2002 TREFOIL SEISMIC REPROCESSING

FINAL REPORT

T/18P, BASS BASIN, TASMANIA

Distribution List :

Mineral Resources Tasmania
Geoscience Australia

Origin Energy Resources Limited
AWE Petroleum Limited
CalEnergy Gas (Australia) Ltd
Wandoo Petroleum Pty Ltd

Origin Energy Resources Limited
ABN 66 007 845 338
John Oxley Centre, 339 Coronation Drive
MILTON QLD 4064

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Greenfields:\T-18P\BA018 - T Technical\Trefoil Seismic Reprocessing 2002 Final Report.doc

1. INTRODUCTION

Reprocessing of vintage 2D seismic data over Trefoil was undertaken in February 2002 by CGG (Perth) as part of a geotechnical evaluation, with a view to elevating the prospect to drillable status.

The Trefoil prospect is located approximately 36km west from the Yolla Gas field in T/18P of the Bass Basin (**Figure 1.1**).

2. AIMS OF THE REPROCESSING

The key aims of the Trefoil prospect seismic reprocessing were:

- To provide a revised and improved 2D seismic dataset from which accurate structural depth models for prospective hydrocarbon bearing levels at Trefoil might be derived

- To provide a uniformly processed seismic grid with 'true' amplitudes preserved with which to further assess AVO anomalies recognised previously at Trefoil.

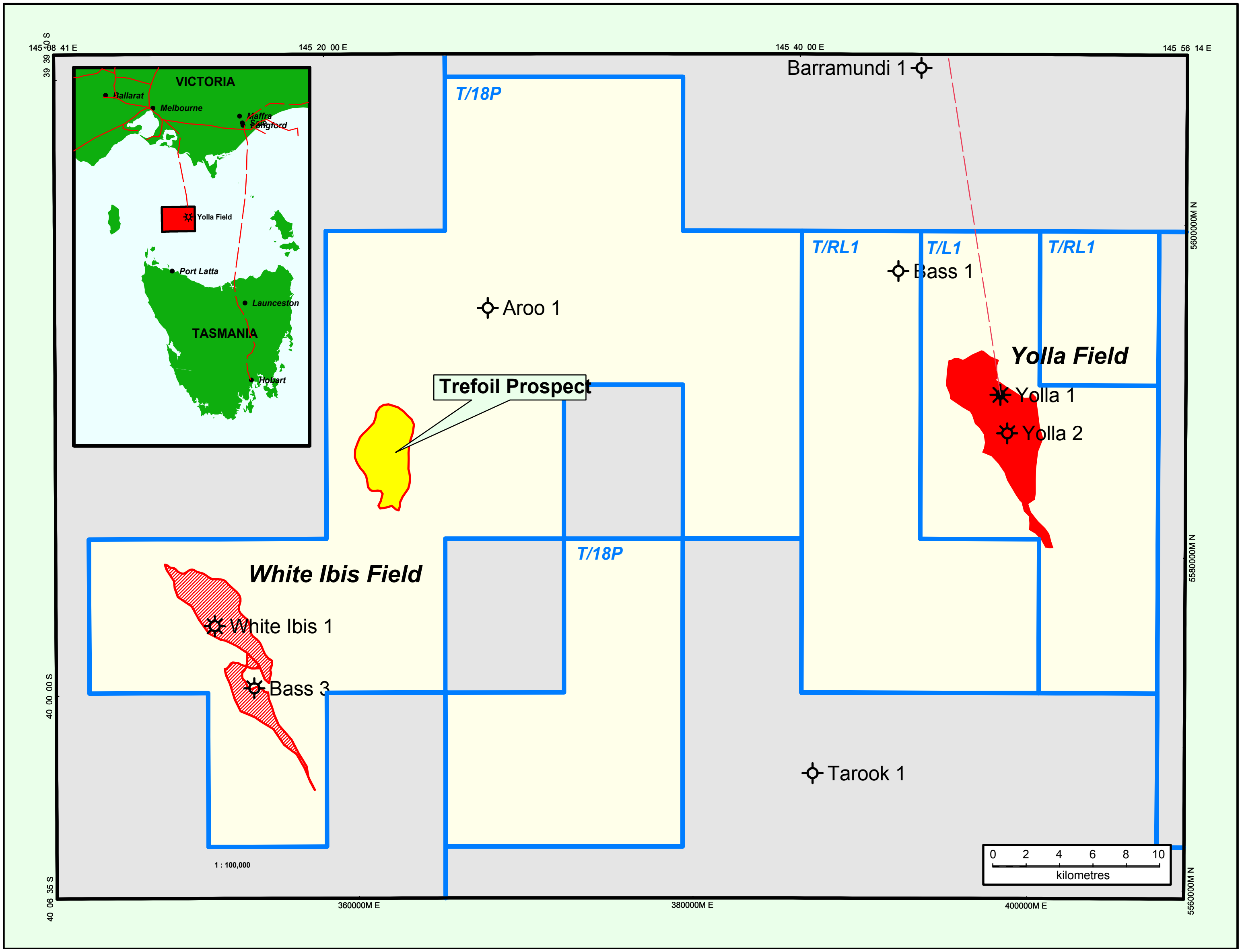

Figure 1.1 - Trefoil prospect location The Trefoil prospect is located 36 km to the west of the Yolla Gas Field in T/18P of the Bass Basin.

3. PROGRAMME

A total of 19 lines of 2D seismic data was included in the 2002 Trefoil reprocessing programme and is summarised as follows:

Linename	Year	Survey Name	SP Range	No Kilometres
HB75A-200	1975	HB75A	-13-427	29.3
TQH5-29A	1985	TQH5	540-1050	15.3
TQH5-31	"	"	740-1400	19.8
TQH5-33	"	"	1290-1850	16.8
TQH5-48	"	"	240-770	15.9
TQH5-52	"	"	1-500	15.0
SB94A-110	1994	SB94A (Rocky Cape)	31-715	17.1
SB94A-112	"	"	111-724	15.3
SB94A-113	"	"	385-1150	19.1
SB94A-115	"	"	385-1102	17.9
BHB96-101	1996	Hummock	1331-2195	19.8
BHB96-103	"	"	1430-2288	19.6
BHB96-105	"	"	1435-2288	19.5
BHB96-106	"	"	988-1618	14.4
BHB96-107	"	"	1000-2094	25.0
BHB96-108	"	"	917-1572	15.0
BHB96-110	"	"	989-1618	14.4
BHB96-112	"	"	917-1548	14.4
BHB96-114	"	"	985-1752	17.5
			TOTAL	**341.1**

Table 3.1 Seismic Line Summary

Line ORS01-13 from the 2001 Shelduck Seismic Survey, which runs centrally across the Trefoil feature, was not included in the reprocessing since processing of this line had been completed by CGG just prior to the commencement of the Trefoil Reprocessing project. The reprocessed seismic grid is shown in **Figure 3.1**.

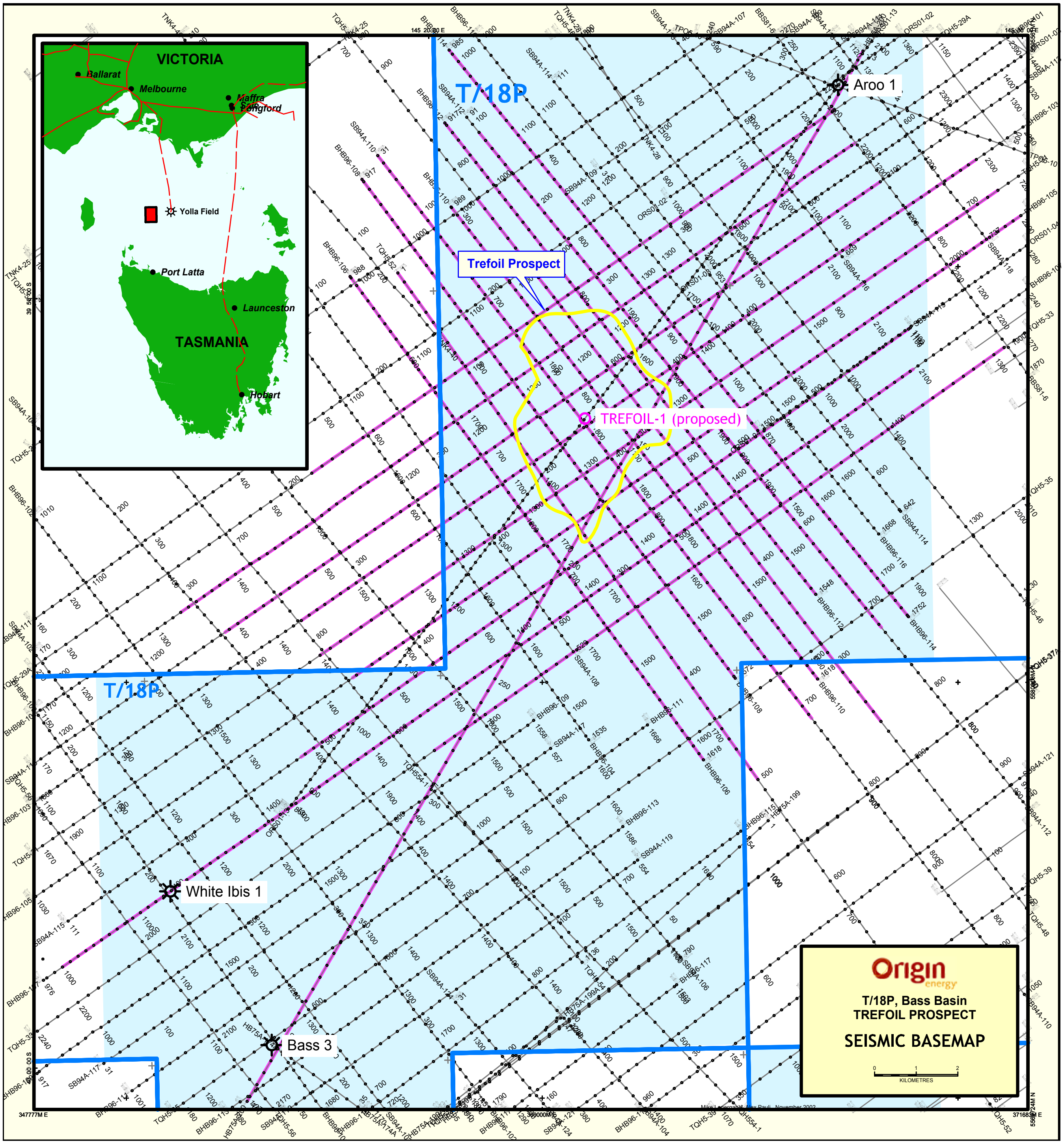

Figure 3.1 Trefoil Prospect 2002 Seismic Reprocessing Location

4. REPROCESSING

The reprocessing of the 2D seismic grid over Trefoil as carried out by CGG (Perth) in 2002 is summarised in the Contractor's Final Report included in **Appendix 1**.

A relatively straightforward Pre-Stack Time Migration (PSTM) processing sequence was adopted (**Appendix 1**). The PSTM stacked data were cross-correlated with reflectivity series at White Ibis-1 and Aroo-1, establishing that the dataset is approximately zero-phase. **Figure 4.1** shows a comparison between the original processing and the 2002 reprocessed data, demonstrating the improved stratigraphic resolution of the 2002 reprocessing at the zone of interest.

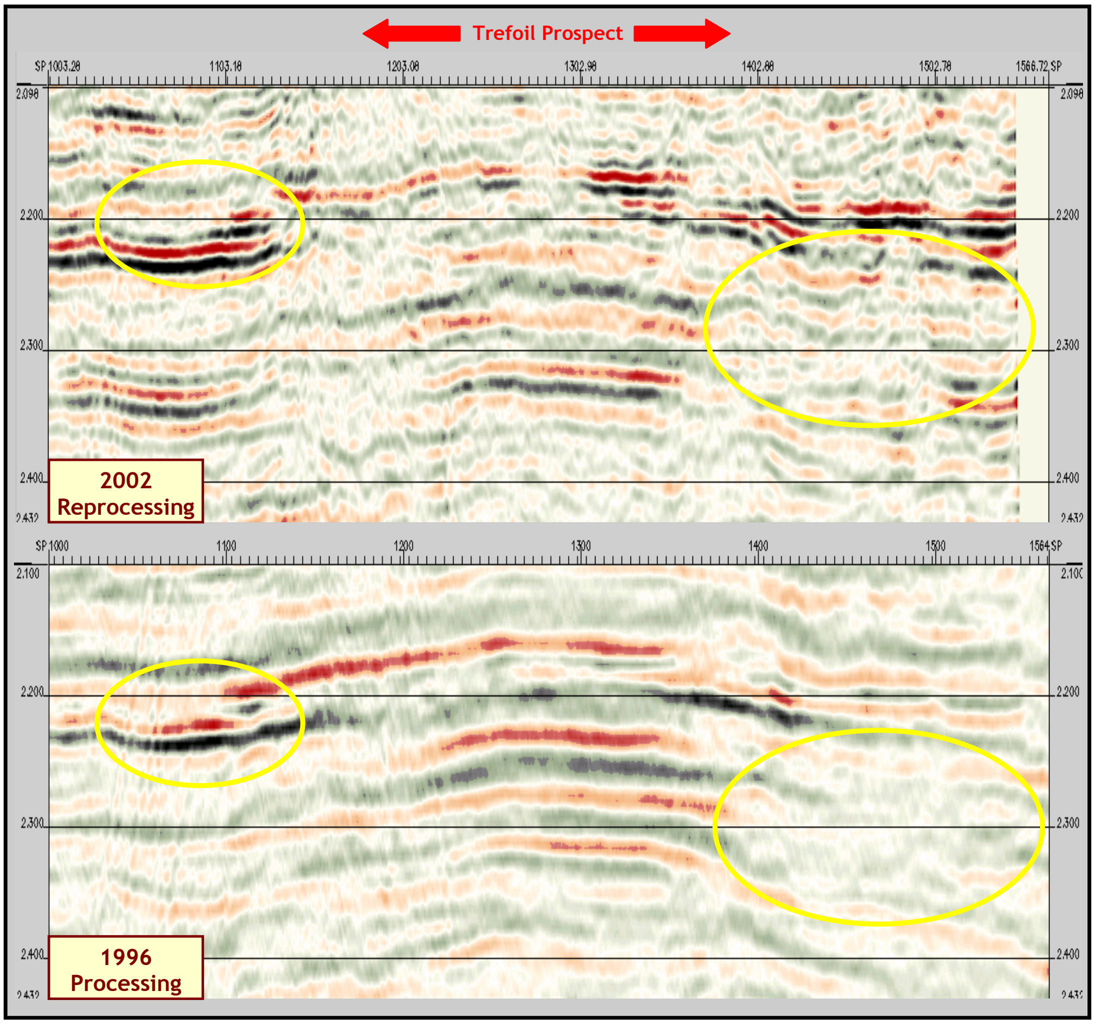

Figure 4.1 – Seismic data processing comparison, line BHB96-108.

