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 it 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 faults 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

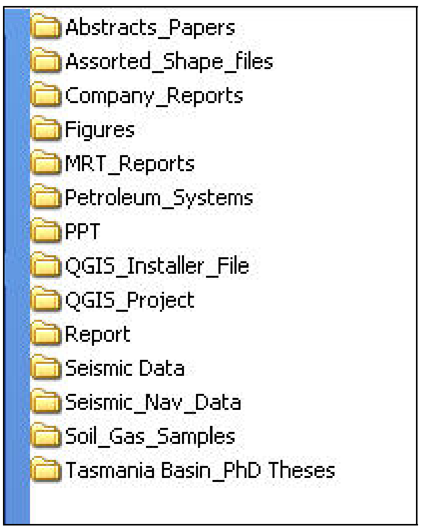
EL582009 is a broadly north-south trending exploration permit located near the coast, along the north-eastern margin of Tasmania. Very little is currently known about the petroleum geology or prospectivity of this region and so a geoscience programme was developed to:

- 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 msecs (~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.

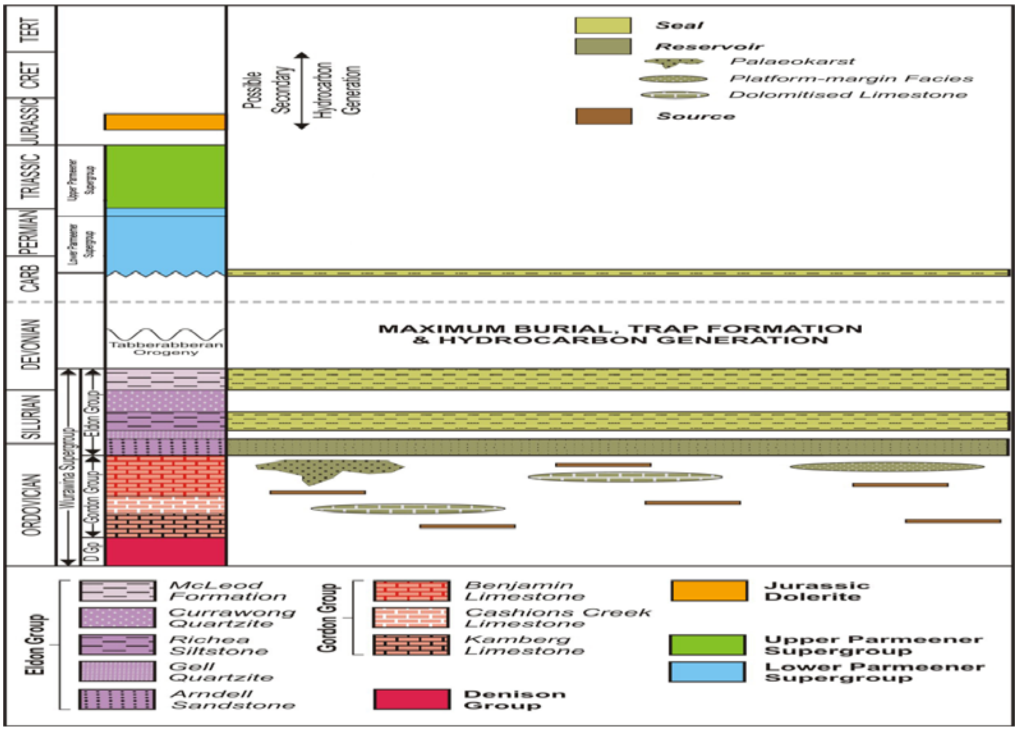


Figure 2-1. Larapintine petroleum system.

