



# **RELINQUISHMENT REPORT**

**for part of**

**SEL 58/2008**

**Prepared by**

**E & P Investments Australia Pty Ltd**

**August 2011**

## **INTRODUCTION**

E & P Investments Australia Pty Ltd (E&P) made application for an exploration permit over an onshore area of Tasmania on November 25, 2008. The application was for a Category 4 Onshore Exploration Licence over an approximate area of 1560 sq km, located on the eastern coastline between Scamander and Cape Lodi.

E&P explained that onshore hydrocarbon exploration in Tasmania to date has yielded little success. The Company's exploration approach was to conduct initial screening of the permit to ascertain evidence of surface hydrocarbons with a particular focus on oil, utilizing the Gore Surface Geochemistry sampling system. E&P believed it possible that hydrocarbon generation may have occurred offshore, east of the Tasmanian mainland in a hydrocarbon kitchen similar to the Gippsland basin, with migration to the coast and trapping in pinch-out or sub-cropping structures. The Company also considered the possibility of onshore hydrocarbon generation from the Gondwanan system and the Tasmanite oil shales.

Given the lack of success to date, E&P believed it fundamental that some evidence of possible trapped hydrocarbons is confirmed before the significant commitment to seismic acquisition and drilling is made. Providing the surface geochemistry confirms an economic zone of interest, a specific 2D seismic grid would be designed and acquired to cover the identified zone so that traditional geophysical interpretation and mapping can be conducted. The licence SEL 58/2008 was granted on July 3, 2009 by the Director of Mines and deemed to expire on 22 June, 2014.

The Company has completed two Gore surveys and engaged independent consultants to assist in the planning and interpretation of the data, and has reviewed the commerciality of the only significant zone of interest to attempt to justify further commitment to exploration over EL 58/2008 (the Permit). To date, over \$400,000 has been expended by E&P on the exploration and management of the Permit.

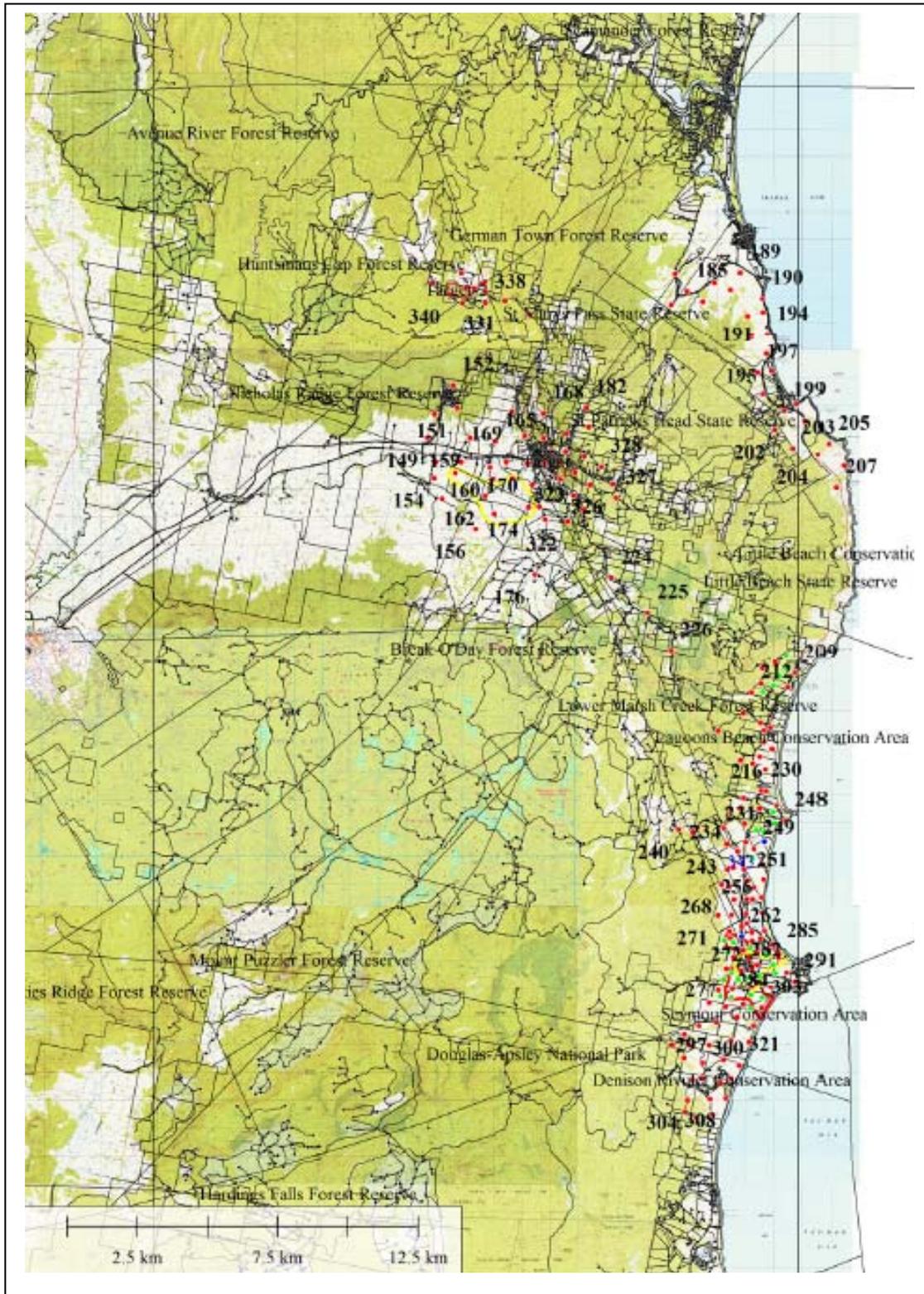
## **WORK PROGRAMME CONDUCTED TO DATE**

E&P has been working this exploration permit diligently with a number of specialist, technical and survey approaches in an attempt to develop sufficient evidence that a commercial hydrocarbon accumulation could exist. E&P previously agreed with your department and officers that given the history with onshore exploration in Tasmania, and the lack of exploration success to date, our approach was to conduct initial screening of the identified areas of interest to ascertain evidence of surface petroleum signatures by utilizing the Gore Surface Geochemistry sampling system and undertake desktop studies to determine if possible source and structural elements could exist in the permit area. It was agreed that if the Company could confirm the possibility of a commercial accumulation of hydrocarbons, the Company would advance the exploration efforts with the acquisition of new 2D seismic.

Additionally, basic structural geological reviews were conducted to identify possible regions of fault activity and potential traps. Aero-mag and Radiometric survey data available to the Company were reviewed by our consultants to establish zones of potential interest, conduct fault

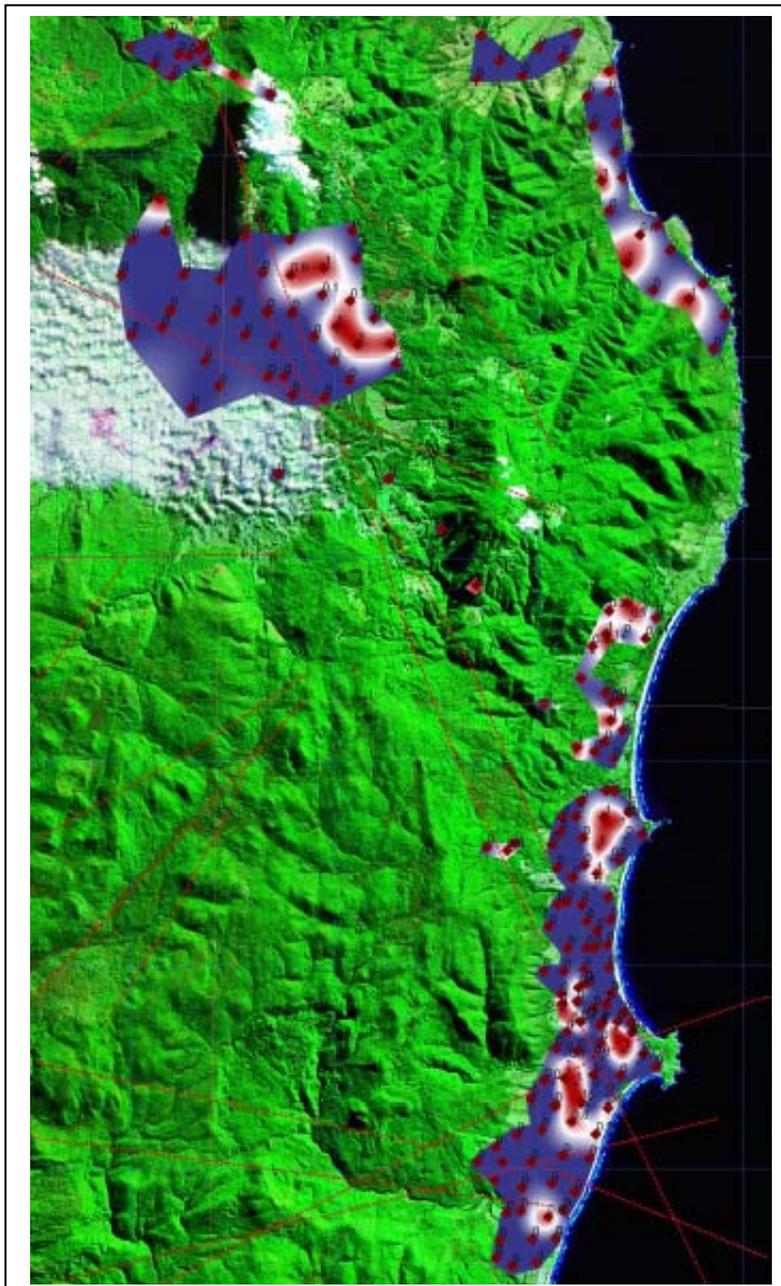
mapping, and identify the most probable hydrocarbon sources in the permit, as well as reservoir and seal sections. Trap types were also considered. This work was developed by independent consultants, Dr. Geoff O'Brien, Dr. Tim Rawlings and Mr. Phil Skladzien (studies attached as Appendix A & B).

Three primary areas within the Permit were identified for the Gore fieldwork. One just west of St Marys, the second close to German Town (these first two corresponding to strong radiometric signatures) and the third region along the coast between Falmouth and Seymour. These areas, the extent of the Gore sampling and results are fully detailed in the full Gore Report dated March 31, 2011, and are depicted in the image below.

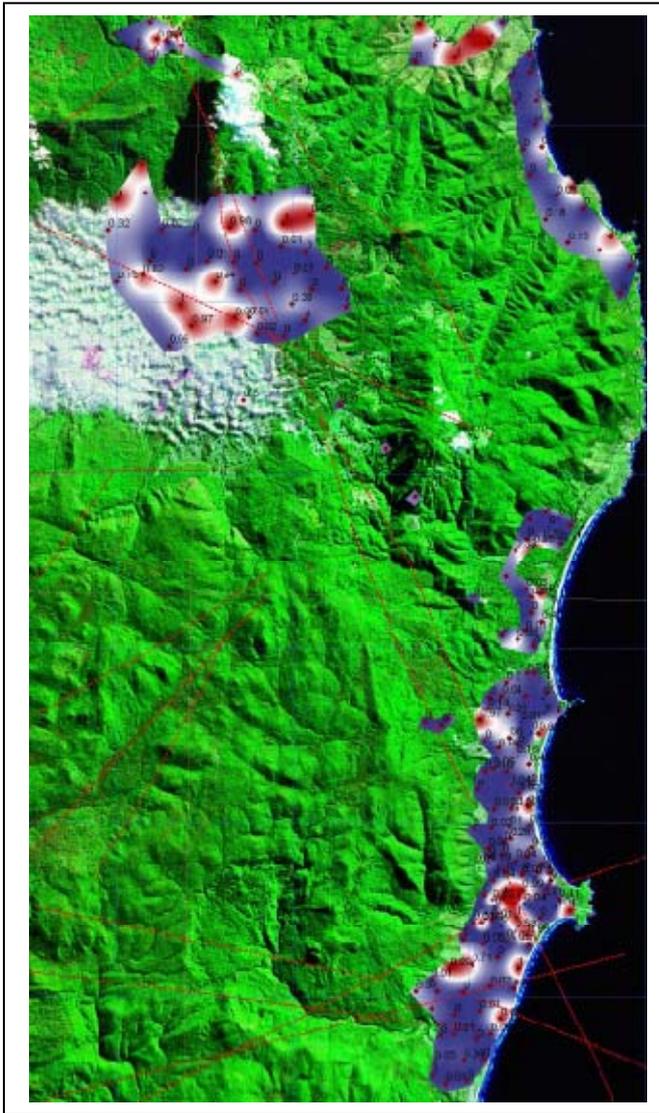


The Gore survey was extended to two areas outside the Permit area to attempt to record signatures of possible hydrocarbon sources, one relating to off-shore marine source similar to the Gippsland Basin and the second over a known oil seep in Tasmania associated with the Tasmanite shale oils. The Company conducted surveys over the Wombat gas field in Gippsland and a limited survey over the Lonnavale quarry in Tasmania. These results were utilized to create signatures of the two potential hydrocarbon sources considered probable for the Permit area and the final Gore survey results were calibrated to these signatures. Ultimately, the Permit Gore survey results calibrated to each source offered slightly conflicting correlation, confirming that the source could be a combination of either the Tasmanite oil shales or offshore marine rock. The Gore survey results calibrated to Tasmanite are immediately below, then followed by Wombat calibration, Cluster and Alkane analysis in the Seymour area. Geochemical signatures are also provided.

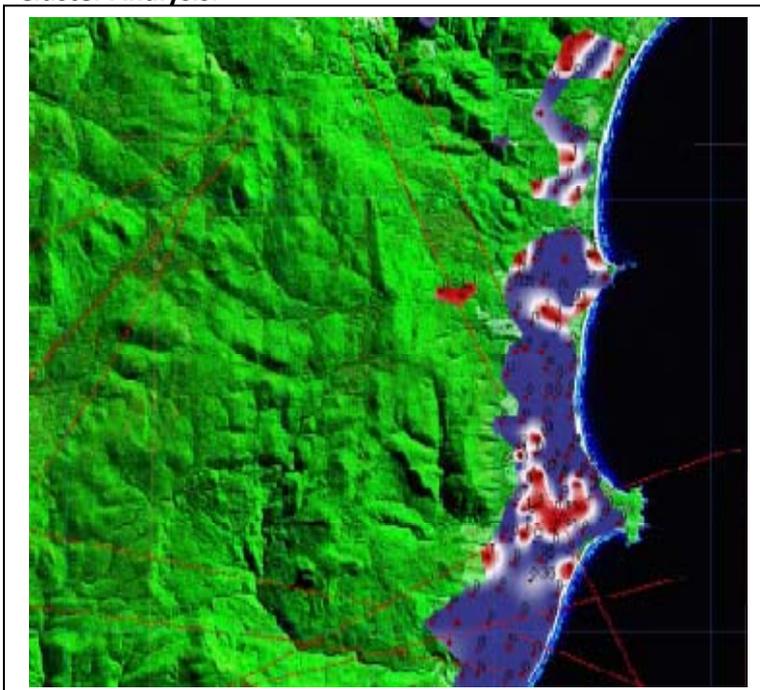
**Wombat gas field calibration:**



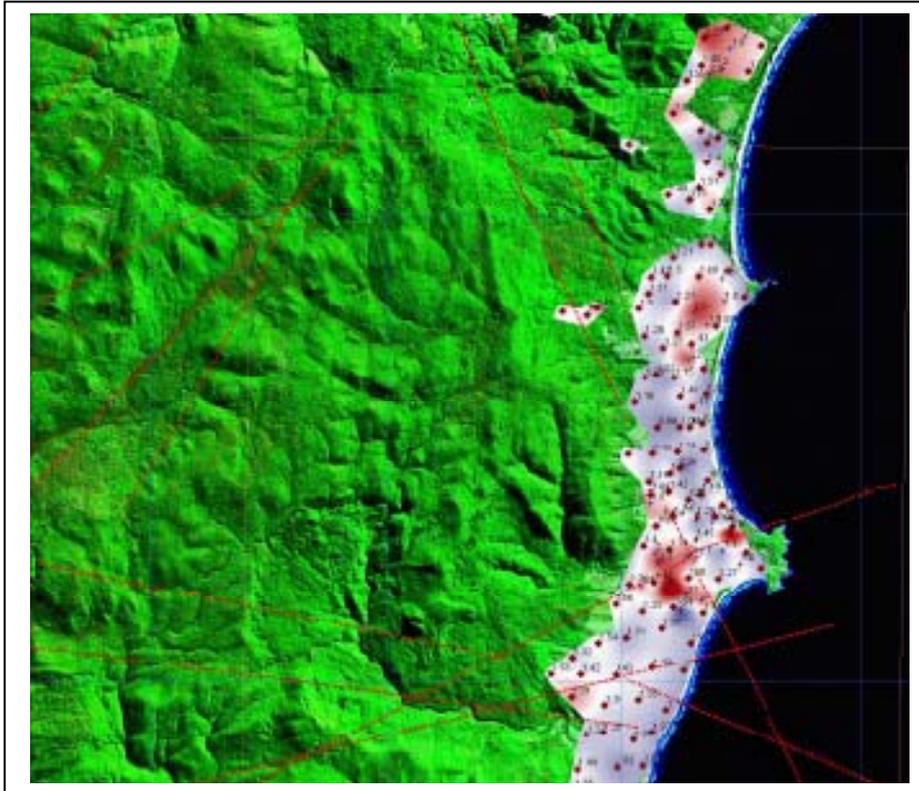
**Wombat Calibration:**



**Cluster Analysis:**



### Alkane analysis:



The Gore survey results were largely disappointing, with a few small zones identified from the results of the first survey. Most zones only provided a few positive sample results defining the closures, and the Company had concerns that some of the results possibly resulted from contamination. In particular, the positive sample points related to the zones near St Mary's were heavily discounted due to probable contamination given their proximity to built up areas and the extensive coal mining and transport operations. Accordingly, a second Gore survey was conducted which specifically targeted three of the positive zones on the coast with a number of higher probability recordings so that a higher density grid of Gore infill samples could be installed, where greater care was taken to avoid existing infrastructure and roads.

