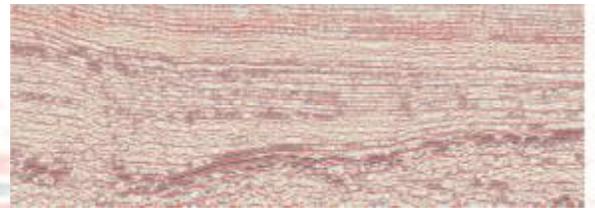


**SEISMIC REPROCESSING INTERPRETATION  
POTENTIAL PROSPECT EVALUATION AND  
TOTAL RESOURCE ESTIMATION REPORT  
OF THE OEHL OIL&GAS EXPLORATION  
LICENCE BLOCK SEL 5/2005**

**prepared by**



**CAPD**

**C-A Petroleum Consulting**

**November, 2012**

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**OIL & GAS EXPLORATION LICENCE BLOCK SEL 5/2005**



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Prepared By

**CAPD Petroleum Consulting Ltd. Şti.**

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**November, 2012 Ankara TURKEY**

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## ABSTRACT

The island of Tasmania is situated off the southeastern coast of Australian continent. Most of the central and eastern part of this island is covered by the Tasmania Sedimentary Basin which is an erosional remnant of a larger shallow intracratonic (epicrotonic) basin, consisting of sedimentary successions deposited in the Late Carboniferous to the Late Triassic and intruded heavily by the mid-Jurassic dolerite rocks. The basin was uplifted and deformed in the Late Cretaceous to the Early Tertiary times. It is also underlain by the deformed Ordovician to Early Devonian sedimentary and much older crystalline basement rocks.

The pre-Carboniferous rocks of the Tasmania Basin have been affected by a mid-Devonian tectonic-orogenic event, called the Tabberabberan Orogeny. The deformed Ordovician to the Early Devonian sedimentary successions are called the Wurawina Supergroup and contain petroleum potential. The relatively flat-lying younger Late Carboniferous to the Late Triassic sedimentary successions are called the Parmeener Supergroup which consist of good source and thick reservoir rocks with extensive coal measures for petroleum generation and presevation. Therefore petroleum prospectivity in the basin could be rewarding. This later sedimentary succession was extensively affected by the Early Tertiary and younger faulting events that are quite prevalent in the seismic sections and observed as structural lineation on the surface throughout the island. This younger faulting event is contemporaneous with petroleum generation and migration in the basin that could provide structural traps for petroleum entrapment and preservation and is good for the petroleum prospectivity in the basin.

OEHL owns 100% interest in the oil and gas exploration license block SEL 5/2005 which covers the potentially petroleum prospective central northern part of the Tasmania Basin, adjoining and bordering the prolific petroleum producing Bass Basin to the North. OEHL has started exploration activities in the licence block with an exploration well named Westwood-1, drilled in the latter part of 2009. In addition, they shot 11 lines of 42.68 kilometres of 2D seismic in various prospective parts of the license block in early 2012. After a local G&G company failed to provide satisfactory results in processing and interpretation of the raw data OEHL asked CAPD Consulting and Engineering to carry out a reprocessing and interpretation of the seismic data.

CAPD carried out the reprocessing and interpretation of the seismic data throughout October and November 2012 and produced a preliminary assessment and estimation of the oil and gas resources. These look quite encouraging and favorable with respect to furthering the exploration activities in the license block.

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## **1. LICENSE BLOCK DESCRIPTION**

The Tasmania Basin is a shallow intracratonic frontier basin which covers around half of the island of Tasmania, a state of the commonwealth of Australia. This basin contains a succession of predominantly flat-lying sedimentary rocks of the Late Carboniferous to Late Triassic age, known as the Parmeener Supergroup. This sedimentary succession has been intruded by thick sheets and sills of mid Jurassic dolerite that currently occupy most of the outcrop area of the basin. The total known thickness of the sedimentary succession, excluding the dolerite thicknesses is around 1.7 kilometres. The Tasmania present basin limits are erosional, not depositional, and the original basin was probably considerably larger. OEHL holds 100% interest in Oil & Gas Exploration License Block SEL 5/2005 which covers the potentially prospective northern portion of the Tasmania Basin (Figure 1). OEHL had drilled an exploration well, named Westwood-1 in the license block in the latter part of 2009, TD'ied at 1679 m. The well did not encounter any hydrocarbons and was plugged and later abandoned.

## **2. GEOLOGICAL CHARACTERISTICS AND REGIONAL SETTING OF TASMANIA BASIN**

### **2.1. Seismic Data**

OEHL has acquired 11 lines (42.68 kilometres) of reflection seismic data across the license block area in early 2012, grouped in four regions, namely Bass Highway, Wesbury, Batman Bridge and Weymouth Road, with one of the lines shot near the Westwood-1 well, drilled in 2009 for the correlation and geological interpretation purposes. The grid of seismic data is somewhat random as it seemed to have been acquired mainly along roadsides (Figure 15). Initial processing and preliminary interpretation of the data were carried out by DownUnder GeoSolutions Terrex Seismic Company in the late summer of 2012.

Nevertheless, because of the poor seismic resolution and insufficient interpretation of the data with respect to mapping potential prospects and identifying drillable location sites, OEHL had asked CAPD Consulting to undertake reprocessing and interpretation of the same data with the purpose of improving seismic resolution and mapping some of the prospective subsurface reflective horizons; so that a number of potential drillable sites could be located and identified. Furthermore, complex surface geological conditions and the presence of high velocity mid Jurassic dolerite rocks had a deteriorating impact on the quality of seismic data acquisition and resolution. CAPD Consulting tried to do its best to improve seismic resolution by calculating static velocities painstakingly and applying a number of near surface models to suppress near surface noise; so that the potential reflective horizons could be interpreted, correlated and mapped properly. An appreciable amount of success was achieved in improving seismic resolution after reprocessing the seismic data.

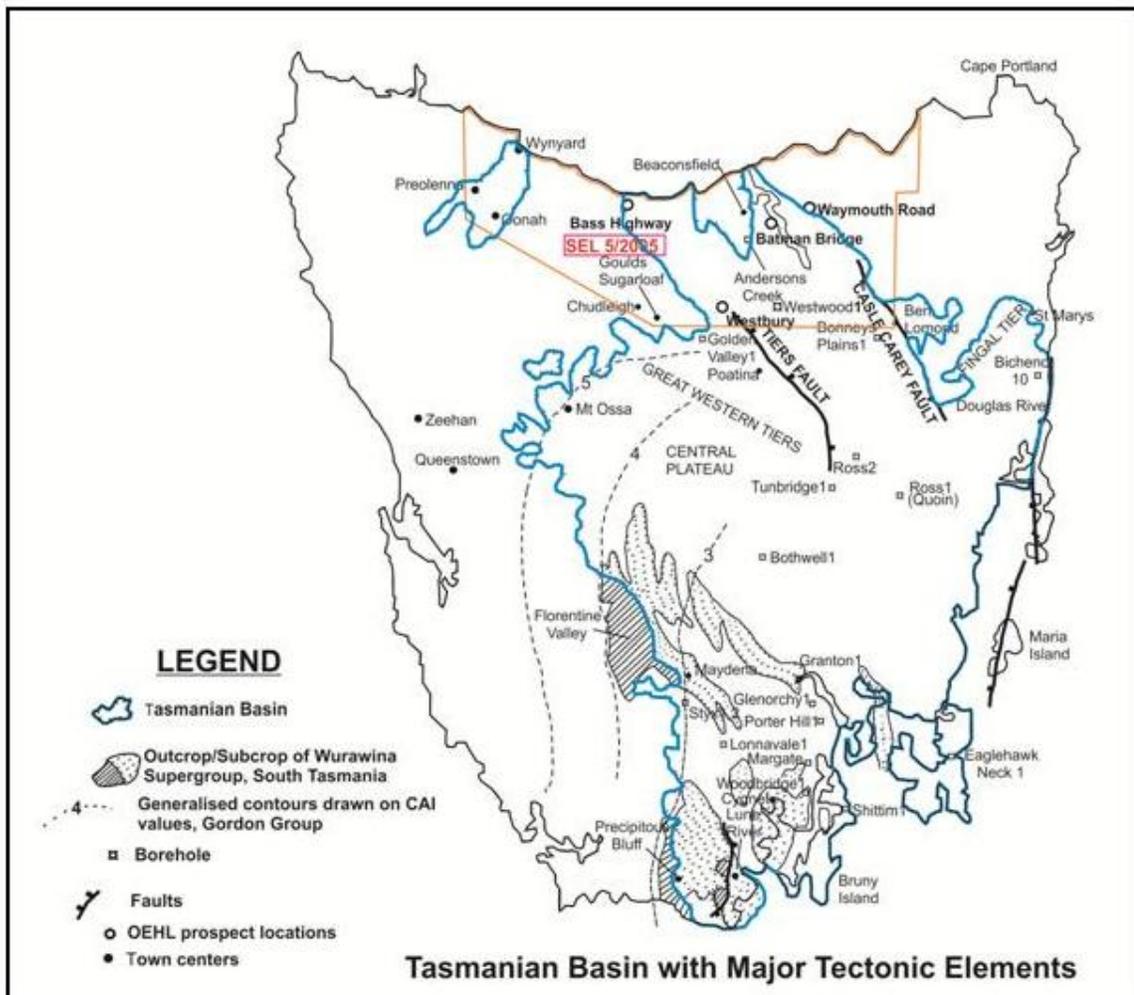


Figure 1. The intracratonic Tasmania Basin map, showing the outlines of the Late Carboniferous to Late Triassic Tasmania sedimentary basin and distribution of pre-Carboniferous successions with OEHL License Block SEL 5/2005 plotted.

## 2.2. Reprocessing of Seismic Data

This report includes processing of approximately 42.68 km of onshore 2D seismic data shot within the OEHL license block SEL 5/2005 located in north central Tasmania. This reprocessing project covers 11 lines which were acquired by Terex Seismic on behalf of Overseas Energy Holdings Limited (OEHL) between 27 January, 2012 and 3 February, 2012. The seismic data reprocessing work was carried out by the CAPD Data Processing Office.

### 2.2.1. Objectives

The main objectives of the project were:

1. To reprocess recently collected 2D seismic data by improving signal to noise ratio.
2. To achieve seismic data resolution.
3. To apply processing techniques that will lead to better imaging of the areas.

## Devonport Onshore 2D Seismic Acquisition Parameters

Licence Number	: SEL 5/2005
Survey Location	: Devonport, Tasmania
Survey crew	: Terrex Seismic Crew 407
Source Type	: Vibroseis
Record Length	: 6 seconds
Sample interval	: 2 ms
Acquisition Filter applied	: 0.8 linear Phase
Number of source	: 3 Vib inline. Vib control Ve 464
Sweep length	: 6 Seconds
Sweep	: Linear 8-96 Hz. 0.200 start and end tapers
Source array	: 3 vibes in line, 12.5m pad to pad, centered on half station
Geophone array	: 12 phones over 20 m, geophone spacing 1.65 m
Station Interval	: 20 m
Shot interval	: 20 m
Number of channels	: 300 live channel
Record system	: Sercel 428XL – 24 bit system
Tape format	: SEGD

### 2.2.2. Format Conversion

SEGY is an input program designed to transcribe seismic data in SEGY format into internal-format traces that can be processed in Disco or Focus.

### 2.2.3. Geometry Construction

The SPS data or related paper documents were processed in the field and forwarded to the processing centre where it was used to update seismic trace headers with geometry information.

### 2.2.4. Crooked Line

Crooked Line geometry assignment gives a truer picture of the subsurface than other geometry packages because it takes into account the angular relationships between the shots and their receivers. Crooked Line program generates a CDP path, or line, through source-to-midpoint locations established by crooked line seismic acquisition. It determines the CDP path automatically by performing a continuous least-square analysis through a radius of midpoint locations. The newly

generated line determines which traces will be assigned to CDP bins during trace sorting process (Figure 2 and Figure 3).

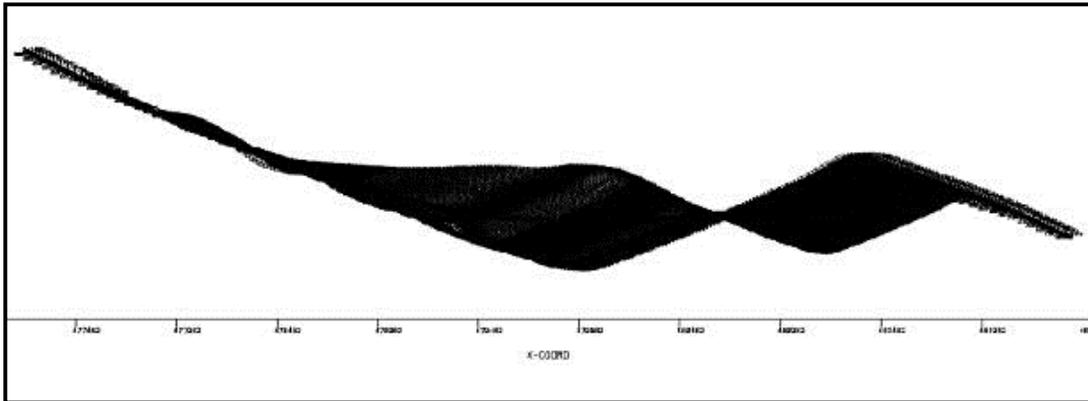


Figure 2. CDP distribution of Line OE12D-04.

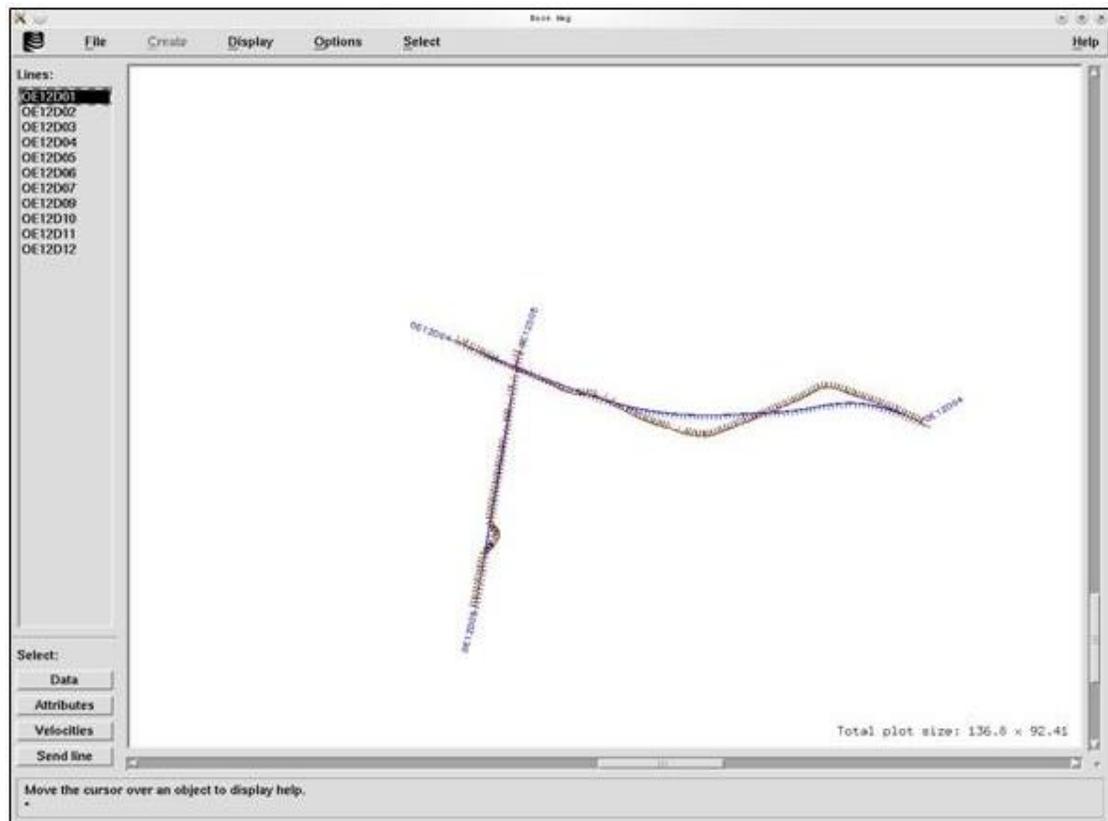


Figure 3. Red line is receiver Line, Blue line is CDP Line after crooked line processing.

### **2.2.5. Trace Editing**

Bad shots and traces edited manually in EDIT, however, BALAPP was also used to edit noisy traces.

### **2.2.6. Linear Noise Elimination**

Low Frequency Array Filtering attenuates surface-wave noise via low frequency array forming. Given the surface velocity and a low frequency band, the algorithm first transforms the data from the time-space domain to the frequency-space domain. Next, each frequency component is convoluted with a boxcar function, which is the appropriate calculated array to cancel the shot generated noise train with the specified velocity. Frequency components outside the specified frequency band remain unchanged. The data are returned to the time-space domain.

### **2.2.7. Spherical Divergence Correction**

The module GAIN provides a method of balancing seismic trace amplitude by applying a time-variant exponential or linear scalar to a set of data. The spherical divergence correction is applied uniformly to all traces after removing linear noise.

### **2.2.8. Spiking Deconvolution**

Deconvolution designs and applies deconvolution filter to seismic traces. Spiking decon operators were designed from auto-correlations of windows within the trace and were applied on a trace-by-trace basis. 'Analyse Window Start' times were used to control the location of the design windows so that high amplitude and, first-break energy was excluded from the design.

### **2.2.9. Band-Pass Filter and AGC**

A BP filter and AGC applied after deconvolution. A band-pass filter was described by low-cut and high-cut frequencies and associated dB/octave cut-off slopes.

### **2.2.10. First Break Picking and Refraction Statics**

First Break picking estimates first arrival times for subsequent refraction statics computation. The program determines first arrival times using a neural network learning algorithm and procedure. The training and testing of neural network is performed interactively. FB pick quality of the data was very low because of contaminated first break by surface noises. Statics corrections are designed to remove the effect(s) of the weathered layer(s) from seismic sections. These corrections are based on the assumption of a nearly vertical travel path through the weathered layer(s). This further implies that all energy either emitted or received at a given surface location will experience the same weathering induced perturbation (surface consistency). The Refraction Statics Program Computation builds a refractor model and computes refractor statics. The input to this 2D process is a database containing geometry information and refraction pick times.

Refraction static program reads database first arrivals generated by First Break pick program. Refraction static program retrieves these first breaks from the Focus database along with the necessary geometry information and calculates shot and receiver statics. Single refractor is used to calculate statics in this project (Figure 4).

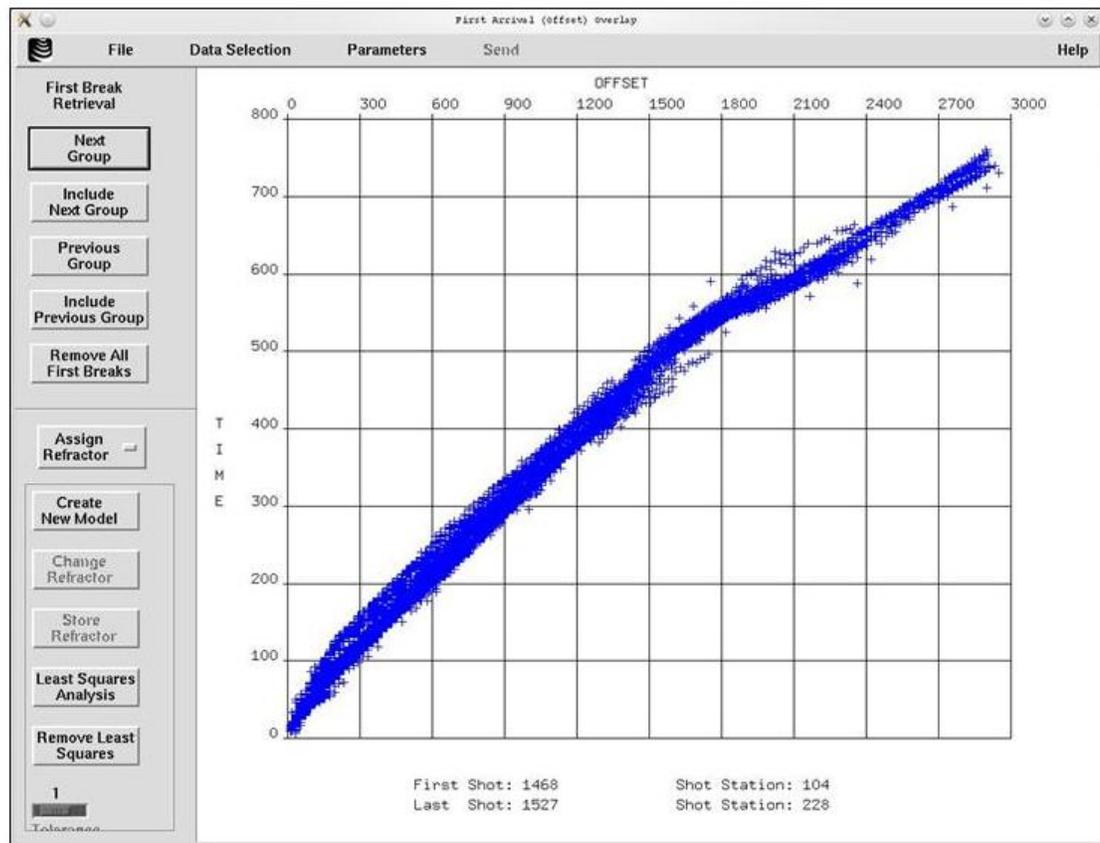


Figure 4. First breaks pick values for the line OE12D-04

### 2.2.11. Sort

Data sorted to CDP gathers after pre-stack processing and statics applied prior to velocity analysis and normal move-out corrections. Prior to application static values have been written to the trace headers. These statics are computed from shot and receiver refraction statics values stored in the trace headers and, applied.

### 2.2.12. Preliminary Velocity Analysis

Velocity analysis was performed using Disco Focus module VELDEF at every 50 cdp (500 m.) At regular intervals across the survey CMP gather data were selected. From the velocity stack and velocity, semblance values were computed. For each velocity location, stacked data, semblances and gathers are displayed interactively allowing stacking velocities to be interpreted.

VELDEF performs contoured coherence-type velocity computations. It allows the user to graphically specify velocity functions at each cdp. The picked velocities are stored in the current job file and in the seismic database as time-velocity pairs. The file in the database that contains a velocity function can subsequently be accessed. By other programs, which use the velocity function for such processing tasks as applying normal move out corrections to seismic data.

Velocity stacks and NMO-corrected gathers are then produced to check the validity of the picks and any necessary changes made before the velocity field is output (Velocity field display of the test line after preliminary velocity analysis is given in Figure 5).



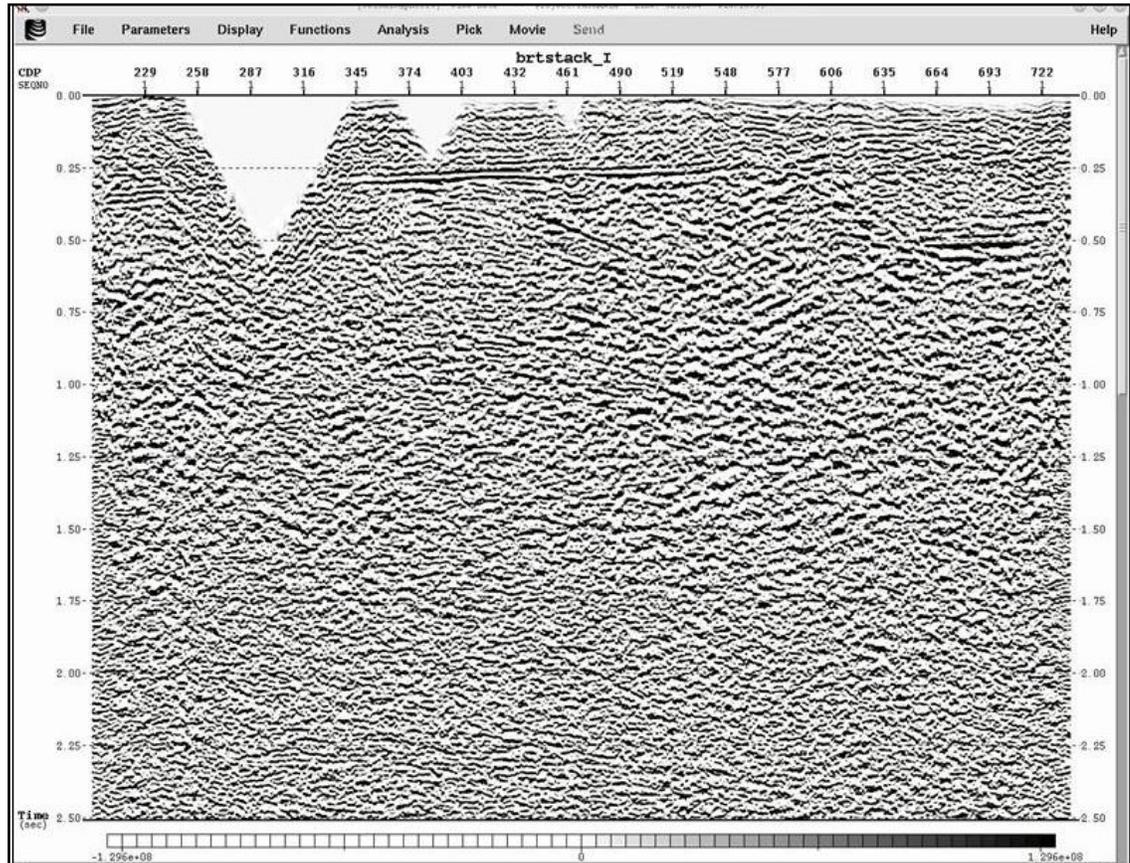


Figure 6. Display of the brute stack-1.

### 2.2.15. Surface-Consistent Residual Static Computation

The key assumption is that residual statics are surface consistent. This means that static shifts are time delays that solely depend on source or receiver locations at the surface not on ray paths in the subsurface. This assumption is valid if all ray paths regardless of source-receiver offset, are vertical in the near surface layering. Since the weathered layer usually has quite a low velocity and refraction at its base, which tends to make travel paths vertical. The assumption may not be good for high-velocity layer that causes rays to bend away from vertical (Figure 7).

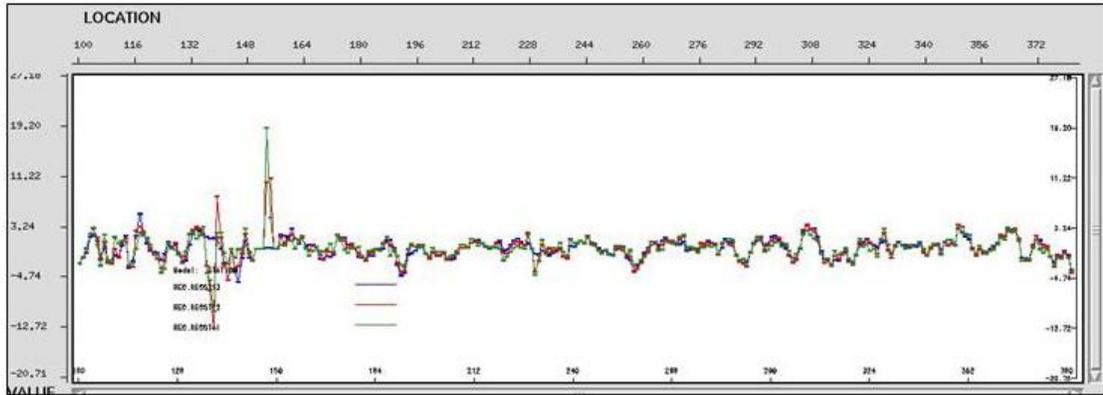


Figure 7. Receiver residual statics values 1, 2, 3 iterations.

Surface consistent reflection residual statics were calculated from pre-processed CDP gathers. The process is split into two phases – first, picks the time shifts for each prestack trace and the second computes surface consistent statics from these picks.

The field statics values in the trace headers were updated running static program and stored in the header and applied during NMO correction to the data. Correlation shift parameter picked as 16 ms for processing.

#### 2.2.16. Residual Static-1, NMO-1, 2nd Brute Stack

Subsequent to the first residual statics, NMO and mute applications and, stack have been performed to generate 2<sup>nd</sup> brute stack (Figure 8).

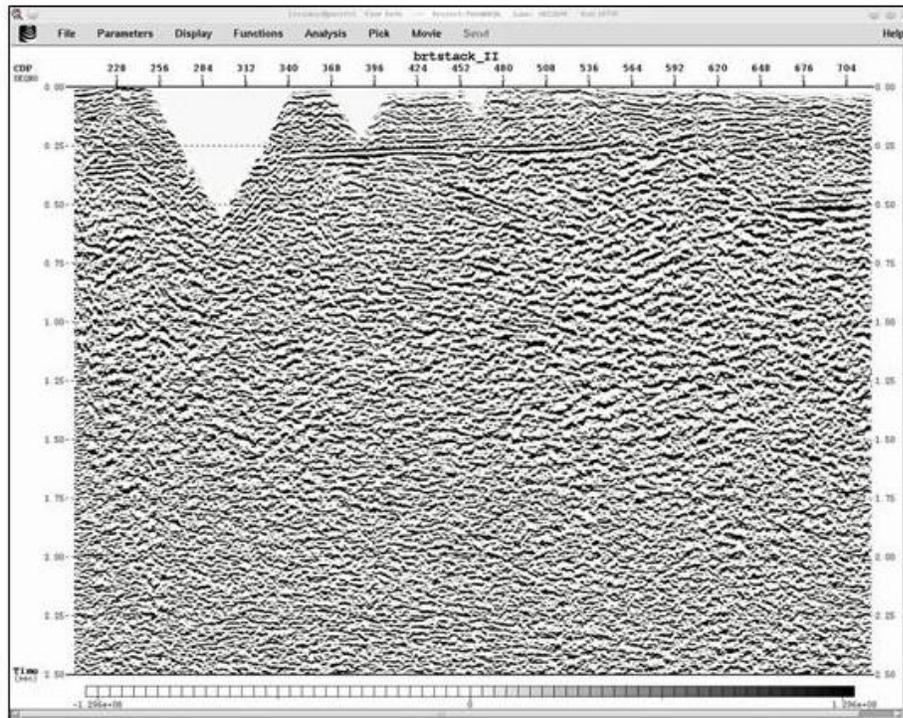


Figure 8. Brute stack-2 after residual statics correction.

## 2.2.17. Velocity Analysis-II

After updating the static values on trace headers with the first residual statics values velocity analysis was performed second time by running velocity picking module VELDEF (Figure 9).