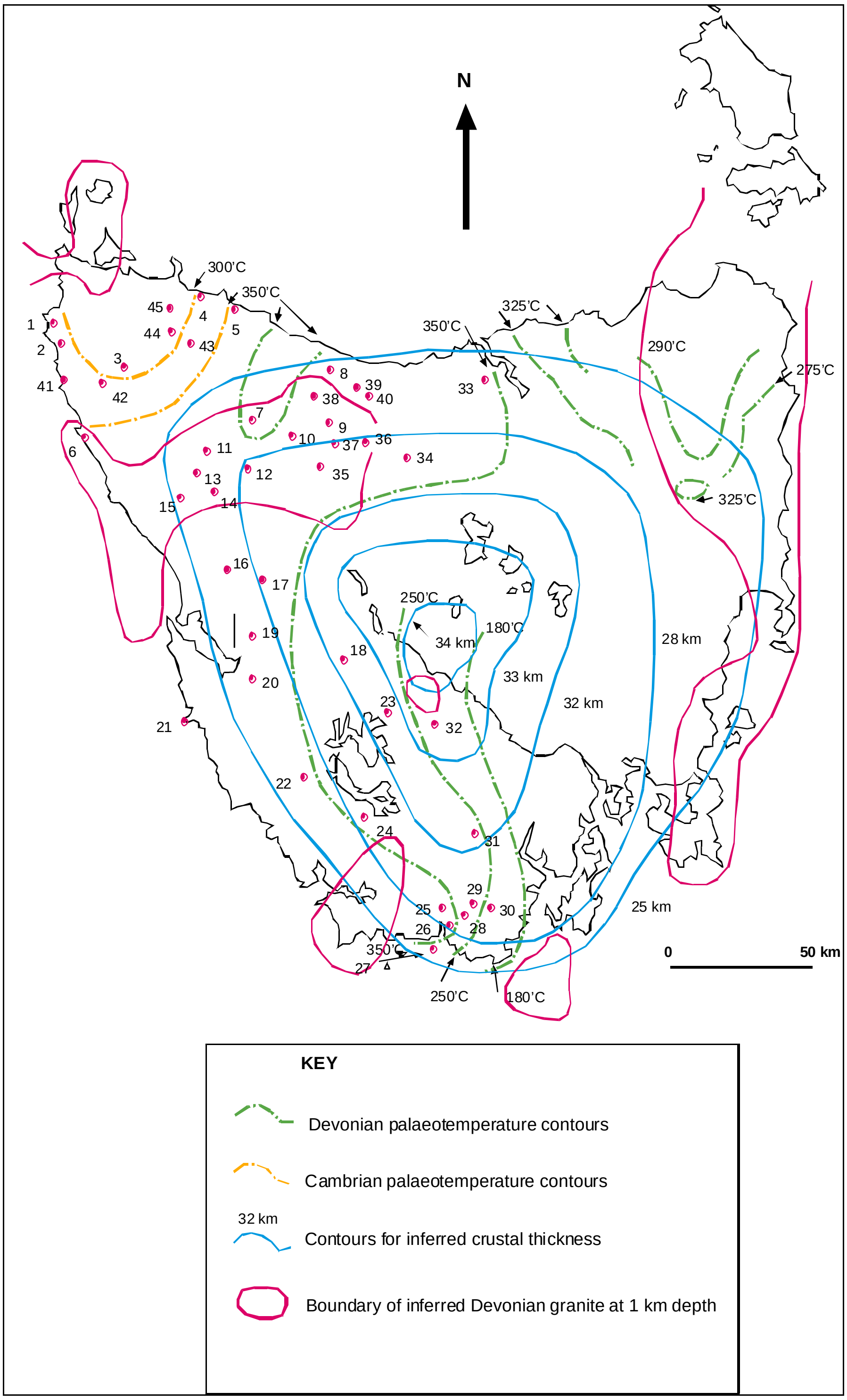


Figure 2-2. Reproduced from Chester (2006). Devonian/Carboniferous palaeotemperature contours for Tasmania plotted along with features that may have bearing on the palaeotemperature distribution. Palaeotemperature contours in northeastern Tasmania after Patison et al. (2001). Palaeotemperature data points 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 are 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.

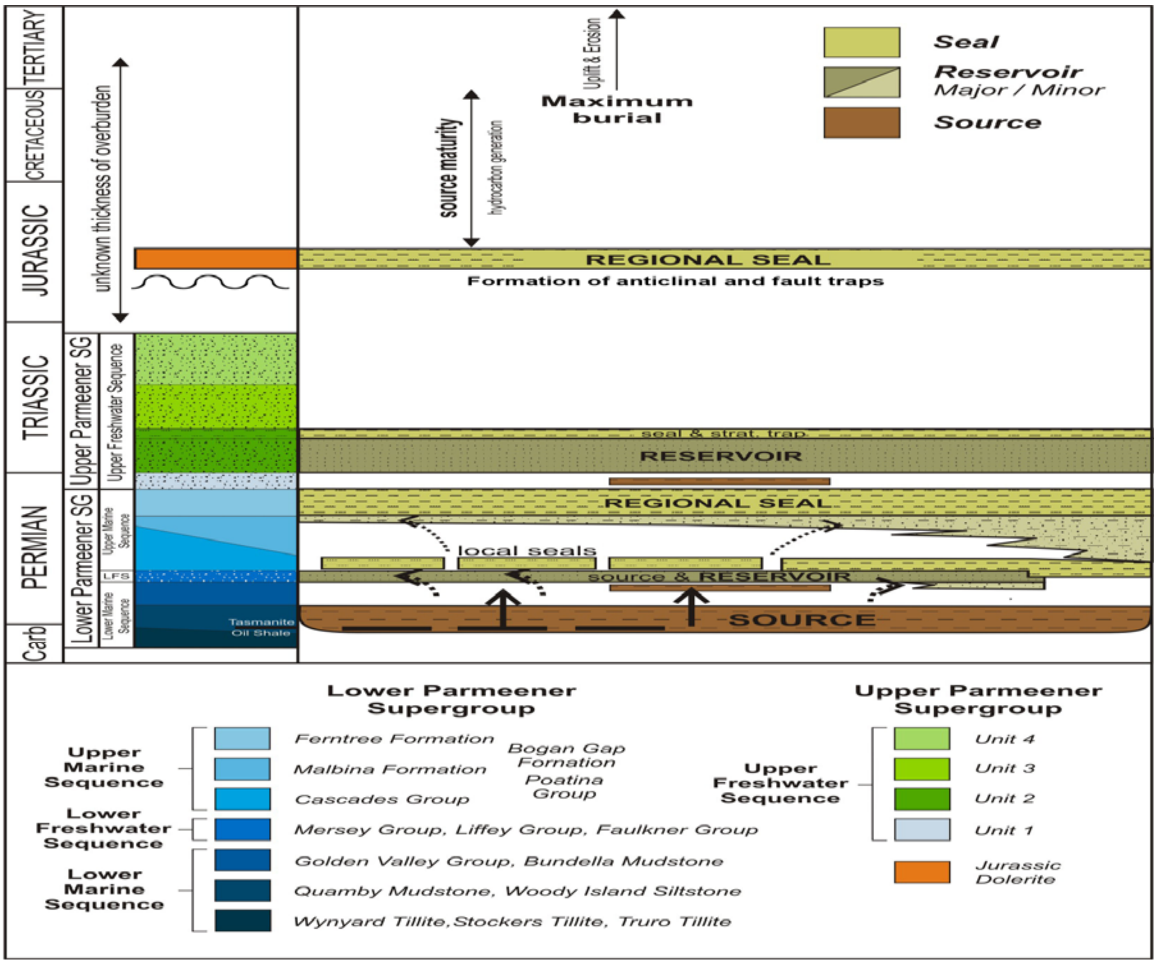


Figure 2-3. Gondwanan petroleum system.