This demonstrates the improved resolution of the 2002 reprocessing compared to the original 1996 processed data. The highlighted areas demonstrate noticeably improved stratigraphic resolution. The greater signal bandwidth of the 2002 data is therefore expected to lead to comparatively more robust amplitude information. The section shown encompasses the Palaeocene section over the Trefoil Prospect.

Non-standard processes used were Q compensation and time slice median filtering, both applied to the PSTM gathers. Q compensation attempts to compensate for frequency attenuation due to earth filter effects, and was applied to the data with seismic amplitude and attribute work in mind and in the interests of maintaining wide bandwidth and preserving "true" amplitudes. Time-slice median filtering is a random and coherent noise attenuation process that improves the signal-to-noise ratio of the gathers such that they are more suitable for AVO analysis.

5. INTERPRETATION & MAPPING

The stratigraphy of the Bass Basin is summarised in **Figure 5.1** and is adopted here for well correlations. Seismic ties to the key wells in the immediate vicinity to Trefoil were reviewed, namely White Ibis-1, Bass-3 and Aroo-1. Seismic line SB94A-110 across the Trefoil prospect is shown in **Figure 5.2**, indicating interpreted horizons.

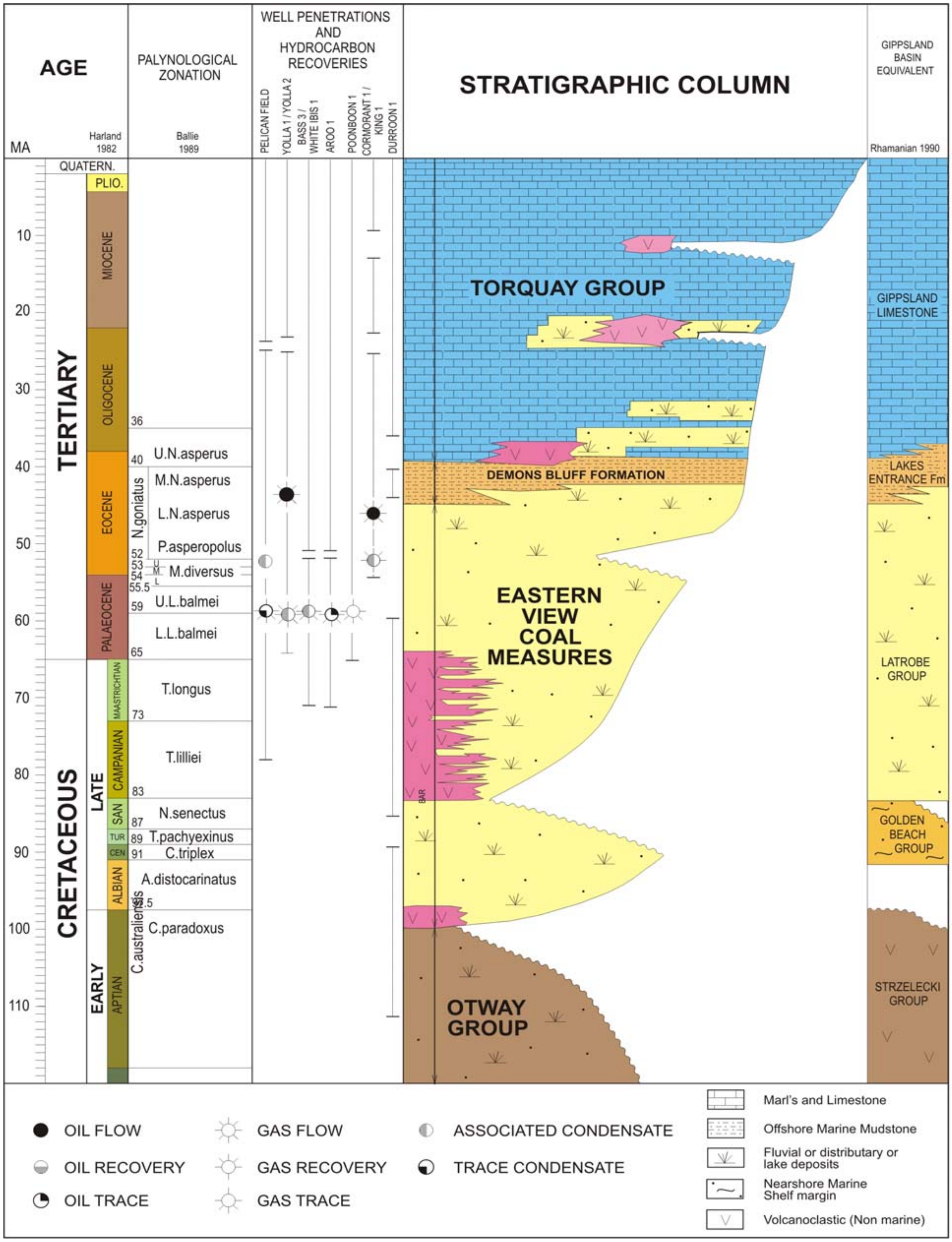

Figure 5.1 – Stratigraphic column, Bass Basin

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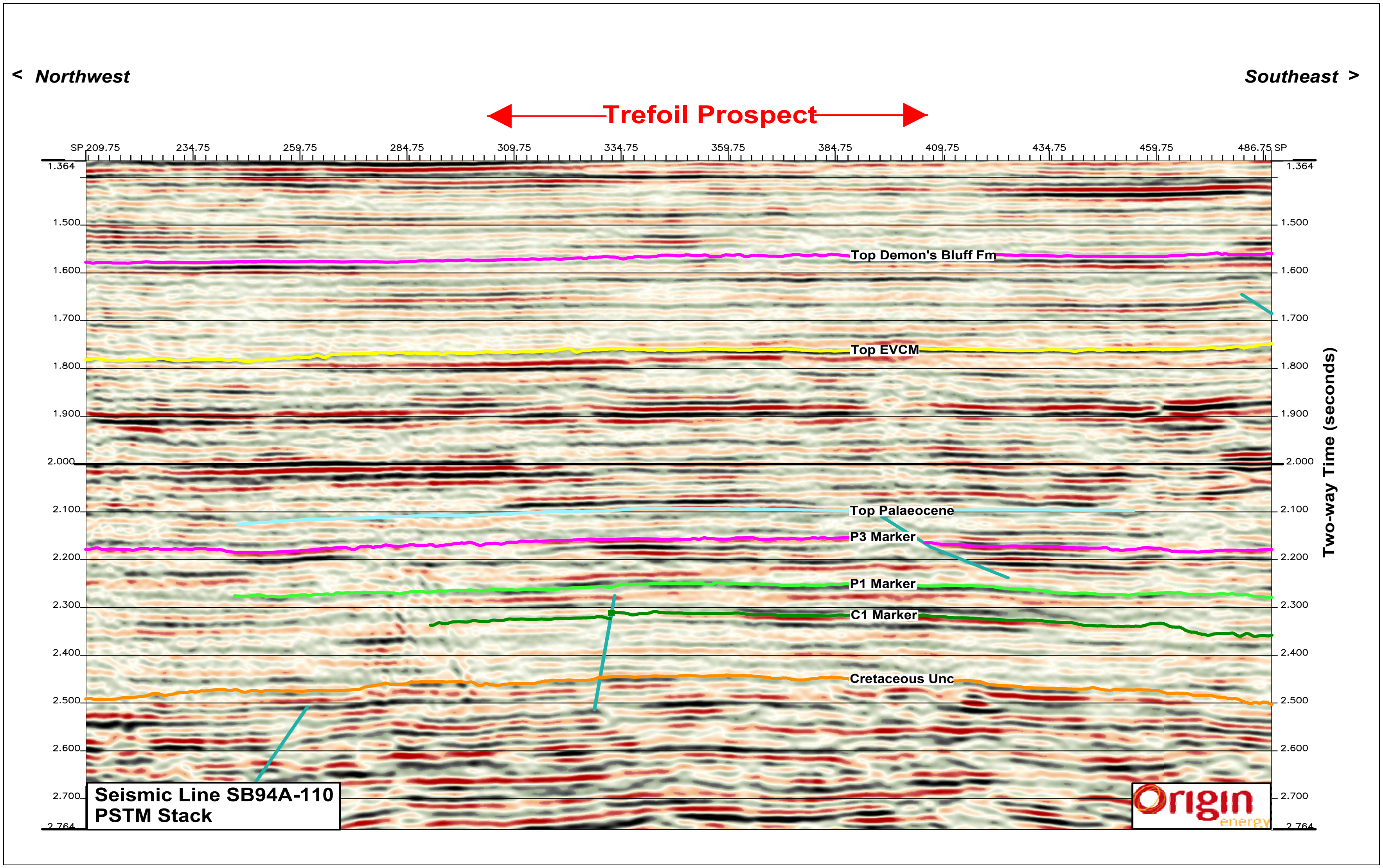


Figure 5.2 – Seismic Line SB94A-110. Key seismic markers interpreted at Trefoil are indicated, with the P3 Marker representing the top of the primary target.

Mapped horizons were the Top EVCM, Palaeocene Marker 3 (P3) and Cretaceous Unconformity, which are considered representative of structuring at possible Eocene, Palaeocene and Cretaceous reservoirs respectively. Time structure maps produced for the Top EVCM, Palaeocene Marker 3 and the Cretaceous Unconformity are included as **Figures A.1, A.2** and **A.3** in **Appendix 2.**

6. DEPTH CONVERSION

The velocity field in T/18P, and throughout the Bass Basin, is complicated by volcanic intrusives and extrusives, which are generally characterised by "pull-up" on seismic time sections due to anomalously high velocities in the vicinity of the volcanics. The proximity to volcanics and the subtlety of the time closure at Trefoil (less than 20ms) therefore warrants a more rigorous approach than simply using average velocities derived from well time/depth relationships as might normally be applied.

Depth conversion was carried out using an Horizon-based Stacking Velocity Analysis (HSVA) method, utilising optimum stacking velocities derived from seismic for each target horizon. A stacking velocity map is created for each horizon and calibrated to average velocities for a given horizon at well locations. The calibrated average velocity map is then used to scale time migrated maps to depth.

Using Paradigm Geophysical's GeoDepth software, HSVA analysis was performed on the Top EVCM, Palaeocene Marker 3 and Cretaceous Unconformity for all seismic lines in the Trefoil grid, with ties into White Ibis-1, Aroo-1 and Bass-3.

Average velocity maps derived using HSVA for the Top EVCM, Palaeocene Marker 3 and the Cretaceous Unconformity are included as **Figures A.4, A.5** and **A.6** in **Appendix 2**.

Depth maps derived using HSVA for the Top EVCM, Palaeocene Marker 3 and the Cretaceous Unconformity are included as **Figures A.7, A.8** and **A.9** in **Appendix 2**.

7. CONCLUSIONS

- Reprocessing of the Trefoil seismic grid is believed to have produced a dataset with improved structural integrity, enhanced stratigraphic resolution, uniform phase and ‘true’ amplitudes preserved.
- Depth mapping utilising an Horizon Stacking Velocity Analysis (HSVA) technique has confirmed the Trefoil prospect as a low relief, four-way dip closed anticline at prospective levels within the Palaeocene and upper Cretaceous.
- Negligible closure is recognised at Trefoil in the upper EVCM.
- All of the above results are naturally compromised to some degree due to the nature of 2D seismic and its inherent data sampling restrictions.

APPENDIX 1

CONTRACTOR'S FINAL REPORT

Report of seismic data processing

carried out by: **Compagnie Générale de Géophysique**

for : ***ORIGIN ENERGY RESOURCES LTD.***

Area : ***T/18P, BASS BASIN, TASMANIA***

Survey : ***TREFOIL REPRO 2002***

CGG Australia
Level 1
2 Ord Street
WEST PERTH WA 6005
AUSTRALIA

Tel : **(08) 9226 2233**
Fax : **(08) 9226 2234**

Date : July 2002

Author: **Robert Chua**
Web: www.cgg.com

1 Introduction

1. Introduction

1.1. Scope of report

This report describes the processing of seismic data by COMPAGNIE GENERALE DE GEOPHYSIQUE (CGG) for the period between Feb 1st 2002 and July 18th 2002 for Origin Energy Resources Limited. The data source is from four different vintages: BHB96, SB94A, TQH5, HB75A.

The reprocessing was carried out by CGG at its data processing centre in PERTH (AUSTRALIA).

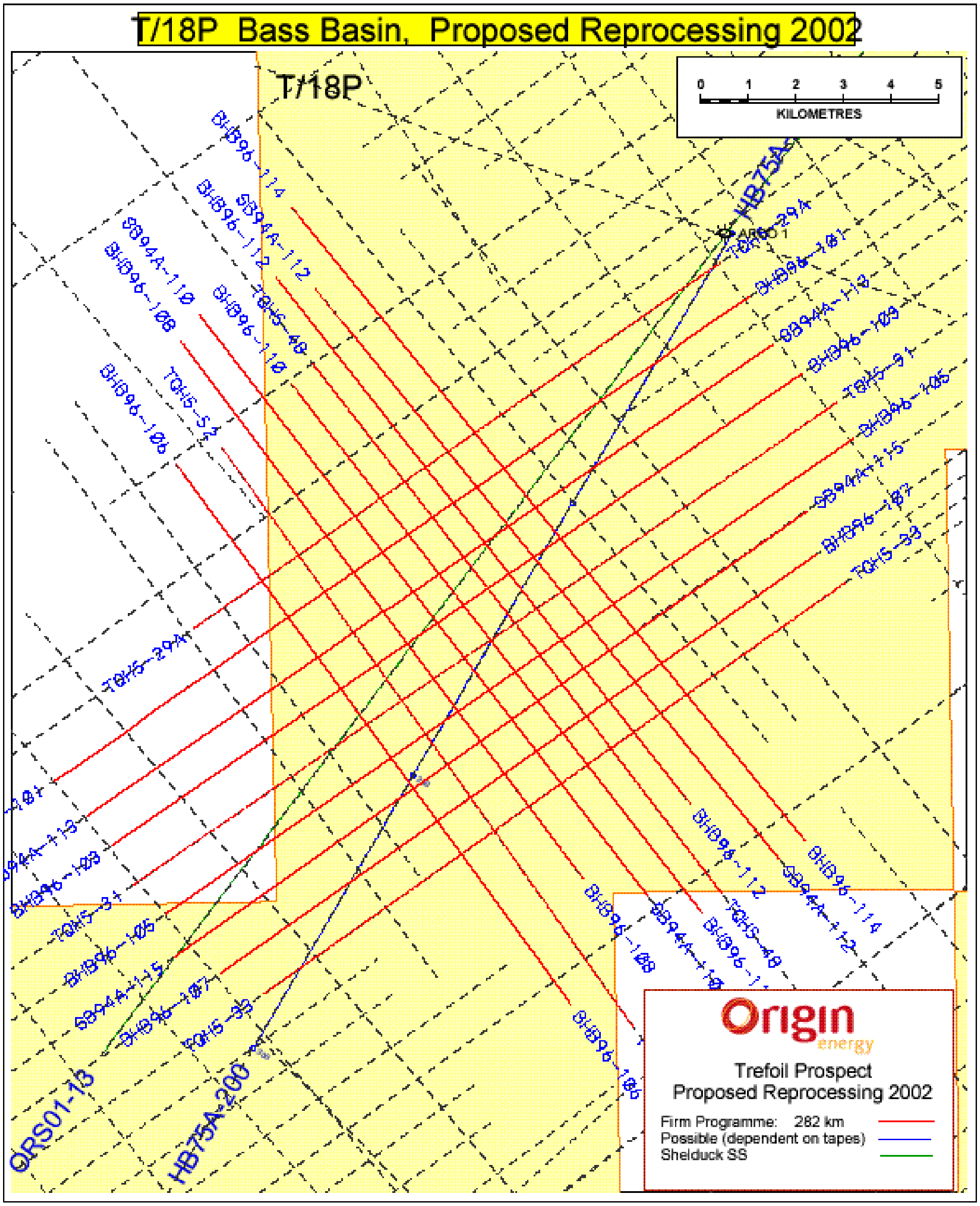
The processing agreement is referenced by CGG project number 5671/501P1CE.