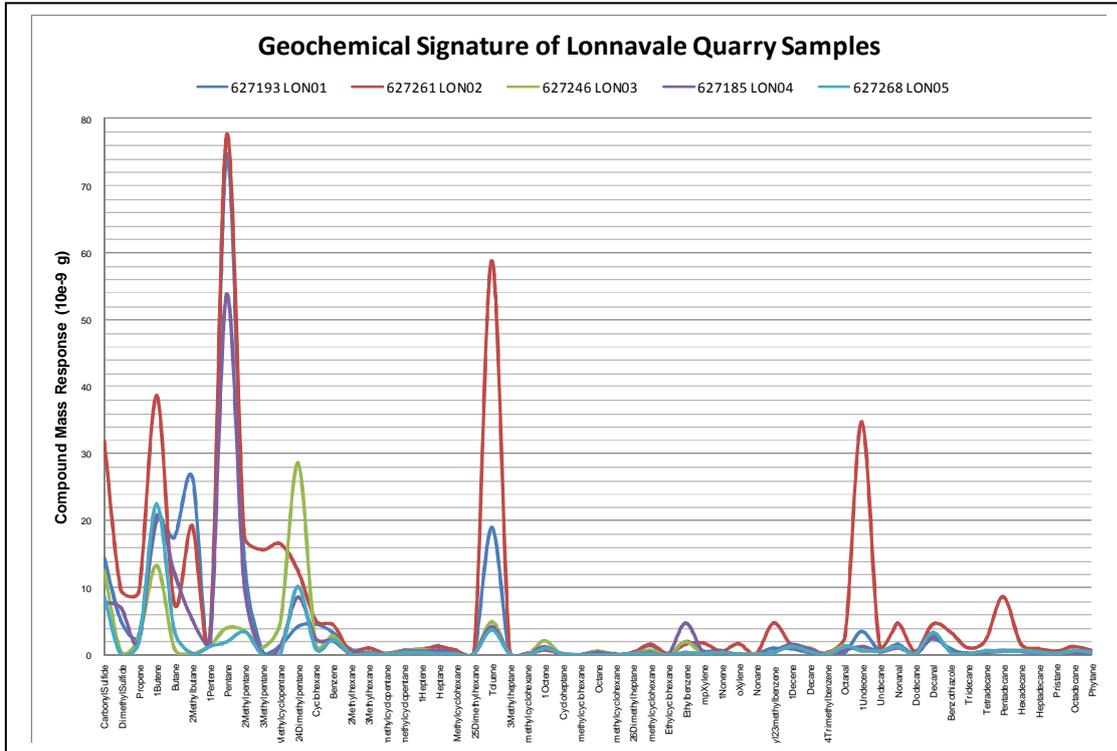
The infill samples confirmed that the two northern zones were not valid. However, a small zone immediately to the west of Seymour remained valid and further geological assessment and economic screening was undertaken.

The Gore results are designed to demonstrate a surface signature of potentially trapped hydrocarbons where according to Gore the extent of the surface signature is considered likely to closely correlate to the sub-surface extent of the underlying trap. The Seymour zone was confirmed by both the initial and subsequent infill sampling and analysis. The zone lies in close proximity to a potential mapped fault derived from analysis of existing aero-magnetic data. It was calculated that the zone of interest had an estimated closure that may correlate to a potential trap of approximately 2 km<sup>2</sup>.

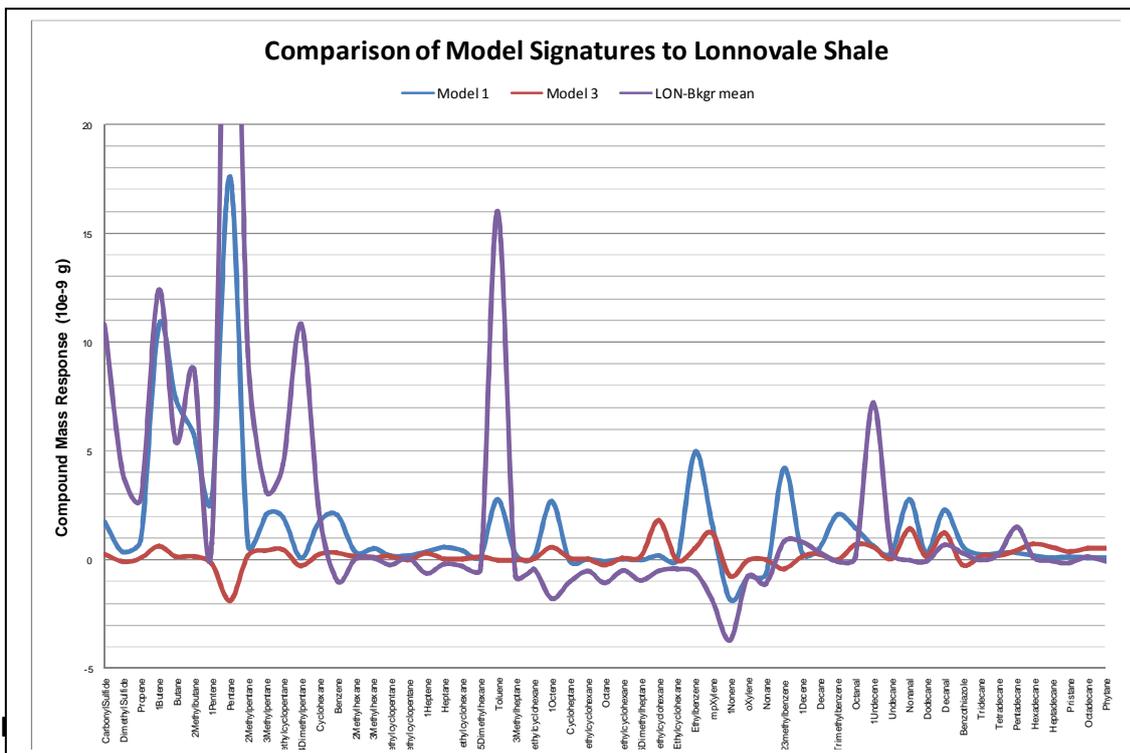
The Company again utilized Drs O'Brien and Rawling to estimate the most likely nature and extent of a possible trap in the Seymour region. The off-shore 2D seismic data (T69B-1, 2 & 3

acquired by Esso) was procured, digitized and reviewed to help estimate probable displacement or offset in stratigraphy across faults along the coastal regions of the Permit. While significant offsets have been noted along the scarps inland to the west of the coast, the consultants do not believe there can be a large offset along the coastal fault near Seymour and within the potential closure defined by the Gore Survey, that may suggest a significant fault bounded trap.

**Lonnvale signatures:**



**Permit model signatures compared to Lonnvale:**



A literature review of potential reservoir quality for the region was also undertaken. The range of reservoir porosity believed to be reasonable for economic modelling by the Company and its consultants was 7.5% to 17.5%.

Accordingly, the Company then developed an assessment of the potential accumulation and considered the commerciality of the high, most likely and low cases to screen and confirm the viability of undertaking significant further investment in the exploration, appraisal and production facilities that could be associated with any discovery. The assessment and assumptions are attached as Appendix C.

Our consultants do not believe it supportable to consider a maximum column in this foreshore area greater than 15m within the 2 km<sup>2</sup> closure identified by the Gore survey. Assuming a 40% recovery rate for oil (a reasonable assumption for a smaller field) the high, most likely and low cases indicate risked potential recoverable resource at 460,000, 176,000 and 66,000 bbls respectively. Initially, an exploration risk of 75% was utilized (25% chance of success), which could be regarded as high at this point, but expected to support drilling.

The Company then employed a basic screening model presented in Appendix C to consider the project returns from estimated exploration and capital expenditures deemed reasonable for the most likely case. Clearly, the project returns for the most likely case (using a 25% probability of exploration success) would not support further investment of high risk capital. When the exploration success probability was elevated to 50%, the risked potential resources increased to 923,580, 351,840 and 131,194 bbls respectively, and the most likely case provided a potential modest return when one considers the impact of State royalties and corporate taxation.

## **CONCLUSION**

The Company believes the majority of the Permit is not prospective, and has elected to relinquish most of the Permit area (approximately 1112 km<sup>2</sup>), but plans to make application to reduce the Permit area from 1162 km<sup>2</sup> to around 50 km<sup>2</sup> to adequately cover the Seymour lead identified by the Gore Surface Geochemistry results. While the Company accepts that the next major step in exploration would be to acquire new 2D seismic data, at this point, it is very difficult to support and justify the investment to acquire and interpret new 2D seismic. E&P had expected to identify a much larger potential closures from the Gore survey results. The Gore signature over this small potential closure effectively lies across a mapped fault and may be valid, but it may also only be demonstrating historic leakage from the fault, and not a valid trap.

E&P proposes to make application to significantly reduce the area of the Permit and request a further year to undertake additional studies to attempt to increase confidence in the lead, including further field work to attempt to identify natural seeps in the lakes and creeks running through the mapped Gore closure, and to undertake a structural geology study try to evaluate in more detail the proposals of Stacey regarding block tilting in the region to estimate fault offsets and potential effects on hydrocarbon migration from regions with better maturity characteristics.

## APPENDIX A

**Programme to Evaluate the  
Petroleum Systems of EL582008,  
Onshore Eastern Tasmania  
2009**

**A Report Prepared For E & P Investments Australia Pty Ltd**

**by:**

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**Disclaimer: The authors of this report have attempted to make this study, and the data and interpretations contained within it, as accurate and complete as possible, within the constraints of data availability and the project's budget. E & P Investments Australia Pty Ltd should not, however, rely solely on the data and interpretations contained within this report when making commercial decisions.**

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## Summary

A high-level assessment of the likely first-order petroleum systems operative within exploration permit EL582009, located in eastern Tasmania, was carried out. The primary purpose of the study was to identify the most likely operative petroleum system and to then develop an inventory of testable concepts and targets which could be investigated by a combination of field work and soil-gas sampling.

From this screening study, it appears that the offshore part of the East Tasmanian margin was starved of sediment throughout most of the Mesozoic and Tertiary and as a consequence, the sedimentary section is thin on the shelf and upper slope. As a consequence, thermal maturation of source rocks within the Mesozoic-Tertiary interval on the present day continental shelf and slope, and its subsequent migration onto appears unlikely.

Onshore, within EL582008, the deeper Ordovician-Silurian Larapintine petroleum system is probably at too high a thermal maturity and if present, would probably only represent a dry gas source. The Late Carboniferous-Permian-Late Triassic Gondwanan petroleum system is the one most likely to be operative within EL582008, although it probably occurs at relatively low thermal maturities ( $VR = 0.5-0.7\%$ ) over most of the permit. Local enhancement of thermal maturation, associated with the intrusion of Jurassic dolerite dykes and sills, is perhaps an important mechanism for producing sweet-spots within the permit.

Two dominant fault trends have been identified within EL582008 in the potential field data:

- a north to north-northwest trend, and
- an east-northeast trend. Some of the northeast structures appear to crosscut and displace the north-northwest structures, indicating the latter are probably older structures.

A minor west-northwest structural trend is also apparent in the data.

Complex zones of fault intersections probably represent the best opportunity to sample the deeper petroleum systems via soil-gas analysis and thereby determine the presence or absence of a working Gondwanan (and/or Larapintine) petroleum system in the region. Targets have been developed on this basis.

# 1. Introduction

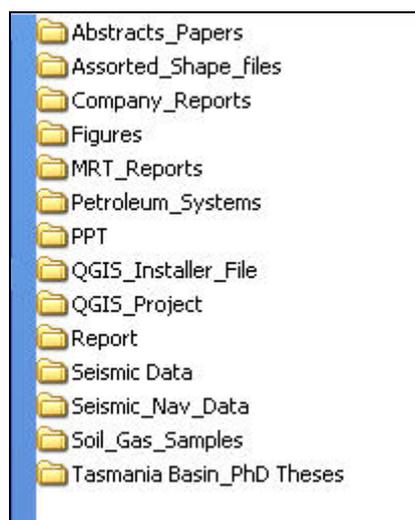
EL582009 is a broadly north-south trending exploration permit located near the coast, along the north-eastern margin of Tasmania. Very little is currently known about the petroleum geology or prospectivity of this region and so a geoscience programme was developed to:

- Undertake a high-level assessment of the likely first-order petroleum systems operative within the permit, and
- Develop an inventory of testable concepts and targets which could be investigated by a combination of field work and soil-gas sampling.

The study initially involved a literature of the available company and published material, including university theses, which focused upon understanding the petroleum systems within and around the exploration permit. This included the collation of the available seismic data from the adjacent East Tasmanian continental shelf and slope.

Subsequently, an investigation was carried out of the permit and surrounds using publicly available geological, potential field and elevation data. This phase of the study attempted to delineate the best areas within which a “snapshot” or sample of the deeper petroleum systems might be best obtained via field work and also soil-gas analysis.

These data were integrated in an open-source GIS software package, Quantum GIS. The directory structure of the report and data contained in a folder (*\\E&P\_Investments\_EL582008*) with the structure outlined below.



## **2. Literature Review**

### **2.1 Petroleum Systems Evaluation**

Several key pieces of literature were located of relevance to the petroleum systems in EL582008. These included a PhD thesis (Alan Chester), an Honours thesis (Paul Lane) and several company reports, including those by Dr Catherine Reid on the Gondwanan petroleum system (2002), Dr Larry Wakefield (1999) and a multi-author report (2002) on the petroleum systems modelling of onshore Tasmania (University of Tasmania). All of these reports are included in the folder: `\E&P_Investments_EL582008\Petroleum_Systems`. A thesis by Andrew Stacey on the regional geology of onshore Tasmania is also included and contains the most recent structural evaluation of the broader region.

### **2.2 Mesozoic-Tertiary Offshore System**

The original concept that E & P Investments Australia Pty Ltd wished to be tested was that hydrocarbons generated within the Mesozoic or Tertiary interval on the outer continental shelf or slope may have migrated into the coastal zone, within which EL582008 is located.

To test this possibility, the available seismic data were obtained, as were reports related to the seismic surveys. All of the seismic data (located in folder `\E&P_Investments_EL582008\Seismic Data\Seismic_Scans`) were old and were acquired in either 1969 (T69 survey data) or as part of the 1973 Shell Petrel survey. The data are of poor quality but suggest, as do the accompanying reports and the available literature, that the East Tasmanian margin contains minimal thickness of Mesozoic and Tertiary sediments.

Interpretative maps from the T69 survey indicate a maximum sediment thickness of approximately 500 msec (~500 m) between the seafloor and basement. Clearly, the East Tasmanian margin has been an area of sediment bypass for most of the Mesozoic and Tertiary. These minimal sediment thicknesses effectively negate the offshore area as a potential contributor to the onshore hydrocarbon inventory in and around EL582008.

### **2.3 Larapintine Petroleum System**

The Ordovician-Silurian Larapintine petroleum system (Figure 2-1) may potentially be present within EL582008. However, work by Chester (2006) strongly indicates that the Larapintine system will have reached very elevated temperatures over most of onshore Tasmania (Figure 2-2) in the Devonian. If correct, then the Larapintine system will be thermally overmature within EL582008 and will probably have expelled most of its hydrocarbon inventory during the Devonian. Preservation of this inventory will present a significant issue.

It is assumed, based upon this information, that the Larapintine petroleum system will not be prospective within EL582008. However, this needs to be confirmed, preferably by field sampling. Samples of any potential Ordovician and Silurian source rocks should be obtained for both geochemical and maturity analysis. Samples of Devonian rocks would also be helpful for maturation studies, as these would provide a minimum maturity for the deeper intervals. The potential thermal effects of the Jurassic dolerite intrusions need to be considered when sampling.