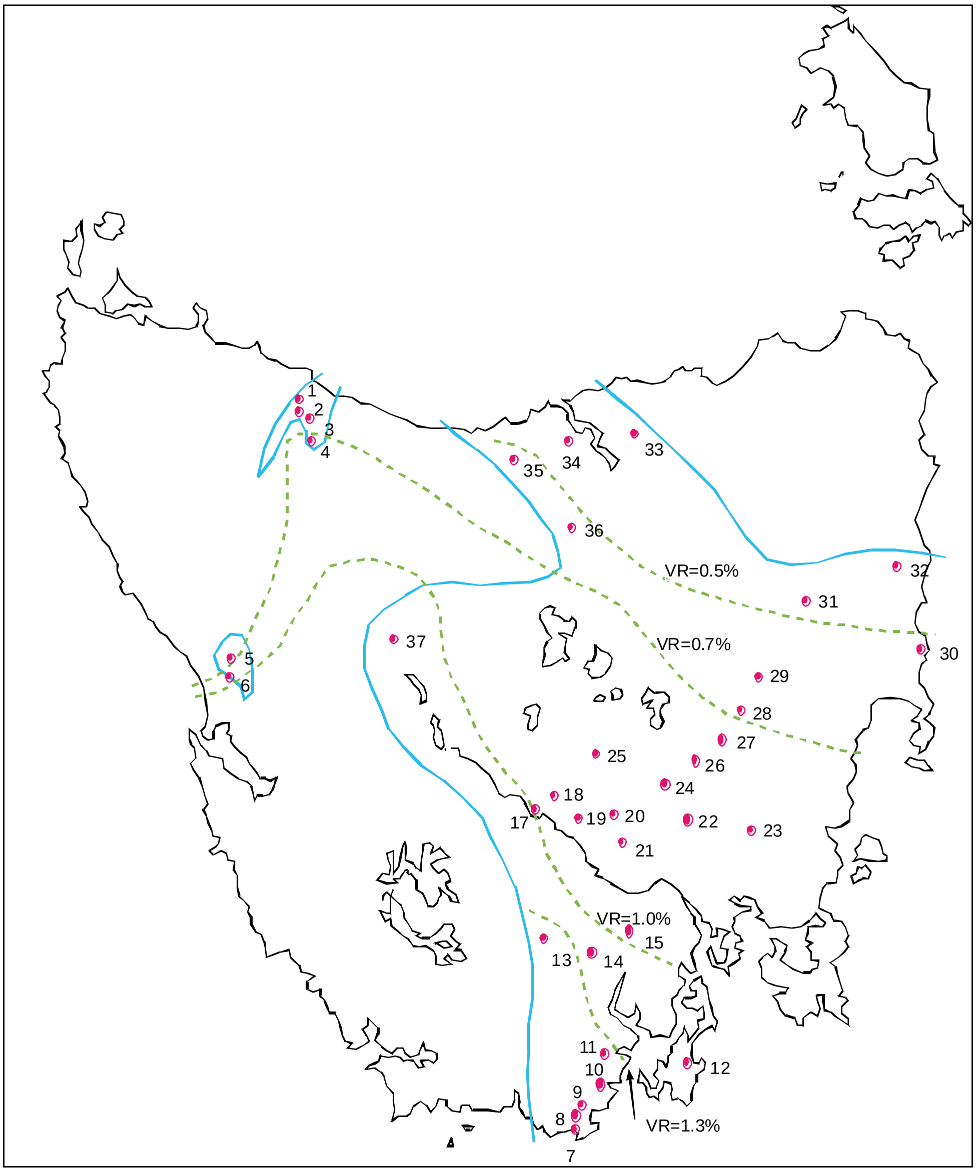


Figure 2-4.From Chester (2006). Maturity determined for Parmeener Supergroup sequences within the Tasmania Basin from vitrinite reflectance and calorific values of coal, vitrinite reflectance from potential source rocks and Rock-Eval pyrolysis of potential source rocks. Blue lines show the boundaries 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.

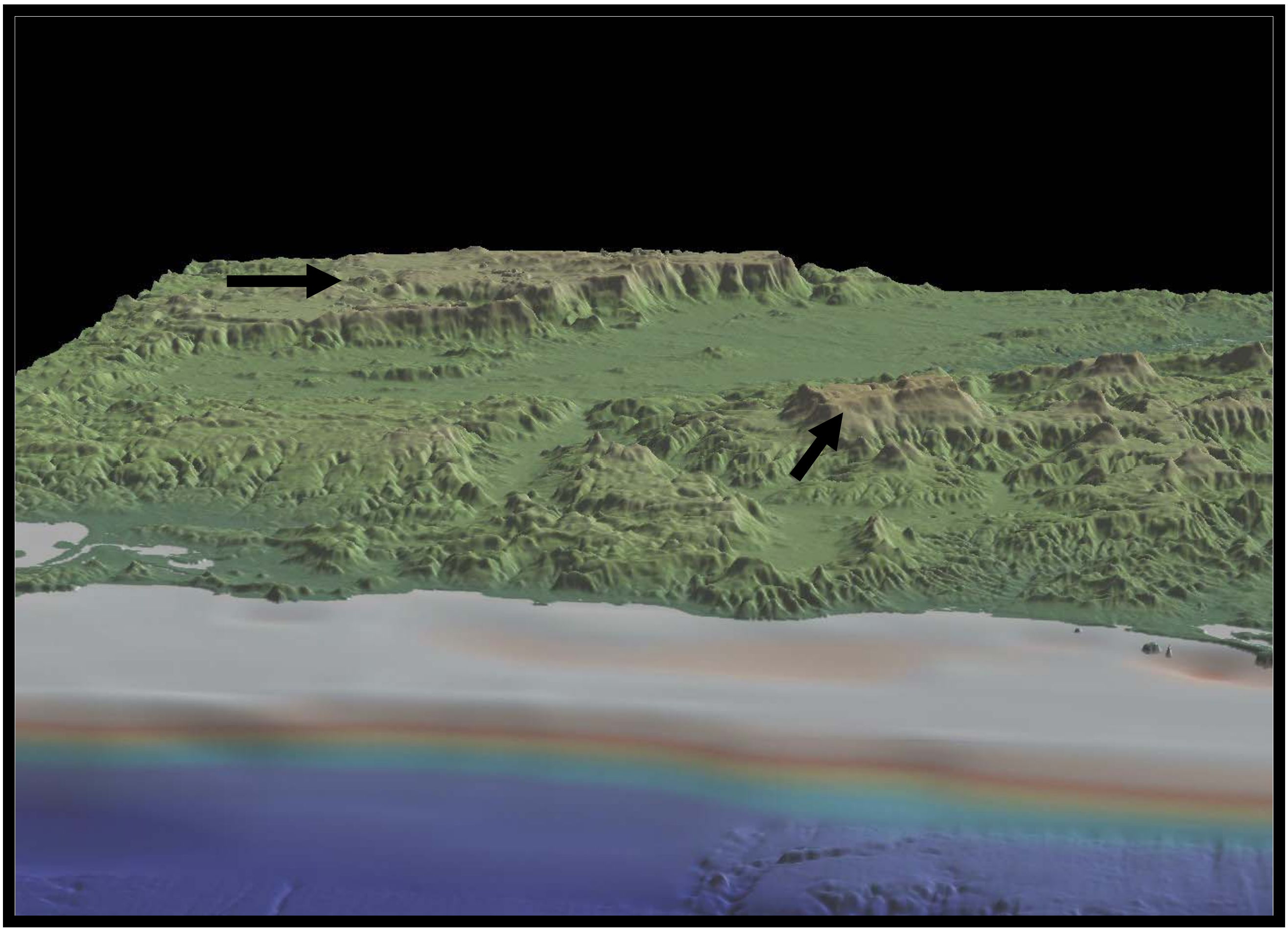


Figure 3-. Perspective view of the topography of the region looking to the west. The remnant plateaus described in the text are marked with arrows.

