

**YOLLA 3D SEISMIC DATA INTERPRETATION**

**T/RL1, BASS BASIN**

**OFFSHORE TASMANIA**

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for BERL on behalf  
of the T/RL1 Joint Venture  
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## 1 SUMMARY

The Yolla structure is confidently defined by the 3D seismic data.

This interpretation has confirmed and refined the results of previous 2D seismic based work, and further identified considerable potential in deep onlapping reservoirs, and extensions to the top EVCM oil pool.

The final depth conversion technique is undergoing further revision with additional processing, particularly in relation to the Miocene Volcanic interval. However, other important questions regarding reservoir quality and distribution, hydrocarbon deliverability and fluid content, will only be addressed by the drilling of appraisal wells.

## 2 BACKGROUND

The Yolla gas-condensate-oil field is located in Retention Lease T/RL1 in the Tasmanian portion of the offshore Bass Basin (Figure 1). The Yolla 1 discovery well was completed on 11 October 1985, and flowed oil, gas and condensate from several zones within the Eastern View Coal Measures (EVCM) (see Figure 2). Table 1 summarises the relevant DST results. The participants of the T/RL1 permit are as follows:

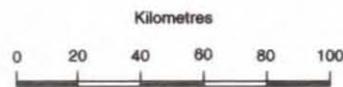
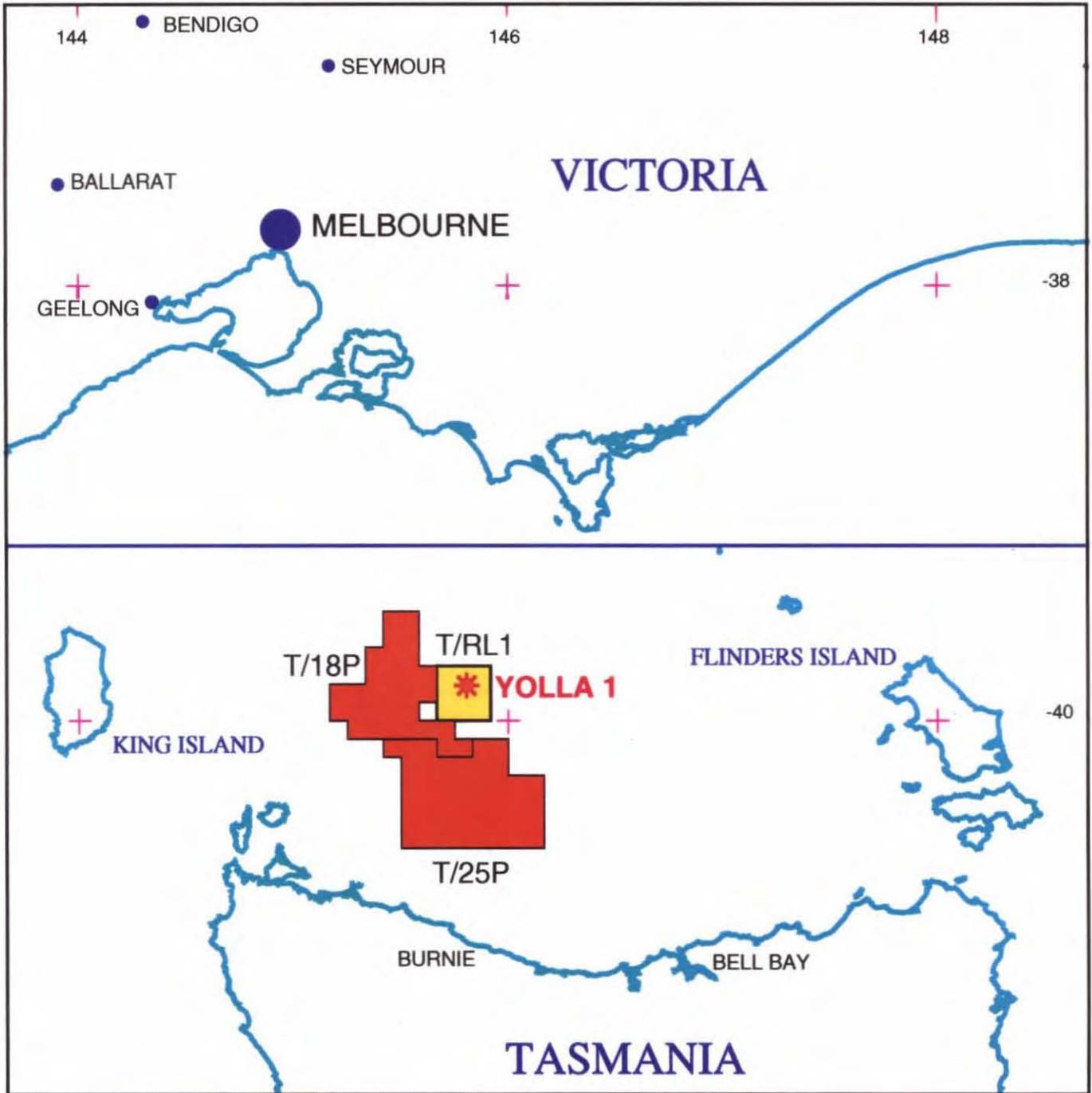
	Boral Energy Resources Limited	53.8615% (Operator)
*	GFE Resources NL	16.6915%
	Galveston Mining Corp Pty Ltd	14.0%
	Cultus Petroleum (Aust) NL	10.447%
**	Boral Energy Northwest Ltd	5.0%

\* Cultus purchased GFE from the Victorian Government during 1995.

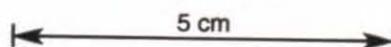
\*\* Boral Energy purchased Petroz's interest with effect from 31 March 1995.

A 260 square kilometre 3D seismic survey was acquired over the field during early 1994 (5 February - 16 March), in order to improve understanding of the structure prior to appraisal drilling.

The data were acquired by the Western Geophysical vessel the MV Western Atlas, and comprised 13,766 subsurface line kilometres of data at 30 fold with a 12.5 x 25 metre bin size. The in-line direction of 33.33 degrees was chosen to provide the best conditions for imaging the secondary fault system that lies perpendicular to the in-lines, and is an essential component in forming the structural closure at Yolla 1. Further detail on the acquisition, and the processing by Digital Exploration Limited, is contained in the SAGASCO Resources Ltd report "1994 Yolla 3D Seismic Survey, Data Acquisition and Processing Report, T/RL1 Tasmania".



# BASS BASIN TASMANIA LOCATION MAP

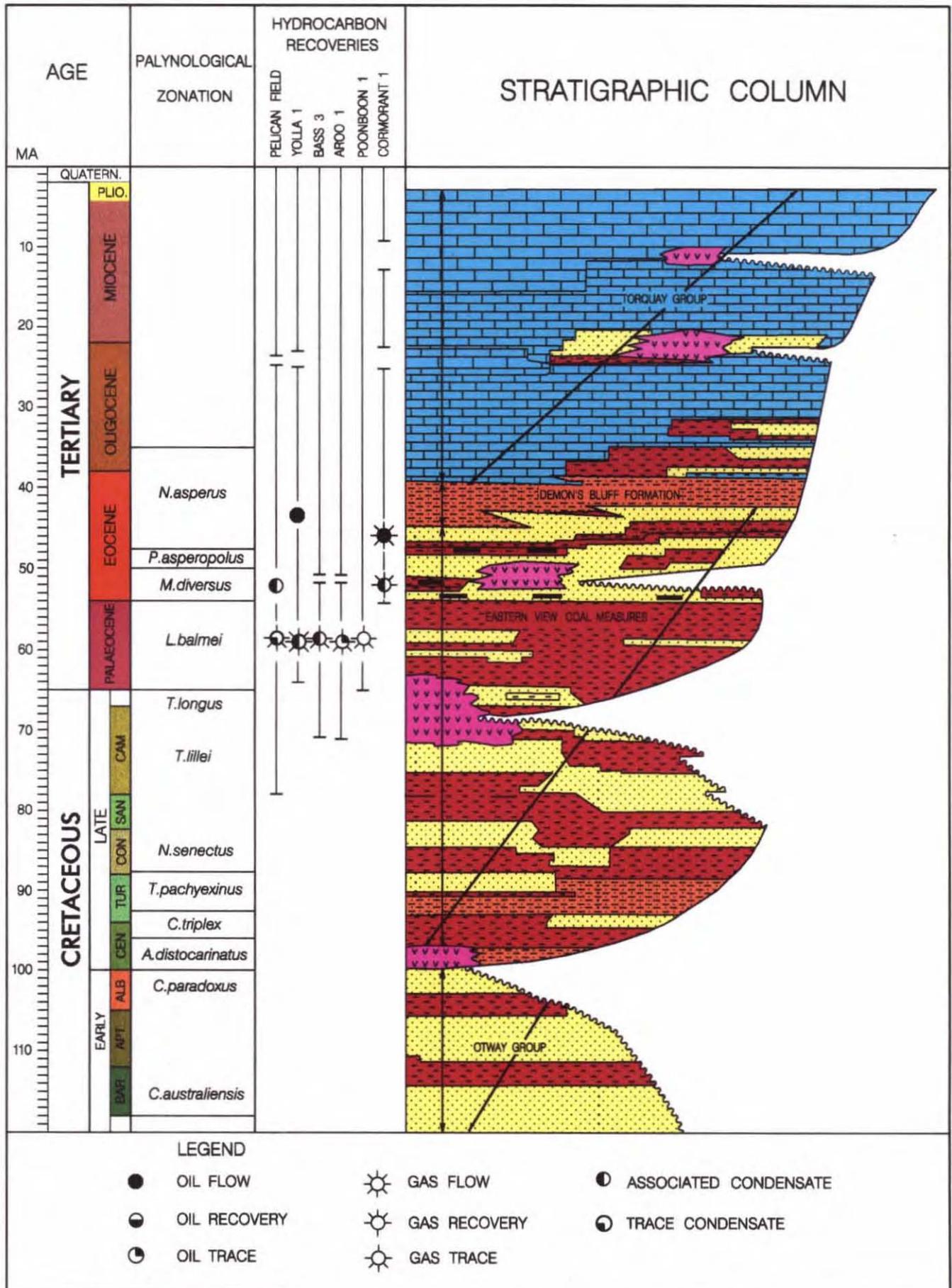


**TABLE 1**  
**YOLLA 1 - DST SUMMARY**

TEST	DEPTH METRES KB	AVERAGE FLOW			CHOKE SIZE INCHES	OIL/COND API GR
		GAS MMSCF/D	OIL/COND STB/DAY	WATER BBL/DAY		
DST #1 (FLOW #1)	2809.1 - 2814.2 2817.9 - 2824.6	10.2	420	-	30/64"	50.5
DST #1 (FLOW #2)	2809.1 - 2814.2 2817.9 - 2824.6	15.1	580	-	40/64"	51.2
DST #2A	1833.2 - 1833.8	1.02	302	-	16/64"	45.5
DST #3	1813 - 1833.1	11.8	892	-	80/64"	50.6

# BASS BASIN – TASMANIA STRATIGRAPHIC COLUMN

516009



LEGEND

- OIL FLOW
- ☼ GAS FLOW
- ⦿ ASSOCIATED CONDENSATE
- ◐ OIL RECOVERY
- ☼ GAS RECOVERY
- ◑ TRACE CONDENSATE
- ◒ OIL TRACE
- ☼ GAS TRACE

5 cm

### 3 INTERPRETATION

#### 3.1 Data Quality and Phase

Extensive deconvolution trials and demultiple tests were conducted to select the final parameters used during the processing sequence. These were aimed at producing zero-phase data and reducing short period multiples. To check this, both minimum-phase and zero-phase synthetics were constructed for Yolla 1, and then compared to the data. The zero-phase synthetic was selected as having the best tie to the chosen designature, and the final data set is therefore assumed to be near zero phase. Post-migration Trace Equalisation was performed on overlapping 1000 millisecond gates, being large enough to preserve true relative amplitudes, but also aid significantly in the interpretation by the presentation of a better looking data set.

The 3D-migration process produced clean sharp fault cuts superior to those shown by the previous 2D data, and justified the decision on in-line shooting direction. However, the presence of multiples remains a problem in the EVCM, particularly below the Middle M. diversus coal dominated sequence.

##### 3.1.1 Well Tie

A synthetic seismogram was created for the Yolla 1 well using LOGM software, and is shown here in Enclosure 1. The check shot data was input to correct the sonic, and both sonic and density logs were used to calculate the reflection co-efficient series. The normal polarity convention used here, is that an increasing velocity interface will produce a negative trough on the seismic data. The LOGM software considers this as "Reversed Polarity".

At Miocene levels, approximately 1 second two-way time, the seismic frequency content is 40-50 Hertz. At the deeper Palaeocene levels (2 seconds twt), this is reduced considerably to 20-25 Hertz. The two synthetics presented in Enclosure 1, reflect the data frequency content by using two zero-phase Ricker wavelets at 25 and 45 Hertz. Table 2 lists the mapped events in time and depth, for the Yolla 1 well on seismic in-line 530 cdp 1010.

##### 3.1.2 Tuning Thickness

It is generally accepted that the stratigraphic tuning thickness of individual beds is one quarter the seismic wavelength, ( $\lambda/4$ ).

Below this the seismic reflections no longer coincide with the stratigraphic interfaces, but to a composite response of many overlapping wavelets. Additionally, the amplitude of a particular composite event starts changing at half the wavelength ( $\lambda/2$ ), increasing to a peak at  $\lambda/4$  and then decreasing as beds became thinner than  $\lambda/4$  (for more detail refer to AR Brown 1991, AAPG Memoir 42 "Interpretation of 3D seismic data"). At Miocene levels the frequency is 40-50 Hz, which at an interval velocity of 2500 metres/second gives wavelengths of 63-50 metres, and hence tuning thickness of  $\lambda/4 = 16-12.5$  metres. At the deeper Palaeocene level, frequencies of 20-25 Hz give rise to  $\lambda = 185-148$  metres at a velocity of 3700 metres/second, and a subsequent tuning thickness of  $\lambda/4 = 46-37$  metres.

At the main gas/condensate reservoir level between approximately 2700 and 3000 metres, it is therefore unlikely that the data will "see" the individual reservoirs. The exploded synthetic of Enclosure 3, using both sonic and density logs blocked at major interfaces, illustrates how the composite seismic response is made up of the wavelet components produced at several individual boundaries.

**TABLE 2****WELL - SEISMIC CORRELATION TABLE**

<b>STRATIGRAPHIC LEVEL</b>	<b>Depth KB (metres)</b>	<b>Depth Subsea (metres)</b>	<b>Two-Way-Time (seconds)</b>
Seafloor *	79.7	-68.6	0.108
Mid Miocene *	569.1	-558	0.501
Lower Mid Miocene *	815.1	-804	0.683
Top Miocene Volcanics (seismic) *	1219.1	-1208	1.070
Top Volcanics (logs)	1240	-1228.9	1.092
Base Volcanics (logs)	1268	-1256.9	1.115
Base Miocene Volcanics (seismic) *	1365.1	-1354	1.181
Demons Bluff Formation	1668.1	-1657	1.378
Top Eastern View Coal Measures (EVCM) *	1799.1	-1788	1.470
Top EVCM bright spot	1831.6	-1820.5	1.489
Early Eocene *	2190.1	-2179	1.718
Middle M. Diversus *	2375.1	-2364	1.837
Top Igneous intrusive	2584.1	-2573	1.950
Base Igneous intrusive	2650.9	-2639.8	1.978
Near top 2718 sand *	2679.1	-2668	1.991
2718 sand	2718	-2706.9	2.013
2808 sand	2808	-2797.9	2.052
Early Palaeocene *	2906.1	-2895	2.108
2972.5 sand	2972.5	-2961.4	2.139
Deep Seismic Onlap Event *	NI	NI	NI
Top Basalt *	3032.1	-3021	2.167
TD	3351.1	-3340	

Yolla 1 KB = 11.1 metres  
 \* = Mapped events  
 NI = Not intersected in Yolla 1

## 3.2 Method

### 3.2.1 Data Loading

The digital data were loaded onto a Geoquest workstation system for interpretation. The final filtered and scaled Migrated versions were selected and all primary in-lines (35-899) were loaded as 16-bit data, rather than 8-bit, in order to preserve more of the amplitude character.

From these 865 in-lines, cross-lines were constructed between shotpoints 110 and 1680 at every 10th shotpoint. Time slices were constructed at 8 millisecond intervals between 400 and 2500 milliseconds two way time, except between 1500 and 2000 milliseconds where they were constructed at 4 millisecond intervals.

A further 73 randomly oriented lines (reconstruction cuts) were constructed at different times throughout the interpretation process, to address specific local problems, usually associated with narrow fault corridors and particularly complex difficulties with the seismic correlations.

Within IES (Geoquest interpretation system), a 16-segment colour bar was used. This allowed 14 interpretation colours. A 32 segment colour bar would add definition, but then the colours able to be used for interpretation are restricted to 6. To unravel the complex structural picture the 14 colours were necessary to distinguish between the multiple horizons and faults. A red-white-blue colour table with ends enhanced by orange and cyan was used extensively, and is illustrated in Figure 3.

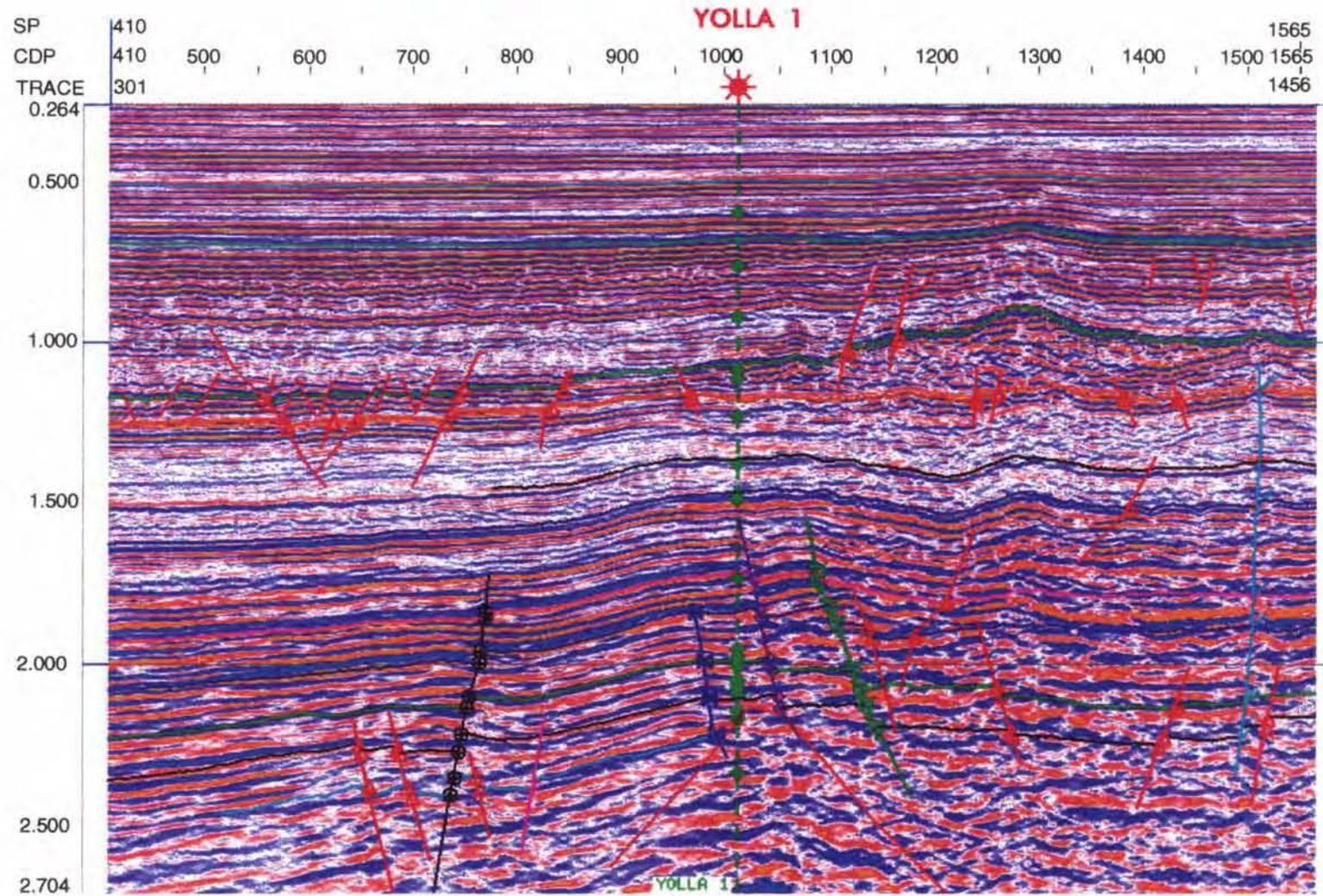
### 3.2.2 Data interpretation style, and limitations

Where the data quality was excellent, with strong continuous events throughout the data set, the IES autopick facility was used extensively. The Seafloor, Mid-Miocene and Lower Mid-Miocene events were very simply interpreted using the autopicker.