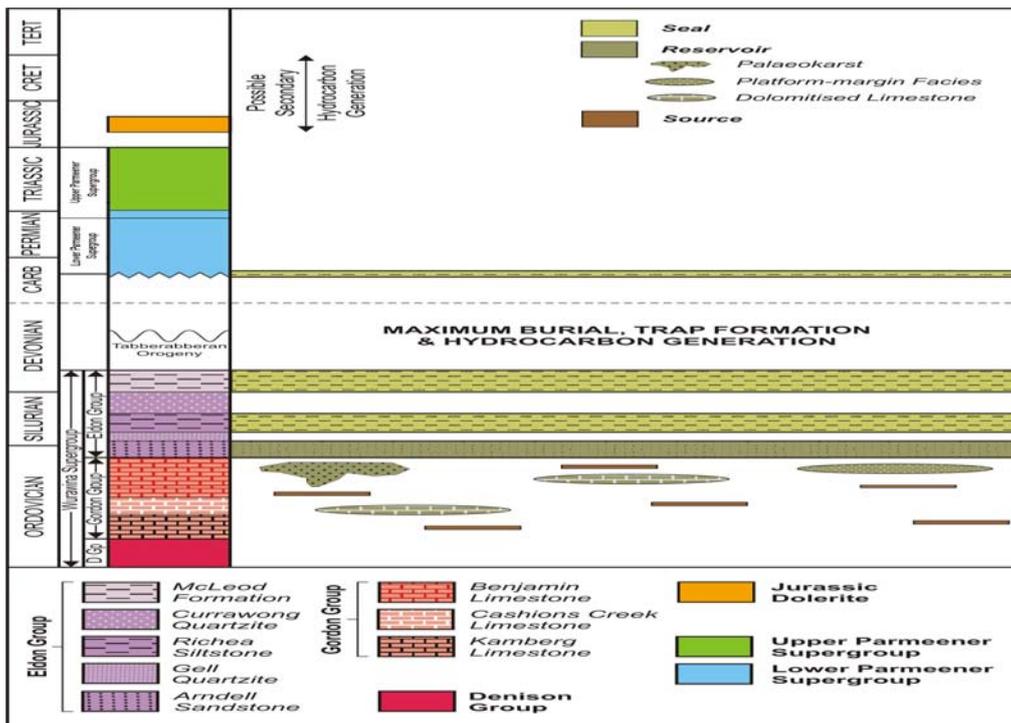


Figure 2-1. Larapintine petroleum system.

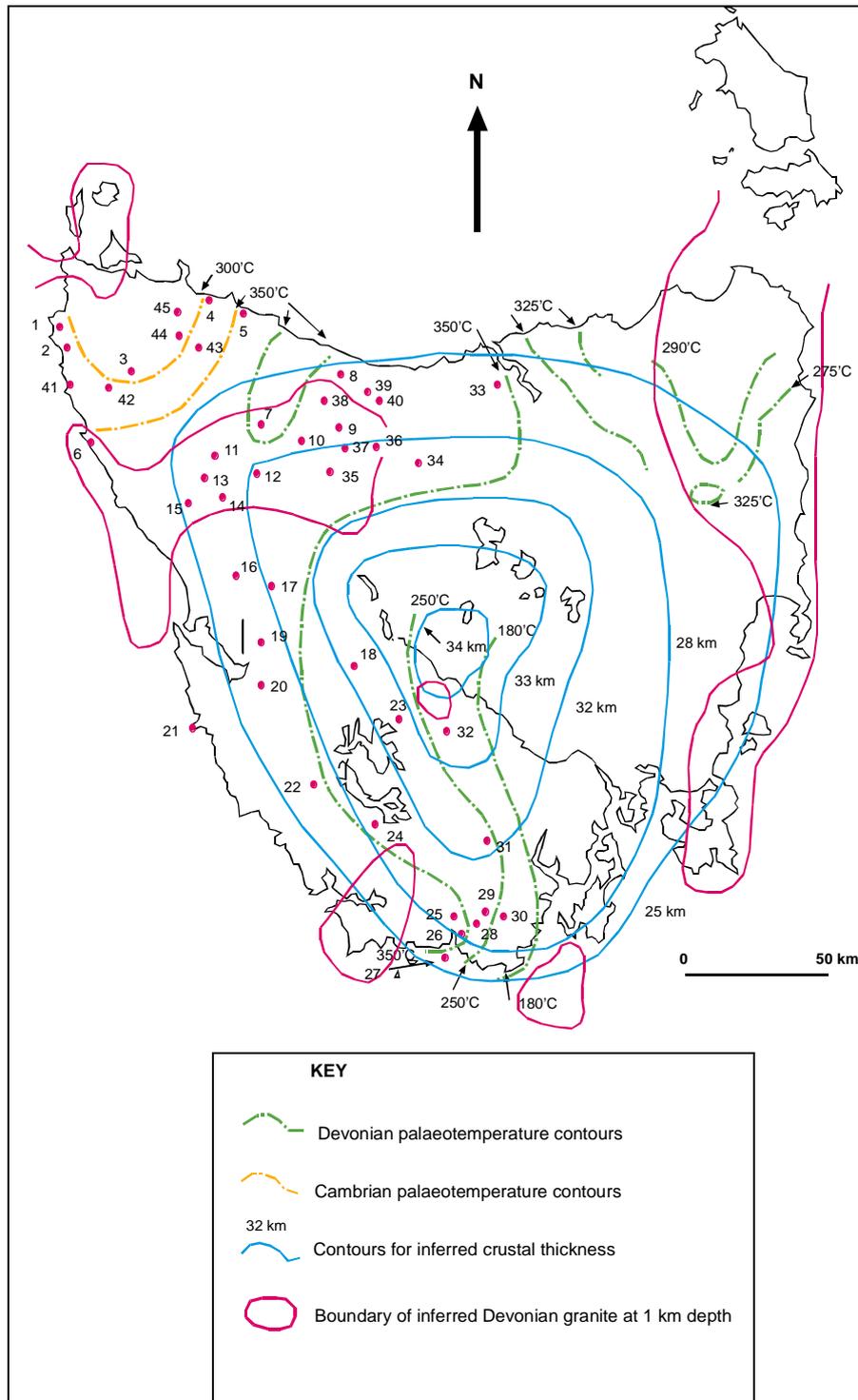


Figure 2-2. Reproduced from Chester (2006). Devonian/Carboniferous palaeotemperature contours for Tasmania plotted along with features that may have bearing on the palaeotemperature distribution. Palaeotemperature contours in northeastern Tasmania after Patison et al. (2001). Palaeotemperature data points are numbered and Table 4.6 indicates location name, inferred maximum palaeotemperature, method used to derive data and references. Inferred Devonian granite contours are from Leaman and Richardson (1992). Inferred crustal thickness contours after Leaman (1988b) with contributions from Vitesnik (1984) and Richardson (1980).

## 2.4 Gondwanan Petroleum System

The Gondwanan petroleum system (Figure 2-3) is probably the most prospective within EL582008.

The system is definitely present within the permit and maturity analysis by Chester (2006) indicates that the Permian will have reached maturities equivalent to vitrinite reflectances of between 0.5-0.7% (Figure 2-4). Whilst such maturities are marginal, they may be higher locally and will have certainly been significantly increased by thermal contact metamorphism associated with the intrusion of the Jurassic dolerites. Areas around the contact aureole – between the Permian (and other Gondwanan source rocks) and the Jurassic dolerites need to be investigated closely via the soil-gas programme.

Representative source rocks of the Gondwanan system within EL582008 need to be sampled and analysed for both source richness and maturity, both adjacent to the Jurassic dolerites and well away from them. In that way, an overall assessment of the richness and maturity of the Gondwanan system within EL582008 can be developed and any sweet-spots within the permit identified.

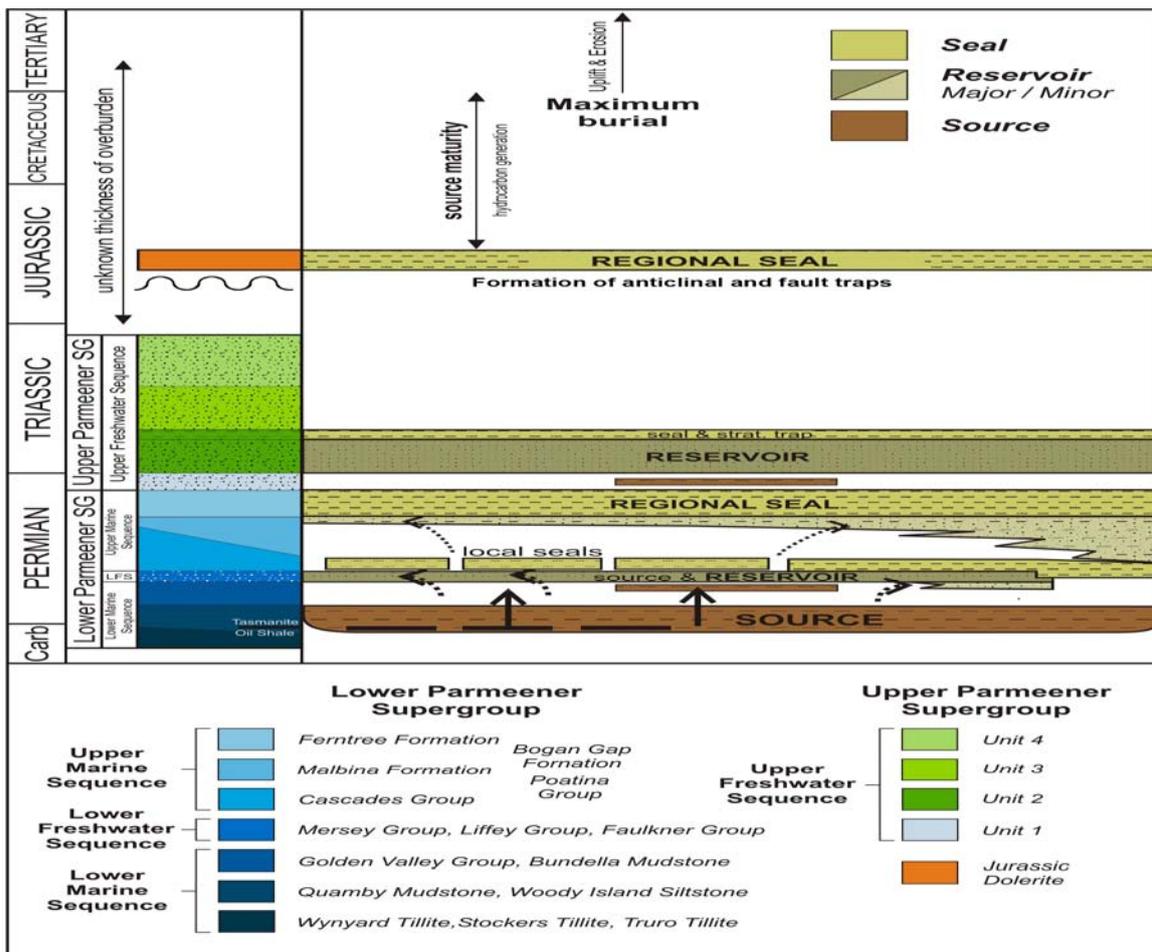


Figure 2-3. Gondwanan petroleum system.

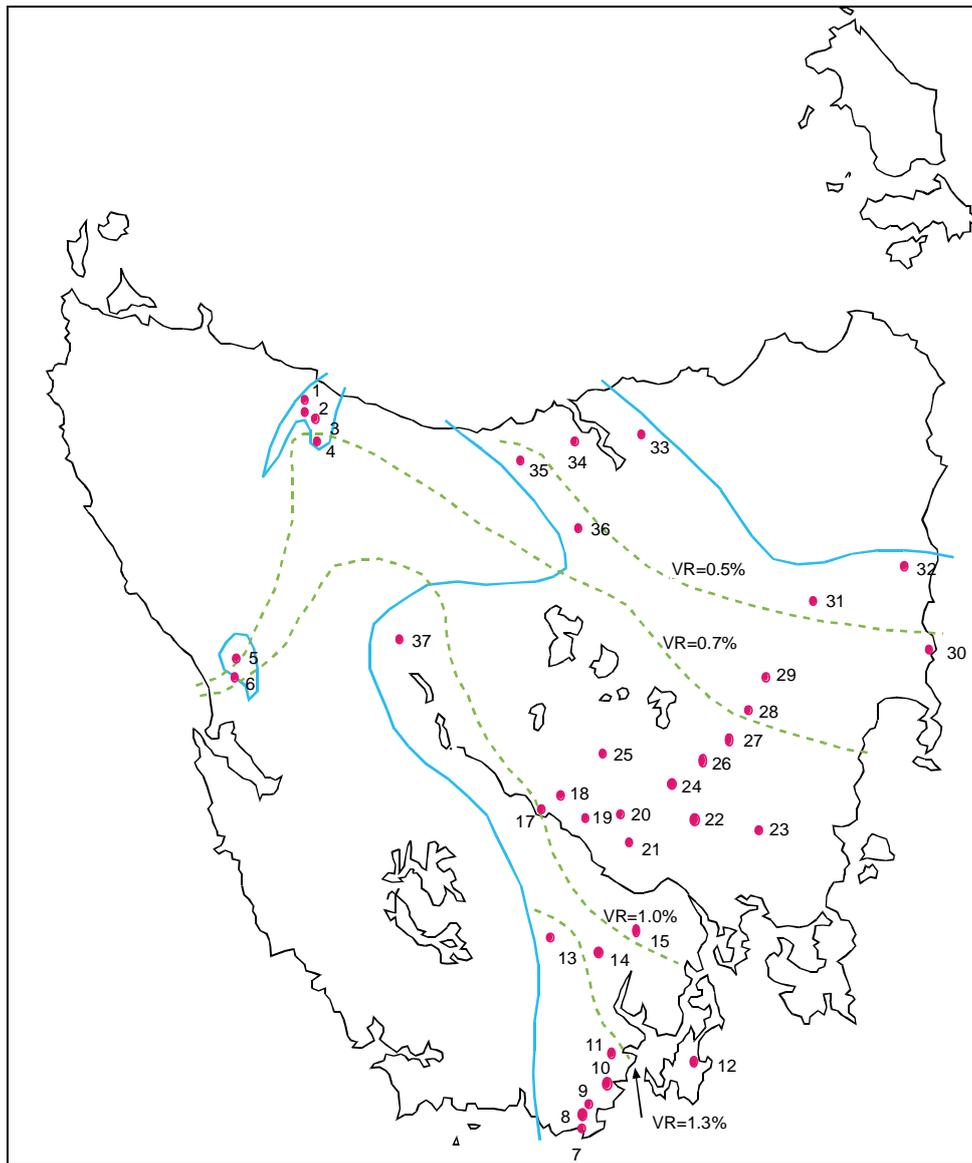


Figure 2-4. From Chester (2006). Maturity determined for Parmeener Supergroup sequences within the Tasmania Basin from vitrinite reflectance and calorific values of coal, vitrinite reflectance from potential source rocks and Rock-Eval pyrolysis of potential source rocks. Blue lines show the boundaries of the Tasmania Basin and note that there are outliers of this basin in the northwest and west of the state. Green dashed lines are vitrinite reflectance contours showing an increase in maturity from north to south. Contours have been selected to show approximate position for beginning of oil generation (VR = 0.5%), peak oil generation (VR = 0.7%), peak wet gas generation (VR = 1.0%) and end of oil generation (VR = 1.3%).

## 2.5 Petroleum Systems Summary

Based upon available data, it appears that the Gondwanan (probably principally Permian) petroleum system will have the highest potential within EL582008. Migration from the offshore is considered unlikely due to a lack of adequate sediment thickness and either a lack or discontinuous carrier beds. If present, the Larapintine petroleum system is probably thermally overmature within EL582008, although this needs to be confirmed.