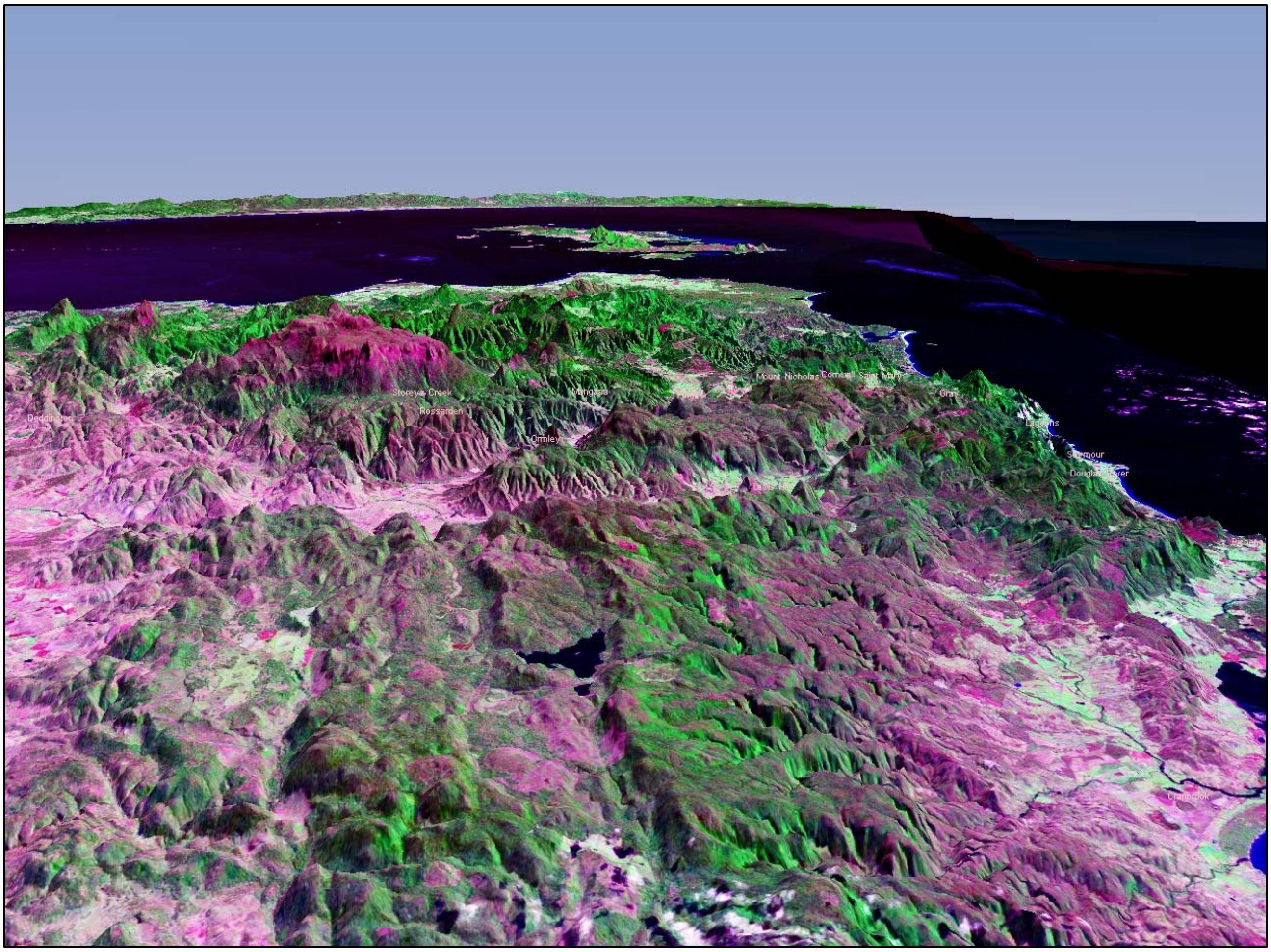


Figure 3-2. View of the pseudo-coloured Landsat imagery draped on topography viewed from the south. Again the plateau remnants are clearly preserved and the tilt blocks bound by reactivated basement faults are visible in the bottom of the image.

