6.1 Summary of the regulated activities conducted under the licence during the year

Eden has not undertaken any regulated activities as defined under the Petroleum & Geothermal Energy Act 2000 (“Act”) in GEL 169 during the licence year.

6.2 Report for the year on compliance with the Act, these Regulations, the licence and any relevant Statement of Environmental Objectives

Given that no regulated activities were undertaken during the reporting period, many of the regulations are inapplicable at this stage and no non-compliances have been noted, with the exception of late submission of this report.

6.3 Statement concerning any action to rectify non-compliance with obligations imposed by the Act, these regulations or the licence, and to minimise the likelihood of the recurrence of any such non-compliance

Eden recognises the importance of achieving regulatory compliance and is committed to achieving appropriate practices in its management strategies, work practices and procedures. Eden is committed to operating in an environmentally and socially responsible manner.

6.4 Summary of any management system audits undertaken during the relevant licence year, including information on any failure or deficiency identified by the audit and any corrective action that has, or will be, taken

Eden’s activities have been essentially desktop studies at this stage and no management system audits have been undertaken as yet.

6.5 List of all reports and data relevant to the operation of the Act generated by the licensee during the relevant licence year

Most of the work conducted during the first licence year comprised compilation of various public domain data and preparation of a number of memoranda by consultants. The contents of the memoranda have been incorporated into this report.

The MT data were previously reported for GEL 169 (and GELs 185 & 177 in combination).

The processing and interpretation report by Quantec was delivered as part of the requirements for this year:

Quantec Geophysics Geophysical Survey Interpretation Report – regarding the Quantec SPARTAN Magnetotelluric Survey over the Cooper Project, South Australia on behalf of Eden Energy

6.6 Report on any Incidents reportable to the Minister under the Act and Regulations during the relevant Licence Year

No reportable incidents occurred.

6.7 Report on any reasonably foreseeable threats (other than threats previously reported on) that reasonably present, or may present, a hazard to facilities or activities under the licence, and a report on any corrective action that has, or will be, taken

No threats have been identified.

Hot Dry Rocks Pty Ltd
ABN 12 114 617 622

PO Box 251 (31/141 Osborne St)
South Yarra VIC 3141 Australia
Phone: +61 3 9867 4072
Email: info@hotdryrocks.com
Web: www.hotdryrocks.com

SEISMIC INTERPRETATION OF GEOTHERMAL EXPLORATION LICENCE (GEL) AREAS 169, 177 & 185, SOUTH AUSTRALIA

A report prepared for Eden Energy Ltd

October 2007

Ben Waining & Gareth Cooper – Hot Dry Rocks Pty Ltd, PO Box 251, South Yarra, Vic 3141, Australia
Ph: 61 (0) 448 503 932 **Email:** Gareth.Cooper@hotdryrocks.com **Web:** http://www.hotdryrocks.com

Contents

List of Figures:

Executive Summary

An interpretation of existing open file seismic data was undertaken at the request of Eden Energy (ENE) for a selected number of lines within GELs 185, 177 and 169 in the NE of South Australia. Key horizons and interpreted depths were mapped, and an outline of potential prospectivity based on these interpretations has been given.

Seismic and drilling data constraints exist for this assessment, due to a lack of comprehensive 2D seismic coverage and wells within the study areas, particularly within depocentres. This has resulted in reasonable assumptions of stratigraphy and stacking velocities having to be made in some instances.

This assessment has concluded that all of the tenements studied hold some level of reasonable prospectivity for geothermal resource exploration.

GEL169; Bollards Lagoon:

- Located on the southern margin of the Tenappera Trough.
- Interpreted ?granite basement at approximately 2000m depth, although speculative due to a lack of direct evidence.
- The lack of greater than 2000m of sedimentary cover (subject to thermal modeling), therefore the potential for a DBSA type geothermal play is low.
- High calculated geothermal gradient and favourable modelled heat flows for the tenement provide the potential for the development of an EGS play within basement.
- Drill testing of the depth to interpreted ?granite, and associated thermal condition measurements, are recommended as a first phase exploration program.

GEL177; Mungerannie:

- Located on the eastern side of the Birdsville Ridge, within the Eromanga Basin.
- Depth to crystalline basement within this region has been interpreted to be on average approximately 2000m. There is no drill testing to this depth to fully test this assumption.
- A calculated average geothermal gradient of about 56°C/km exists at Mulkarra West-1, indicating probable low temperature risks (subject to thermal modeling).
- Risks associated with thermal resistance (insulation) may be reduced in the north of the tenement where basin sequences are thicker.
- It is unlikely that Deeply Buried Sedimentary Aquifer (DBSA)-type geothermal plays will be viable. Consequently EGS-type plays are more likely.
- Consideration should be given to further refining temperatures in the area through a program of shallow drilling and heat flow modelling.

GEL185; Moomba North:

- Located at the southern end of the Nappamerri Trough, a section of the deepest Permian sediments in the Cooper Basin.
- Sedimentary formations included in the Permian succession include those associated with the majority of oil and gas reservoirs in the Cooper Basin.
- Given both elevated geothermal gradients and thick sedimentary sequences with potentially suitable physical properties of porosity and permeability this area may be suited to the exploration for both DBSA and EGS type plays.
- Definition of the lateral extent and characteristics of sands in potential DBSA plays will require further sequence stratigraphic analysis.
- Depths to sedimentary formations with potential for development of geothermal systems may commence from approximately 2.6km (Toolachee Formation), although this requires validation with thermal modeling within the trough centre.

1. Introduction and Background

Hot Dry Rocks Pty Ltd (HDRPL) was commissioned by Eden Energy Ltd (EDE) to interpret existing seismic data for their three South Australian tenements:-

- GEL169 – Bollards Lagoon
- GEL177 – Mungerannie
- GEL 185 – Moomba North

All three tenements lie within or on the margins of the Cooper Basin, South Australia.

The aims of the study were:-

- To map key horizons, with regards to geothermal systems, from selected 2D reflection seismic lines in each tenement.
- To produce mapped horizons in two way time (TWT) and depth for the purpose of defining potential drill targets
- To advise on prospectivity risks, based on seismic data, for each tenement

To facilitate these aims, the following tasks were undertaken:-

- Identification of suitable open-file 2D seismic data and well completion reports
- Ordering of digital seismic and navigation data
- Loading and quality assurance of SEGY seismic and navigation data in Kingdom Suite software
- Interpretation of 2D seismic lines in TWT, tying of data and integration with limited well data
- Depth conversion of seismic data from average stacking velocity profiles
- Export of XYZ horizon grids and production of maps for key horizons.

2. Limitations

Given time and data constraints for this project, interpretations have been based on formation tops from existing well reports (lithostratigraphy). No detailed sequence stratigraphic analysis was undertaken. In the absence of well synthetics and velocity data only simple depth conversion was undertaken based on average stacking velocities. As existing wells are located on marginal basement highs and away from the trough axis (depocentre), the use of stacking velocities should provide reasonable estimates of depth.

Temperature data, including bottom hole temperatures and geothermal gradients, used for this report are based on data provided within well completion reports. Where these data have been used to extrapolate indicative values for temperature across the areas of study it should be noted that such extrapolations are simplistic and to not account for lateral and vertical variation in bulk rock conductivity or heat flow. Delineation of the detailed temperature regimes would require further specific study, beyond the scope of this report.

3. Geology of the Cooper Basin

The intracratonic Cooper Basin represents a Late Carboniferous to Triassic depositional episode terminated at the end of the Middle Triassic with widespread compressional folding, regional uplift and erosion. It lies unconformably over early Palaeozoic sediments of the Warburton Basin and is overlain disconformably by the central Eromanga Basin. The three major troughs (Patchawarra, Nappamerri and Tenappera) are separated by ridges that may be structurally associated with the reactivation of NW trending thrust faults in the underlying Warburton Basin, (PIRSA 2006) or may be topographic highs with significant shaping from glacial geomorphic processes (Boucher, 2001).

The evolution of the Cooper Basin commenced with deformation along the eastern Australian Plate, leading to uplift in central Australia and subsequent development of a major continental ice sheet. The Cooper Basin floor became an erosional surface with relief being topographic rather than structural (Gravestock, Jensen-Schmidt ch5 in Gravestock et al 1998). Decay of the ice sheets from the Late Carboniferous led to the release of enormous volumes of sediment and the deposition of lacustrine units with intervening regressive fluvodeltaic sediments (including the Patchawarra and Tirrawarra Formations) from the Early Permian through until the Early Triassic. An episode of uplift (Daralingie movement) in the Early Permian led to some erosion. Late Permian deposition of peat swamp and floodplain sediments (Toolachee Formation) led conformably into the early Triassic organically lean and oxidised lacustrine and fluvial deposits. There are no recorded coal formations from the Early Triassic period, with a return to peat formation occurring in the Cooper Basin in the Late Triassic (Alexander, E.M. Ch6 in Gravestock et al 1998). Unconformably lying over the Cooper Basin sediments are the Early Jurassic to Late Cretaceous sediments of the Eromanga Basin.

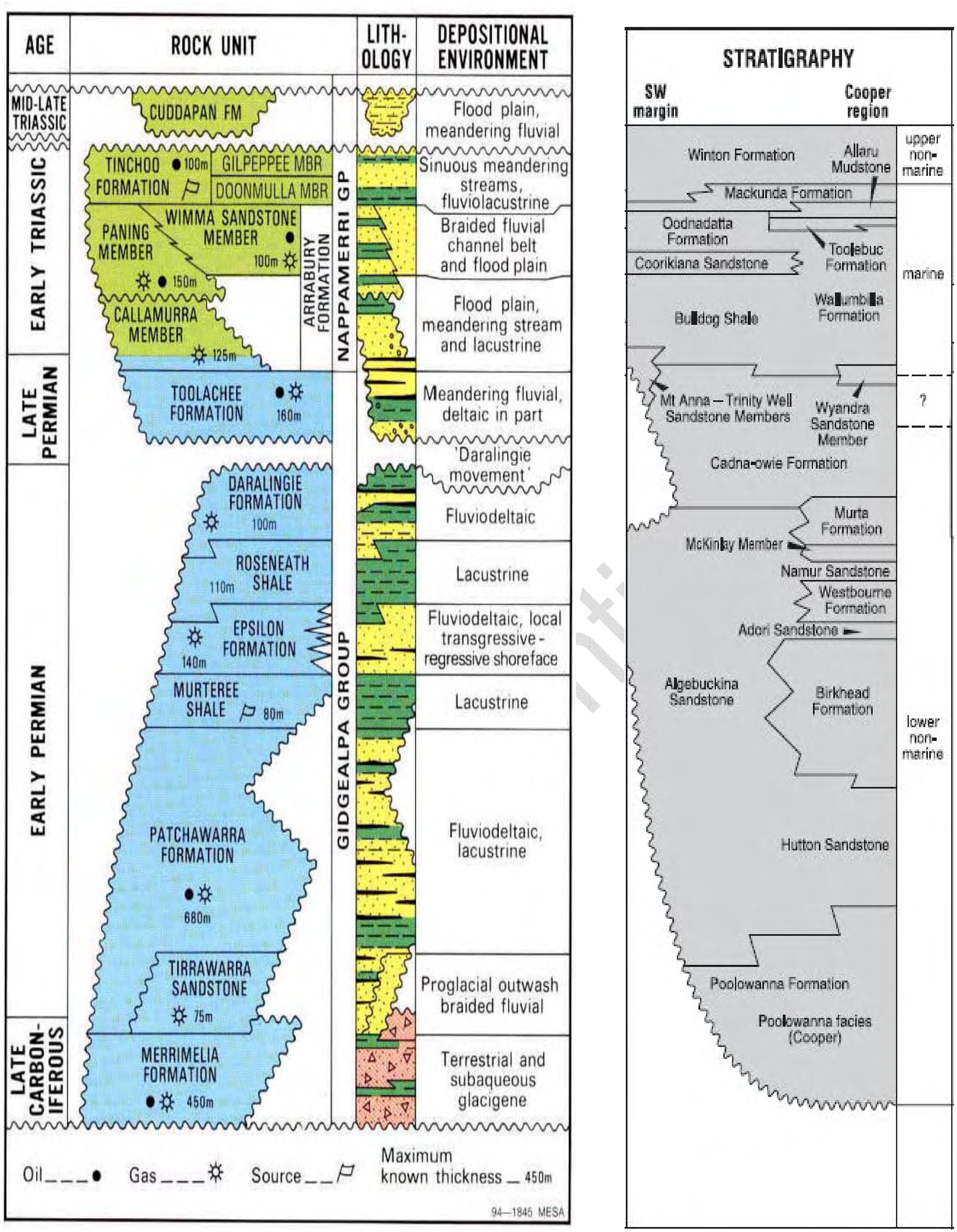

Fig. 1. Geological Summary of the Cooper Basin (Drexel and Preiss 1995) (left) and Eromanga Basin (Alexander and Sansome ch5 in Alexander & Hibburt 96)