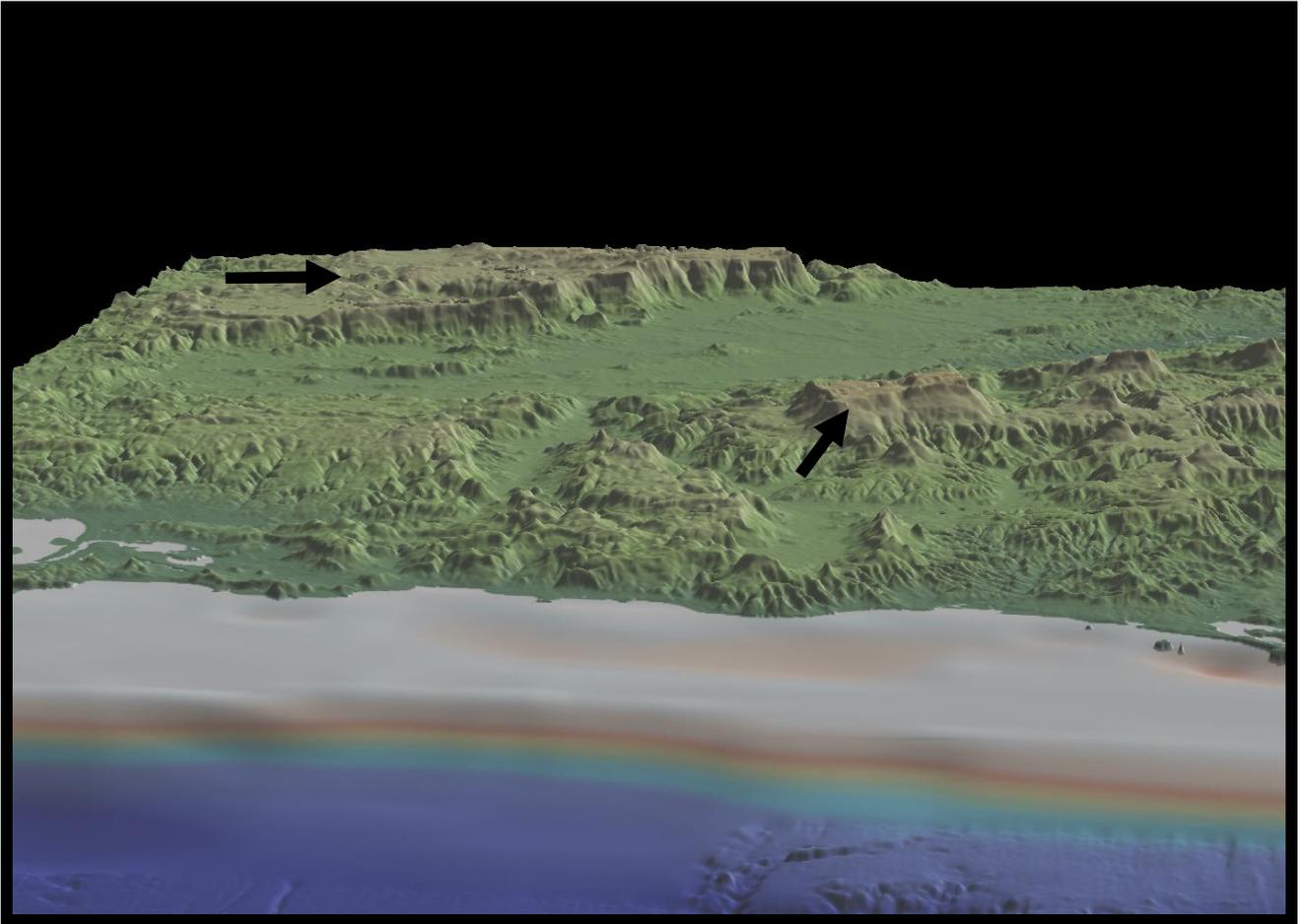
## **3. Geophysical Evaluation of EL582008**

### ***3.1 Geomorphology and Neo-tectonics***

The geomorphology and recent tectonic history of the EL582008 region and the Tamar Valley to the west is of considerable interest to this analysis. The topography of the region is dominated by the elevated ground immediately adjacent to the coast. Two significant U-shaped valleys cut the hills in this region and drain to the west into the Tamar Valley and then to the north into Bass Strait.

The geomorphology of these valleys appears to have been shaped by glaciers but the fact that their headwaters are within a kilometre or two of the east coast and yet they drain away from the coast is significant. This indicates that there has been tectonic tilting in the region and that the geomorphology of this drainage system evolved coevally with this activity.

Evidence for the tectonic tilting is also preserved in the form of a series of fault bound tilt blocks within, and along strike from EL582008. These blocks can be seen in the perspective images in Figures 3-1 and 3-2. The faults that bound these blocks are generally north or north-northwest trending and are likely to be reactivated Paleozoic basement faults and they are cut by a set of generally roughly E-W or NE-SW trending younger faults that can be identified both from the geophysics (see below) and from the DTM and appear to offset the older generation of faults.



*Figure 3-. Perspective view of the topography of the region looking to the west. The remnant plateaus described in the text are marked with arrows.*



The younger faults record 10's – 100's of meters of displacement and may represent a conjugate set or else a master/splay set. Importantly these faults: a) are important controls on topography development, b) crosscut Permian and younger rocks in the onshore and c) extend offshore providing potential migrations conduits and sampling localities.

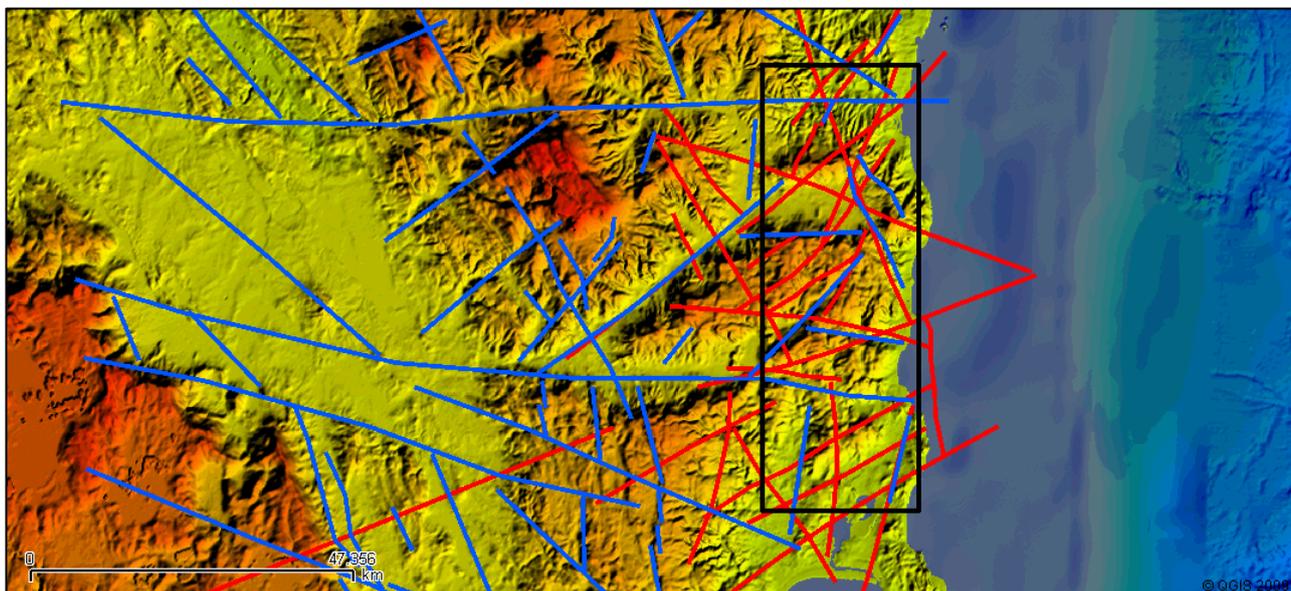


Figure 3-4. Interpreted faults in the region of EL582008 based on interpretation of the potential field geophysical data – red (see description below) and based on the geomorphology and remote sensing datasets – blue.

### 3.2 Geophysics

Magnetic and radiometric data used in the interpretation of a fault network over EL582008, and adjacent areas was sourced from Mineral Resources Tasmania's TASMAR website. A summary of the open file surveys used is given in Table 3-1. GeoScience Victoria's isostatically corrected gravity data was also used in the fault interpretation. All these data have been included as grid files with this report (GDA94 Zone55 projection).

Survey	Year	Line Spacing	Data Sampled
Northeast Tasmania (GA P1143)	2007	200m	Magnetics, radiometrics, elevation
1993Fingal	1993	200m	Magnetics, radiometrics, elevation
Tasmania Regional (BMR P502)	1985	1500m	Magnetics
Scamander Area	1979	300m	Magnetics

Table 3-1. Summary of airborne magnetic surveys used in potential field interpretation.

Gravity data proved particularly useful in the southern two-thirds of EL582008, where the magnetic response is dominated by the high frequency signature associated with Tasmanian Dolerite (Figures 3-5 and 3-6). A number of faults were interpreted from the gravity data alone. Large gravity lows in the south-eastern corner, and just to the north of EL582008 are most likely associated with intrusive bodies at depth (Figure 3-7).

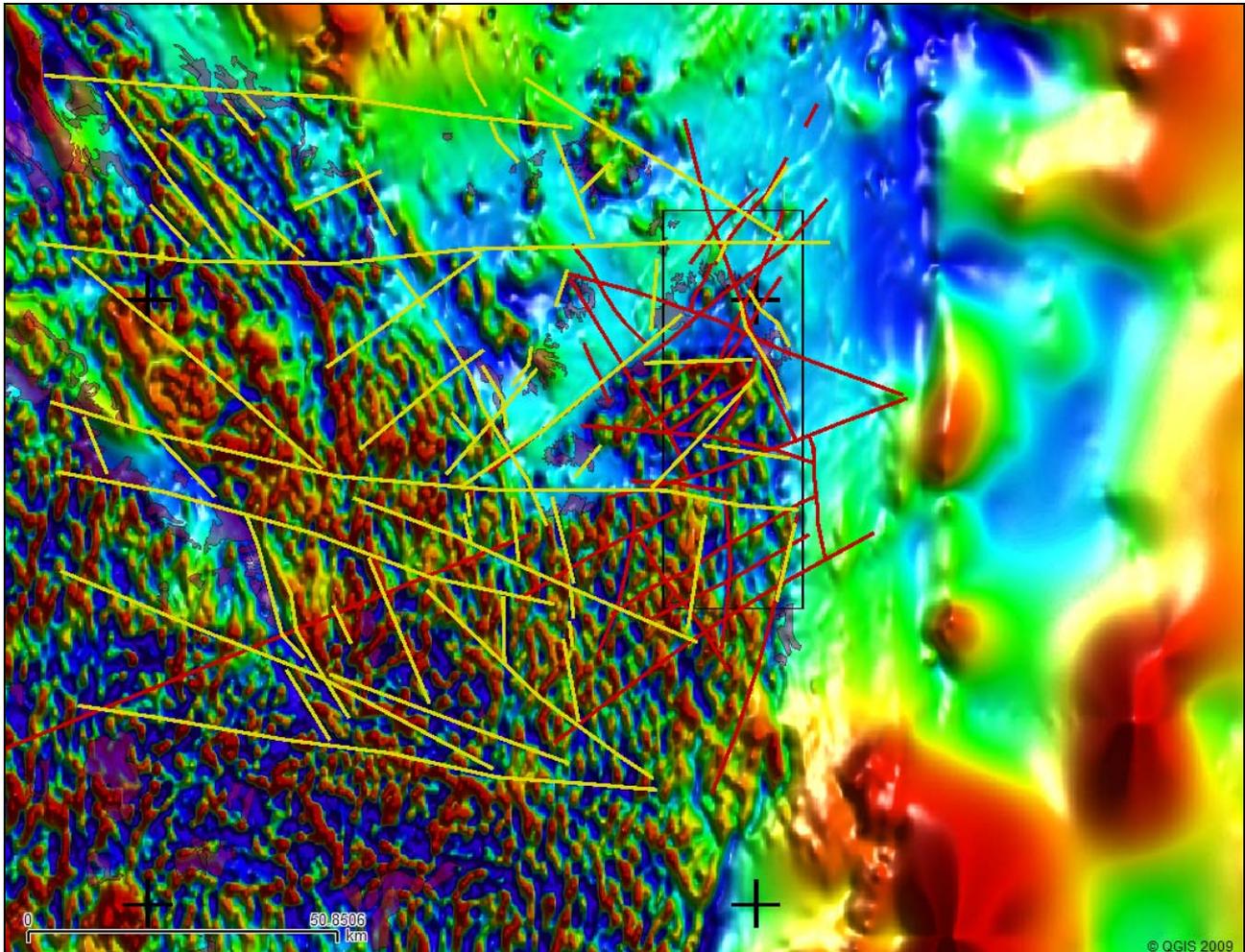


Figure 3-5. Regional TMI image in the region of EL582008. Interpreted faults based on interpretation of the potential field geophysical data – red and geomorphology and remote sensing datasets – yellow.

Magnetic data proved most useful in the northern third of EL582008, the area identified as of particular interest in this study. North to northwest trending magnetic dykes are apparent in the 1<sup>st</sup> vertical derivative of TMI, in places corresponding with interpreted fault traces. A magnetically complex region centered on approximately 394000/5400000 gda94z55 corresponds to a region of outcropping, and presumably sub-cropping Tasmanian Dolerite, overlain by Permian and colluvium sediments.

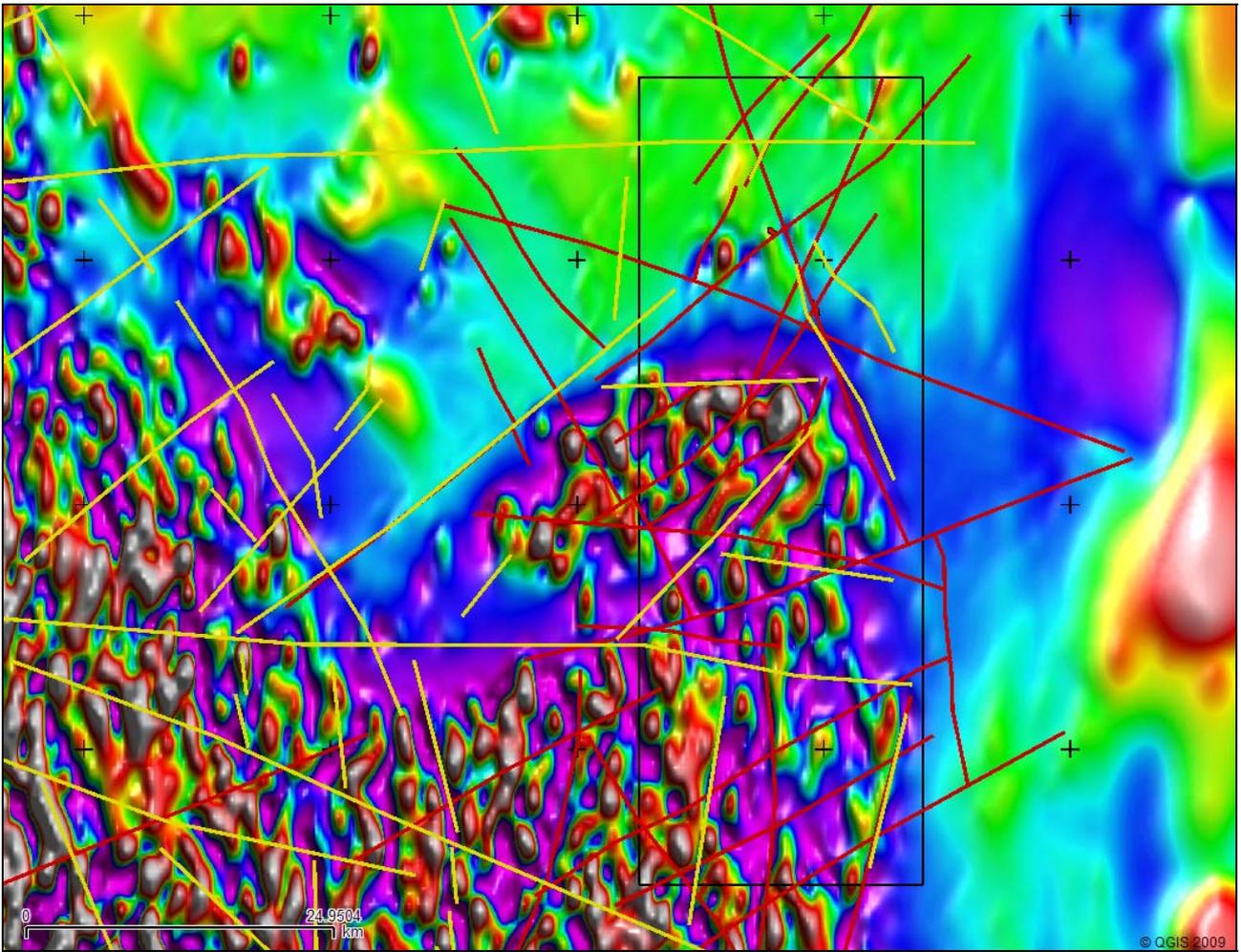


Figure 3-6. TMI (reduced to pole) image in the region of EL582008. Interpreted faults based on interpretation of the potential field geophysical data – red and geomorphology and remote sensing datasets – yellow.