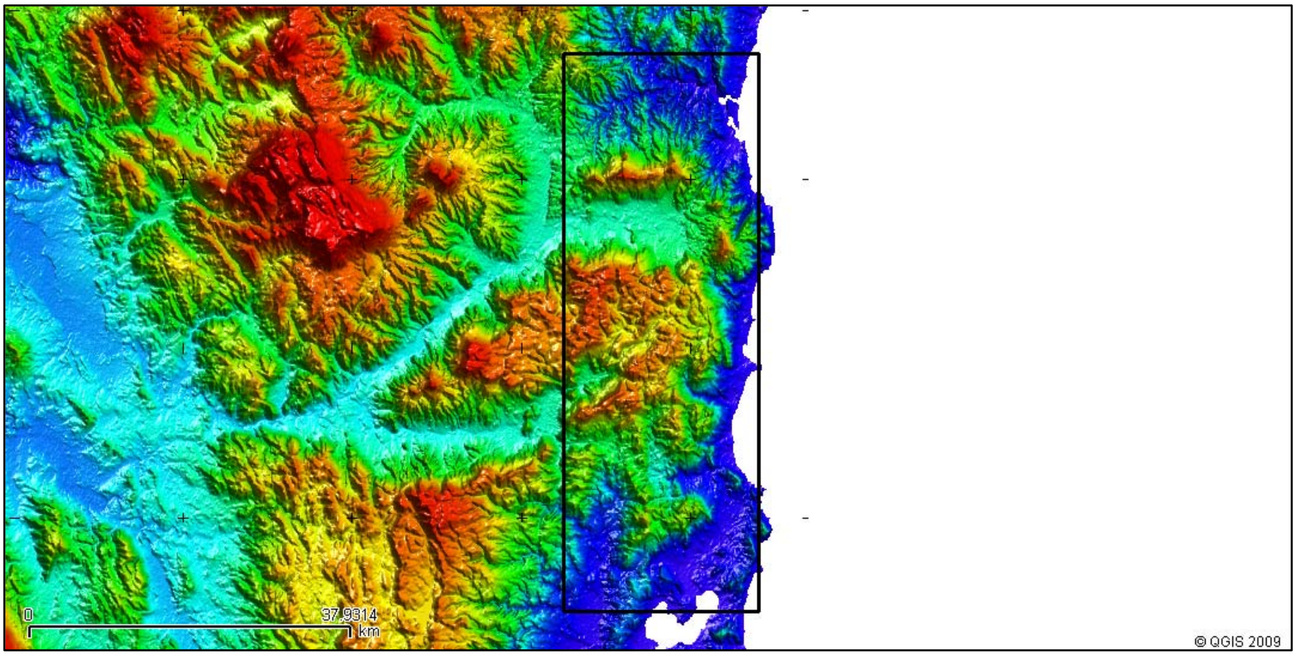


Figure 3-3. DTM of the EL582008 region and Tamar Valley to the west.

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.

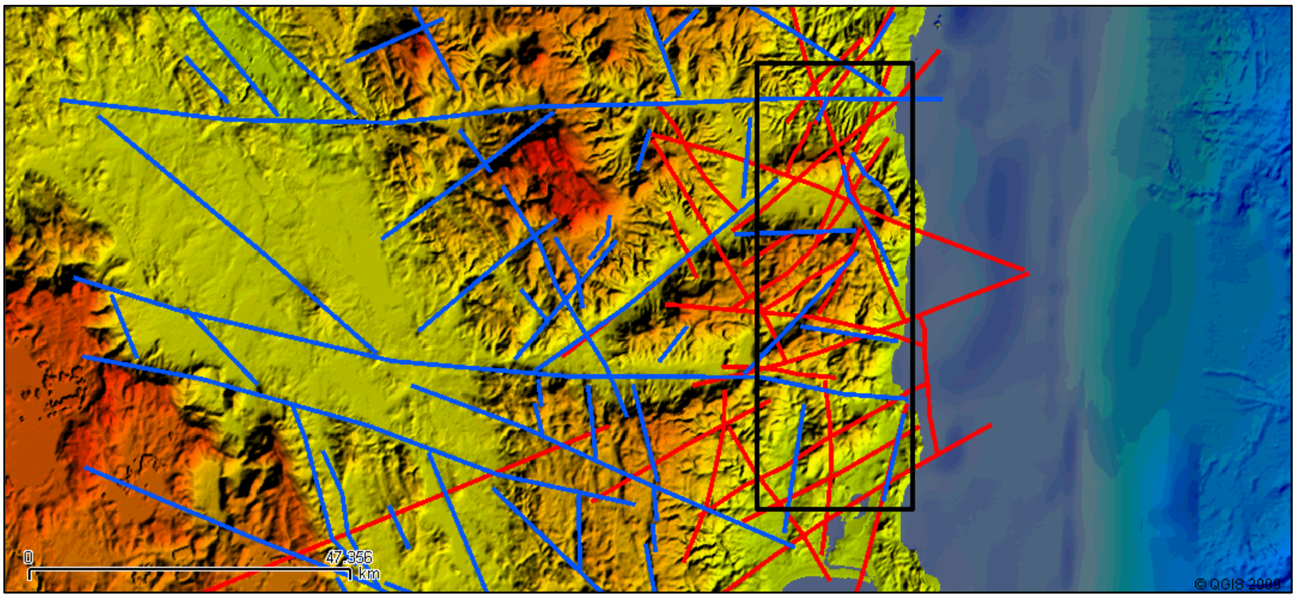


Figure 3-4. Interpreted faults in the region of EL582008 based on interpretation of the potential field geophysical data – red (see description below) and based on the geomorphology and remote sensing datasets – blue.

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 TASMAP 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).