Parameter values:

Analysis spacing : 500 m

Number of CMPs per analysis point : 25 cdp

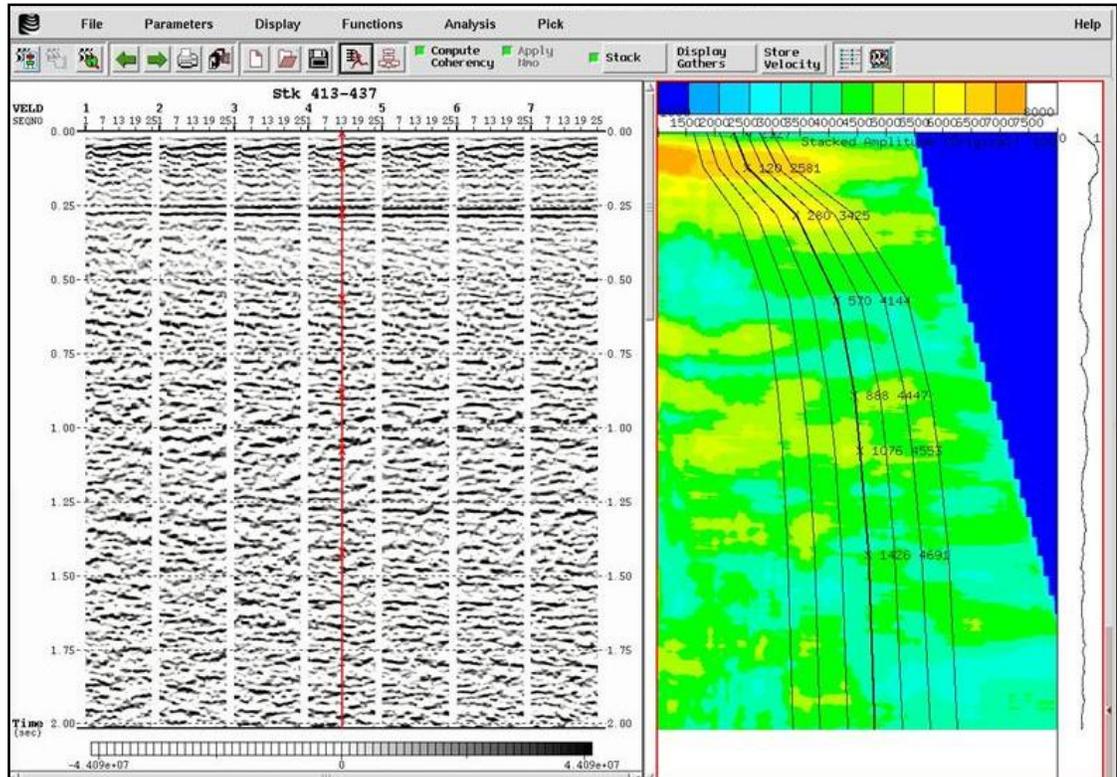


Figure 9. VELDEF-2 displays. Second velocity after residual statics application stacks and semblances.

## 2.2.18. Application of the Residual Statics-1, NMO-II, Mute, 3rd Brute Stack

The 3<sup>rd</sup> brute stack has been generated by computing and application of the first residual statics and NMO-II, mute and stack.

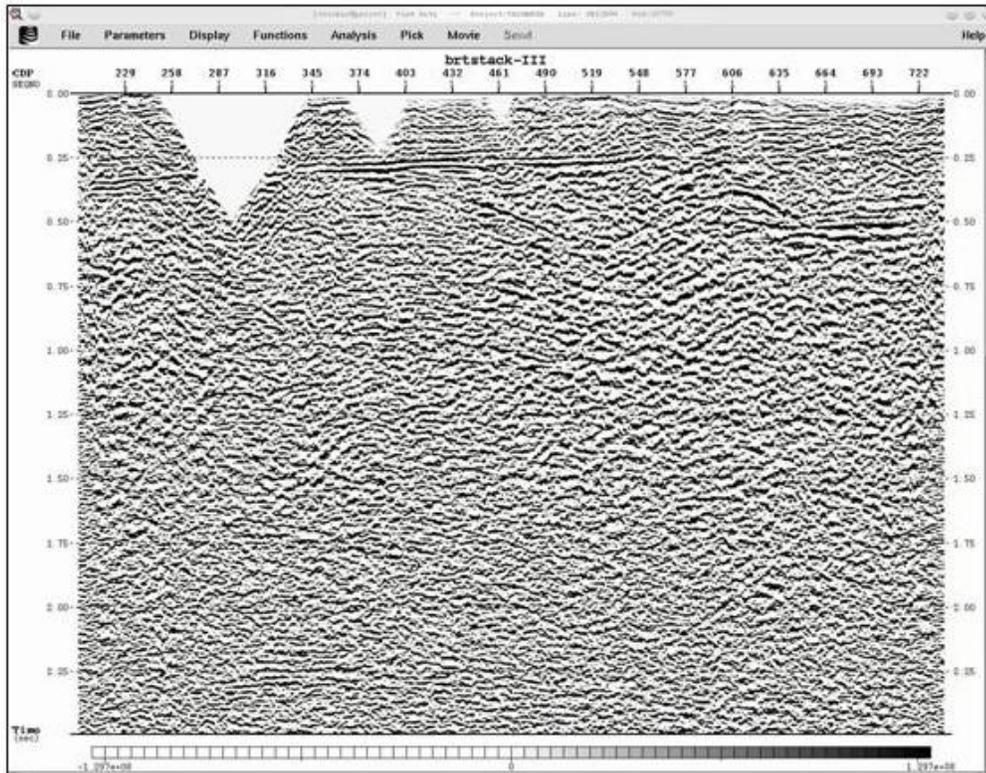


Figure 10. Brute stack-3 after first residual statics and NMO with second velocities.

### 2.2.19. Surface-Consistent residual Statics Computation-II

Updating statics with residual statics-I and picking velocities with new updated statics, Surface consistent residual static have been performed a second time. In the second run 12 ms correlation shift were chosen. After residual statics-II these static values were updated a second time and stored in the header and applied during NMO correction with second velocities to the data and stacked. Figure 11 shows 2<sup>nd</sup> residual statics values with three iterations.

Brut Stack-4 was generated after applying residual static-I, residual static-II and NMO-II as shown in Figure 12.

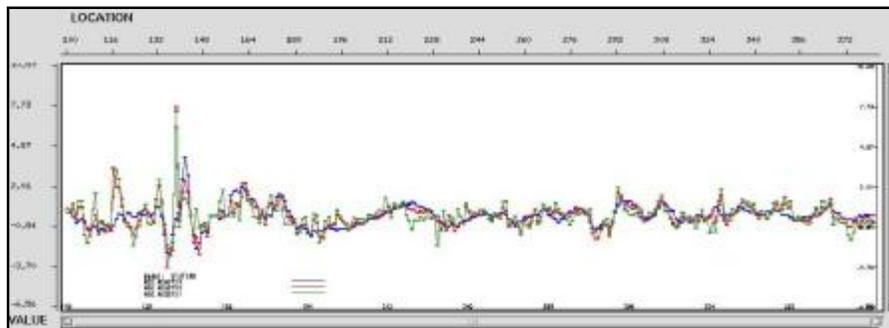


Figure 11. 2<sup>nd</sup> receiver residuals statics values after application of the first residual statics values.

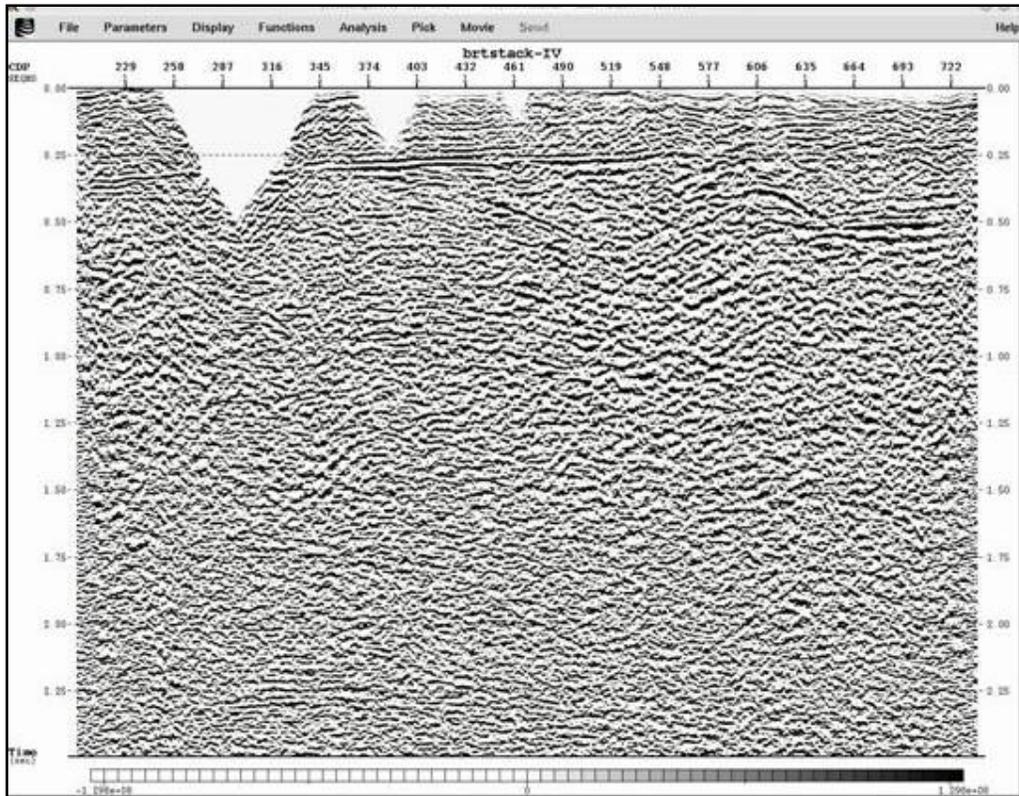


Figure 12. Brut Stack-4 presentation.

#### 2.2.20. Post-Stack processing, Final-stack and FK-Migration

A zero-phase Time Variant Butterworth filter was applied to the data. The filter pass bands were described by low- and high-cut frequencies and associated dB/octave cut-off slopes.

#### 2.2.21. AGC

AGC performs time-variant automatic trace scaling. The program computes the average seismic trace amplitude within a sliding window. AGC outputs traces with all the major time -variant amplitude changes removed.

#### 2.2.22. FK Power

The Function of FK POWER is to enhance the signal to noise ratio in seismic data. TVF, AGC, and FK power applied to the data after brute stack-IV to generate final stack in order to have noise free sections. Figure 13 shows final stack presentation.

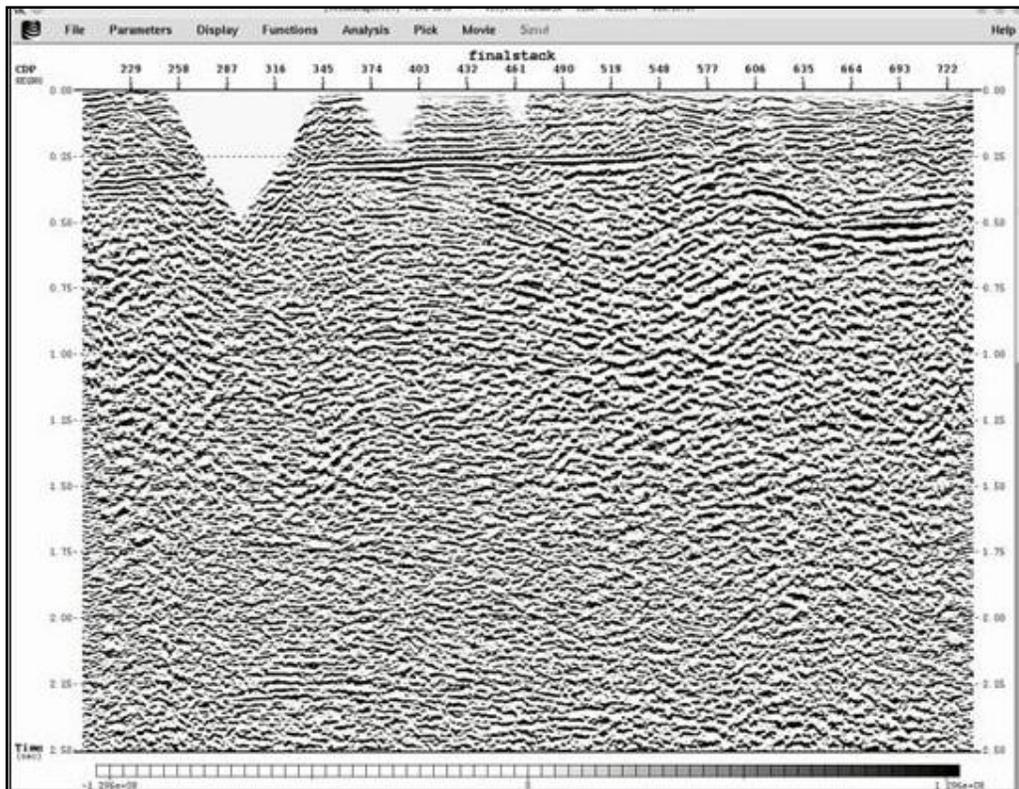


Figure 13. Final Stack presentation.

### 2.2.23. Poststack F-K Migration

FK Stolt Migration is applied to data after stack. The algorithm used to perform F-K Migration was described by Stolt (1978). The stacking or rms velocity function input by the user is converted into interval velocities using the Dix equation. An FK migration operator is applied to the data for each interval velocity layer defined. Time-Variant BP filter, AGC and Fk power signal enhancement applied to data after Migration. Figure 14 shows this type of application.

## CONCLUSION

The main purposes of the processing were to eliminate coherent noise and, to increase S/N ratio. Basic problem in processing was Ground Roll noise, Noisy First Breaks and very high surface velocity which effects the surface consistent residual statics calculation. During the processing, velocity field was improved 2 times before and after applying residual statics.

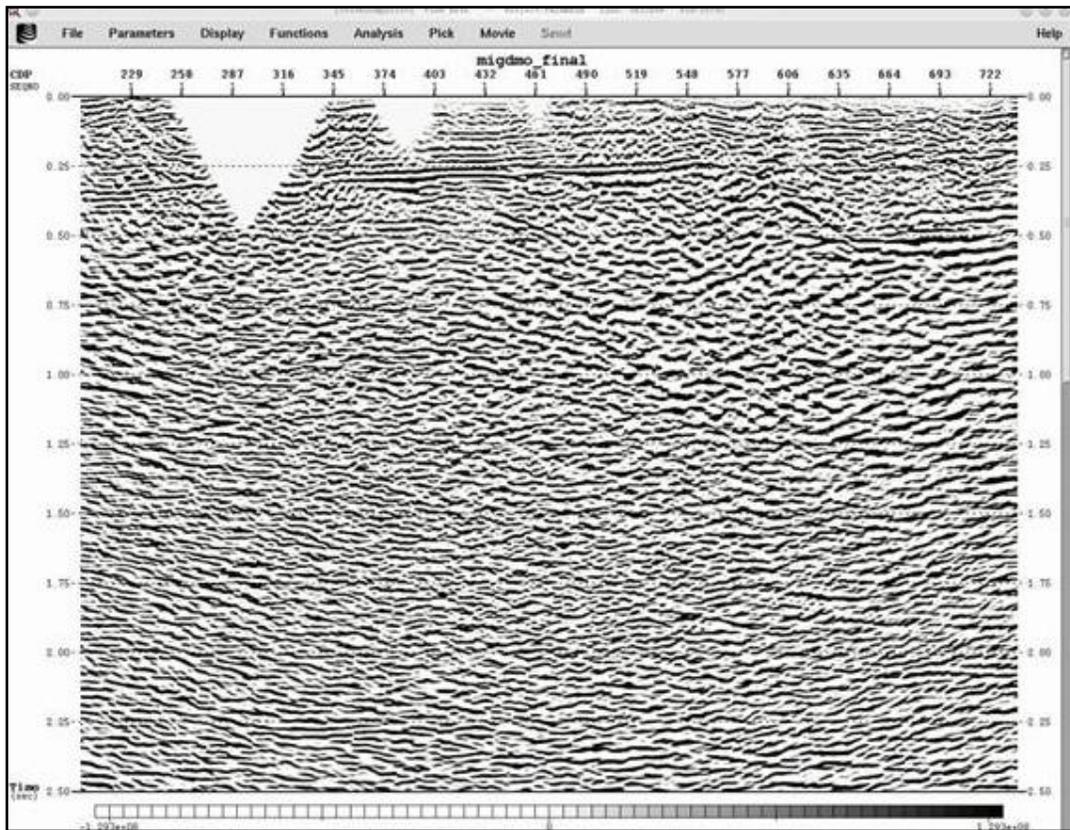


Figure 14. FK Stolt Migration presentation.

### 2.3. Geological and tectonic Setting

The island of Tasmania is situated off the southeastern coast of Australian continent. About half of the island is covered by the erosional remnants of a shallow intracratonic (epicratonic) basin, consisting of sedimentary successions deposited in the Late Carboniferous to the Late Triassic and intruded extensively by the mid Jurassic dolerite magmatic rocks and heavily faulted in the Early Tertiary (Figure 16). This basin is underlain by deformed Devonian and older sedimentary and crystalline basement rocks, which also comprise most of the remaining surface area of Tasmania.

The Tasmania Basin basement rocks are comprised of a diverse and structurally complex array of Proterozoic and lower Paleozoic rocks. The basement rocks have been affected by a mid-Devonian tectono-metamorphic event correlated with the Tabberabberan Orogeny. Part of the basement complex of Tasmania Basin consists of a Late Cambrian to Early Devonian age Wurawina Supergroup sediments with petroleum potential. The stratigraphy of the Tasmania Basin is known mainly from outcrop and the stratigraphic diamond boreholes (Figure 16). The sediments of the basin are separated into two major supergroups: 1. The Wurawina Supergroup of the Early Paleozoic (Late Cambrian to Early Devonian age) and, 2. The Parmeener Supergroup of the Late Paleozoic to Early Mesozoic (Late Carboniferous to Late Triassic) age.

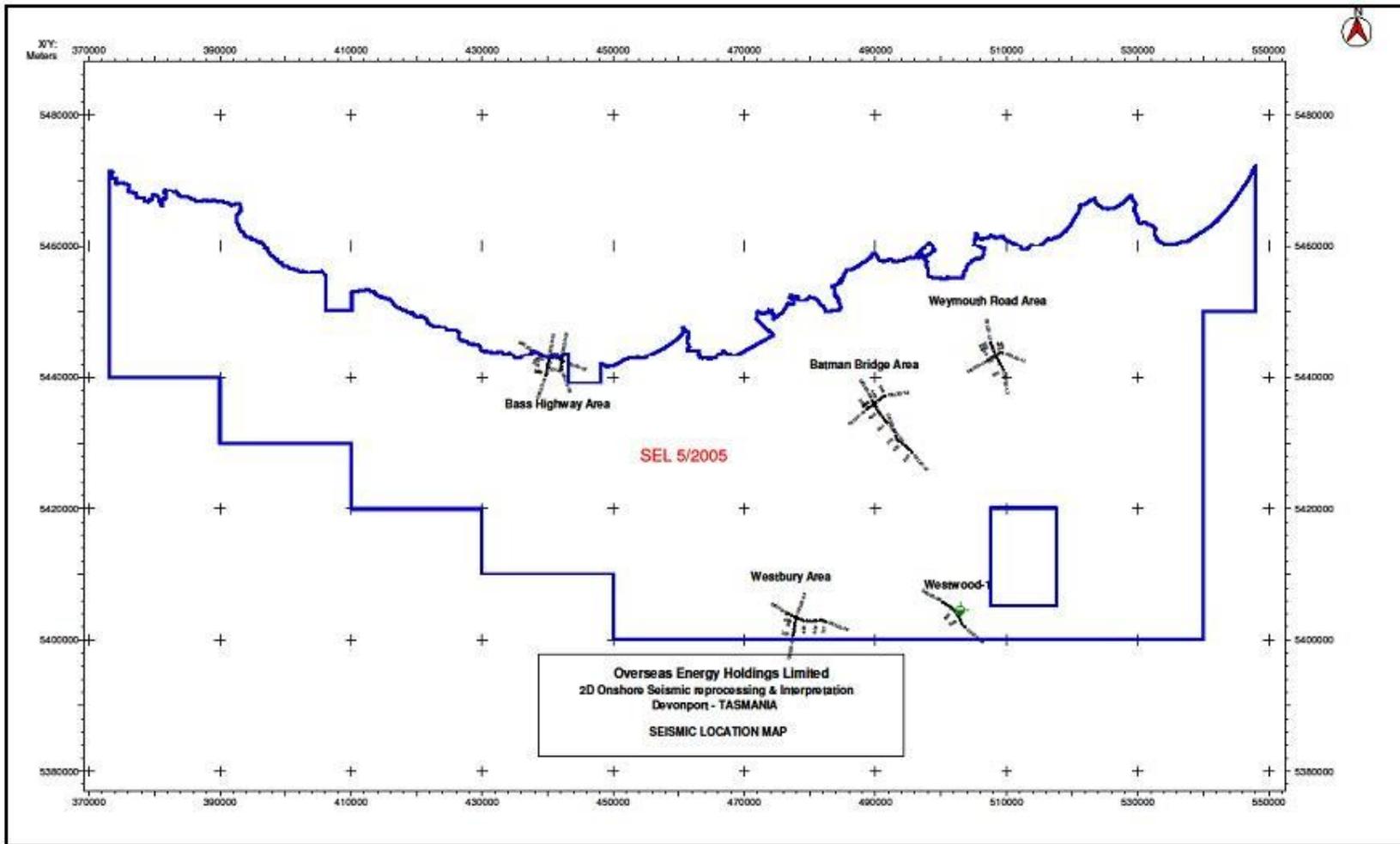


Figure 15. Seismic location map, showing OEHL 2D seismic lines, shot in 2012 and potential prospective areas



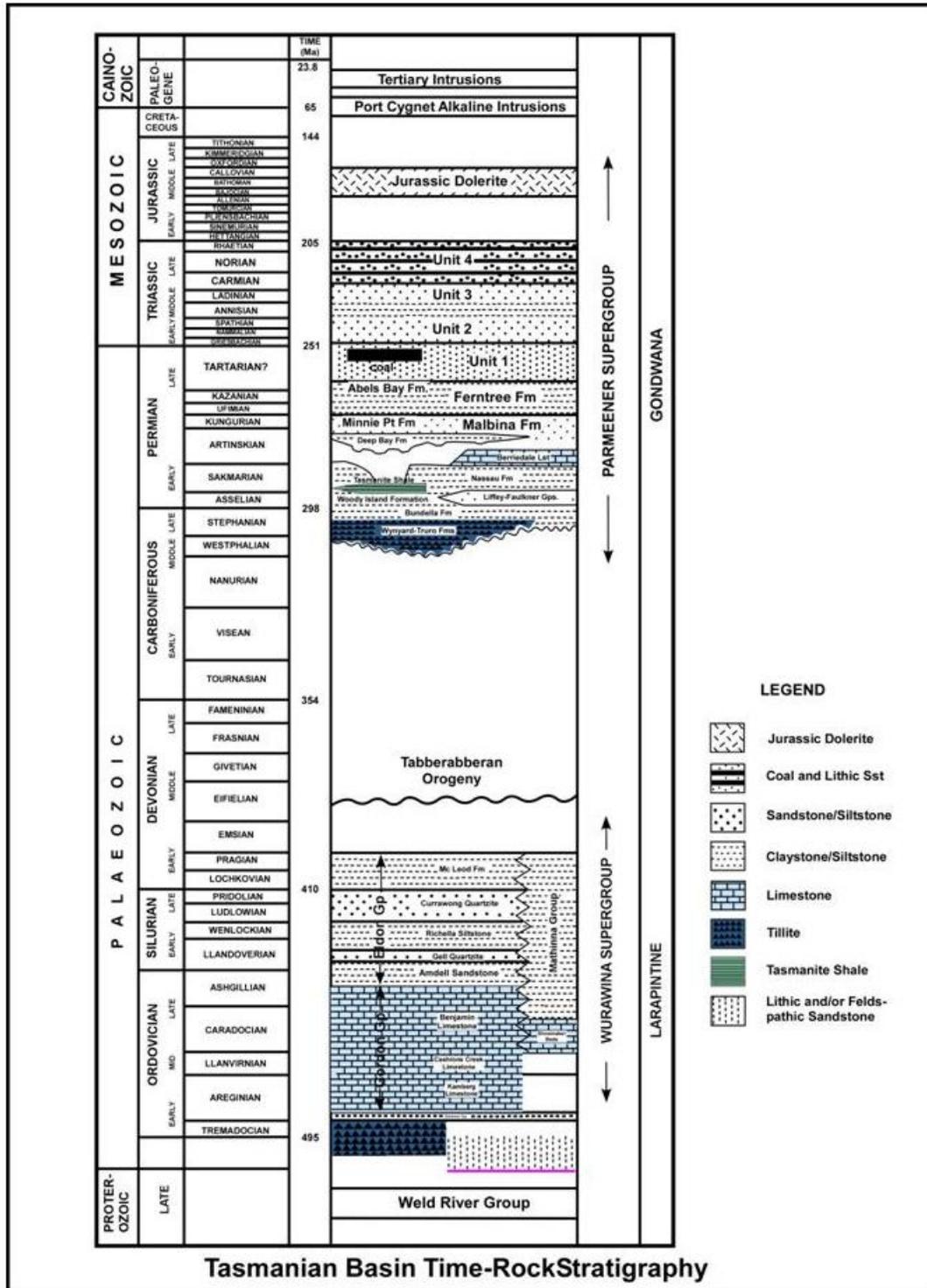


Figure 17. Tasmania Basin time-rock stratigraphy, showing vertical time-rock relationships.

A regional conodont alteration index (CAI) study of the Gordon Group carbonates shows that these rocks are mature for hydrocarbon generation in southern Tasmania (CAI typically between 1.5 and 4). By contrast, the rocks are overmature in western and northern Tasmania (CAI being mainly 5) (Figure 1).

Maturation is likely to have been brought about by high heat flow during the Tabberabberan Orogeny during which gentle to moderate folding affected the Wurawina Supergroup in southern Tasmania. In western Tasmania, the Gordon Group limestone appears to have been subjected to deeper burial, indicating an overburden of 5 km of Eldon Group of sediments is preserved in the deepest synclinoria and Devonian deformation was more intense.

The Tasmania Basin itself is a shallow intracratonic –epicratonic basin which contains a sedimentary sequence of predominantly flat – lying strata, accumulated in the Late Carboniferous to the Late Triassic and known as the Parmeener Supergroup. This sedimentary sequence has been intruded by thick sheets and sills of Jurassic dolerite that currently occupy most of the outcrop area of the basin. The total known thickness of the sequence, excluding the dolerite thickness is about 1.7 km. The Tasmania Basin covers most of the central and eastern Tasmania (Figure 1 and Figure 16). The present basin limits are erosional, not depositional, and the original basin limits were probably considerably larger than the present outline.

The provincialism of the cold-climate Gondwanan biotas hinders precise correlation with the international biozonations. However, correlation within Tasmania is well established, with a detailed local biostratigraphic framework based on marine microinvertebrates in the Lower Parmeener Supergroup.

The Lower Parmeener Supergroup of upper Carboniferous to Upper Permian age, consists largely of glaciogene and shallow-water glaciomarine rocks, resting on a landscape unconformity with a relief of about 1000 metres. In many areas the sequence begins with a unit of tillite, diamictite and rhythmic claystone that reaches a thickness of over 500 m near Wynyard (the Wynyard Tillite) and over 580 m at Cygnet (the Truro Tillite (Figure 16 and Figure 17).

The basal glaciogene rocks are succeeded by a unit of carbonaceous, pyritic mudstone up to 250 m thick, known as the Woody Island Siltstone in southern Tasmania and the Quamby Mudstone in the north (Figure 18). Just above the base of this unit, 'tasmanite' up to about two metres thick is locally present in northern Tasmania. 'The Tasmanite' is the rock name for an oil shale, consisting of a high proportion of the probable green alga Tasmanites punctatus. The Woody Island Siltstone and correlates, including the 'tasmanite' are the main potential source rocks within the Tasmania Basin (Figure 17 and Figure 18). The Woody Island Siltstone and correlates pass up into richly fossiliferous siltstone, sandstone and minor limestone (the Bundella Formation and correlates, including the golden Valley Group in the north). Ice-rafted dropstones are common in these rocks. This succession is nearly everywhere succeeded by a thin (20 – 40 m thick) unit of fluvial to paralic origin (the Lower Freshwater Sequence, also known locally as the Liffey Group, the Faulkner Group or the Mersey Coal Measures). Well-sorted, cross-bedded quartzarenite is characteristic, but siltstone and carbonaceous mudstone is dominant in the southeast near what is inferred to have been the seaward margin of the coastal plain. A thin marine intercalation is present in the southeast and central Tasmania. Lateral equivalents of the Lower Freshwater Sequence are wholly marine in the far southeast. Thin coal seams, aggregating just over one metre are present in the north, northwest and northeast, around the landward margin of the Tasmania Basin.

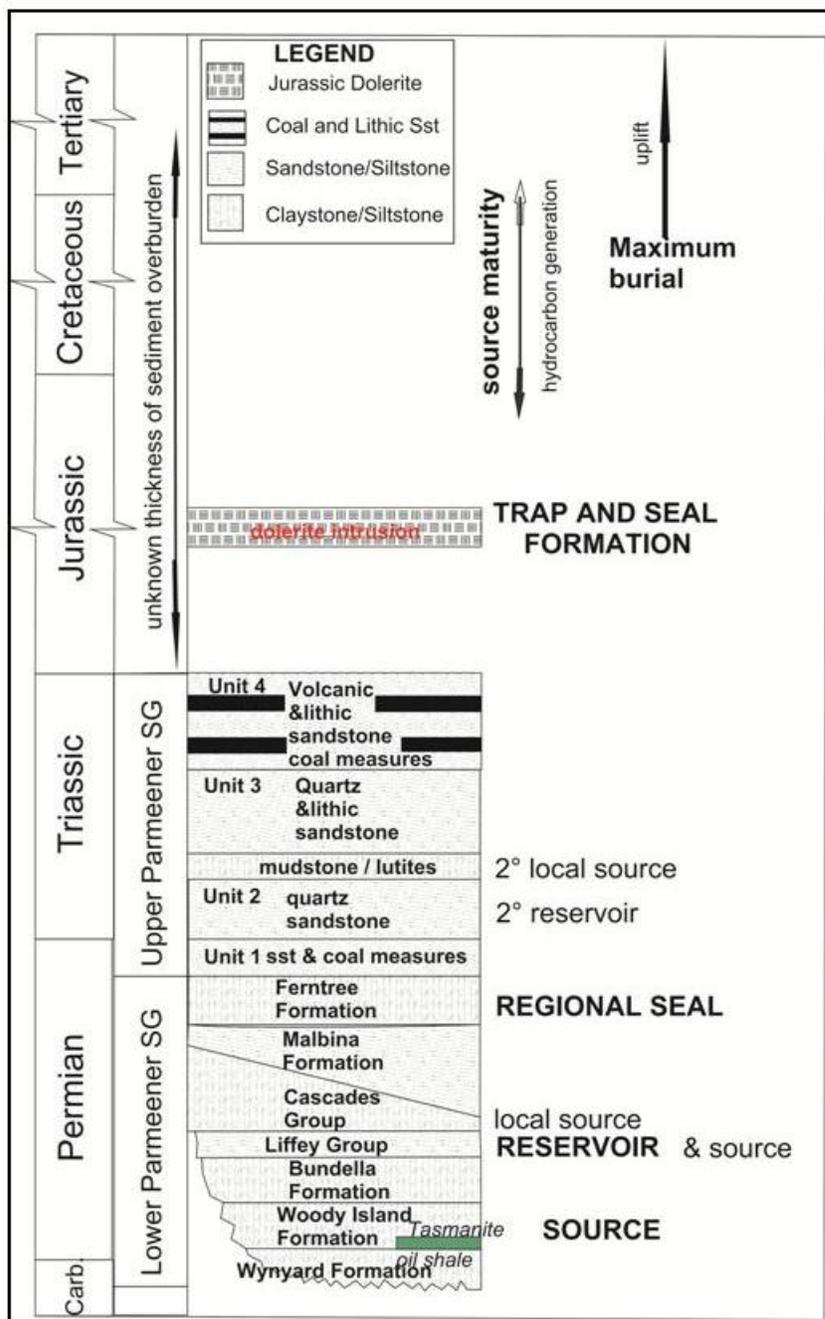


Figure 18. Time-rock stratigraphic model of Parmeener Supergroup of rocks and mid-Jurassic dolerite, with source and reservoir rocks shown.

In the southeast and eastern Tasmania, the Lower Freshwater Sequence is succeeded by marine calcareous siltstone (Nassau Formation and correlates), then bioclastic (bryozoa – crinoid) limestone (Berriedale Limestone and correlates), which together comprise the Cascades Group, roughly 100 m in thickness. Rocks of this age (mid to Late Bernacchian-Early late Permian) are absent from most of the

northern and western Tasmania, which were probably emergent at this time. Presence of minor tuffs in the Cascades Group indicates contemporaneous volcanism during deposition (Figure 17 and Figure 18).