1.2. Purpose and objectives of processing

The purpose of reprocessing was to achieve a higher quality result than previous processing. The surveys aim to get better images of the events at approximately 1.5 – 2.5 seconds TWT. Specific processing goals were to provide high quality sections for interpretation through high frequency preservation, effective multiple removal and preserve amplitudes for future AVO analysis.

1.3. Location

The area of interest for Origin Energy Resources Limited was exploration permit T/18P, located in the Bass Basin approximately midway between The North coast of Tasmania and the Southern coast of Victoria, Australia.



2. Data acquisition

2.1. Data acquisition parameters

2.1.1. Survey Details

19 lines of 2D seismic data approximately 300 km comprising of three different vintages were acquired and used for the Trefoil reprocessing with the following parameters:

Survey	: TREFOIL REPRO 2002 (BHB96)
Location	: Bass Strait, Australia
Survey carried out by	: PGS
Date	: Feb 1996
Total number of lines	: 9 (Prefix BHB96)
Number of traces per shotpoint	: 252
Nominal stacking fold	: 80

Survey	: TREFOIL REPRO 2002 (SB94A)
Location	: Bass Strait, Australia
Survey carried out by	: Western Geophysical
Date	: Mar 1994
Total number of lines	: 4 (Prefix SB94A)
Number of traces per shotpoint	: 240
Nominal stacking fold	: 60

Survey	: TREFOIL REPRO 2002 (TQH5)
Location	: Bass Strait, Australia
Survey carried out by	: GSI
Date	: Oct 1985
Total number of lines	: 5 (Prefix TQH5)
Number of traces per shotpoint	: 240
Nominal stacking fold	: 60

Survey	: TREFOIL REPRO 2002 (HB75A)
Location	: Bass Strait, Australia
Survey carried out by	: GSI
Date	: Jan 1975
Total number of lines	: 1 (Prefix HB75A)
Number of traces per shotpoint	: 48
Nominal stacking fold	: 24

2.1.2. Energy source

BHB96

Source type	: Airgun
Total volume	: 2660 cu in
Air pressure	: 2000 psi
Source depth	: 6 m
Number of sub arrays	: 1
Shotpoint interval	: 22.86 m

SB94A

Source type	:	Airgun
Total volume	:	3305 cu in
Air pressure	:	2000 psi
Source depth	:	6 m
Number of sub arrays	:	1
Shotpoint interval	:	25 m

TQH5

Source type	:	Airgun
Total volume	:	4075 cu in
Air pressure	:	1800 psi
Source depth	:	10 m
Number of sub arrays	:	1
Shotpoint interval	:	30 m

HB75A

Source type	:	Airgun
Total volume	:	1200 cu in
Air pressure	:	1800 psi
Source depth	:	10 m
Number of sub arrays	:	1
Shotpoint interval	:	22.25 m

2.1.3.Receiver spread

BHB96

Streamer type	:	I/O
Number of streamers	:	1
Active length	:	3825 m
Number of groups	:	252
Group interval	:	15.24 m
Near trace	:	252
Streamer depth	:	6 m
Near trace offset from source	:	107.5 m

SB94A

Streamer type	:	LRS
Number of streamers	:	1
Active length	:	3000 m
Number of groups	:	240
Group interval	:	12.5 m
Near trace	:	1
Streamer depth	:	10 m

Near trace offset from source	:	131 m

TQH5

Streamer type	:	GSI Multiplexor
Number of streamers	:	1
Active length	:	3600 m
Number of groups	:	240
Group interval	:	15 m
Near trace	:	240
Streamer depth	:	12 m
Near trace offset from source	:	396 m

HB75A

Streamer type	:	GSI Multiplexor
Number of streamers	:	1
Active length	:	3200 m
Number of groups	:	48
Group interval	:	66.75 m
Near trace	:	48
Streamer depth	:	17 m
Near trace offset from source	:	293 m

2.1.4.Instruments

BHB96

Recording system	:	Syntrak 480
Recording format	:	SEG-D 8015
Record length	:	6144 ms
Sample rate	:	2 ms
Low cut filter	:	3 Hz – 6 dB/oct Out
Antialias filter	:	218 Hz – 484 dB/oct
Channel set	:	252 Seismic channels

SB94A

Recording system	:	WG-24
Recording format	:	SEG-D 8048
Record length	:	6000 ms
Sample rate	:	2 ms
Low cut filter	:	6 Hz – 18 dB/oct Out
Antialias filter	:	196 Hz – 214 dB/oct
Channel set	:	240 Seismic channels

TQH5

Recording system	:	Trace Sequential recorder
Recording format	:	SEG-D 6250
Record length	:	6000 ms
Sample rate	:	2 ms
Low cut filter	:	8 Hz – 18 dB/oct Out
Antialias filter	:	128 Hz – 72 dB/oct
Channel set	:	240 Seismic channels

HB75A

Recording system	:	Trace Sequential recorder
Recording format	:	SEG-D 6250
Record length	:	5000 ms
Sample rate	:	4 ms
Low cut filter	:	8 Hz – 18 dB/oct Out
Antialias filter	:	62 Hz – 72 dB/oct
Channel set	:	48 Seismic channels

2.1.5.Line identification

BHB96 - # ; SB94A - # ; TQH5 - # ; HB75A - #

1 Introduction

2 Data acquisition

3 Processing sequence

4 Conclusion

5 Annexes

3. Processing sequence

3.1. Parameters

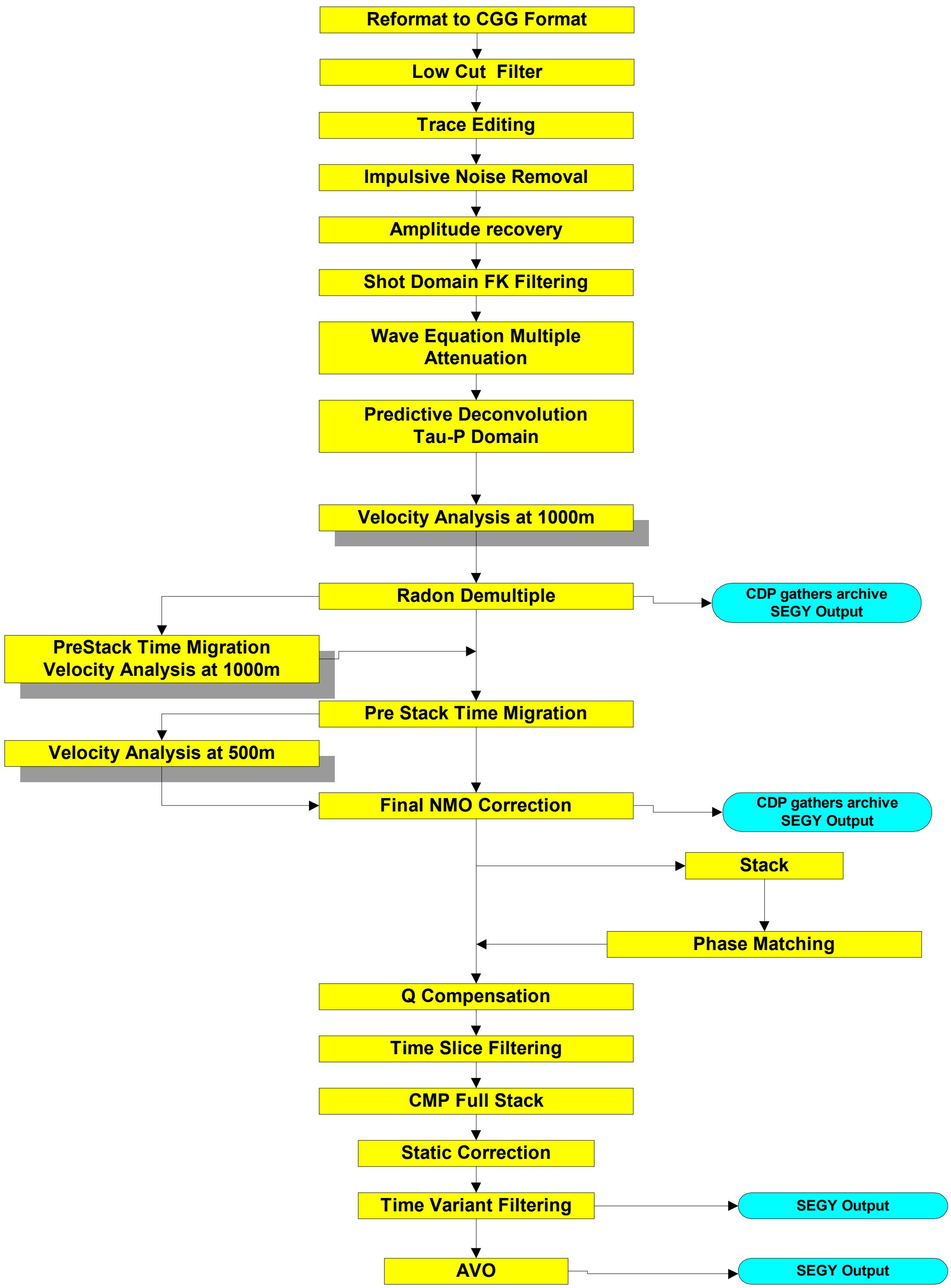
18 lines of 2D seismic data approximately 300 km were processed with the following parameters:

Processing length	:	6000 ms
Processing sample rate	:	2 ms
Datum plane	:	mean sea level

Since the seabed is flat and featureless with water depths varying very little over the entire area, the processing parameters such as design windows, application times, mutes time were not referenced to water bottom.

3.2. Final processing sequence

3.2.1. Flow chart



3.2.2. Details

1. Reformat from SEGD to CGG internal format
2. Trace header geometry updating
3. Observer Log based shots and traces editing;
   Statistical edit of noisy traces;
   Impulsive Noise Removal
4. Amplitude Recovery
   Spherical divergence correction using regional velocity function;
   Exponential gain correction
5. Normal MoveOut (NMO) correction using regional velocities
6. FK filter on shots
   AGC wrap = 200ms
   60db attenuation over velocities +/- 0-2300m/s
   Ramp Off to 0db attenuation for velocities +/- 5000m/s
   Cosine taper used to taper off FK Filter
10. Remove normal moveout correction
11. Wave Equation Multiple Attenuation (WEMA) in shot domain
    Model and subtraction of water bottom multiple
12. Predictive Deconvolution – Tau-P domain
    P traces number 443
    Mild Tau-P domain mute

Design Windows	Operator Length	Gap	Application
1W: 0-1600 ms	200 ms	16 ms	0-1400 ms
2W: 800-2800 ms	400 ms	32 ms	800-2800 ms
3W: 1600-4900 ms	400 ms	48 ms	2000-5000 ms

13. First Pass Velocity Analysis every 1 km
14. CDP sort and NMO correction
15. High Resolution Radon Demultiple
    P range -480 to 2992 ms
    P increment 16 ms
    Differential NMO 96 ms time invariant
    Residual noise removed 60 %
    Maximum Frequency 150 Hz
    Start time 400 ms + 200 ms taper
16. Kirchoff Pre Stack Time Migration (PSTM) for second pass velocity analyses
17. Second Pass Migration Velocity Analyses every 1 km
18. Full Kirchoff Pre Stack Time Migration (PSTM)
    Dip 80^{o} Aperture 5000m
    Viscosity factor 0
19. Third pass velocity analysis every 500m
20. Phase Matching between vintages
21. Q compensation
22. Time Slice Filtering
23. Post stack Time Variant Filter (TVF)
24. Amplitude Versus Offset (AVO) analyses
    Intercept (I), Gradient (G), Product (I*G), Fluid Factor (FF)
25. SEGY Archives
    Radon gathers without Qcomp
    Radon gathers with Qcomp
    PSTM final NMO gathers without Qcomp
    PSTM Qcomp TSFIL gathers
    PSTM Qcomp TSFIL stacks

3.3. Pre-Stack Processing

3.3.1. Pre Stack Processing Tests

Tests and parameters verifications were applied to line ORS01- 13/13A.

Low Cut Filter: Tests consisted of 3,4,5,6 Hz cutoffs with slopes of 12dB/oct. All tests had a high end of 100 Hz 144dB/Oct
***Selected Parameters*:** 5Hz 18dB/Oct

Amplitude recovery:
Spherical Divergence Correction: Spherical Divergence correction was applied using the regional RMS velocities. They were derived after analysing available velocities from this area supplied by Origin Energy: Yolla 3D survey (western corner), line BHB96-103, velocity around the Aroo1 well, velocity analysis of line ORS01-13/13A and stacking velocities from "Geo-Arctic" on-board QC processing.

Time ms	Velocity m/s
100	1500
300	1720
500	2050
700	2200
1000	2250
1500	2400
2000	2680
2500	3030
3000	3350
3500	3800
4000	4050
4500	4350
5000	4600

In additional to Spherical Divergence correction the exponential Gain correction was tested.
Selected Parameters: Spherical Divergence Correction TV^2
and Exponential Gain correction 2dB/sec

Impulsive Noise Removal: Swell noise existed in the data and was removed by an impulsive noise removal technique. The swell noise was detected due to its unusual energy level.