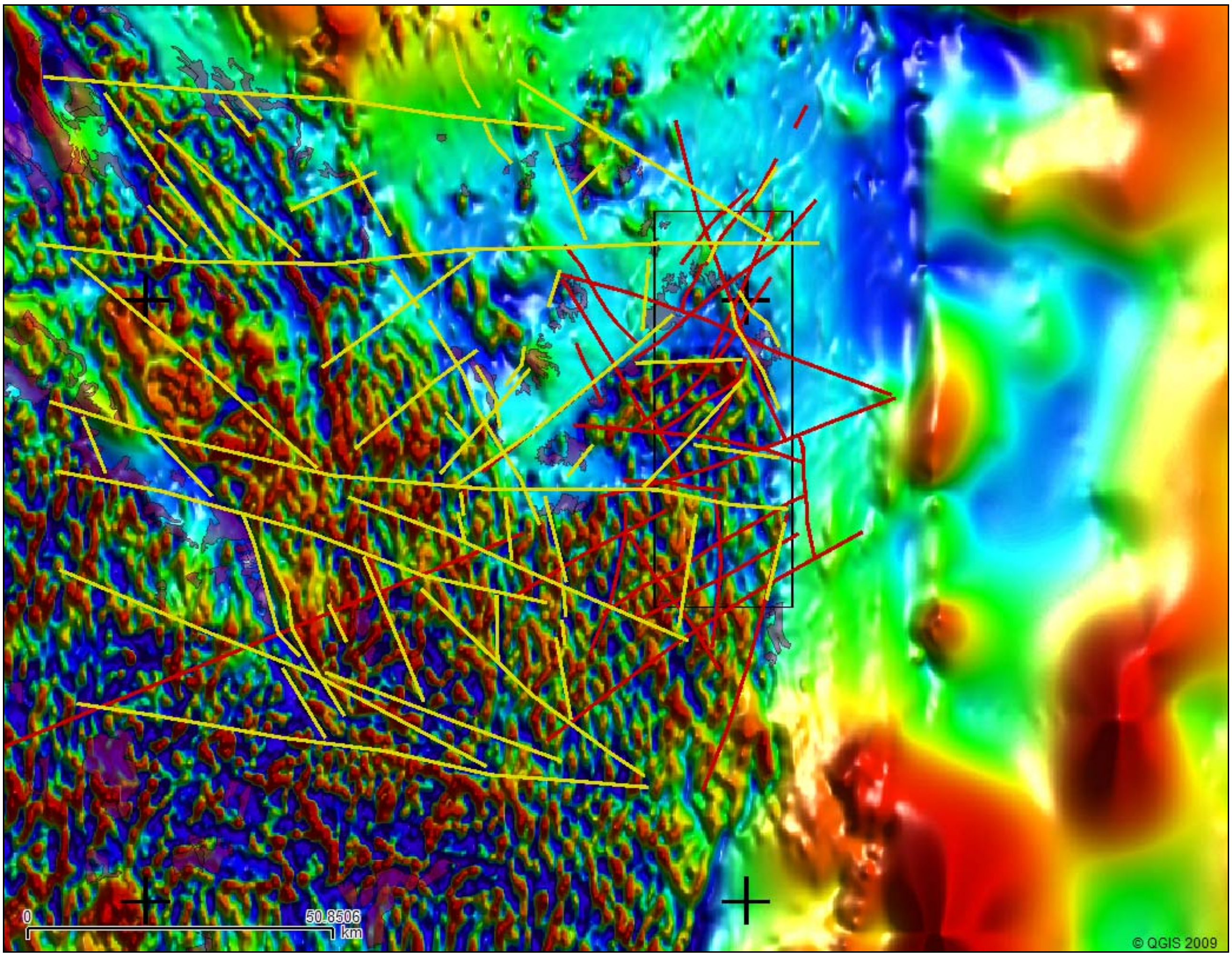


Figure 3-5. Regional TMI image in the region of EL582008. Interpreted faults based on interpretation of the potential field geophysical data – red and geomorphology and remote sensing datasets – yellow.

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 1st 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.

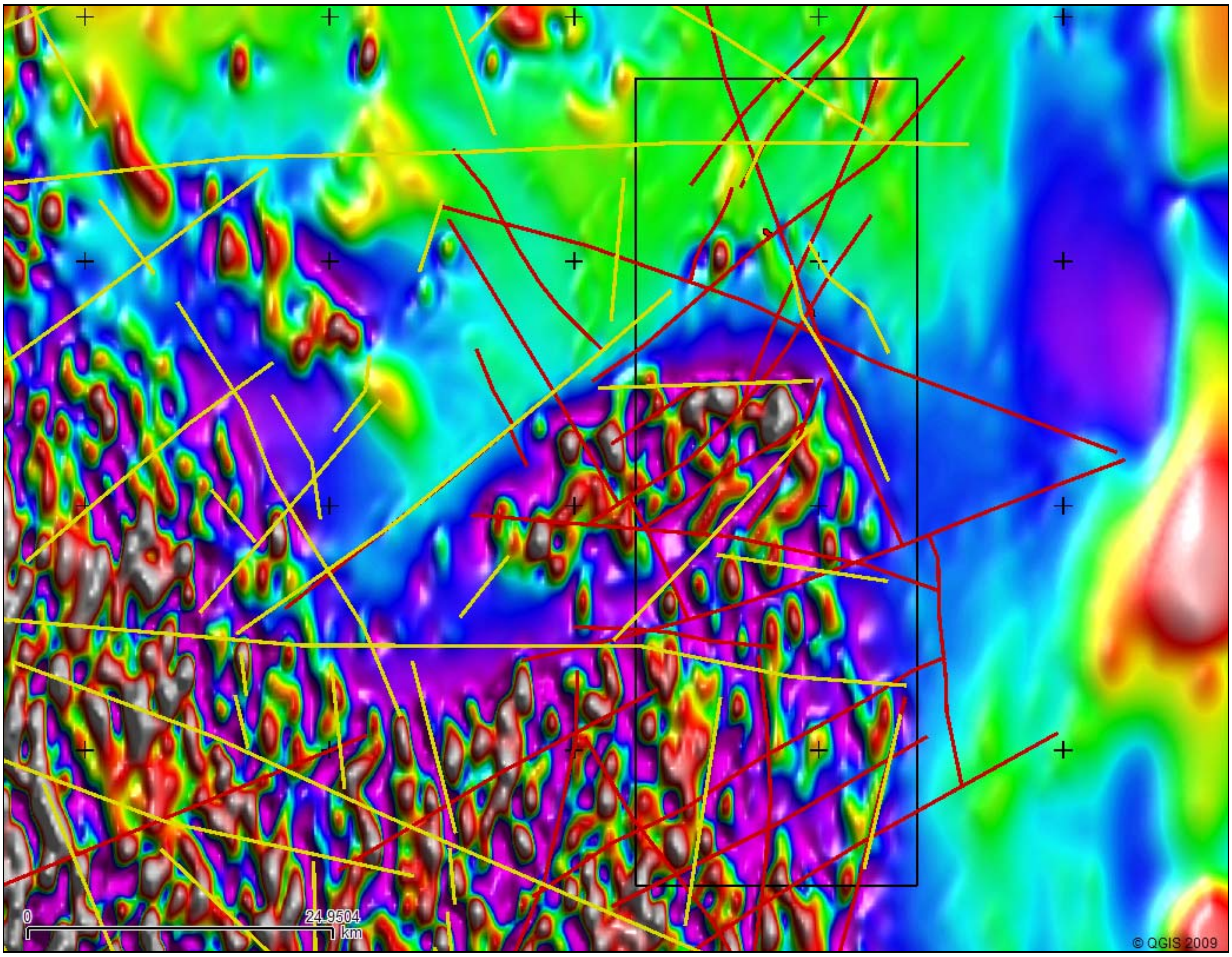


Figure 3-6. TMI (reduced to pole) image in the region of EL582008. Interpreted faults based on interpretation of the potential field geophysical data – red and geomorphology and remote sensing datasets – yellow.