Interpretation at deeper levels required that the fault architecture was first established. Faults were identified on the individual section displays, and time slices were used to aid in the correlation of the fault traces, and to identify fault trends not easily recognisable on the sections, eg Figure 4. Where the data quality lessened below the thick coaly package of the Mid M.diversus zone, and when combined with more intense faulting in this zone, the time slices became less useful and not as indicative at identifying fault traces.

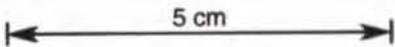
Below the Early Eocene marker (Figure 5) the detail picking of a seismic event was first done in a 2D sense, with every 5th line being interpreted, ie at 125 metre line spacing, prior to any autopicking. In localised areas, particularly beneath the Miocene extrusives, the poorer data quality and high signal variability significantly reduced the accuracy of the autopick function, and the data had to be manually interpreted in greater density. This had later implications during the mapping and contouring phase, particularly with the generation of Dip Azimuth, Dip Magnitude and Amplitude attributes. Attribute maps created from the 125 metre grid (every 5th line) were too smoothed and featureless to identify any trends not already detected on the data. To attain more information from the attribute data, the following data manipulation sequence was performed:-

# IN LINE 530 MIGRATED

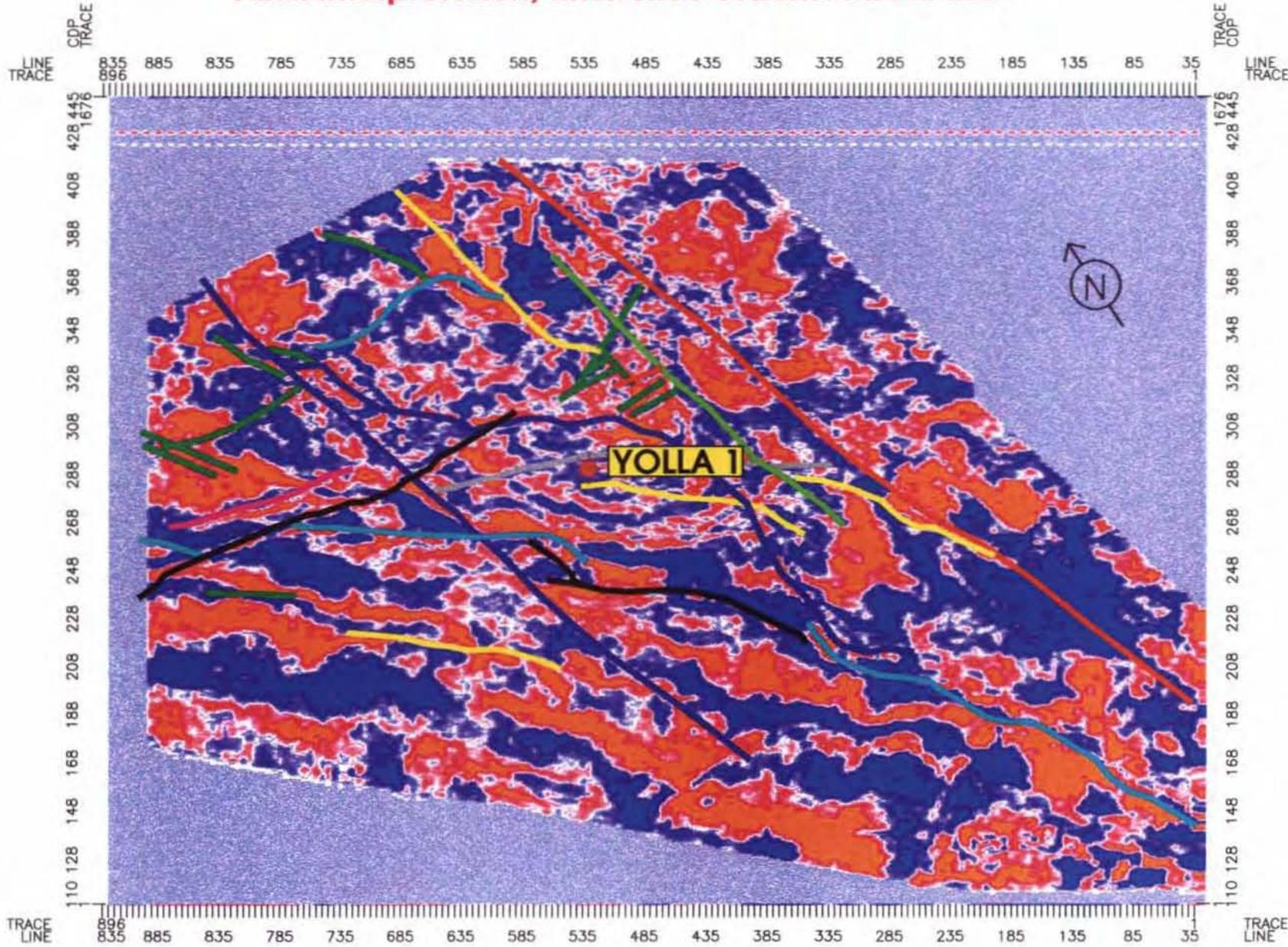


5 cm

Negative Amplitudes Positive Amplitudes



# T/RL1 BASS BASIN TASMANIA Fault Interpretation, Time Slice 1920ms MIGRATED



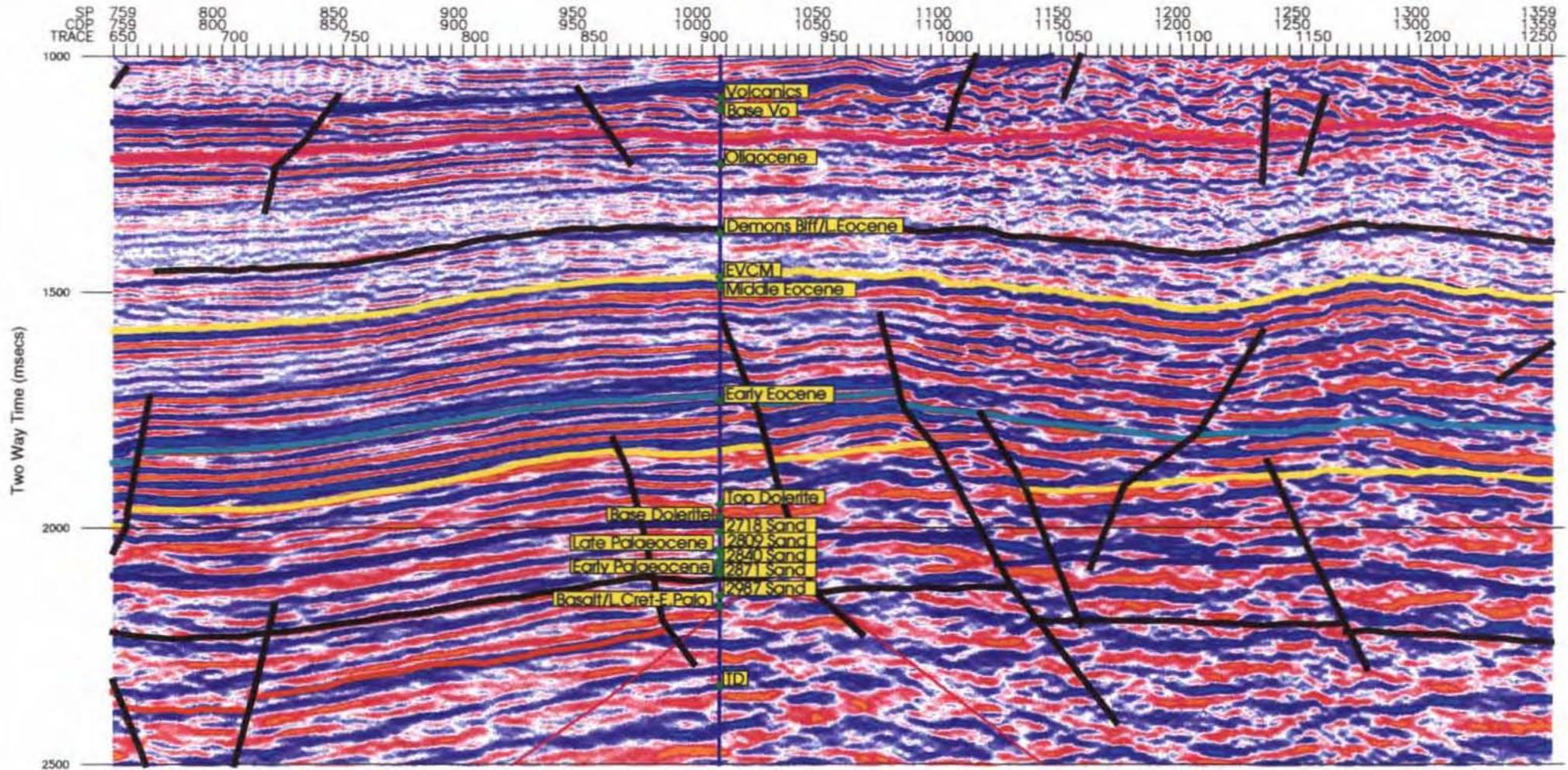
5 cm

516015



# SEISMIC IN-LINE 530 - DIP LINE THROUGH YOLLA 1

  
**YOLLA 1**



- 1 the grid of "interpreted data" was taken, and a simple data interpolation procedure was done to get a value for every grid cell at 12.5 x 25 metres;
- 2 this surface of data was cut along every in-line location and back-interpolated to the seismic data;
- 3 with interpreted data on every line, the horizon was re-snapped to pick the apex/nadir of the wavelet peak/trough as appropriate, and the attribute data subsequently extracted.

As illustrated by a comparison of Figures 6 and 7 which show the Near top 2718 sand amplitude data before and after this sequence, a considerable amount of extra detail is attained using this technique. The Dip, Azimuth and Amplitude attributes are useful for identifying structural and stratigraphic detail and trends not recognisable in a 2D sense. The Dip and Azimuth maps effectively take out the structural detail and leave the faults and lineaments visible. A good example of this is shown in Figures 8 and 9. Figure 8 shows a small area of the Early Eocene dip magnitude map, with four distinctive lineaments not previously interpreted. As illustrated in Figure 9, on in-line 850, these translate into faults on the section. While the Early Eocene marker shows no disruption or displacement, lineament 2 for example, is clearly associated with displacement at shallower levels and coincident with a line of disruption at deeper levels. Clearly, this technique is useful in identifying faults with throws at or below the seismic resolution level, and is particularly important in this area where reservoirs are generally less than 20 metres thick, and small throw faults could become barriers to hydrocarbon migration due to seal juxtaposition.

The Amplitude attribute also can identify structural lineaments, but is primarily recognised as being a tool for the recognition and prediction of sand quality or fluid content. This attribute will become much more useful in a predictive and quantitative sense, following the drilling of a few appraisal wells, for calibration of the seismic response.

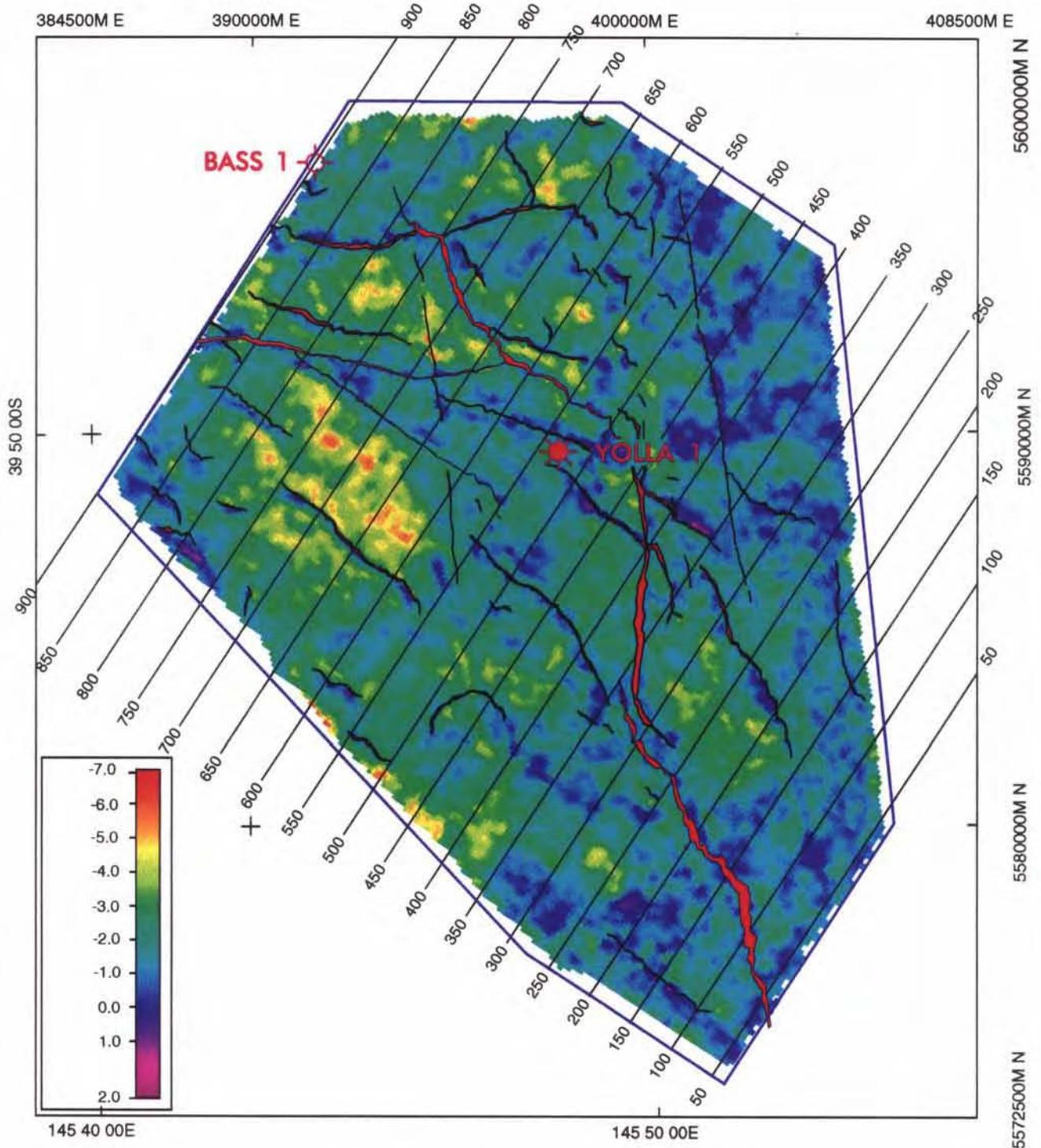
For some problem areas or levels, it was also found useful to use the other attributes available on the IES system, eg Instantaneous Phase, Instantaneous Frequency, Apparent Polarity etc. These can be calculated for specific in-lines and used to aid in the recognition of specific events. For example, the Instantaneous Phase is particularly useful in helping to identify the seismic character of the deep Palaeocene volcanic sequence.

## **4 RESULTS**

Contour maps of time and depth structure, velocity and various attributes have been produced at each mapped level, at a scale of 1:25000, and copies have been forwarded to the Joint Venture partners under separate cover. For the purpose of this report, all maps, at approximately 1:150,000 scale are contained in Appendix I. Time and depth structure maps of the three main reservoir levels at a scale of 1:25000 are also included as Enclosures 4 to 9.

### **4.1 Structural History**

The basic basin architecture was established during an Early Cretaceous rifting phase, related to the pull apart of the Australian and Antarctic plates. A deep structural ridge, underlying Yolla, was probably formed at this time, and remained a positive structural feature throughout the deposition of the EVCM. Drape and compaction form the dominant structural mechanisms with faults showing growth and increasing intensity with depth.

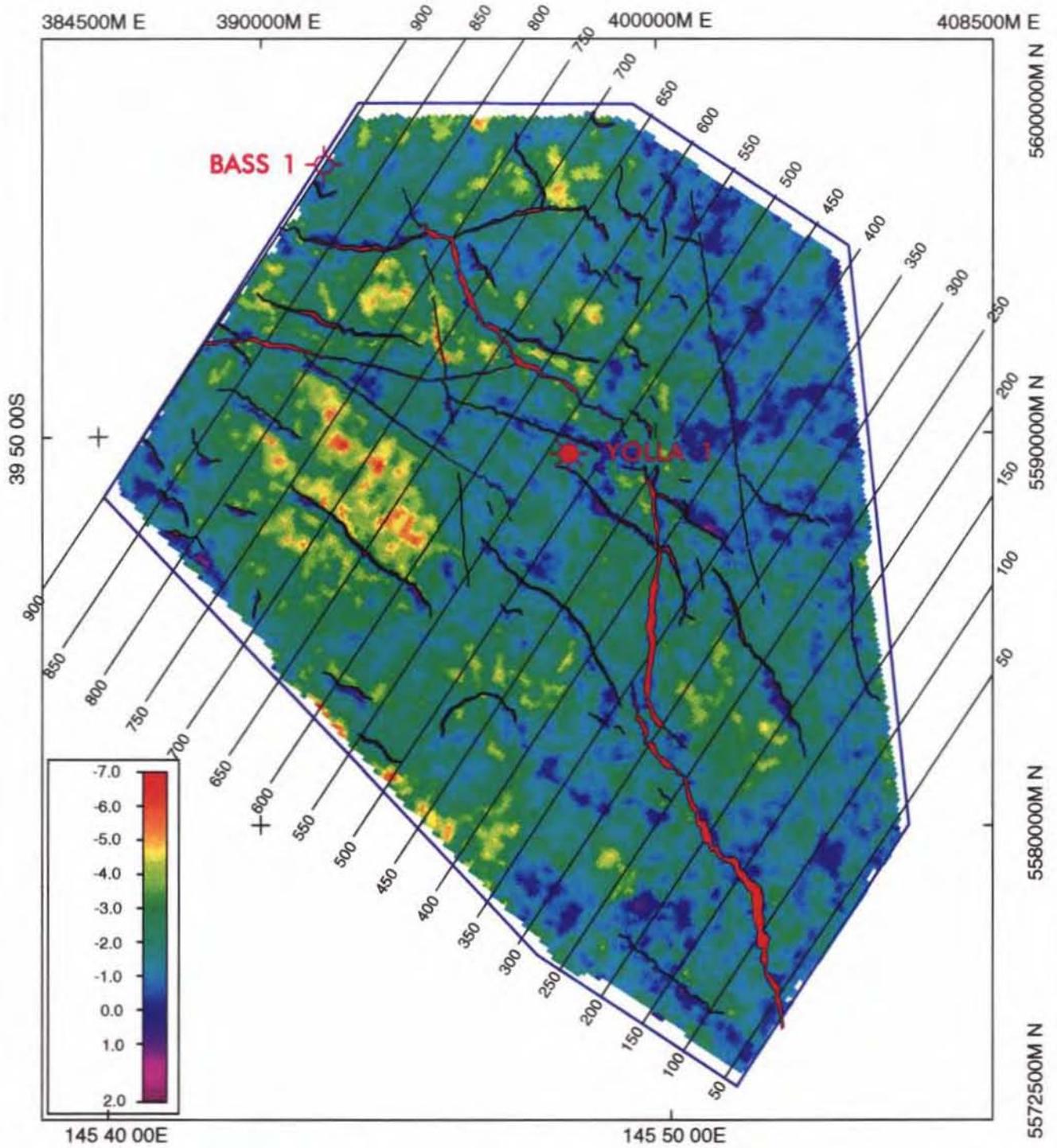


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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RLI BASS BASIN TASMANIA**