4. Depth Conversion

Average stacking velocities were compiled to derive a polynomial best-fit for available seismic data (Fig. 2). This time-depth relationship was used to approximate depth maps in each area. Given the absence of well velocity data for the central trough area it is reasonable to assume that this methodology will produce adequate depth maps within an error margin of about ±200m.

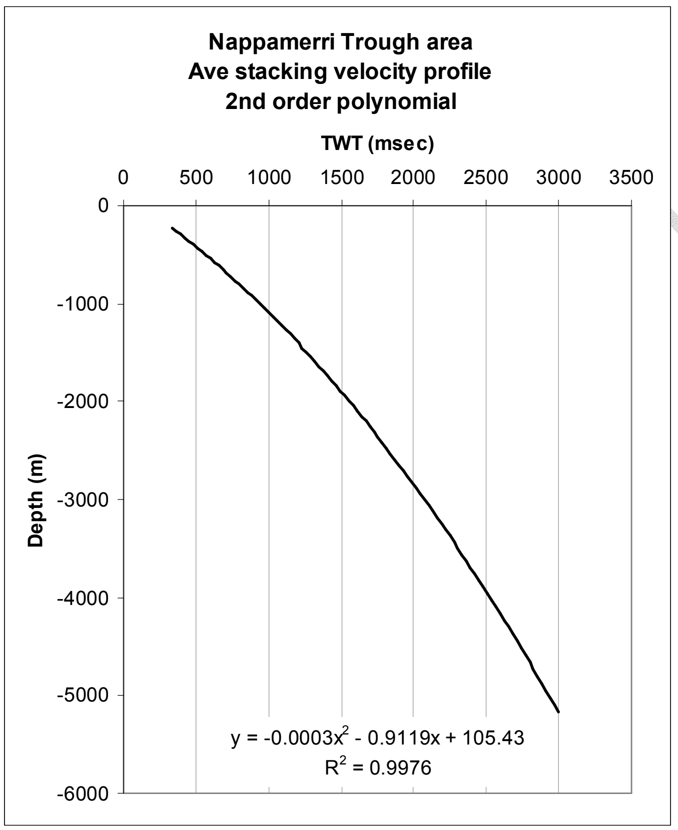

Fig. 2 Sample of time – depth relationship from average seismic stacking velocities

5. Interpretation of GELs

5.1 GEL 169 – Bollards Lagoon

5.1.1 Location & geology

Located on the southern margin of the Cooper Basin on the southern flank of the Tenappera Trough (in an area referred to as the Battunga Trough in the Beach Petroleum Noarlunga-1 well completion report), this area comprises a basement high which was drilled for hydrocarbons (Noarlunga-1). The well intersected a condensed Jurassic and Permian sequence before entering pre-Permian basement at 1504m depth (about 1260msec TWT). The well was terminated at 1539m in basement metasediments.

The recoded BHT was corrected to give a value of 91.3°C (Beardsmore, 2007) giving a geothermal gradient of 44.1°C /km. Further north Aldinga-1 has a calculated geothermal gradient of 55.1°C /km.

5.1.2 Seismic interpretation

The Bollards Lagoon area is notable for having relatively shallow basement (1200-1300msec TWT, or about 1500m depth). Consequently it is unlikely that, at these shallow depths, significant geothermal aquifers will be intersected. Consequently seismic interpretation has concentrated on the deeper horizons at or beneath basement level.

Sample strike and dip seismic lines are shown in figures 3 and 4 respectively. Key horizons are described as:-

- **Palaeozoic basement:** a poorly defined trough at around 1200-1300msec TWT characterised by distinctive onlap of overlying Permian and Jurassic sediments. The basement seismic package is characterised by a weak sub-parallel reflectors which appear to show growth towards major faults, indicating an older rift sequence (Warburton Basin). The basement horizon is offset by a number of larger normal faults, some of which exhibit inversion.

- **?Granite horizon:** the interpretation of granite at depth in this area is speculative. Whilst there are some indicators of possible igneous intrusion in the area, such as high heat flow, there remains an absence of direct evidence such as well intersections. However seismic data show a general diffuse zone of reflectors at depth which may be characteristic of a ?Carboniferous granite. Reflectors may also represent high density metasediments of the Warburton Trough. Confidence in the interpretation of this horizon is poor and the horizon is typically marked by the cessation of sub-parallel reflectors, interpreted to be the approximate base of Palaeozoic metasediments. Depth to the interpreted ?Granite is highly variable, but at Noarlunga-1 it is interpreted to be at about 1500msec TWT or ~2000m depth.

- **Numur Sandstone:** this horizon has been interpreted for reference purposes only and is characterised by a dominant trough at about 1000mesc TWT. There is some truncation of reflectors beneath the horizon and mild downlap onto the horizon, suggesting a period of structuring and erosion at the end of the Late Jurassic-Early Cretaceous.

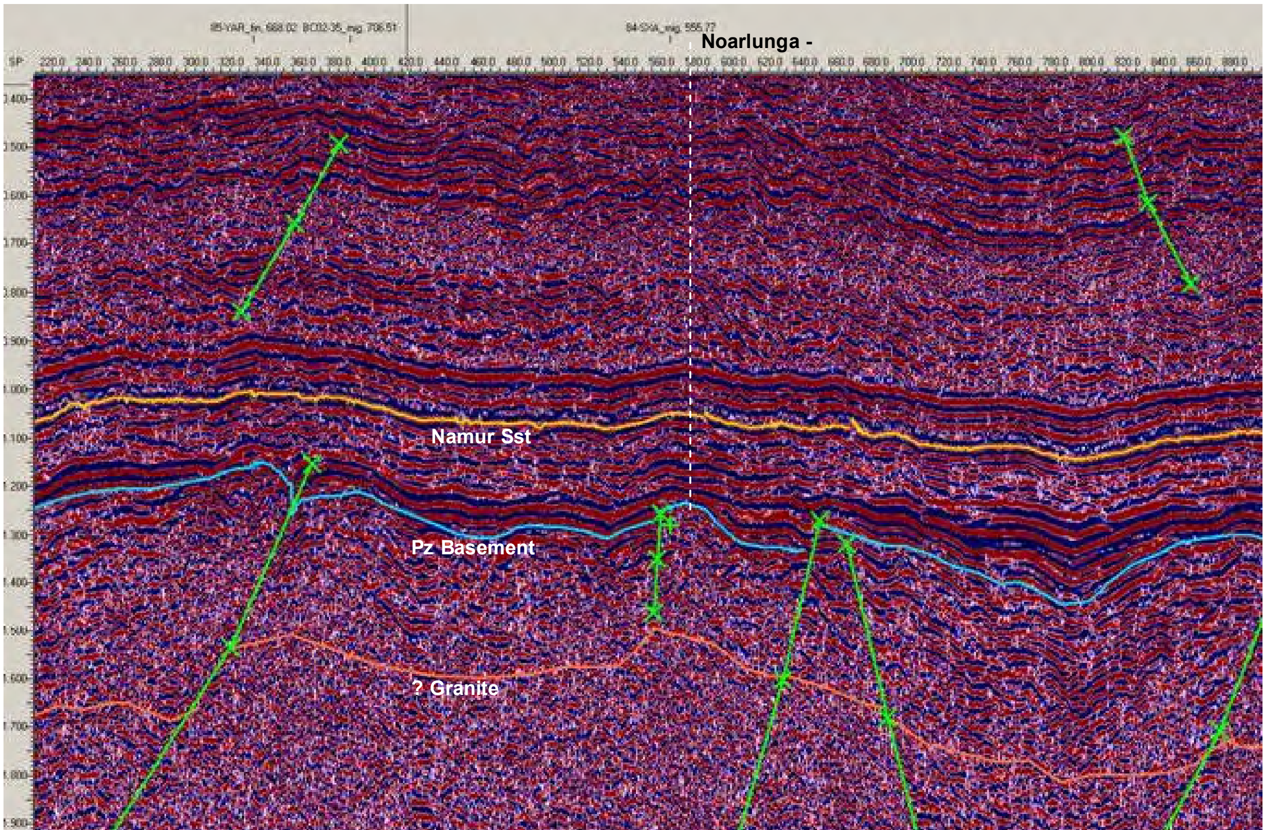

Fig 3 Seismic strike line 84SWX through Noarlunga-1 (see Fig. 5 for location)