Uplift in southern Tasmania resulted in local erosion down to the level of the Bundella Formation, and a more widespread disconformity at the top of the Berriedale Limestone, before renewed marine sedimentation of the Early upper Permian time. These rocks, the Malbina Formation, Deep Bay Formation and their correlates are dominantly fossiliferous siltstone and poorly sorted sandstone in which ice-rafted limestones are common (Figure 17). Thicknesses reach a maximum of 180m along the long axis of the basin, but thin rapidly to the west and northeast, the latter area being marked by condensed shallow water glauconite sandstone in places only a few metres thick.

The upper Permian in the basin is represented by the uppermost Malbina Formation and the Ferntree Formation and its correlates, including the Abels Bay Formation. These sequences are characterized by a predominance of bioturbated, unfossiliferous siltstone of probable brackish-estuarine environment, and minor fossiliferous intervals representing brief-fully marine incursions in the southeast. Invertebrate affinities suggest a Kazanian-upper Permian age.

There are two or more thin, a few metres thick, coarse grained units probably representing brief regressions (Risdon Sandstone and Blackwood Conglomerates). This succession is thickest (180 metres) in the southeast and thins to the northeast and northwest. At the top of this succession in many areas, there is a transition over several metres into the Upper Parmeener Supergroup, although there is commonly an erosional disconformity at the base of the Upper Parmeener Supergroup.

Units viewed as potential reservoirs in the Lower Parmeener Supergroup include the Lower Freshwater Sequence, various marine sandstone units, and Berriedale Limestone.

The Upper Parmeener Supergroup, a nonmarine sequence of Late Permian to Late Triassic age, has been divided into four lithological units. Unit 1 corresponds to the Late Permian Cygnet Coal Measures and its correlates. This unit consists of well-sorted, cross-bedded sandstone, feldspathic in southern Tasmania, but tending to be more quartz-rich and micaceous in the north, and carbonaceous siltstone and mudstone. Thin coal seams are present in the far southeast (Cygnet-Bruny Island) and in the northwest (Mt Ossa). The unit is thickest in the west (108 metres thick) and in most other areas is around 50 metres thick, but wedges out to the northeast, at least partly, because of erosion prior to the deposition of Unit 2.

Unit 2 is 200-300m thick, but is thinner in the northeast. This unit consists predominantly of well-sorted quartzarenite, with a widespread lutite-dominated interval, 20 – 60 m thick, at the top of Unit 2, and 35 m of lutite in the middle of the unit at Hobart. Conglomeratic horizons are common in the northwest. The sequence was deposited from low sinuosity rivers flowing east or southeast. The unit is widely distributed and may have originally extended across western Tasmania, but wedges out against high basement in the northeast. A microflora near the middle of the unit is assigned a lower Triassic age (Griesbachian to mid-Smithian (Figure 18).

Unit 3 begins with a quartzitic conglomerate, which is pebbly in places and around 5 m thick, overlain by interbedded quartz sandstone, lithic sandstone and lutite. Then follows an interval, about 80 m thick in the southern Midlands, of interbedded lithic sandstone and lutite. Lithic grains are mostly of fine-grained felsic volcanic type. Unit 3 ends with an interval, 100m thick in the Midlands, but thinner elsewhere of quartz sandstone interbedded with lutite and minor lithic and

feldspathic sandstone. Thin coal seams are locally present. In far eastern Tasmania, this uppermost interval overlaps all the older units of the Upper Parmeener Supergroup to rest directly on eroded Lower Parmeener Supergroup and basalt flows are present locally. Microflora indicate a Middle Triassic (Anisian to Ladinian) age for the Unit 3.

Unit 4 is predominantly lithic sandstone with minor lutite and coal, and the thickest preserved sections are in the northeast (about 350 m thick). Unit 4 contains all of Tasmania's economic coal reserves, also mostly located in the northeast, where eight or more seams or group of seams are present. The base of Unit 4 is transitional on Unit 3 and is diachronous being slightly older in the northeast than elsewhere. The lithic sandstone is largely of intermediate to felsic volcanic provenance, and there are rare, thin (< 1 m) felsic tuffs high in Unit 4. There are also rare conglomerates with common rhyolitic clasts. Unit 4 is characterized, almost throughout, by Carnian (Upper Triassic) microfloras. The youngest preserved part of Unit 4 is a lutite – dominated interval, about 100m thick, near Douglas River, with Norian (Upper Triassic) microfloras (Figure 16 and Figure 18).

## 2.4. Jurassic Dolerite

Large volumes of tholeiitic dolerite (from tholeiitic magma-basaltic magma lacking olivine) was intruded into the Tasmania crust in the Middle Jurassic, mainly as sheets in the flat-lying sediments of the Tasmania Basin. These sheets are typically 400 – 500 m thick, and dolerite is currently exposed over most of the area of the Tasmania Basin (Figure 18).

Basalt flows near Lune River, in far southern Tasmania, associated with Jurassic plant-bearing sediments, are the only known extrusive occurrences of this phase of magmatism. Dolerite sills, unroofed by erosion are underlain by rocks as young as Norian. In general, contact metamorphism is limited to the immediate vicinity of intrusions; thus a magma of low heat capacity and low in volatiles is indicated. Metamorphism is more severe over the roof of the intrusions.

## 2.5. Structuration

The Parmeener Supergroup is essentially sub–horizontal. However, the intrusion of the Jurassic dolerite and widespread Cretaceous to Early Tertiary normal faulting have resulted in complex structures, particularly in the southern part of the basin. Dips rarely exceed 10° in areas free of Tertiary extensional faulting, but in faulted areas dips may exceed 25°. There is localized evidence of gentle compressional deformation. A structural complex near Zeehan area displays gentle northwest-trending folds of unknown age and there are broad, gentle domes at Hunterston, Cygnet and Forcet (Figure 16). Outcrop-scale folding, concentric in style occurs at National Park and other localities; such folds tend to be associated with major dolerite intrusions or faults.

The dolerite intrusions are complex in form, tending to occur as stepped sheets, around 400 m thick, broadly trough-shaped or cone-shaped in section. Virtually every part of the basin has been intruded by at least one such sheet. Only a single sheet intruding the Upper Parmeener Supergroup appears to be present over much of the northern part of the basin. In the southern and the central parts of the basin, two and even three large sheets are present in many places and the Lower Parmeener Supergroup is extensively intruded. There may have been four or five main periods of intrusion in the Hobart district, resulting in transgressive and laterally overlapping sheets.

Older basement rocks, consisting of Proterozoic crystalline rocks, exposed on the western half of Tasmania and the Cambrian to early Devonian age sedimentary sequences of the Wurawina Supergroup were deformed by the mid Devonian tectonic event called the Tabberabberan Orogeny, a major pan-Australian event. The basin was uplifted at the end of the Cretaceous, probably associated with the Australian-Antarctic continental break-up. Erosion of approximately two kilometres of sediment is interpreted to have occurred. No further sediment was deposited until the Tertiary. Tertiary deposits are only a few hundred metres.

The Tasmania basin can be divided into three major structural elements. The Longford Sub-basin, an onshore extension of the Bass Basin to the north, effectively divides the rest of the basin into a large western half called the Central Lakes-Huon Block, and an eastern half called the Douglas River Block (Figure 16). All of these areas are underlain by the folded Paleozoic rocks of Cambrian to the Devonian age. Over much of the basin, the Earlier Paleozoic rocks are covered by generally flat-lying Late Carboniferous to the Late Triassic sediments (the Parmeener Supergroup) and the Jurassic dolerite.

In addition steep normal faults of Jurassic to Early Tertiary age are widespread in the Tasmania Basin. North to northwest fault trends are dominant. Among the more significant faults, affecting the Tasmania basin are the Tiers Fault which is partly Jurassic and has a throw of 700 – 1000 m near Poatina; the Castle Carey Fault with a throw of about 600 m, south of Ben Lomond, and the Lune River Fault (Figure 16). The Cascades Fault near Hobart is also partly Jurassic, with a displacement in excess of 1300 m in places.

### **3. SOURCE, RESERVOIR AND MATURITY IN THE TASMANIA BASIN**

There have been no oil or gas field discovered to date in the Tasmania Basin, although several oil seeps have been reported. The seeps reported in the Tasmania Basin have had limited correlations made to the source rocks. However, there is a seep in a recent quarry at Lonnvale to the southwest of Hobart that has been correlated with the Permian age Tasmanite Oil Shale and is the best indication yet that a significant petroleum system possibly exist in the basin.

#### **3.1. Potential Source Rocks**

The oldest potential source rocks in the Tasmania Basin is the Ordovician, although organic richness (organic matter content) data has not been adequately studied. Measurements of total organic carbon (TOC) and Rock-Eval pyrolysis have been made on a few samples of limestones within the Gordon Group. These analyses indicate TOC values above 1%, suggesting possibility of source rock potential in the shalier intervals of the Gordon Group.

In addition, sediments in the Gordon Group are reported to have a petroliferous odour when struck by a hammer and bituminous films have been seen along the stylolites, providing evidence of generation and migration. Further occurrences of pyrobitumen have been sighted at road cuttings east of Queenstown. A sample of upper Gordon Limestone from Florentine Valley liberated gas on crushing.

#### **3.2. Woody Island Formation and Correlates**

The Woody Island Formation is present over a wide area in the Tasmania Basin. Figure 19 shows thickness distribution of the Woody Island Formation over the whole of the basin. The thickness distribution of the Woody Island Formation illustrates that the formation has a north-south thickness trend with the depocenter

being located in the north–centre of the basin, associated with the thickest areas of the formation. Figure 20 shows a north to south borehole and outcrop stratigraphic section, illustrating thickness trends and characteristics of the formations and facies. The Woody Island Formation as shown in Figure 20 is quite ubiquitous throughout the basin and particularly thick in the central and northern areas.

The Woody Island Formation and its northern correlate the Quamby Mudstone consists of monotonous dark grey, thick–bedded to massive pyritic siltstone or mudstone which generally lacks fossils. It is deposited in proximity of retreating glaciers, characterized by glacial dropstones. Beds of *tasmanite* are locally present near the base of the unit in the northern part of the basin (Figure 19).

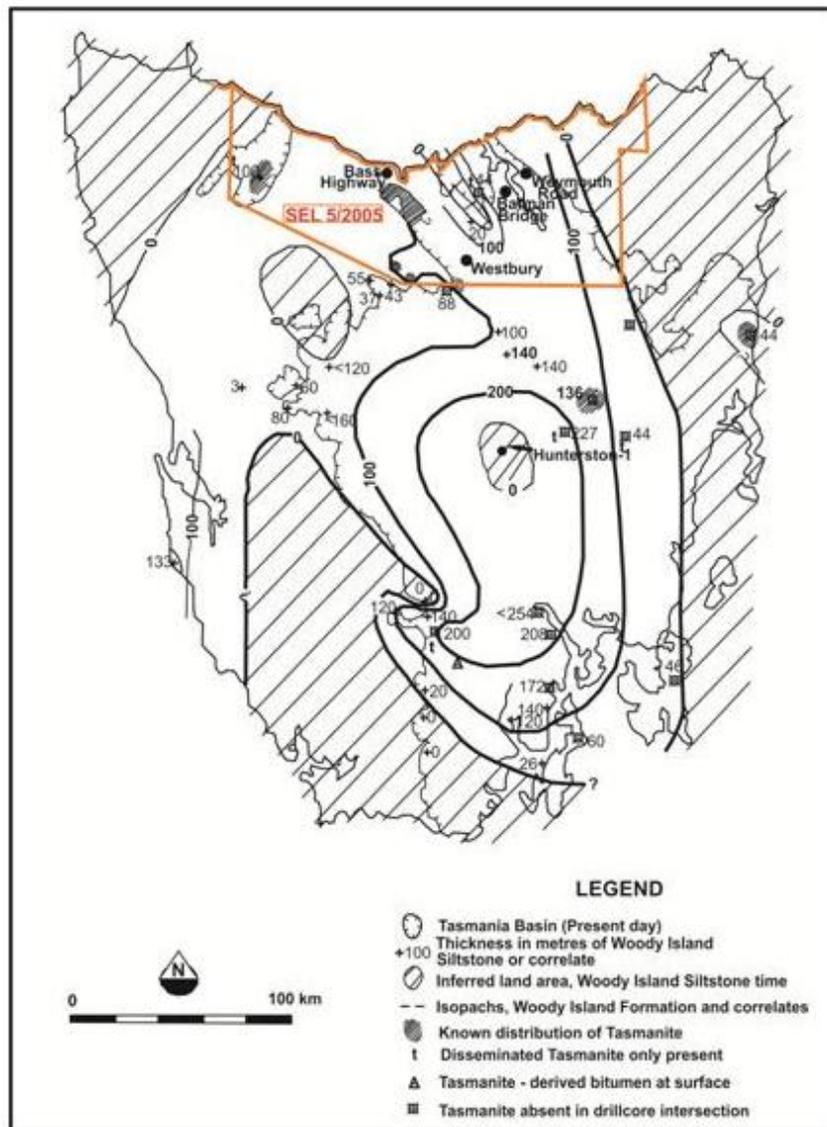


Figure 19. Isopach map of the Woody Island Formation and known distribution of the Tasmanite Oil Shale with the posted thicknesses of the Woody Island Formation shown and OEHL License Block SEL 5/2005 plotted.

The formation has poor to fair source potential with TOC values of 0.5 to 2%, and contains Type III to Type II/III gas and oil prone kerogen. The formation crops out around the erosional northern and western margins of the Tasmania Basin and is present in the subsurface throughout the basin, and has been intersected in the fully cored drillholes (Figures 19 and 20). TOC determinations were carried out in several drillholes such as Bicheno-10, Ross-1 (Quoin), Golden Valley-1, Anderson Creek -1 and Oonah (Figure 16). Average TOC values of 1.2 % with a maximum of 1.7 % in Bicheno-10 and 1.1 % in Ross-1 were determined. Hydrogen Index (HI) values were 300 to 433.  $T_{max}$  values for the Woody Island Formation varies from approximately 430°C to 465°C with the vitrinite reflectance values varying between 0.55 % to 0.8 % and 1.3 % from north to south, indicating oil and gas window maturity levels.

It is clear that the basin produced marine organic matter and it was preserved in highly concentrated thin beds, such as the Tasmanite Oil Shale beds. The quality of the Woody Island Formation suggests that the basin had favorable conditions for the preservation of organic matter.

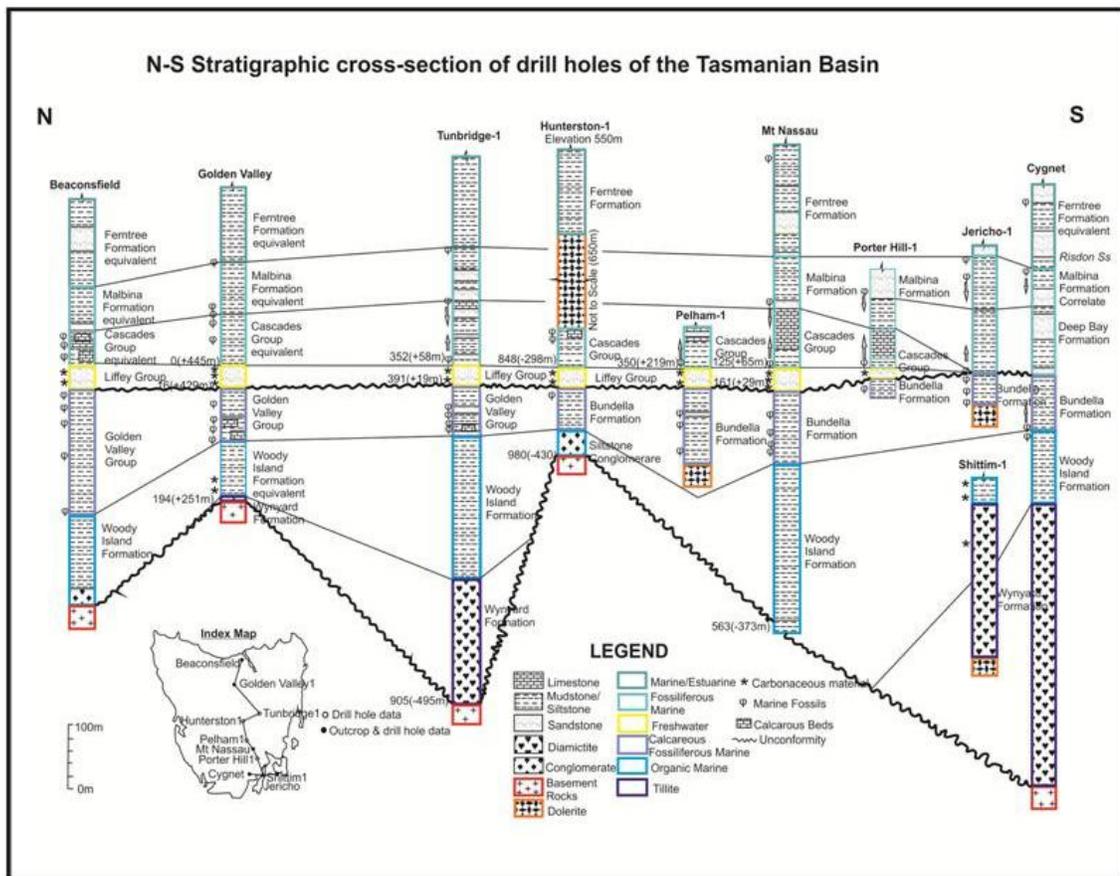


Figure 20. Stratigraphic cross-section of drillholes and outcrops in north-south direction, showing relative position and thicknesses of various formations and sediments penetrated.

### 3.3. Tasmanite Oil Shale

The Permian aged Tasmanite Oil Shale is the most well known source rock in Tasmania. It has been documented as having TOC content ranges from good to

very good, containing TOC values of 2.5 % to over 60 % and a hydrogen index (HI) between 700 to 1000 mgHC/gTOC. The production index (S1+S2) levels are high (from 10 to 900 mg/gm of rock), and although the Tasmanite Oil Shale bands are thin, they can produce up to 3.7 bbls/m<sup>2</sup> of oil. The distribution of the Tasmanite Oil Shale is illustrated in Figure 19. It is observed that the Tasmanite Oil Shale is mostly known to occur in the northern and eastern areas of the basin. It appears that several regions of the basin were sufficiently low in oxygen for some algal beds to be preserved.

The Tasmanite Oil Shale consists of silty shales with a high content (i.e. 10-70%) of compacted cysts of the probable green alga 'Tasmanites punctatus'. The tasmanite occurs as two or more close-spaced beds or seams, with an aggregate thickness of up to 1.5 m, at a stratigraphic level 15 – 20 m above the base of the Woody Island Formation at a number of localities in the north of the basin. The individual algal bands range from 3 to 30 cm thick. As such, the Tasmanite Oil Shale is a rich concentration of algal type kerogen (Type I organic matter, capable of generating liquid oil when mature).

The high HI of the *tasmanite* demonstrates that it contains predominantly hydrogen-rich, oil prone Type I kerogen, over 70 % of which is convertible to hydrocarbons. The *tasmanite* also contains small amount of vitrinite and inertinite kerogens (Type II and III organic matter, capable of generating gas when mature).

### 3.4. Other Possible Source Rocks in The Parmeener Supergroup

Shales in the lower levels of the Lower Freshwater Sequence (Liffey – Faulkner groups) and the coals within the Freshwater Sequence appear to be good, but volumetrically minor potential source rocks. The remaining parts of the Lower Parmeener Supergroup, including the basal tillite are unlikely to be good source rocks.

Based on Rock-Eval analyses of samples from Preolenna and maceral analyses, coals from the Lower Freshwater Sequence are good potential source rocks with Type II – III kerogen, both oil and gas-prone type organic matter. The Late Triassic coal measures (Unit 4) are unlikely to be a viable hydrocarbon sources (Figure 17 and Figure 18). In the northeast coal fields and in central Tasmania, vitrinite reflectance data indicate that the coals are submature to marginally mature, except where close to the dolerite. Coal consists predominantly of inertinite kerogen (Type III organic matter), a poorly gas-prone hydrocarbon source.

### 3.5. Timing of Hydrocarbon Generation in The Tasmania Basin

Two potential petroleum systems have been determined and described in the Tasmania Basin. They are the Pre-Carboniferous system, known as the Larapintine petroleum system and the Permian system, known as the Gondwanan petroleum system. In the Larapintine petroleum system, Ordovician age Gordon Group is the source rock and matures in the Late Triassic to Early Jurassic time, generating oil and gas, under sufficient overburden provided by the Parmeener Supergroup rock sequences (Figure 21). In this petroleum system, structuration and deformation of Ordovician and Silurian rocks took place during the mid Devonian Tabberabberan Orogenic events. It is assumed that oil and gas generated in the Late Triassic and Early Jurassic might have been migrated into the structural traps formed in the mid Devonian times.

In the Gondwanan petroleum system, source rocks are the Woody Island Formation (and its equivalent Quamby Formation in the north) and the Tasmanite Oil Shale with Triassic shales and coals forming secondary and minor sources. These source

rocks are thought to have been matured in Late Cretaceous to Early Tertiary, generating both oil and gas under the overburden of the Parmeener Supergroup of rocks and the Jurassic dolerite. Structuration and trap forming of these rocks took place at the end of the Cretaceous to Early Tertiary, when the Tasmania Basin was subjected to uplift, erosion and normal fault-related deformation.

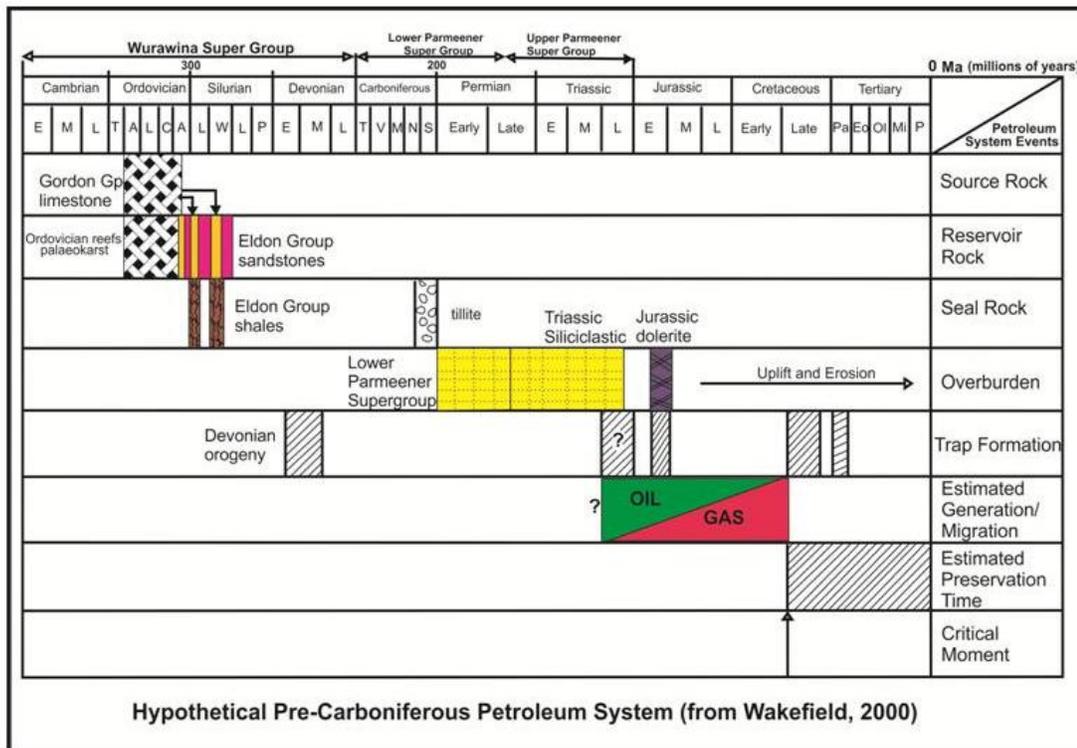


Figure 21. Hypothetical Larapintine petroleum system, illustrating time of petroleum generation for the Wurawina Supergroup of source rocks (Pre-Carboniferous).

Erosion of approximately two kilometres of sediment is interpreted to have occurred at this stage. It is assumed that oil and gas generated at this interval of time might have migrated into the Late Carboniferous to Early Triassic reservoir rocks (Liffey – Faulkner and the Unit 2 of the Upper Parmeener Supergroup) found in the structural traps formed in the Early to Middle Tertiary (Figure 22).

Organic matter typing, HI, and maturation indicators such as vitrinite reflectance (VR), maximum temperature of conversion of organic matter to oil (Tmax) and burial depth, determined from source rock samples collected from such wells as Bicheno-10, Golden Valley-1, Tunbridge-1, Ross-1 and 2, Styx River-1 and from the northern outcrop localities shows that the kerogen ranges from Type II/III to Type I with relatively low HI values, ranging from 150 to 350 and Tmax values, ranging from 430 to 460 °C with the VR values ranging from 0.75 to over 1 % (Figure 23).

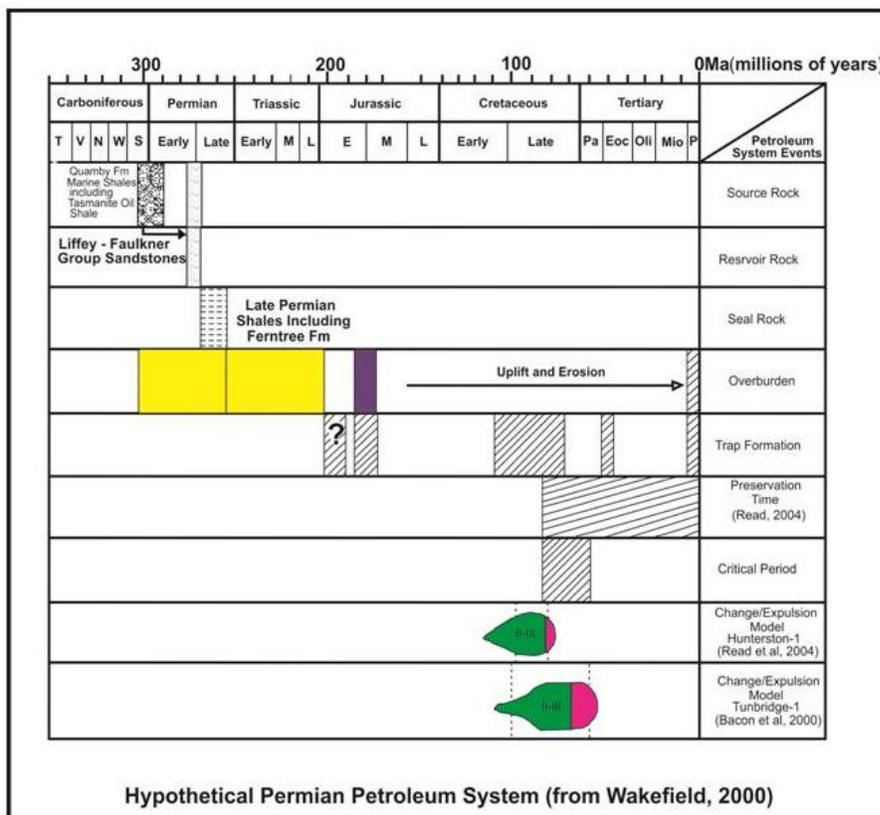


Figure 22. Gondwanan petroleum system, showing time of petroleum generation for the Lower Parmeener Supergroup of rocks (mostly Permian age).

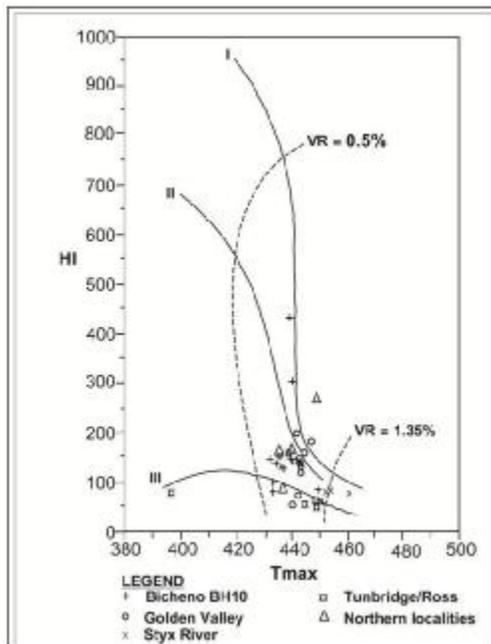


Figure 23. HI plotted against Tmax from various borehole and outcrop samples, showing organic matter for various parts of the Tasmania Basin.

These results indicate that source rocks in these wells and outcrop areas have poor to fair source quality with predominantly gas-prone type and minor oil-condensate generative capability. These results also prove that the source rocks analyzed are mature enough to generate oil and gas, but not as voluminous as the mature Tasmanite Oil Shale would generate. It also indicates that the Tasmanite Oil Shale in the most likelihood, was not present in these analyzed samples.

In addition, burial history studies and modelling of the source rocks from Tunbridge-1 and Douglas River Block area suggest that most Tasmania Basin source rocks were at a relatively high temperatures (> 95 °C) until the Late Cretaceous to the Early Tertiary (i.e. 100 - 50 Ma), supporting the previous maturation results obtained from the analyses of source rock samples taken from boreholes and outcrop localities illustrated in Figure 23. Starting from the Early Tertiary, rocks of the Tasmania Basin have undergone rapid cooling due to uplift and erosion (Figure 24). The maximum burial of sediments in the basin occurred just before the Early Tertiary and as much as 1.8 km of sedimentary section was removed by erosion in the ensuing uplift stage in the Early to Middle Tertiary times (Figure 24).

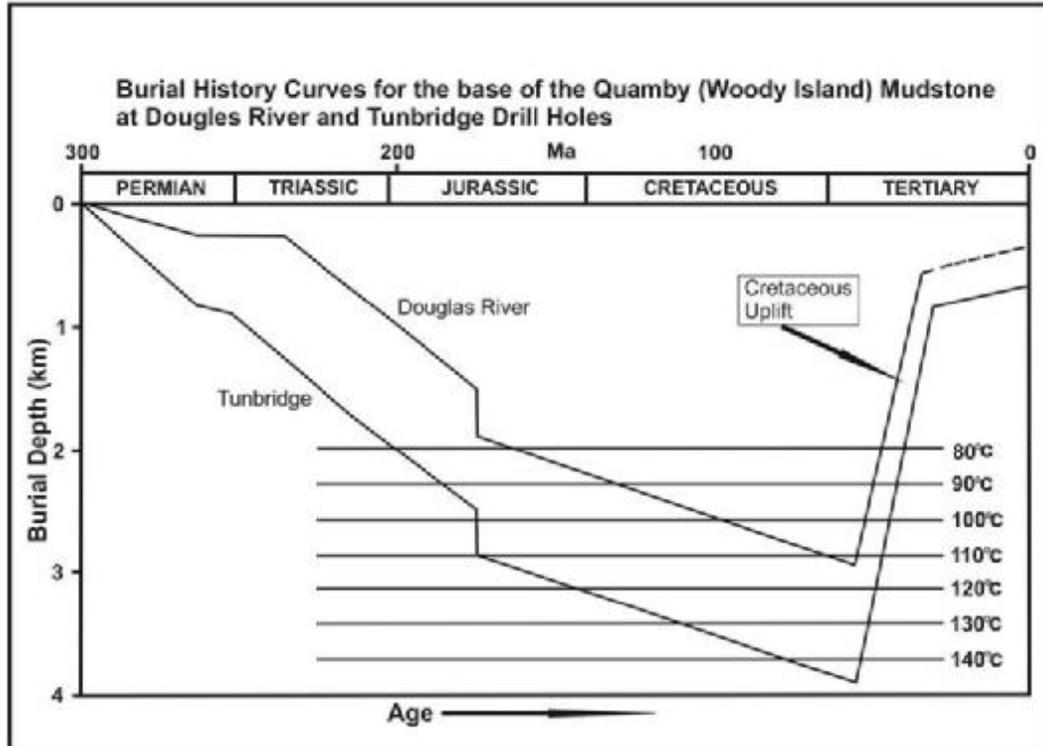


Figure 24. Burial history curves for the base of the Quamby Mudstone correlate (the Woody Island Formation) at the Douglas River and Tunbridge drill holes, illustrating maximum burial at the end of the Cretaceous and uplift and erosion in the Early to Middle Tertiary.