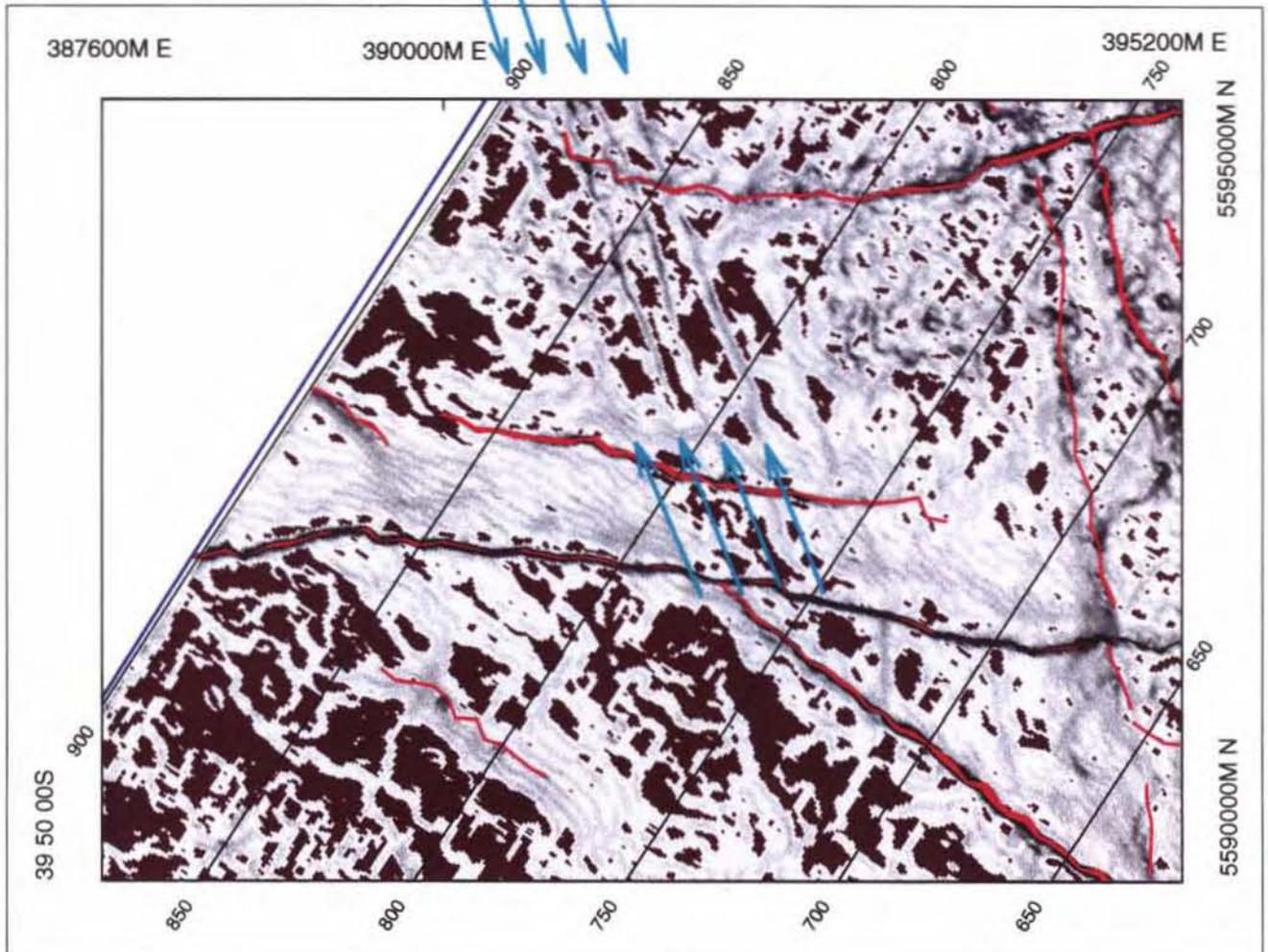
**NEAR TOP 2718 SAND, AMPLITUDE**

← 5 cm →

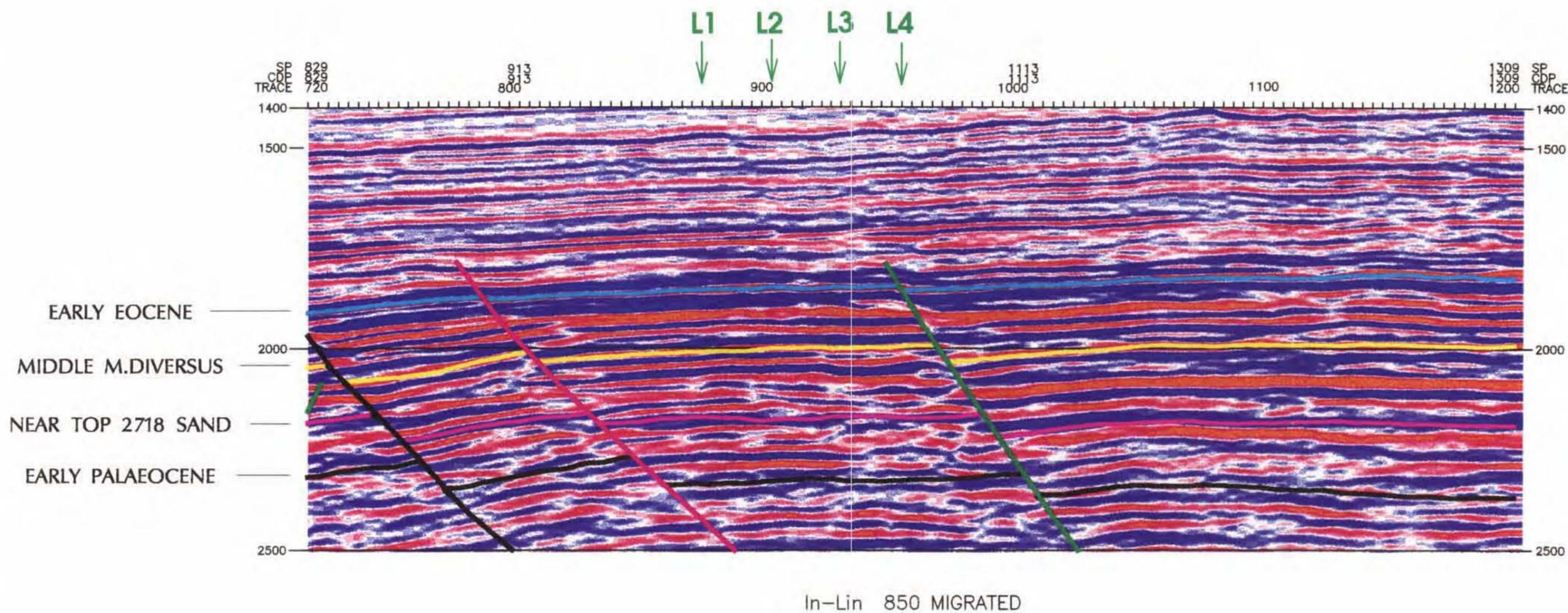


5 cm

1 2 3 4



# T/RL1 BASS BASIN TASMANIA Lineaments, In-line 850



L1-L4: Points where seismic line 850 intersects the 4 lineaments at the Early Eocene Marker level.

5 cm

The deep basalts encountered in the base of Yolla 1, probably sit on the Late Cretaceous - Tertiary unconformity, and are related to a widespread volcanic episode at that time. Similar extrusives are found in the nearby Tilana 1 well, and on the opposite side of the Cormorant Trough at Aroo 1. By the Top EVCM, a quiet period structurally commenced, and continued throughout the deposition of the marine shale Demon's Bluff Formation, and the early part of the Torquay Group limestones, shales and marls, until the Oligocene/Miocene unconformity boundary. At this time, the adjacent Cormorant Trough was structurally inverted, and was accompanied in the Yolla area by the development of a massive volcanic complex. Volcanoes were formed, and show signs of a long history of multiple and overlapping cones and eruptions. While some of the earlier faults show signs of reactivation and may have formed feeder conduits for the volcanic material, the majority of material was sourced up through a north-south trending fault system that dominates the structural picture from the Late Oligocene onwards (see Figure 10). Another phase of this episode included the intrusion of igneous material into the EVCM, forming thick sills like the dolerites encountered in the Yolla 1 and Tilana 1 wells.

The probable mechanism for this period is the intrusion of a sub-volcanic magma chamber, that in its pre-eruption stage causes doming and uplift of the adjacent Cormorant Trough. This is followed by the eruptions of tuffs and lavas which then trigger collapse and subsidence, and form the many crestal collapse features seen in the faulted Oligocene/Miocene aged band of sediment (Figure 11).

After this flurry of activity, there remained a quiet period structurally throughout deposition of the remaining part of the Torquay Group limestones, that has continued to the present day.

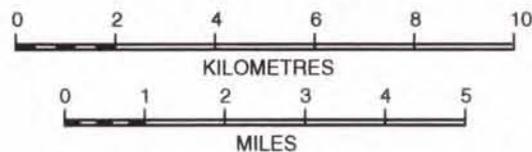
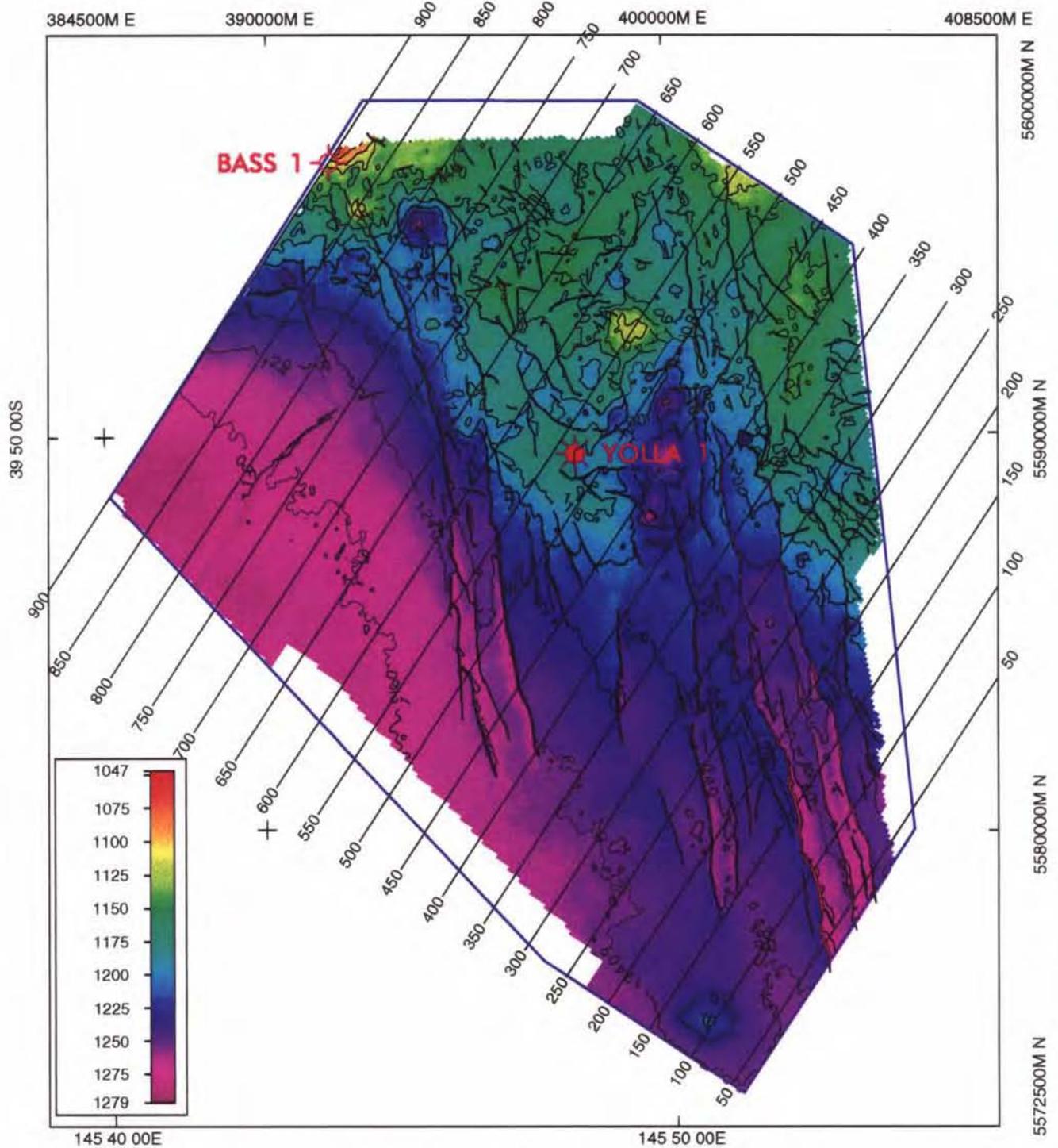
#### 4.2 Seismic Signature

The presence of volcanic extrusives and igneous intrusives has added a degree of complexity to the seismic interpretation and depth conversion. The extrusive pile show time pull-up distortion of the seismic data beneath them, consistent with the presence of faster-than-normal velocity material, as shown in Figure 12. However, as shown on crossline 1220 of Figure 13, time push-down, due to a slower velocity material, also occurs. The latter is probably related to the presence of scorias and ash flows or possibly the presence of gas, as opposed to the more dense lava flows of the higher velocity material.

These zones of high and low extrusive material cause considerable disruption of the underlying seismic data. Fortunately the bulk of the Yolla Field is not affected, with most implications confined to the smaller Yolla Northeast closure on the down thrown side of the main fault at the deeper levels, and the top EVCM oil/gas/condensate reservoirs.

The igneous intrusives could occur anywhere within the EVCM. In the shallower part of the EVCM, the intrusives are obvious, as shown in Figure 14. However, deeper within the EVCM, and particularly below the thick coaly sequence of the middle M.diversus, the intrusives are not seismically definitive. They are possibly represented by zones of distortion around faults, and in some areas by very low frequency, high amplitude events that aren't correlatable over any appreciable distance (Figure 15).