FK Filtering: FK filter tests were carried out in the SP domain. Tests in the SP domain consisted of rejecting velocities in the ranges of ± 1500m/s, ± 1750m/s, ± 2000m/s,
± 2300m/s, ± 2500m/s and ± 3000m/s with NMO protection. FK filtering in the SP domain effectively removed linear noise in the SP gather and subsequent stack upto a filter of ± 2300m/s. Beyond ± 2000ms the FK filtering attenuated diffractions in the data.
Selected Parameters:

NMO applied prior to FK Filter using regional velocity
FK filter in the SP domain
Full application at 200ms + 300ms taper
AGC wrap = 200ms
60dB attenuation over ± 2300m/s

Ramp off to 0dB attenuation at ± 5000m/s
Cosine taper used to ramp off FK Filter

Anti-Multiple on Shot records : Prior to Deconvolution two methods of demultiple implemented in the shot domain were tested:

- Wave Equation Multiple attenuation. (WEMA) This method uses the wave equation to design a model of the multiples and then subtracts this model from the data.
- Surface Multiple Attenuation technique (SMA) For input traces were computed and then subtracted the surface related multiples for each input trace satisfying the 1D geology approximation model.

Selected Method : WEMA.

This method in combination with Tau-P deconvolution significantly helped attenuate water bottom multiple energy in the data.

Deconvolution before Stack (DBS): Water bottom multiples are a known problem in marine processing. Various predictive deconvolution tests were performed. The following deconvolution parameters were tested on non-NMO corrected full 252-channel shot records with final decisions for deconvolution made from examining stacked sections.

The predictive deconvolution were tested in Time and in Tau-P domains with various computing windows (gates):

1 gate : 0-3.0 secs, operator length 240ms, predictive distance (gap) 24 ms ;
2 gates : 0-2.8, 2.0 - 5.0 secs, operator 200/400ms: gaps 16/24, 24/32, 32/48 and 24/48 ms ;
3 gates : 0-2.0, 0.9-2.8, 2.0-5.0 operator lengths 200/200/400 gaps16/24/32 and 24/32/48 .

Selected DBS method: Predictive Deconvolution in Tau-P domain, 3 computing windows.

Within the Tau-P domain Primary and Multiple have a more regular periodicity. This allows a deconvolution operator to work more efficiently than would occur in the t-x domain.

Selected Parameters:

- ✓ ***Tau-P transform: P trace number: 443***
- ✓ ***Deconvolution Parameters:***

WINDOW:	***1st***	***2nd***	***3rd***
COMPUTING:	***0-1600,***	***800-2800,***	***1600-4900 ms***
APPLICATION:	***0-1400,***	***800-2800,***	***2000-5000 ms***
Operator Lengths:	***200,***	***400,***	***400 ms***
Predictive distance :	***16,***	***32,***	***48 ms***

- ✓ ***Mild mute applied in Tau-P domain***
- ✓ ***Tau-P transform inverse***

Demultiple:

Radon Demultiple tests included:

- Radon Demultiple standard (non high resolution),
- Radon Demultiple High Resolution, in the frequency domain,
- Radon Demultiple High Resolution, in the time domain.

The industrial state-of-the-art velocity based method is the parabolic Radon filtering of NMO corrected CDPs. Although simple and efficient enough for most cases, standard implementations of this method suffer from several drawbacks:

- medium focusing in tau-p domain,
- edge effects (limited aperture),
- sensitivity to spatial aliasing, resulting in amplitude inaccuracies (mainly on near-offset traces)
- inability to attenuate very slow (aliased) multiples.

CGG has developed a high resolution Radon decomposition: by introducing a sparseness constraint we improve the focusing in the tau-q domain, and by using low frequency information to drive high frequency components of the decomposition we solve the aliasing problem. This algorithm proved to better preserve primary amplitudes and attenuate multiple energy.

Selected demultiple method: Radon Demultiple High Resolution, in the frequency domain.
Selected Parameters:
P range: -480/2992 ms
P increment: 16 ms
P trace number: 217
Differential NMO: 96 ms time invariant
Residual noise removed: 60%
Start time: 400ms +200 ms tape.

This data is archived in SEG-Y format.

Pre Stack Time Migration (PSTM):

II. Kirchhoff Pre Stack Migration method includes the following data processing sequence:

1. NMO using smoothed velocity field
2. Kirchhoff PSTM for Velocity analysis
3. Reverse NMO
4. Velocity Analyses
5. NMO using smoothed velocity
6. Final Kirchhoff PSTM and reverse NMO
7. Final NMO
8. Stack of PSTM data

Selected migration method: Kirchhoff Pre Stack Time Migration.
Migration velocity: Smoothed 100% velocity using second pass PSTM Velocity analysis, smooth operator 5 kms
Selected Parameters for PSTM:
Migration Dip Limited: 80 degrees

Migration Aperture: ***5000 m***
Viscosity factor : ***0***

This data is archived in SEG-Y format.

3.4. Post PSTM Stack Processing

Pre-Stack Time Migrated data were stacked using Final 3rd pass velocity analysis.

3.4.1.Post Migration Processing

Time Variant Filtering:

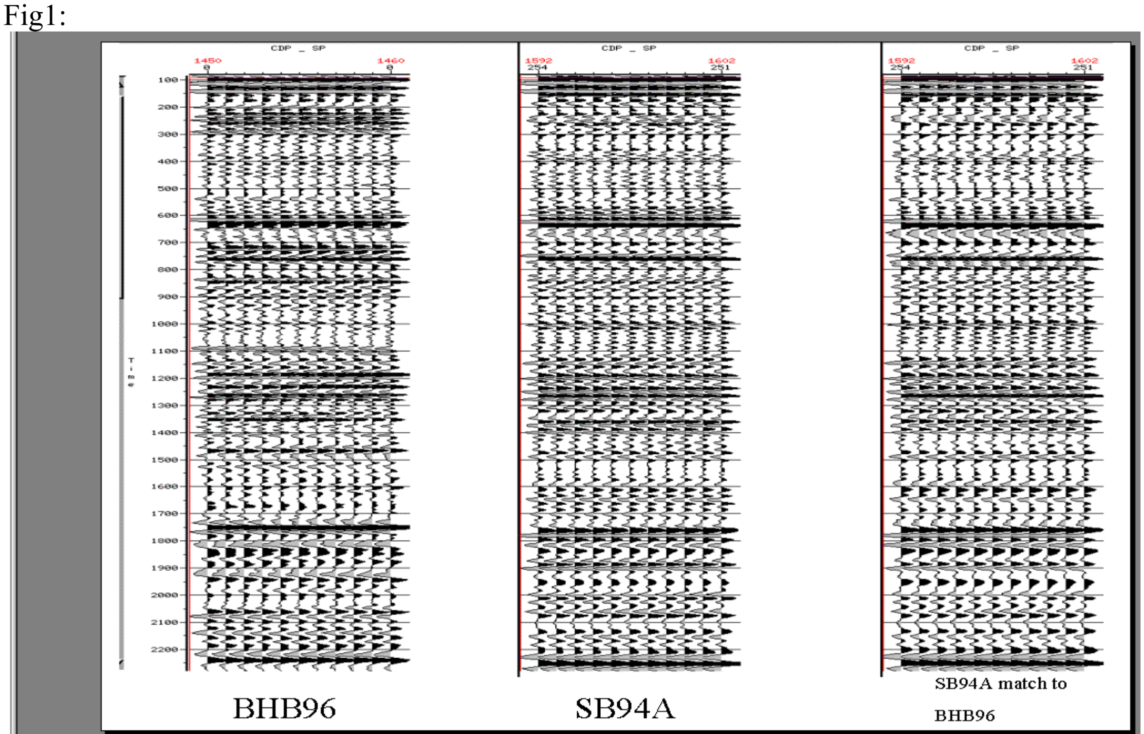
Selected Parameters: ***The high frequency Time Variant Butterworth filter:***

T=0ms-1000ms	***100Hz, 72 dB/Oct***
T=1600-2200ms	***70Hz, 72 dB/Oct***
T=2500-6000ms	***40Hz, 48 dB/Oct***

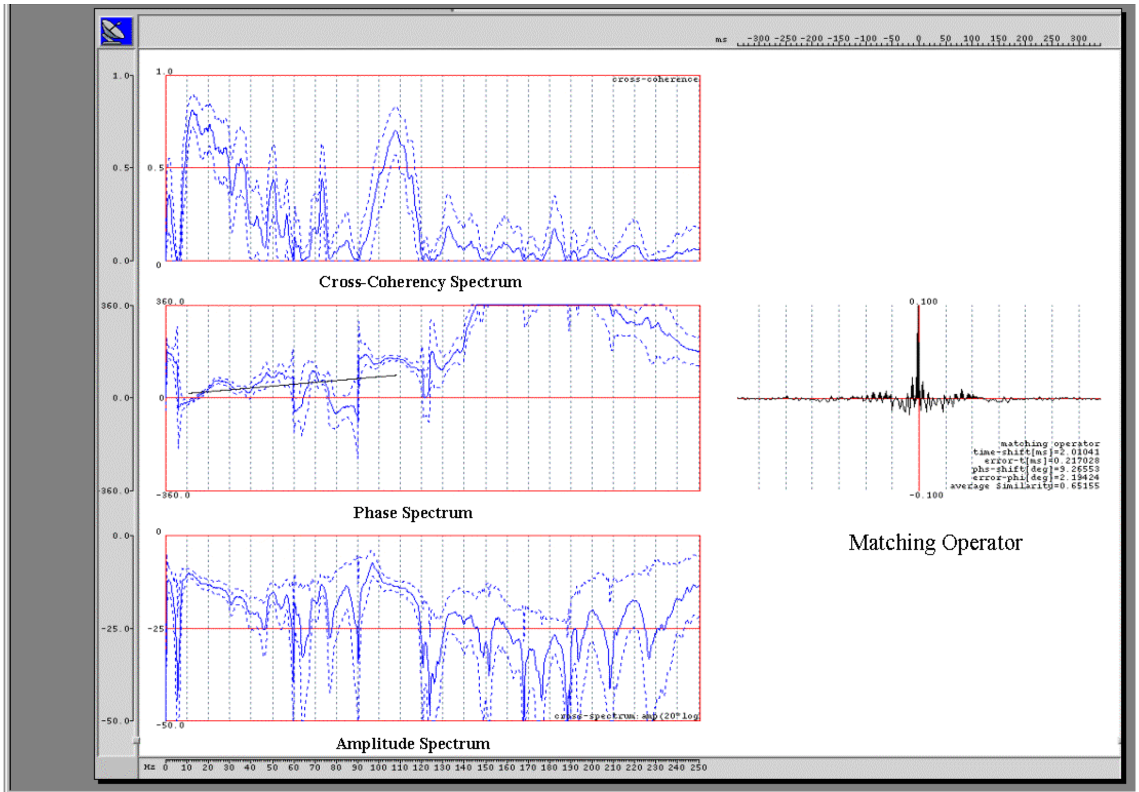
Phase Matching:

Phase matching between vintages was carried out to match vintages SB94A and TQH5 to BHB96. (See Fig 1 below).

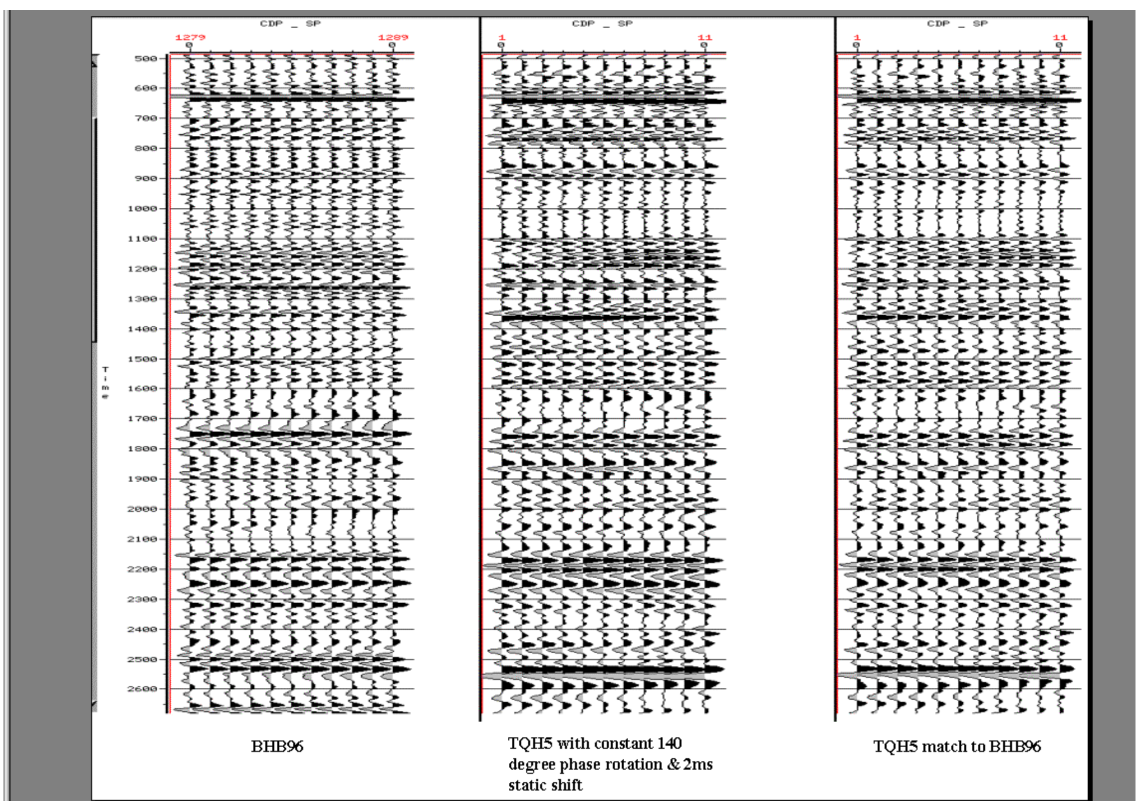
Fig1:



This match is taken from the intersection of BHB96-103 and SB94A-110 on the basemap. The data is from selected traces of the PSTM stacks with no Q Comp or TSFIL applied.



This is the matching statistics for the vintages BHB96 and SB94A showing the matching operator, cross-coherency, phase and amplitude spectra.