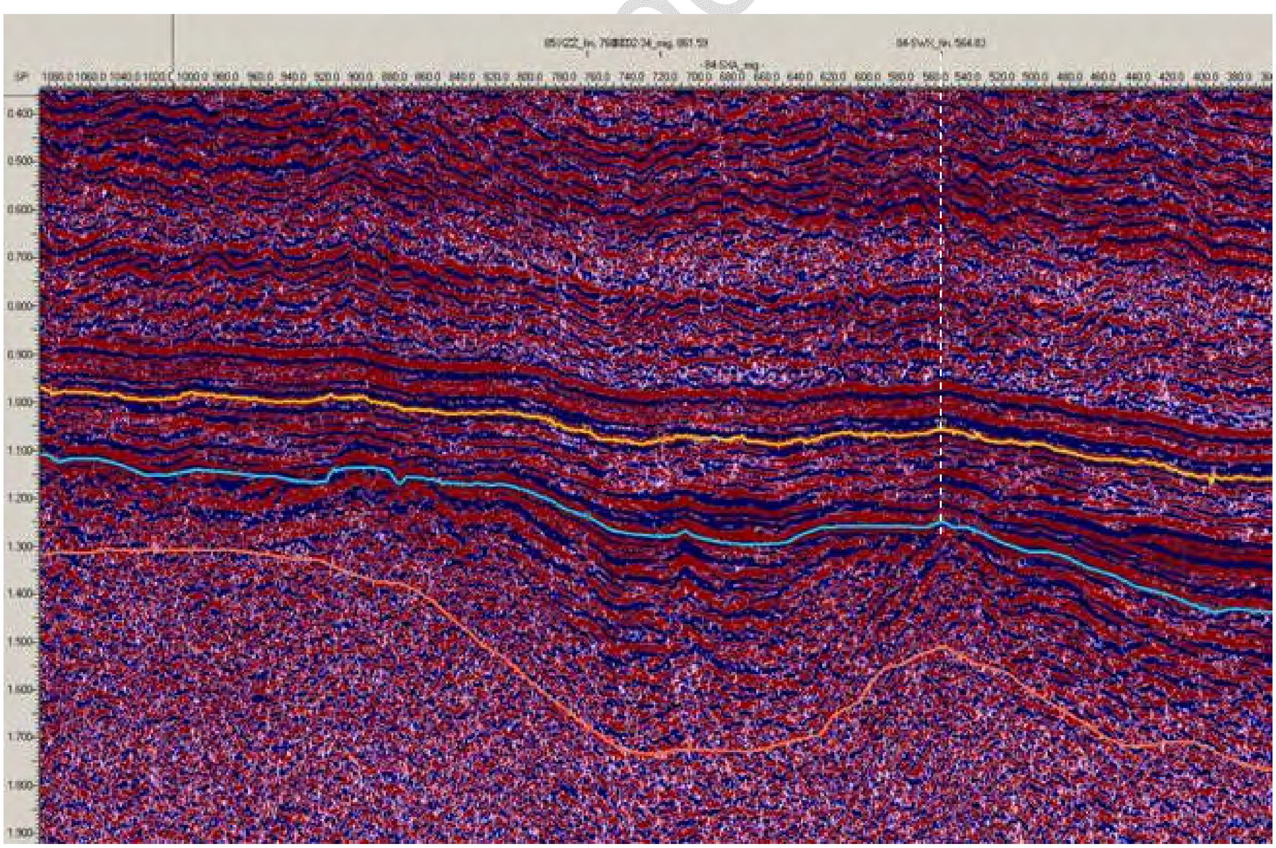

Fig 4 Seismic dip line 84SXA through Noarlunga-1 (see Fig. 5 for location)

The thinning of the Permian and Jurassic sequences onto basement highs and the characteristic onlap of these reflectors indicates that the pre-Permian basement at Noarlunga-1 and further to the south was an existing high at the time of Tenappera Trough development such that only a condensed section is present through much of the tenement.

Mapping of the top Palaeozoic basement horizon in TWT and depth shows basement is highest in the south (Fig. 5) at about 1200m depth and reaches about 2000m depth in the north. Although speculative, interpreted the top ?granite horizon shows a similar trend, although its relief is more rugose (Fig. 6).

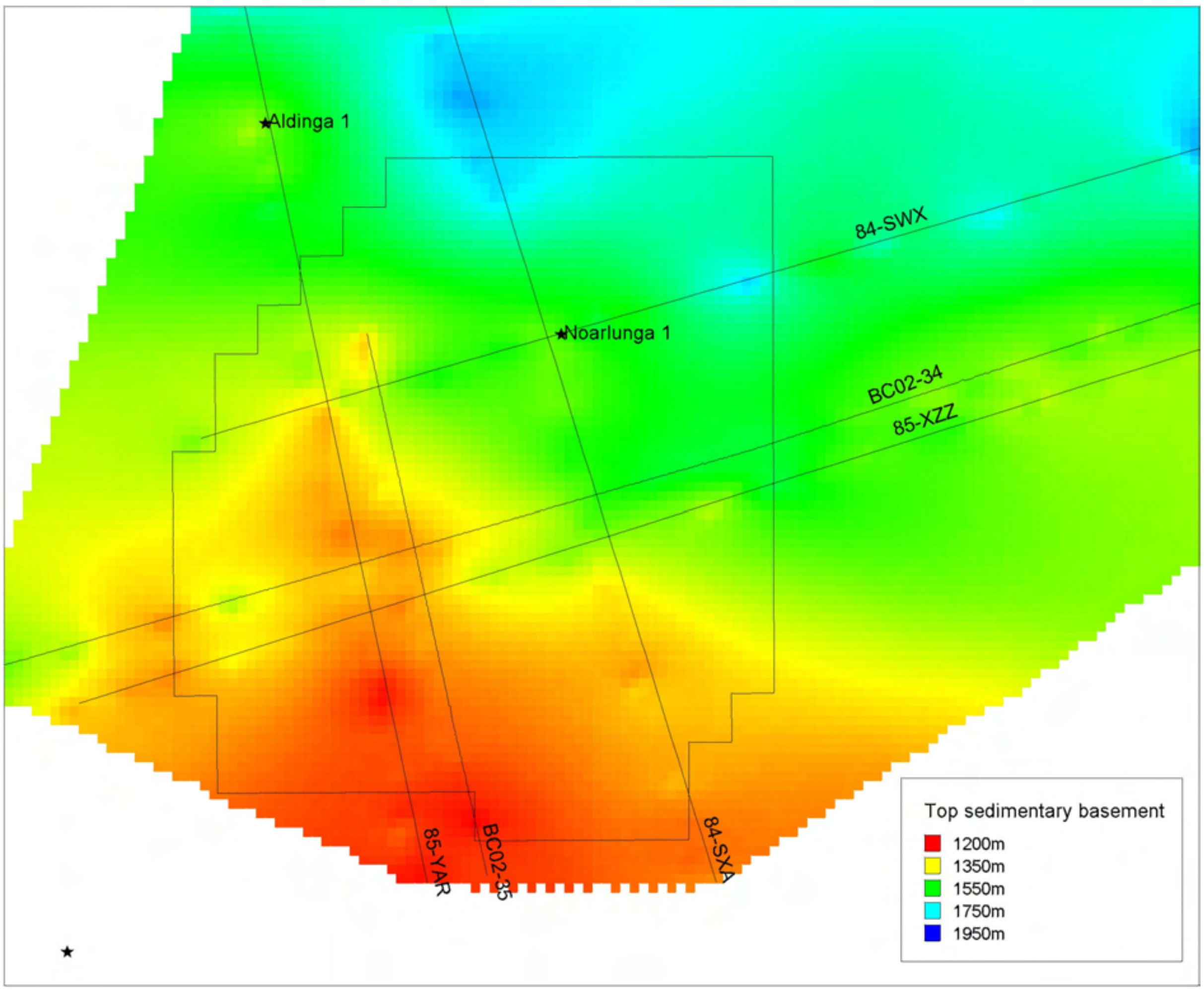

Fig 5 Depth (m) interpreted top Palaeozoic basement metasediments, GEL 169.

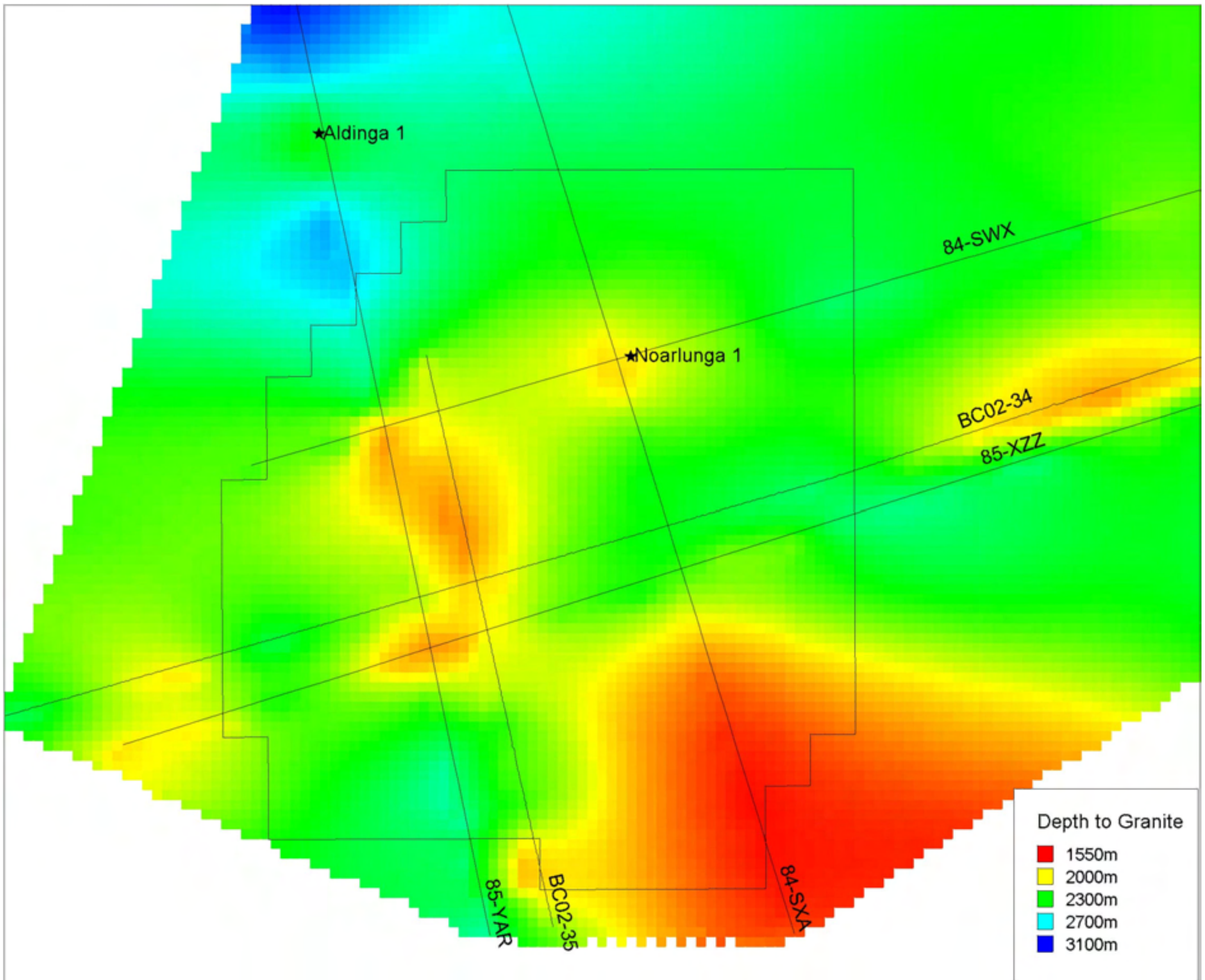

Fig 6 Depth (m) speculative interpretation of top ?granite, GEL 169.

5.1.3 Geothermal Systems Assessment

A comprehensive geothermal systems assessment of GEL169 was conducted by Beardsmore (2007) on behalf of Eden Energy Ltd. This report highlights favourable modelled heat flows for the tenement (100-119 mWm^{-2}) and suggests that the major risks are associated with the nature of the reservoir, in particular whether or not granite may subcrop in the area.

The characteristics of seismic reflectors assessed in this study suggest that a granite body at depth may be interpreted in this area, however the absence of direct evidence means that this interpretation remains speculative.

Seismic data also suggest that the tenement has a relatively thin post-Permian basin cover, particularly in the south and as such it is probable that risks associated with thermal resistance (insulation) may be reduced in the north of the tenement where basin sequences are almost 2km thick (Fig. 5).

Given the relatively shallow depth of the post-Permian basin sequence in this tenement, it is unlikely that Deeply Buried Sedimentary Aquifer (DBSA)-type geothermal plays will be viable. Consequently EGS-type plays are more likely.

5.1.4 Recommendations & possible drilling targets

It is recommended that prior to deep drilling, value may be obtained by testing the interpretation of seismic data presented in this report by re-entering drill hole Noarlunga-1, if technically possible. If the interpreted granite is present, as discussed in this report, the granite may be intersected at a depth of 400-500m below the present TD level of Noarlunga-1. This may prove a cost effective way in mitigating reservoir risks prior to deep drilling.