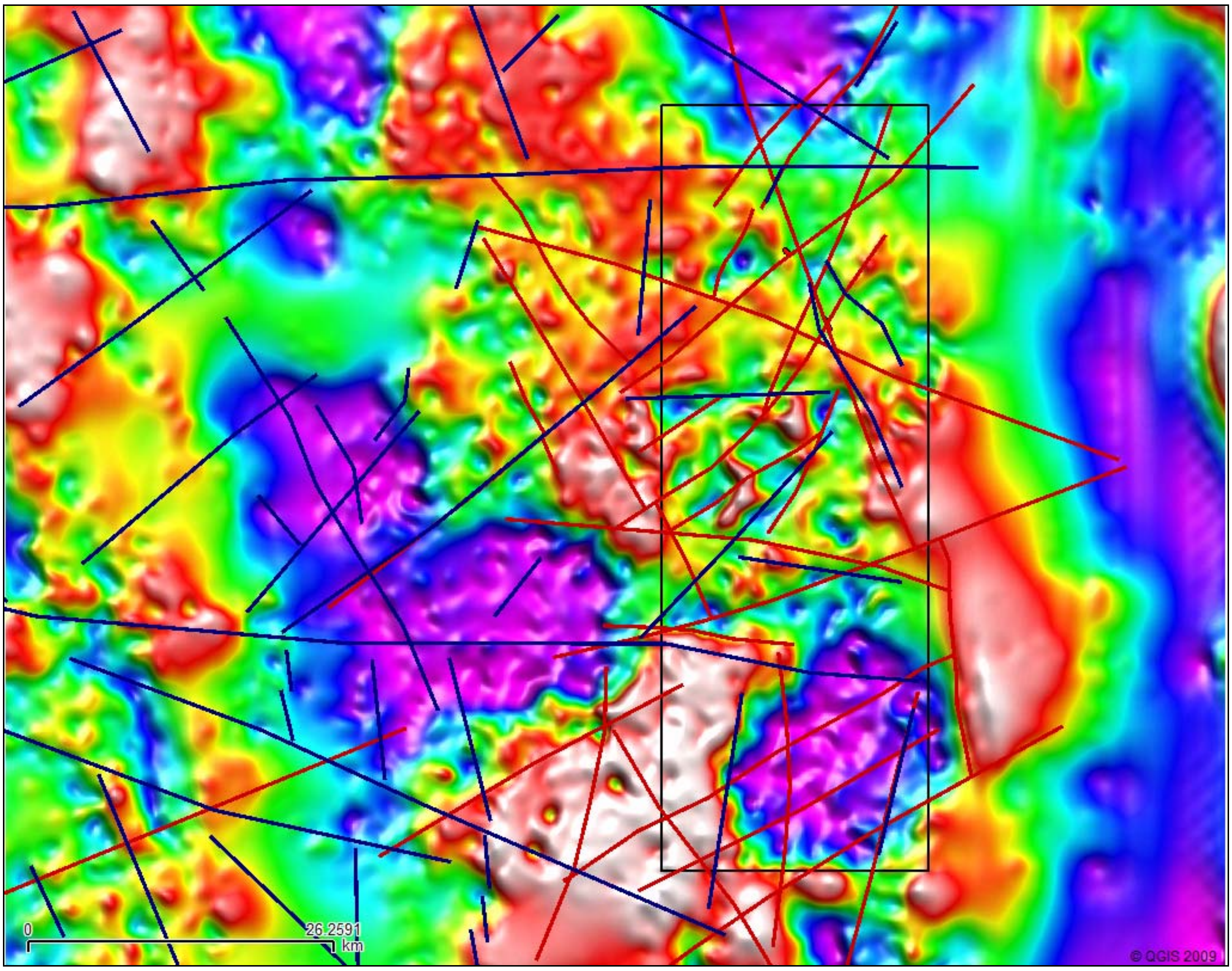


Figure 3-7. Isostatic gravity image in the region of EL582008. Interpreted faults based on interpretation of the potential field geophysical data – red and geomorphology and remote sensing datasets – blue.

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.

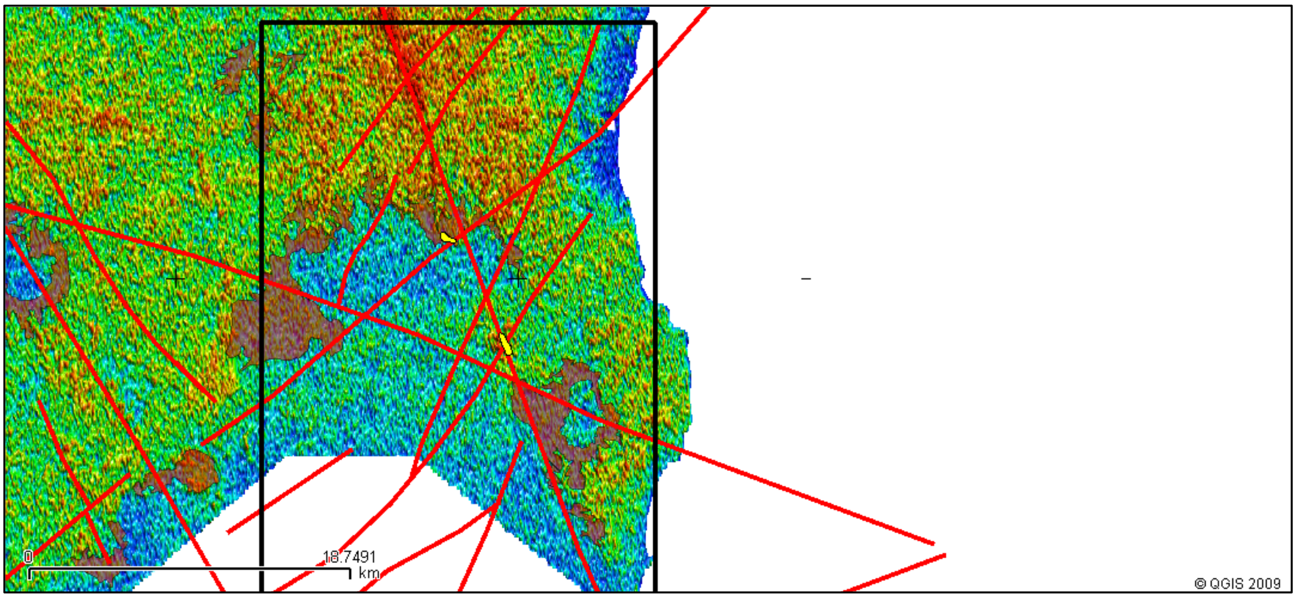


Figure 3-8. Potential targets for soil-gas sampling.

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).