### 3.6. Potential Reservoir Rocks

The primary reservoirs within the Pre-Carboniferous successions are the carbonates of the Gordon Group. Leached and dolomitized limestones, reefal and fractured reservoirs could be anticipated, but not much is known about these sequences. Likewise, the overlying sandstones of the Eldon Group are potential reservoirs, but no accurately documented information is available from these rocks.

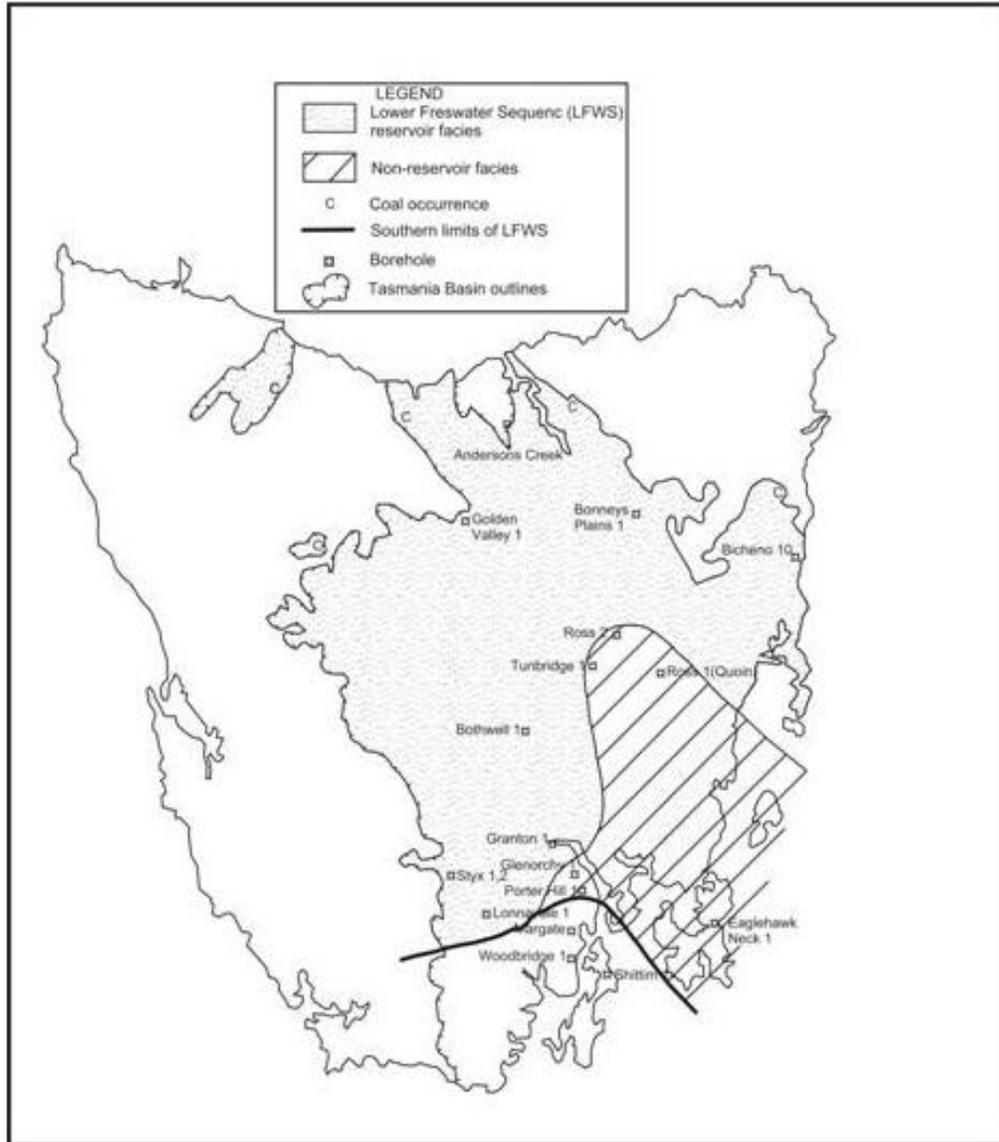


Figure 25. Paleogeographic map of the Lower Freshwater Sequence (Liffey – Faulkner Group), showing inferred generalized distribution of reservoir and non-reservoir facies.

Paleokarst features have been reported within the Gordon Group at various locations. This implies that any Gordon Group limestone sub-aerially exposed before the Parmeener Supergroup deposition may also have developed karst features.

Sandstones in the Silurian – Devonian Eldon Group have also been suggested as the potential reservoirs, although no data are available on porosity and permeability. Pyrobitumens are reported to be common in vugs in the Eldon Group sandstones near Zeehan in western Tasmania (Figure 16).

Within the Lower Parmeener Supergroup, there are a number of sandstone intervals with good reservoir characteristics. These sands are considered to be extensive and porosities vary. The main potential reservoir unit in the Lower Parmeener Supergroup is the Lower Freshwater Sequence, the unit known as the Liffey – Faulkner Group, is a widespread succession 20 – 40 m thick, of fluvial to paralic sandstone, siltstone, shale and coal (Figure 17 and Figure 20). A paleogeographic reconstruction of this unit shows a broad sandy coastal plain with the sea lying to the southeast (Figure 25). The unit is dominated by well-sorted, cross-bedded quartz-rich fluvial sandstone in the north of the basin. The main coal developments are found around the landward margins in north of the basin, at Preolenna, Latrobe and St Marys (Figure 16). Up to four coal seams may be present with an aggregate thickness of one metre. The sequence tends to become finer grained to the southeast. A study of the reservoir potential of the Liffey - Faulkner Group in eight drill holes spread across the basin from Golden Valley to Hobart area, found that there were considerable lateral and vertical variations in reservoir quality. The average porosity of the whole unit is 10.9 %. In most sections, the middle 15 – 20 m of the unit has a range of fair to good reservoir potential (Figure 20).

Apart from the Liffey – Faulkner group (the Lower Freshwater Sequence), a number of other marine sandstone units are possible reservoirs. They are in stratigraphic order, the Bundella Formation, the Malbina Formation, Minnie Point Formation and Risdon Sandstone (Figure 17).

The Bundella Formation is a shallow marine shelf deposit, underlying the Liffey – Faulkner Group, and consists of about 120 m of fossiliferous siltstone with minor sandstone and conglomerate. Samples from the Shittim-1 well have porosities of 7.4 to 22.3 % and horizontal permeabilities of 0.07 to 9 md. The Malbina Formation correlates with the Minnie Point Formation and consists of a shallow marine shelf deposit, comprising 50 – 90 m thick, poorly – sorted, pebbly feldspathic sandstone and siltstone. Porosities of 14.1 to 16.6 % have been measured in the Minnie Point Formation. The Risdon Sandstone is an offshore barrier bar deposit, consisting of coarse-grained, cross-bedded sandstone, 8 m thick in the Cygnet area, but generally thinner elsewhere. Porosities of 13.7 to 14.7 % have been measured on outcrop samples. Most of the porosity is secondary, resulting from feldspar dissolution.

In addition, cross-bedded and well-sorted quartz sandstones of Unit 2 of the Upper Parmeener Supergroup is widespread, and typically about 200 m thick with little or no interbedded shale or coal. This unit has the best reservoir potential. Porosity determinations show 12.7 % on the average, but as much as 23 % porosity was measured with only fair permeability of 9.8 md. The volcanic lithic sandstones with coal measures, Units 3 and 4 have poor reservoir characteristics. The volcanic lithic sandstones were deposited in a meandering fluvial environment, resulting in abundant lutite intervals, which may act as seals. Table 1 shows reservoir parameters of some of the reservoir rocks in the Lower Parmeener Supergroup.

Formation Name	Porosity ( %)	Thickness (m)	Depositional Environment
Liffey-Faulkner Group	10.9	20 - 40	Coastal channel
Bundella Formation	7.4 – 22.3	120	Shallow marine shelf
Minnie Point Formation	14.1 – 16.6	50 - 90	Shallow marine shelf
Risdon Sandstone	13.7 – 14.7	8	Offshore barrier bar deposit

Table 1. Reservoir parameters and environment of deposition of some of the reservoir rocks in the Lower Parmeener Supergroup.

### 3.7. Seal Rocks

Reservoirs within the Lower Paleozoic rocks, such as the palaeokarst reservoirs of the Gordon Group limestones could be sealed by shales in the Eldon Group in anticlinal structural traps. In addition, the base-Parmeener Supergroup unconformity is overlain by tillite and mudstones. Relatively late timing of oil generation (post-Permian) in the Paleozoic section, or post Permian to Tertiary migration of pre-Carboniferous hydrocarbon accumulations into various sub-unconformity traps are conceivable and they could be sealed with the Eldon Group shales as the lateral seal and the basal Parmeener Supergroup unconformity could be a top seal for the Ordovician – Silurian reservoir rocks in general. The Malbina and Cascades Group formations are also marine mudstones and provide potential seal units above the Liffey – Faulkner Group sandstones. Marine mudstones and silty mudstones in the Lower Parmeener Supergroup, such as the Cascades Group of shales and the Ferntree Mudstones, and the Jurassic dolerite are the most likely potential seals for the post-Carboniferous reservoirs and traps (Figure 17 and Figure 20).

## 4. SEDIMENTATION AND PETROLEUM PROSPECTIVITY OF LICENCE BLOCK SEL 5/2005

OEHL Licence Block SEL 5/2005 with an extensive areal coverage of 13,300 km<sup>2</sup>, is located in the north central part of Tasmania, bordered from the north by the Bass Strait and the prolific petroleum producing Bass Sedimentary Basin. Crystalline basement rocks, consisting of granites and various kind of metamorphic rock assemblages, Pre-Cambrian to Lower Cambrian in age outcrop in the eastern and western parts of the license block area (Figure 26 and Figure 27). Central part of the license area contains thick sedimentary accumulations, associated with the greater Tasmania Basin depositional system, developed in the Late Carboniferous to the Late Triassic times. These sediments in the license block area in particular, and in the greater Tasmania Basin area in general were subjected to intense tectonism and faulting in the mid-Jurassic and in the Early Tertiary times, resulting in the intrusion of thick dolerite rocks in the mid-Jurassic and folding and faulting, mostly in normal offset type in the Early Tertiary.

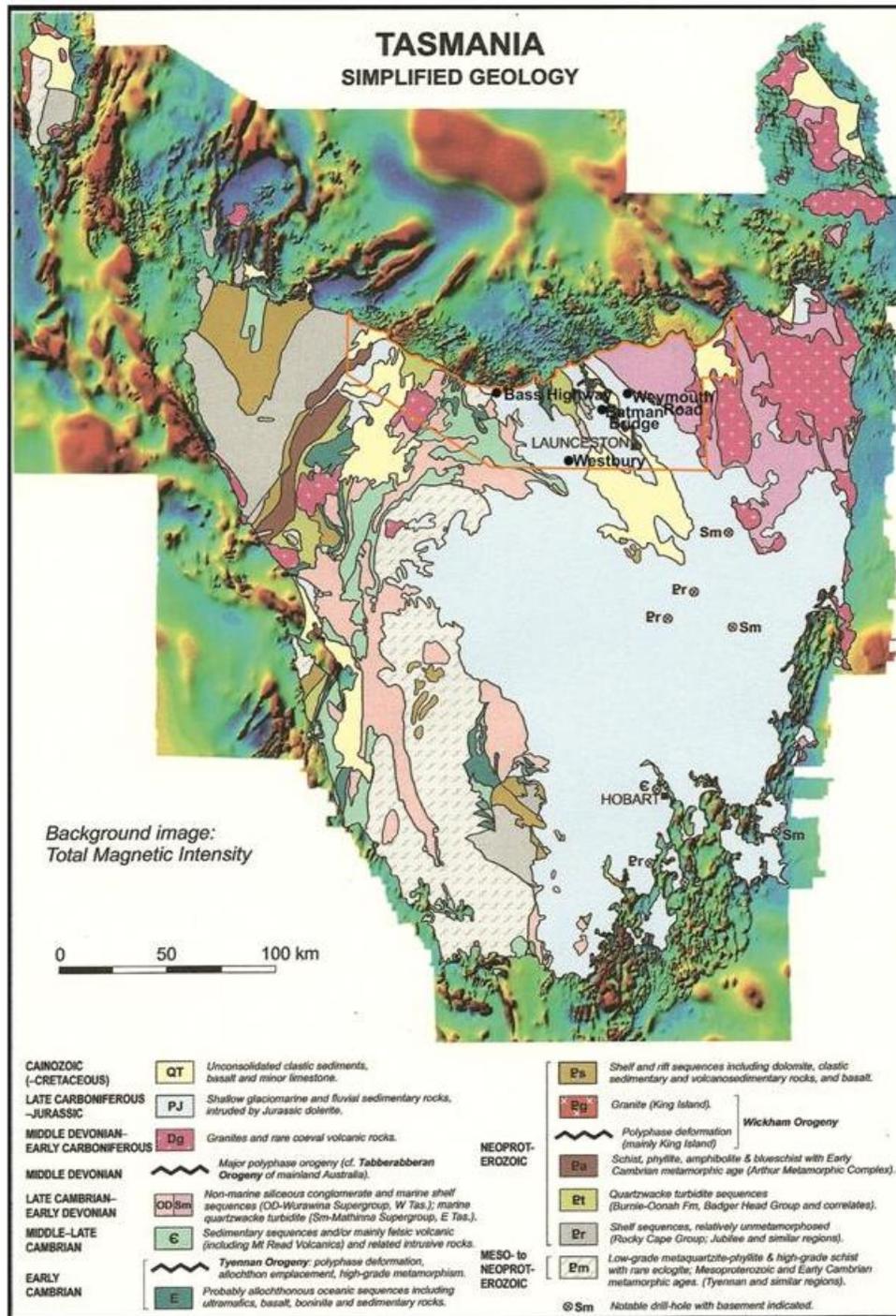


Figure 26. Geological map of Tasmania with OEHL License Block SEL 5/2005 outlines plotted in orange color and OEHL potential Prospects shown. Red color with plus signs are granites, pink and green are the outcropping Wurawina sediments, gray color with stipples are metamorphic rocks and the faint blue in the center is the Parmeener Group of sediments and outcropping dolerites.

These tectonic activities caused deformation in parts of the sedimentary trough in the licence block area, and widespread basalt extrusions, covering large tracts of the surface area in the northern part of the Tasmania Basin where the licence block located, occurred through the conduits created by the normal faulting in the Tertiary (Figure 27). These basalts are quite ubiquitous in northern Tasmania and present several challenges for petroleum exploration, including the reduction of seismic signal and poor seismic data resolution. Because basalts cause seismic energy to be scattered before being projected into the Earth, thereby weakening the seismic energy going into the Earth, thus resulting in seismic resolution loss. Basalts are so widespread in the license block area, that Devonport region where the Bass Highway potential prospect is located, was affected extensively and inundated by the Tertiary basalt flows (Figure 28).

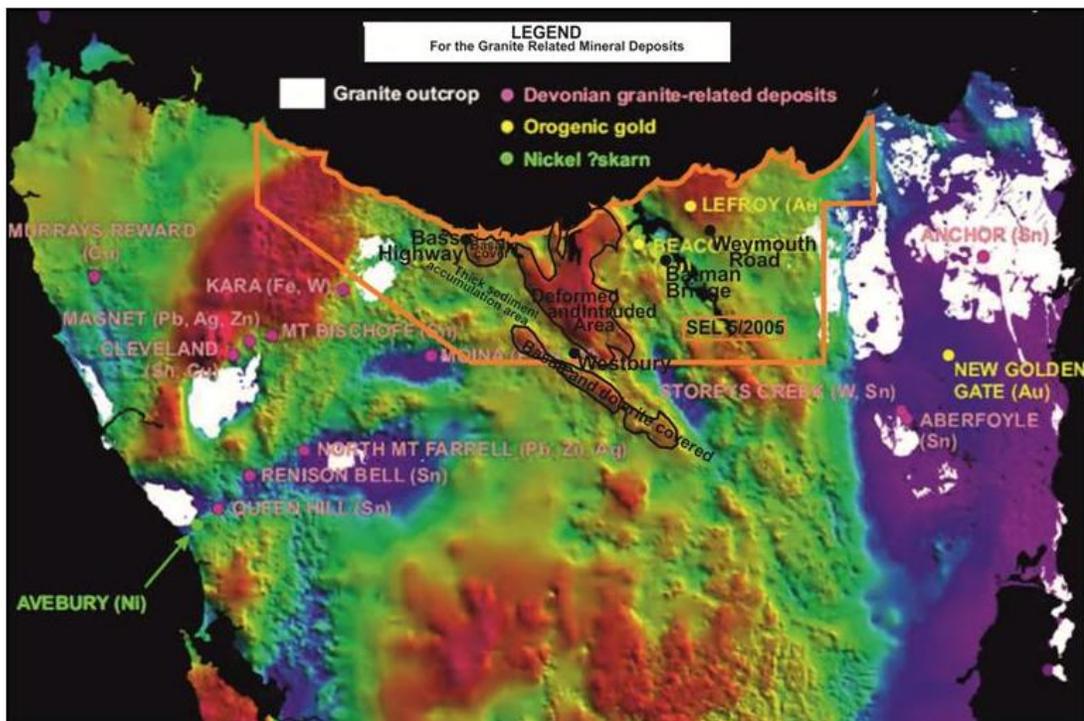


Figure 27. Terrain - Corrected residual gravity anomaly map of northern Tasmania, showing OEHL License Block SEL 5/2005 outlines, colored in orange and potential prospect locations with some of the surface structural features such as basalts and deformed areas outlined.

During the uplift and erosional stage in the Tertiary, many parts of northern Tasmania experienced extensive removal of sedimentary cover by erosion, exposing the mid-Jurassic age dolerites. As a result, like the flood basalts covering extensive surface areas, exposed dolerites cover large surface areas in northern Tasmania in general and in the OEHL license block area in particular. As such, Launceston area, where the Batman Bridge potential prospect located, is largely affected by the occurrence of exposed dolerite rocks (Figure 29).

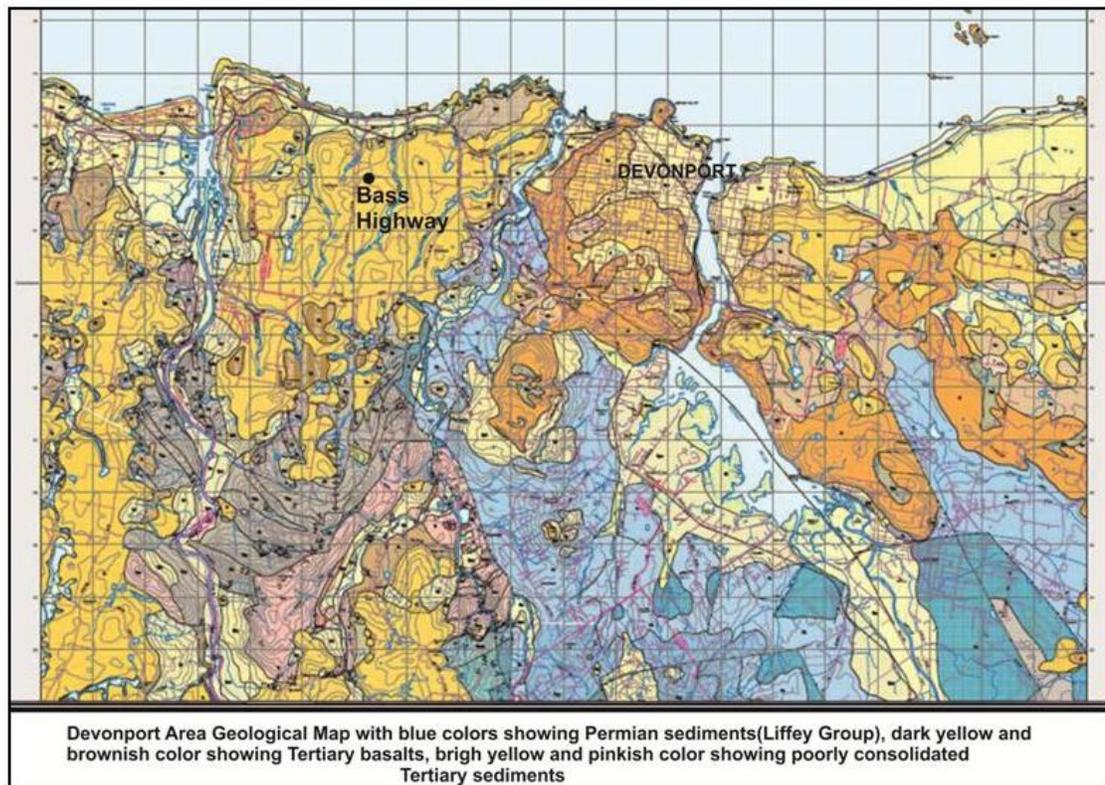


Figure 28. Geological map of Devonport area in northern Tasmania showing widespread basalt occurrence in yellow and brown colors. Blue represents Lower Permian Supergroup of sedimentary rocks.

Notwithstanding the basalt flows and widespread dolerite rock exposures in the licence block area, Bouguer gravity data collected by OEHL in some of the potential prospect areas show that good and thick sedimentary successions exist, indicating good possibility of petroleum occurrence. Hence, good petroleum potential exist in the license block area. A Bouguer gravity anomaly map, compiled and constructed from the OEHL gravity data in Devonport area where the Bass Highway potential prospect located, shows a very well developed NE – SW trending sedimentary trough with possible occurrence of thick petroleum prospective sediments (Figure 30). Occurrence of such thick sedimentary successions in the Devonport area, should have potential mature source rocks and reservoir facies that could contain commercial quantities of oil and gas, making the the Bass Highway potential prospect area in Devonport region especially an attractive area with respect to oil and gas find.

Likewise, Bouguer gravity anomaly maps, compiled and constructed by the OEHL consultants in the Westwood-1 well site area and the Weymouth Road potential prospect area show that good and thick sedimentary accumulations are observed in the south and southwest of the Westwood–1 well site area, but such sediment accumulation does not exist in the Weymouth Road potential prospect area (Figure 31 Figure 32). These results show that the Westbury potential prospect area, located in the southwest of the Westwood-1 well site holds good petroleum potential with respect to finding mature source rocks and reservoir facies and hence prospectivity of petroleum occurrence is good in the area. It is also observed from the Bouguer gravity anomaly map that the Weymouth Road potential prospect area

is seen to be covered by the deformed and partly crystalline basement type rocks which may show that the area may not possess good petroleum prospectivity as do the other areas discussed above.

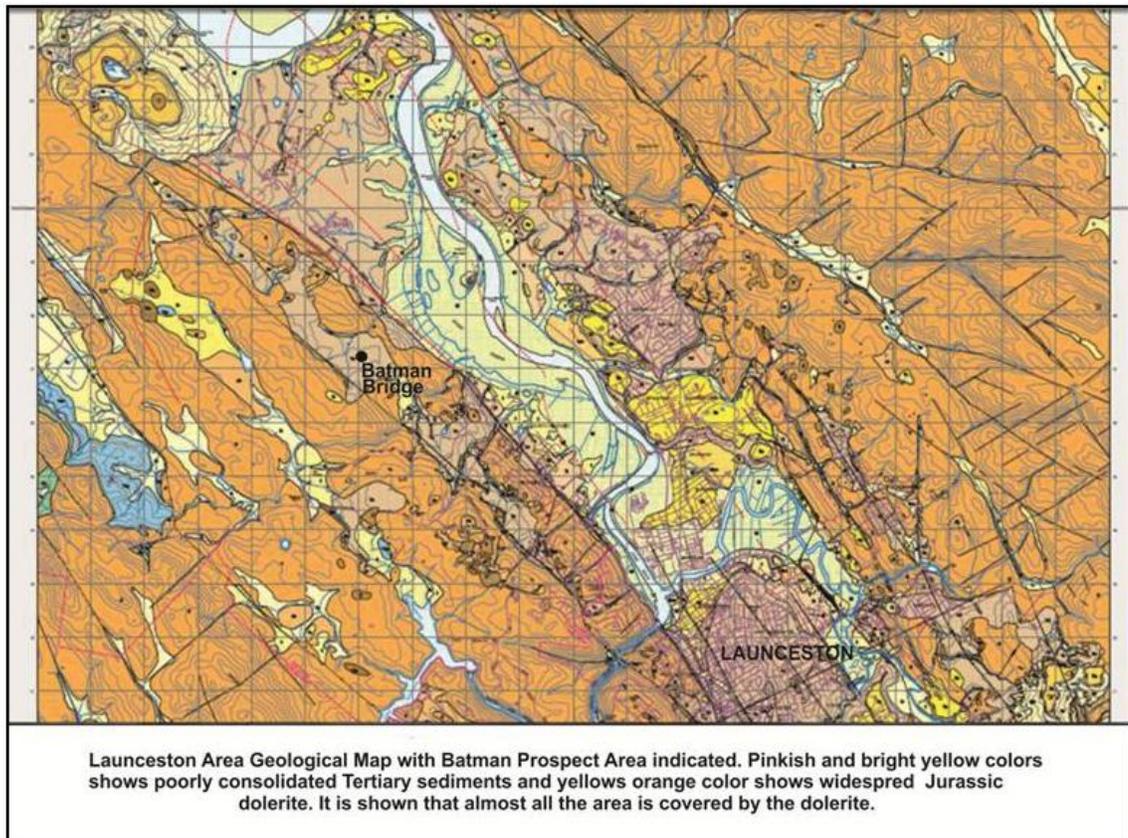


Figure 29. Geological map of Launceston area, showing widespread dolerite coverage, represented by the orange color.

Unfortunately, new gravity data were not collected in the Batman Bridge potential prospect area to be able to assess the prospectivity and sedimentary characteristics of the area. Nevertheless, regional gravity and geological characteristics show that the region is covered with widespread dolerite exposures which represent uplift and extensive erosion. Moreover, these mid-Jurassic dolerites conceal beneath them appreciable thicknesses of Parmeener Supergroup of sediments in many parts of the Tasmania Basin and if such properly preserved sedimentary sequences are found beneath the exposed dolerite rocks in the Batman Bridge potential prospect area, it would not be unreasonable to expect that the area could also hold good petroleum potential, because the whole sedimentary sequence from the Late Carboniferous to the Late Triassic could be preserved below the dolerite rocks and these rocks could contain both mature source rocks for petroleum generation and reservoir facies to hold and store them.

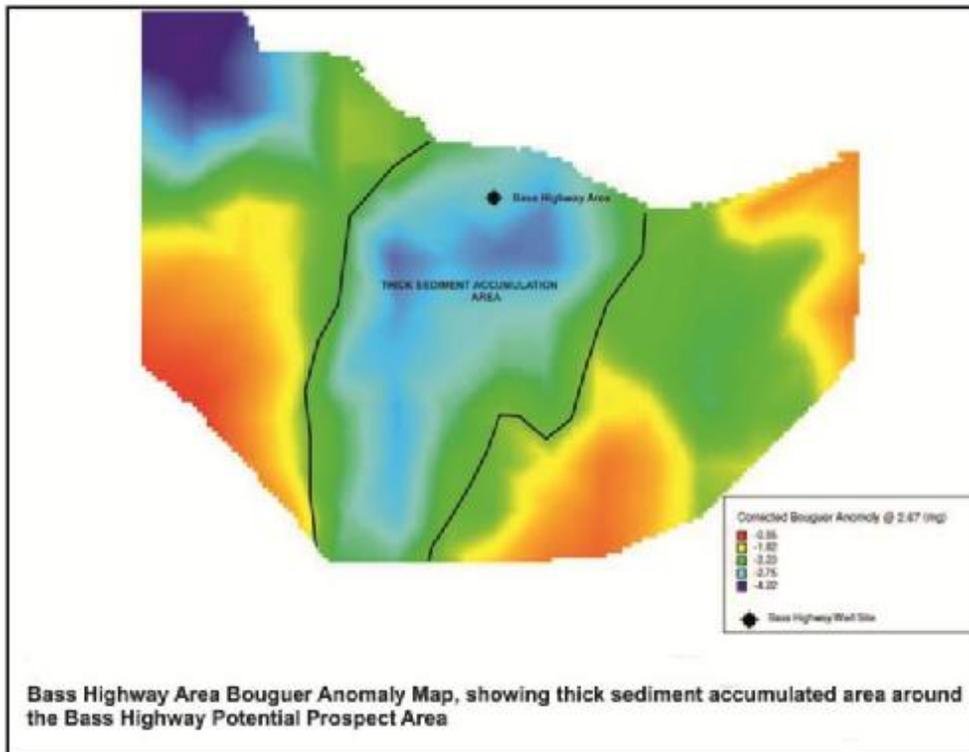


Figure 30. Devonport area Bouguer anomaly map, showing a NE – SW trending sedimentary trough (blue coloration) that may hold good petroleum prospectivity in the Bass Highway potential prospect as shown.

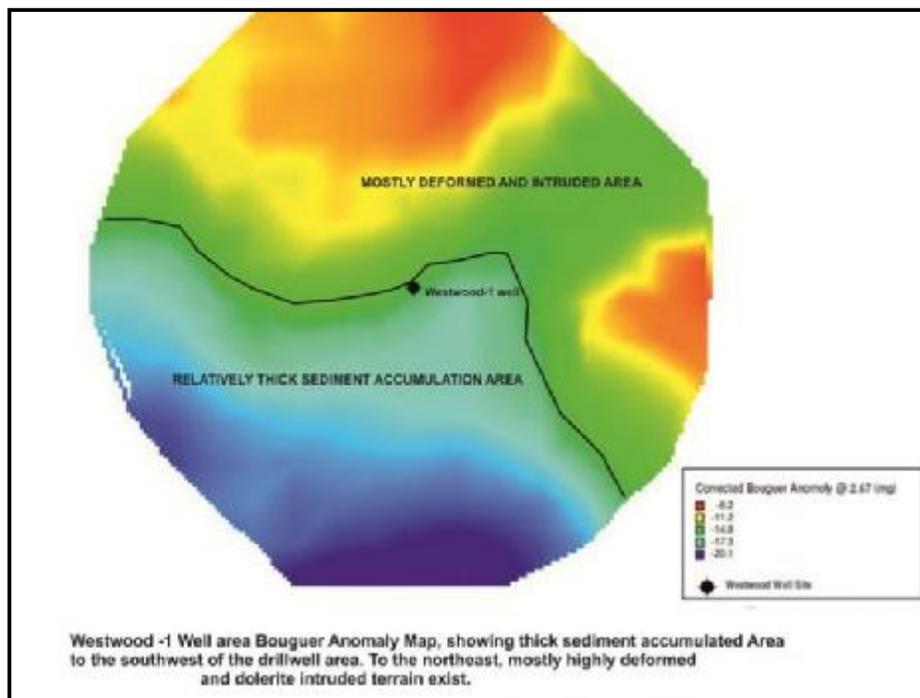


Figure 31. Bouguer anomaly map in the Westwood -1 well site and the vicinity, illustrating good sediment accumulations in the south and southwest of the well site.