In terms of overall drilling risk for geothermal exploration, thermal resistance risks may be better addressed by drilling targets in the NW of the tenement where basin sequences reach about 2km in depth and the interpreted ?granite (if present) is in excess of 2.5km in depth. Based on temperature modelling of wells for this tenement (Beardsmore, 2007) it is expected that workable geothermal gradients (>150°C) may be intersected at depths of about 3km (approximately at the same level as the top of the interpreted granite to the north of the tenement, Figure 6). However the lateral and vertical distributions of temperature throughout the tenement require detailed thermal modeling to validate this.

5.2 GEL 177 – Mungerannie

5.2.1 Location & geology

Located predominantly within the Eromanga Basin and on the eastern side of the Birdsville Ridge (and possibly within the southwest margin of the Cooper Basin), Mulkarra West-1 was drilled on the eastern margin of the tenement and terminated in what is described as "Cambrian-Ordovician" metasediments, although palynological dating of samples ceases above this point in the mid – late Jurassic Birkhead Fm. Consequently the age correlations at depth in this well are questionable. The lithology of the TD core was described in the Mulkarra West-1 well completion report as a colorless to white meta sandstone with almost 100% quartz grains with minor associated trace minerals. Alternatively this may describe an occurrence of the Cooper Basin Hutton Sandstone, or a sandstone member of the Eromanga Basin Poolwanna Fm.

The well was terminated at 1286.9m within "metasediments" with a BHT of 92.5°C and an average geothermal gradient of about 56°C/km.

5.2.2 Seismic interpretation

The Mulkarra West-1 well suggests that the Mungerannie area has a relatively shallow basement (1000msec TWT, or about 1200m depth). Consequently it is unlikely that, at these shallow depths, significant geothermal sedimentary aquifers will be intersected. Consequently seismic interpretation has concentrated on the deeper horizons at or beneath basement level, as interpreted from well data.

Sample strike and dip seismic lines are shown in figures 7 and 8 respectively. Key horizons are described as:-

- **Palaeozoic basement (from well pick):** Mulkarra West-1 indicates that Palaeozoic metasediments are intersected at about 1200m depth. This position coincides with a strong negative trough in the seismic data (about 1000msec TWT). However both the depth and seismic characteristics of this horizon are inconsistent with known basement intersections in other parts of the region. In particular seismic line 84TZQ shows minor offset of this horizon (yellow horizon) by multiple planar faults. These faults do not offset deeper seismic horizons beneath 1300msec TWT, suggesting ductile displacement at this level. This is not characteristic of brittle basement metasediments. In addition to this the seismic package between 1000 and 1300msec TWT exhibits a number of sequence boundaries, defined by multiple downlaps and apparent prograding sequences from the south (Fig. 8). This progradational sequence is probably more consistent with the glacial-fluvial depositional environment of the Permian and perhaps Jurassic. Given the absence of palynological control for the age determination at this level of the well, the "Palaeozoic basement" horizon as defined from the well is regarded in this study to more characteristic of the Hutton Sandstone or related unit.

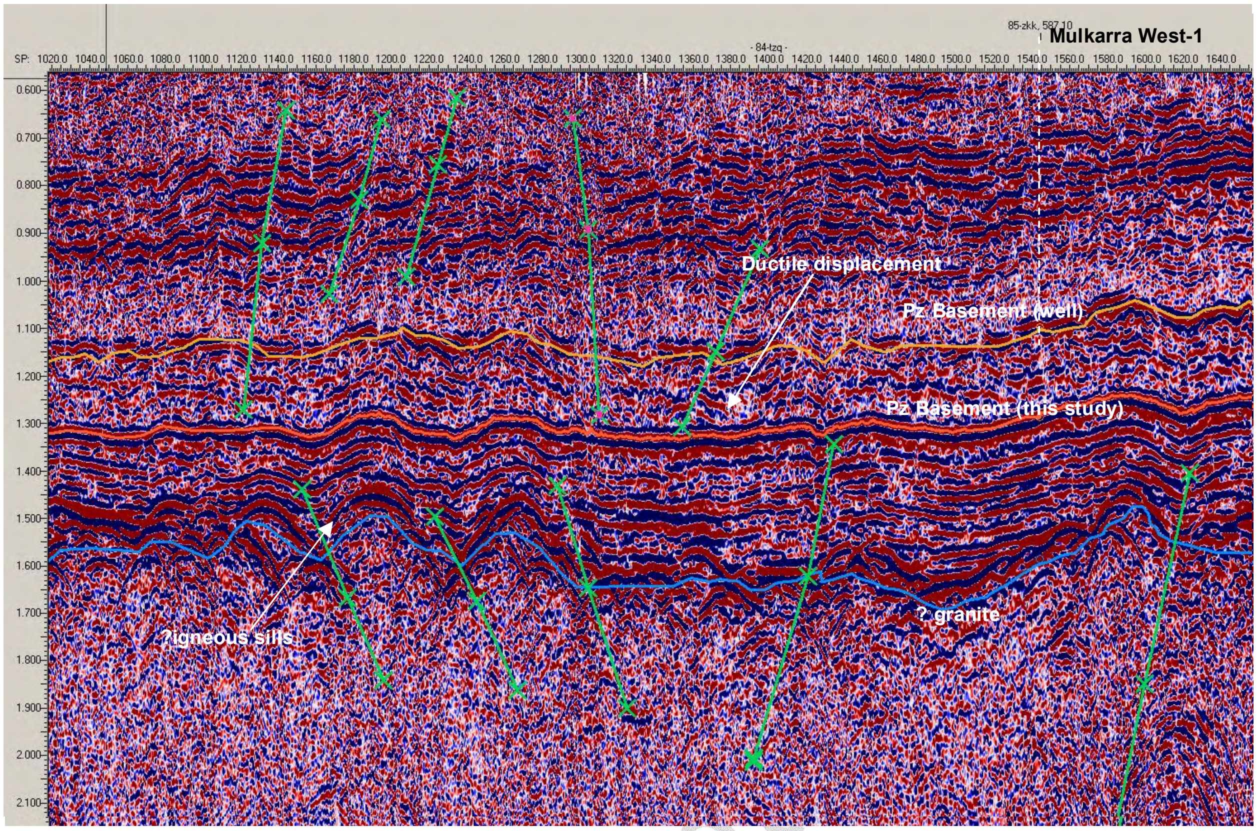

Fig 7. Seismic line 84TZQ through Mulkarra West-1 (see Fig. 9 for location)

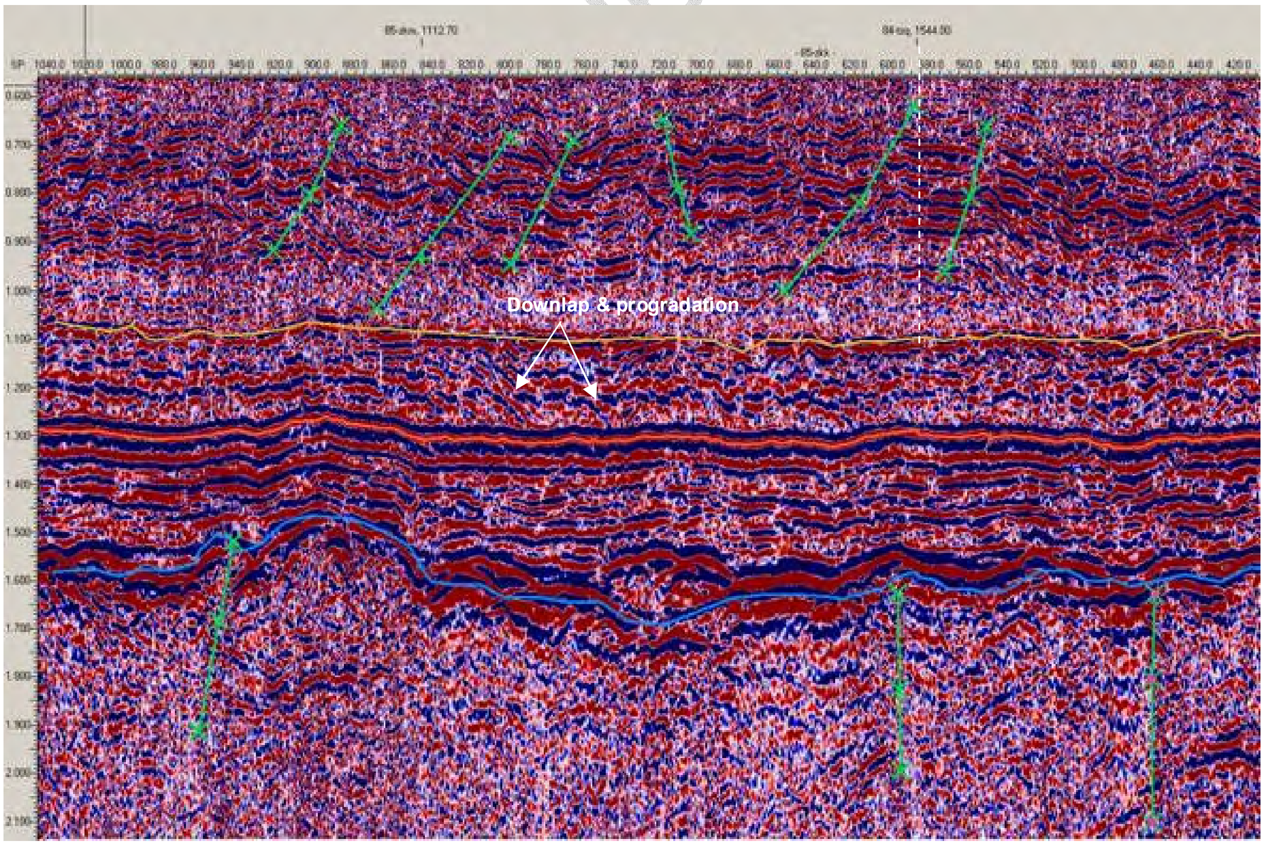

Fig 8. Seismic line 85zkk, Mungerannie Region.

- **Palaeozoic basement (this study):** The interpreted top Palaeozoic basement horizon in this study is defined by a dominant acoustic impedance boundary at about 1300msec TWT. The basement sequence comprises a package of sub-parallel reflectors interpreted to represent the Cambrian-Ordovician Warburton Basin sequence. The basement reflector is downlapped by possible Permian reflectors of a prograding sequence. Whilst similar seismic characteristics have been observed for the basement in other areas, the absence of deep well control means that this interpretation is unconstrained for GEL177.

- **Granite? Horizon:** The deepest and most prominent acoustic impedance boundary in GEL177 occurs at 1500-1600msec TWT and represents a marked density/lithology change. It is possible that this reflector may represent Warburton Basin sequence or alternatively it may represent ?Carboniferous granite. Apparent onlap of overlying seismic reflectors may suggest an unconformable contact with the Warburton Basin sequence, however the draping of reflectors across highs may be more indicative of differential compaction above a granite. Some seismic lines in this area show uplift of reflectors adjacent to highs, indicative of igneous intrusion. Likewise the blue horizon in figures 7 and 8 shows a characteristic bell or ringing geometry which may also be indicative of igneous sills near the top of a disconformable contact. Again, whilst speculative, there are seismic characteristics in this area which may be indicative of granite at depth.

Mapping of the speculative top ?granite horizon in this area (Fig. 9) shows that the horizon is shallowest in the southeast of the tenement (about 1800m depth) and deepest in the northwest of the tenement (about 2200m depth).