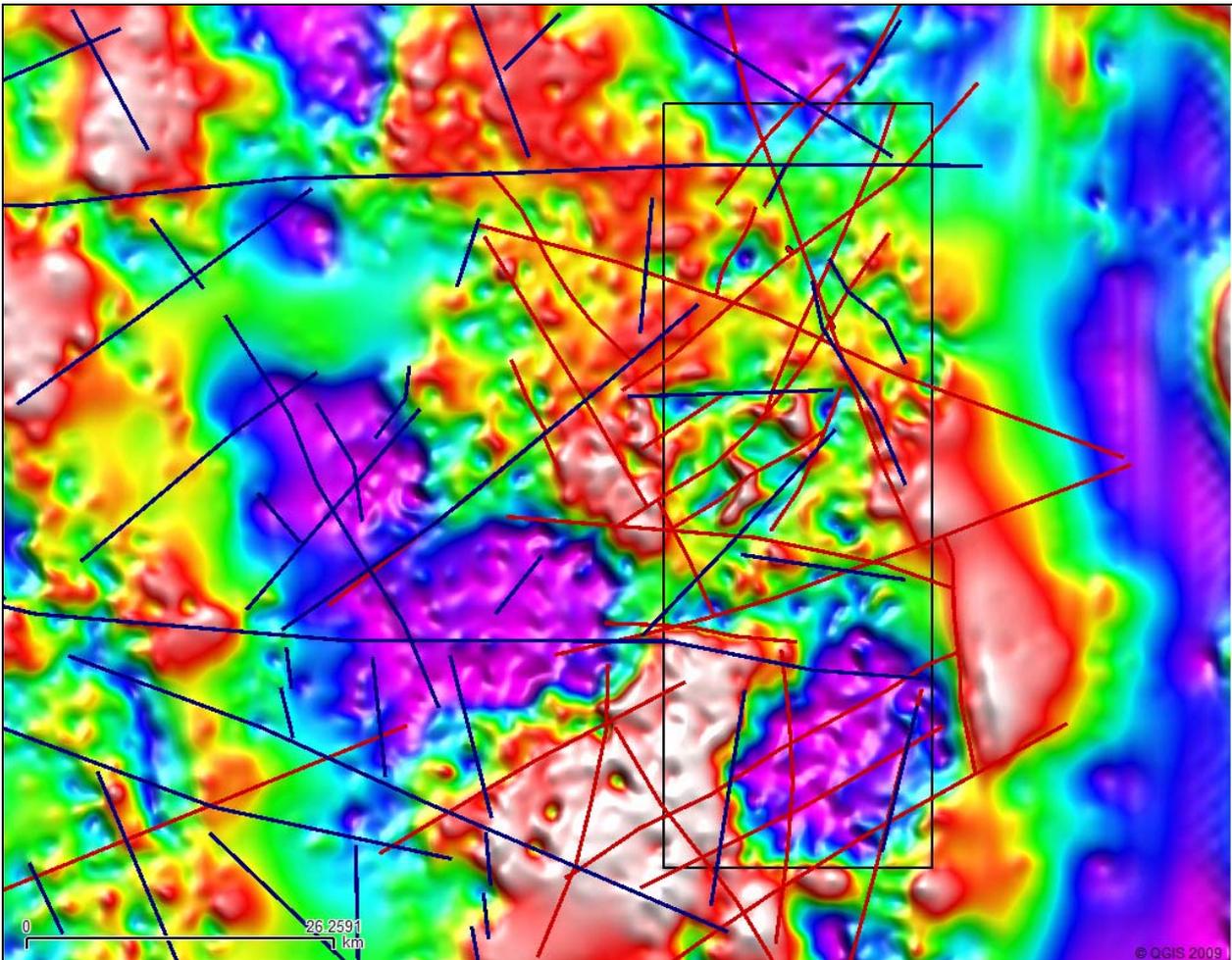


Figure 3-7. Isostatic gravity image in the region of EL582008. Interpreted faults based on interpretation of the potential field geophysical data – red and geomorphology and remote sensing datasets – blue.

Two dominant faults trends are identified in the potential field data:

1. a north to north-northwest trend, and
2. an east-northeast trend. Some of the northeast structures appear to crosscut and displace the north-northwest structures, indicating the latter are probably older structures.

A minor west-northwest structural trend is also apparent in the data.

Where available radiometric data was also investigated, and any anomalous areas were identified, particularly in the vicinity of faults. Particular attention was give to uranium channel, as this signature may potentially be associated with the presence of hydrocarbons.

### 3.3 Target Delineation

Two small targets have been defined and these are represented on the “target” layer in the accompanying GIS dataset as well as in yellow in the image below (Figure 3-8). These provide an example of how the potential sampling targets (for soil-gas) were developed.

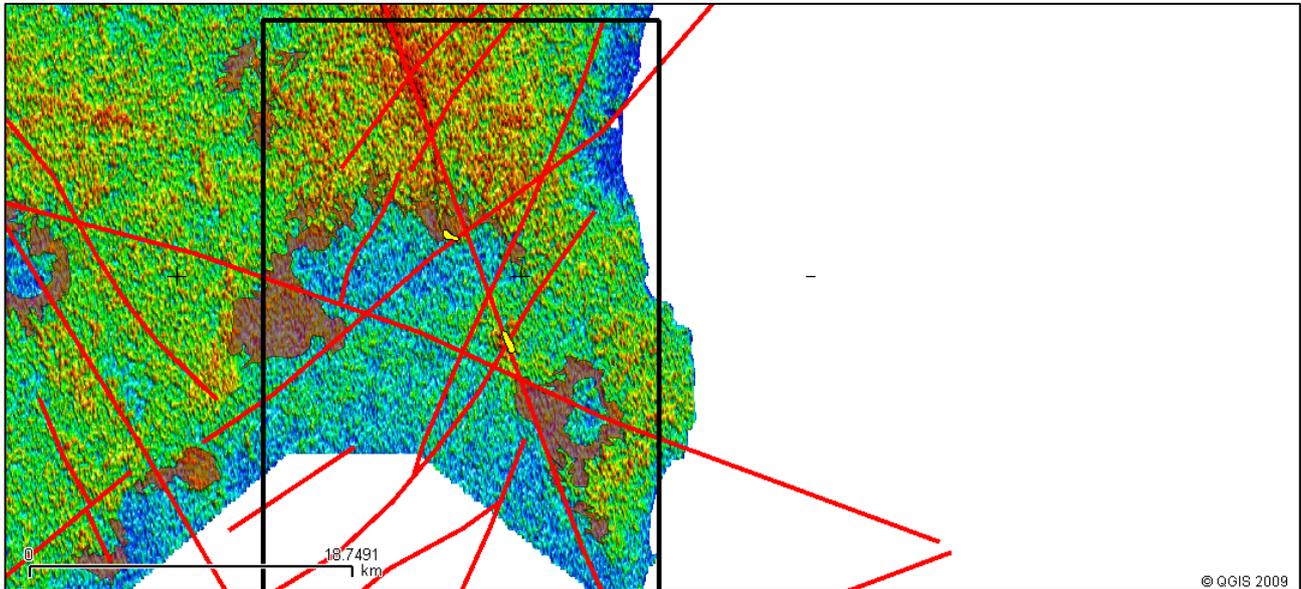


Figure 3-8. Potential targets for soil-gas sampling.

A complete recommended sampling programme was developed from the observations presented in this report. These are shown in Figure 3-9 and on Table 3-2. These targets have principally been defined based on the coincidence of:

- significant fault systems that span the onshore and offshore geology,
- fault intersections creating dilatancy and damage zones enhancing fluid migration,
- Permian rocks outcropping in the vicinity, and
- enhanced U response on the radiometrics imagery potentially indicative of hydrocarbon seepage and associated alteration (Figure 3-10). In some areas, hydrocarbon migration pathways are anomalously-rich in uranium due to a combination of fluid flow and redox effects. Uranium, migrating in the oxidized hexavalent oxidation state, forms uranyl carbonate complexes which are highly mobile. Upon meeting a reductant, such as an organically-rich source rock or migrating hydrocarbons or bitumen (associated with a hydrocarbon seep), the hexavalent uranium is reduced to the tetravalent oxidation state and precipitates from solution. Over time, significant uranium (and its daughter products) can become concentrated in and around migration pathways, source rocks and seeps. An example of such a process was recently published in the onshore Gippsland Basin by O'Brien et al. (2008).

In addition, a suite of possible targets was developed which included some or all of the

following characteristics:

- Located within low-U responsive Permian section (outcrop),
- Located around the edge of the (interpreted) thermal contact aureole between the Jurassic dolerites and the Permian (and other sequences),
- Along the coast (to catch any hydrocarbon inventory migrating from offshore (even though this is considered unlikely), and
- General dip and strike transects across major structures (to provide both anomalous and background gas readings).

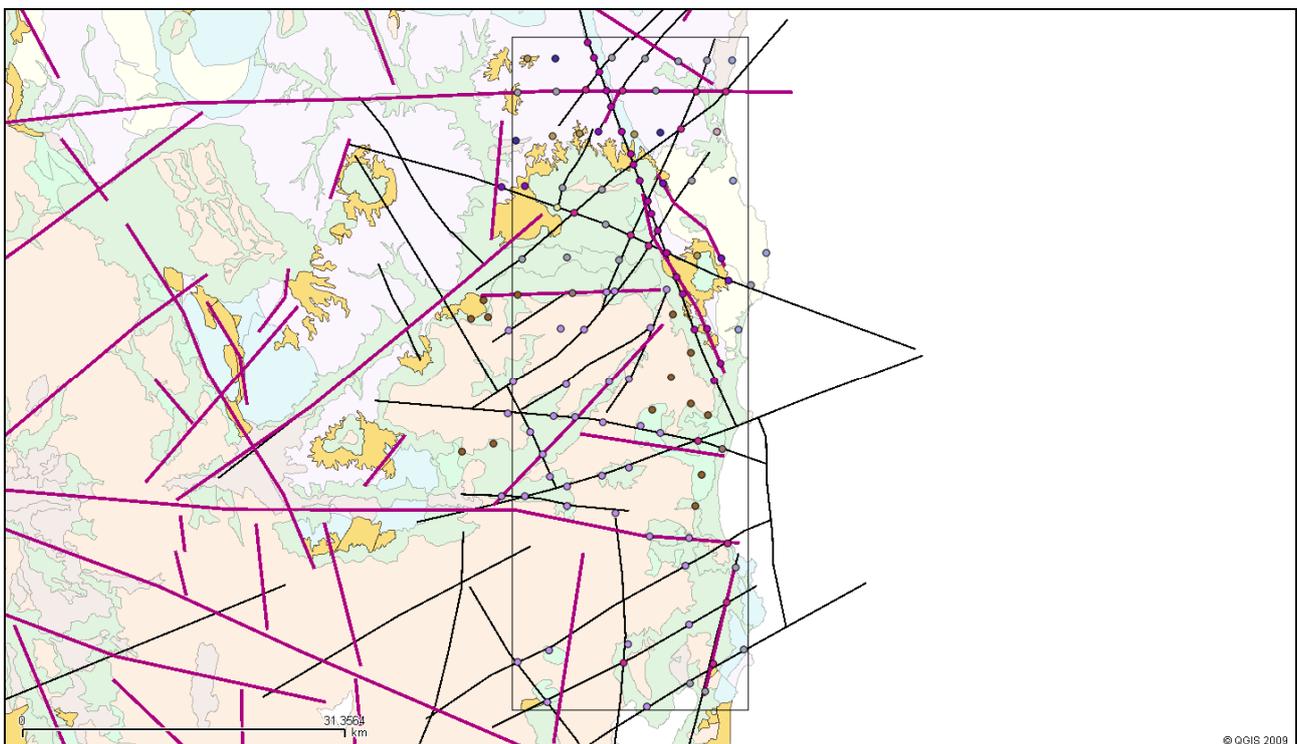


Figure 3-9. Potential soil-gas sample locations.

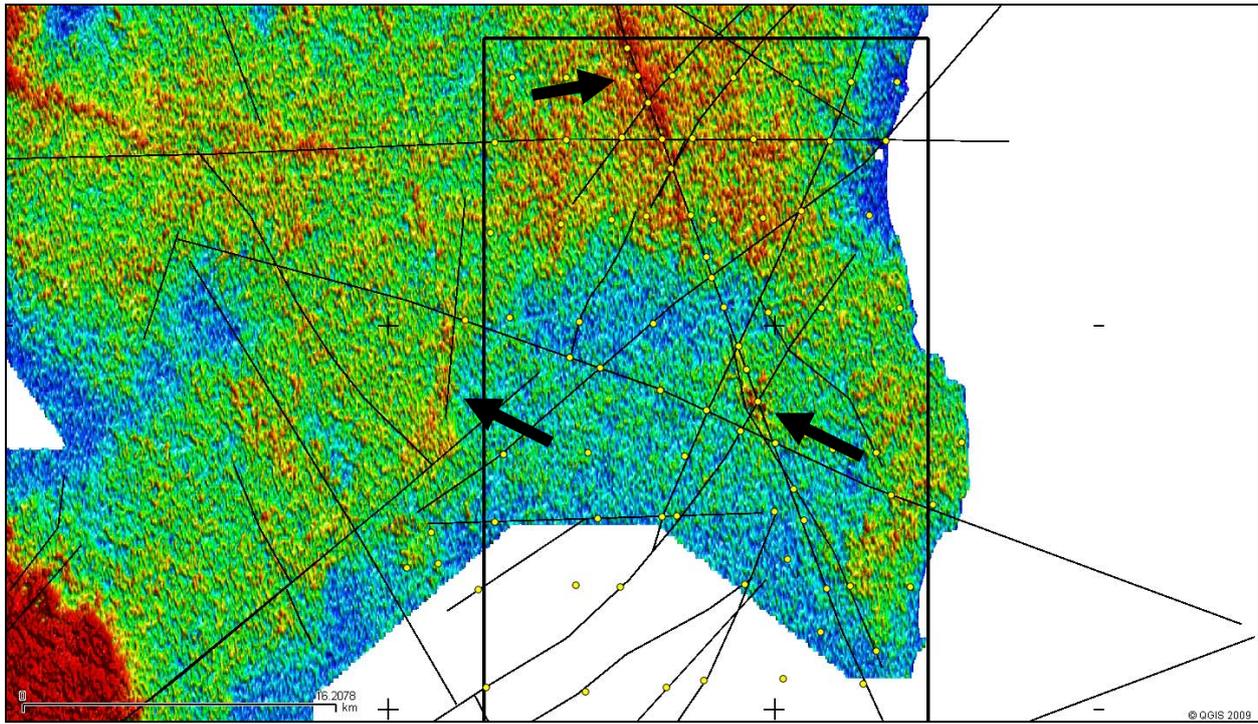


Figure 3-10. Radiometrics (uranium channel) with locations of some potential soil-gas samples indicated. Arrows denote locations of radiometrically anomalous (uranium channel) faults.

#### 4. Conclusions and Recommended Future Work

EL582008, located on the eastern margin of Tasmania, has been evaluated to develop a potential soil-gas sampling programme to test the region’s petroleum prospectivity. Petroleum systems data suggest that the Gondwanan system is likely to be the most prospective in the region. Key exploration uncertainties associated with the Gondwanan system are its thermal maturity, as available data indicate that it is only at a maximum vitrinite reflectance of approximately 0.7% over much of the permit. Areas where the Gondwanan source rocks have been thermally affected by the emplacement of Jurassic dolerites may represent potential sweet-spots which require additional evaluation. The older Larapintine system, if present, is probably thermally overmature over most of the area whereas the Mesozoic and Tertiary interval offshore is too thin to have generated hydrocarbons.

On the basis of these observations, a work programme has been developed which focuses principally on evaluating the Gondwanan petroleum system within EL582008 using soil-gas analysis. The geophysical and elevation data been used to determine the principal structural grain in the permit and in turn this grain, in combination with the petroleum systems assessment, has been used to develop a potential soil-gas programme.

Key recommended future technical approaches include the following.

- Undertake a comprehensive sampling programme of the source potential and thermal maturity of the Larapintine and Gondwanan petroleum source rocks within EL582008. Additional analysis of any Devonian intervals would also be useful. Such a programme would allow the soil-gas data to be better interpreted and would provide the data necessary to assess source rock richness and thermal history across the permit.
- Take near-surface soil samples to refine the radiometric response of the radiometric data.
- Integrate the obtained soil-gas data with the available structural data and also any new petroleum systems information.
- Satellite-based remote sensing evaluation of the permit to test leakage and seepage models derived from soil-gas work.
- Given that the Gondwanan source Permian rocks within EL582008 would appear to provide the most likely targets and that the extent in outcrop is limited it is critical that the geometry and extent of these rocks is better understood in three dimensions. There are a number of potential approaches to address this. Obviously drilling and/or seismic acquisition would provide valuable constraints but both are too costly and time consuming at this stage. A better approach would be to spend a short time compiling all available mapping for the region and then following this with a short, targeted structural mapping campaign. The results would be integrated into a 3D model with all available geophysical datasets to provide a constrained geological and structural framework on which to base further sampling and exploration decisions.