5 cm



UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

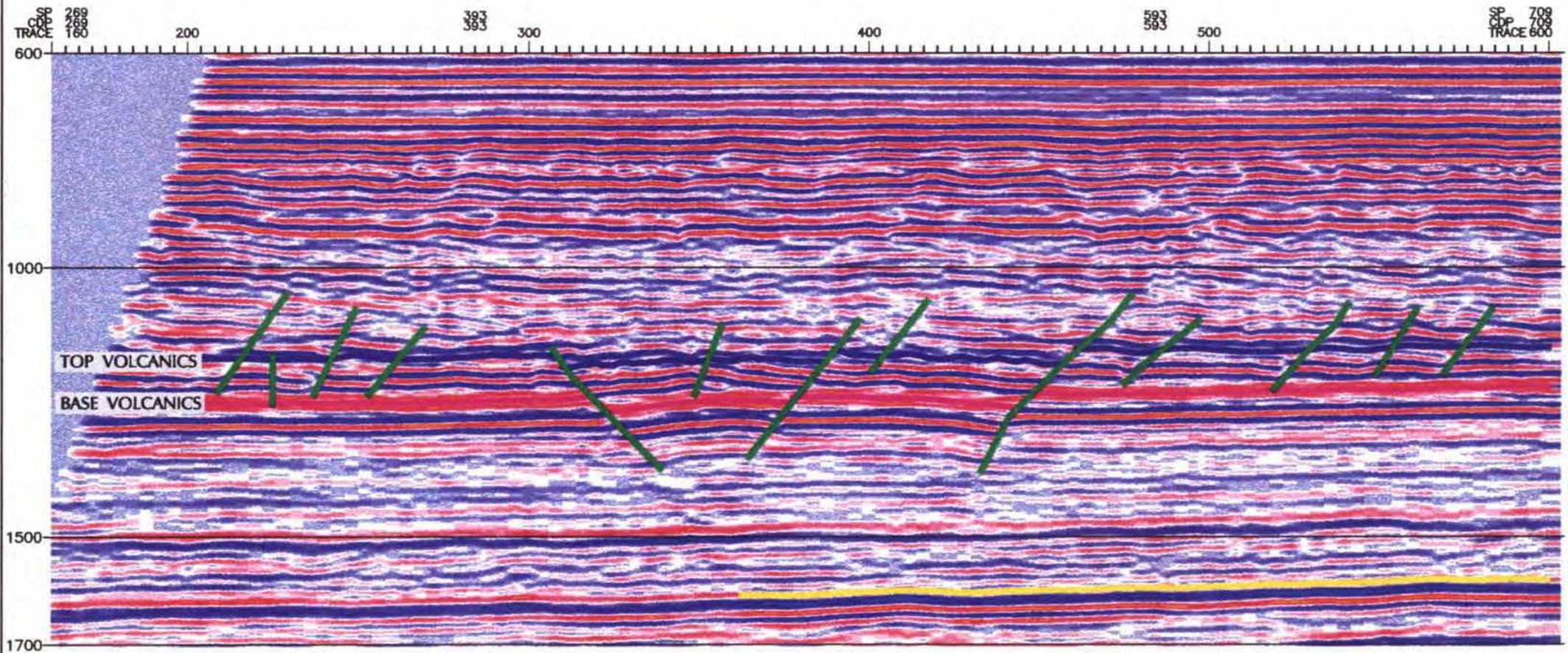
**T/RL1 BASS BASIN TASMANIA**  
**BASE MIOCENE VOLCANICS, TIME STRUCTURE**

516023



# T/RL1 BASS BASIN TASMANIA Oligocene / Miocene Faults, In-line 450

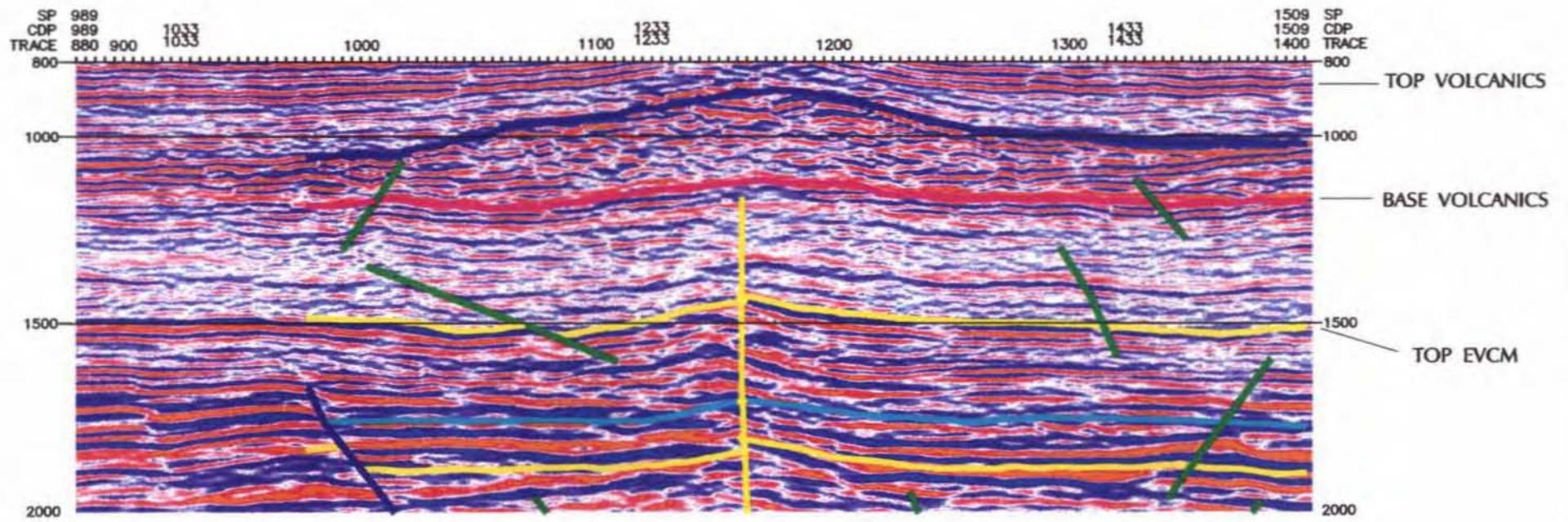
5 cm



In-Line 450 MIGRATED

# T/RL1 BASS BASIN TASMANIA

## Time Pull Up Beneath Volcanc Interval, In-line 560



5 cm

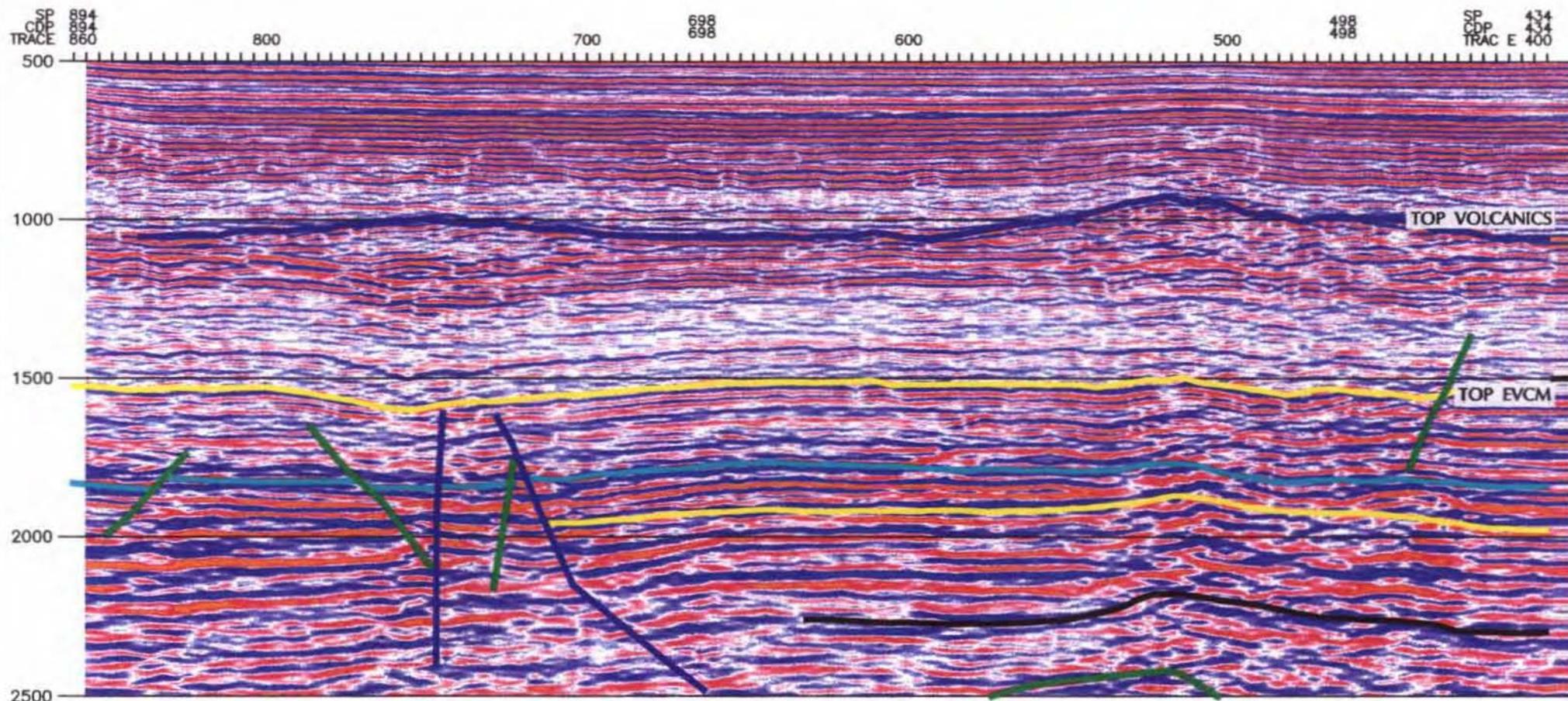
5 cm

516025



# T/RL1 BASS BASIN TASMANIA

## Push Down Beneath Volcanic Interval, Cross-line 1220



SP 894  
CDP 894  
TRACE 860

800

700

698  
698

600

500

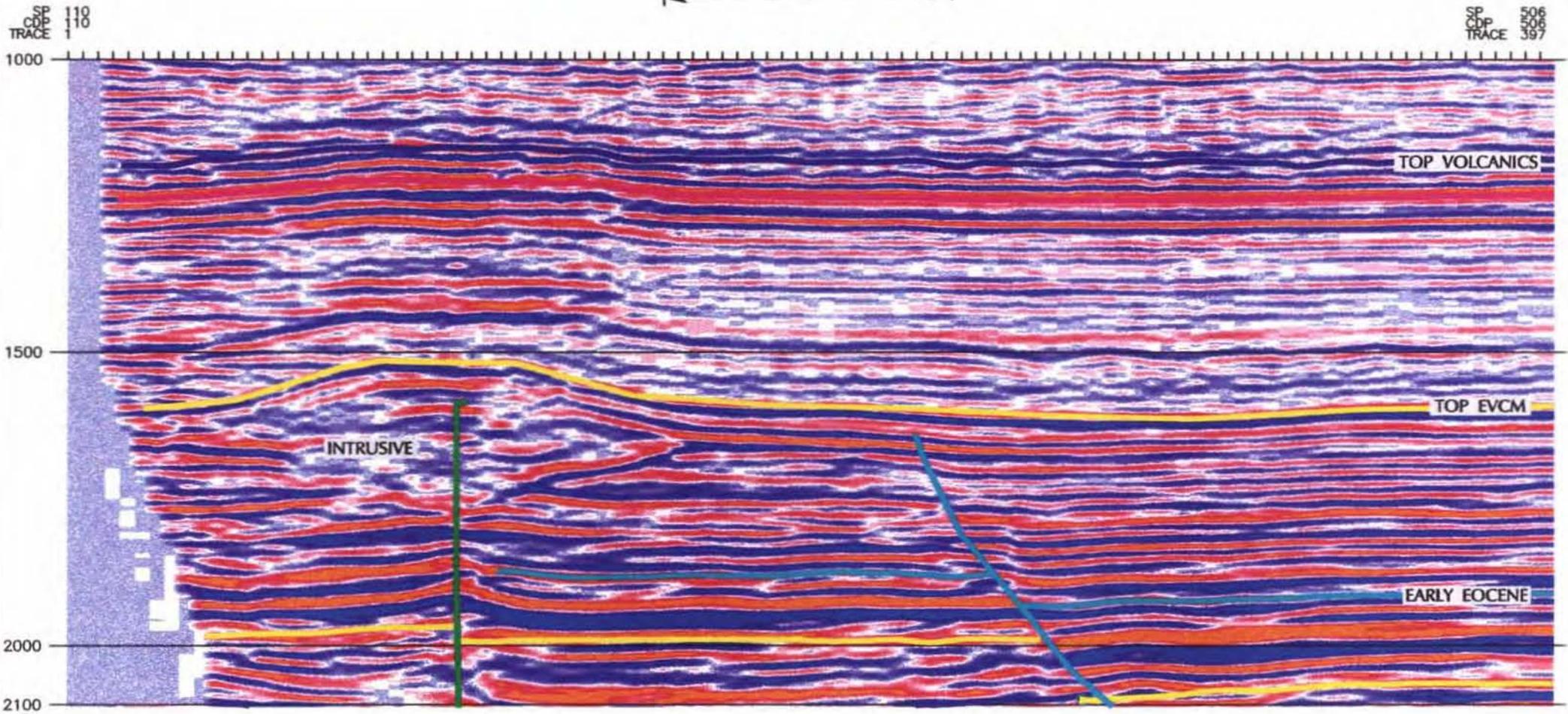
498  
498

SP 434  
CDP 434  
TRACE E 400

Cross-Line CDP=1220 MIGRATED

# T/RL1 BASS BASIN TASMANIA Upper EVCM Intrusive, In-line 100

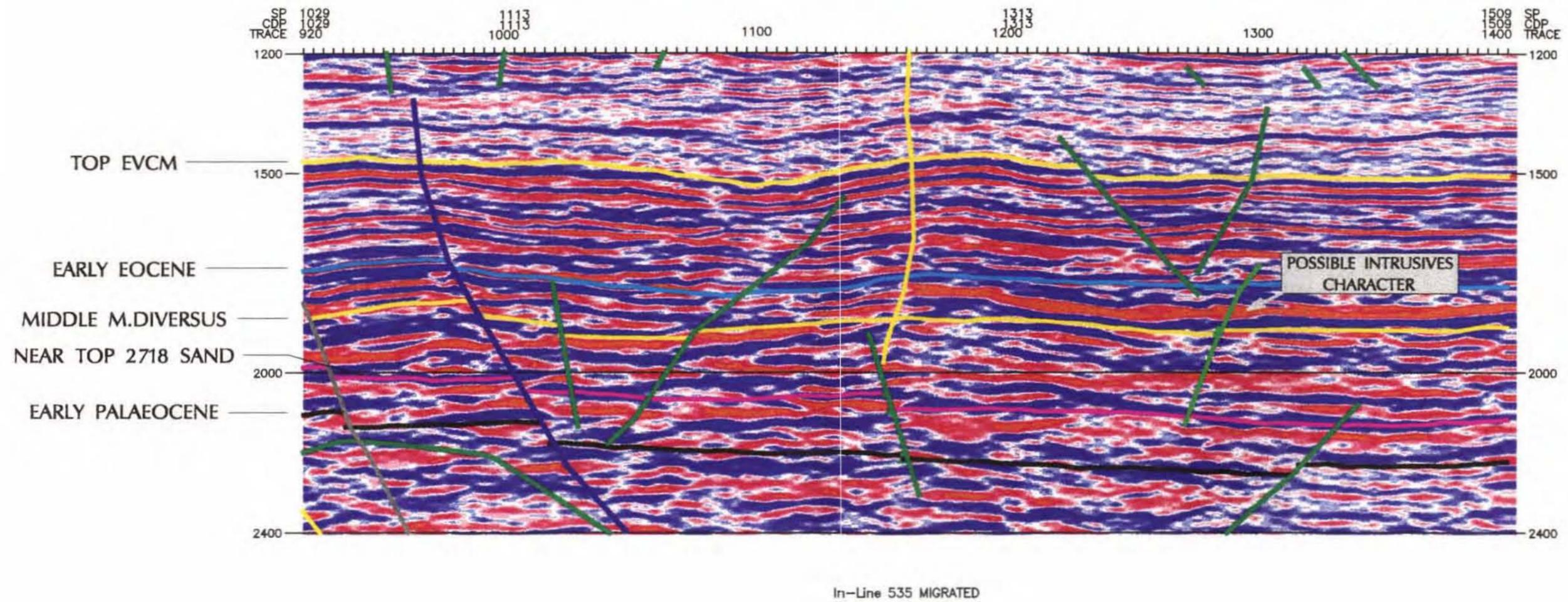
5 cm



In-Line 100 MIGRATED

# T/RL1 BASS BASIN TASMANIA

## Possible Intrusives, In-line 535



5 cm

The other mapped seismic events showed good correlatability at most levels over the area of the main Yolla structure, grading to very poor in some of the more heavily disrupted zones beneath the volcanics. The Early Eocene, Middle M. diversus and possibly the Near Top 2718 sand and Early Palaeocene seismic markers represent unconformity surfaces. Between the latter two events there is a considerable amount of thinning indicated towards the structural crest, with possible truncation of events. However, as discussed in previous sections, the tuning thickness of approximately 40 metres, and the presence of short period inter-bed multiples will distort the continuity of seismic character and definition.

The deep seismic onlap event corresponds to a high amplitude event that lies within previously undrilled section and that appears to onlap the basalt surface. As illustrated in Figure 16 the basalt surface is difficult to identify, but there do appear to be linear features steeper than the sedimentary dip, and coincident with subtle changes in character, dip, polarity or continuity, that may represent a conical shape, similar to the Miocene extrusive piles. This shape has been picked as the basalt surface.

#### 4.3 Description of Maps

The Yolla field is a simple fault bounded structure lying over a prominent Early Cretaceous ridge on the flanks of the Cormorant Trough. Drape and compaction over this ridge, with active fault growth provides the dominant structural control. The top EVCM structure is primarily four-way-dip with the intensity and frequency of faults increasing with depth. The field is compartmentalised by the faults at deeper levels into four main areas, the Yolla 1 fault block, Yolla North fault block, Yolla Northwest and Yolla Northeast blocks (Figure 17).

The Yolla South closure as identified on the previous 2D seismic data, appears now to be part of the main Yolla 1 closure. Regional 2D mapping supports the time structure contours wrapping into the main fault to the south and outside of the detailed 3D survey area. The 2D data is located at 2-3 kilometre intervals but does show that a larger upside to the Yolla 1 block closure is possible (Figure 17).

The Yolla 1, Yolla North and Yolla Northwest fault compartments lie together on the upthrown side of the main controlling fault, but are separated by lesser faults. The main fault obviously is providing a seal to gas/condensate migration, but the sealing capacity of the minor faults is unknown. As fault throws are interpreted to be relatively small, down to in the order of 10-20 metres, the three areas may be linked in one continuous system.

However, if the faults are providing adequate reservoir seals, then there exists a much greater potential for hydrocarbon entrapment, particularly in the Yolla Northwest compartment which has closure extending well below that of the Yolla 1 compartment.

#### 4.4 Amplitude Mapping

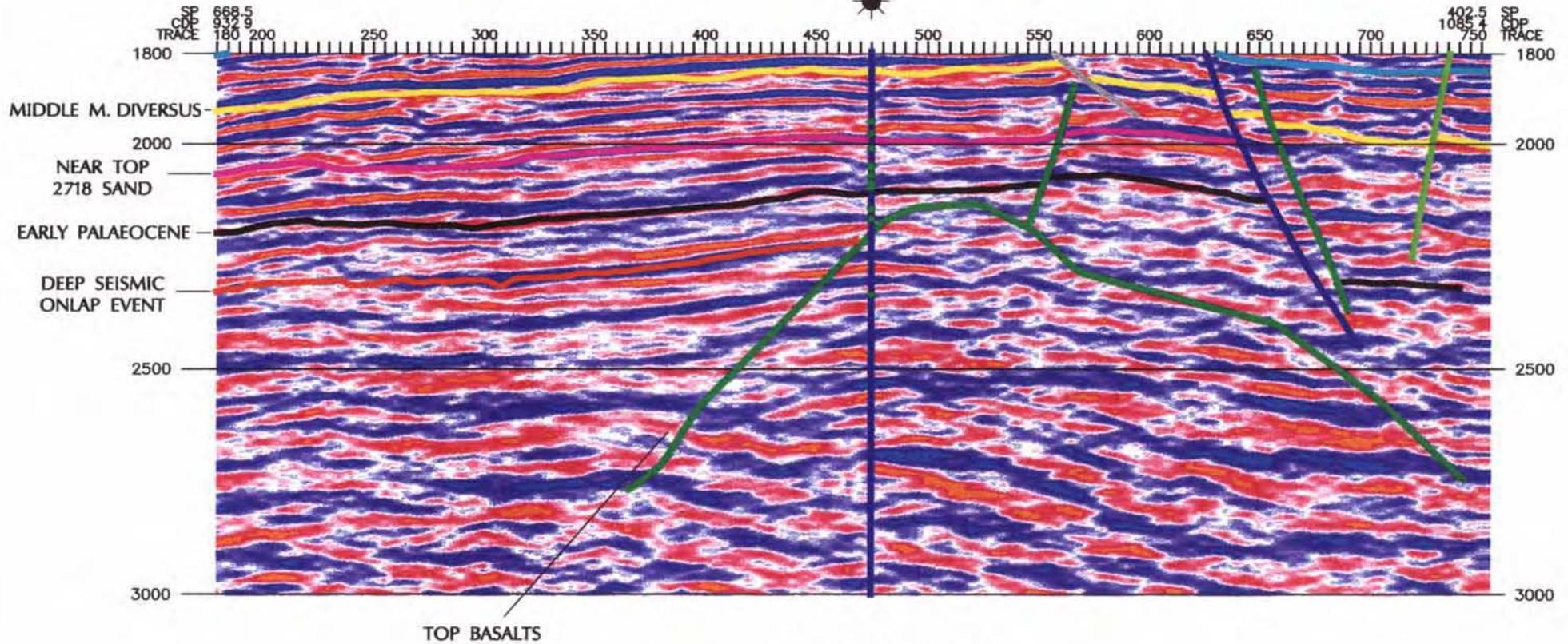
##### 4.4.1 Top EVCM Gas/Oil Reservoirs

The top EVCM seismic reflector was picked on a negative trough. This event is defined as the actual top EVCM marker, but has no anomalous amplitude response, as shown by Drawing Number 13835 of Appendix 1. The following peak however, which corresponds approximately to the gas-oil interface at 1831.6 metres KB does



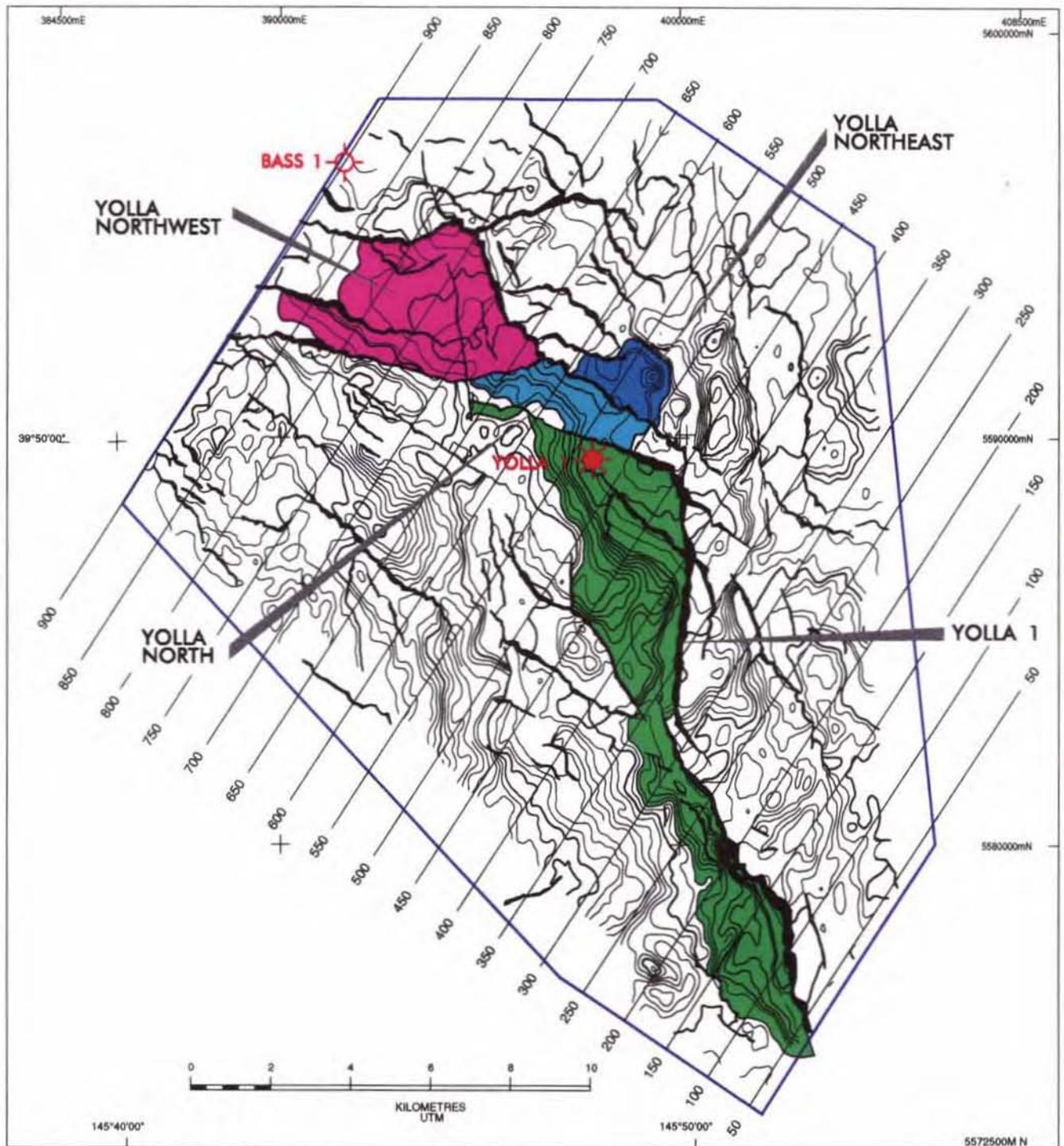
# T/RL1 BASS BASIN TASMANIA DEEP SEISMIC ONLAP EVENT AND BASALT CHARACTER

YOLLA 1



Reconstruction Cut Prop974

5 cm



T/RLT BASS BASIN TASMANIA  
TOP EARLY PALAEOCENE  
DEPTH STRUCTURE  
YOLLA STRUCTURE FAULT COMPARTMENTS

5 cm

have a distinctive seismic amplitude anomaly (Figure 18). The area of this anomaly is larger than that indicated by the time structural closure. If the anomaly is then accurately representing the gas-oil interface, it suggests that the time distortion caused by the overlying Miocene Volcanic sequence is significant.