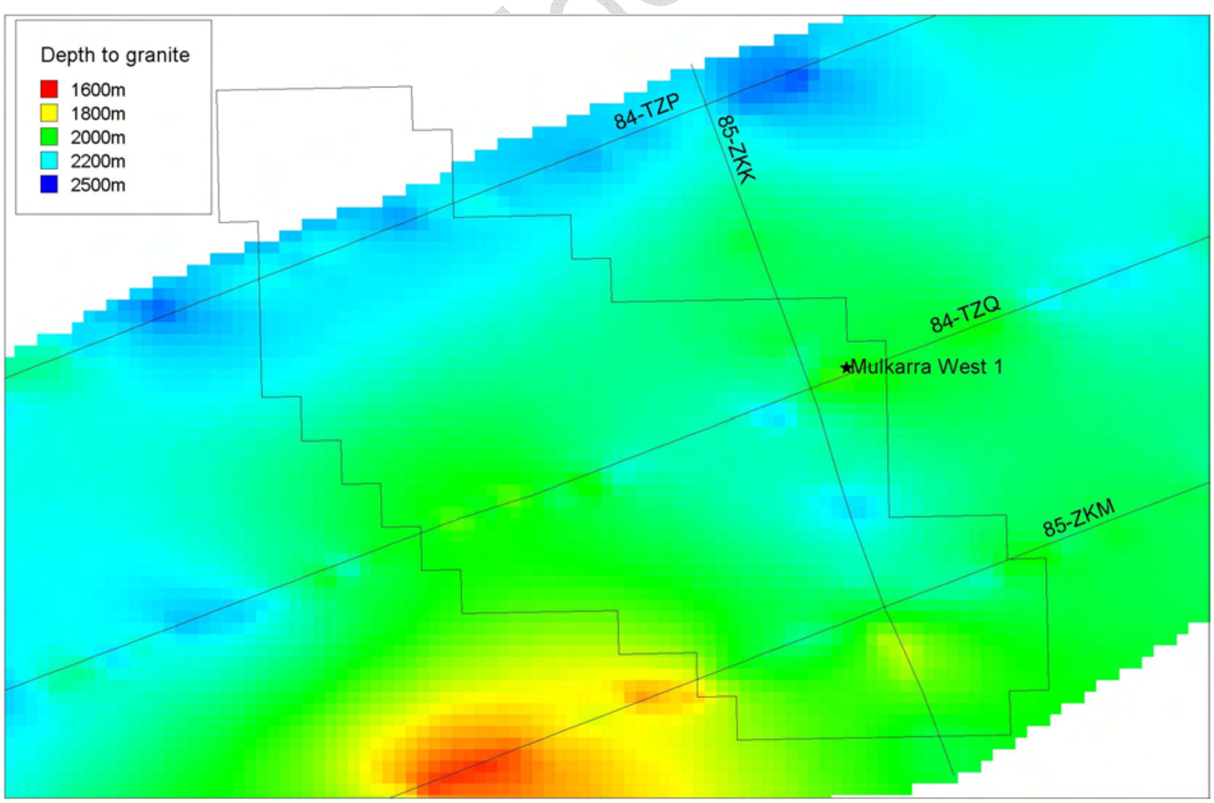

Fig 9. Depth (m) speculative interpretation of top ?granite GEL177.

5.2.3 Geothermal Systems Assessment

Temperature data from Mulkarra West-1, suggest that the geothermal gradient in this area is about 56°C/km, indicating that temperature risks may be low.

Seismic characteristics assessed in this study suggest that a granite body at depth may be interpreted in this area, however the absence of direct evidence means that this interpretation remains speculative.

Seismic data also suggest that the tenement has a relatively thin post-Permian basin cover, particularly in the south and as such it is probable that risks associated with thermal resistance (insulation) may be reduced in the north of the tenement where basin sequences are thicker (Fig. 9). In this area the interpreted Palaeozoic plus post-Permian basin sequence reaches a thickness of about 2.2km, however the lithology and thermal properties of any possible Warburton Basin rocks are unknown.

Given the relatively shallow depth of the post-Permian basin sequence in this tenement, it is unlikely that Deeply Buried Sedimentary Aquifer (DBSA)-type geothermal plays will be viable. Consequently EGS-type plays are more likely.

5.2.4 Recommendations & possible drilling targets

The sedimentary sequences and subsequent depth to interpreted granite of this area are shown to deepen to the north of the tenement (Fig. 9). In terms of overall drilling risk for geothermal exploration, thermal resistance risks may be better addressed by drilling targets in the north and possibly the central eastern area of the tenement where basin sequences reach about 2km in depth and the interpreted ?granite (if present) is in excess of 2.2km in depth. Based on temperature data from Mulkarra West-1 it is expected that workable temperatures (>150°C) may be intersected at depths of about 2.4km which approximates the top of the interpreted ?granite in the north of the tenement (Fig. 9), however extrapolation of temperatures across the tenement requires detailed thermal modelling. Consideration may also be given to further refining temperatures in the area through a program of shallow drilling and heat flow modelling.

5.3 GEL 185 – Moomba North

5.3.1 Location & geology

This area is located at the southern end of the Nappamerri Trough, on the northern flank of the Moomba Field. The Nappamerri Trough contains the deepest and thickest sections of Permian sediments in the Cooper Basin. Wells used to assist in interpretation for this report comprise those drilled within GEL185 including those of the Moomba gas field (specifically Moomba 73 and 86) and Mootanna-1 on the eastern margin of the tenement area. Moomba-73 terminated in pre-Permian basement at 3025m, with Moomba-86 TD of 3085m being within the early Permian Patchawarra Fm, highlighting the deepening of the sediments away from the topographic high of the Moomba gas field. Mootanna-1 had a TD of 3050m and was terminated within early-mid Permian sediments of a Roseneath Shale member, with potentially an additional 1000+m of Permian sediments below this, overlying the basement.

BHTs for these wells ranged from 212^{o}C (Moomba-86) to 183^{o}C (Moomba-73), with calculated geothermal gradients ranging from 54^{o}C/km in Moomba-73, 58^{o}C/km in Mootanna-1 to 62^{o}C/km in Moomba-86.

Given both elevated geothermal gradients and a thick sedimentary sequence, this tenement, unlike GELs 169 and 177, may be ideally suited to Deeply Buried Sedimentary Aquifer (DBSA) geothermal plays, although the lateral and vertical distribution of temperatures across the tenement requires modeling and validation.

5.3.2 Seismic interpretation

Seismic data show that the Moomba North area has a thick sedimentary cover with a deep basement (>2500mesc TWT or >4.2 km deep). Key horizons interpreted in this study include:

- **Toolachee Formation** (yellow)**:** The interpreted top of this formation lies at about 1700mSec to 1900mSec, deepening towards the north. Good lithological control has been achieved on this seismic interpretation from the well picks from Mootanna-1, Moomba-73 and Moomba-86 wells. The top Toolachee is characterised is by a seismic trough which in part is downlapped by progradational sequences from the north of the area (Fig. 12). The rest of the sequence is dominated by strong amplitude reflectors, which appear sub-parallel, but in detail define multiple sequence boundaries. Particularly towards the base of the Toolachee, there are a number of apparent onlapping reflectors and mounded features suggesting possible fan (sand) deposits and associated Trangressive Systems Tracts (TSTs). These deeper reflectors suggest possible sediment supply into a lacustrine-deltaic environment, prograding from the south and are more likely to be associated with the Daralingie and Epsilon Formations (Figures 12 and 13). The position of sandier units within this system may be important with regards to targeting Deeply Buried Sedimentary Aquifer geothermal systems.

- **Patchawarra Formation** (tomato)**:** The basis for the interpretation of this formation was a coal member, the Patchawarra Coal. This member lies at about 2100mSec to 2300mSec, and is picked from a prominent peak from the lower parts of the Patchawarra Formation. The interpreted depth correlates well with the drill data from this area. The top of the Patchawarra is interpreted to be at approximately 150mSec above this coal member. Sandstones are known to occur above the coal marker. The basal Patchawarra represents a major transgressive episode across the basin.

- **Tirrawarra Formation** (green)**:** This formation top has been interpreted at about 2400mSec through the centre of the tenement area. It has been picked as a trough between two distinct seismic peaks. This approximates to 3600 – 3800 metres depth, which correlates with the minor intercept of a Tirrawarra member in Moomba-86 on the northern edge of the Moomba rise, where the Tirrawarra Formation onlaps basement. The Tirrawarra was deposited in a fluvial-lacustrine system and actually comprises a number of sequence boundaries (Seggie, 1997). Sandstones are typically restricted to the marginal highs as braided delta and shore face deposits. Sandstones within the deeper basin trough are more likely to be restricted to fan deposits along major sequence boundaries and overlain by thick mudstones and shales of the Low Stand Systems Tract (LST).

- **Palaeozoic basement** (blue)**:** The interpreted top Palaeozoic basement horizon in this study is defined by a dominant acoustic impedance boundary at about 2500mSec. It exhibits more complex structure and extensive faulting can be identified.

5.3.3 Geothermal Systems Assessment

Unlike the other two permits assessed in this report, this area has significant scope for deeply buried sedimentary aquifer type geothermal plays. It is also possible that potential EGS plays may exist within the basement, however mapping suggest that the sedimentary rock interval from the Toolachee Formation to the Tirrawarra Formation may be deep enough to be within the range of workable geothermal temperatures (>150°C), subject to further thermal modelling. Consequently, if a suitable sedimentary reservoir is defined at these levels, there may be little economic justification for continued drilling to basement depths for an EGS play.

There are three main target formations for the development of a DSBA; the Toolachee, Patchawarra and Tirrawarra formations, all of which are known to have reservoir sands for oil and gas in the Cooper Basin and display the necessary porosity and permeability qualities to allow their development as a DBSA, based on available well data. However defining the location of sand units within these formations will require greater definition of seismic sequence stratigraphy and subsequent mapping.

High geothermal gradients, overlying lithologies that are expected to demonstrate low levels of thermal conductivity (good heat insulation), and the favourable physical sediment properties shown within the sandstone members of these formations all suggest that DBSA plays may be viable.

With increasing depth, and subsequent increase in temperature the Patchawarra and Tirrawarra Sandstone units will be the major targets for the development of DBSA type plays. However it is expected that some of the porosity and permeability characteristics of these formations may be affected by the depth of burial within the Nappamerri Trough, with the effects of compaction being a negative impact in this regard.

Based on well data temperatures in excess of 250°C may expected within the upper basement in this area, although the validity of extrapolating gradients from margin highs to the trough centre requires a greater understanding of bulk rock conductivities. This area may also be a target for the development of an EGS type play.

5.3.4 Recommendations & possible drilling targets

Based on available well BHTs it may be expected that temperatures adequate for the development of a geothermal system (>150° C) should attainable at depths starting at approximately 2.6 km (near the top of the Toolachee Formation), although detailed temperature modeling in the centre of the trough is required to validate this. The lower Toolachee Formation can have favourable sandstones with reservoir qualities, although the lateral extent of these sands in sequence stratigraphic terms is unknown.

The central part of the tenement holds the most attractive depth profile for further investigations. Due to the lack of drill data within this tenement it is recommended that this area be targeted for drill testing and confirmation of interpretations and assumptions made to date.