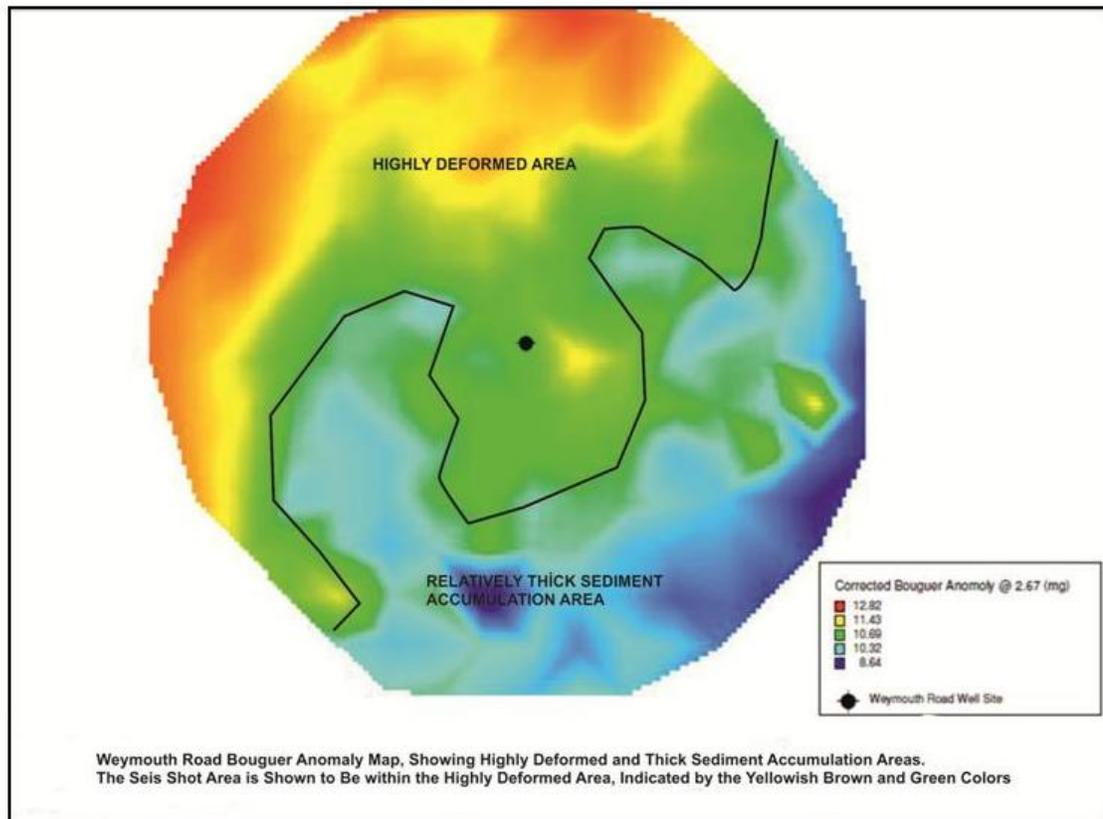


Figure 32. Bouguer anomaly map of the Weymouth Road potential prospect area, showing possibly deformed and metamorphosed basement type crystalline rocks, represented by green and yellowish-red coloration.

## 5. SEISMIC INTERPRETATION AND RESOURCE ESTIMATION OF POTENTIAL PROSPECT AREAS WITH THE SEISMIC COVERAGE WITHIN THE OEHL SEL 5/2005 LICENCE BLOCK

After the reprocessing of 11 seismic lines which were grouped in three or two lines per potential prospect area within the SEL 5/2005 License Block (Figure 15), each one of the seismic sections were horizon correlated based on the geological horizons depth-picked from the Westwood – 1 exploration well drilled by OEHL in 2009 and these horizons were transferred to the seismic lines and interpreted and correlated. After the correlation, structure depth maps of the individually correlated horizons were generated. Altogether, four structure maps per potential prospect area were generated. The names of these potential prospective areas were interpolated from previous studies and seismic survey work. These potential prospective areas are: 1. the Bass Highway Potential Prospect area, located near the Devonport Gulf along the Bass Strait in the north of the license block area; 2. the Westbury Potential Prospect area, located in the south center of the license block near the northern tip of the large Tiers Fault line; 3. the Batman Bridge Potential Prospect area, located in the northeast part of the license block area near the town of Beaconsfield; and 4. the Weymouth Road Potential Prospect area, located in the extreme northeast of the license block area near the northeastern erosional edge of the Tasmania Basin proper (Figure 2 and Figure 3). Within each one of these potential prospect areas, except the Batman Bridge Potential Prospect

area, four structure - depth maps were generated, each representing from top down, (a) the top of the Lower Parmeener Group horizon, (b) the top of the Liffey Group horizon, (c) the top of the intra Eldon Group horizon and (d) the top of the Gordon Group limestones horizon. Following generation of these structure - depth maps of the individual reflective horizons, net pay isopach (thickness) maps of the individual reservoir horizons were generated from the structure - depth maps, assuming that the plunge of the individual structure contour maps defined oil(gas)/water contact or the zero(0) pay thickness for that particular horizon. A total of fourteen (14) pay maps were generated from the structure - depth maps, four isopach maps per potential prospect area except the Batman Potential prospect area. Reflectivity of the seismic lines from the Batman Bridge Potential Prospect area was quite poor despite rigorous reprocessing work of the seismic lines. The poor reflectivity in the Batman Bridge Prospect area was caused by the widespread outcropping of the dolerite rocks in the area (Figure 29). Dolerite rocks are very high velocity rocks, when present on the surface, prevent seismic energy penetrating deep into the earth, thereby weakening of the downgoing seismic energy and hence resolution loss on the seismic acquisition work.

Potential prospective resource reserve estimation calculations were carried out from the net pay isopach maps, assuming that the bottom hole formation temperature from the Westwood-1 well represented a general temperature distribution in the subsurface in the license block area and a uniform 0.465 psi/foot pressure gradient represented the general subsurface pressure distribution in the area. Prospective oil and gas resource estimations (calculation) were presented in the individual potential prospect area resource tables.

## **5.1. Seismic Line Correlation, Interpretation and Mapping**

### **5.1.1. The Bass Highway Potential Prospect Area**

Seismic sections from the Bass Highway Potential Prospect area were correlated and interpreted structurally. Reflectivity and resolution of the seismic sections after the reprocessing work were much improved. Therefore, horizon correlation and interpretation of the seismic sections were relatively good. Figure 33 and Figure 34 illustrate these interpreted seismic sections from the Bass Highway Potential Prospect area. The interpreted sections show the potentially prospective reflective horizons quite clearly.

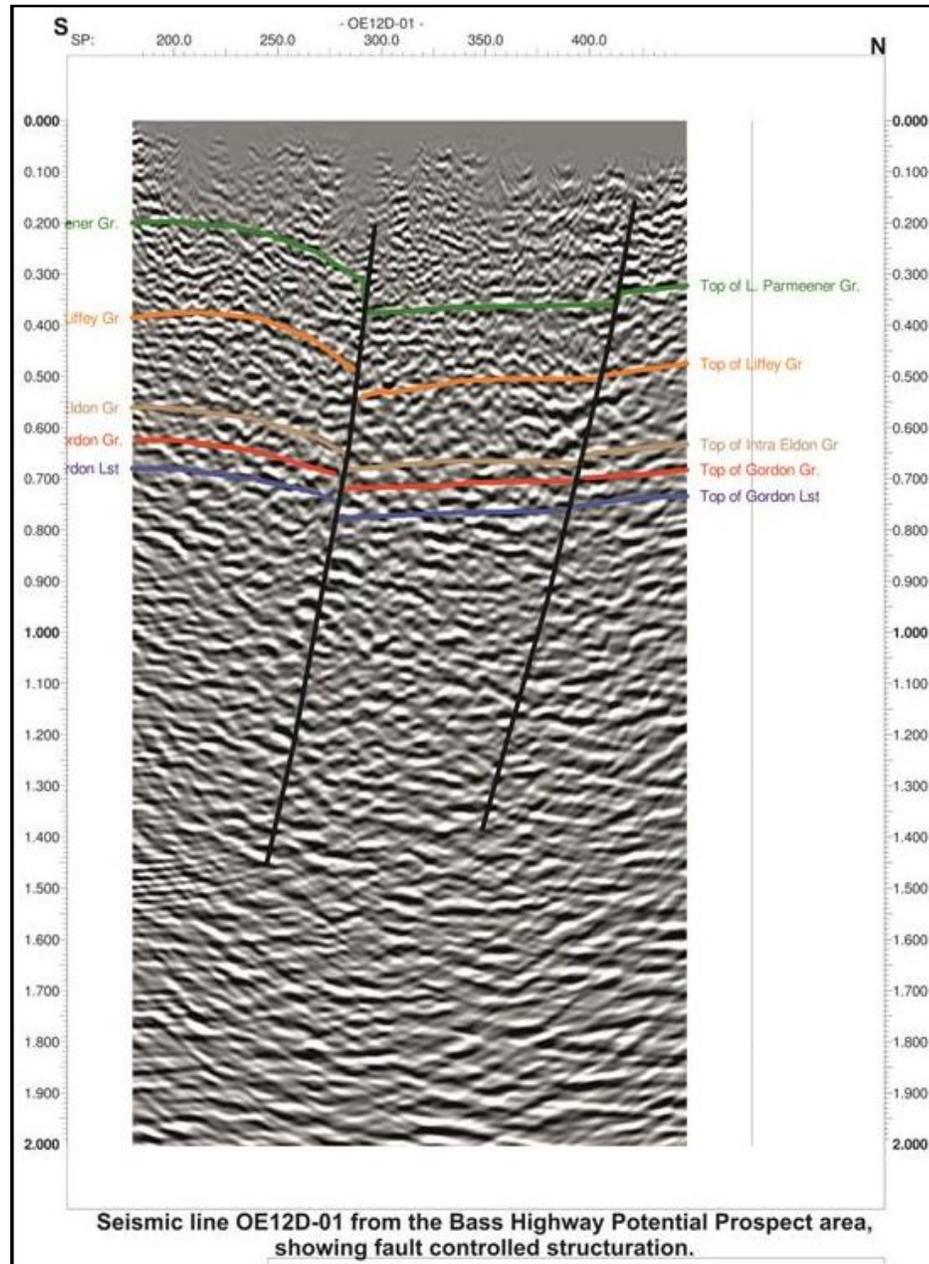


Figure 33. Structurally interpreted N-S seismic line OE12D-01, from the Bass Highway potential prospect area, showing fault controlled structuration on the left hand side of the section. All four prospective horizons are correlated.

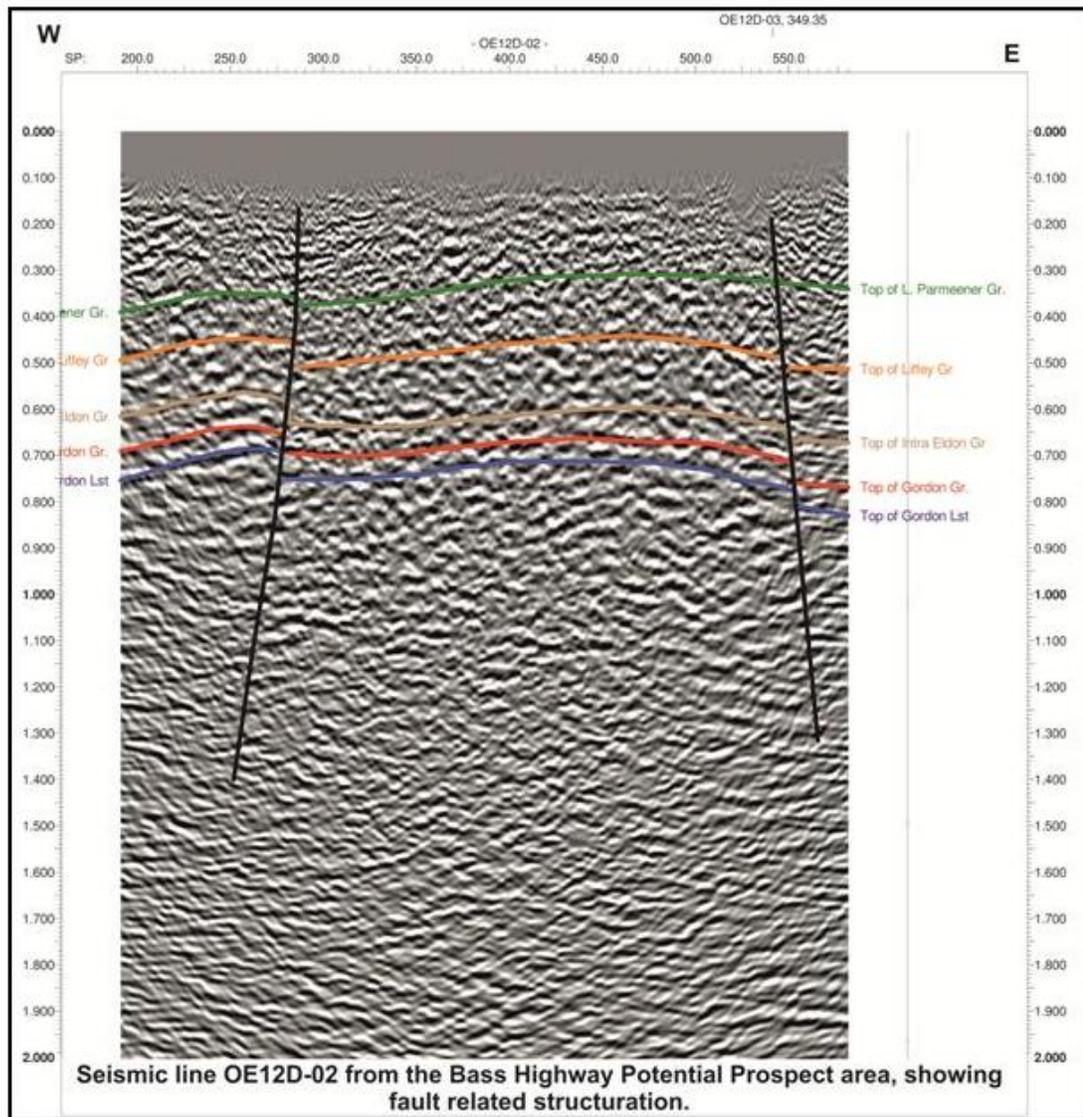


Figure 34. E-W seismic lines OE12D-02 from the Bass Highway Potential Prospect area, illustrating fault controlled structuration on all prospective reflective horizons structurally correlated.

As noted in the interpreted seismic sections, fault controlled structuration developed on all four potentially prospective reflective horizons. Structure – depth maps were generated from these horizons as shown in Figure 35, Figure 36, Figure 37, and Figure 38. These structure maps show clearly the development of structures that are partly defined by faulting which is quite strong and prevalent in the seismic sections interpreted and shown above. Structural closures that are observed in the southwest corner of the maps show good potential with respect to oil and gas entrapment and a possible drill-site is prosed as BH-1, shown in Figure 35 and Figure 37. This particular structural closure exist on all the possible potential reflective horizons interpreted and mapped. The structural closure shows a north–south trend that is in agreement with the general fault trend in the area and as shown in the structure – depth maps in Figure 35 to Figure 38. This shows

that structuration is in part controlled by the faulting and possibly contemporaneous with it which is probably Early to mid-Tertiary in age as the Tasmania Basin had reached its maximum burial at this time, and then was subjected to intense uplift and tectonism which created this type of faulting as observed in the seismic sections and in the maps shown above.

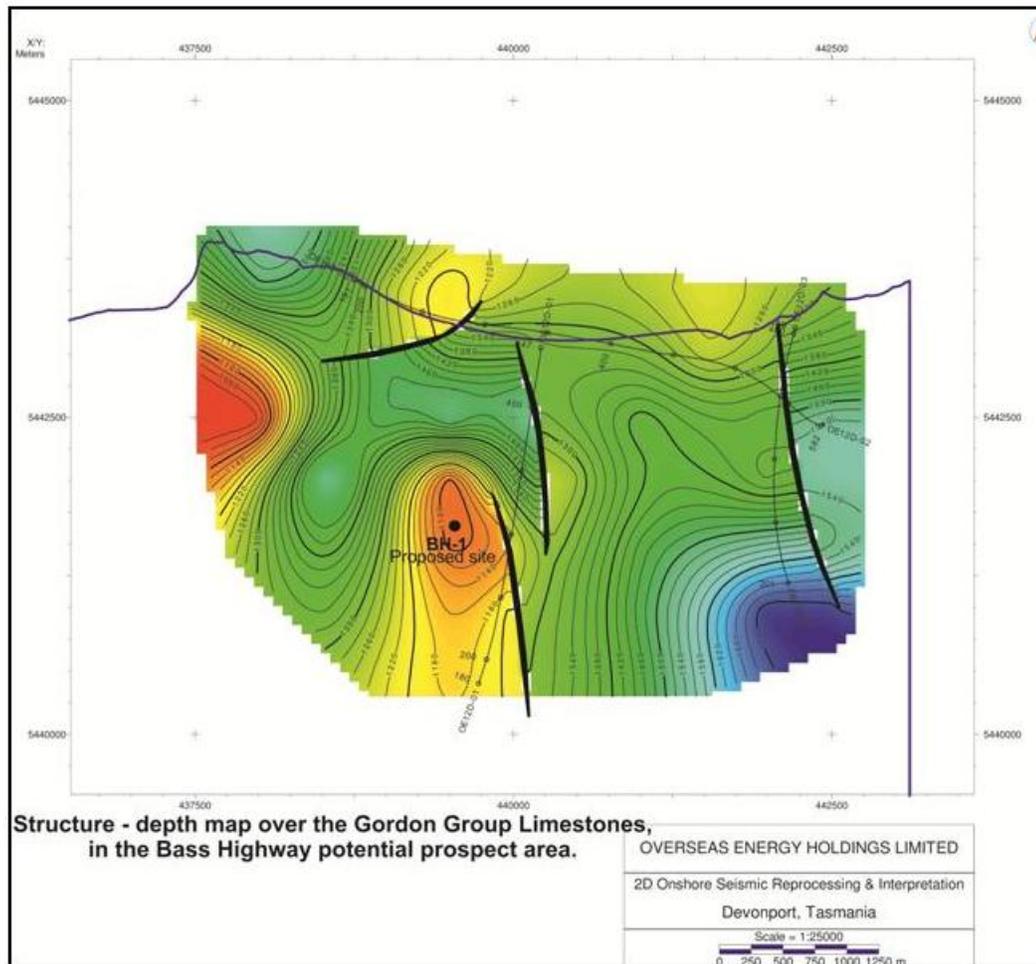


Figure 35. Structure – depth map of the Gordon Gr. Limestones from the Bass Highway potential prospect area, illustrating a good fault controlled structure in the southwest corner of the map.

Furthermore, there is another partial structural development located in the western parts of the maps. But unfortunately, this structural closure is an artifact of the map contouring and lacks enough seismic control and coverage to be able to make it a potential prospective drill-site. If this partial structural development, observed on the western edge of the structural – depth contour maps, could be defined and proved with further additional seismic acquisition work, then it could also possibly be a viable potential structural lead that could be considered for testing by exploration drilling. If it is possible for the OEHL to shoot additional seismic lines over this partial structural closure, then there may be another good potentially prospective drill-site created.

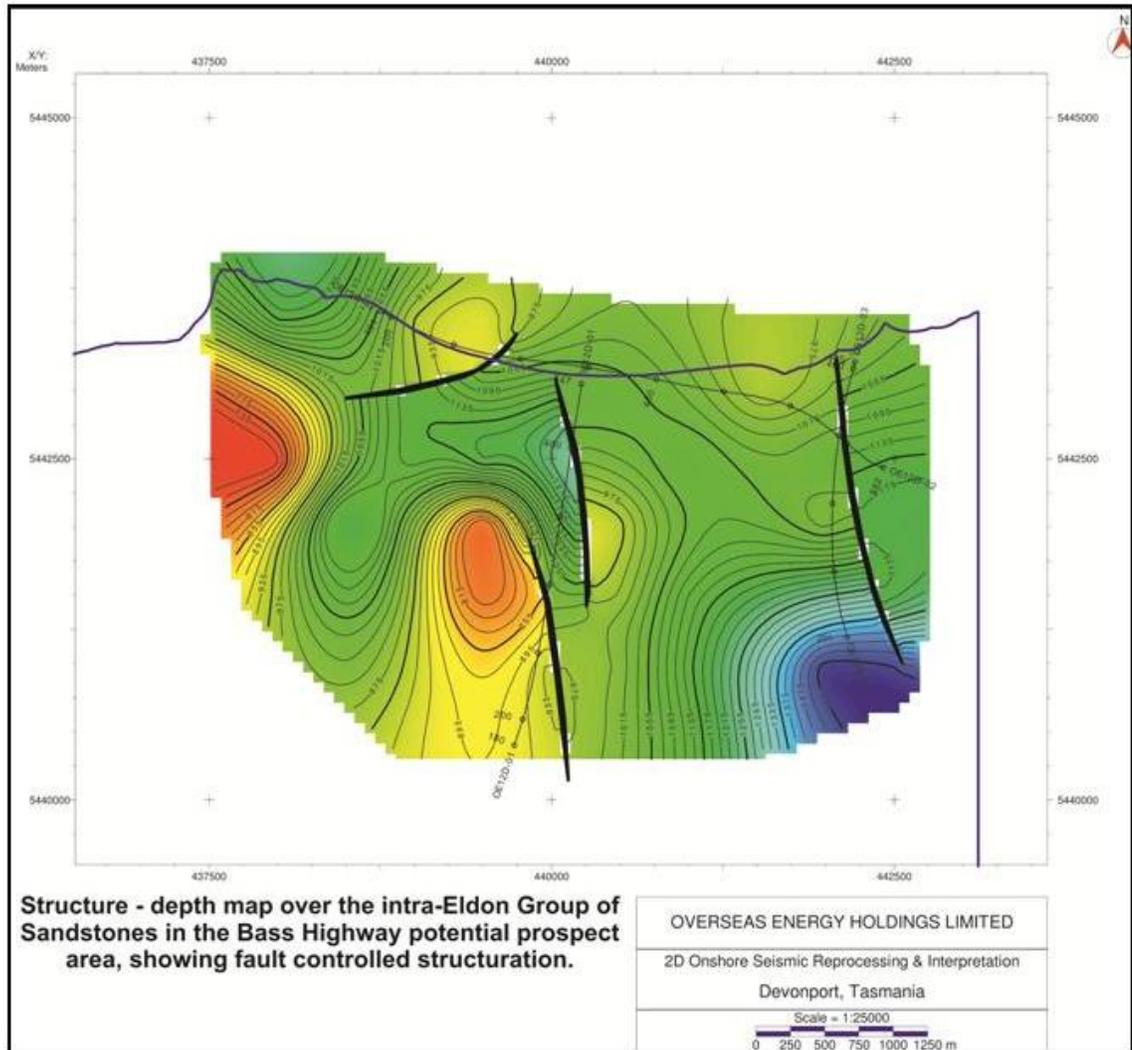


Figure 36. Structure – depth map of the Eldon Gr. of sandstones from the Bass Highway potential prospect area, illustrating a good fault controlled structure in the southwest corner of the map.

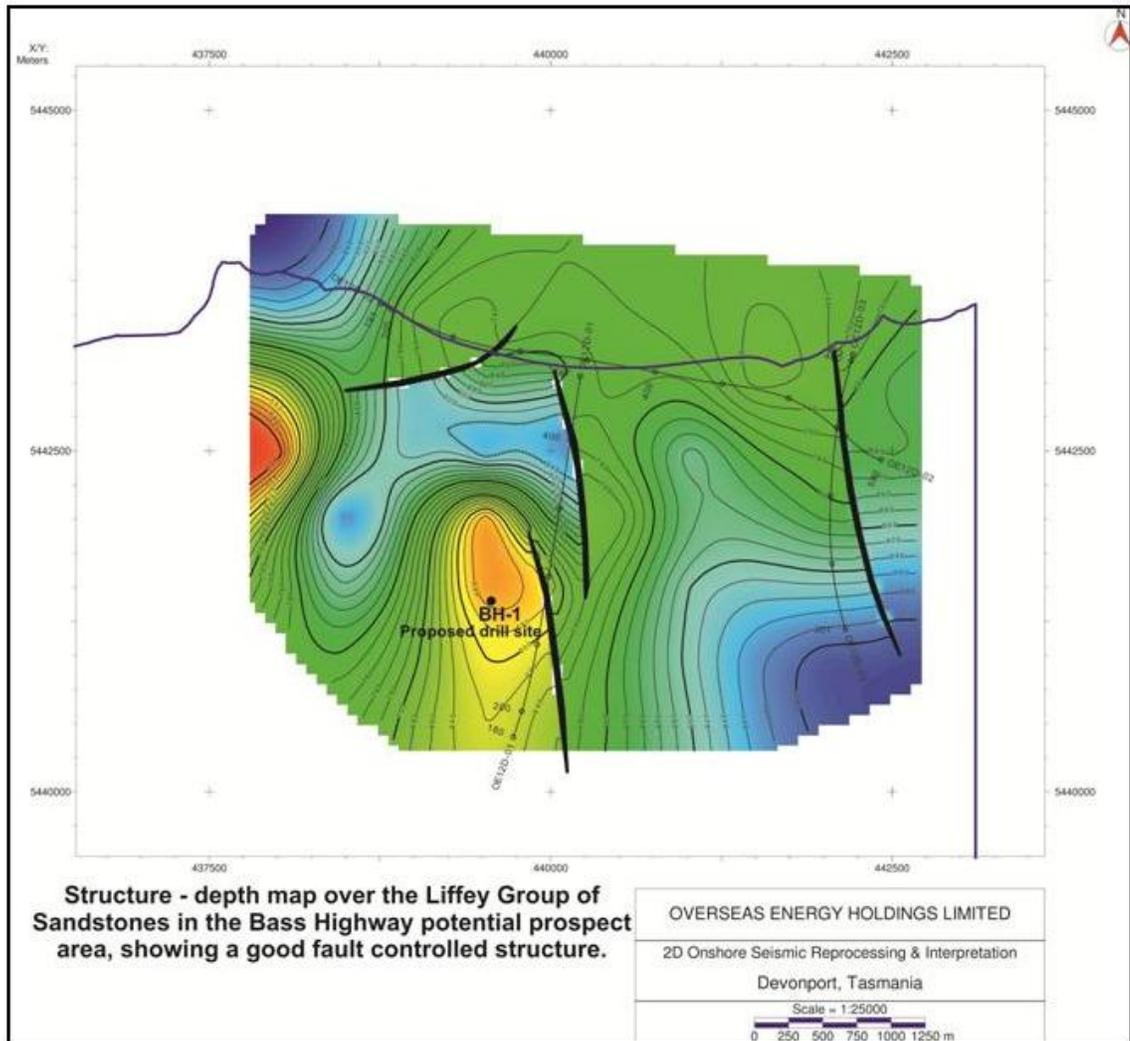


Figure 37. Structure – depth map of the Liffey Gr. of sandstones from the Bass Highway potential prospect area, illustrating a good fault controlled structure in the southwest corner of the map with a proposed drill–site shown.

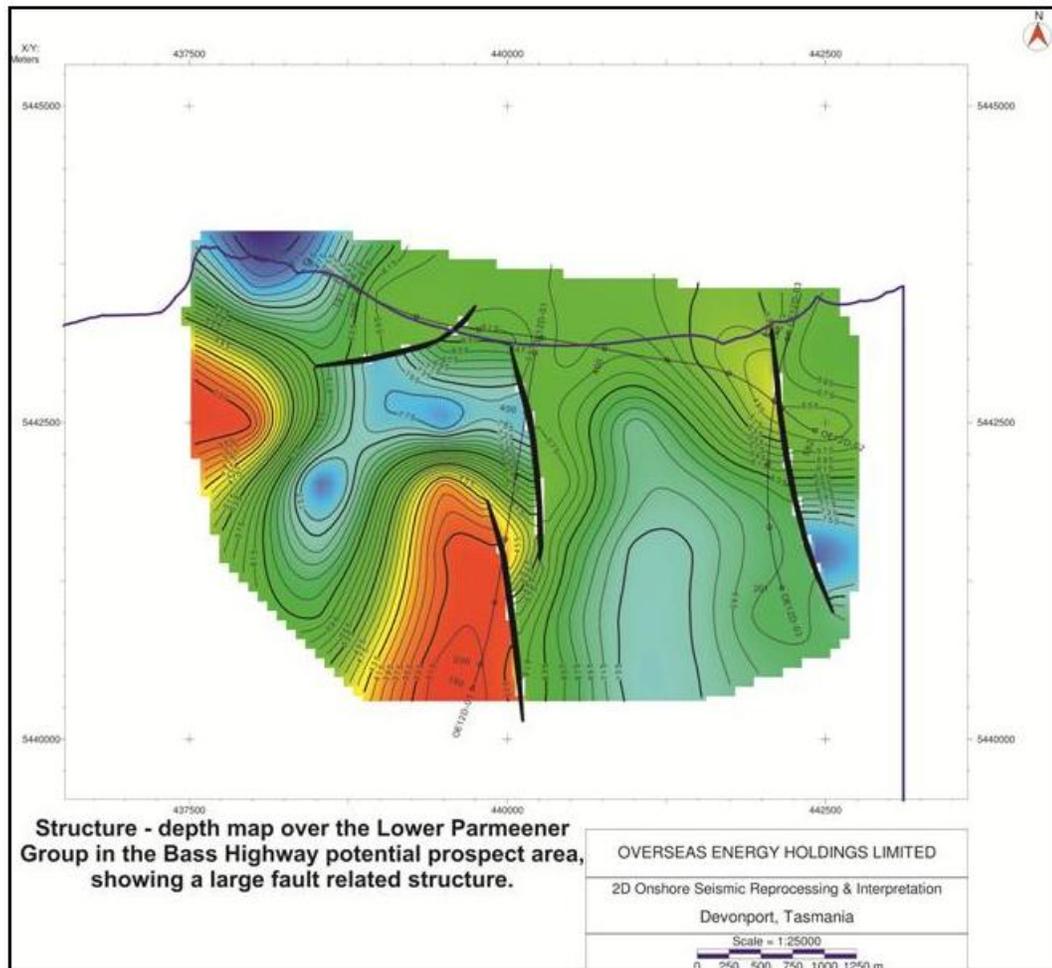


Figure 38. Structure - depth map of the Lower Parmeener Group of sandstones from the Bass Highway potential prospect area, showing fault-related structuration.

### 5.1.2. The Westbury Potential Prospect Area

Similar seismic interpretation and structure – depth contour map generation works were carried out in the Westbury potential prospect area, as described above. Faulting is extensive in the Westbury area just as in the previous case. Structural closures were formed on all four correlated and interpreted reflective horizons, indicating that these horizons could be potentially prospective with respect to oil and gas accumulation. Figure 39 and Figure 40 illustrate two seismic lines from the Westbury potential prospective area with reflective horizon correlation and interpretation. Line in Figure 39 shows good structural development on the reflective horizons interpreted with faults displaying a major role in the structuration. Reflectivity and resolution in both of the seismic sections is quite good and clear which makes horizon correlation easier. However, as both sections illustrate that reflectivity and resolution become quite weak with increasing depth and at greater depths. Such rocks are similar to the high velocity crystalline basement rocks that usually underlie the sedimentary basins that show very weak or no reflectivity.

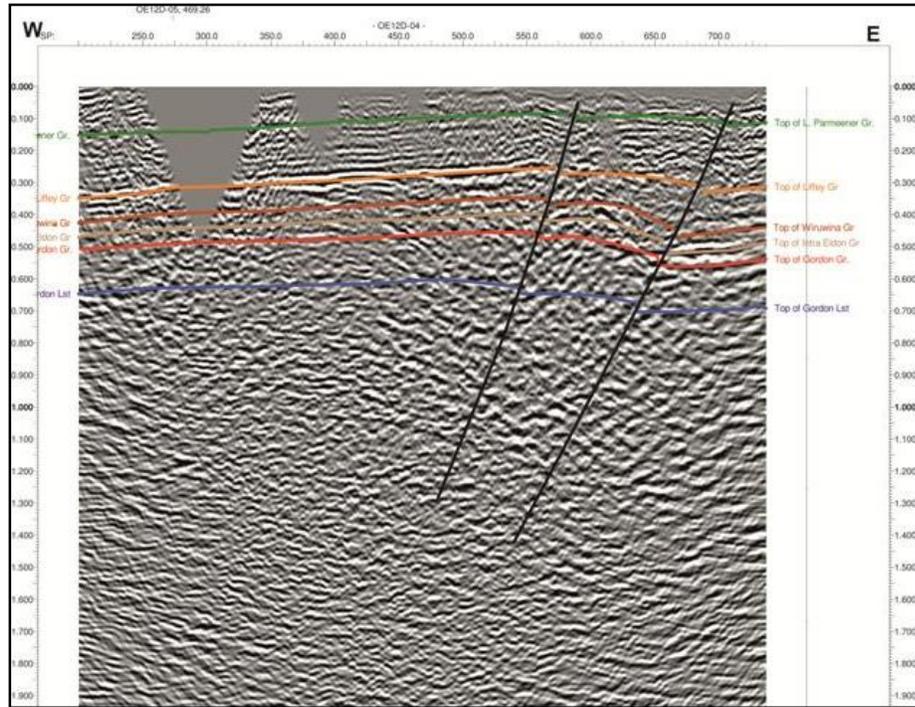


Figure 39. Structurally interpreted W-E seismic line OE12D-04 from the Westbury potential prospect area, showing correlation of the reflective horizons.