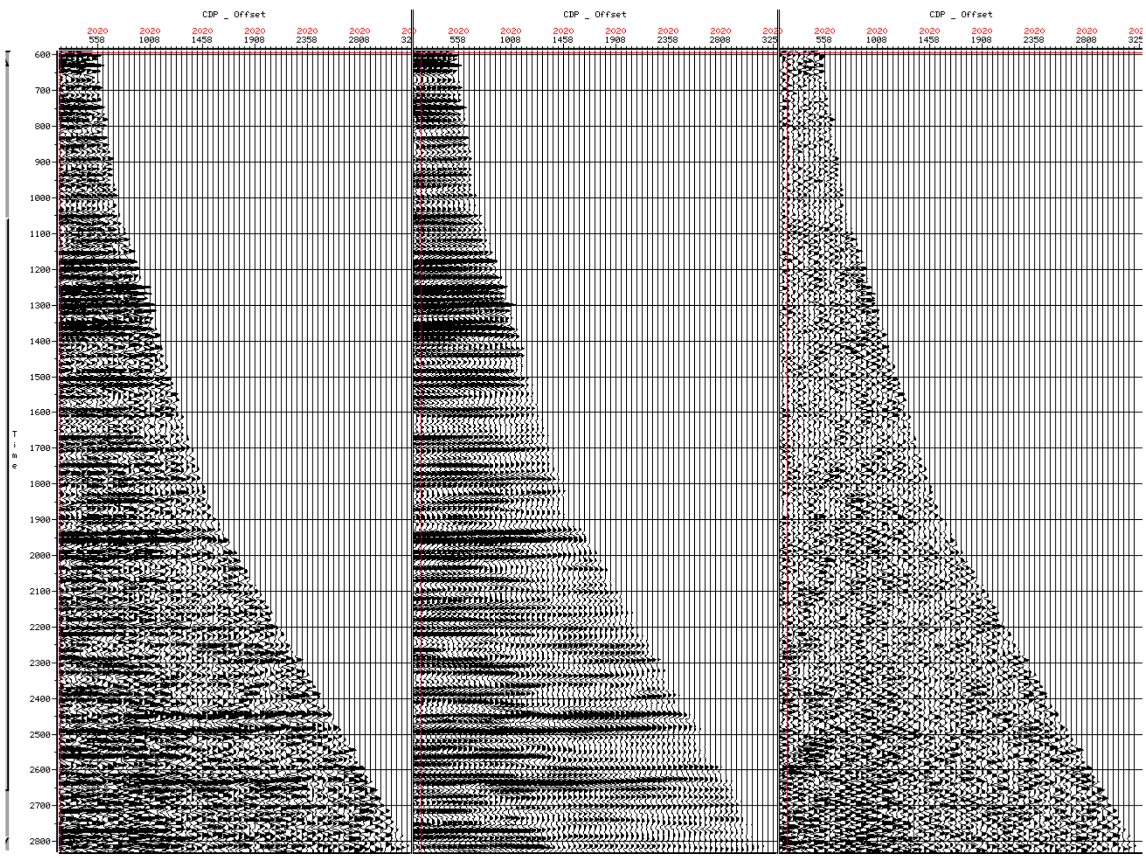


This is the matching of BHB96 and TQH5 vintages taken from the intersection of BHB96-103 and TQH5-48 on the basemap. The middle panel shows TQH5 with a 2ms static shift and a constant 140 degree phase rotation applied.

Q Compensation and Time Slice Filtering:

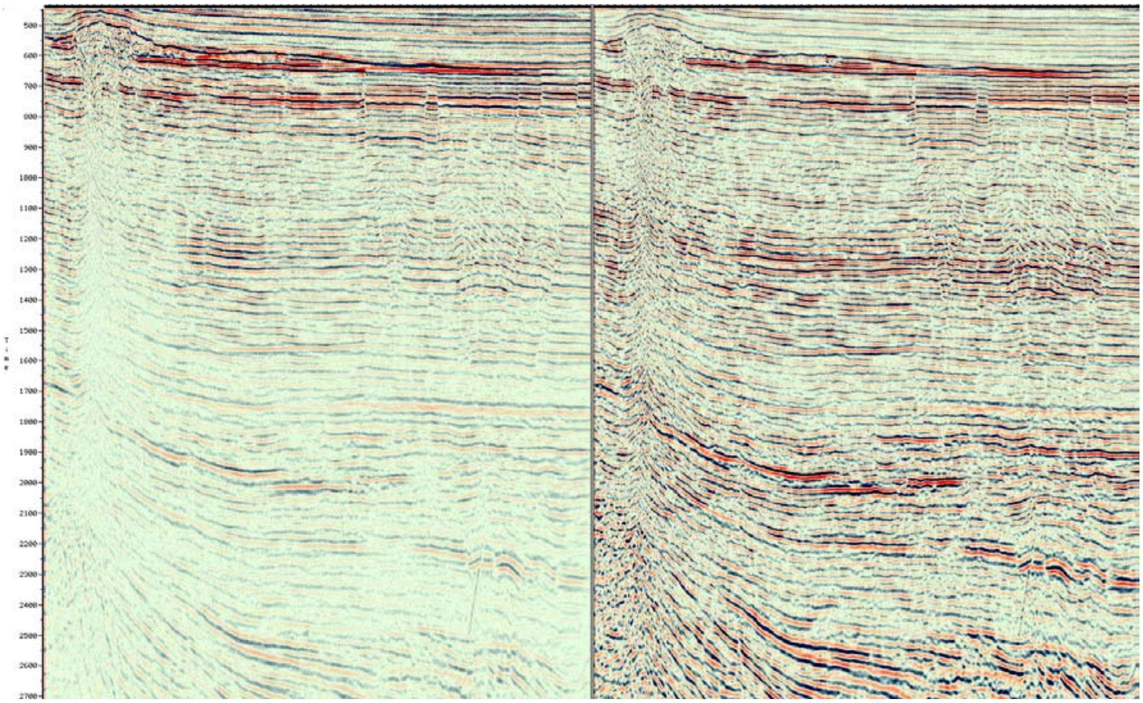
Selected Parameters: Inverse Q filtering to be applied using a time variant Q function to a frequency of 65Hz.

Time (ms)	*Q Factor*
2	*136*
1000	*136*
2000	*150*
3000	*180*
4000	*300*
5200	*300*



Before TSFIL After TSFIL Difference

Fig 2: CDP 2020 TSFIL variant (dx1,dy2,Ti 200ms, Tf 1000ms)
(dx2,dy2,Ti1000ms, Tf 2500ms)
(dx3,dy3, Ti 2500ms, Tf 6000ms)



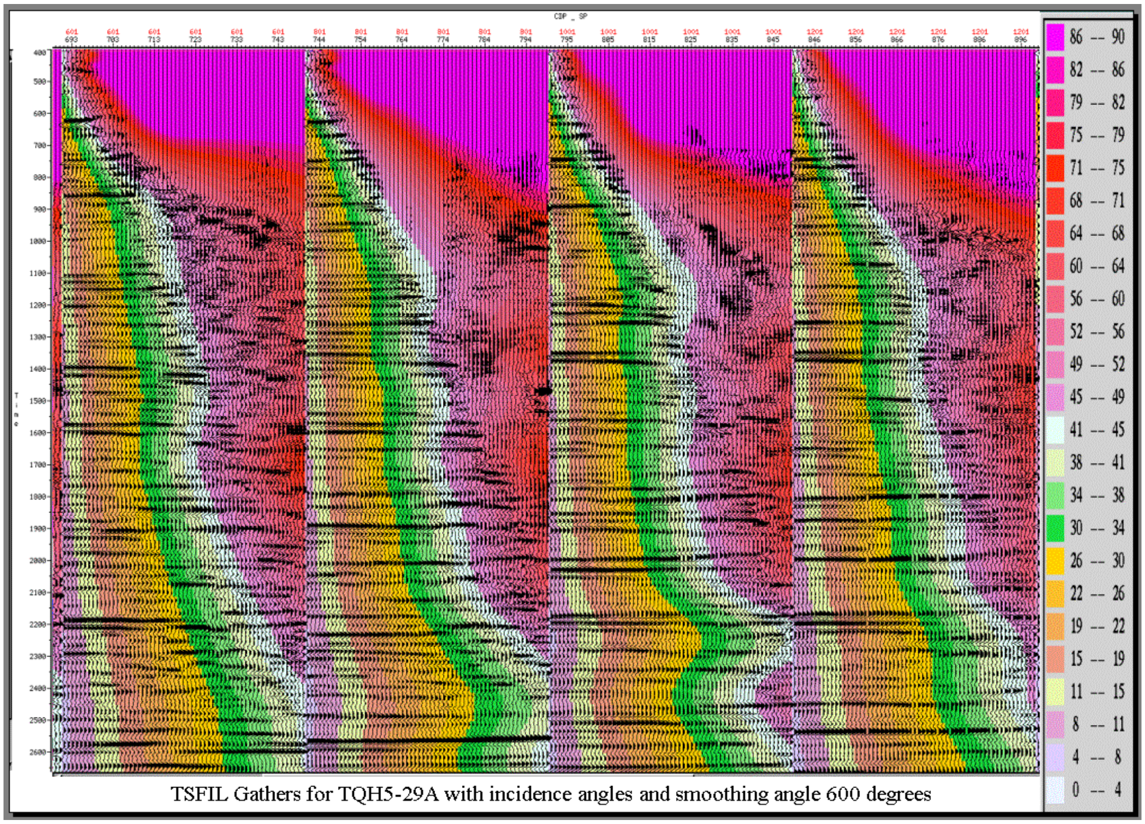
PSTM before Q comp & TSFIL PSTM after Q comp & TSFIL

Fig 3: PSTM stack (line BHB96-107) showing before & after Q Comp & TSFIL

Amplitude Versus Offset (AVO) :

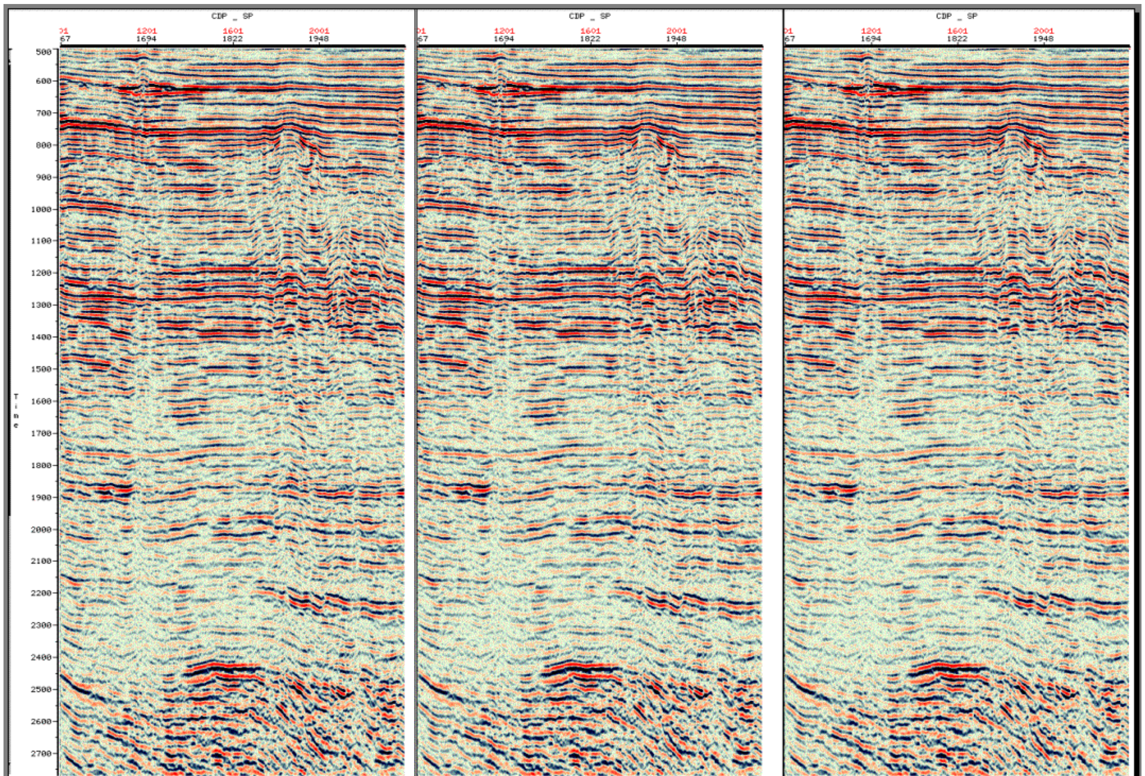
AVO products delivered included Intercept Stack (I), Gradient Stack (G), Product Stack (I*G), and Fluid Factor Stack (FF).

Fig 4:



TSFIL Gathers for TQH5-29A with incidence angles and smoothing angle 600 degrees

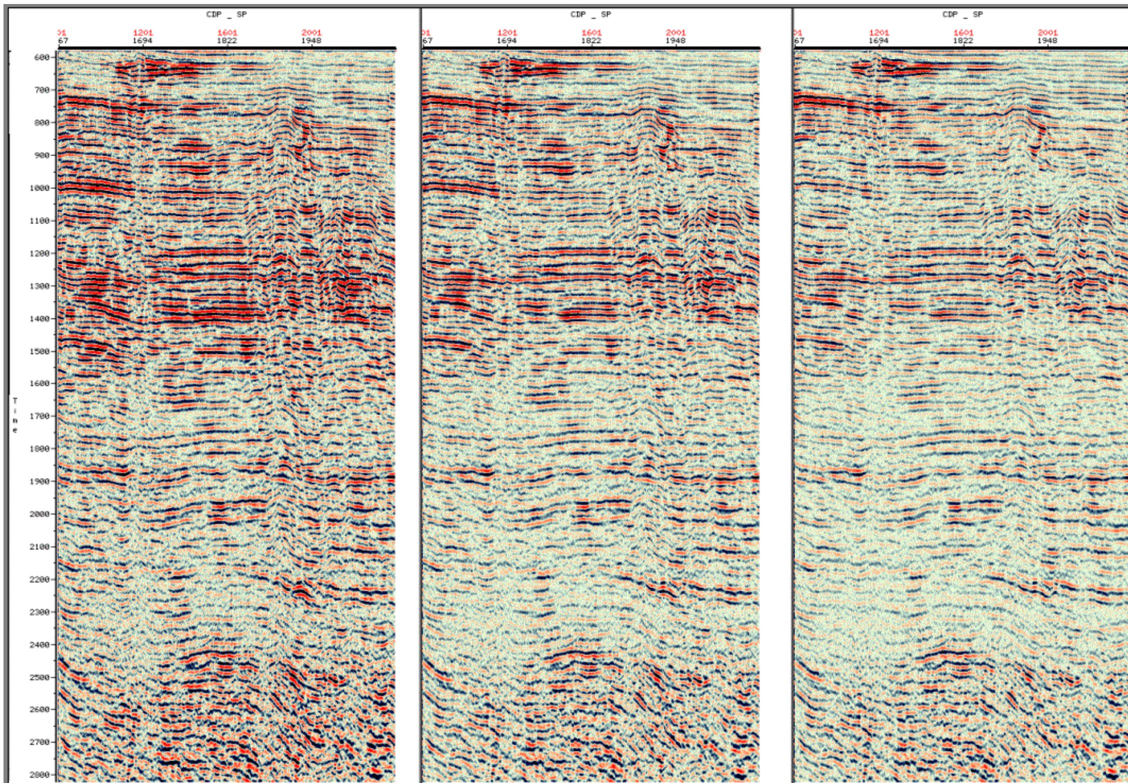
Fig 5:



0-30 degrees 0-35 degrees 0-40 degrees

Intercept stacks of BHB96-101 with various incidence angles

Fig 6:



0-30 degrees 0-35 degrees 0-40 degrees

Gradient stacks of BHB96-101 with various incidence angles

3.5. Velocities

Velocity analysis was carried out using CGG's new package "ChonoVista" with "GeoVel" interactive velocity picking and QC application. GeoVel provides:
velocity spectra, interval velocity, central CMP, picked NMO and re-stacking applied on the fly, mini stacks, automatic picking adjustment, interval and RMS iso-velocity sections, velocity time slices, flexible navigation and window linking, and others.