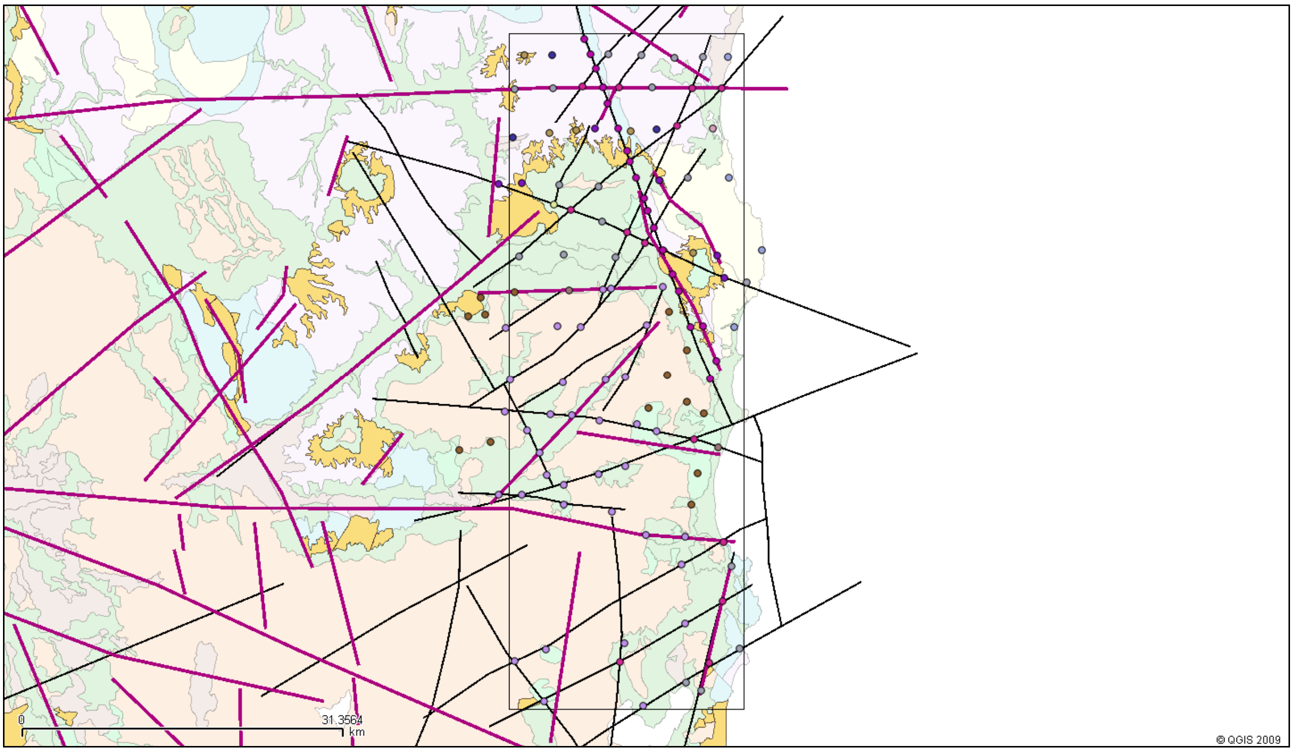


Figure 3-9. Potential soil-gas sample locations.

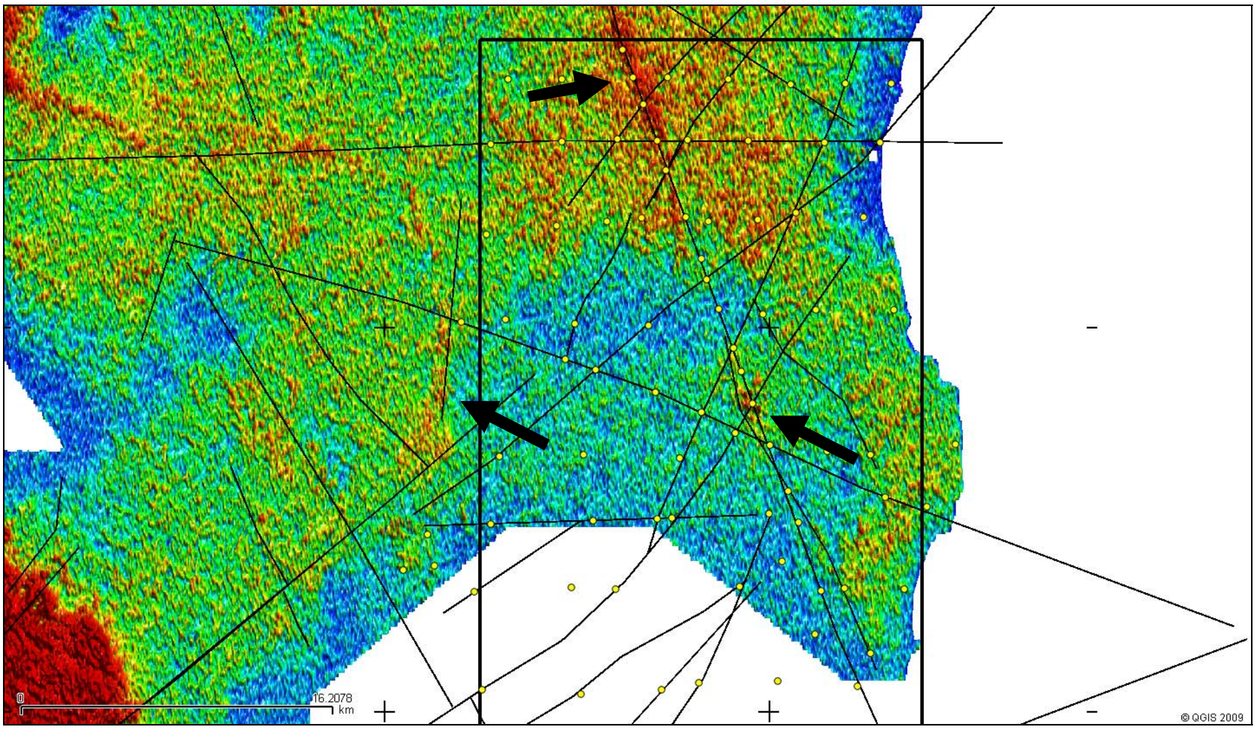


Figure 3-10. Radiometrics (uranium channel) with locations of some potential soil-gas samples indicated. Arrows denote locations of radiometrically anomalous (uranium channel) faults.

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 uncertainities 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.

X	Y	LATITUDE	LONGITUDE	Justification
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)