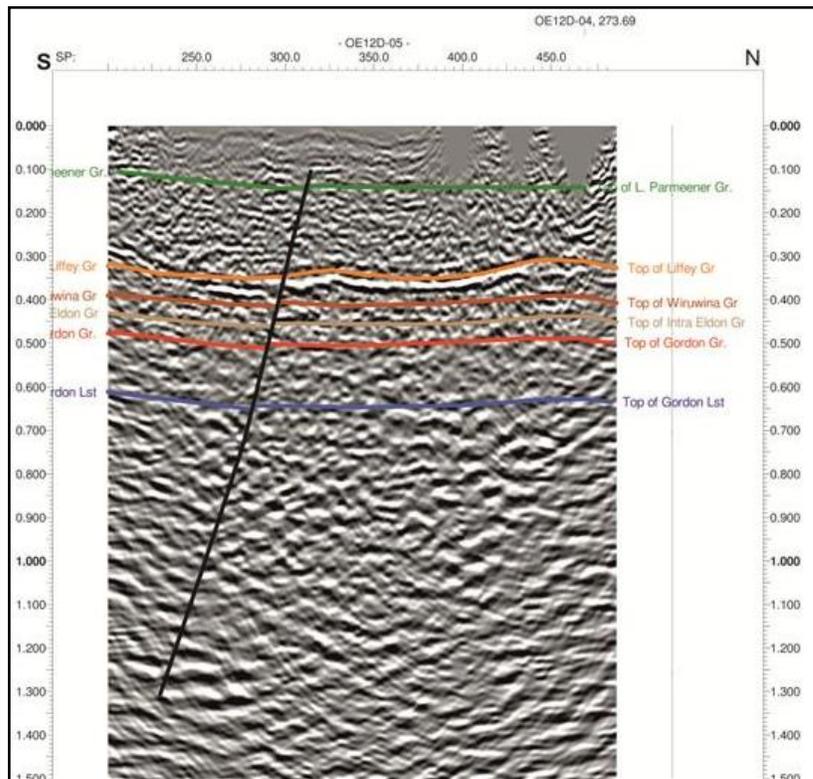


Figure 40. Structurally interpreted N-S seismic line OE12D-05 from the Westbury potential prospect area, showing correlation of reflective horizons.

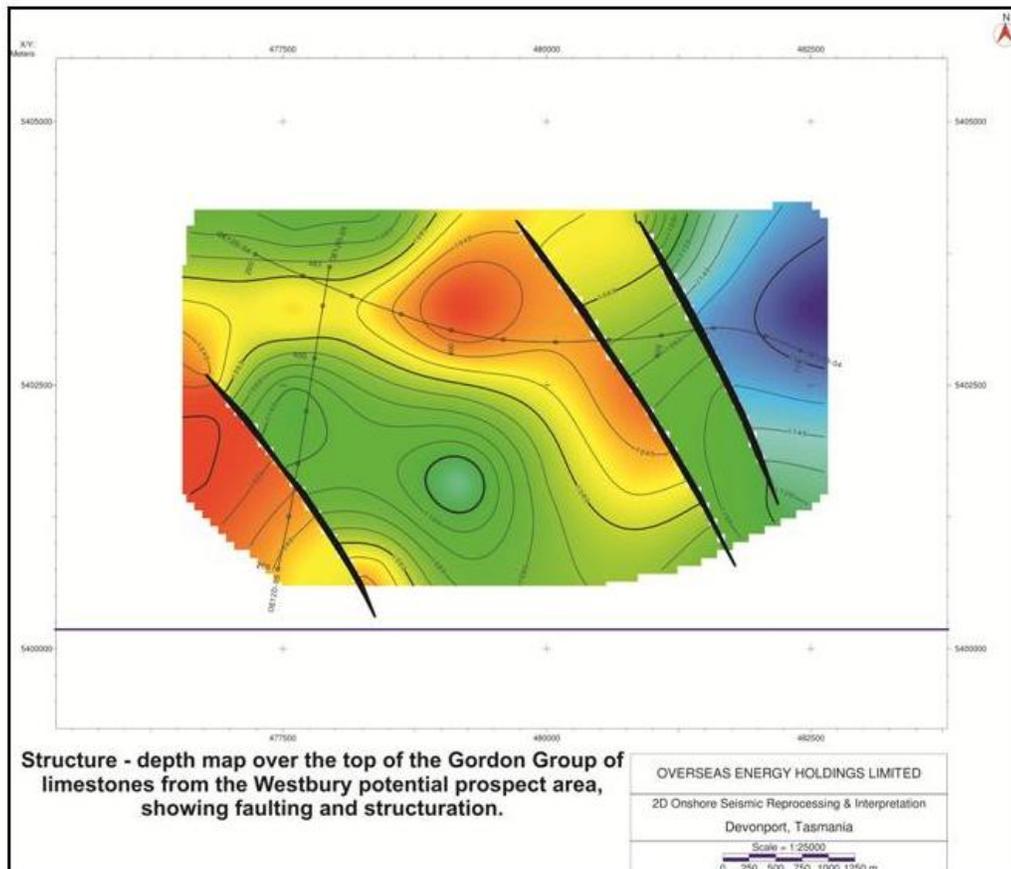


Figure 41. Structure –depth contour map of the Gordon Group limestones from the Westbury potential prospect area, showing fault controlled structuration.

Figure 41 to Figure 44 show structure – depth contour maps of the Gordon Group limestones, Eldon Group sandstones, Lower Parmeener and Liffey Group of sandstones. These maps all show good structural closure developments, controlled by the faulting. Structural closures are quite large in Figure 41,

Figure 42 and Figure 44, indicating that the Gordon Group, the Eldon Group and the Liffey Group of sandstones may hold good potential with respect to oil and gas accumulation and entrapment. Although, seismic section coverage of the area is sparse and not sufficient to make such a decided judgment, it is quite clear from the interpreted and mapped seismic data available that good potential exist as there is definitely four-way structural development took place in the potential prospect area. Furthermore, because of the good structural development in the area as the maps illustrate, a possible potential drill-site, named W-1 is suggested and shown in Figure 44. This well could test the Liffey, the Eldon and the Gordon groups potential all at once.

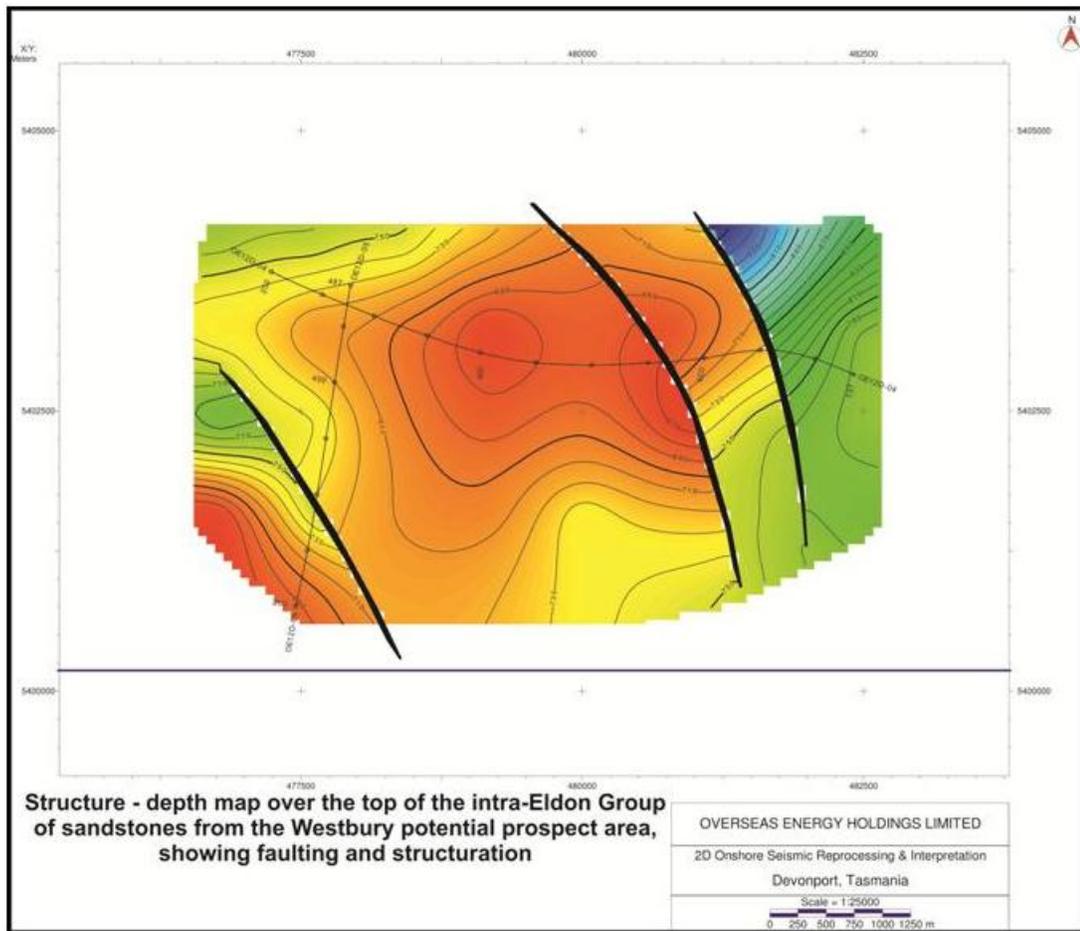


Figure 42. Structure – depth map of the Eldon Group of sands from the Westbury potential prospect area, showing a large structural development in the center.

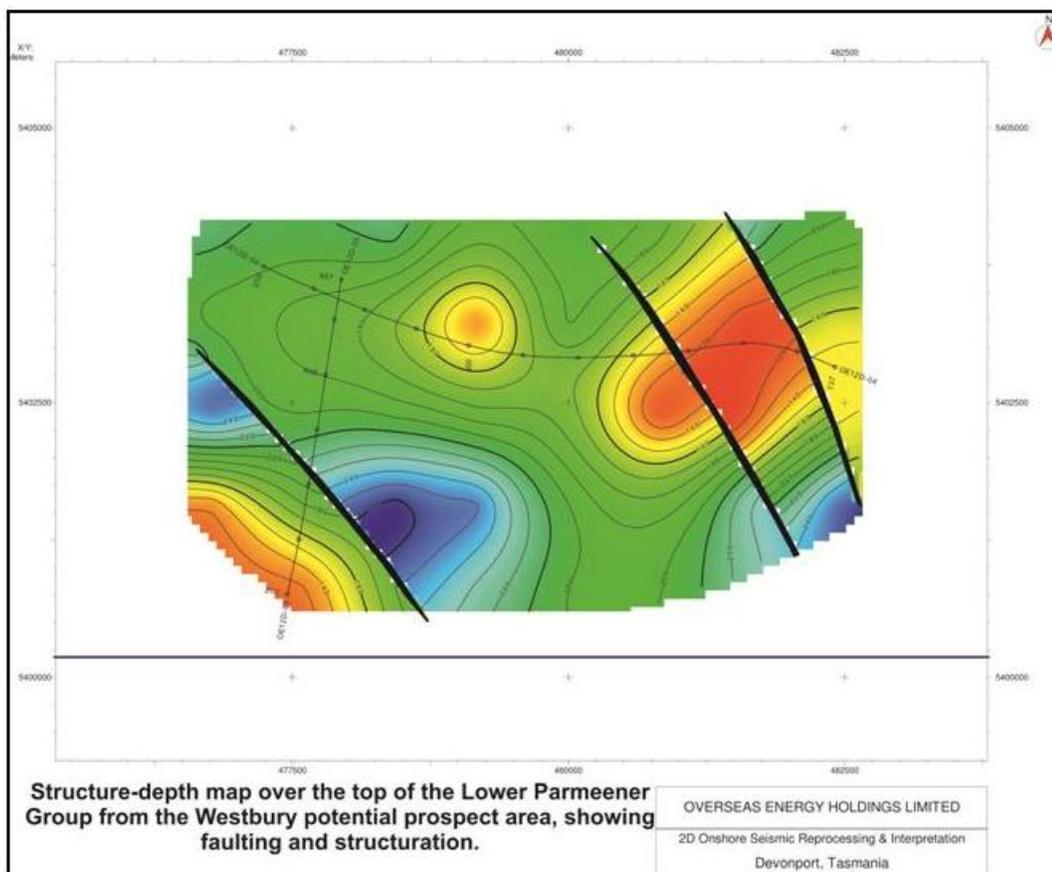


Figure 43. Structure – depth map of the Lower Parmeener Group from the Westbury potential prospect area, showing faulting and structuration in the northeast.

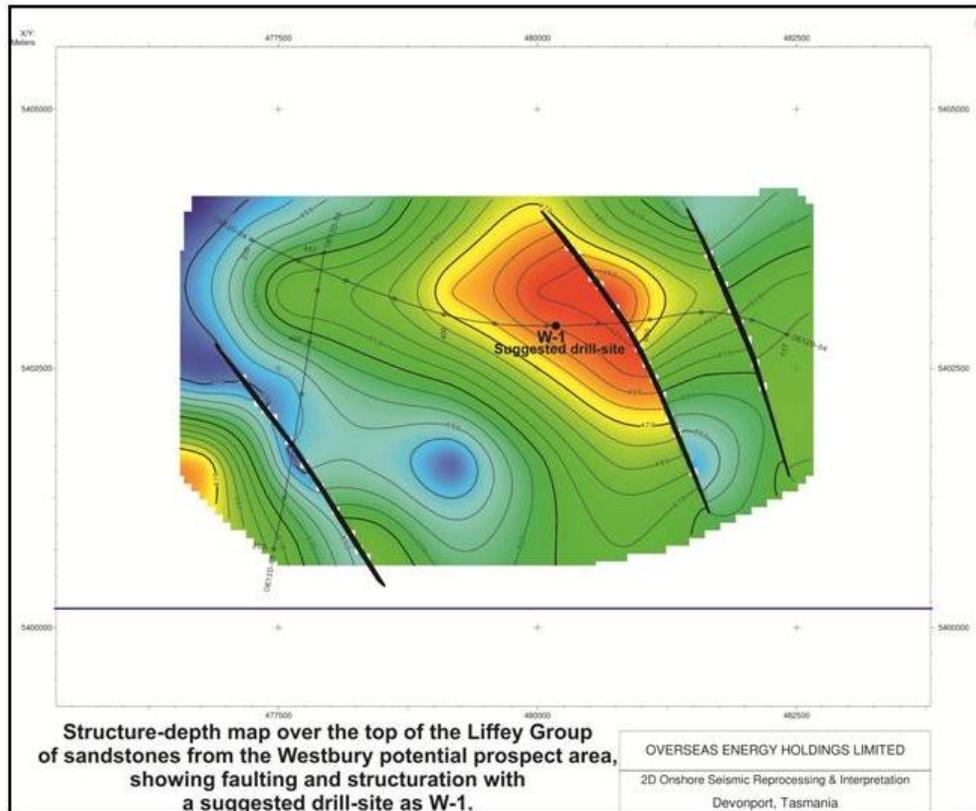


Figure 44. Structure – depth map of the Liffey Group of sandstones from the Westbury potential prospect area, showing fault related structural development.

### 5.1.3. The Weymouth Road Potential Prospect Area

The similar seismic section correlation, interpretation and mapping were carried out in the Weymouth Road potential prospect area as shown in

Figure 45 to Figure 50. Two crossing seismic lines were shot in the area as shown in

Figure 45 and Figure 46, with relatively poor seismic reflectivity and resolution, because of the complex geological terrain and faulting. Reprocessing of these lines improved resolution somewhat. Interpretation and mapping of the reflective horizons show large structural developments in the Lower Parmeener, the Liffey Group and in the Eldon Group horizons as shown in the structure – depth maps in Figure 48 to Figure 50. Because of the geological complexity in region and poor seismic resolution of the seismic lines available, more and better seismic coverage is necessary to better define large structures shown in Figure 48 to Figure 50 to be certain of their integrity. With some additional seismic coverage in the area to better define structures mapped and shown in Figure 48 to Figure 50, good oil and gas prospective leads could be developed with good commercial upsides. At this stage we didn't suggest any drill-sites in this area as we have done in the preceding potential prospect areas.

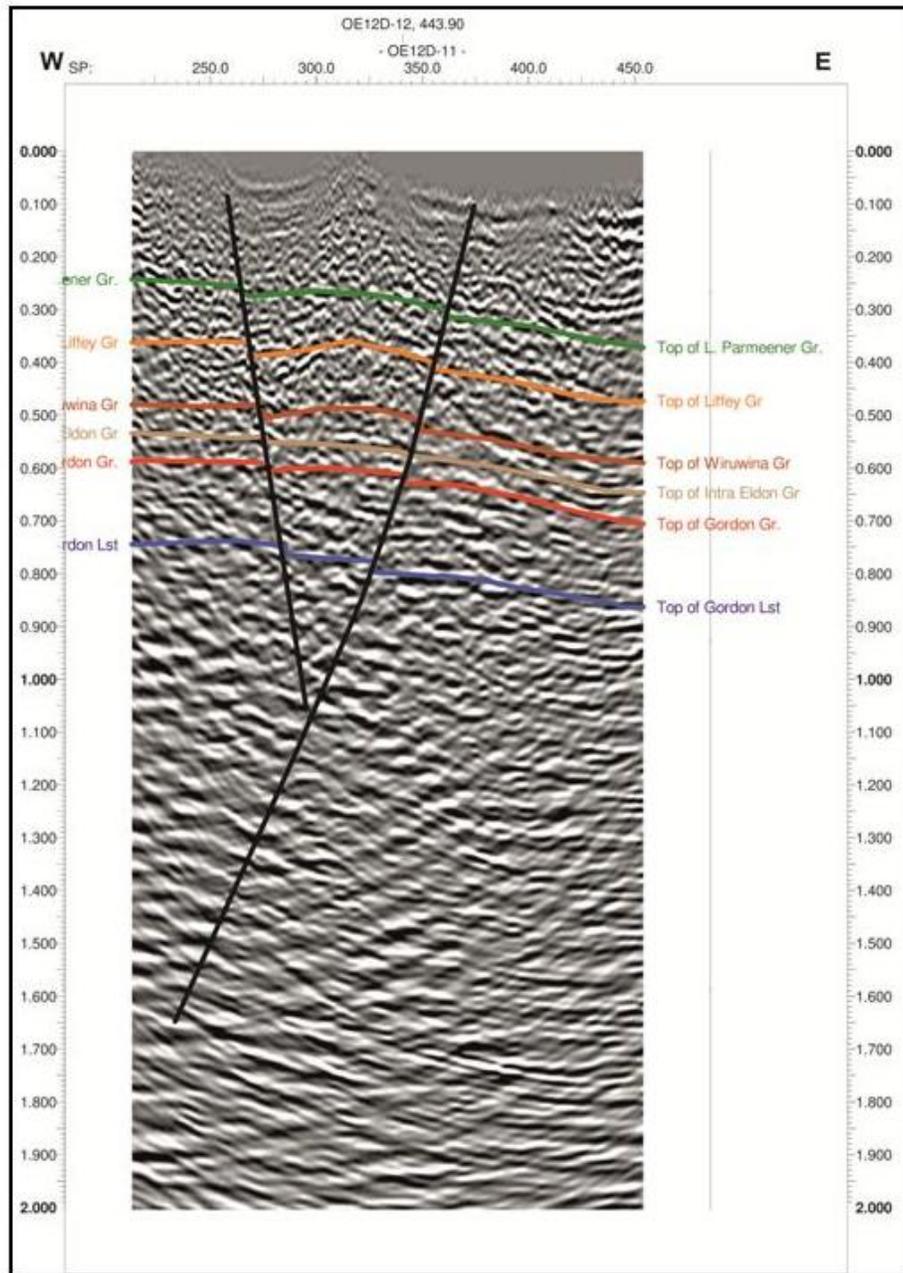


Figure 45. Structurally interpreted seismic line OE12D-11 from the Weymouth Road potential prospect area, showing correlation of the reflective horizons.

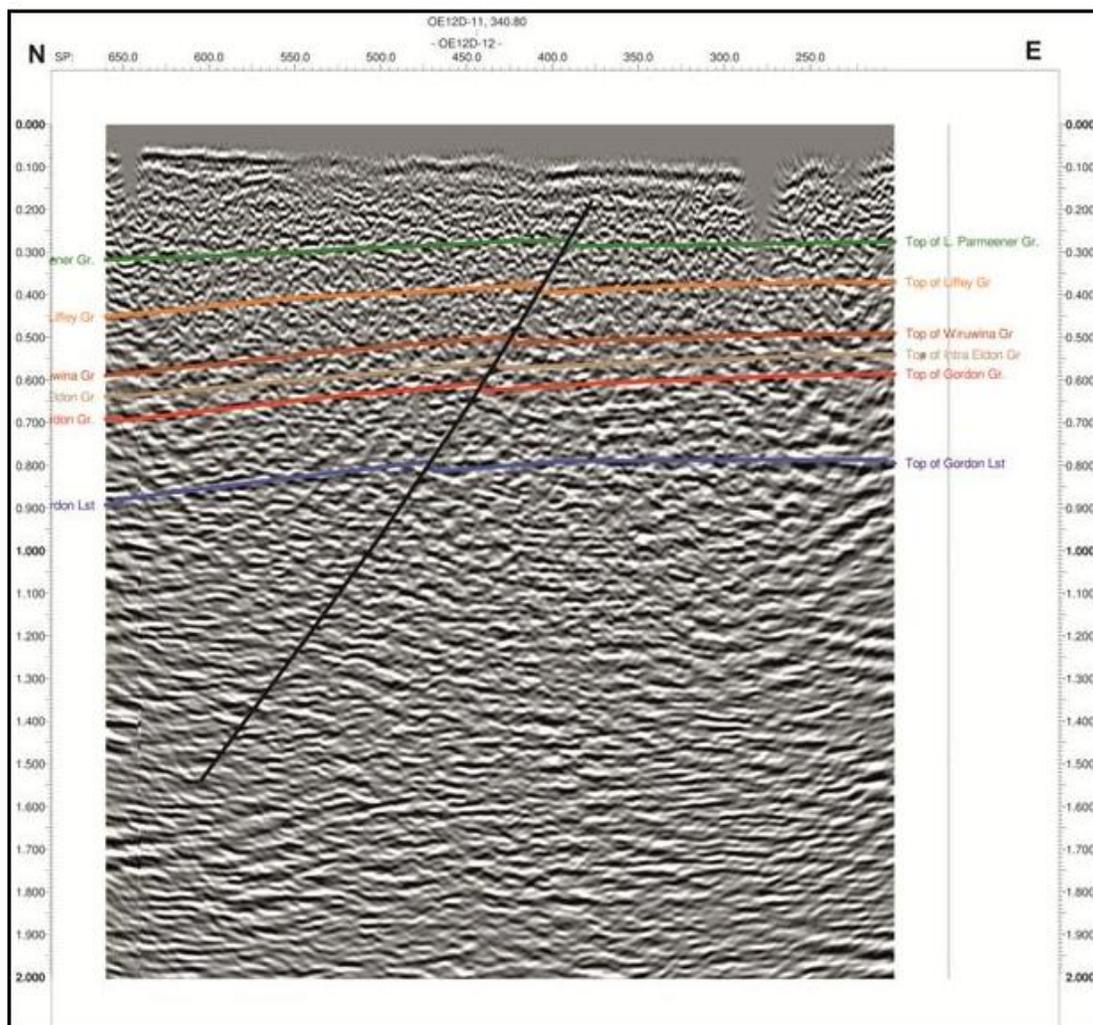


Figure 46. Structurally interpreted seismic line OE12D-12 from the Weymouth Road.

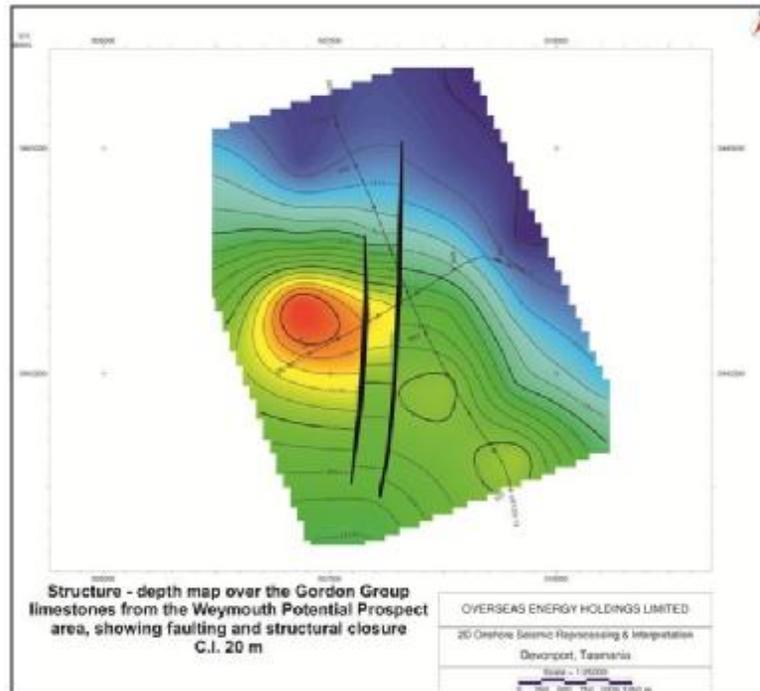


Figure 47. Structure – depth map of the Gordon Group from the Weymouth Road potential prospect area, showing fault-related structural development.

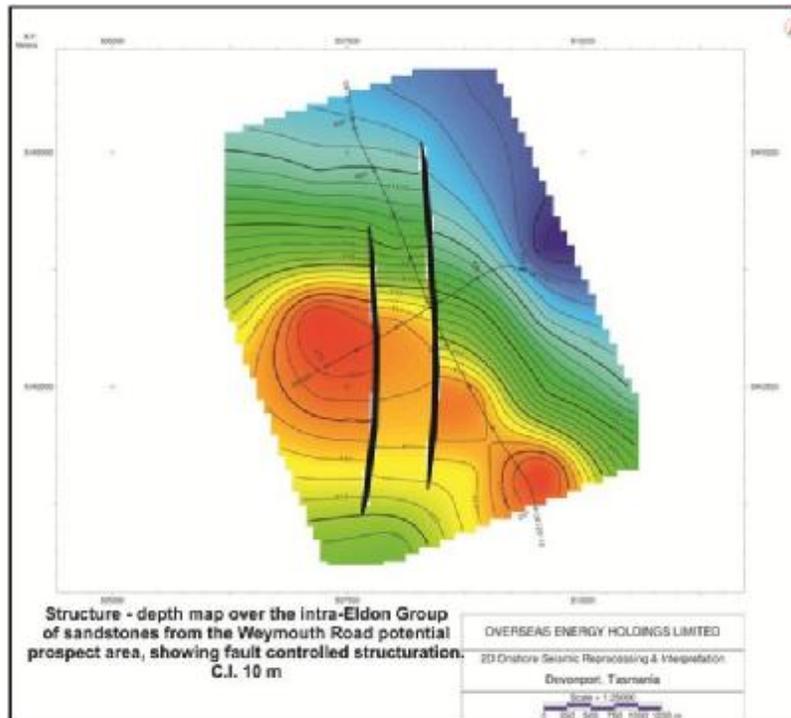


Figure 48. Structure – depth map of the Eldon Group from the Weymouth Road area, showing good structural closures and faulting.

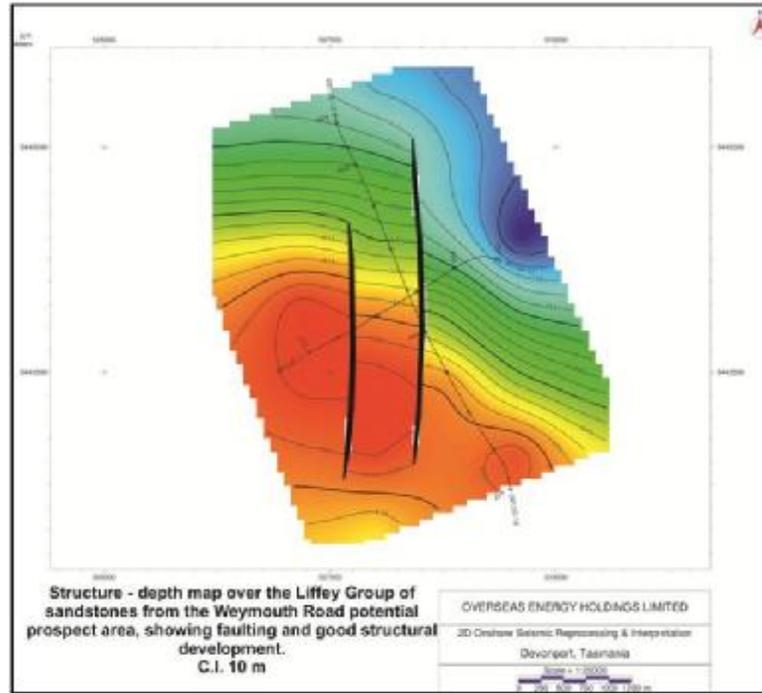


Figure 49. Structure – depth map of the Liffey Group of sandstones from the Weymouth Road area, showing large structural development on the southwest of the map area with fault control.

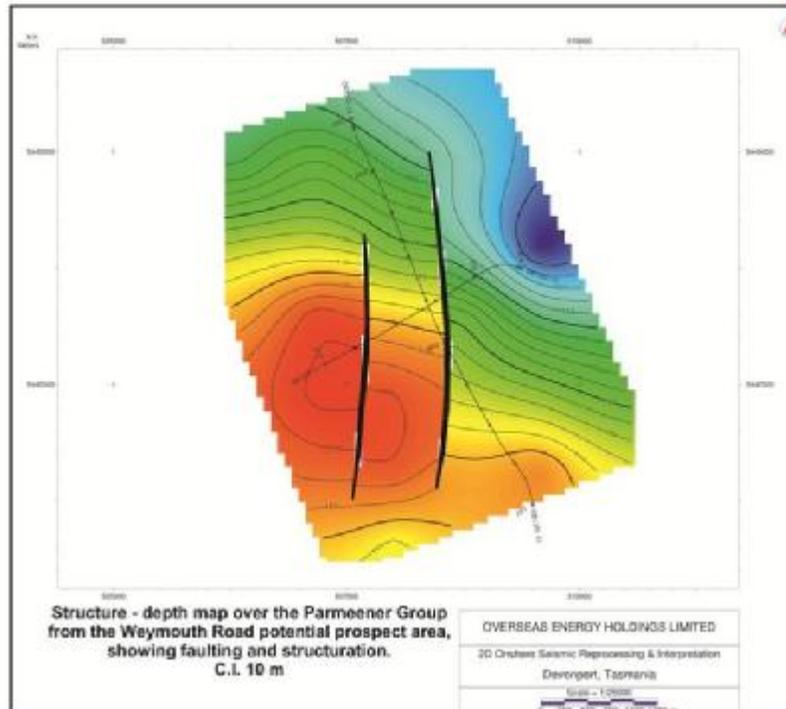


Figure 50. Structure – depth map of the Lower Parmeener Group from the Weymouth Road, showing a large structural development on the west-southwest of the map area, possibly fault controlled.

#### 5.1.4. Batman Bridge Potential Prospect Area

Surface of this area is covered by the high velocity dolerite rocks which cause seismic resolution and reflectivity to be quite poor. Two seismic lines were shot in this area shown in Figure 51 and Figure 52, with relatively poor resolution and reflectivity which makes horizon correlation and interpretation very trying. Although much noise was removed from the seismic sections during the reprocessing work, resolution improvement was relatively limited as can be observed in Figure 51 and Figure 52. Because of limited success in resolution improvement after reprocessing, only two mappable reflective horizons could be identified and correlated for the final map contouring, namely the top of the Liffey Group and the top of the intra-Eldon Group and these two horizons were structure – depth mapped as shown in Figure 53 and Figure 54. Both maps show fault controlled structural closures as shown. However, structural trap development on the top of Liffey Group is better formed compared to the Eldon Group top structuration.