For velocity QC by Origin Energy, Mr Randall Taylor visited our office to pick first pass velocity analysis. 15 CDPs were provided for each velocity analysis location: each 1000m for first and each 500m for final analysis. Time slices also were generated for QC of velocity field.

Three stages of velocity analysis were performed during the processing sequence.

The *first (initial)* pass of velocity analysis was undertaken at 1km intervals along each line before demultiple. An Origin Energy company representative (Dr Nigel Fisher) carried out velocity QC using ProMax software and gave approval to proceed.

The *second* stage of velocity analysis was carried out after PSTM at 1000m intervals along each line, with the first pass velocity field being used as the reference function. Dr Nigel Fisher carried out velocity QC at CGG Perth Processing Centre.

The *third and final* stage of velocity analysis was carried out by Dr Nigel Fisher after Final PSTM at 500m intervals along each line, with the second pass velocity field being used as the guide function. ProMax software was used for the final velocity picking.

4. Conclusions

4.1. Conclusions And Recommendations For Further Work

Overall, the final data quality is considered to be good. However, there are a couple of lines from the same vintage in which the data quality after PSTM does not surpass the original processing. CGG applied Q compensation after PSTM which in some areas are detrimental to the data continuity. On the other hand, this process clearly improved temporal resolution. Perhaps one can argue that the processing sequence used for this whole survey is not entirely appropriate. Maybe a different sequence should have been used; for example this was evident when time slice filtering was applied to the HB75A vintage line which resulted in the data quality being degraded. Also the fact that CGG did not receive any SEGY data of the original processing which made it difficult for us to make comparisons on screen. Instead we only received paper plots which were not sufficient in making QC comparisons.

1 Introduction

2 Data acquisition

3 Processing sequence

4 Conclusion

5 Annexes

5. Annexes

5.1. List of lines processed

T18P Bass Basin
Trefoil Prospect Reprocessing 2002

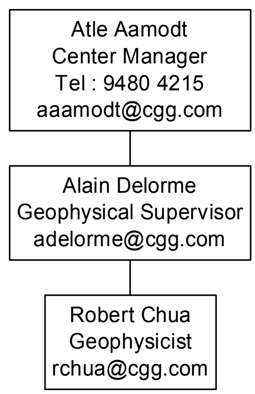
Line	Start SP	End SP	Kilometres	Data Medium
BHB96-101	1420	2200	17.83	Exabyte Tapes
BHB96-103	1430	2200	17.60	Exabyte Tapes
BHB96-105	1430	2200	17.60	Exabyte Tapes
BHB96-106	1001	1618	14.11	Exabyte Tapes
BHB96-107	1430	2100	15.32	Exabyte Tapes
BHB96-108	917	1535	14.13	Exabyte Tapes
BHB96-110	1001	1618	14.10	Exabyte Tapes
BHB96-112	917	1535	14.13	Exabyte Tapes
BHB96-114	1001	1752	17.17	Exabyte Tapes
SB94A-110	31	650	15.47	3480 Cartridge
SB94A-112	111	730	15.47	3480 Cartridge
SB94A-113	450	1150	17.50	3480 Cartridge
SB94A-115	450	1102	16.30	3480 Cartridge
TQH5-29A	600	1050	13.51	3590 Cartridge
TQH5-31	800	1400	17.98	3590 Cartridge
TQH5-33	1350	1850	14.99	3590 Cartridge
TQH5-48	300	770	14.08	3590 Cartridge
TQH5-52	1	500	14.96	3590 Cartridge
		TOTAL:	282.24	kilometres.

(shaded) Transcription from 9-track tapes is being done by AGSO
Data available by mid Feb

HB75A-200 1 1318

5.2. Overall production

5.2.1.CGG personnel



5.2.2.Client supervision and information

Mr. Nigel Fisher for Origin Energy Resources Ltd picked the final pass velocity analysis.
Test panels were sent by email to Mr. Randall Taylor for QC and approval.

5.3. Final documents and tapes

5.3.1. Final Tape products

5.3.1.1. Stacked Data

The final products:

1. PSTM Stacks with Q Comp & TSFIL (filtered & scaled)
2. AVO stacks

for each processed line on 8 mm Exabyte tapes in SEG-Y format.

The following table summarises the tape contents for each line provided to Origin Energy Ltd.

Line Number	First CDP	Last CDP	First SP	Last SP	1.PSTM Raw		2.PSTM Filtered/Scaled		3.AVO Filtered/Scaled	
					Tape No	File No	Tape No	File No	Tape No	File No
BHB96-101	1	2592	1420	2200	102	1	103	1	202	1
BHB96-103	1	2561	2200	1430	102	2	103	2	202	2
BHB96-105	1	2562	2200	1430	102	3	103	3	202	3
BHB96-106	1	2103	1001	1618	102	4	103	4	202	4
BHB96-107	1	3552	1000	2100	102	5	103	5	202	5
BHB96-108	1	2106	1535	917	102	6	103	6	202	6
BHB96-110	1	2103	1001	1618	102	7	103	7	202	7
BHB96-112	1	2506	1535	917	102	8	103	8	202	8
BHB96-114	1	2505	1001	1752	102	9	103	9	202	9
SB94A-110	1	2712	650	31	102	10	103	10	202	10
SB94A-112	1	2716	111	730	102	11	103	11	202	11
SB94A-113	1	3040	450	1150	102	12	103	12	202	12
SB94A-115	1	2848	450	1102	102	13	103	13	202	13
TQH5-29A	2	2041	600	1050	102	14	103	14	202	14
TQH5-31	2	2641	800	1400	102	15	103	15	202	15
TQH5-33	2	2241	1350	1850	102	16	103	16	202	16
TQH5-48	2	2121	300	770	102	17	103	17	202	17
TQH5-52	2	2237	2	500	102	18	103	18	202	18
HB75A-200	1	2730	1	1318			1001		1002	

CDP Gathers

The following pre stack data were archived on 8 mm Exabyte tapes in SEG-Y format with 6000 ms Record length/2 ms Sample rate:

1. CDP gathers after Radon Demultiple, NMO uncorrected and unscaled.
   The following table indicates contents of each tape provided to Origin Energy Ltd.

Tape Number	Line Number	CDP Range
400	BHB96-101	1-2592
401	BHB96-103	1-2561
402	BHB96-105	1-2562
403	BHB96-106	1-2103
404	BHB96-107	1-3552
405	BHB96-108	1-2106
406	BHB96-110	1-2103
407	BHB96-112	1-2506
408	BHB96-114	1-2505
409	SB94A-110	1-2712
410	SB94A-112	1-2716
411	SB94A-113	1-3040
412	SB94A-115	1-2848
413	TQH5-29A	2-2041
414	TQH5-31	2-2641
415	TQH5-33	2-2241
416	TQH5-48	2-2121
417	TQH5-52	2-2237

2. CDP gathers after Radon Demultiple, NMO uncorrected and scaled (Q comp).
The following table indicates contents of each tape provided to Origin Energy Ltd.

Tape Number	Line Number	CDP Range
1	BHB96-101	1-2592
2	BHB96-103	1-2561
3	BHB96-105	1-2562
4	BHB96-106	1-2103
5	BHB96-107	1-3552
6	BHB96-108	1-2106
7	BHB96-110	1-2103
8	BHB96-112	1-2506
9	BHB96-114	1-2505
10	SB94A-110	1-2712
11	SB94A-112	1-2716
12	SB94A-113	1-3040
13	SB94A-115	1-2848
14	TQH5-29A	2-2041
15	TQH5-31	2-2641
16	TQH5-33	2-2241
17	TQH5-48	2-2121
18	TQH5-52	2-2237

3. CDP gathers after PSTM, NMO corrected and unscaled (no Q comp).
   The following table indicates contents of each tape provided to Origin Energy Ltd.

Tape Number	Line Number	CDP Range
700	BHB96-101	1-2592
701	BHB96-103	1-2561
702	BHB96-105	1-2562
703	BHB96-106	1-2103
704	BHB96-107	1-3552
705	BHB96-108	1-2106
706	BHB96-110	1-2103
707	BHB96-112	1-2506
708	BHB96-114	1-2505
709	SB94A-110	1-2712
710	SB94A-112	1-2716
711	SB94A-113	1-3040
712	SB94A-115	1-2848
713	TQH5-29A	2-2041
714	TQH5-31	2-2641
715	TQH5-33	2-2241
716	TQH5-48	2-2121
717	TQH5-52	2-2237

4. CDP gathers after PSTM, NMO corrected and scaled (Q comp) with TSFIL.
   The following table indicates contents of each tape provided to Origin Energy Ltd.

Tape Number	Line Number	CDP Range
500	BHB96-101	1-2592
501	BHB96-103	1-2561
502	BHB96-105	1-2562
503	BHB96-106	1-2103
504	BHB96-107	1-3552
505	BHB96-108	1-2106
506	BHB96-110	1-2103
507	BHB96-112	1-2506
508	BHB96-114	1-2505
509	SB94A-110	1-2712
510	SB94A-112	1-2716
511	SB94A-113	1-3040
512	SB94A-115	1-2848
513	TQH5-29A	2-2041
514	TQH5-31	2-2641
515	TQH5-33	2-2241
516	TQH5-48	2-2121
517	TQH5-52	2-2237