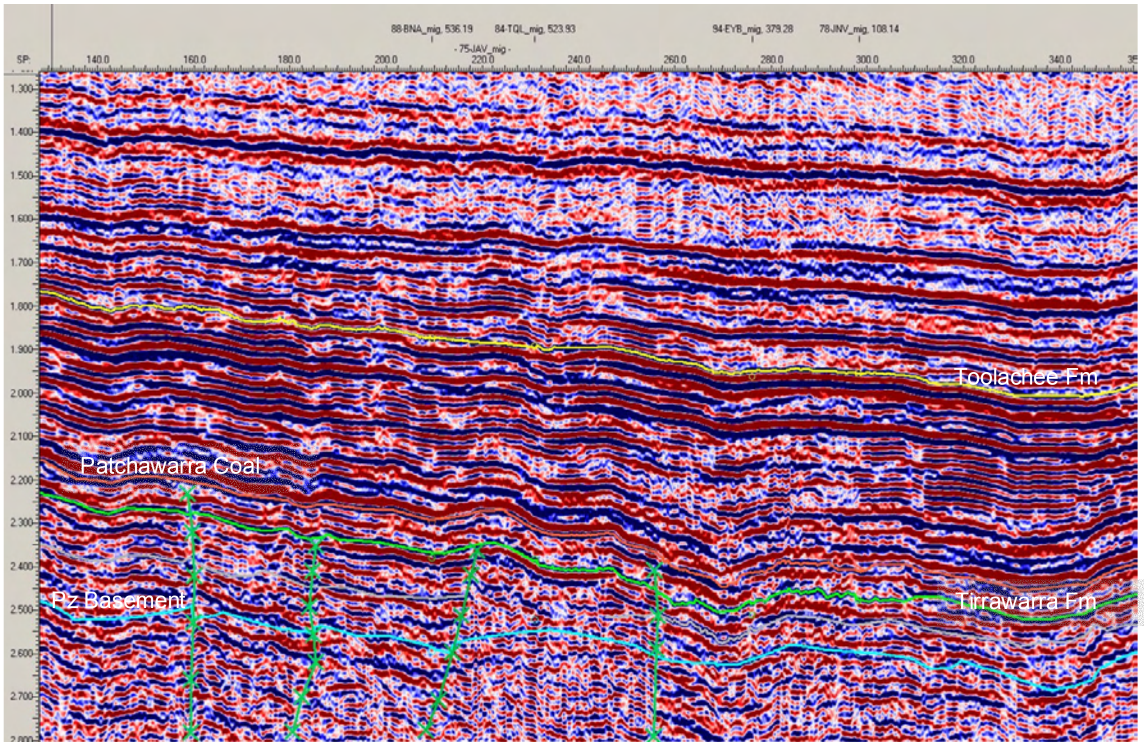

Fig 10 Seismic line 75JAV, Moomba North area (see Fig. 14-17 for location)

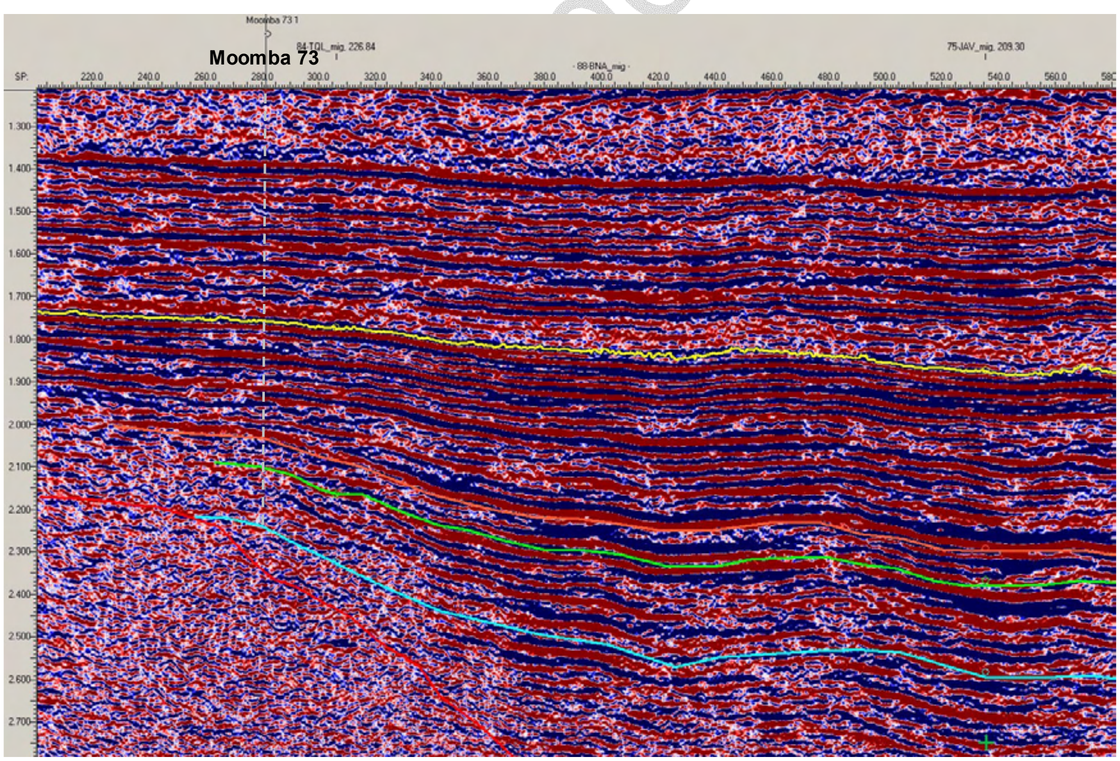

Fig 11 Seismic line 88BNA, Moomba North area (see Fig. 14-17 for location)

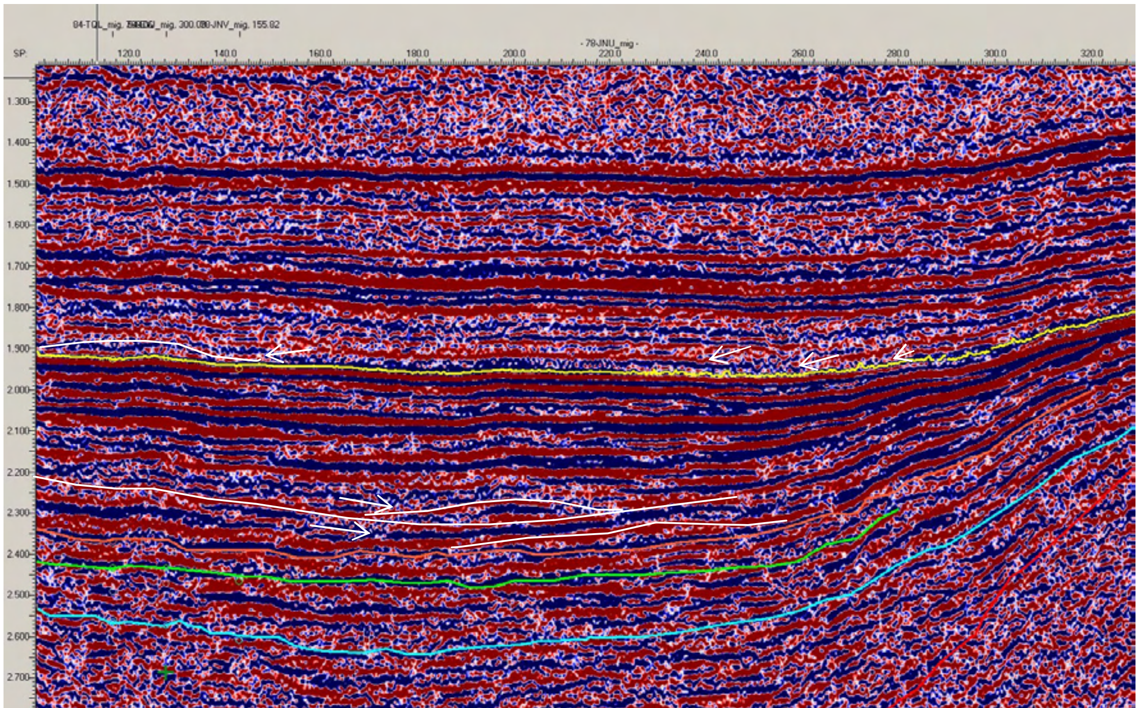

Fig 12 Seismic line 78JNU, Moomba North area (see Fig. 14-17 for location)

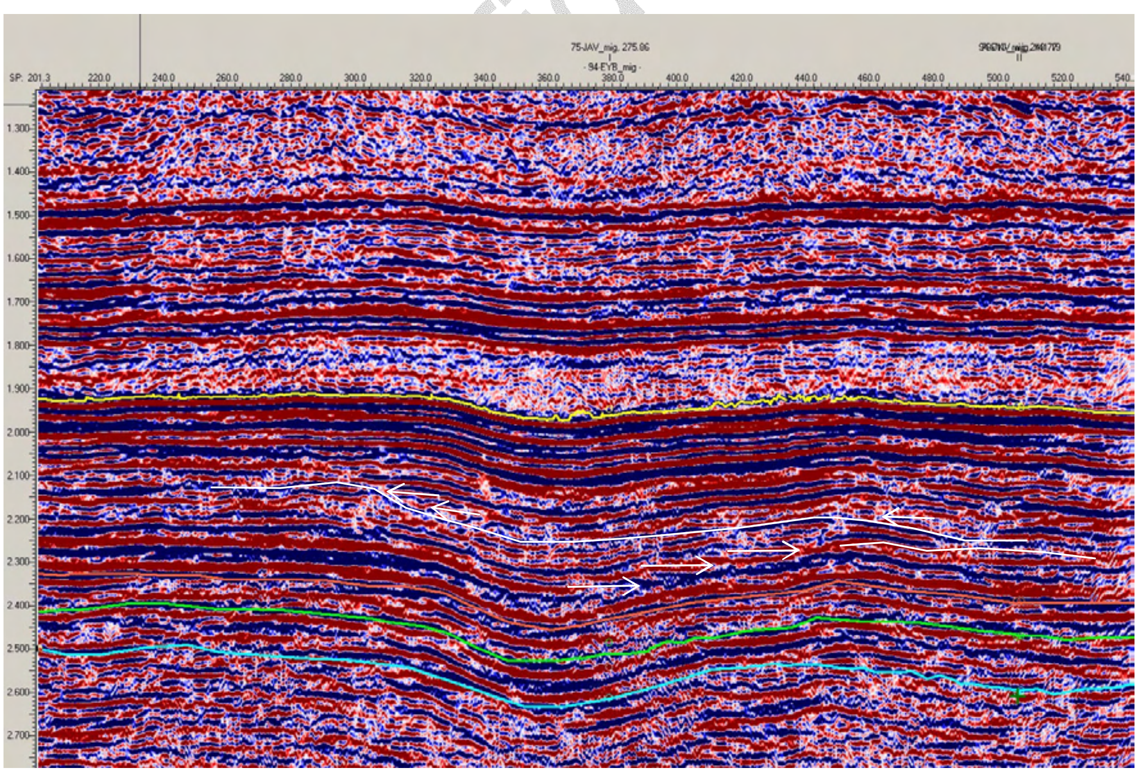

Fig 13 Seismic line 94EYB, Moomba North area (see Fig. 14-17 for location)