The apparent time closure does not then accurately represent the depth structure, and a much larger oil-gas-condensate resource may be present at top EVCM than previously thought.

#### 4.4.2 Mid-EVCM Gas/Condensate Reservoirs

There are no obvious areally significant amplitude anomalies associated with the interpreted seismic events at Near top 2718 sand or Early Palaeocene levels. These are shown by Drawing numbers 13856 and 13864 of Appendix 1. There exist, at both levels, some areally consistent features that may be significant, but these will require further well control to constrain and define the model. The best response is associated with the amplitude of the deep seismic onlap event, Figure 19, that shows an anomalous area roughly coincident with the interpreted structural closure in the Yolla 1 fault compartment, Figure 20.

This anomaly may be representative of the presence of hydrocarbon filled sand, and hopefully not a lava flow from the Late Cretaceous volcanic episode.

Despite the large tuning thickness at this level, and the apparent lack of amplitude response from the Near top 2718 sand and Early Palaeocene markers, a series of trials were initiated to investigate the amplitude response of other seismic events between those mapped in detail. The above two events were chosen for detailed mapping, due to their strong and persistent seismic character, but they are not directly coincident with the sand tops as shown in Table 2. These trials were to determine if further detailed mapping work was warranted, prior to the drilling of any appraisal wells.

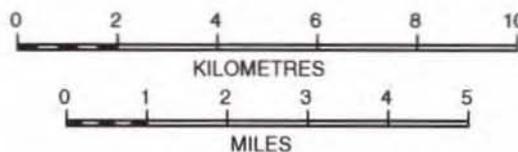
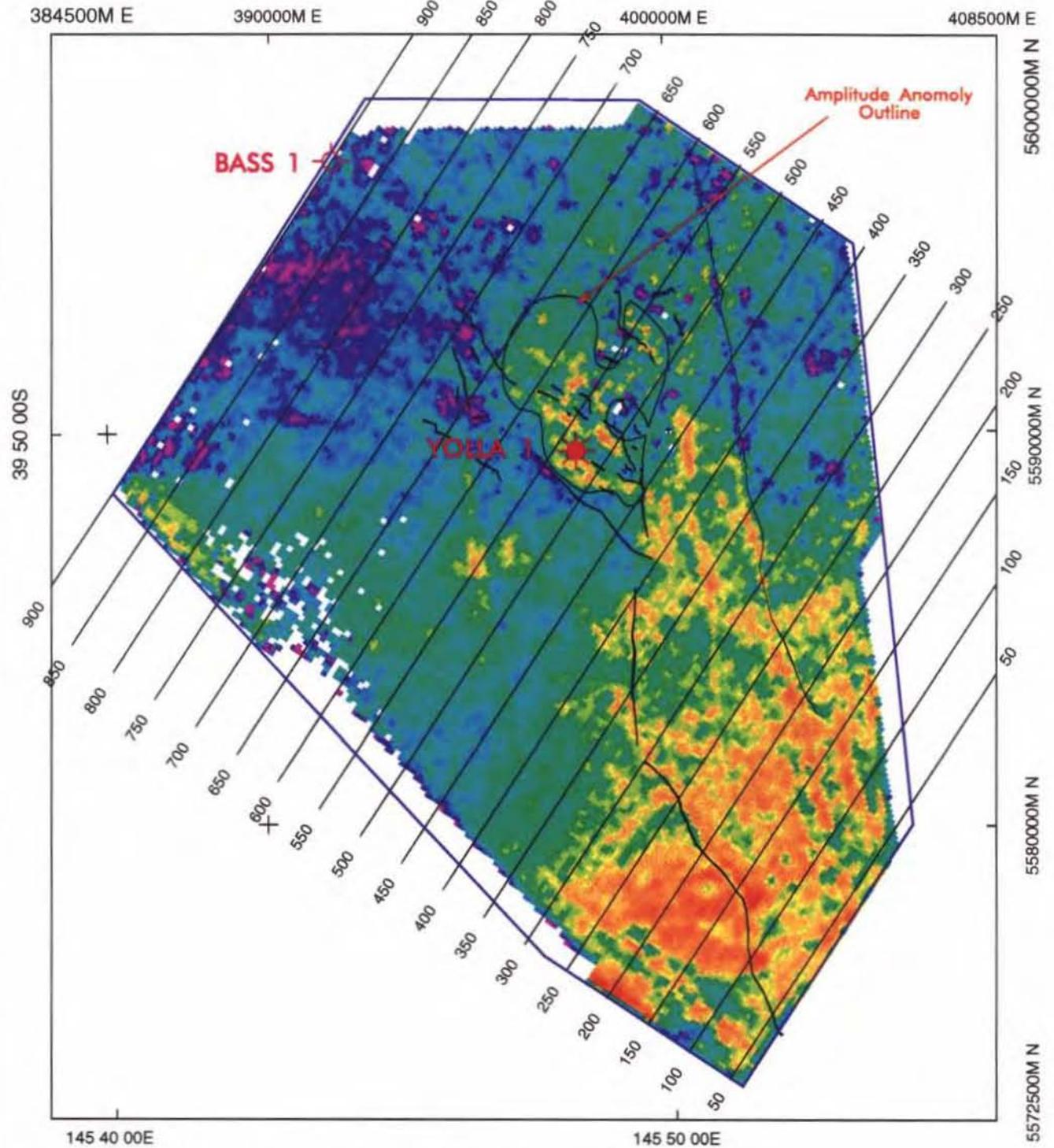
Using a similar methodology as described previously, a bulk shift was applied to a grid of data, read back onto the individual lines and re-snapped to align with another seismic reflector. Table 3 below lists the bulk shifts applied, and the subsequent markers are illustrated in Figure 21.

**TABLE 3**

#### **AMPLITUDE TRIALS**

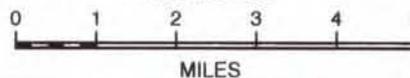
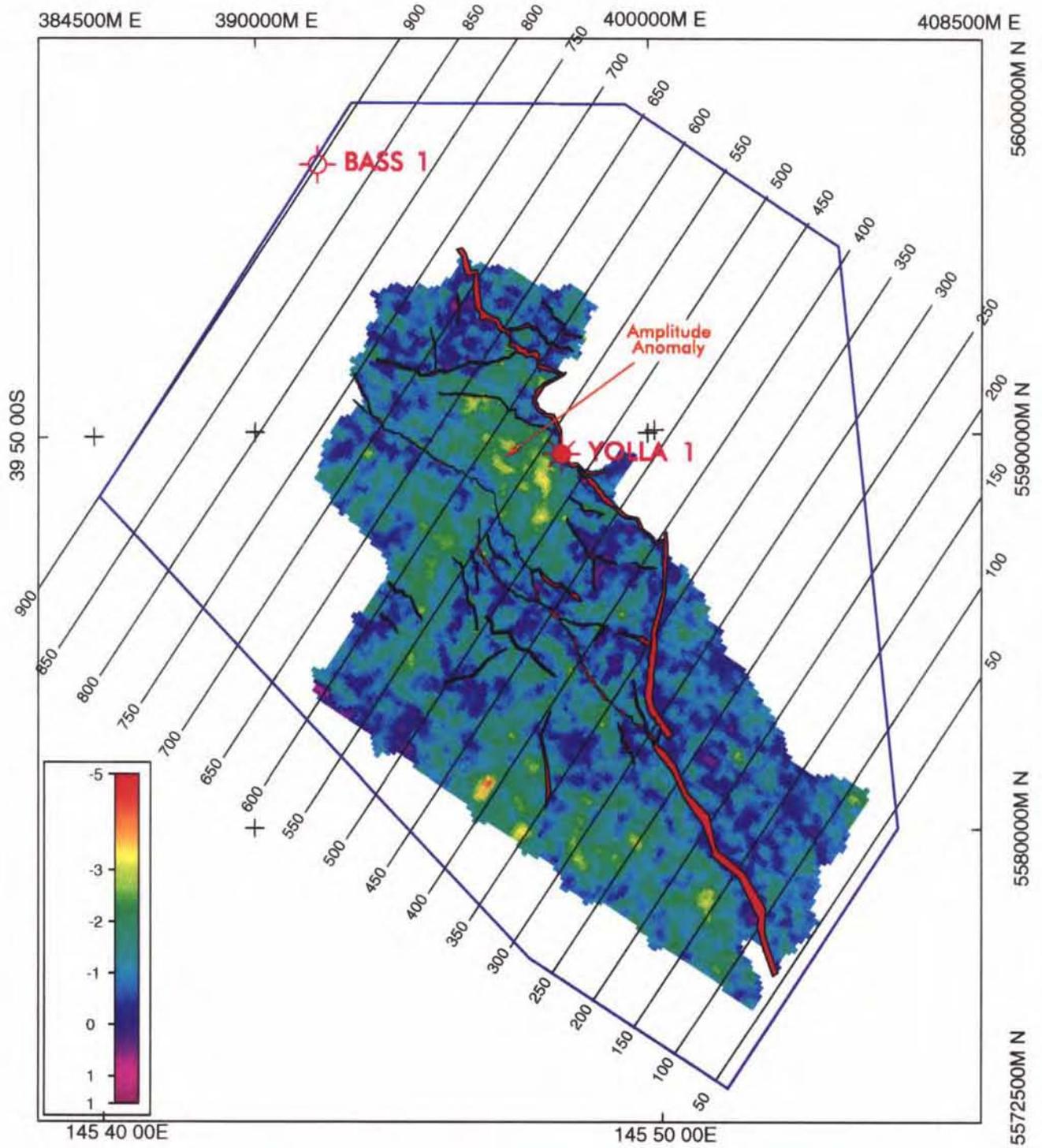
<b>Mapped Event</b>	<b>Bulk Shift</b>	<b>Seismic Signature</b>	<b>Marker</b>
Near Top 2718 sand (Peak)	+ 30 milliseconds	(Trough)	Trial 1
	+ 55 milliseconds	(Peak)	Trial 2
Early Palaeocene (Trough)	-25 milliseconds	(Peak)	Trial 3
	+ 55 milliseconds	(Trough)	Trial 4

5 cm



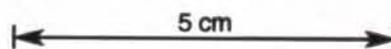
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

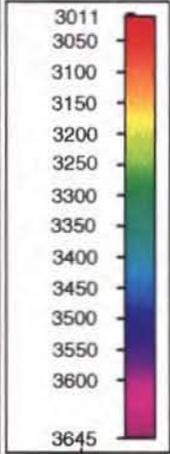
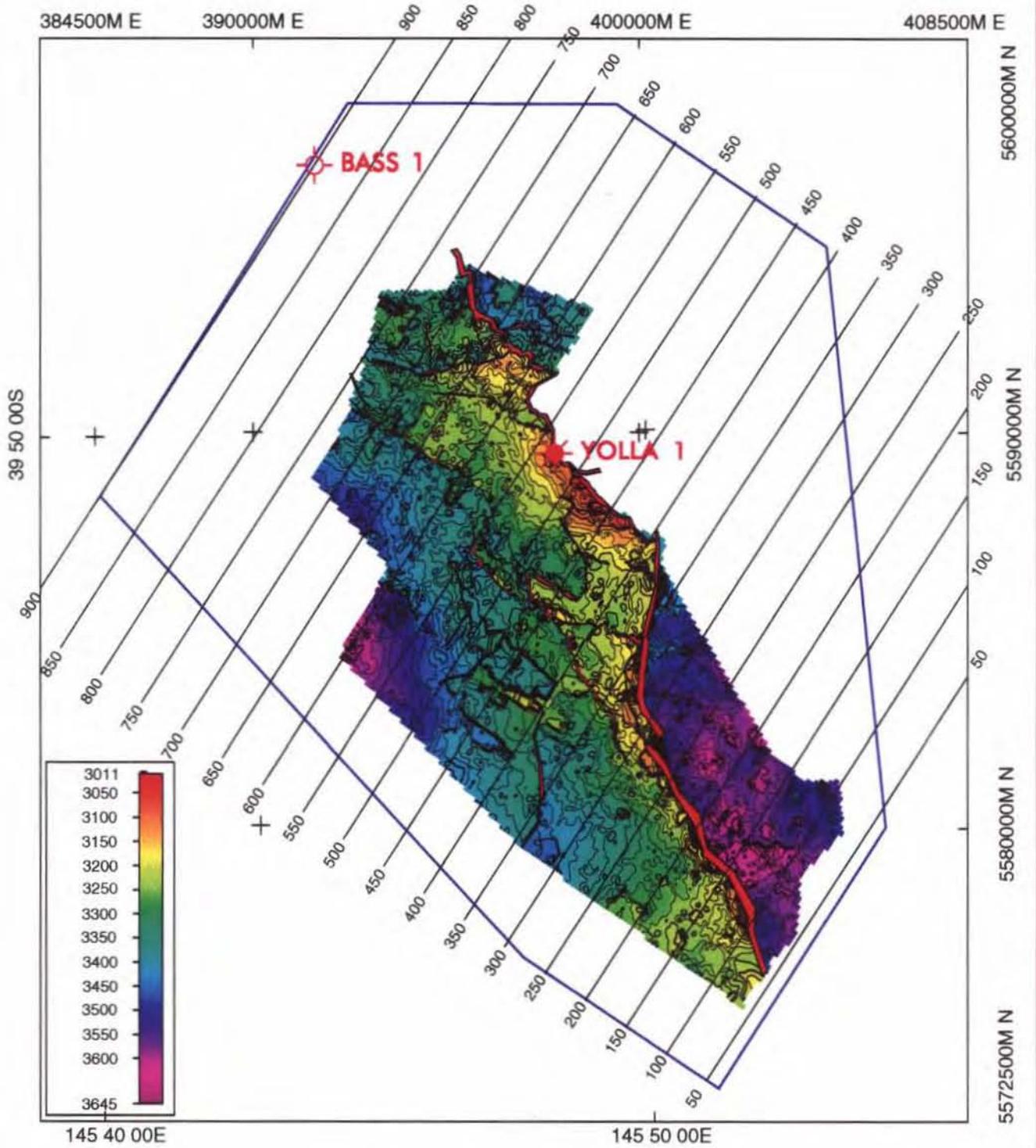
**T/RL1 BASS BASIN TASMANIA**  
**TOP EVCM + 15 MSECS, AMPLITUDE**  
**AND BRIGHT SPOT**



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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN    TASMANIA**  
**DEEP SEISMIC ONLAP EVENT, AMPLITUDE**

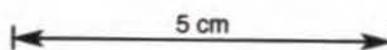




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 CENTRAL MERIDIAN 147 00 00E

T/RL1 BASS BASIN    TASMANIA

**DEEP SEISMIC ONLAP EVENT, DEPTH STRUCTURE**



The amplitude data were extracted for the four trial surfaces. This technique should work well in the individual fault blocks, however, the bulk shift value doesn't compensate for the extra thickness of section off structure, and the trial event will start to "snap" to a different reflector. The results were generally inconclusive, although the Trial 2 and Trial 3 surfaces showed some northeast lineations that align with the interpreted strand plain direction of the marine-deltaic depositional system, (Figures 22 and 23). If this is the case, then there should exist good reservoir continuity over the Yolla structure. (The seismic response of the Trial 2 and Trial 3 events are more likely to be affected by the thick reservoir sand at 2809 metres that flowed 15 MMCFD on testing).

A second series of trials involved interpreting one in-line and an intersecting cross line within the Yolla 1 fault compartment, at the same four levels as identified for the previous trial series (Figure 21). The correlation co-efficient was tightened up for the autopick system, which was then activated. The aim was to see how far the autopick would be able to interpret, and hence give some idea of the continuity of the reservoir sands. Reasonable continuity was indicated by the results, as shown in Figures 24 and 25, the time maps for the Trial 2 and Trial 3 surfaces. Perhaps these two maps also indicate the significance of the small fault between the Yolla 1 and Yolla North compartments at different levels by the larger amount of data present over the fault at the Trial 2 level.

## **5 DEPTH CONVERSION**

### **5.1 Average Velocity**

Three separate methods were employed to convert the interpreted time data to depth. The first and simplest involved using a single average velocity, as determined from the Yolla 1 well. The nearby Bass 1 well didn't penetrate to the M.diversus level and hence doesn't provide any useful velocity data, and the Tilana 1 well, penetrating a similar section to Yolla 1, shows little or no variance in the average velocity field. So the single velocity for each level provided a quick look depth map. Table 4 lists the interval and average velocities at each interpreted level.

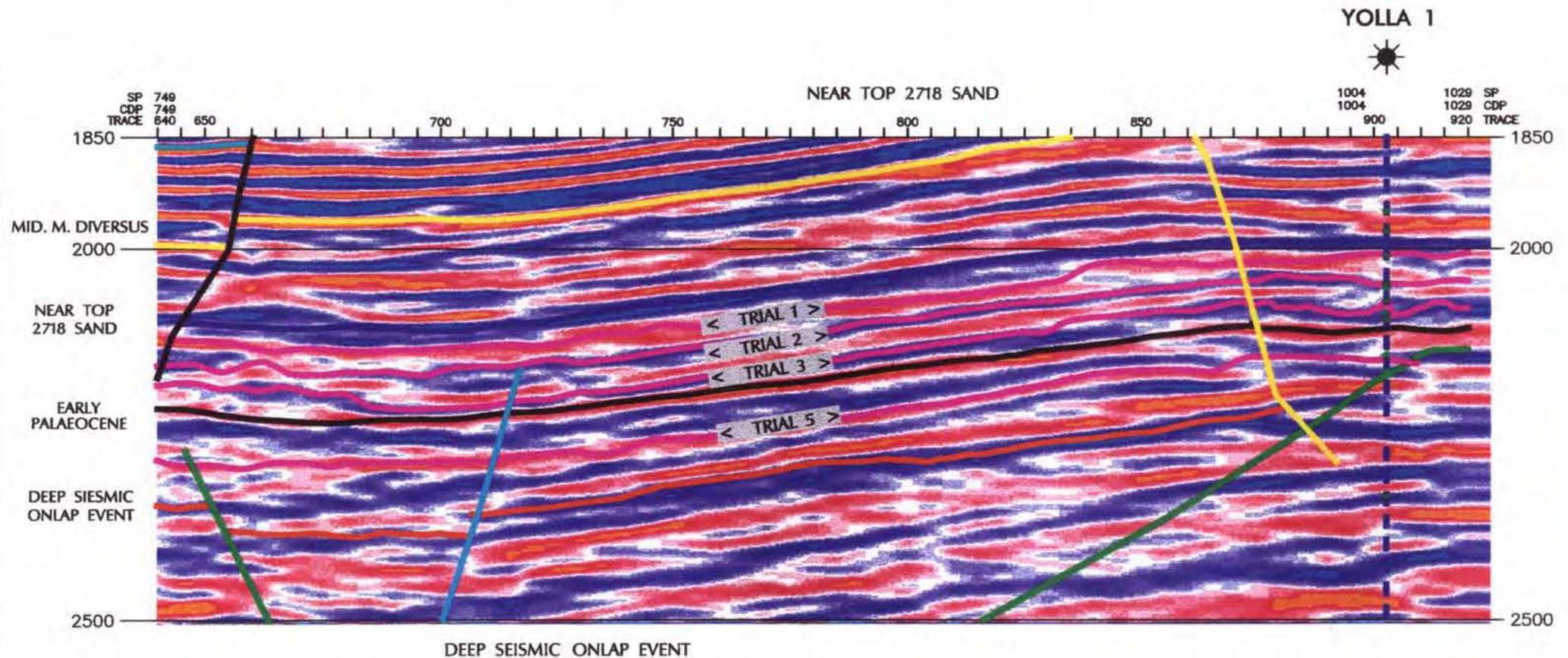
**TABLE 4****YOLLA 1 AVERAGE AND INTERVAL VELOCITIES**

<b>Seismic Event</b>	<b>Depth Sub-Sea (Metres)</b>	<b>Average velocity (metres/second)</b>	<b>Interval velocity (metres/second)</b>
Seafloor	-68.6		2495
Mid-Miocene	-558		2690
Lower Mid-Miocene	-804		2090
Top Miocene Volcanics	-1208		Varying
Base Miocene Volcanics	-1354		2990
Top EVCM	-1788	2435	3130
Early Eocene	-2179		3110
Middle M.Diversus	-2364		3950
Near Top 2718 sand	-2668	2680	3880
Early Palaeocene	-2895	2745	3900
Deep Seismic Onlap event	NI		3900
Top Basalts	-3021		