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Table 3-2. Locations of potential soil-gas sample sites, with the rationale for locations.

<b>X</b>	<b>Y</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>Justification</b>
592409.46	5414470.396	41° 24' 57.6324" S	148° 06' 20.7272" E	hot fault (radiometrics)
593495.463	5411630.081	41° 26' 29.2661" S	148° 07' 9.0818" E	hot fault (radiometrics)
594205.542	5409750.461	41° 27' 29.9062" S	148° 07' 40.7318" E	hot fault (radiometrics)
594665.004	5408204.996	41° 28' 19.8165" S	148° 08' 1.4060" E	hot fault (radiometrics)
595709.238	5405782.374	41° 29' 37.9128" S	148° 08' 47.8032" E	hot fault (radiometrics)
596544.625	5403610.369	41° 30' 47.9689" S	148° 09' 25.0786" E	hot fault (radiometrics)
596795.241	5402524.366	41° 31' 23.0683" S	148° 09' 36.5172" E	hot fault (radiometrics)
597421.781	5400978.9	41° 32' 12.8986" S	148° 10' 4.4469" E	hot fault (radiometrics)
598215.398	5398973.972	41° 33' 17.5486" S	148° 10' 39.8698" E	hot fault (radiometrics)
598591.322	5397720.892	41° 33' 58.0064" S	148° 10' 56.8353" E	hot fault (radiometrics)
599176.093	5396050.118	41° 34' 51.9115" S	148° 11' 23.0725" E	hot fault (radiometrics)
600095.018	5393919.882	41° 36' 0.5595" S	148° 12' 4.0295" E	hot fault (radiometrics)
601055.713	5391497.261	41° 37' 18.6627" S	148° 12' 46.9932" E	hot fault (radiometrics)
601598.714	5389868.257	41° 38' 11.2247" S	148° 13' 11.4487" E	hot fault (radiometrics)
586478.214	5412966.7	41° 25' 48.7617" S	148° 02' 6.0421" E	Permian
589234.991	5412966.7	41° 25' 47.6762" S	148° 04' 4.8024" E	Infill sample
592952.462	5413050.239	41° 25' 43.4500" S	148° 06' 44.8997" E	hot fault (radiometrics)
594748.543	5413050.239	41° 25' 42.6946" S	148° 08' 2.2703" E	fault
597923.013	5412966.7	41° 25' 44.0324" S	148° 10' 19.0650" E	fault
601181.021	5412674.315	41° 25' 52.0580" S	148° 12' 39.5846" E	fault
604021.336	5412716.084	41° 25' 49.3977" S	148° 14' 41.9120" E	fault
606402.188	5412716.084	41° 25' 48.2750" S	148° 16' 24.4704" E	Coastal
585559.289	5409583.384	41° 27' 38.8097" S	148° 01' 28.1802" E	fault
589276.76	5409708.692	41° 27' 33.2890" S	148° 04' 8.3352" E	fault
592158.844	5409834	41° 27' 28.0534" S	148° 06' 12.4788" E	fault intersection
595792.777	5409792.23	41° 27' 27.8755" S	148° 08' 49.1126" E	fault intersection
598967.246	5409750.461	41° 27' 27.8429" S	148° 11' 5.9440" E	fault
602935.333	5409666.922	41° 27' 28.7541" S	148° 13' 57.0008" E	fault intersection
605817.418	5409666.922	41° 27' 27.4045" S	148° 16' 1.2035" E	fault intersection
585350.442	5404863.449	41° 30' 11.9184" S	148° 01' 21.5843" E	Infill sample
588984.375	5405322.911	41° 29' 55.5987" S	148° 03' 58.0637" E	Permian
591615.843	5405573.527	41° 29' 46.4060" S	148° 05' 51.4070" E	Permian
593411.924	5405740.605	41° 29' 40.2428" S	148° 07' 8.7650" E	Permian / fault
596878.779	5405531.758	41° 29' 45.5320" S	148° 09' 38.3790" E	Permian
599468.478	5405657.066	41° 29' 40.3274" S	148° 11' 29.9753" E	Infill sample
601431.637	5405991.221	41° 29' 28.6084" S	148° 12' 54.4237" E	fault intersection
604982.031	5405782.374	41° 29' 33.7333" S	148° 15' 27.6371" E	Coastal / fault
584003.381	5400321.033	41° 32' 39.7037" S	148° 00' 25.7708" E	Permian / fault
586300.695	5400446.341	41° 32' 34.7608" S	148° 02' 4.8478" E	Permian / fault
589934.627	5400237.495	41° 32' 40.0909" S	148° 04' 41.7793" E	fault
593777.406	5400112.187	41° 32' 42.5651" S	148° 07' 27.6825" E	fault
599750.421	5400738.727	41° 32' 19.6522" S	148° 11' 45.0671" E	Permian / fault

602507.198	5400947.573	41° 32' 11.6273" S	148° 13' 43.8909" E	fault
606558.823	5400947.573	41° 32' 9.7221" S	148° 16' 38.7055" E	Coastal
586008.309	5393303.785	41° 36' 26.4440" S	148° 01' 55.9153" E	fault
590394.09	5393429.093	41° 36' 20.6369" S	148° 05' 5.2993" E	fault
595406.41	5393220.246	41° 36' 25.3079" S	148° 08' 41.9260" E	fault
596534.182	5395601.098	41° 35' 7.6334" S	148° 09' 29.2603" E	fault intersection
598288.495	5394556.865	41° 35' 40.7168" S	148° 10' 45.6290" E	fault intersection
603050.199	5393596.17	41° 36' 9.7005" S	148° 14' 11.8632" E	Permian
605347.513	5393387.323	41° 36' 15.3917" S	148° 15' 51.2185" E	Permian / fault
609775.062	5393930.325	41° 35' 55.6414" S	148° 19' 2.0916" E	Coastal
585548.847	5389795.16	41° 38' 20.3746" S	148° 01' 37.8728" E	Dolerite margin
594236.869	5390045.776	41° 38' 8.7237" S	148° 07' 53.2056" E	Dolerite margin / fault
594988.717	5390129.315	41° 38' 5.6943" S	148° 08' 25.6489" E	Dolerite margin / fault
600042.807	5390338.162	41° 37' 56.6990" S	148° 12' 3.9285" E	Dolerite margin / fault
606099.361	5391215.318	41° 37' 25.4457" S	148° 16' 25.0772" E	Permian / fault
608271.366	5390714.086	41° 37' 40.6440" S	148° 17' 59.2437" E	fault
589433.395	5398357.874	41° 33' 41.2321" S	148° 04' 21.1559" E	fault intersection / Permian
591020.63	5397814.873	41° 33' 58.1917" S	148° 05' 29.9669" E	fault intersection
594153.33	5396645.332	41° 34' 34.8022" S	148° 07' 45.8621" E	fault
584694.011	5386281.8	41° 40' 14.6092" S	148° 01' 2.7202" E	Dolerite margin / fault
589737.571	5386503.495	41° 40' 5.4337" S	148° 04' 40.6805" E	Dolerite margin / fault
592065.367	5386392.647	41° 40' 8.0710" S	148° 06' 21.3892" E	Dolerite margin / fault
598494.52	5386558.918	41° 39' 59.9123" S	148° 10' 59.2655" E	Dolerite margin / fault
602762.147	5386337.223	41° 40' 5.1586" S	148° 14' 3.9104" E	hot fault (radiometrics)
603981.469	5386448.071	41° 40' 0.9955" S	148° 14' 56.5580" E	hot fault (radiometrics)
607085.198	5386392.647	41° 40' 1.3120" S	148° 17' 10.7789" E	Coastal
585081.977	5381182.817	41° 42' 59.7722" S	148° 01' 22.1140" E	Dolerite margin / fault
590236.384	5380961.122	41° 43' 4.9141" S	148° 05' 5.2660" E	Dolerite margin / fault
594448.587	5381182.817	41° 42' 55.9660" S	148° 08' 7.4023" E	Dolerite margin / fault
596388.418	5381515.359	41° 42' 44.3474" S	148° 09' 31.1413" E	Dolerite margin / fault
604646.554	5381349.088	41° 42' 45.9805" S	148° 15' 28.5317" E	hot fault (radiometrics)
600489.774	5381626.206	41° 42' 38.9266" S	148° 12' 28.5201" E	Dolerite margin
584583.164	5378079.088	41° 44' 40.5880" S	148° 01' 2.1173" E	Dolerite margin / fault
589072.486	5377801.969	41° 44' 47.8057" S	148° 04' 16.6047" E	Dolerite margin / fault
591178.587	5377691.122	41° 44' 50.5392" S	148° 05' 47.8386" E	Dolerite margin / fault
593838.926	5377247.732	41° 45' 3.7982" S	148° 07' 43.2562" E	Dolerite margin / fault
599436.723	5376194.681	41° 45' 35.4845" S	148° 11' 46.2271" E	Dolerite margin / fault
580980.621	5387390.274	41° 39' 40.0614" S	147° 58' 21.6108" E	Dolerite margin
582643.333	5387611.969	41° 39' 32.2592" S	147° 59' 33.3860" E	Dolerite margin
582255.367	5389274.681	41° 38' 38.4967" S	147° 59' 15.7897" E	Dolerite margin
590901.469	5389995.189	41° 38' 11.7576" S	148° 05' 29.0927" E	
600711.469	5387833.664	41° 39' 17.5888" S	148° 12' 34.3407" E	Dolerite margin
602429.604	5384064.851	41° 41' 18.9793" S	148° 13' 50.9365" E	Dolerite margin
604036.892	5377912.817	41° 44' 37.6648" S	148° 15' 4.3163" E	Dolerite margin
602374.181	5379021.291	41° 44' 2.5078" S	148° 13' 51.6583" E	Dolerite margin

598660.791	5378467.054	41° 44' 22.1661" S	148° 11' 11.2745" E	Dolerite margin
597496.893	5376859.766	41° 45' 14.7894" S	148° 10' 21.8449" E	Dolerite margin / fault
580149.265	5374310.274	41° 46' 44.4306" S	147° 57' 52.0033" E	Dolerite margin
583197.571	5375086.206	41° 46' 18.1451" S	148° 00' 3.6432" E	Dolerite margin
586800.113	5376250.105	41° 45' 39.0228" S	148° 02' 39.0483" E	Dolerite margin / fault
588019.435	5374033.156	41° 46' 50.4125" S	148° 03' 33.0270" E	Dolerite margin / fault
588739.943	5371871.63	41° 48' 0.1992" S	148° 04' 5.3977" E	Dolerite margin / fault
590402.655	5370929.427	41° 48' 30.0686" S	148° 05' 17.9531" E	Dolerite margin / fault
593783.503	5371927.054	41° 47' 56.3127" S	148° 07' 43.8806" E	Dolerite margin / fault
596388.418	5372758.41	41° 47' 28.2369" S	148° 09' 36.2502" E	Dolerite margin / fault
586301.299	5369987.223	41° 49' 2.2602" S	148° 02' 20.7273" E	Dolerite margin / fault
584028.926	5369987.223	41° 49' 3.1394" S	148° 00' 42.2464" E	Dolerite margin / fault
590402.655	5368989.596	41° 49' 32.9563" S	148° 05' 19.0181" E	Dolerite margin / fault
602872.994	5368989.596	41° 49' 27.4801" S	148° 14' 19.5015" E	Dolerite margin
605477.909	5374587.393	41° 46' 24.7824" S	148° 16' 8.8148" E	
603150.113	5375363.325	41° 46' 0.7299" S	148° 14' 27.5236" E	fault intersection
602263.333	5365830.444	41° 51' 10.1758" S	148° 13' 55.0428" E	Dolerite margin / fault
603482.655	5372037.901	41° 47' 48.3762" S	148° 14' 44.0090" E	Dolerite margin
598383.672	5366052.139	41° 51' 4.7593" S	148° 11' 6.6892" E	Dolerite margin / fault
601930.791	5363114.681	41° 52' 38.3680" S	148° 13' 42.3092" E	Dolerite margin / fault
605976.723	5365331.63	41° 51' 24.5872" S	148° 16' 36.3720" E	fault intersection
605921.299	5359567.562	41° 54' 31.4654" S	148° 16' 37.6887" E	fault intersection
604591.13	5353526.376	41° 57' 47.9375" S	148° 15' 43.8244" E	fault intersection
603815.198	5350810.613	41° 59' 16.3418" S	148° 15' 11.8488" E	fault
602318.757	5351641.969	41° 58' 50.0970" S	148° 14' 6.3066" E	fault
598161.977	5349314.173	42° 00' 7.4612" S	148° 11' 7.1100" E	Dolerite margin / fault
595834.181	5353637.224	41° 57' 48.3511" S	148° 09' 23.4035" E	fault intersection
596277.57	5355466.207	41° 56' 48.8655" S	148° 09' 41.5854" E	Dolerite margin / fault
606752.655	5362948.41	41° 52' 41.4675" S	148° 17' 11.5662" E	fault
588462.825	5349757.563	41° 59' 57.2254" S	148° 04' 5.3213" E	Dolerite margin / fault
588573.672	5354856.546	41° 57' 11.8793" S	148° 04' 7.3739" E	Dolerite margin / fault
585525.367	5353692.647	41° 57' 50.8229" S	148° 01' 55.5947" E	Dolerite margin / fault
595058.248	5368269.088	41° 49' 54.3523" S	148° 08' 41.2195" E	Dolerite margin / fault
607528.587	5354911.969	41° 57' 1.5997" S	148° 17' 50.4960" E	fault
602207.909	5357350.613	41° 55' 45.0932" S	148° 13' 57.9227" E	Dolerite margin / fault
605311.638	5383067.223	41° 41' 49.9664" S	148° 15' 56.2137" E	hot fault (radiometrics)

## APPENDIX B

# Structural geology assessment of the Bisheno – St Mary's region of eastern Tasmania

Tim Rawling – Raw Dimensions

## *Background and scope*

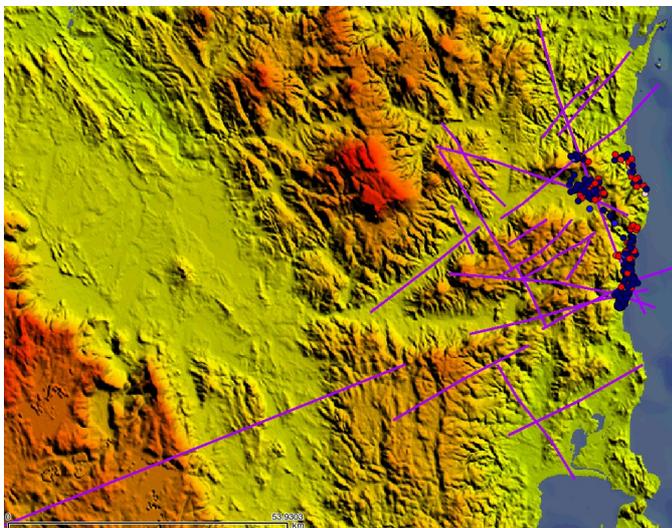
This study was designed to assess the results of the recent sorber study conducted by Gore in the Bisheno region of eastern Tasmania in the context of the structural controls on hydrocarbon migration. In a previous study a number of faults and related structures were identified as a result of analysis of available magnetics, gravity, radiometrics and topographic datasets. Many of these faults were shown to be related to (or reactivated during) Tertiary or younger tilting. This tilting may have effected hydrocarbon migration pathways. A number of anomalies were identified from the radiometric datasets (in particular the U total count) that appeared to be related to these fault sets and in particular a couple of fault intersections. It was suggested that these anomalies could be related to alteration induced by hydrocarbon leakage along or up some of these fault structures. As a result a number of sampling targets were identified for the Gore sampling study.

Whilst the results of the Gore study did not conclusively find evidence for hydrocarbon leakage coincident with the U alteration sites, a number of interesting localities were identified.

This study attempts to: 1) reassess the relationship between Gore sampling localities that showed high potential for hydrocarbon leakage with the available structural data, 2) consider the potential for structural plays in the region, 3) highlight uncertainties and 4) suggest a further work program in the context of additional sampling and data acquisition processing.

## *Structural overview*

Figure 1 is a regional topography map that plots the Gore data with the interpreted faults from the previous study. The sample localities are plotted as points (rather than as a grid) and are coloured by hydrocarbon potential (Blue=low, white=intermediate, red=high) to highlight the distribution of the sampling and the relationships between some of the high hydrocarbon probability anomalies and the fault structures.



Initial analysis of the gore results with the interpreted faults from the previous study highlights a number of relationships between the surface expressions of the fault structures and the hydrocarbon potential values. Whilst there is potential for contamination in the northern sampling region due to the fact many of the sample site were located within the town of St Mary's there remain some clear relationships between structural elements and the high probability values (see Figure 2 below).