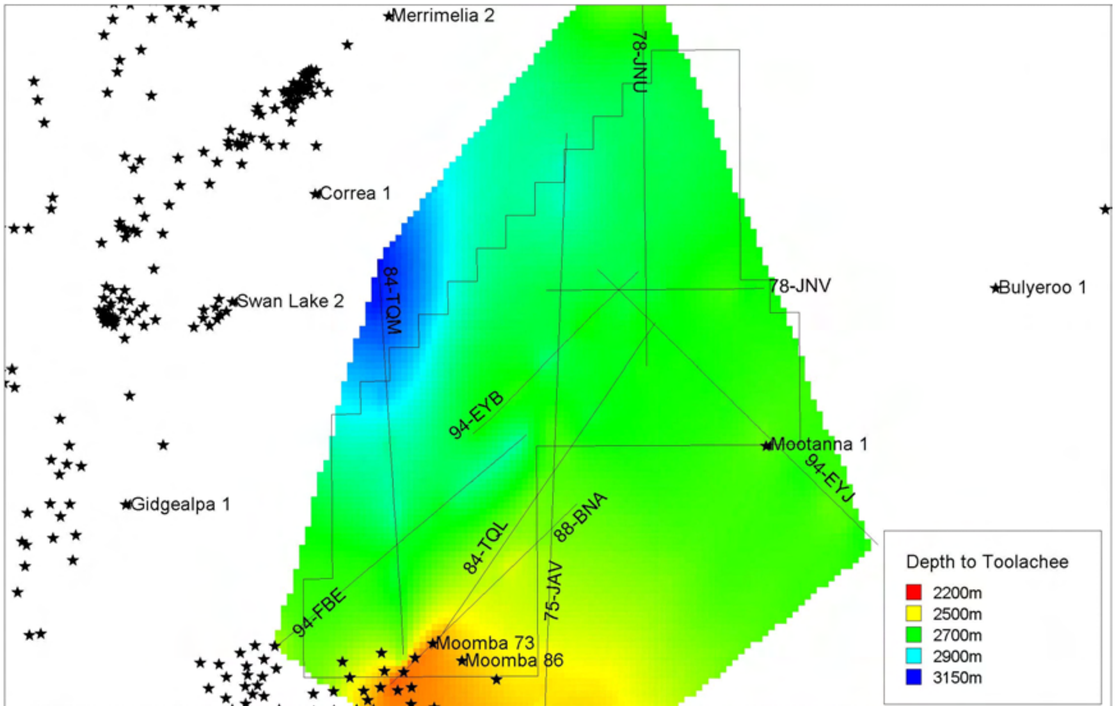

Fig14. Depth (m) interpreted top Toolachee Fm GEL185

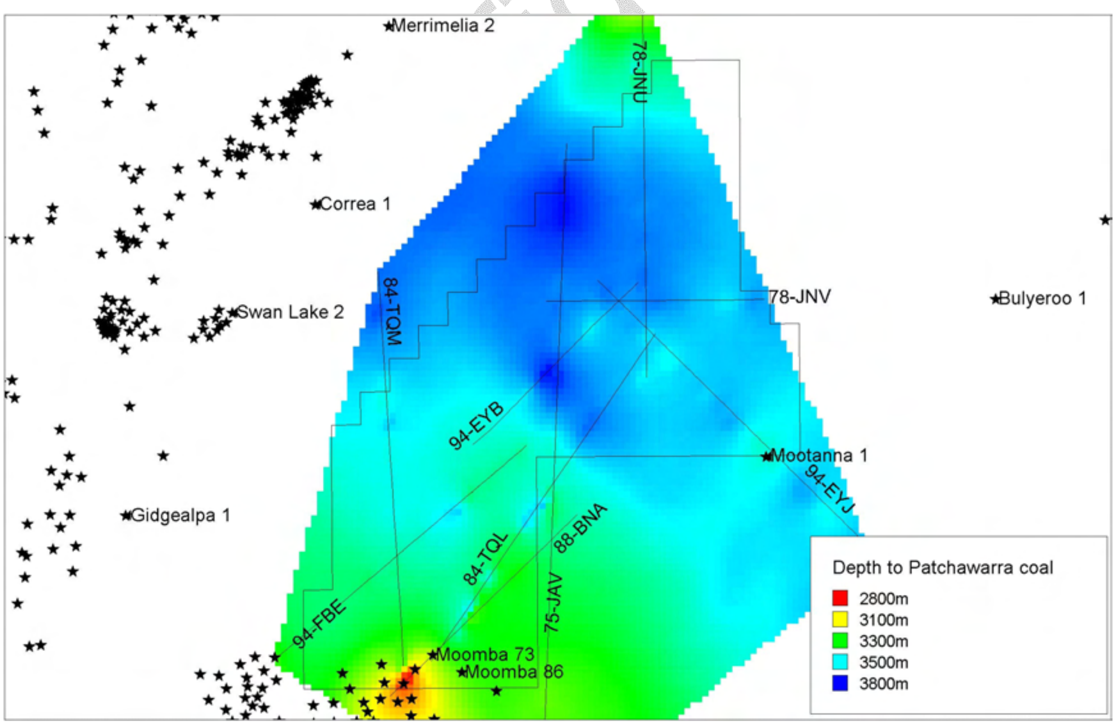

Fig 15. Depth (m) interpreted top Patchawarra Coal member GEL185

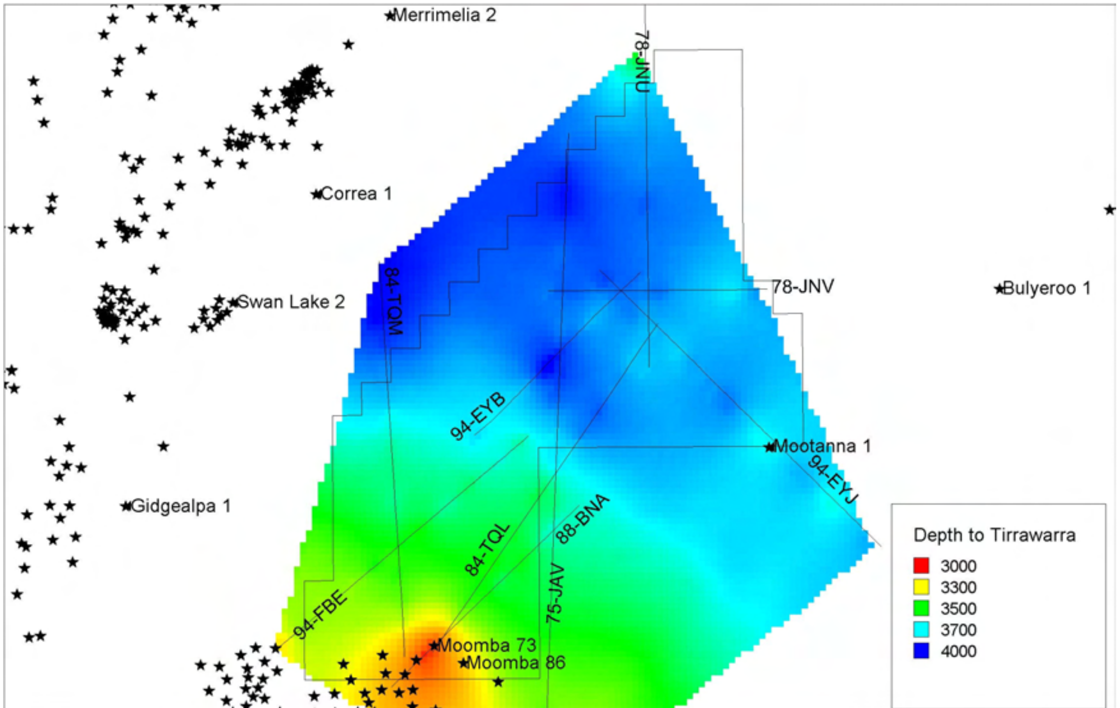

Fig 16. Depth (m) interpreted top Tirrawarra Fm GEL185

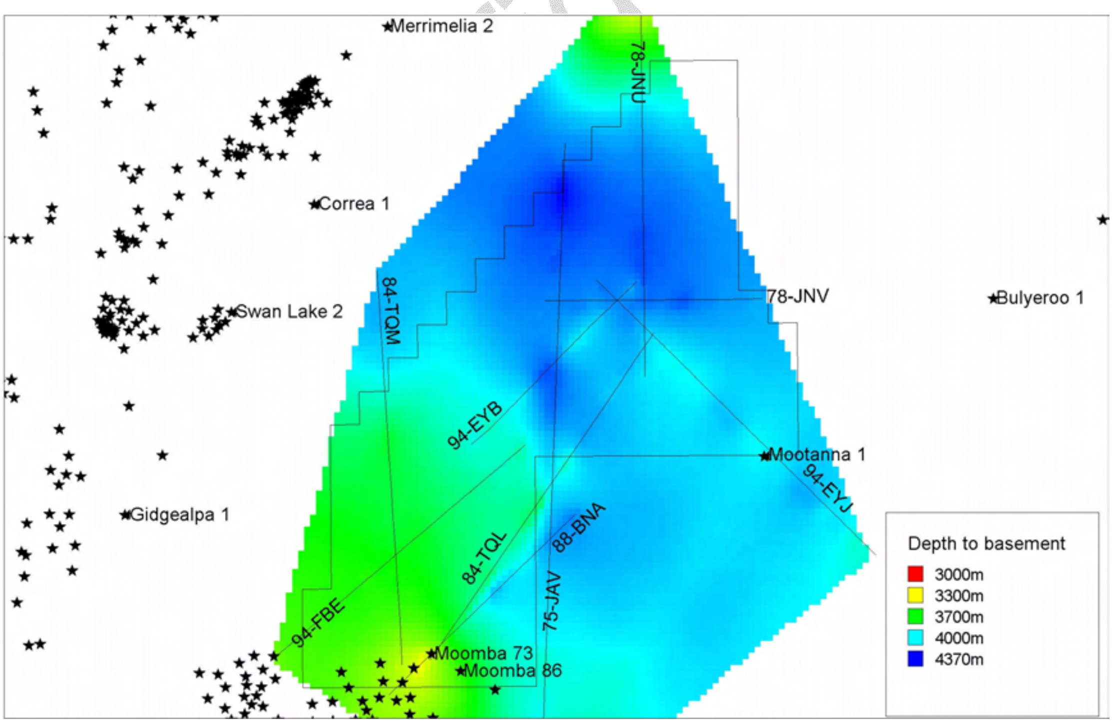

Fig 17. Depth (m) interpreted top Pre Permian Basement GEL185

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Hot Dry Rocks Pty Ltd
Geothermal Energy Consultants

HEAD OFFICE
PO Box 251
South Yarra, Vic 3141
Australia
T +61 3 9867 4078
F +61 3 9279 3955
E info@hotdryrocks.com
W www.hotdryrocks.com

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Terratherma – Risk Assessment of Identified Geothermal Plays.

Prepared for Terratherma Ltd

October 2008 Final Report

Ben Waining

Executive summary

Terratherma hold significant acreage of geothermal tenements in South Australia and NSW. In order to allow for the strategic planning of required exploration activities across these tenements and for the development of a roadmap to inferred resource estimation, an analysis of the current level of knowledge and work required has been conducted. This report sets out each of the Terratherma geothermal plays on a tenement by tenement basis.

Details of the known elements of each of the plays have been provided in the context of what is known and what is still required to be ascertained to allow for the development of inferred resources, as per the *Australian Geothermal Reporting Code*. An Inferred Resource is defined as an estimation of thermal energy in place to a low level of confidence.

The status of each of the plays varies considerably in terms of the information held, and what is required for the calculation of inferred resources. All the tenement areas require some drilling of heat flow holes to constrain this aspect of the geothermal system assessments. Reservoir size and types also requires further investigations to allow for calculation of inferred resources to any level of confidence. This aspect of the required works should be possible with detailed analysis of known geological settings and existing geophysics. There is scope for the acquisition of further geophysics in many of the areas to further constrain reservoir geological settings. Deep drilling has been presented as an option to provide greater insights into the geology and temperatures at depth, it is however not seen as a requirement for the development of inferred resources due to the low level of confidence required in the estimation of thermal energy.