The open ended structural development in the left hand side of the maps in Figure 53 and Figure 54 is not fully defined, because only seismic line OE12D-10 defines this structural development and this is not sufficient for the integrity of this half structure. Additional seismic coverage is needed to define and verify it better, so that it could be developed into a commercially viable lead. Because of the poor seismic resolution and reflectivity in this area, additional and better designed seismic coverage is needed to define reflective horizons and structures better.

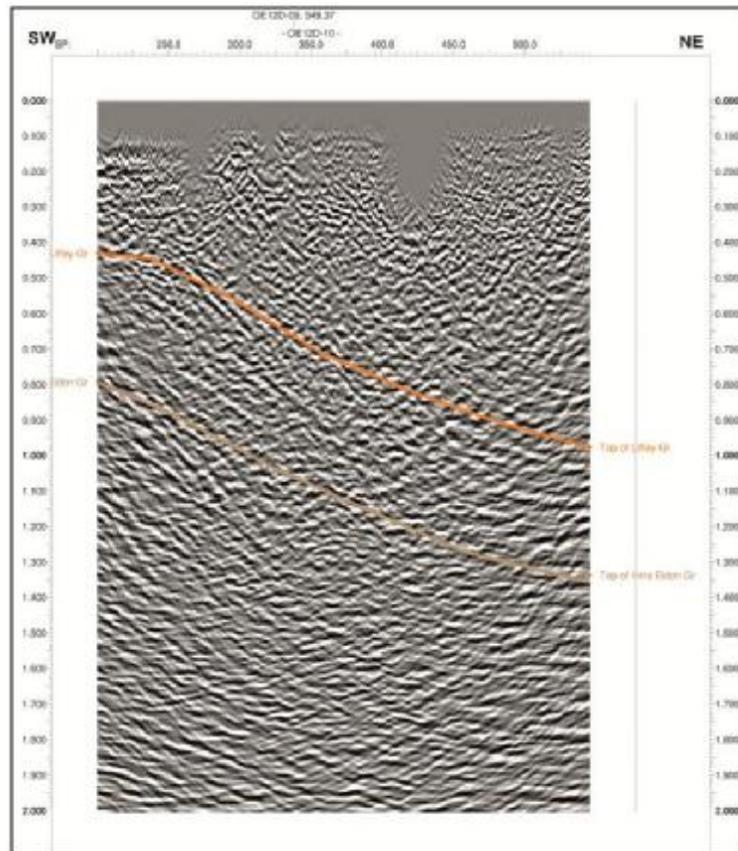


Figure 51. Structurally interpreted seismic line OE12D-10 from the Batman Bridge potential prospect area, showing reflective horizon correlation.

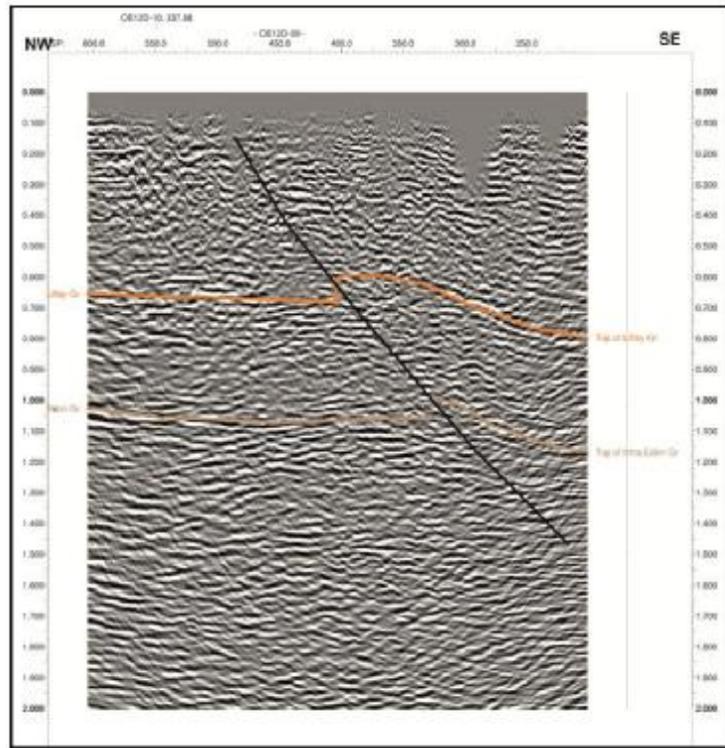


Figure 52. Structurally interpreted seismic line OE12D-09 from the Batman Bridge potential prospect area, showing correlated horizons and a large piercement fault.

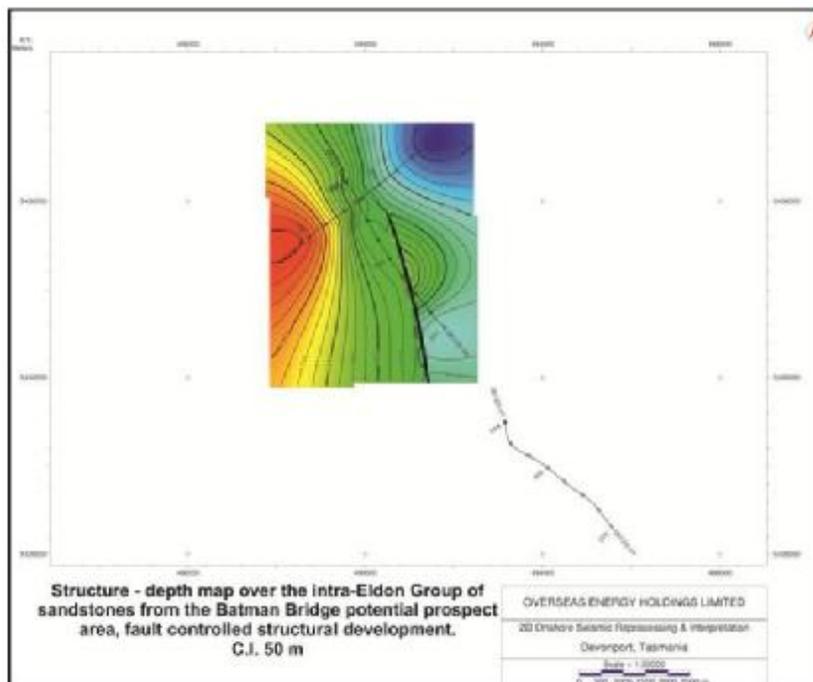


Figure 53. Structure – depth map of the Eldon Group from the Batman Bridge potential prospect area, showing faulting and fault related structuration.

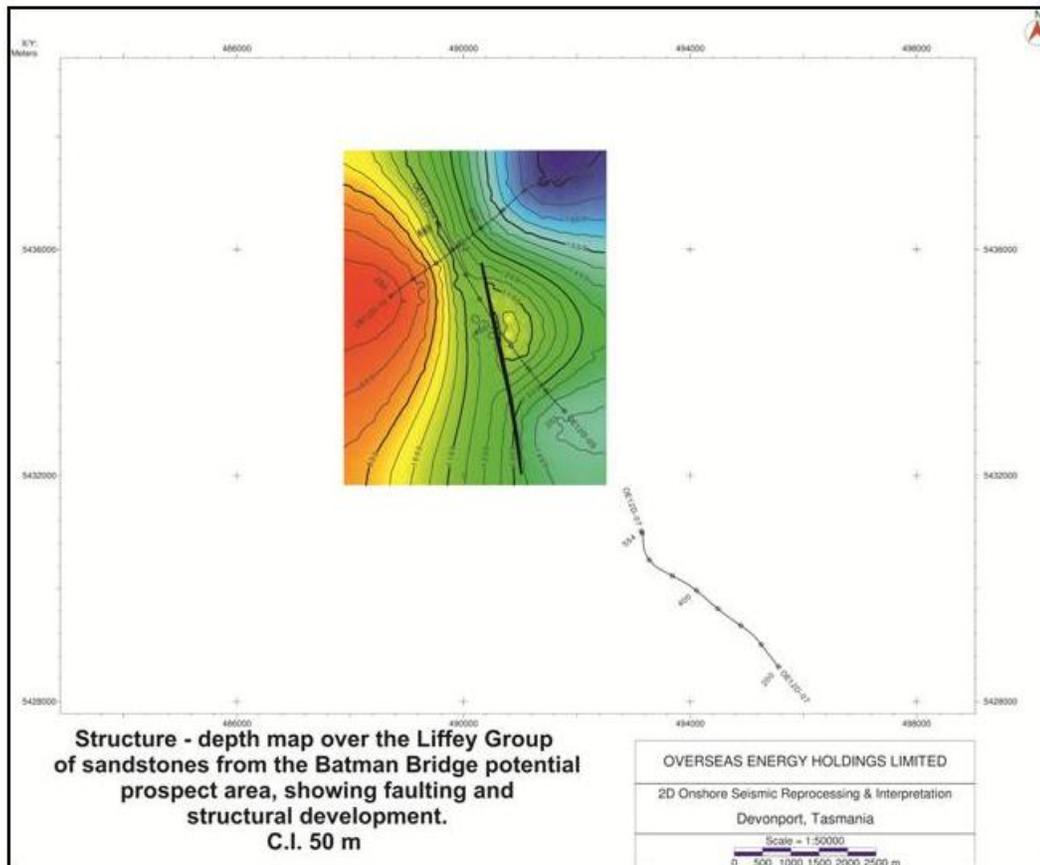


Figure 54. Structure – depth map of the Liffey Group from the Batman Bridge potential prospect area, showing fault controlled structural development.

### 5.1.5. Westwood-1 Well Area

After drilling Westwood-1 in the late 2009 in the license block area, OEHL had detailed bouguer gravity survey and shot one–line of reflection seismic (Line OE12D-06) to see the geological conditions in the area and also to tie and correlate the Westwood-1 with the sedimentary sequences present in the area. The results of the gravity survey and mapping are shown in Figure 31 and Figure 55. Figure 55 also shows seismic line OE12D-06 with respect to the gravity survey area. The gravity mapping shows that the thick sedimentary sequences occur to the southwest of the seismic shot and seismic line was shot over much deformed area and where the crystalline basement rocks may be shallower than what they are to the southwest of the gravity survey area. If OEHL wants to further pursue the petroleum potential of the Westwood-1 well area, then they should concentrate in the southwest of the seismic line OE12D-06 and maybe several regional seismic lines shot in this particular southwest area could determine and define where the good and oil and gas prospective structural leads could be located.

shows structurally interpreted seismic line OE12D-06 and Figure 57 to Figure 59 illustrate structure – depth contour mapping based on the interpretation of line OE12D-06. Seismic resolution and reflectivity is quite good in the seismic line after reprocessing and its structural and horizon interpretation high quality as shown in

Figure 56. The structure - depth maps however were generated based on only one seismic line, namely line OE12D-06 and the contour lines do not close as there are no other second or third data points to make a loop and make the contours close. This interpretation of the seismic line and depth maps generated from it is to illustrate the general geological structural trends and how the subsurface sedimentary sequences behave in the area. The maps in Figure 57 to Figure 59 show that there is a general NW to SE structural trend in the area and basement gets deeper southwestward, which is quite in good agreement with the general geological structural trend in the area and match quite nicely with the results of the Bouguer gravity survey and mapping shown in Figure 31 and Figure 55.



Figure 56. Structurally interpreted NW-SE seismic section OE12D-06, from the Westwood-1 well area, illustrating fault and horizon interpretation and correlation with Westwood-1 projected. Faulting in the area is quite intense as shown.

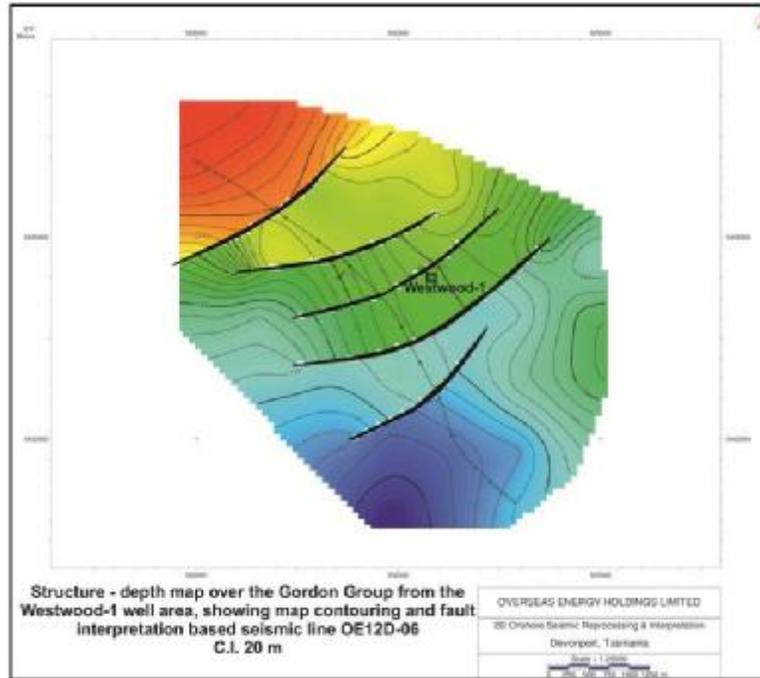


Figure 57. Structure-depth map over the Gordon Group from the Westwood-1 well area, illustrating a general northwest rising trend with sub-parallel faulting pattern.

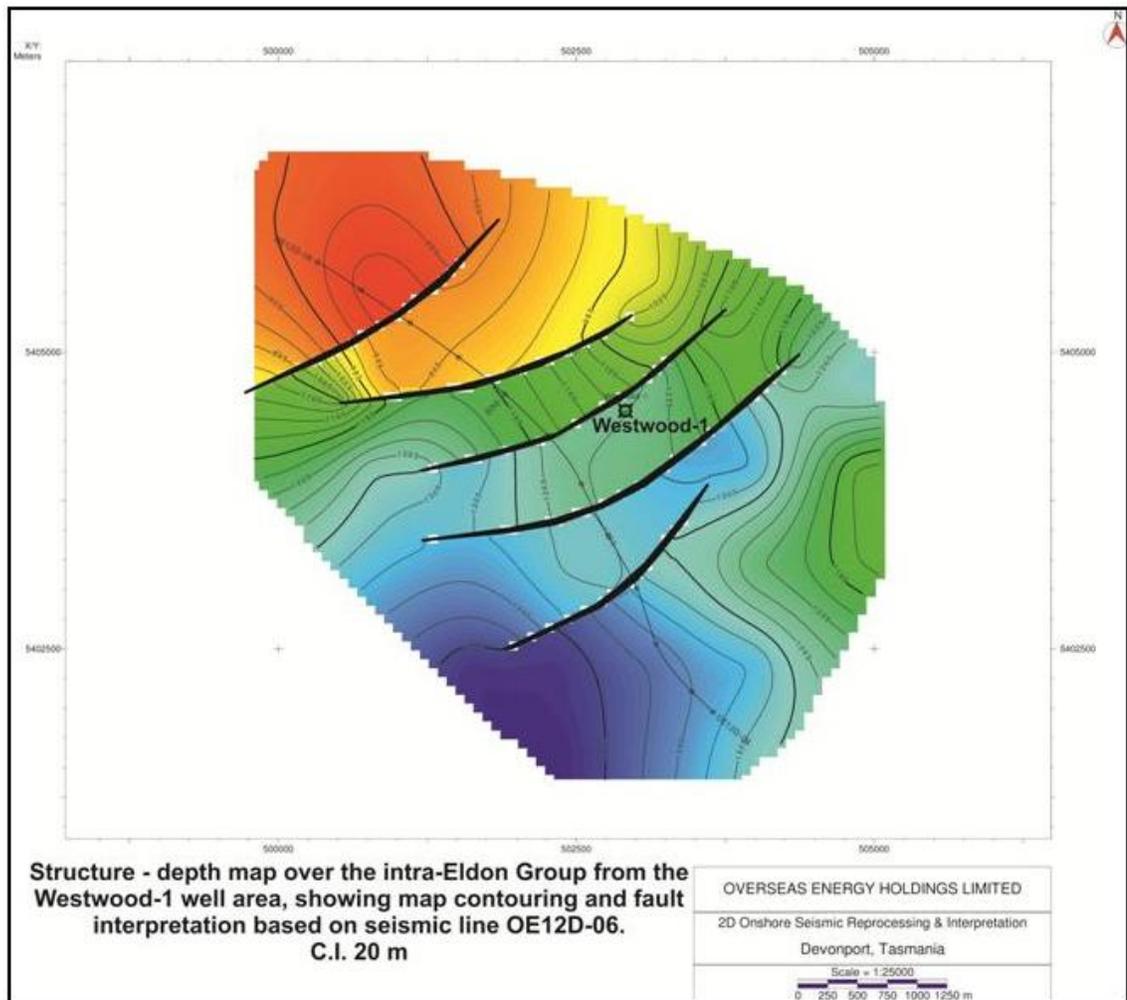


Figure 58. Structure-depth map over the Eldon Group from the Westwood-1 well area, illustrating a general northwest rising structural trend with sub-parallel faulting pattern

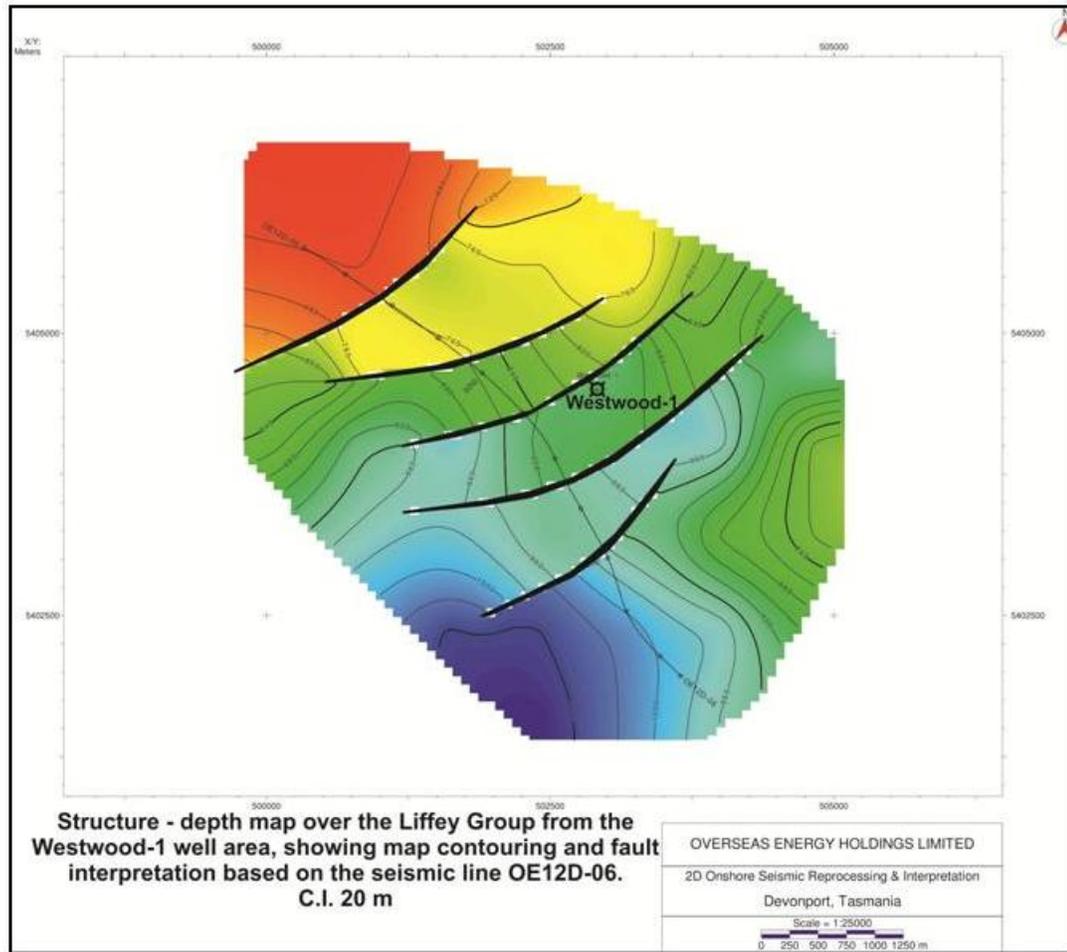


Figure 59. Structure-depth map over the Liffey Group from the Westwood-1 well area, illustrating a general northwest rising structural trend with sub-parallel faulting pattern and deepening of the basement to the southwest.

## 5.2. Net Pay Isopach Mapping and Potential Resource Estimation Calculation

### 5.2.1. Net Pay Isopach Map Generation

Net pay isopach (thickness) maps were generated over the potential prospective horizons mapped structurally in the Bass Highway, Westbury, Weymouth and Batman Bridge areas. As explained and described in the preceding pages, net pay isopach mapping was carried out based on the structure – depth map contouring over the potential prospective horizons, sequentially from bottom to top, namely the Gordon Group of limestones (Ordovician in age), the Eldon Group of sandstones (Silurian in age), the Liffey Group of sandstones (Late Carboniferous to Early Permian in age), and the Lower Parmeener Group of sandstones (Late Permian in age). A total of fourteen (14) net pay isopach maps were generated and shown in Figure 60 to Figure 73, four(4) each from the Bass Highway, Westwood, and Weymouth Road area, and two from the Batman Bridge area where the seismic coverage were carried out. Net pay isopach mapping assumed that the steep

plunge of every potential prospective horizon constituted an oil(gas)/water contact and hence zero(0) pay line and the remaining inside contouring was carried out based on the overall thickness of the particular formation and its reservoir characteristics (i.e. porosity, permeability and grain size distribution), deduced from the published information pertaining to the geology of the area and the formations under consideration.

As a result both the structure – depth map generation and net pay isopach mapping indicate that the most prospective areas are the Bass Highway and the Westbury where there is thicker and quieter sedimentation. On the other hand, the Batman Bridge and the Weymouth areas are highly deformed and faulted and more and better seismic data coverage are needed to define and delineate the potential prospective structural leads.

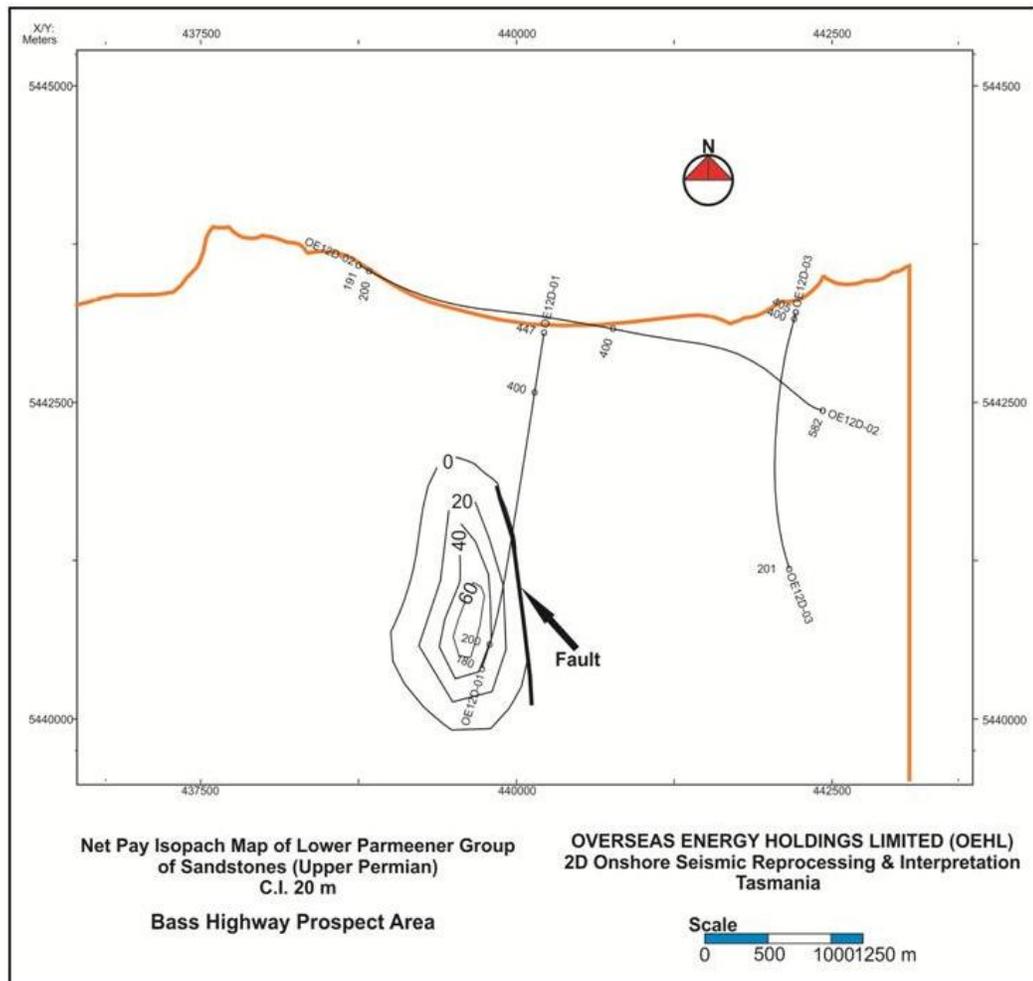


Figure 60. Net pay isopach map of the Lower Permian Group of sandstones from the Bass Highway potential prospect area.

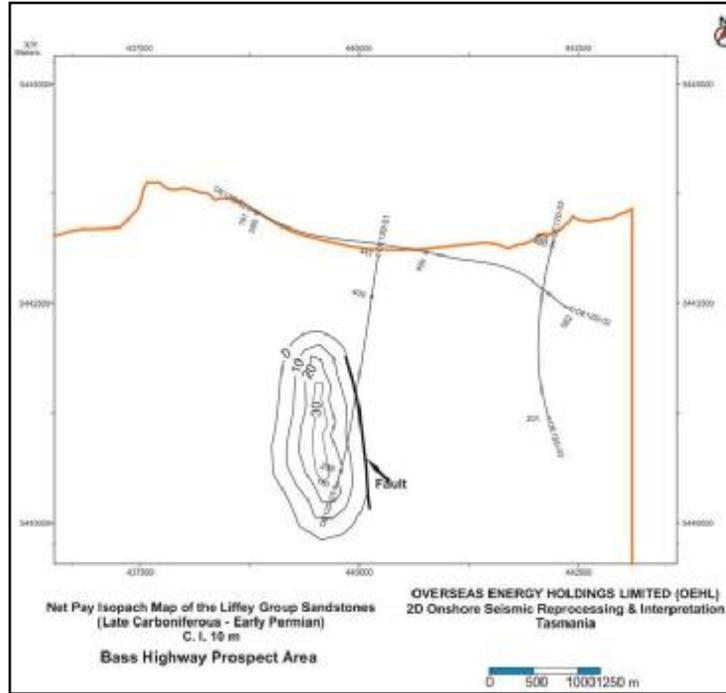


Figure 61. Net pay isopach map of the Liffey Group of sandstone from the Bass Highway potential prospect area.

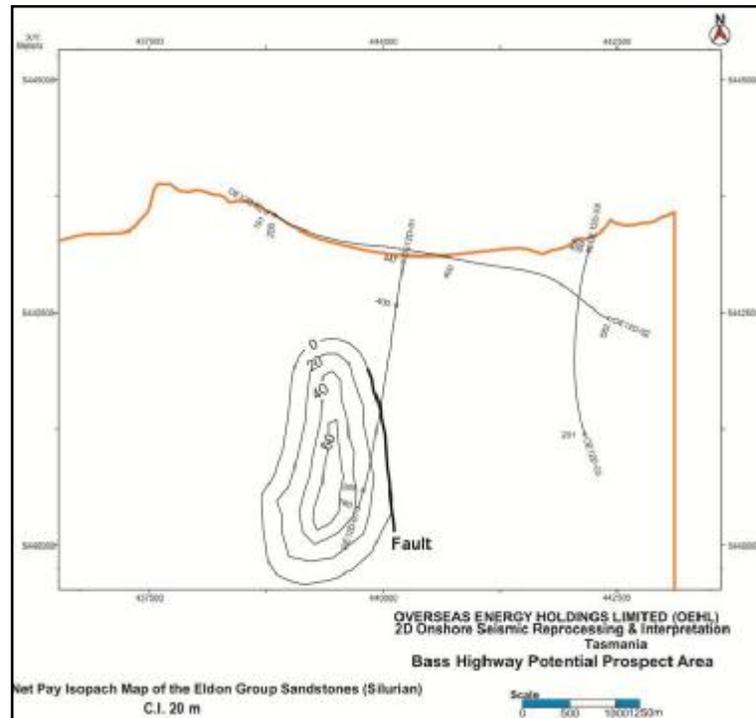


Figure 62. Net pay isopach map of the Eldon Group of sandstones from the Bass Highway potential prospect area.

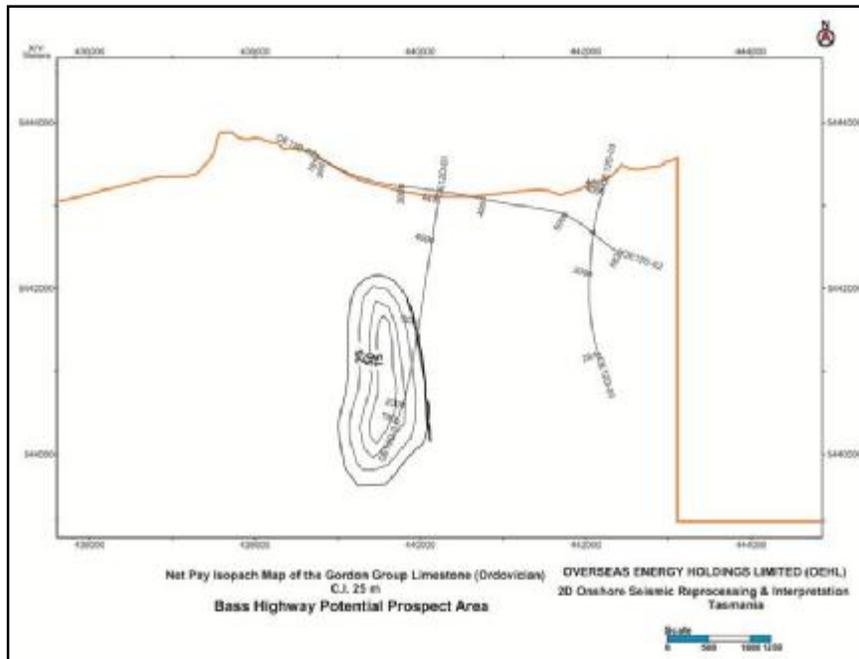


Figure 63. Net pay isopach map of the Gordon Group limestones from the Bass Highway potential prospect area.

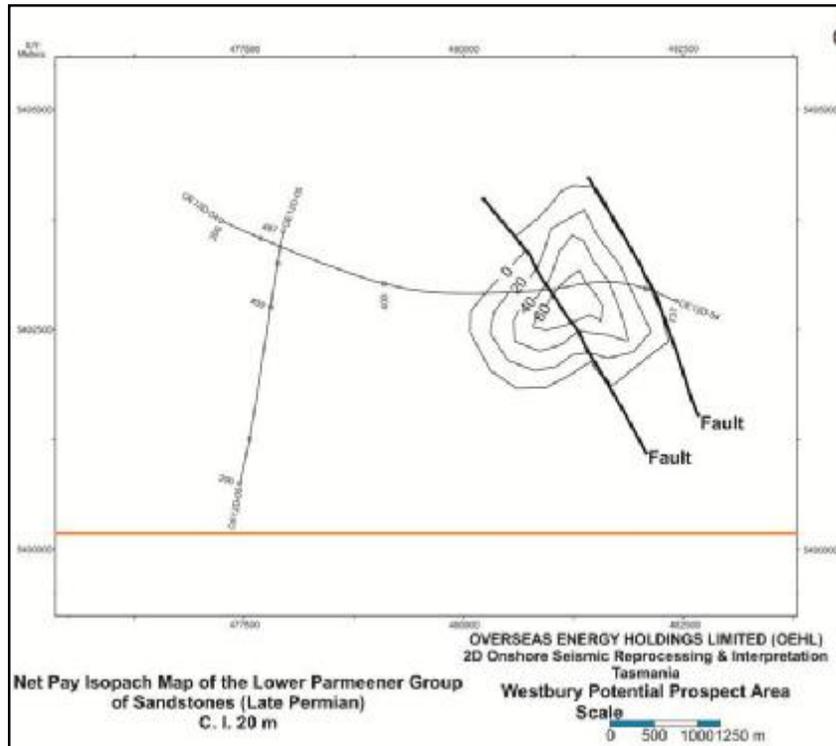


Figure 64. Net pay isopach map of the Lower Permian Group of sandstones from the Westbury potential prospect area.