APPENDIX 2

TIME STRUCTURE MAPS
AVERAGE VELOCITY MAPS
DEPTH STRUCTURE MAPS

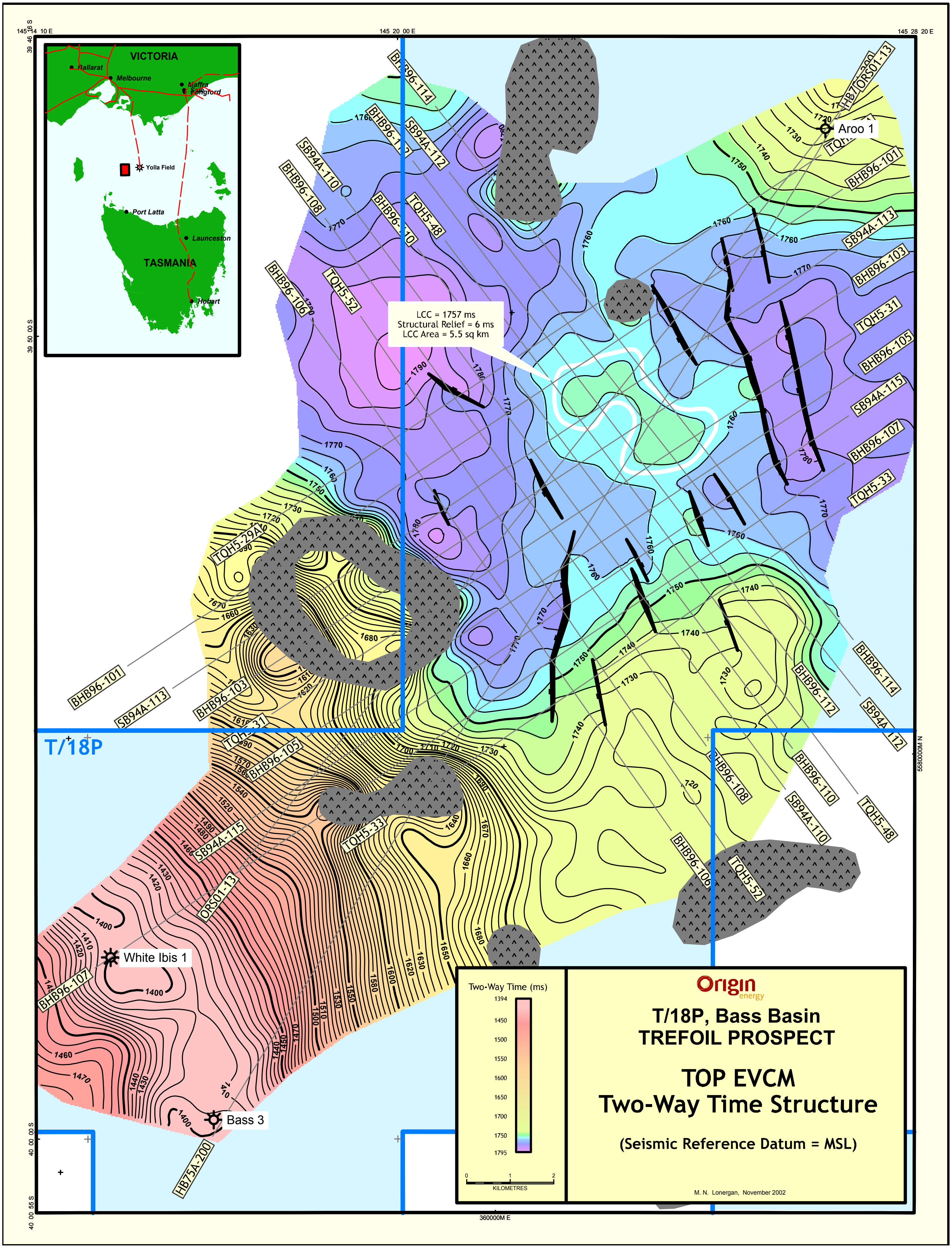


Figure A.1 – Top EVCM Two-Way Time Structure

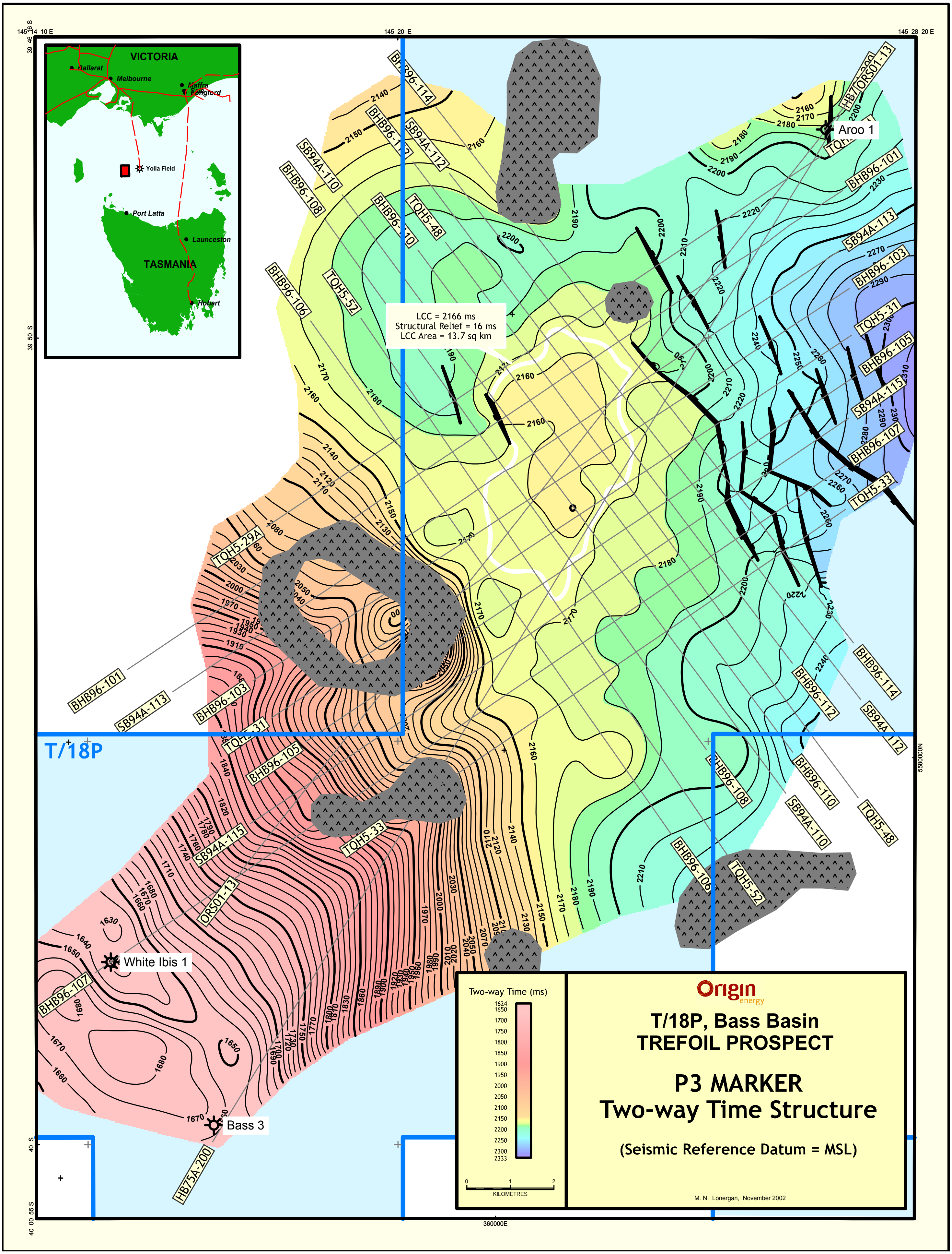


Figure A.2 – Palaeocene Marker 3 Two-Way Time Structure

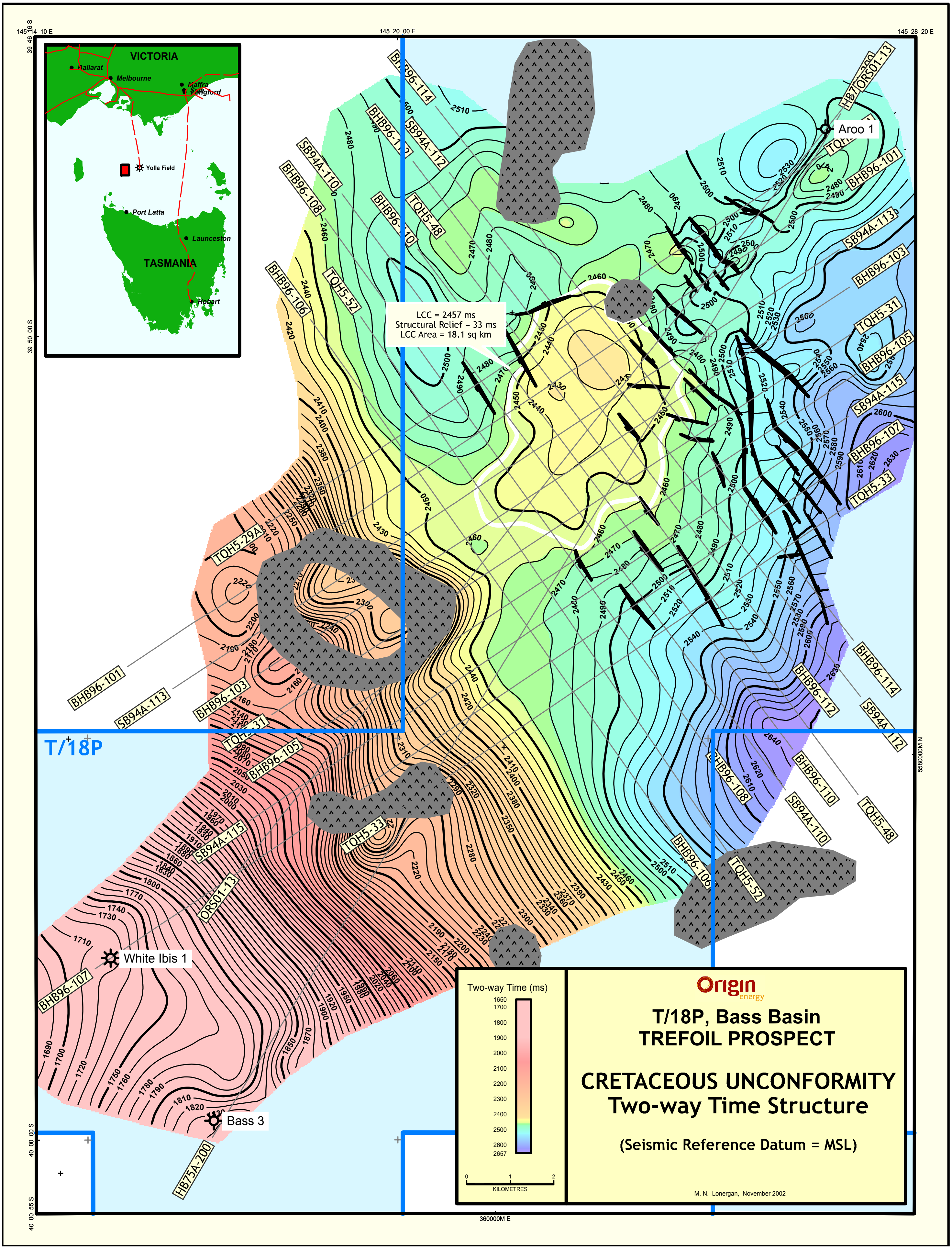


Figure A.3 – Cretaceous Unconformity Two-Way Time Structure

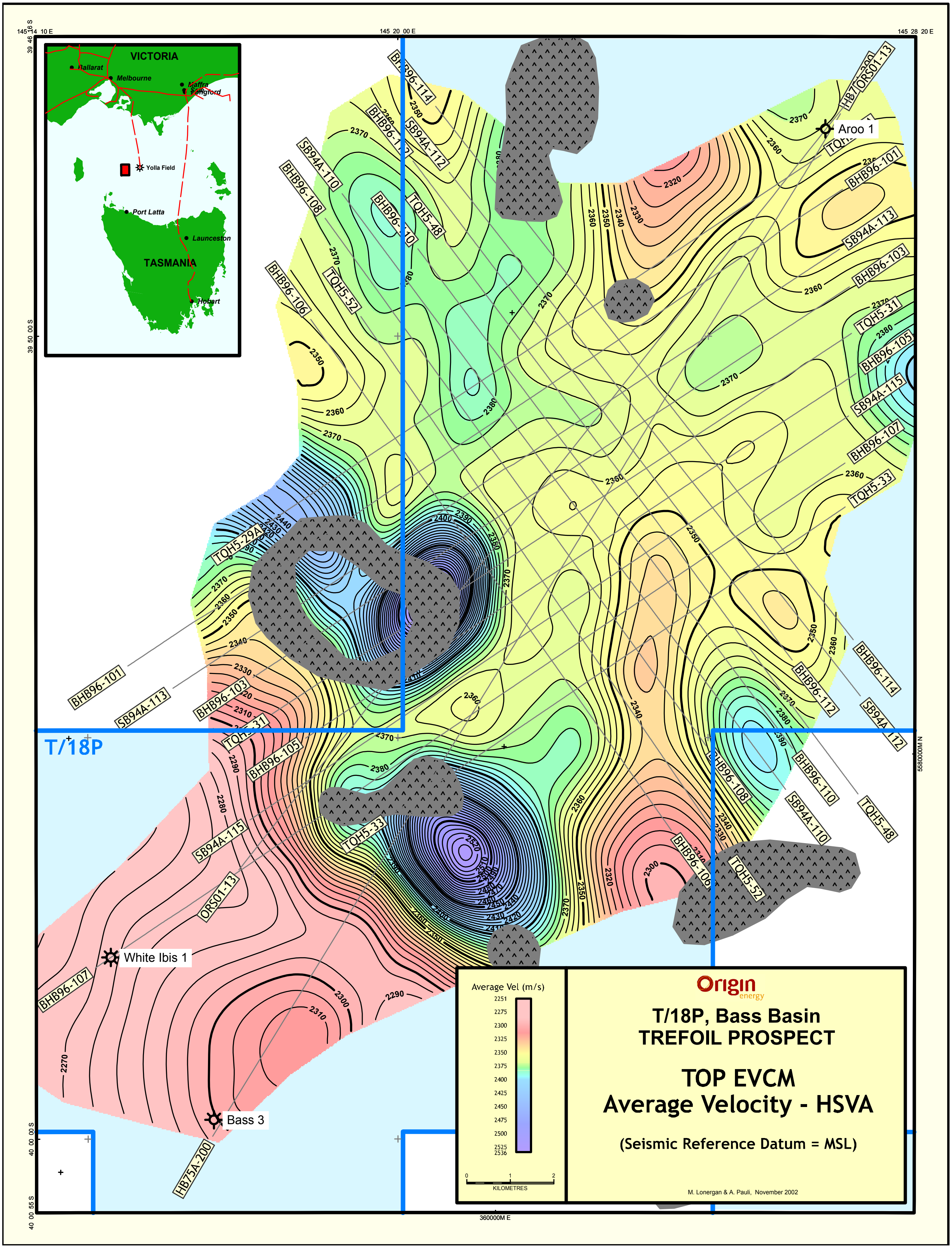


Figure A.4 – Top EVCM Average Velocity from HSVA

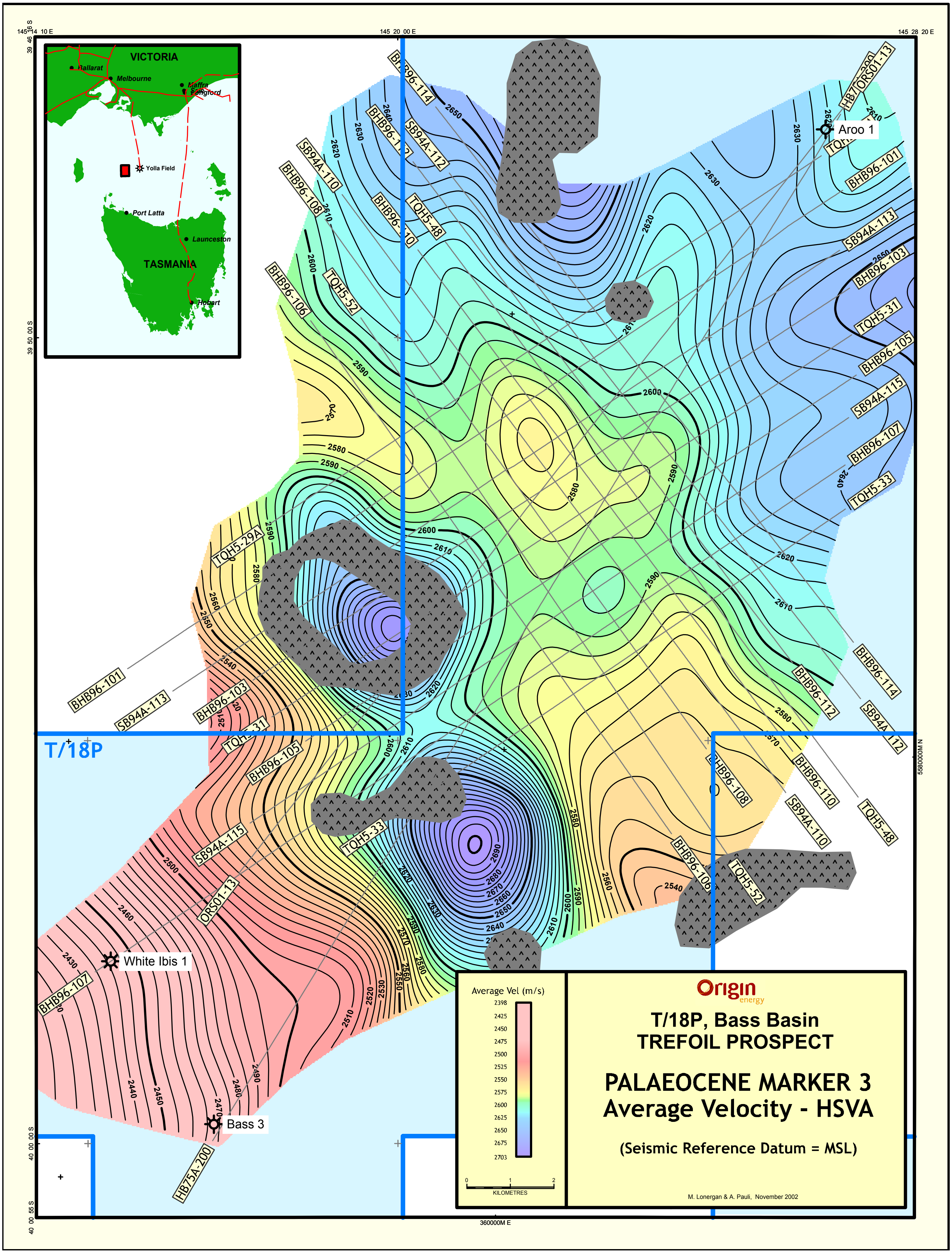