# T/RL1 BASS BASIN TASMANIA

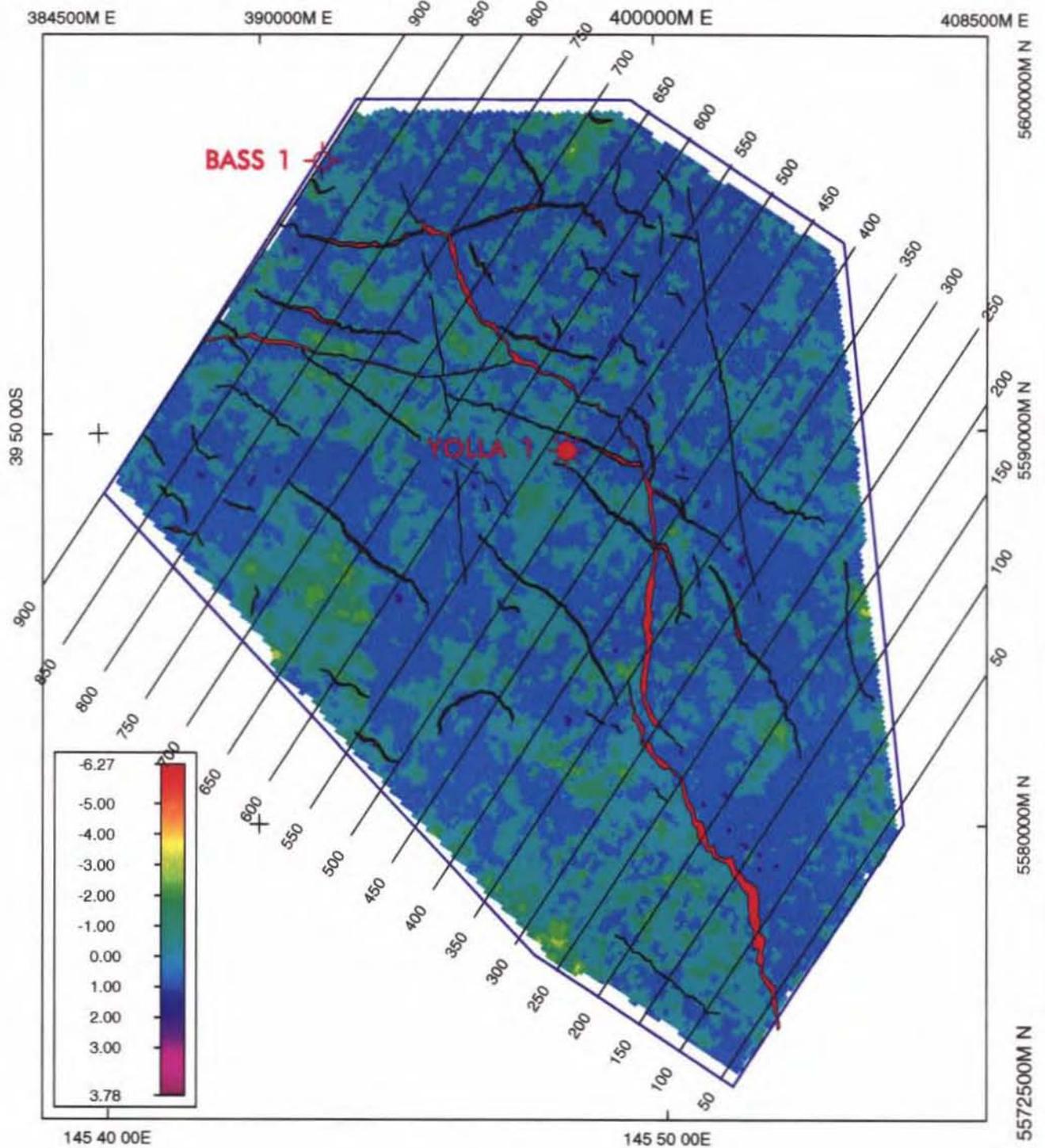
## Seismic Events Chosen For Amplitude Trials, In-line 530



In-Line 530 MIGRATED

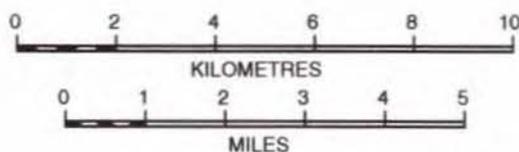
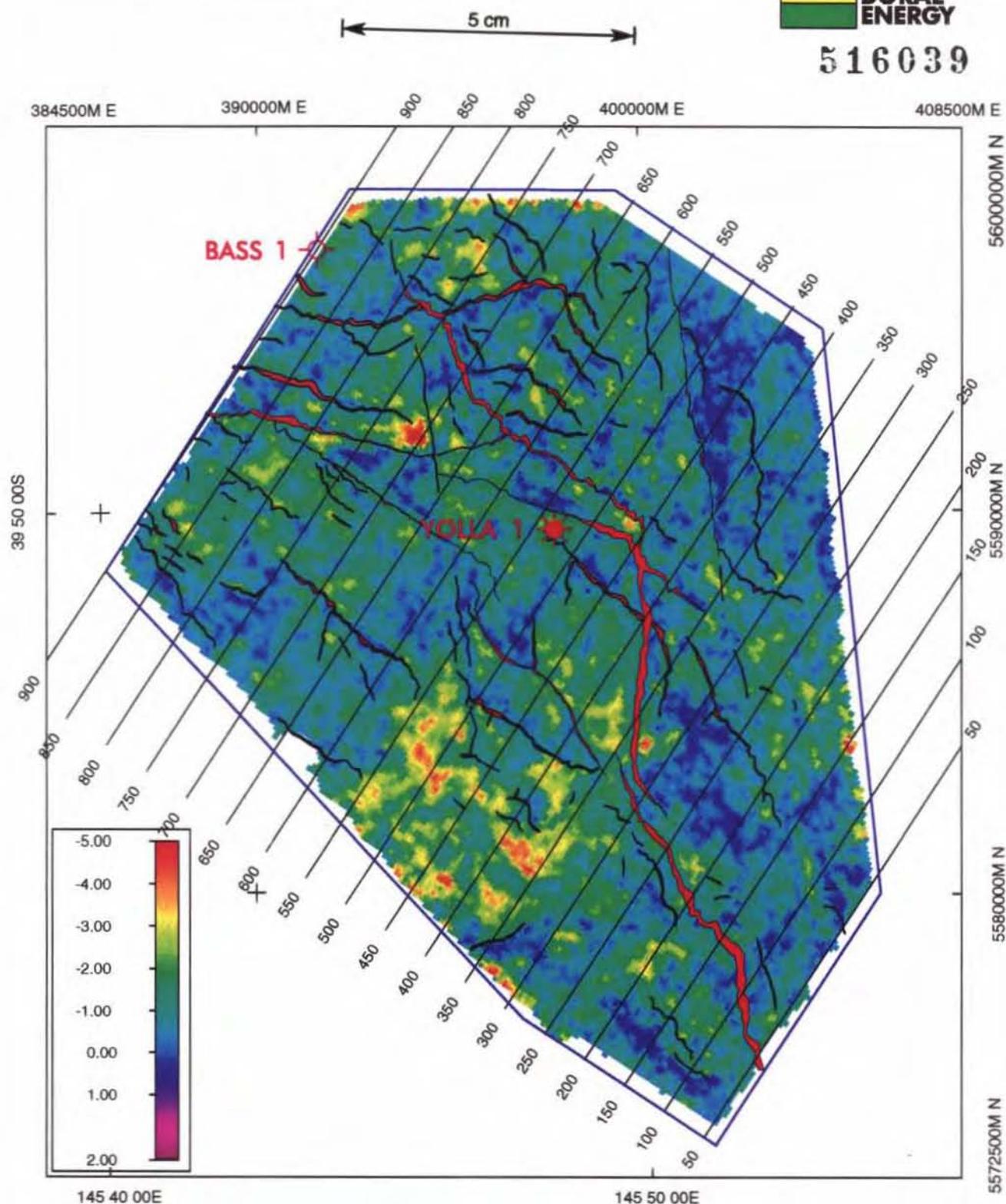
5 cm

5 cm



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CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**TRIAL 2 (NEAR TOP 2718 SAND**  
**+ 55MSECS), AMPLITUDE**

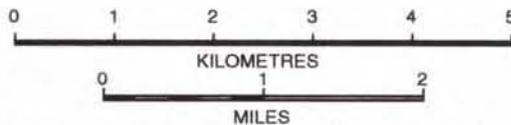
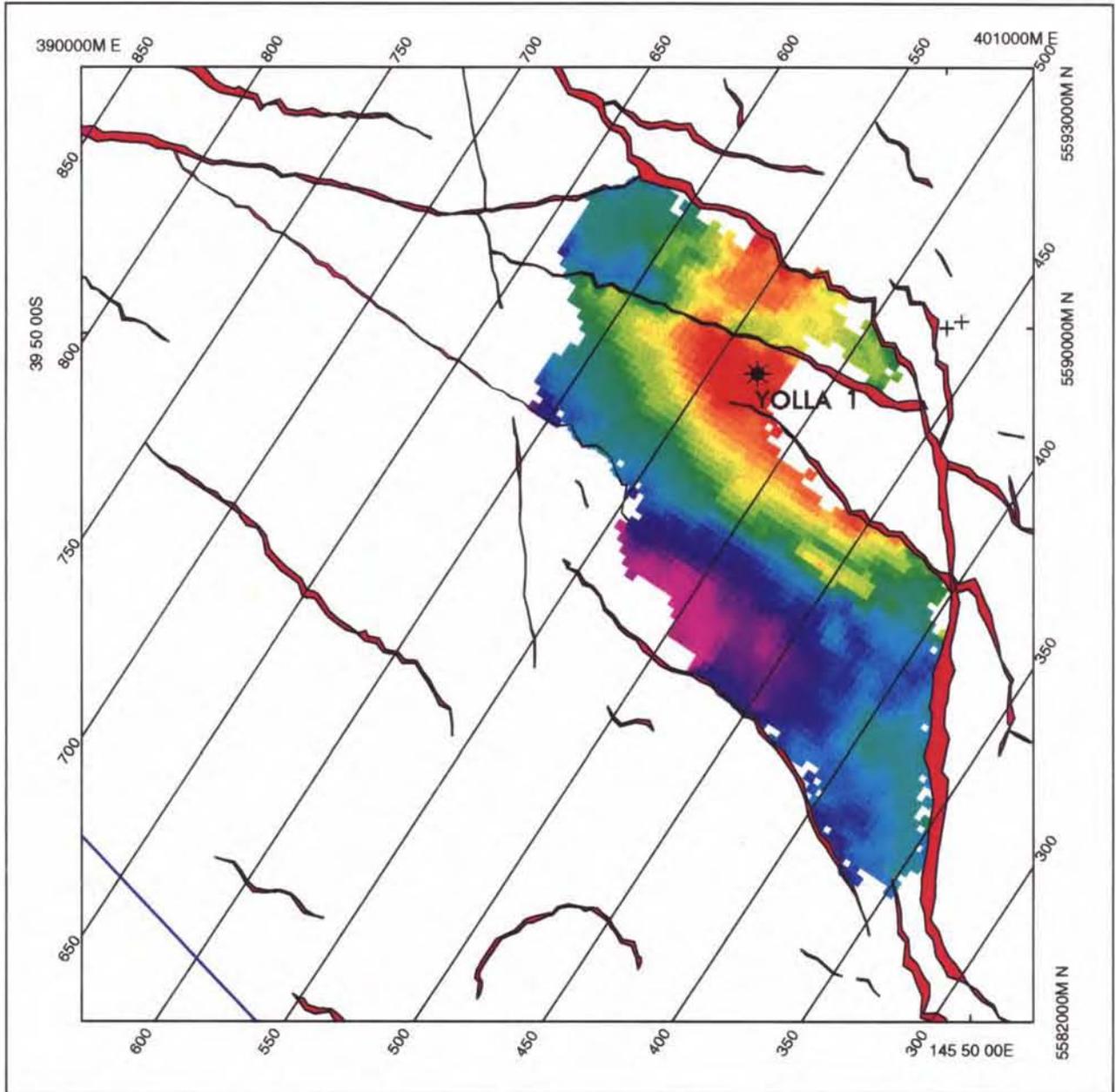


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**T/RL1 BASS BASIN    TASMANIA**

**TRIAL 3 (EARLY PALAEOCENE – 25 MSECS),  
AMPLITUDE**

5 cm

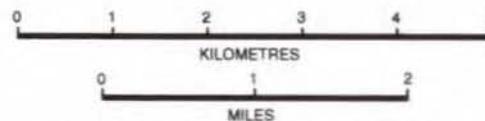
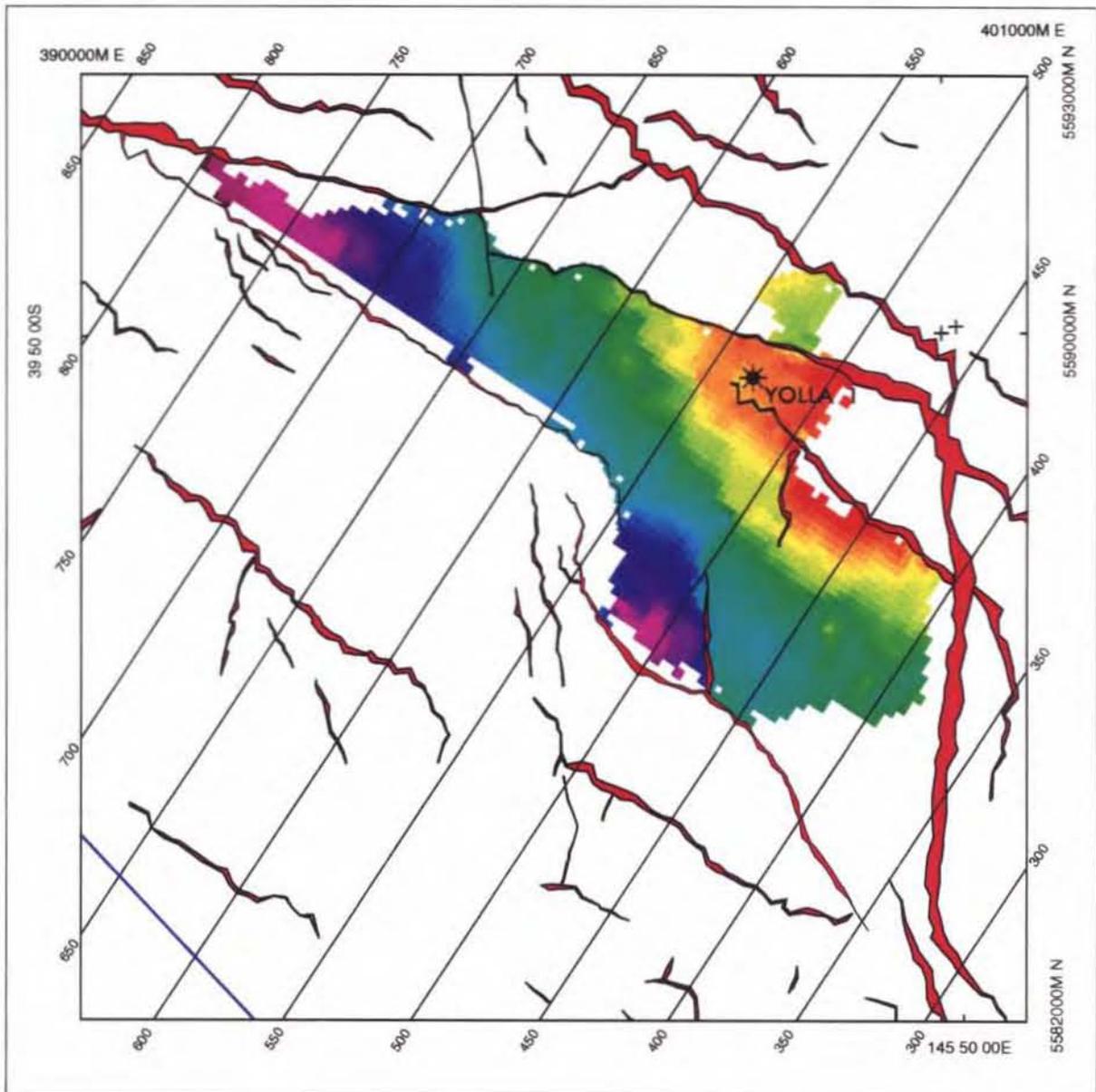


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**TRL1 BASS BASIN TASMANIA**

**TRIAL 2, AUTOPICK TIME IN YOLLA 1  
FAULT COMPARTMENT**

5 cm

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CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**TRIAL 3, AUTOPICK TIME IN YOLLA 1**  
**FAULT COMPARTMENT**

## 5.2 Stacking Velocity

The only possible control on variations of the velocity field away from the Yolla 1 well, is the information contained in the stacking velocity data determined during processing.

The post-DMO stacking velocities, calculated at 1000 metre intervals, were loaded into the mapping system. The velocity data were extracted at the relevant interpreted seismic levels, and then converted, using the DIX equation, to a pseudo-derived Average Velocity. These were used to create an average velocity grid of data, as displayed in Drawing numbers 13838, 13859 and 13867 of Appendix 1. These grids of average velocity were then combined with the appropriate time maps to produce maps in depth.

The limitations with this method involve the presence of the shallow Miocene volcanics, and how they cause distortion of the hyperbolic move-out on the gathers, and hence in the NMO equation.

The acquisition direction for the swathe of in-lines either side of Yolla 1, was northeast. As the seismic boat, and hence the front part of the spread approaches the zone of high velocity volcanic material, the seismic waves travelling through the volcanics, produce distorted gathers. The stacking velocities are incorrectly chosen to overcompensate for this distortion. The resulting velocity field is typified by "bulls eyes" of high-low-high velocity, as illustrated in Figure 26.

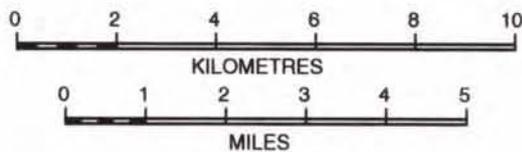
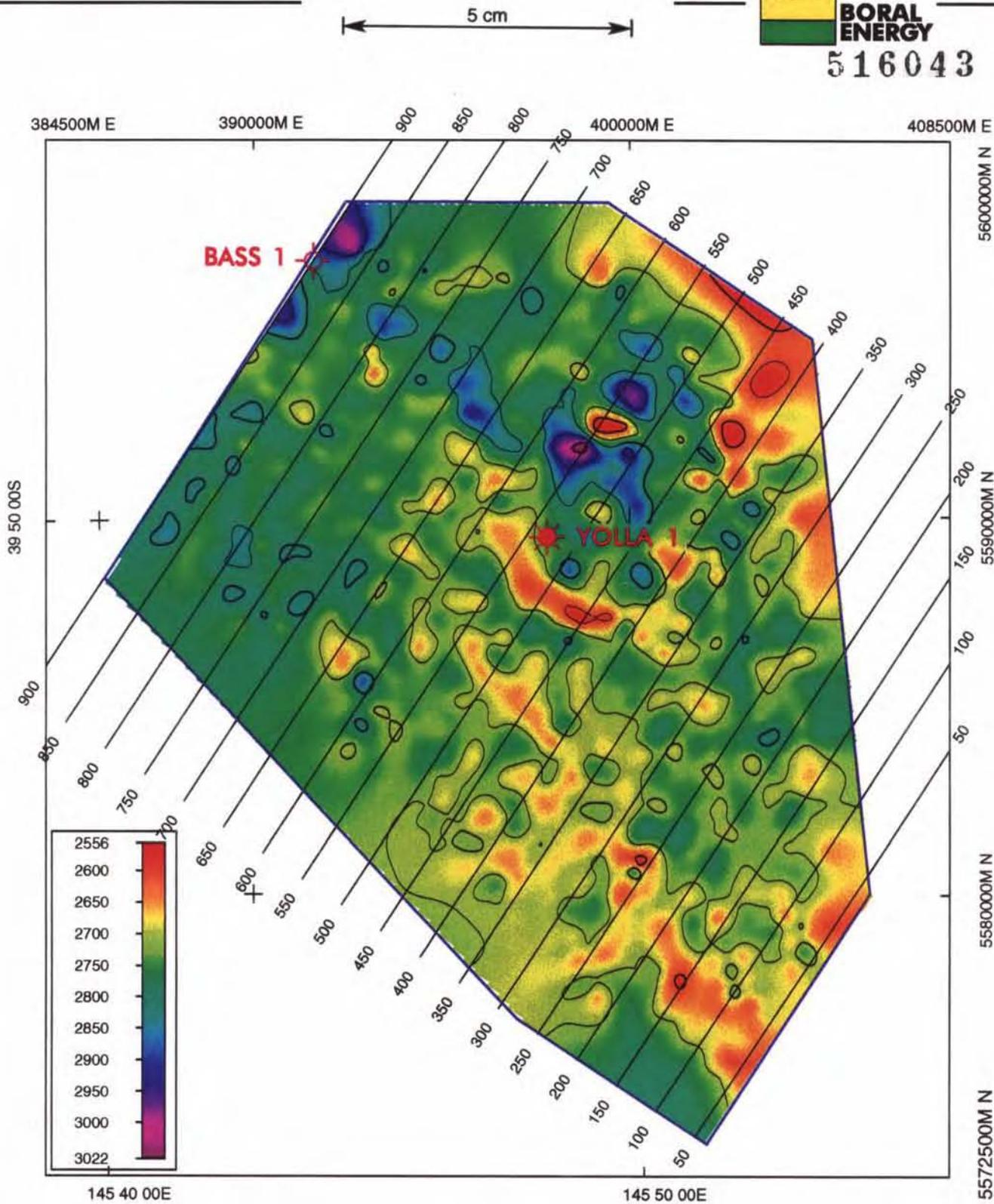
This technique is therefore applicable in areas away from the Miocene volcanic material, but likely produces unreal depth results in the Yolla 1 and in particular the Yolla North fault compartments.