Table of Contents

1.0 Introduction

This document outlines the current level of knowledge and available data for each of Terratherma's geothermal projects, and so provides an indication of the risks associated with the reservoir and temperature (heat flow, thermal resistance) aspects of each of the identified plays. The aim of this report is to allow Terratherma to develop a roadmap for their exploration activities that will allow for the determination of Inferred Resources (as per the *Australian Geothermal Reporting Code, 2008*) contained within each of the identified plays.

The Inferred Resource category, as defined in the *Australian Geothermal Reporting Code, 2008*), requires each play to have sufficient data to enable the calculation of thermal energy in place, to a low level of confidence. The resource is inferred from geological, geochemical and geophysical evidence and is assumed but not verified as to its ability to deliver the geothermal energy. A reasonable understanding of the three dimensional subsurface geology, measurements (can be indirect) of temperature (heat flow and conductivity to allow for extrapolations of temperature below measured depths), and sufficient information to allow for an estimate of the areal and volumetric extent of the resource are required to progress exploration results to the Inferred Resource category. It should not be necessary to undertake deep drilling to gain an inferred resource estimation, however this approach is an option that may constrain geological and geophysical assumptions.

In the context of the plays within the Terratherma tenements the required information will include (but should not necessarily be limited to): building of a geological model, measurements of heat flow and conductivity with associated analysis and extrapolation of temperatures to depth (specifically to depths where temperature would exceed an economic cut off of 150°C), analysis of available geophysical data (seismic, gravity and MT) to determine extent, depth and thickness of target reservoir units, and possible sequence stratigraphy analysis of seismic data to determine the probability of encountering permeable sedimentary units of suitable thickness.

A summary sheet of requirements per tenement is provided at the end of each chapter. These summaries outline of the interpreted geological risks and uncertainties associated with two of the key geothermal system requirements (temperature and reservoir) and also provide a guide for further work. The fourth key element of a geothermal system – water, has not been considered in this report.

3.0 GEL 169 (Bollards Lagoon)

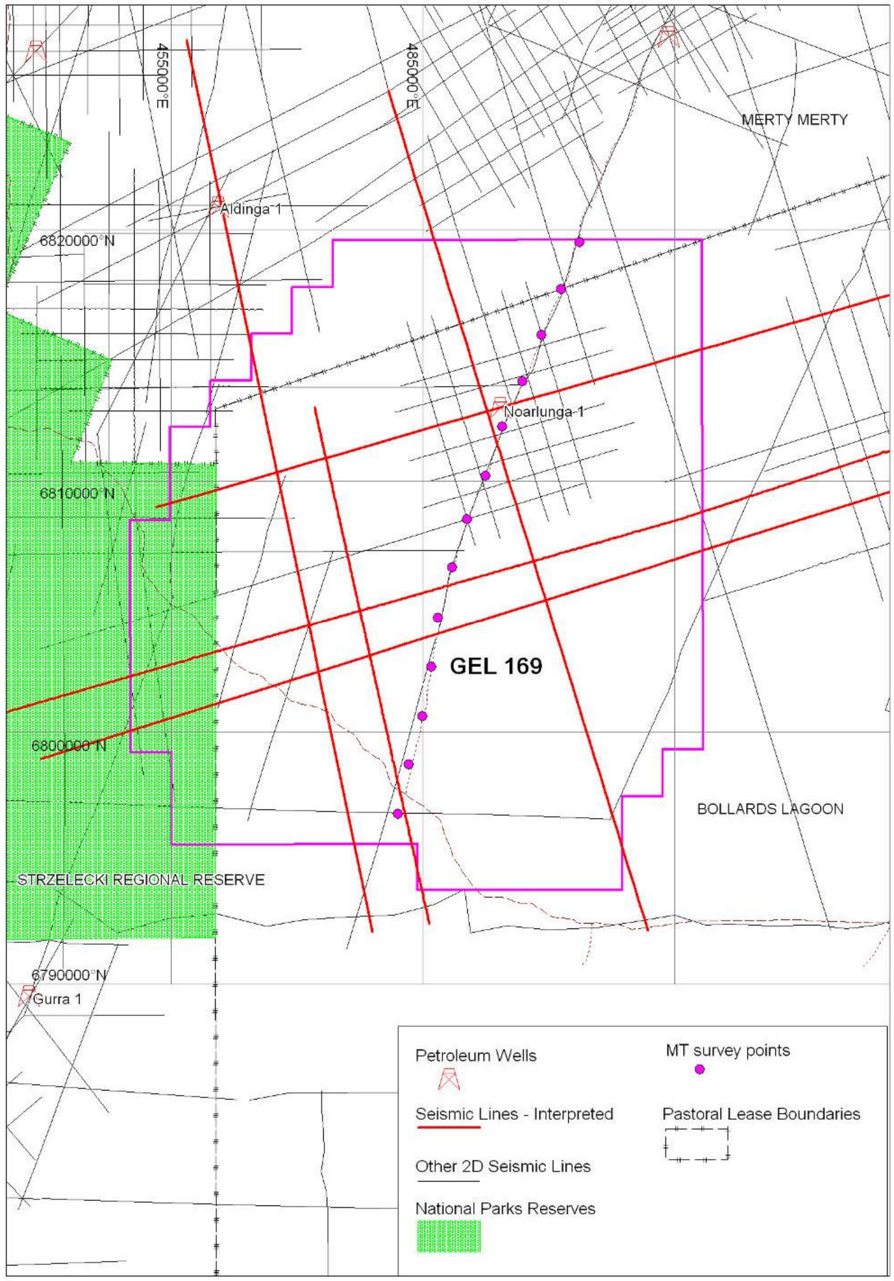

Figure 3.1 Location and works summary – GEL169

3.1 GEL 169 key risks.

3.1.1 Thermal Resistance (insulation)

Seismic interpretation of existing 2D lines and the lithologies encountered in the Noarlunga 1 well give good evidence for a maximum thickness in the order of two kilometres of sediment package overlying basement. Cooper Basin sediments of this thickness are towards the lower end of requirements for sufficient thermal insulation to develop high temperatures at depth. The sediment cover is interpreted to thin towards the southeast quarter of the tenement.

3.1.2 Heat Flow

The combination of published conductivities for the overlying sediments and reported temperatures from the wells drilled in this area have allowed for the estimation of heat flow for GEL169. A conservative estimate of heat flow in Noarlunga 1 was provided by HDRPL (Beardsmore 2007[6]) at a value of 100 mW/m^2. This level of heat flow is considered to be low risk in terms of there being adequate heat flow for the development of a geothermal system, and is equivalent to other highly prospective regions throughout Australia. Confirmation of this level of heat flow occurring across the whole tenement area is required.

3.1.3 Temperature

With the assumptions of purely conductive vertical heat flow, and a basement geology homogenous to a depth of 5000 m and equivalent to the Big Lake Suite Granodiorite, temperature projections to depth indicate that at depths of 3000 – 3500 m, temperature in the order of >150°C can be achieved.

3.1.4 Reservoir

The development of a reservoir within GEL169 poses the highest risk in this play. Insufficient sedimentary cover precludes the option of developing a DBSA type play, leaving an EGS type play the most probable option. The ability to enhance or develop sufficient fracture permeability within the granitic basement for economic rates of flow is currently undemonstrated for this type of play, although expectations are that this goal can be achieved.

3.1.5 Land Access

There are no identified significant issues related to land access for this tenement. The extreme western margin of the tenement coincides with the Strzelecki Regional Reserve, however this should not be an impediment to project development. The tenement area is currently utilised as grazing leases.

3.2 Plays:

3.2.1 Engineered Geothermal Systems (EGS)

An EGS play is the most viable option for this tenement area. The interpretation of a granitic basement is speculative at this stage, based primarily on seismic interpretation (Cooper and Waining 2007[5]) and an assumption of a granitic heat

[6] **Beardsmore, G.R. 2007.** Review of Geothermal Systems in GEL 169. Unpublished report to Eden Energy.

source to explain the modelled high heat flow. There was no drill intercept of granite in Noarlunga 1, with this well terminating in Palaeozoic sediments of the Warburton Basin.

3.3 Inferred Resource Requirements

To allow for the development of an Inferred Resource (low level confidence estimation of Thermal Energy in Place) for GEL 169, some key uncertainties require clarification.

Modelled high heat flow in this area should be confirmed through the drilling of a specific heat flow hole. The temperatures reported within Noarlunga 1 were not equilibrated, so conservative estimates of true formation temperatures were used in the calculation of the 100 mW/m² value for this well. A heat flow hole should be located to the south of Noarlunga 1.

The interpretation of a granitic basement remains speculative due to the lack of direct evidence such as well intersections. However, seismic data and the apparent elevated heat flow are consistent with the existence of a granite at depth. Detailed geophysical studies (eg. gravity survey) may help delineate basement lithology, alternatively physical evidence of basement lithology may be obtained with drilling to about 2000 m.

An Inferred Resource can be estimated without the physical evidence of granitic basement, providing that the heat flow value is confirmed and assumptions are made regarding the existence of a viable reservoir lithology in the basement.

Steps to an Inferred Resource: GEL169

- Constrain heat flow estimate, with at least one well.
- Confirm existence of granitic basement (geophysical study/physical sampling – drill, or use probabilistic approach of high heat)
- Ascertain areal extent and thickness of potential reservoir – seismic/MT/gravity
- Input data to 3D modeller (eg “GeoTherm”) for inversion and 3D heat flow modelling and interpretation.

Task	Timeline – setup	Timeline – execution	Cost
Drilling – Heat Flow holes x 1	6 months lead in: regulatory approvals, securing of rig.	±2 weeks / 500m hole. 2 weeks total	$300 000 per well
MT interpretation	Book in for interpretation ±1 week wait	±2 weeks	$5,000
Deep Drilling	6 months, post above efforts. Rig securing, regulatory approvals	±6 – 8 weeks for 3 – 5 km deep slim hole.	approx. $5M to 3500 m

GEL 169	Bollards Lagoon. Cooper Basin	498.25 km^2

Temperature at Depth

Positive Indications
High regional heat flow. Calculated values from the Noarlunga well provides a high level surface heat flow of 97mW/m^2. Cooper Basin sediments of 2 km thickness in this area provide adequate insulation for a resource below 3000 m, within interpreted granitic basement.

Significant Unknowns:
Extent of high heat flow. Nature of basement lithology (interpreted to be granite, possibly heat producing).

Negative Indications:
None known

Best Estimate based on current Information
Modelling of heat flow and lithology data estimates temperatures of >150 Deg C at approximately 3200 m, where sediments at least 2000 m thick.

Risk Analysis		Uncertainty analysis
no evidence of heat flow extending over all tenement. Confirmation required in southern parts	0.75	

Actions to de-risk Temperature at Depth

drill additional heat flow in the southern part of tenement - confirm continuation of high heat flow

EGS Reservoir

Positive Indications
Published studies on the regional stress regime show a predominantly compressive regime (Sv minimum), allowing for the preferential development of horizontal (sub) fractures. Primary target within economic drilling depths

Significant Unknowns:
Basement lithology. Pre existing fracture state, localised stress regime

Negative Indications:
none known

Risk Analysis		Uncertainty analysis
speculative interpretation of granitic basement from seismic, no physical evidence.	0.75	

Actions to de-risk Reservoir

Drill well to >2000 m to confirm basement lithology interpretation, ascertain stimulation capacity, and confirm heat generation assumptions. Reinterpret geophysics for further clarification of target reservoir state.

Geological Risk	0.563

3.4 Summary Table GEL 169