Figure 1

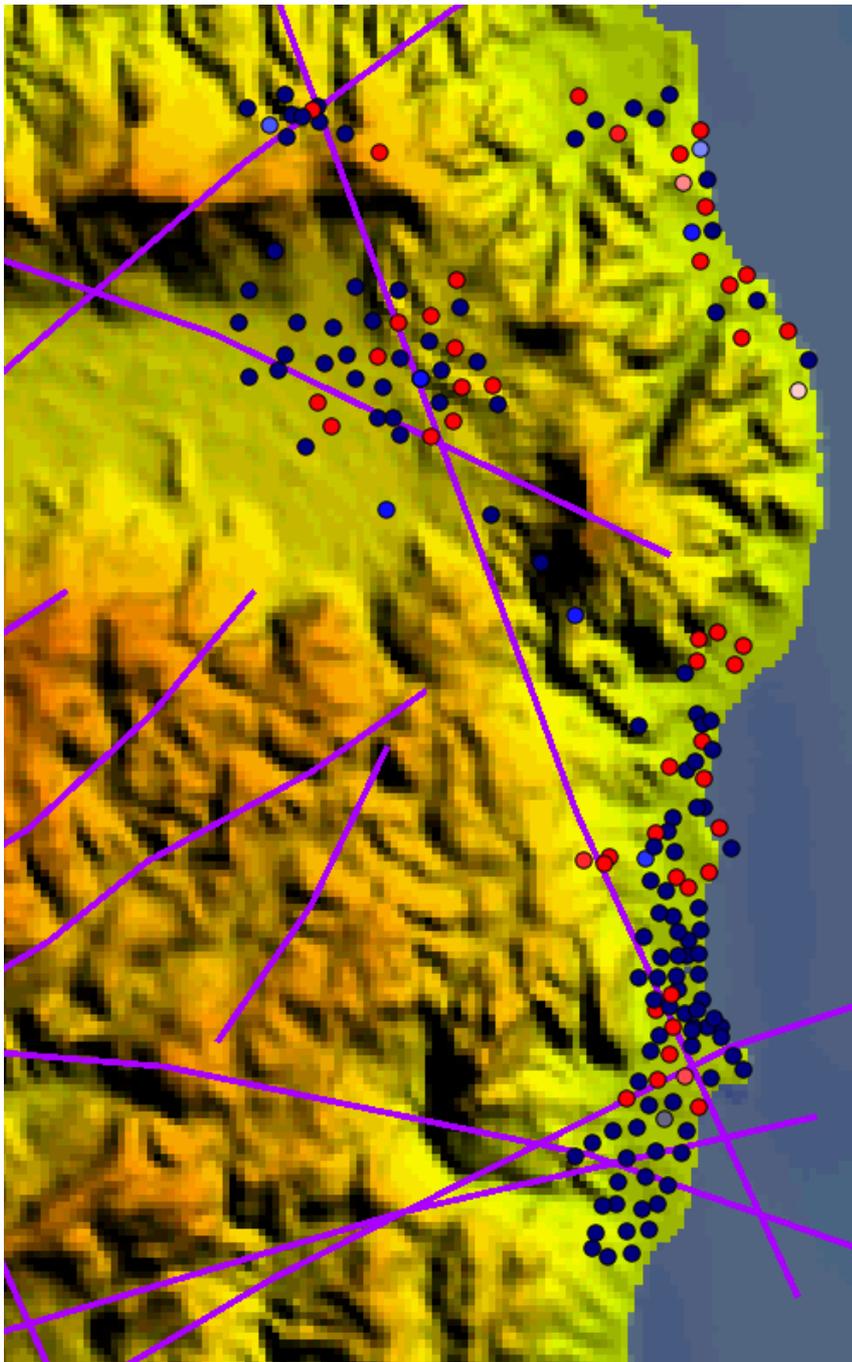


Figure 2

As described above the sampling shown in Figure 2 was developed in order to test for leakage along the faults shown in purple. In particular the intersections of these structures were targeted along with the afore mentioned uranium alteration zones. Whilst there was little correlation between the location of the high probability samples and the uranium alteration there does seem to be a clear relationship between the mapped faults and the high probability samples. In particular there are high probability samples co-located with the intersections between faults at both St Mary's and also at the fault intersection to the NNW of the town. As has already been mentioned there may be some contamination associated with some of these samples due to them being collected within the town however the relationship is quite striking. Following the major fault to the SSE towards the coast and there is a small pocket of three high probability samples all sitting above the fault and then a series of seven high to intermediate probability samples

collected along the same fault near the coast and also coincident with its intersection with a ENE trending structure as well as along that structure to the WSW. It could also be argued that the cluster of five high probability sample sites located along the coast to the north could be associated with the same NW trending cross cutting fault sampled at St Mary's. Finally, and perhaps drawing a longer bow, the northernmost grouping of coastal samples come from a section of coast where the coastline is broadly parallel to the major NNW trending fault in Figure 2. It is possible that the orientation of the coastline here is controlled by a second fault of the same type as the major mapped structure. If this is the case then it becomes possible to account for all of the high hydrocarbon potential sample sites (including those suspected of contamination) if there was migration and leakage of hydrocarbons along two sets of faults oriented NNW-SSE and NW-SE respectively, with minor dispersal along other cross cutting faults in the south (see Figure 3).

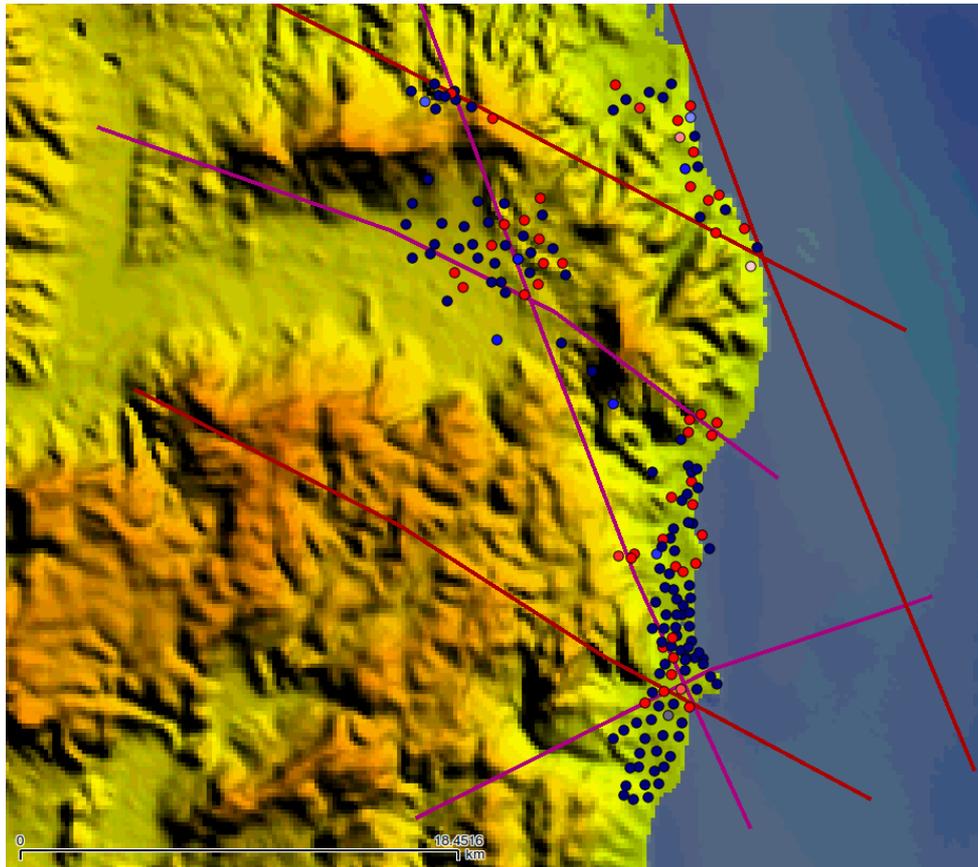
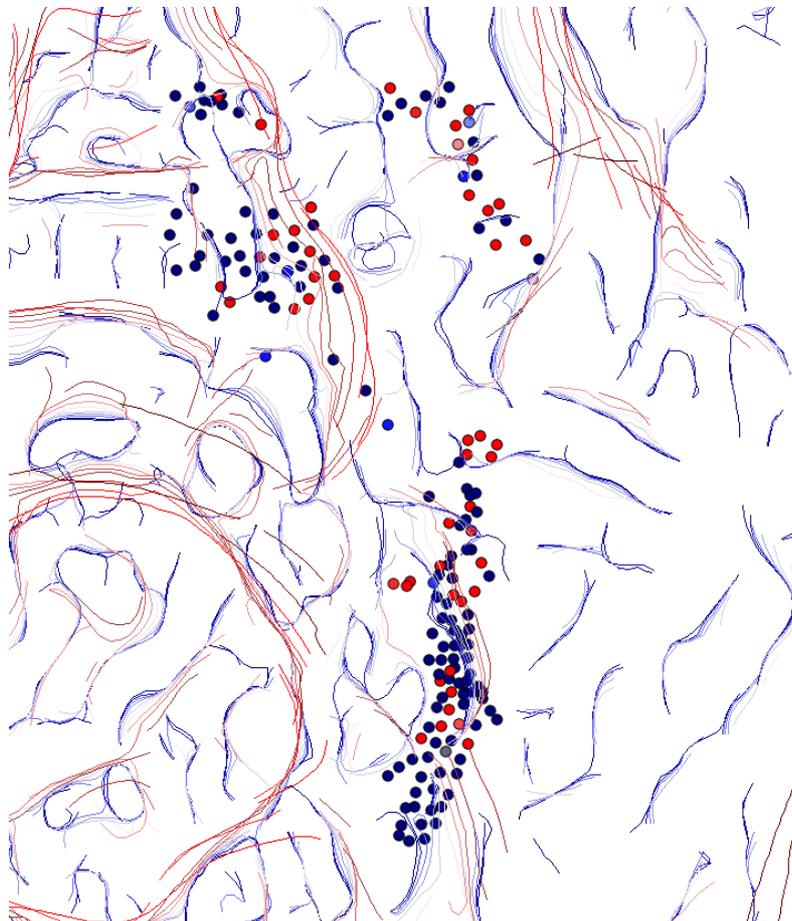


Figure 3 – new proposed faults in pink – existing faults in red.

In order to better assess the geometry of these fault structures I put together a magnetic gradient edge map (worm map). This is a technique which identifies high gradients in upwardly continued



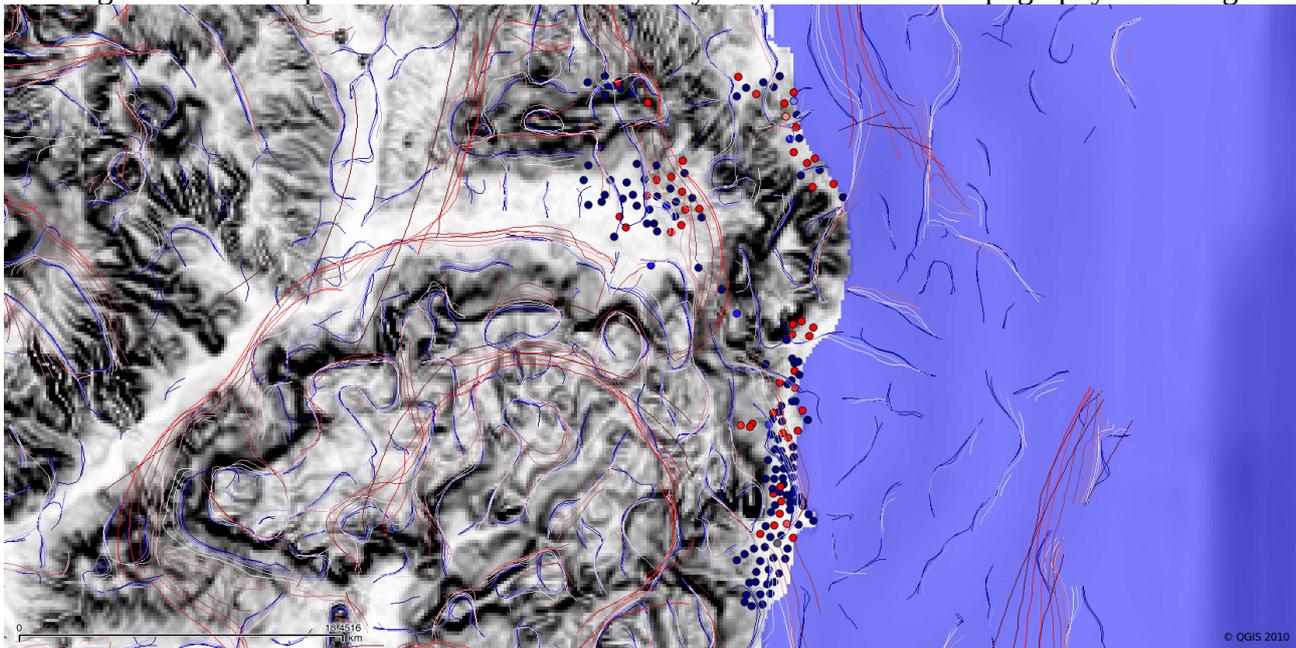
potential field images thus defining not only the shape of the structures that the gradients relate to (often faults) but also the depth of penetration and possibly also the dip of the structures. Often worm maps allow the geologist to identify subtle geophysical features that otherwise may have been overlooked.

Figure 4 shows the worm map with the Gore sample localities. Faults that are defined by blue worms alone tend to be shallower whilst those that have red and blue worms are deeper seated structures. Where the worms all lie on top of each other the fault is steep whereas where the red worms migrate away from the blue ones the fault dips at depth.

This figure shows that NNW oriented structure defined above is a substantial structure that can clearly

be seen defined by a strong worm trace cutting through both the St Mary's and southern coastal sampling groups. Interestingly there does appear to be evidence for a series of roughly NW-SE oriented structures both as St Mary's as well as cutting through the 5 high probability samples on the coast. There also appears to be evidence for the NNW striking cast defining fault system in the NE of the image. This structure is offset from the coast somewhat but is clearly large and parallel to the NNW fault as described above. In short, the worm data supports the suggestion that there is a strong structural control on the Gore sorber data and that this signature (at least in the region sampled in this study) is dominated by the effects of 2 fault sets oriented to the NNW and to the NW.

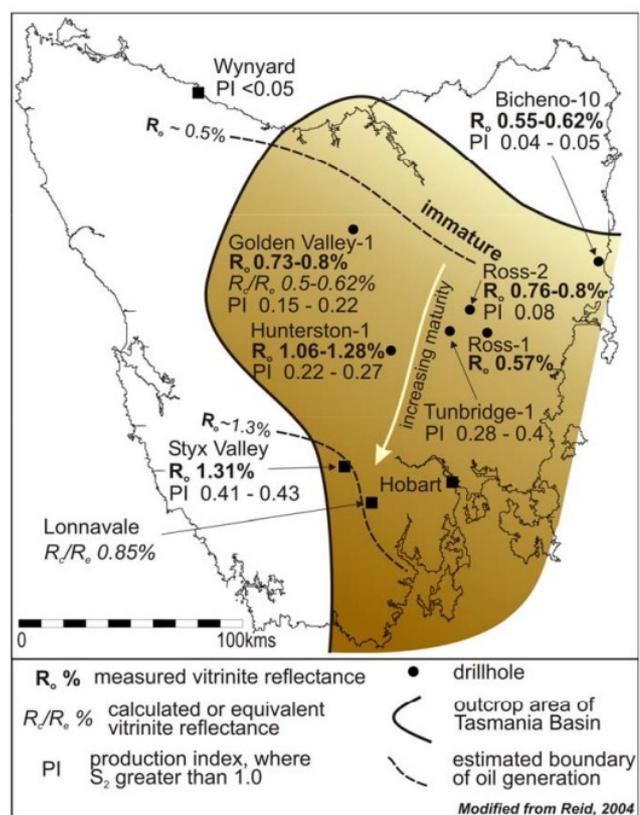
Figure 5, below, also plots the worm data but this time with the slope map as an underlay clearly showing the relationship between the faults defined by the worms and the topography of the region.



### Structural plays

Whilst there are clearly hydrocarbons in the study region (eg Bicheno well and historically recorded seeps and tar-sand deposits) most of the maturity mapping suggests that the source rocks in the Tasmanian Basin must be located some distance to the SW. See figure 6 from Stacey (2009) as well as Bacon et al.