## 5.3 Interval Velocity Model

The depth conversion technique most favoured here is that using interval velocities. The well derived interval velocities, as shown in Table 4, are combined with the interpreted seismic time thicknesses which are then summed to produce the depth data. A model was also developed to predict the velocity of the Miocene volcanics interval.

As illustrated in Figure 27, a replacement velocity was determined for the volcanics interval at specific points, based on the observed push down or pull up affect, and the thickness of the extrusive material. This technique produced a complex velocity field, as shown in Figure 28, with individual volcanoes exhibiting both fast and slow velocity characteristics.

These results were independently confirmed by inspection of several pre-stack depth migrations. The volcanics interval for in-line 535 was depth migrated using a range of constant velocities between 2200 and 2900 m/sec. A visual inspection of the stack response identified the areas, and at which velocity the stack was best. This resulted in a velocity profile very similar to that determined above, as shown in Figure 29, and confirms that the individual volcanic piles can vary sufficiently in character to produce both fast and slow velocity affects.

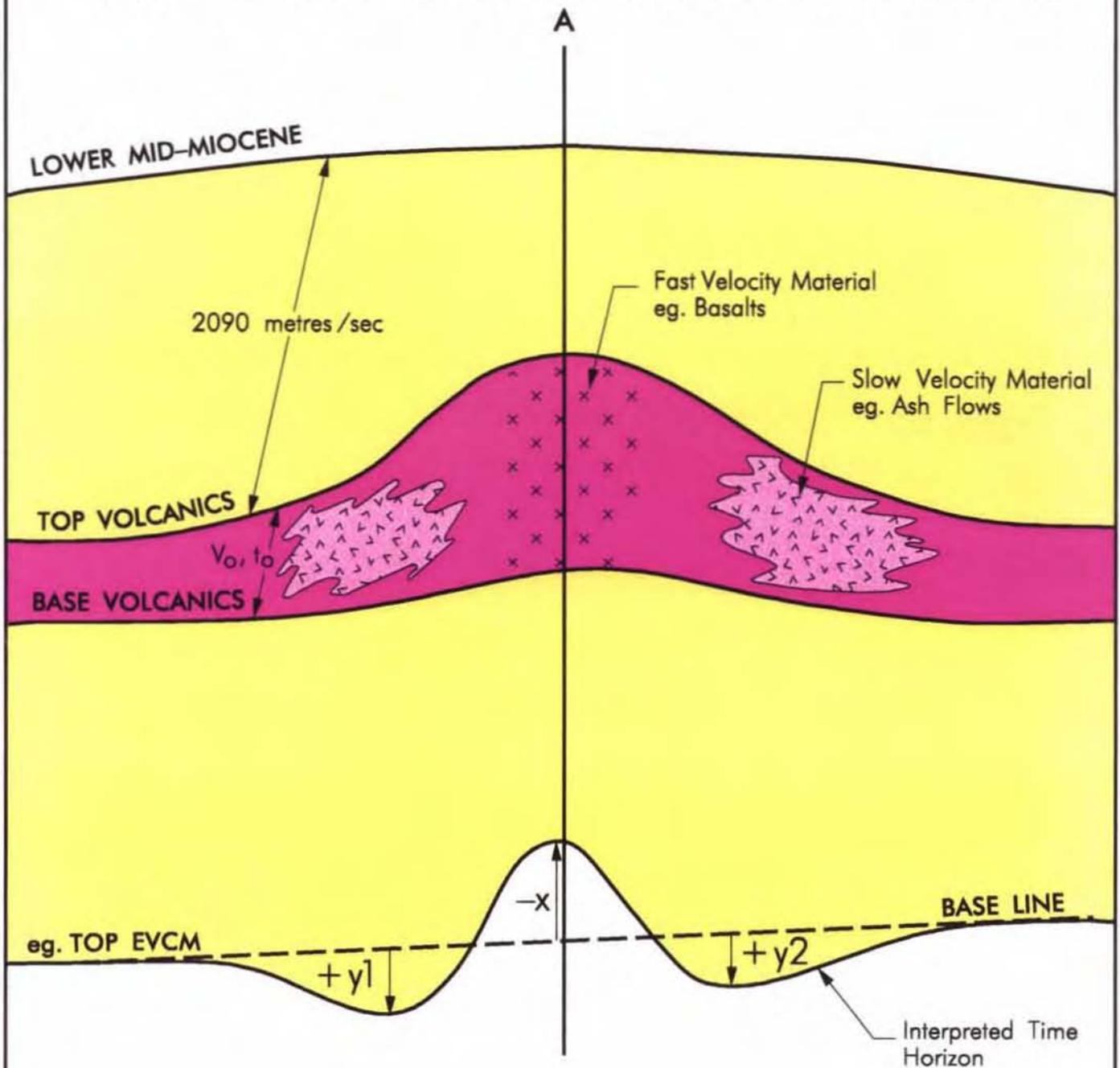


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**T/RL1 BASS BASIN TASMANIA**  
**STACKING VELOCITY DISTORTION**  
**CLOSE TO VOLCANICS**

5 cm

# CALCULATION OF VOLCANIC VELOCITY MODEL



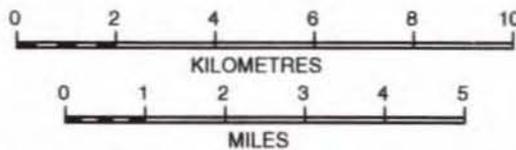
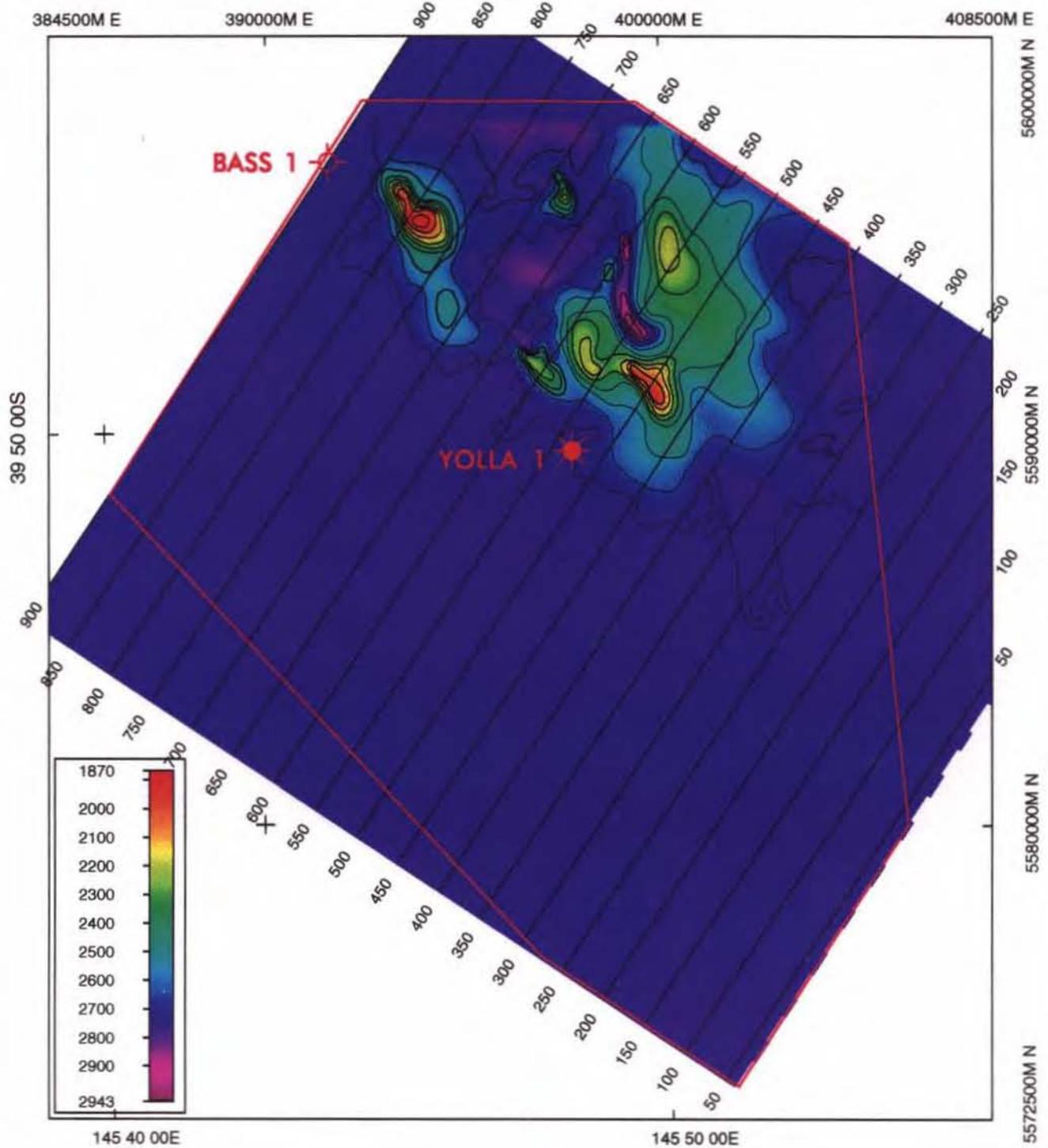
$x, y$  = Observed pull up or push down away from base line  
 $V_0, t_0$  = Interval velocity and time thickness of volcanic pile

for example, at position A:

$$V_0 \times t_0 = 2090 (t_0 + x)$$

$$V_0 = 2090 (t_0 + x) / t_0$$

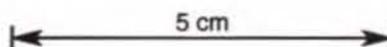
$V_0$  = the interval velocity required to cause the  $x$  millisecond pull up when compared to the surrounding medium velocity of 2090 m/sec, and interval thickness of  $t_0$  milliseconds



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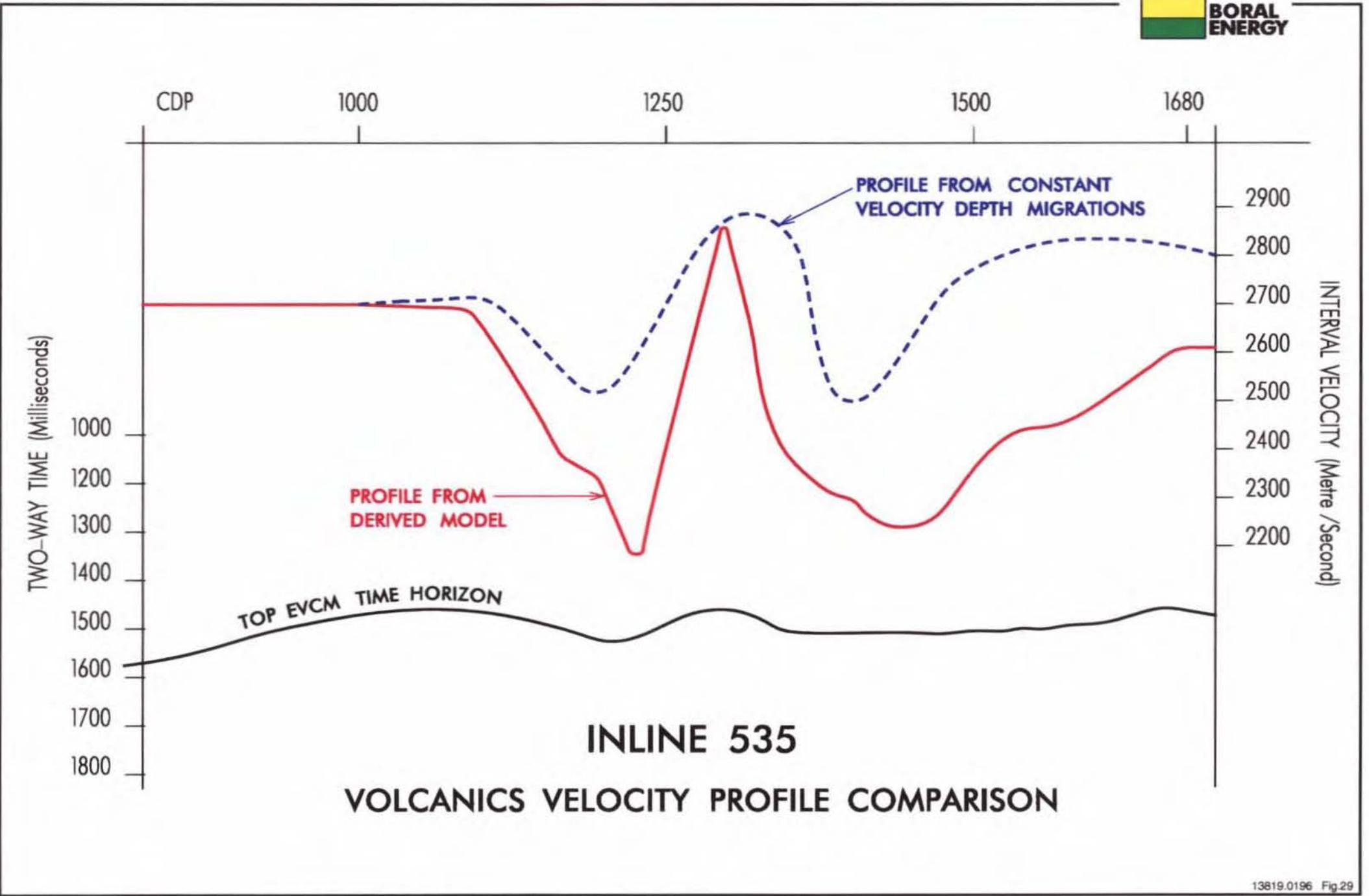
T/RL1 BASS BASIN TASMANIA

**MIOCENE VOLCANICS INTERVAL VELOCITY MODEL**





5 cm



INLINE 535  
VOLCANICS VELOCITY PROFILE COMPARISON

The Top EVCM depth map calculated using the interval velocity model, Figure 30, shows a larger closure area than the time map, but there remains a residual pull up affect beneath the centre of the extrusives. The results are indicating the basis of the model is correct, but that it needs further refinement. Recent work by an Adelaide University Honours student, shows that a much higher range of velocities do exist in modern day volcanic systems. Laboratory measurements of some volcanic samples from tertiary volcanoes in the southeast of the state, found velocities as high as 4500 metres/second. (Pers Comm C. Faustmann). Additional work currently being undertaken by the Joint Venture includes further pre-stack depth migration trials and a tomographic analysis, in an attempt to resolve the velocity distribution. The Velocity Model and subsequent depth conversion will be revised when further results are available.

#### 5.4 Summary

The Interval Velocity Model solution is the preferred depth conversion technique. While it is undergoing constant revision, it remains the only model to account for the shallow volcanics, and any regional thickness variations of the mapped intervals. The depth results are similar to those determined from the Stacking Velocity Model in the southern part of the 3D area, where the stacking velocities aren't obviously distorted by the extrusives. This indicates that the well derived interval velocities probably don't change significantly away from Yolla 1, and that the velocity field is reasonably stable.

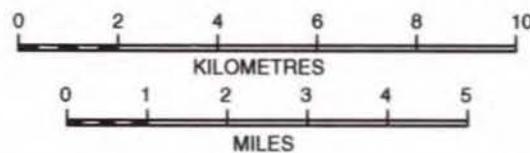
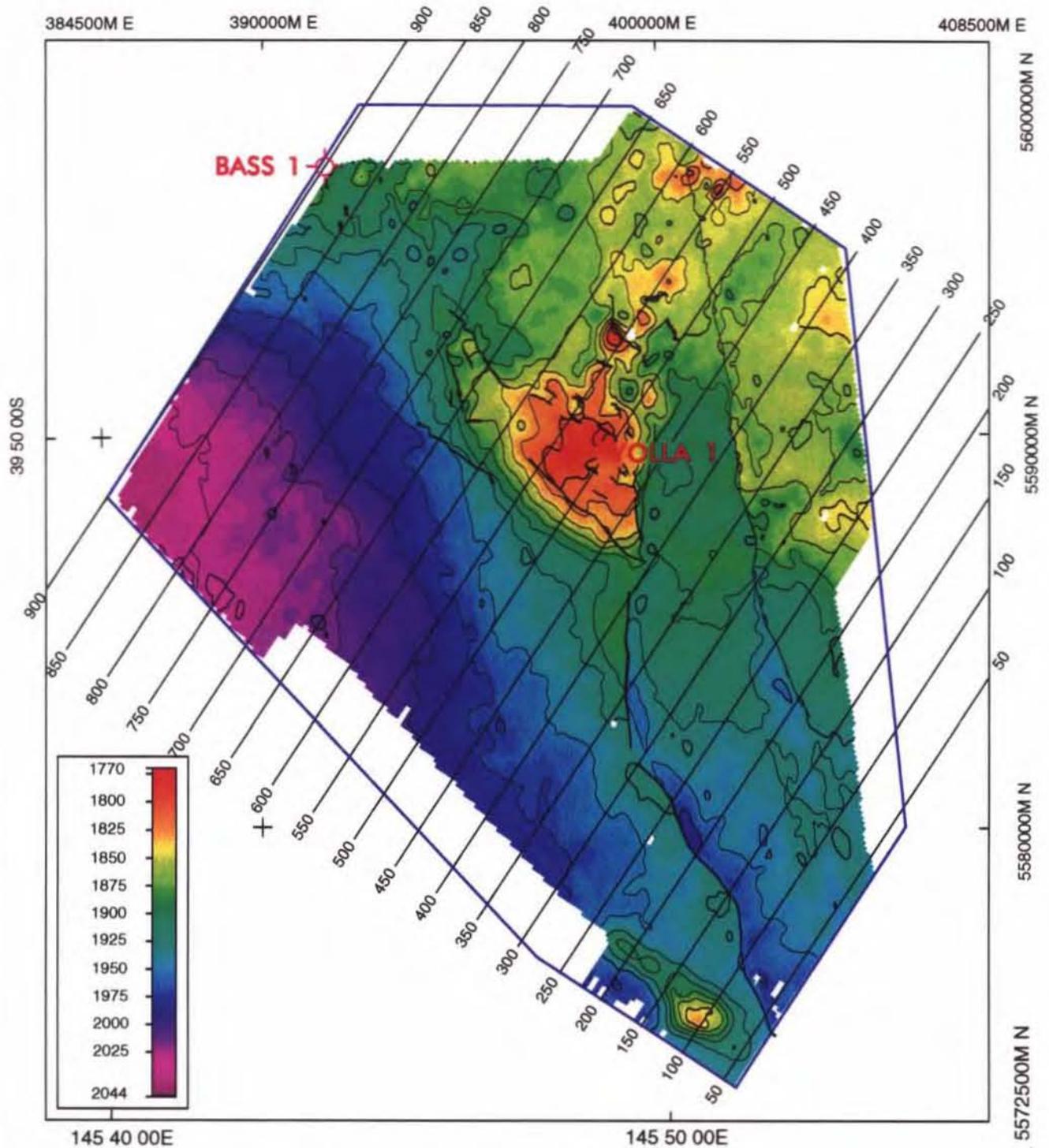
#### 6.0 CONCLUSIONS

The Yolla oil-gas-condensate field is well defined structurally by the 3D seismic data. There exists considerable potential for big extensions to the known hydrocarbon potential, as illustrated in the schematic diagram of Figure 31. The preferred depth conversion model and amplitude studies are indicating that the top EVCM gas/oil accumulation may be much larger than previously thought. A Palaeocene derived component to the shallow oil pool has been identified, and raises the possibility of oil rims on the deeper gas/condensate reservoirs. An onlapping event, not intersected by the well, and showing a favourable amplitude response, may indicate thick hydrocarbon bearing sands present on the flanks of the structure.