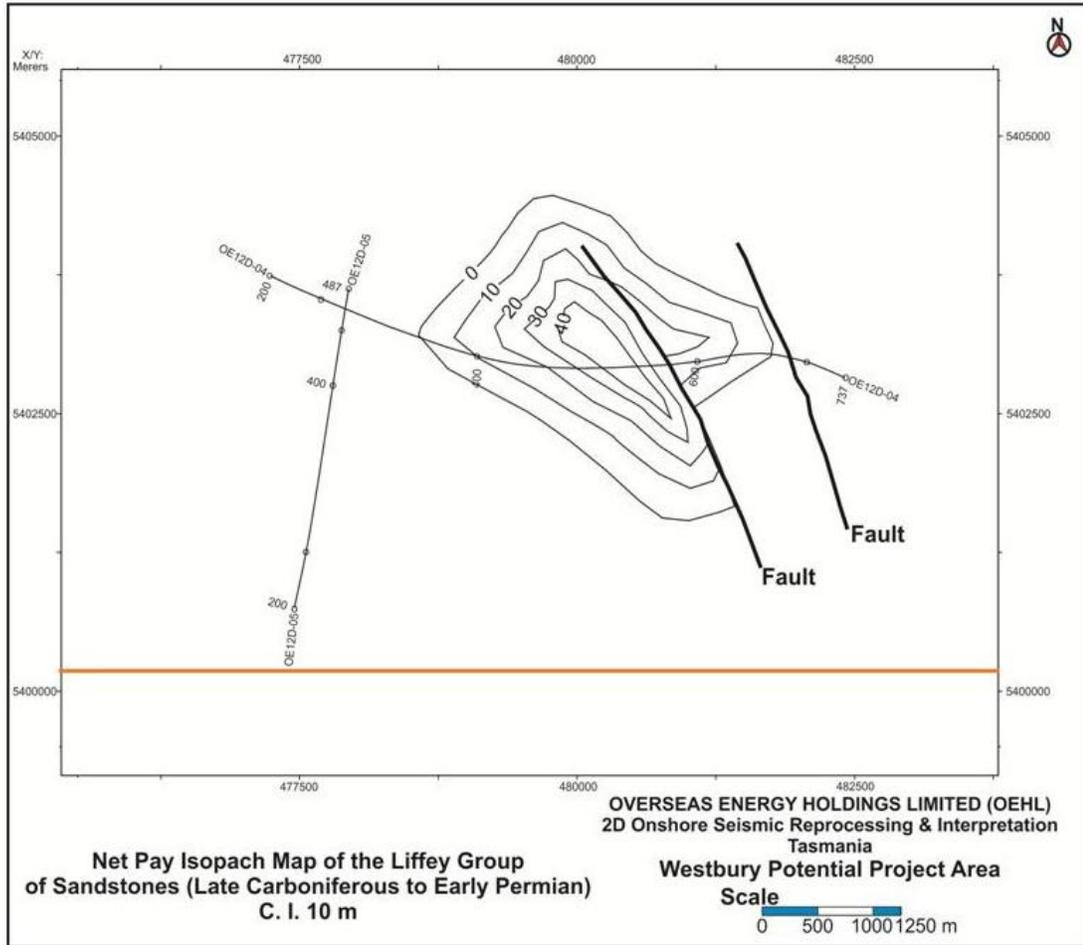


Figure 65. Net pay isopach map of the liffey Group of sandstones from the Westbury potential prospect area.

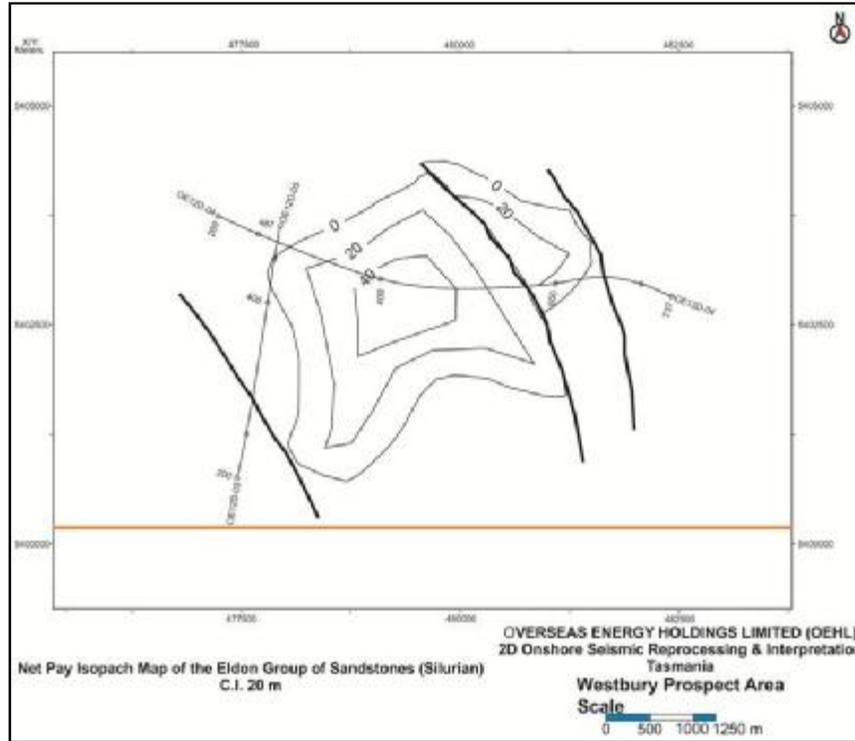


Figure 66. Net pay isopach map of the Eldon Group of sandstones from the Westbury potential prospect area.

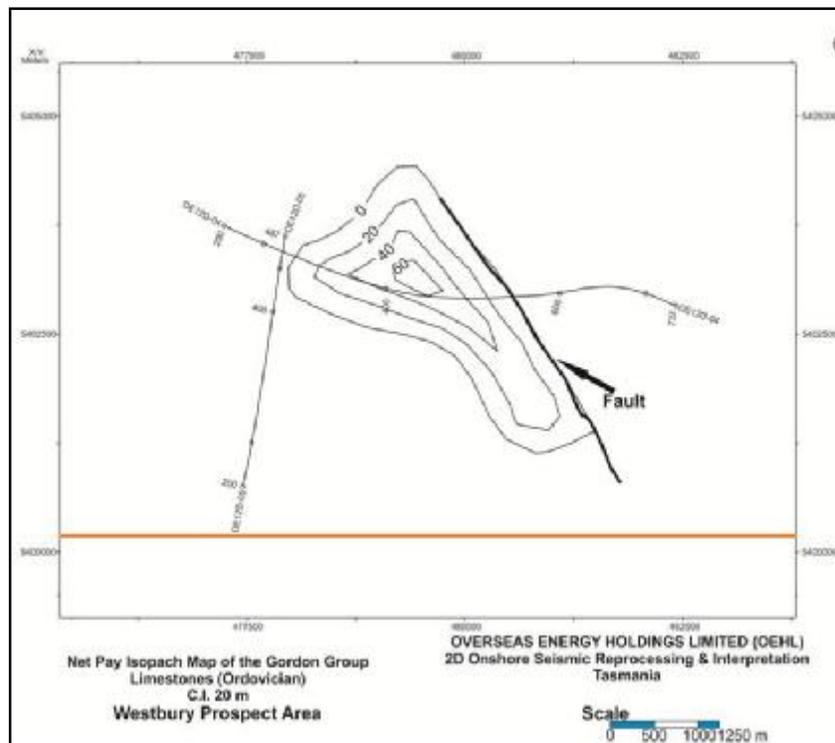


Figure 67. Net pay isopach map of the Gordon Group limestones from the Westbury potential prospect area.

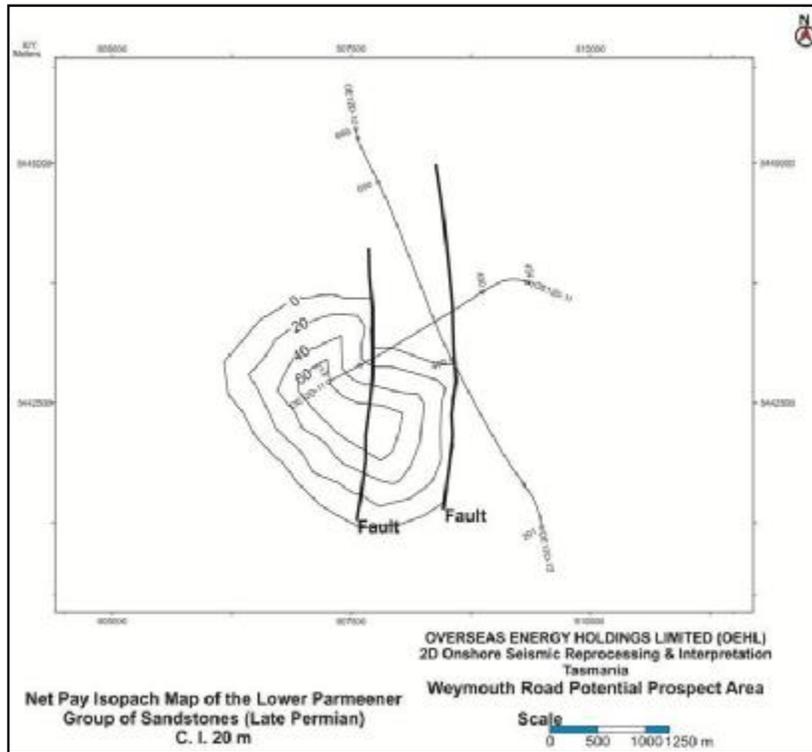


Figure 68. Net pay isopach map of the Lower Permian Group of sandstones from the Weymouth potential prospect area.

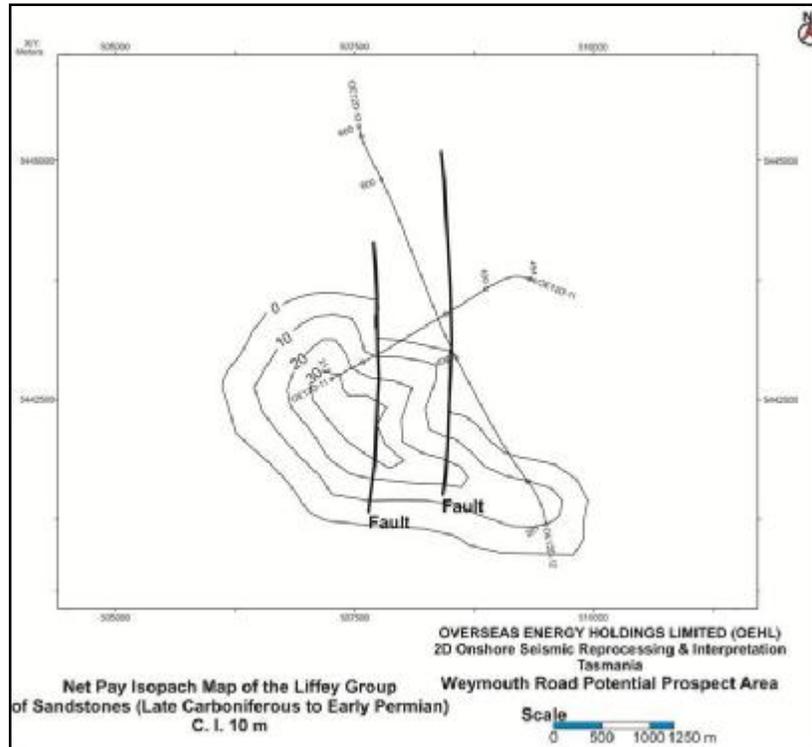


Figure 69. Net pay isopach map of the Liffey Group of sandstones from the Weymouth potential prospect area.

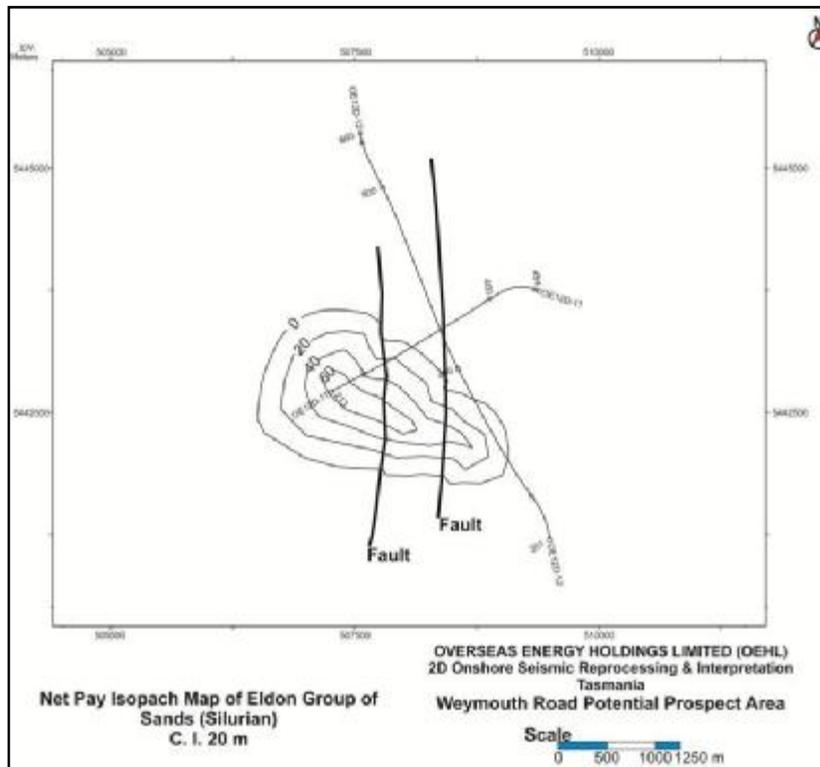


Figure 70. Net pay isopach map of the Eldon Group of sandstones from the Weymouth potential prospect area.

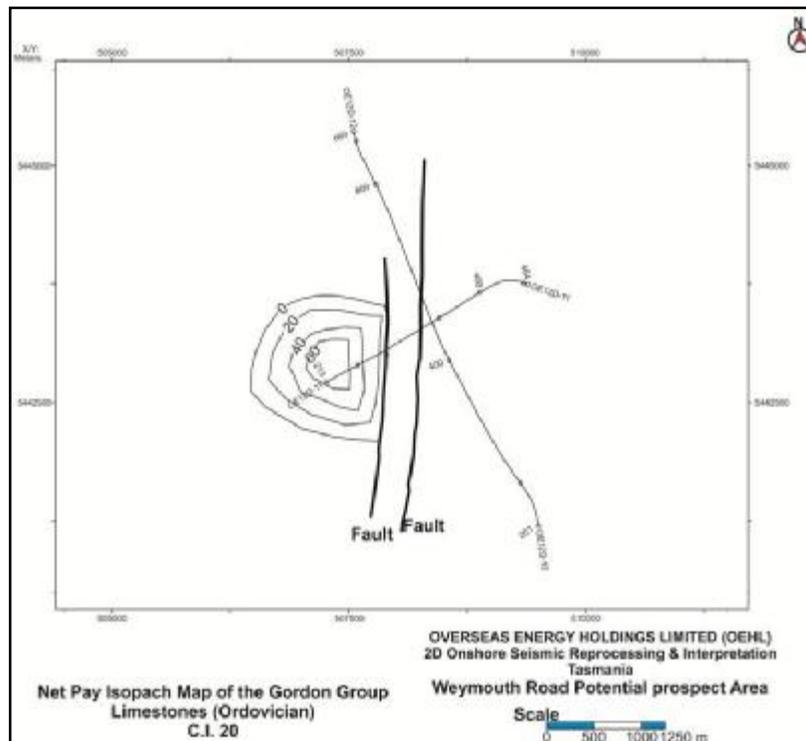


Figure 71. Net pay isopach map of the Gordon Group limestones from the Weymouth potential prospect area.

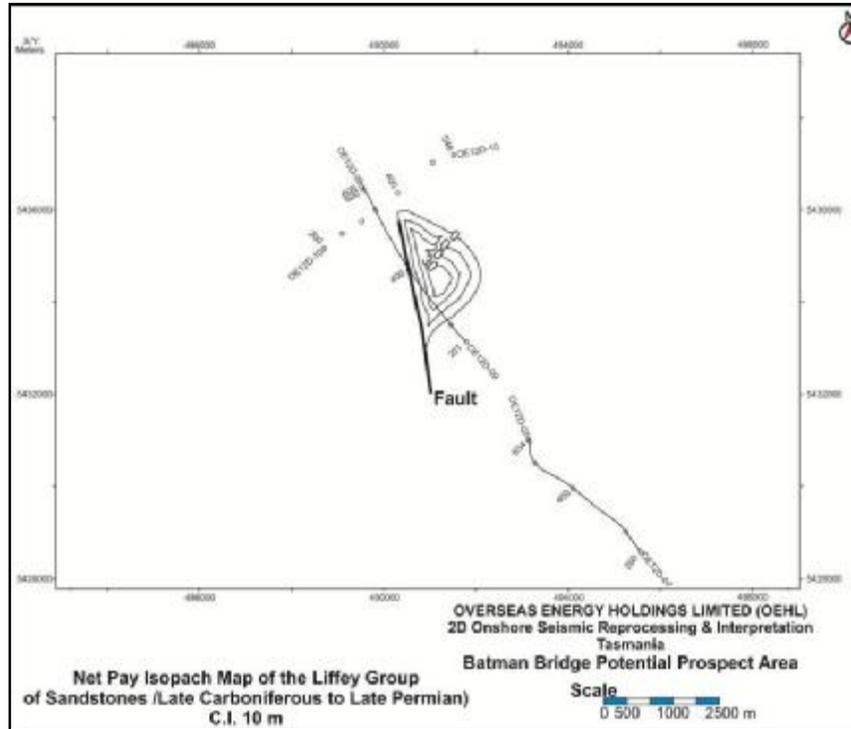


Figure 72. Net pay isopach map of the Liffey Group of sandstones from the Batman Bridge potential prospect area.

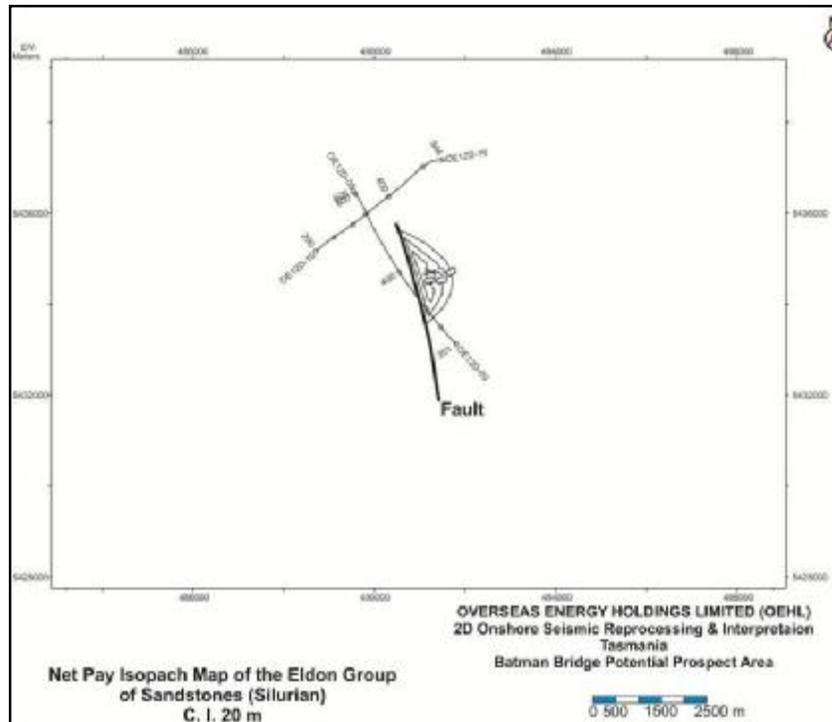


Figure 73. Net pay isopach map of the Eldon Group of sandstones from the Batman Bridge potential prospect area.

OVERSEAS ENERGY HOLDINGS LIMITED (OEHL) SEL 5/2005 License Block 2D Onshore Seismic Reprocessing and Interpretation, Devonport Area, Tasmania Bass Highway Potential Prospect Area Reserve Calculations				
Reservoir Parameters	Potentially Prospective Horizons			
	Top of L. Parmeener	Top of Liffey Sst.	Top of Eldon Sst.	Top of Gordon Lst.
Reservoir depth(m)	340	575	840	1150
Area (m <sup>2</sup> )	990586	1972765	2387128	2132852
Area (acres)	245	487	590	527
Gross Pay (m)	60	40	90	90
Net Pay (m)	45	22	45	50
NP/GP (%)	75	55	50	56
Sw (%)	45	45	45	45
Porosity-Φ (%)	14	11	7	7
Pressure-P (MPa)	4	6	9	12
Pressure-P (psi)	517	877	1281	1754
For. Temp. (°C)	32	38	51	65
Gas Comp. (z)	0.8	0.8	0.8	0.8
Recov.(Ro-Rg)(%)	28-85	28-85	28-85	28-85
Res. (mmbbls)	17.33	13.17	20.86	20.65
Rec.Res.(mmbbls)	4.85	3.7	5.84	5.78
Resgas(mmmcf)	4.9	6.2	13.7	15.4
Rec.Resg(mmmcf)	4.2	5.3	11.65	13.1
1MPa=145.04 psi				
T(F)=t(°C)×1.8+32				
1acre=4046.8m <sup>2</sup>				

Table 2. Bass Highway potential prospect area oil case and gas case resource estimations with reservoir parameters shown.

OVERSEAS ENERGY HOLDINGS LIMITED (OEHL) SEL 5/2005 License Block 2D Onshore Seismic Reprocessing and Interpretation, Devonport Area, Tasmania Westbury Potential Prospect Area Reserve Calculations				
Reservoir Parameters	Potentially Prospective Horizons			
	Top of L. Parmeener	Top of Liffey Sst.	Top of Eldon Sst.	Top of Gordon Lst.
Reservoir depth(m):	130	450	700	1050
Area (m <sup>2</sup> )	2800000	3727110	5425000	4225000
Area (acres)	692	921	1341	1044
Gross Pay (m)	80	40	90	90
Net Pay (m)	40	25	25	25
NP/GP (%)	50	62.5	28	28
Sw (%)	50	50	50	50
Porosity- $\Phi$ (%)	14	11	7	7
Pressure-P (MPa)	1.4	5	7.4	11
Pressure-P (psi)	200	687	1068	1600
For. Temp. (°C)	23	34	45	60
Gas Comp. (z)	0.83	0.83	0.83	0.83
Recov.(Ro-Rg)(%)	28-85	28-85	28-85	28-85
Resoil. (mmbbls)	39.4	26.00	23.9	18.6
Rec.Resoil.(mmbbls)	11.00	7.00	6.7	5.2
Resgas(mmmcf)	4.43	10.00	13.35	14.9
Rec.Resg(mmmcf)	4.00	8.5	11.35	12.7
1MPa=145.04 psi				
T(F)=t(°C)x1.8+32				
1acre=4046.8m <sup>2</sup>				

Table 3. Westbury potential prospect area oil case and gas case resource estimations with reservoir parameters shown

OVERSEAS ENERGY HOLDINGS LIMITED (OEHL) SEL 5/2005 License Block 2D Onshore Seismic Reprocessing and Interpretation, Devonport Area, Tasmania Weymouth Road Potential Prospect Area Reserve Calculations				
Reservoir Parameters	Potentially Prospective Horizons			
	Top of L. Parmeener	Top of Liffey Sst.	Top of Eldon Sst.	Top of Gordon Lst.
Reservoir depth(m)	400	600	880	1375
Area (m <sup>2</sup> )	4040620	5945192	2756352	1830593
Area (acres)	999	1469	681	452
Gross Pay (m)	70	40	80	85
Net Pay (m)	30	18	30	30
NP/GP (%)	43	45	38	35
Sw (%)	45	45	45	45
Porosity-Φ (%)	14	11	7	7
Pressure-P (MPa)	4.2	6.3	9.3	14.5
Pressure-P (psi)	610	915	1342	2097
For. Temp. (°C)	34	40	53	75
Gas Comp. (z)	0.83	0.83	0.83	0.83
Recov.(Ro-Rg)(%)	28-85	28-85	28-85	28-85
Resoil. (mmbbls)	46.3	32.54	16	10.6
Rec.Resoil.(mmbbls)	13	9.11	4.5	3
Resgas(mmmcf)	15.5	15.8	10.9	10.62
Rec.Resg(mmmcf)	13.2	13.5	9.3	9
1MPa=145.04 psi				
T(F)=t(°C)x1.8+32				
1acre=4046.8m <sup>2</sup>				

Table 4. Weymouth Road potential prospect area oil case and gas case resource estimations with reservoir parameters shown

OVERSEAS ENERGY HOLDINGS LIMITED (OEHL) SEL 5/2005 License Block 2D Onshore Seismic Reprocessing and Interpretation, Devonport Area, Tasmania Batman Bridge Potential Prospect Area Reserve Calculations				
Reservoir Parameters	Potentially Prospective Horizons			
	Top of L. Parmeener	Top of Liffey Sst.	Top of Eldon Sst.	Top of Gordon Lst.
Reservoir depth(m):		1100	2100	
Area (m <sup>2</sup> )		1148437	406000	
Area (acres)		284	100	
Gross Pay (m)		40	60	
Net Pay (m)		15	20	
NP/GP (%)		37.5	33	
Sw (%)		45	45	
Porosity-Φ (%)		11	7	
Pressure-P (MPa)		11.6	22	
Pressure-P (psi)		1678	3200	
For. Temp. (°C)		62	101	
Gas Comp. (z)		0.83	0.83	
Recov.(Ro-Rg)(%)		28-85	28-85	
Resoil. (mmbbls)		5.23	1.6	
Rec.Resoil.(mmbbls)		1.5	0.442	
Resgas(mmmcf)		4.4	2.25	
Rec.Resg(mmmcf)		3.7	1.9	
1MPa=145.04 psi				
T(F)=t(°C)×1.8+32				
1acre=4046.8m <sup>2</sup>				

Table 5. Batman Bridge potential prospect area oil case and gas case resource estimations with reservoir parameters shown.

### 5.2.2. Potential Resource Estimation Calculations

Following the generation and construction of structure – depth and net pay isopach mapping, potential resource estimation calculations were carried out volumetrically, using generally accepted petroleum engineering oil and gas reserve formulas that are available in the petroleum engineering text books. Since there is no oil or gas production in onshore Tasmania, certain assumptions were made in calculating some of the subsurface reservoir parameters. It is assumed that subsurface temperature distribution was similar to that of the bottom hole temperatures recorded in the Westwood-1 well. It was noted from the available reports that there was not any blow-out or overpressure type problem occurrence during the drilling of Westwood-1 well, so that the subsurface formation pressure held close to hydrostatic head pressures and thought to match to the pressure gradient of a salt water with a 90,000 ppm dissolved salt or solids content which is 0.465 psi. With these assumptions, formation temperatures and pressures were calculated. Average net pay thicknesses and area of net pay for each potential reservoir horizon was calculated directly from the net pay isopach maps constructed in consideration with general reservoir characteristics, such as porosity, permeability and grain size properties of the individual formations which were deduced from the available reports and published studies in relation to Tasmania petroleum geology and mineral genesis.

Table 2 to Table 5 provide reservoir parameters and resource estimations for the potential prospective horizons mapped in every potential prospect area with seismic coverage. Perusing the resource tables, it is observed that the Bass Highway area contains 72 million barrels of oil in-place and 20.2 million barrels of recoverable oil in case of oil presence and 39.7 billion cubic feet of gas in - place and 34.3 billion cubic feet of recoverable gas in case of gas presence; the Westbury area contains 108 million barrels of oil in – place and 30 million barrels of recoverable oil for the oil case and 42.7 billion cubic feet of gas in – place and 36.6 billion cubic feet of recoverable gas for the case of gas; the Weymouth Road area contains 105.4 million barrels of oil in-place and 29.6 million barrels of recoverable oil for the oil case and 52.8 billion cubic feet of gas in-place and 45 billion cubic feet of recoverable gas for the gas case; and the Batman Bridge area contains 6.8 million barrels of oil in-place and 1.94 million barrels of recoverable oil for the oil case and 6.7 billion cubic feet of gas in – place and 5.6 billion cubic feet of recoverable gas for the cas case.

It must be noted that Table 5 for the Batman Bridge potential prospect area contains only two columns for the top of Liffey Group sandstones and the top of the Eldon Group of sandstones for their resource estimations. It is already explained in the preceding pages that the seismic resolution and reflectivity after much work of reprocessing was not improved tremendously in this area which was mostly caused by the outcropping thick, high velocity dolerite rocks (Figure 29). The resolution problem in the seismic sections in the Batman Bridge area prevented a clear and easy identification and correletion of the potential prospective reflective horizons and only two horizons, namely the top of the Liffey Group and the top of the intra-Eldon Group could be identified and mapped with any clarity and certainty. As a result, the resource estimation in the Batman Bridge area only consists of these two horizons that were structure – depth and net pay isopach mapped.

Overall, the estimated resource potential of OEHL License Block Sel 5/2005 is 290 million barrels of oil in-place and 81.7 million barrels of recoverable oil, in case the resource is oil and 142 billion cubic feet of gas in-place and 121.5 billion cubic feet of recoverable gas in case the resource is gas with the present knowledge and data

at hand. With additional exploration work such as more seismic data acquisition and exploration well drilling in the area in the years to come, these resource estimate values could greatly change upwards.

## 6. CONCLUSIONS

The seismic data shot in the OEHL License Block SEL 5/2005 in early 2012 were received by CAPD Consulting and Engineering in mid-September in SEG-Y digital format and were reprocessed. Reprocessing of the seismic data took more time than anticipated. Because, the original seismic data contained so much noise that noise and the real reflection data were altogether mixed up. In order to identify noise from the real reflection data and then to clean the noise from the real data by applying hand calculated static correction methods from the first arrival reflection pics were laborious and time consuming. Notwithstanding the length of time spent in reprocessing, however, much improvement and cleaning was accomplished in the resolution and reflectivity of the seismic sections after the CAPD reprocessing work as compared with the previous processing work of the same data.

After the reprocessing work, the seismic sections were horizon-correlated and structurally interpreted and a series of structure - depth maps were generated from these interpreted reflective horizons which were ultimately used to construct a series of net pay isopach (thickness) maps for the purpose of estimating oil and/or gas resources in the seismically covered potential prospective areas. Fourteen (14) net pay isopach maps were generated from these identified, interpreted and structure-depth mapped reflective horizons from four potential prospective areas, namely the Bass Highway, the Westbury, the Weymouth Road and the Batman Bridge areas. These net pay isopach maps were used to estimate the resource potential of the individual potential reflective horizons in particular and the potential prospective areas in general.

From the resource estimations of the potential prospective areas, it was shown that the OEHL License Block SEL 5/2005 contained a total resource potential of 290 million barrells of oil - in place and 82 million barrells of oil recoverable in oil case estimations and 142 billion cubic feet of gas in - place and 122 billion cubic feet of gas recoverable in the gas case estimations.

These results do not mean that the total resource potential of the license block is this much. These results only reflect the present knowledge and data that are available for the estimations made. With additional exploration work such as additional, better seismic acquisition and exploration drilling, the resource estimate potential of the license block could be proven to be a lot more than what is estimated in this report.