Figure A.5 – Palaeocene Marker 3 Average Velocity from HSVA

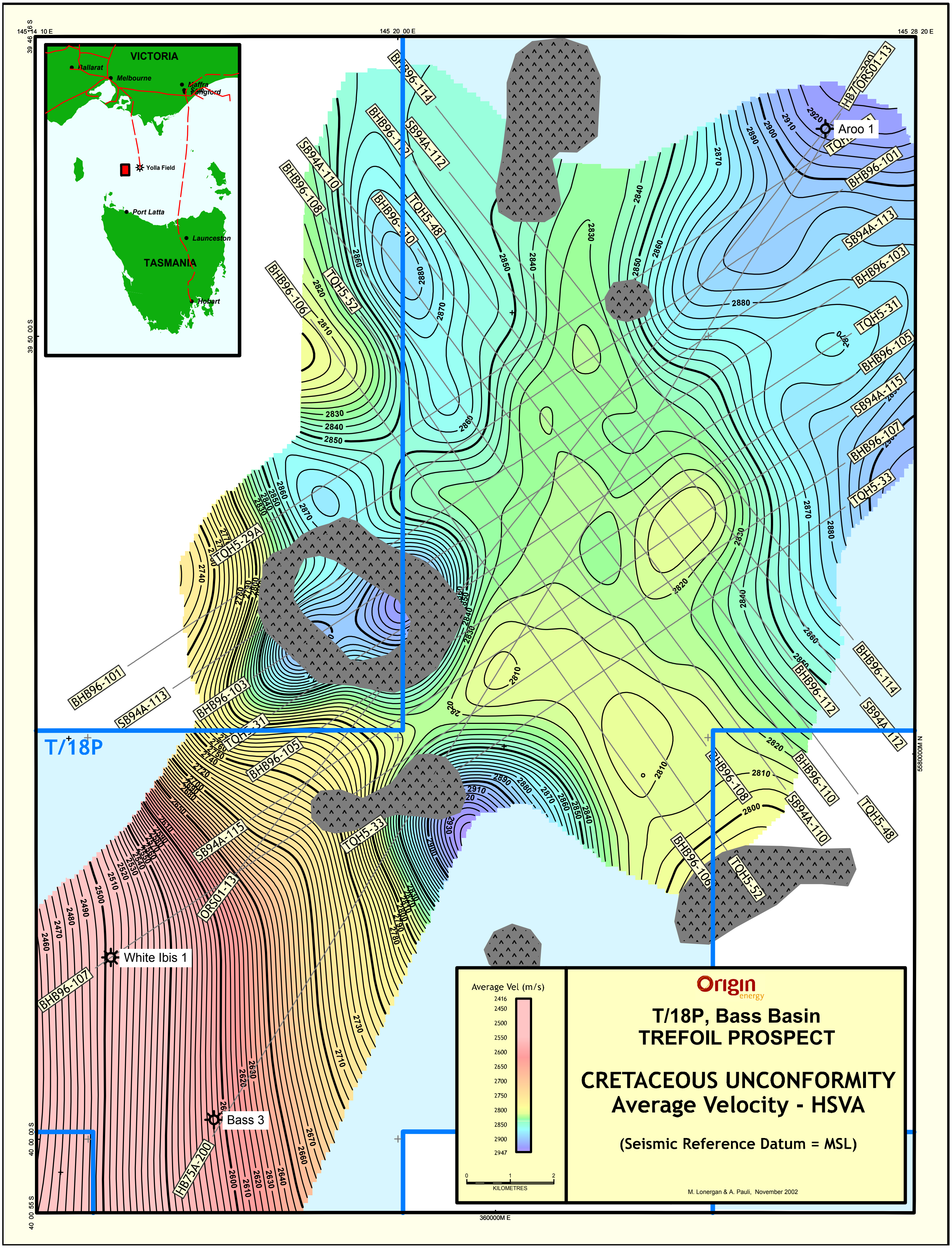


Figure A.6 – Cretaceous Unconformity Average Velocity from HSVA

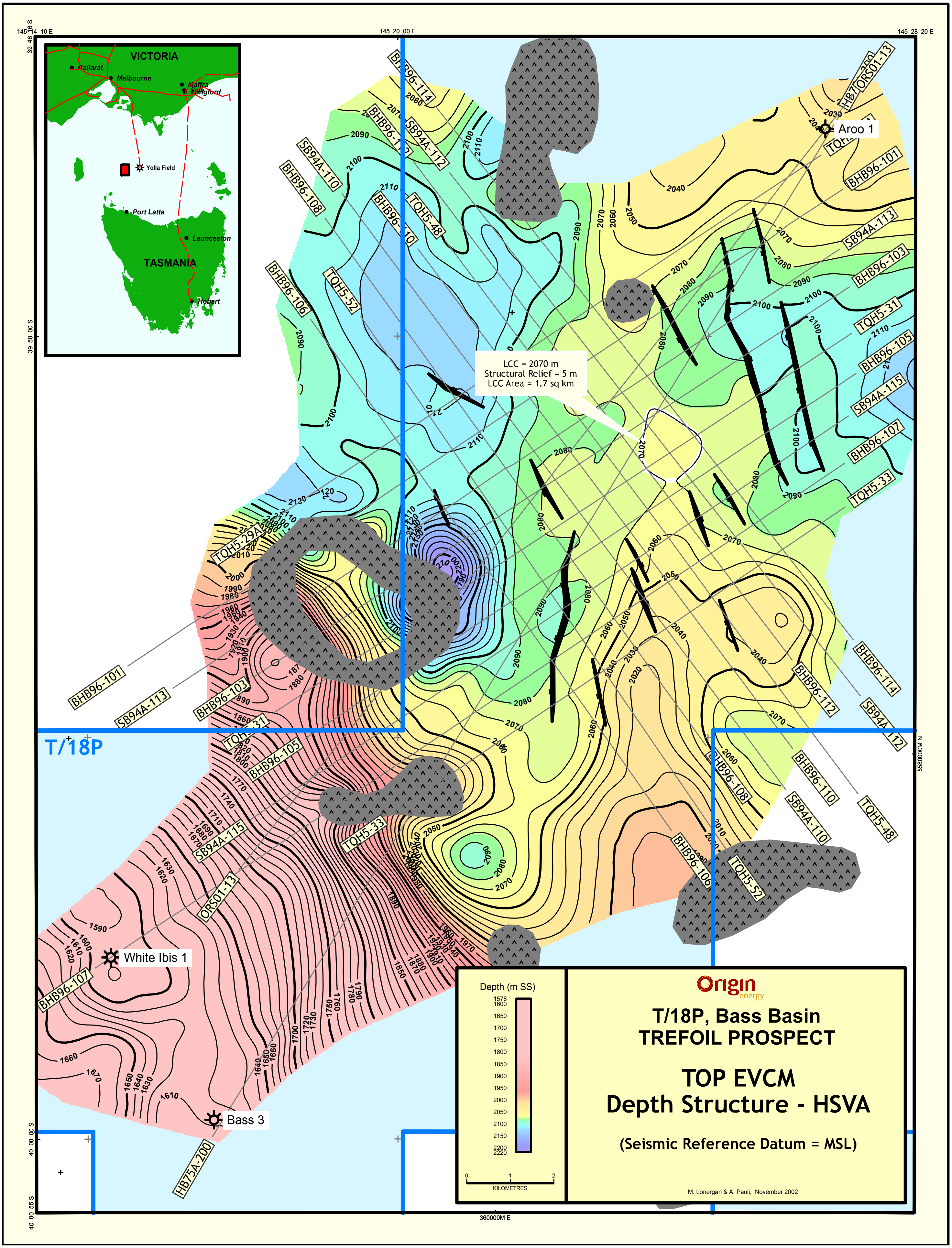


Figure A.7 – Top EVCM Depth Structure from HSVA

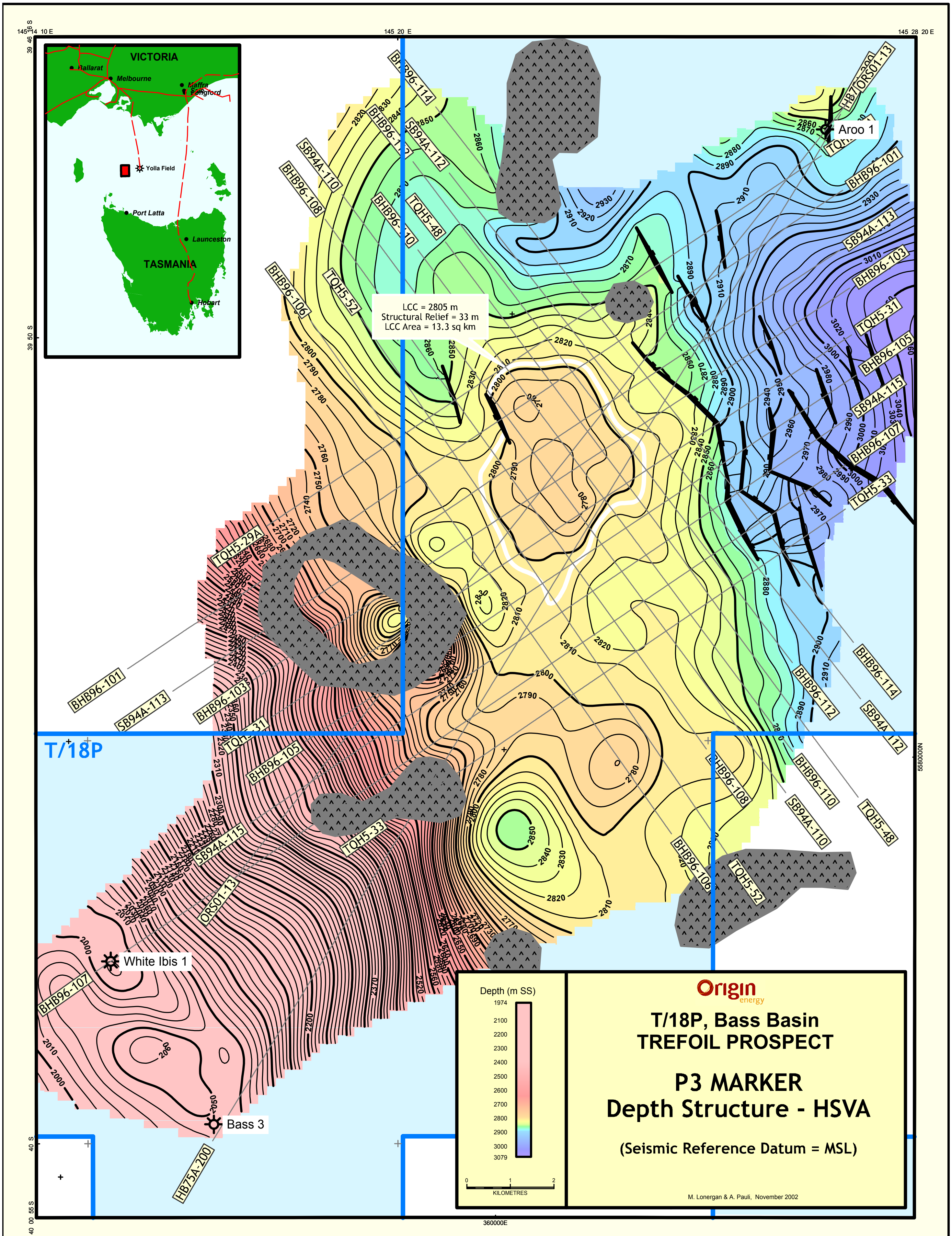


Figure A.8 – Palaeocene Marker 3 Depth Structure from HSVA

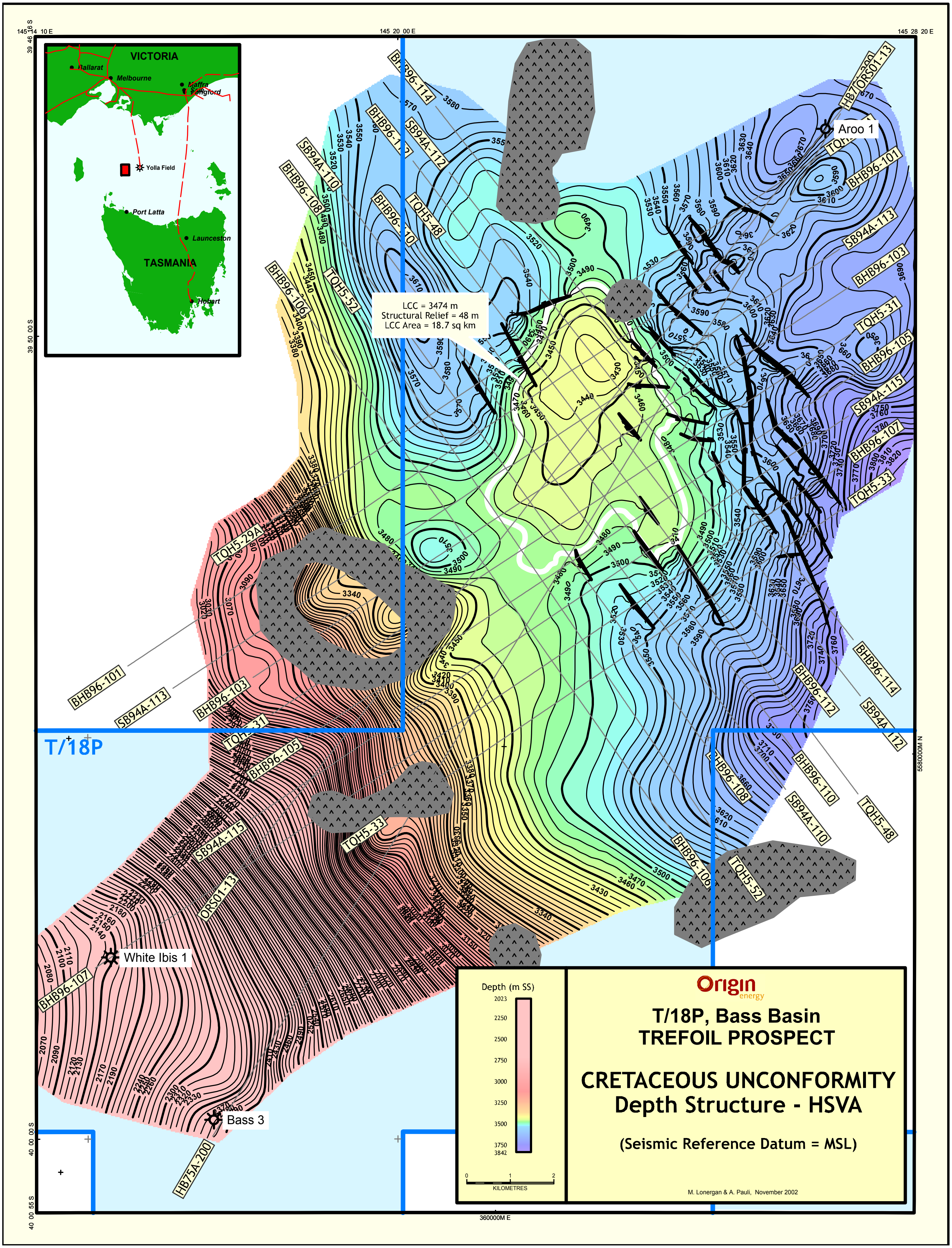


Figure A.9 – Cretaceous Unconformity Depth Structure from HSVA