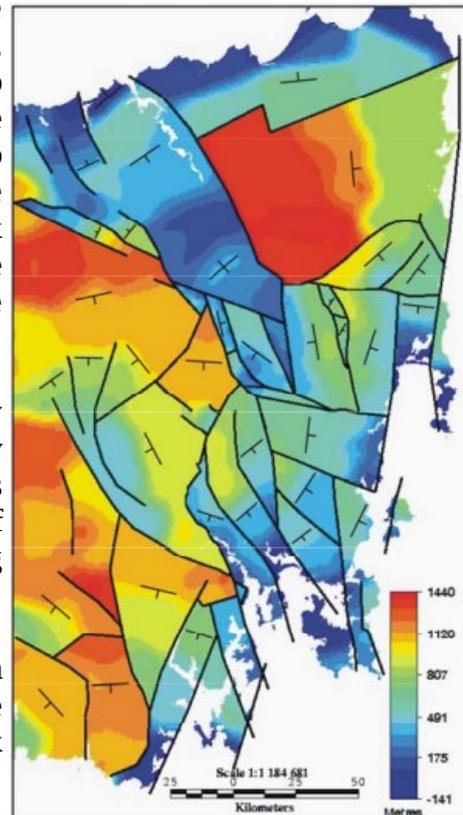
In a recent structural PhD study Andrew Stacey (2009) did a nice piece of work in which he argued that the entire Tasmanian Basin has been dissected into a series of fault bound blocks. He then identified a series of remnant landforms in each of these regions and used them to define tilting orientations for each of the blocks (see figure 7 below and Stacey, 2009).



The timing and orientation of this tilting, as well as the nature and sealing characteristics of the faults that bound the blocks, has significant implications for the potential for the Bisheno region given the location of the mature source rocks. The apparent tilting on the proximal fault blocks to the Bisheno region to the S or W could aid in hydrocarbon supply to the region of interest. However, the eastward tilting of the block immediately to the west of Bisheno could potentially have generated a barrier to migration from the more mature source regions.

In addition secondary supply of hydrocarbons from any offshore plays to the east could mean that we are actually dealing with two systems here. This is something that is definitely worth considering and additional interpretation of the three available seismic lines could aid in understanding this system better.

I don't believe that there is enough data to take this argument a lot further at this stage but it is something that could be addressed with a relatively small amount of additional work (see below).



**Figure 4.11:** Tertiary Palaeo-Surfaces combined with the Tertiary Fault Pattern

Figure 7 – fault bound tilt blocks as defined by Stacey (2009)

#### *Further work*

In light of the above observations I would suggest that the initial Gore survey was a success to the extent that it proved that there has been hydrocarbon migration and leakage in the survey region. The initial report highlighted that the samples were calibrated against known seep compositions from the Wombat field in Victoria rather than samples from the Tasmania Basin. As a result it is difficult to ascertain what component of the high potential samples was from contamination, but also which system we are really dealing with at this locality. The Tasmanian Basin lies largely to the west of the site and there is clear potential for migration from the mature portions of the basin further to the south. However, there is also a possibility that some component of the hydrocarbons in the system, particularly from the coastal sample localities may have been sourced from some of the narrow offshore basin sequences to the east.

As a result I believe there is value in:

- (1) doing additional sampling in the southern region (and potentially up the coast) away from roads and any other anthropogenic hydrocarbon sources to firmly establish that the sources of the high potential anomalies are natural seeps.
- (2) Calibrate the analysis against samples known to have been sourced from the Tasmanian Basin (and any samples from wells that may be tapping material from the offshore sequences)
- (3) Digitising the available paper seismic and converting to SEG Y format so that the lines can be interpreted properly and a simple model for potential east to west migration pathways can be established.
- (4) Some field work be carried out along the creeks that may be feeding the reported

- natural slicks on the lakes in the south and some hand-held radiometric analysis conducted in order to try to find evidence for seepage or leakage sites.
- (5) A short field based structural study be undertaken in the area in order to asses in more detail the overall enveloping surface dips and to try to evaluate in more detail the proposals of Stacey regarding block tilting in the region and its potential effect on hydrocarbon migration from regions with better maturity characteristics.

*References:*

Stacey A. 2009 - The structural history of Tasmania from the Devonian to the Recent. Unpublished PhD thesis, University of Tasmania.

C. A. Bacon, C. R. Calver, C. J. Boreham , D. E. Leaman, K. C. Morrison, A. T. Reville & J. K. Volkman, 2000. The petroleum potential of onshore Tasmania: a review. GEOLOGICAL SURVEY BULLETIN 71.

## APPENDIX C

**EL 58/2008 Seymour  
Lead Potential  
Resource  
Calculations**

ALL INPUT CELLS BLUE

Estimated closure based on  
Gore probability mapping 2 sq km

Capacity = A\*H\*phi\*rho\*E

- A= Area m2
- H = height of reservoir (m)
- Phi = porosity %
- Rho = density at depth (tonne/m3)
- E = efficiency factor
- Recovery factor
- Exploration risk

0.8  
0.6  
0.4  
75%

Divide by 4 (MillionBbLS)  
To Account For  
Geometries - Dome vs  
anticline vs fault bounded  
structure

Recovered  
Hydrocarbons  
Risked Potential  
Resource

Case			Kilolitres	Barrels	MMStdBbLS	Divide by 4 (MillionBbLS) To Account For Geometries - Dome vs anticline vs fault bounded structure	Recovered Hydrocarbons	Risked Potential Resource
<b>Case 1</b>								
	A	2000000						
	H	5						
	Phi	0.1						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00048						
	Capacity	480000	Billion Tonnes	559200	3518400	3.5184	0.8796	0.35184
			Tonnes					0.08796
<b>Case 2</b>								
	A	2000000						
	H	5						
	Phi	0.2						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00096						
	Capacity	960000	Billion Tonnes	1118400	7036800	7.0368	1.7592	0.70368
			Tonnes					0.17592
<b>Case 3</b>								
	A	2000000						
	H	10						
	Phi	0.1						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00096						
	Capacity	960000	Billion Tonnes	1118400	7036800	7.0368	1.7592	0.70368
			Tonnes					0.17592
<b>Case 4</b>								
	30% Porosity							
	2km2							
	A	2000000						
	H	10						
	Phi	0.2						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00192						
	Capacity	1920000	Billion Tonnes	2236800	14073600	14.0736	3.5184	1.40736
			Tonnes					0.35184

**Case 5**

A 2000000  
 H 15  
 Phi 0.1  
 Rho 0.8  
 E 0.6  
 divide 10<sup>9</sup> 0.00144  
 Capacity 1440000

Billion Tonnes  
 Tonnes

1677600 10555200 10.5552 2.6388 1.05552 0.26388

**Case 6**

A 2000000  
 H 15  
 Phi 0.2  
 Rho 0.8  
 E 0.6  
 divide 10<sup>9</sup> 0.00288  
 Capacity 2880000

Billion Tonnes  
 Tonnes

3355200 21110400 21.1104 5.2776 2.11104 0.52776

**Realistic I (High Case)**

20% Porosity; 15 m Reservoir

A 2000000  
 H 15  
 Phi 0.175  
 Rho 0.8  
 E 0.6  
 divide 10<sup>9</sup> 0.00252  
 Capacity 2520000

Billion Tonnes  
 Tonnes

2935800 18471600 18.4716 4.6179 1.84716 0.46179

**Realistic II (Mid Case)**

10% Porosity; 10 m Reservoir

A 2000000  
 H 10  
 Phi 0.1  
 Rho 0.8  
 E 0.6  
 divide 10<sup>9</sup> 0.00096  
 Capacity 960000

Billion Tonnes  
 Tonnes

1118400 7036800 7.0368 1.7592 0.70368 0.17592

**Realistic III (Low Case)**

7.5% Porosity; 5 m Reservoir

A 2000000  
 H 5  
 Phi 0.075  
 Rho 0.8  
 E 0.6  
 divide 10<sup>9</sup> 0.00036  
 Capacity 360000

Billion Tonnes  
 Tonnes

419400 2638800 2.6388 0.6597 0.26388 0.06597

ALL INPUT  
CELLS BLUE

Return calculations on High, Mid and Low Cases  
AUD

Exploration cost to date	414,981
2D seismic (30 line km)	600,000
Interpretation & well Plan	150,000
Exploration well	3,000,000
Development wells (2)	6,000,000
Recovery & Storage	350,000
Transport	250,000
Abandonment	1,500,000
<b>Total Investment</b>	<b>12,264,981</b>

Oil price assumption \$ 80.00

Production Profile

Year	1	2	3	4	5	6	7	8
Total recovered: 0.975	0.15	0.3	0.25	0.1	0.08	0.06	0.025	0.01

Assumed Risked Resource

High	0.46179
Mid	0.17592
Low	0.06597

Production bbls/y

										<b>Totals</b>
High	69268.5	138537	115447.5	46179	36943.2	27707.4	11544.75	4617.9		450245.25
Mid	26388	52776	43980	17592	14073.6	10555.2	4398	1759.2		171522
Low	9896	19791	16493	6597	5278	3958	1649	660		64321

Revenues

High	\$ 5,541,480	\$ 11,082,960	\$ 9,235,800	\$ 3,694,320	\$ 2,955,456	\$ 2,216,592	\$ 923,580	\$ 369,432	\$ 36,019,620
Mid	\$ 2,111,040	\$ 4,222,080	\$ 3,518,400	\$ 1,407,360	\$ 1,125,888	\$ 844,416	\$ 351,840	\$ 140,736	\$ 13,721,760
Low	\$ 791,640	\$ 1,583,280	\$ 1,319,400	\$ 527,760	\$ 422,208	\$ 316,656	\$ 131,940	\$ 52,776	\$ 5,145,660

Opex (including transport to market)

High	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	\$ 8,000,000
Mid	750,000	750,000	750,000	750,000	750,000	750,000	750,000	750,000	\$ 6,000,000
Low	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	\$ 2,800,000

Gross cash flow

High	-12,264,981	\$ 4,541,480	\$ 10,082,960	\$ 8,235,800	\$ 2,694,320	\$ 1,955,456	\$ 1,216,592	-\$ 76,420	-\$ 630,568	\$ 28,019,620
Mid	-12,264,981	\$ 1,361,040	\$ 3,472,080	\$ 2,768,400	\$ 657,360	\$ 375,888	\$ 94,416	-\$ 398,160	-\$ 609,264	\$ 7,721,760
Low	-12,264,981	\$ 441,640	\$ 1,233,280	\$ 969,400	\$ 177,760	\$ 72,208	-\$ 33,344	-\$ 218,060	-\$ 297,224	\$ 2,345,660

Fiscal Performance before taxation and royalties

IRR (First 6 years)

High	42%
Mid	-12%
Low	#NUM!

NPV @ 10%

High	\$9,169,364
Mid	-\$5,042,623
Low	-\$9,163,999

**EL 58/2008 Seymour  
Lead Potential  
Resource  
Calculations**

ALL INPUT CELLS BLUE

Estimated closure based on  
Gore probability mapping 2 sq km

Capacity = A\*H\*phi\*rho\*E

A= Area m2  
H = height of reservoir (m)  
Phi = porosity %  
Rho = density at depth  
(tonne/m3)  
E = efficiency factor  
Recovery factor  
Exploration risk

0.8  
0.6  
0.4  
50%

Divide by 4 (MillionBbLS)  
To Account For  
Geometries - Dome vs  
anticline vs fault bounded  
structure

Recovered  
Hydrocarbons  
Risked Potential  
Resource

Case			Kilolitres	Barrels	MMStdBbLS	Divide by 4 (MillionBbLS) To Account For Geometries - Dome vs anticline vs fault bounded structure	Recovered Hydrocarbons	Risked Potential Resource
<b>Case 1</b>								
	A	2000000						
	H	5						
	Phi	0.1						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00048						
	Capacity	480000	Billion Tonnes	559200	3518400	3.5184	0.8796	0.35184
			Tonnes					0.17592
<b>Case 2</b>								
	A	2000000						
	H	5						
	Phi	0.2						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00096						
	Capacity	960000	Billion Tonnes	1118400	7036800	7.0368	1.7592	0.70368
			Tonnes					0.35184
<b>Case 3</b>								
	A	2000000						
	H	10						
	Phi	0.1						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00096						
	Capacity	960000	Billion Tonnes	1118400	7036800	7.0368	1.7592	0.70368
			Tonnes					0.35184
<b>Case 4</b>								
	30% Porosity							
	2km2							
	A	2000000						
	H	10						
	Phi	0.2						
	Rho	0.8						
	E	0.6						
	divide 10^9	0.00192						
	Capacity	1920000	Billion Tonnes	2236800	14073600	14.0736	3.5184	1.40736
			Tonnes					0.70368

**Case 5**

A	2000000							
H	15							
Phi	0.1							
Rho	0.8							
E	0.6							
divide 10 <sup>9</sup>	0.00144	Billion Tonnes						
Capacity	1440000	Tonnes	1677600	10555200	10.5552	2.6388	1.05552	0.52776

**Case 6**

A	2000000							
H	15							
Phi	0.2							
Rho	0.8							
E	0.6							
divide 10 <sup>9</sup>	0.00288	Billion Tonnes						
Capacity	2880000	Tonnes	3355200	21110400	21.1104	5.2776	2.11104	1.05552

**Realistic I (High Case)**

20% Porosity; 15 m Reservoir

A	2000000							
H	15							
Phi	0.175							
Rho	0.8							
E	0.6							
divide 10 <sup>9</sup>	0.00252	Billion Tonnes						
Capacity	2520000	Tonnes	2935800	18471600	18.4716	4.6179	1.84716	0.92358

**Realistic II (Mid Case)**

10% Porosity; 10 m Reservoir

A	2000000							
H	10							
Phi	0.1							
Rho	0.8							
E	0.6							
divide 10 <sup>9</sup>	0.00096	Billion Tonnes						
Capacity	960000	Tonnes	1118400	7036800	7.0368	1.7592	0.70368	0.35184

**Realistic III (Low Case)**

7.5% Porosity; 5 m Reservoir

A	2000000							
H	5							
Phi	0.075							
Rho	0.8							
E	0.6							
divide 10 <sup>9</sup>	0.00036	Billion Tonnes						
Capacity	360000	Tonnes	419400	2638800	2.6388	0.6597	0.26388	0.13194

**ALL INPUT  
CELLS BLUE**

**Return calculations on High, Mid and Low Cases  
AUD**

Exploration cost to date	414,981
2D seismic (30 line km)	600,000
Interpretation & well Plan	150,000
Exploration well	3,000,000
Development wells (2)	6,000,000
Recovery & Storage	350,000
Transport	250,000
Abandonment	1,500,000
<b>Total Investment</b>	<b>12,264,981</b>

Oil price assumption           \$       80.00

**Production Profile**

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Total recovered: 0.975	0.15	0.3	0.25	0.1	0.08	0.06	0.025	0.01

**Assumed Risked Resource**

High	0.92358
Mid	0.35184
Low	0.13194

**Production bbls/y**

									<b>Totals</b>
High	138537	277074	230895	92358	73886.4	55414.8	23089.5	9235.8	900490.5
Mid	52776	105552	87960	35184	28147.2	21110.4	8796	3518.4	343044
Low	19791	39582	32985	13194	10555	7916	3299	1319	128642

**Revenues**

High	\$ 11,082,960	\$ 22,165,920	\$ 18,471,600	\$ 7,388,640	\$ 5,910,912	\$ 4,433,184	\$ 1,847,160	\$ 738,864	\$ 72,039,240
Mid	\$ 4,222,080	\$ 8,444,160	\$ 7,036,800	\$ 2,814,720	\$ 2,251,776	\$ 1,688,832	\$ 703,680	\$ 281,472	\$ 27,443,520
Low	\$ 1,583,280	\$ 3,166,560	\$ 2,638,800	\$ 1,055,520	\$ 844,416	\$ 633,312	\$ 263,880	\$ 105,552	\$ 10,291,320

**Opex (including transport to market)**

High	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	\$ 8,000,000
Mid	750,000	750,000	750,000	750,000	750,000	750,000	750,000	750,000	\$ 6,000,000
Low	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	\$ 2,800,000

**Gross cash flow**

**Investment**

High	-12,264,981	\$ 10,082,960	\$ 21,165,920	\$ 17,471,600	\$ 6,388,640	\$ 4,910,912	\$ 3,433,184	\$ 847,160	-\$ 261,136	\$ 64,039,240
Mid	-12,264,981	\$ 3,472,080	\$ 7,694,160	\$ 6,286,800	\$ 2,064,720	\$ 1,501,776	\$ 938,832	-\$ 46,320	-\$ 468,528	\$ 21,443,520
Low	-12,264,981	\$ 1,233,280	\$ 2,816,560	\$ 2,288,800	\$ 705,520	\$ 494,416	\$ 283,312	-\$ 86,120	-\$ 244,448	\$ 7,491,320

**Fiscal Performance before taxation and royalties**

**IRR (First 6 years)**

High	107%
Mid	26%
Low	-15%

**NPV @ 10%**

**10%**

High	\$33,914,546
Mid	\$4,384,113
Low	-\$5,628,973