The Yolla 1 well didn't penetrate the Cretaceous section. As a dominant Cretaceous ridge underpins the Yolla structure, there exists potential targets in reservoirs of Late Cretaceous age. Satellite closures on the up and down thrown sides of the major fault, also form a considerable upside to potential, particularly if the minor faults form independent seals, and the separate fault compartments are filled to spill.

These, and other questions related to reservoir quality and continuity hydrocarbon deliverability and fluid content, require the drilling of further appraisal wells to fully define the hydrocarbon potential of the Yolla Field.

5 cm



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CENTRAL MERIDIAN 147 00 00E

TRL1 BASS BASIN TASMANIA

TOP EASTERN VIEW COAL MEASURES, DEPTH STRUCTURE

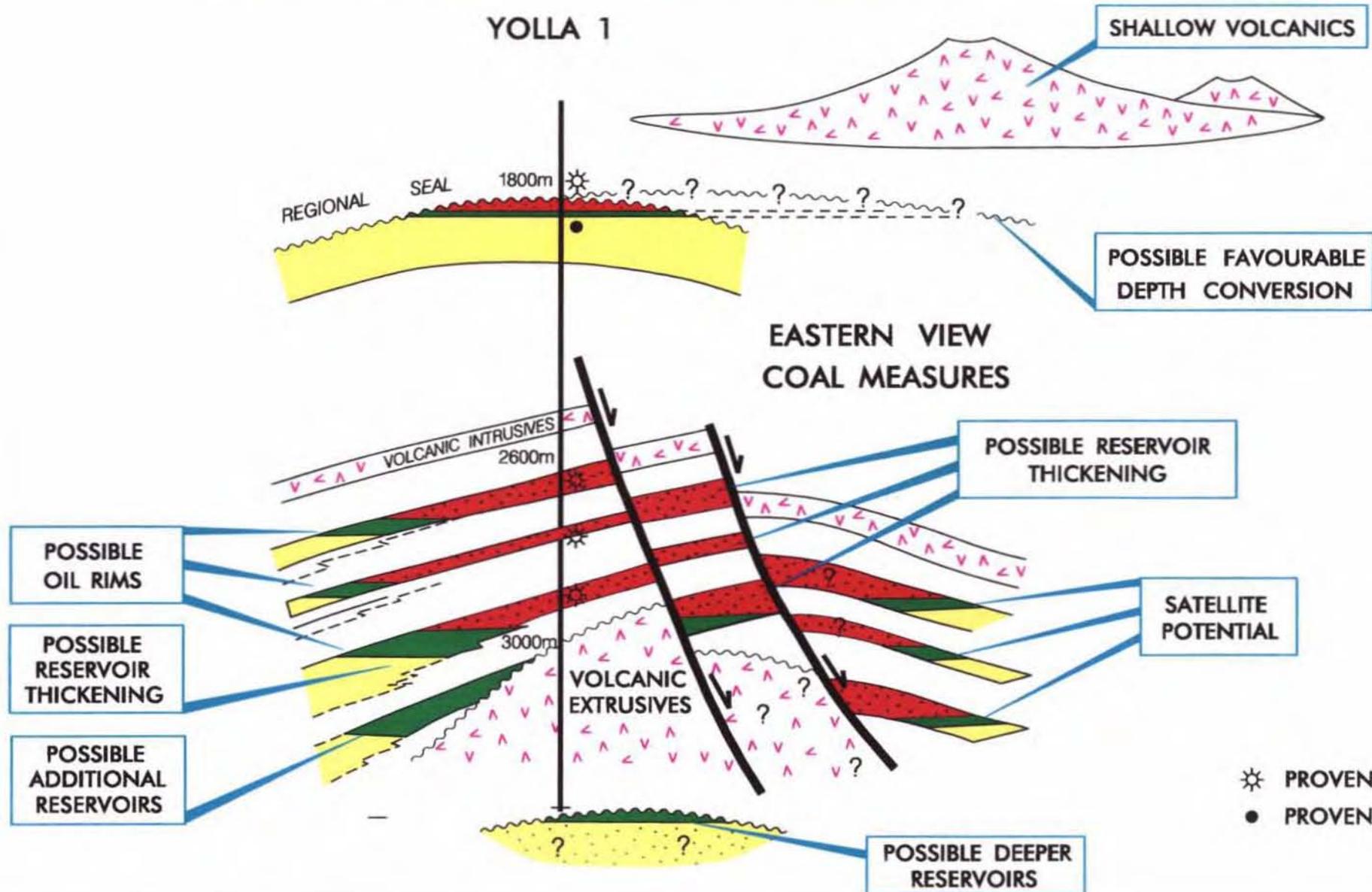
5 cm

516049



# YOLLA STRUCTURE SCHEMATIC

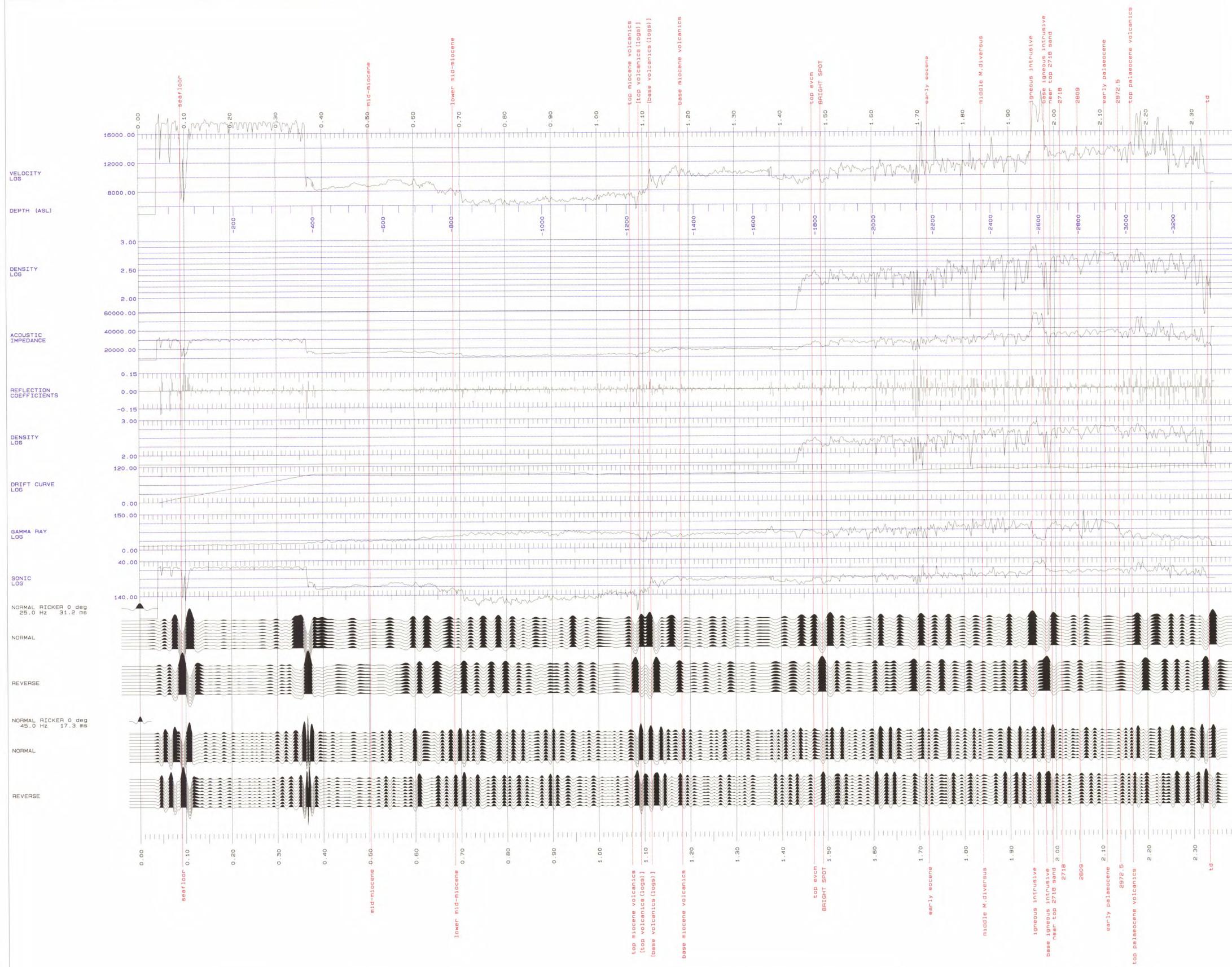
YOLLA 1



TASMANIA /BASS BASIN/YOLLA YOLLA 1  
Sagasco Resources Ltd.

5 cm

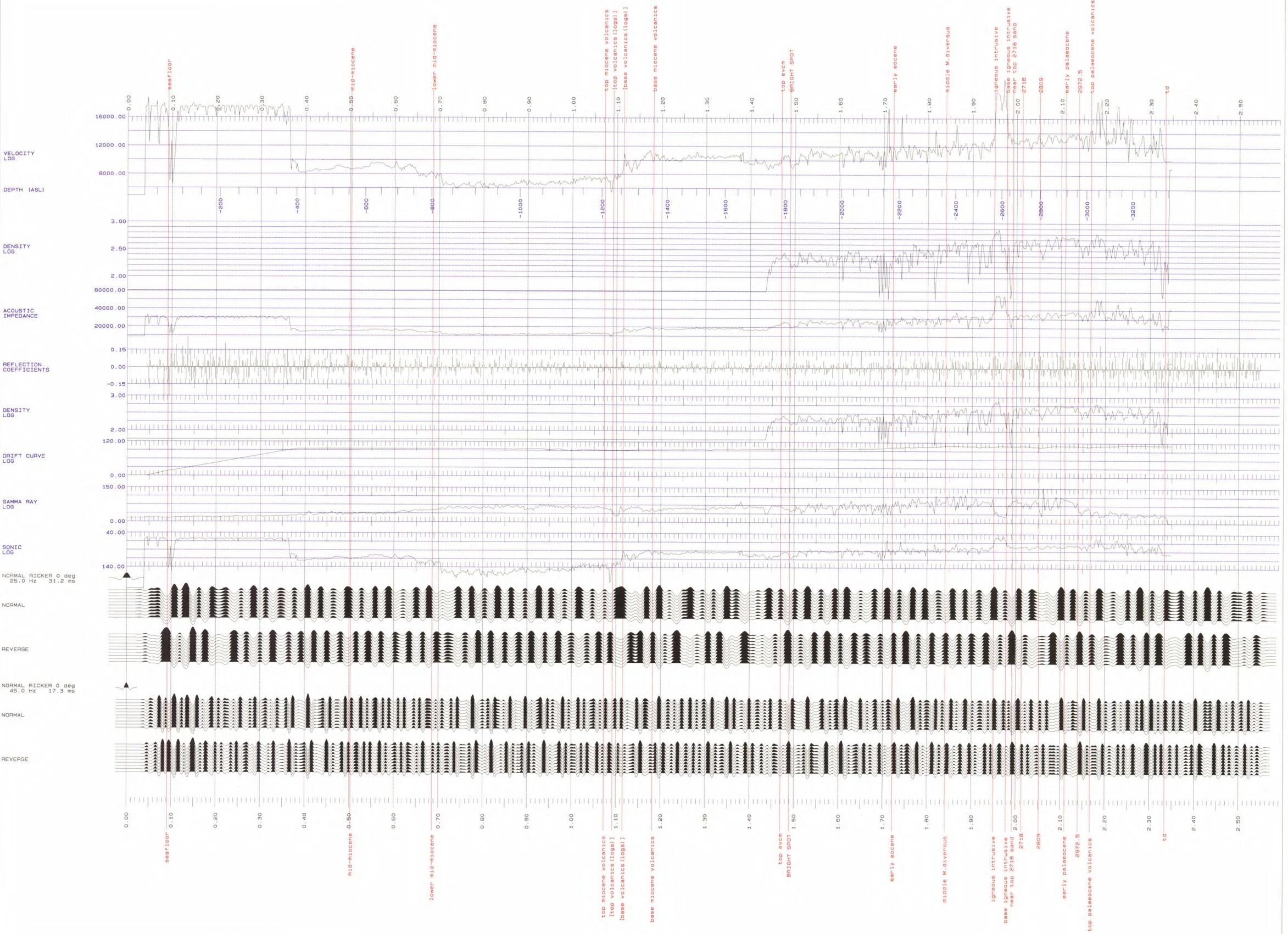
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TIME DATUM =0.0 M  
SAMPLE INTERVAL =2.0 MS  
AMPLITUDE =0.5  
# OF TRADES =10  
CHECK SHOT APPLIED =Y  
TRAVEL TIME CURVE =SONIC  
MULTIPLES =NONE  
WAVELET # 1 RICKER :  
PERIOD =31.2 MS  
FREQUENCY =25.0 HZ  
PHASE =0 DEG  
LOGS USED IN RC CALC. =SONIC & DENSITY  
AGC LENGTH =300.0 MS  
TRACES PER INCH =15.0  
INCHES PER SEC =9.84  
WAVELET # 2 RICKER :  
PERIOD =17.3 MS  
FREQUENCY =45.0 HZ  
PHASE =0 DEG



YOLLA 1									
FORMATION	DEPTH m (KB)	DEPTH m (ASL)	TIME Seconds	AVG VEL m/s	RMS VEL m/s	INT VEL m/s	INT TIME Seconds	INT DEN kg/mm	
sea floor	79.7	-68.6	0.091	1503	1496	2379	0.411	0.0	
mid-miocene	569.1	-559.0	0.503	2220	2260	2686	0.183	0.0	
lower mid-miocene	816.1	-804.0	0.686	2344	2393	2990	0.387	0.0	
top miocene volcanics	1219.1	-1208.0	1.073	2253	2297	2170	0.019	0.0	
[top volcanics (logs)]	1240.0	-1228.9	1.092	2251	2296	2398	0.023	0.0	
[base volcanics (logs)]	1268.0	-1256.9	1.115	2254	2298	3015	0.288	0.0	
base miocene volcanics	1365.1	-1354.0	1.182	2291	2339	2909	0.087	0.0	
top evcm	1799.1	-1788.0	1.470	2433	2495	3290	0.020	2365.0	
BRIGHT SPOT	1831.6	-1820.5	1.489	2444	2506	3105	0.119	2372.8	
early eocene	2190.1	-2179.0	1.721	2532	2602	3081	0.232	2301.6	
middle M. diversus	2375.1	-2364.0	1.841	2569	2654	3624	0.109	2511.5	
igneous intrusive	2684.1	-2673.0	1.950	2639	2755	4765	0.028	2559.8	
base igneous intrusive	2690.0	-2679.9	1.976	2669	2814	4622	0.014	2172.4	
near top 2718 sand	2679.1	-2668.0	1.992	2679	2825	3670	0.021	2613.3	
2718	2718.0	-2706.9	2.013	2699	2837	4729	0.038	2616.9	
2809	2809.0	-2797.9	2.052	2727	2889	4423	0.030	2706.3	
early palaeocene	2806.1	-2805.0	2.109	2745	2908	3367	0.058	2628.1	
2872.5	2872.5	-2861.4	2.139	2769	2934	4375	0.027	2538.7	
top palaeocene volcanics	3032.1	-3021.0	2.187	2789	2959	3811	0.187	2515.1	
td	3391.1	-3340.0	2.334	2862	3040				

TASMANIA /BASS BASIN/YOLLA YOLLA 1  
Sagasco Resources Ltd.

**GMA LOGM**  
**KB ELEVATION=11.1 M**  
 TIME DATUM =0.0 M  
 SAMPLE INTERVAL =2.0 MS  
 AMPLITUDE =0.5  
 # OF TRACES =10  
 CHECK SHOT APPLIED =Y  
 TRAVEL TIME CURVE =SONIC  
 SURFACE TIME =0.0  
 WAVELET # 1 RICKER :  
 PERIOD =31.2 MS  
 FREQUENCY =25.0 Hz  
 PHASE =0 deg  
 LOGS USED IN RC CALC. =SONIC & DENSITY  
 AGC LENGTH =300.0 MS  
 TRACES PER INCH =15.0  
 INCHES PER SEC =9.84  
 SURFACE COEFF. =-1.0  
 WAVELET # 2 RICKER :  
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 PHASE =0 deg

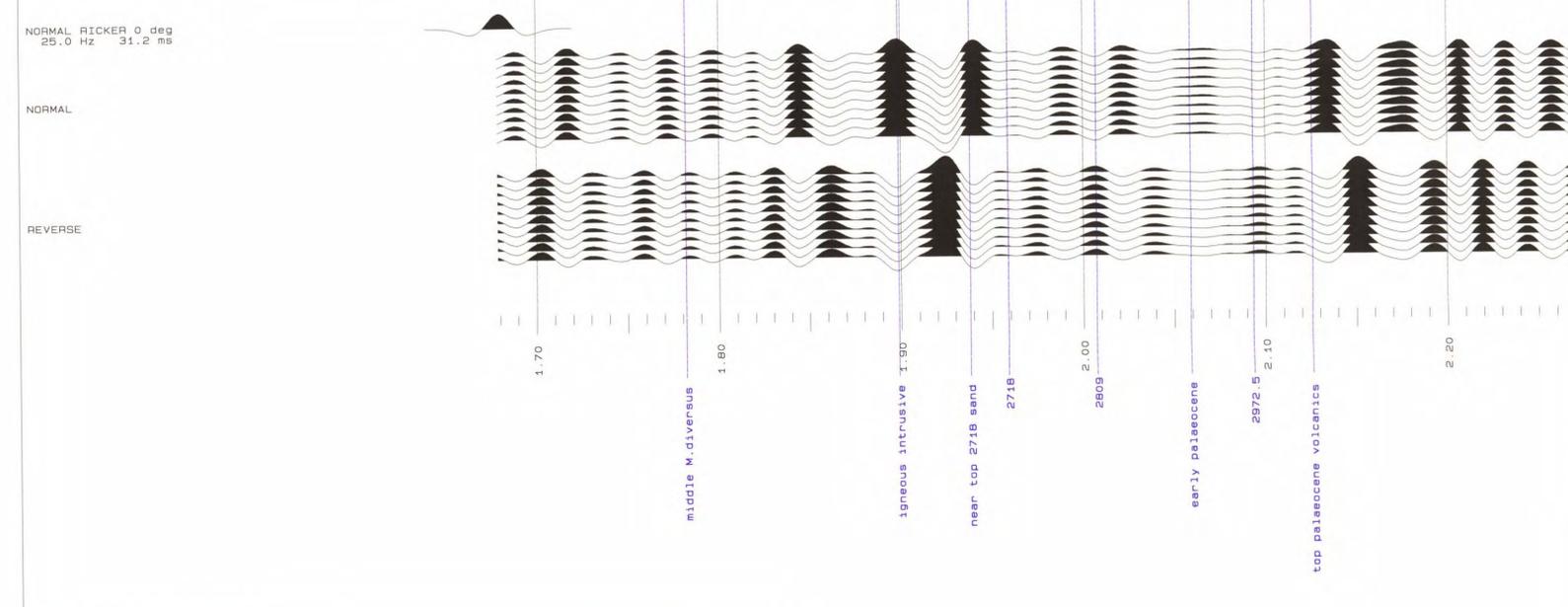
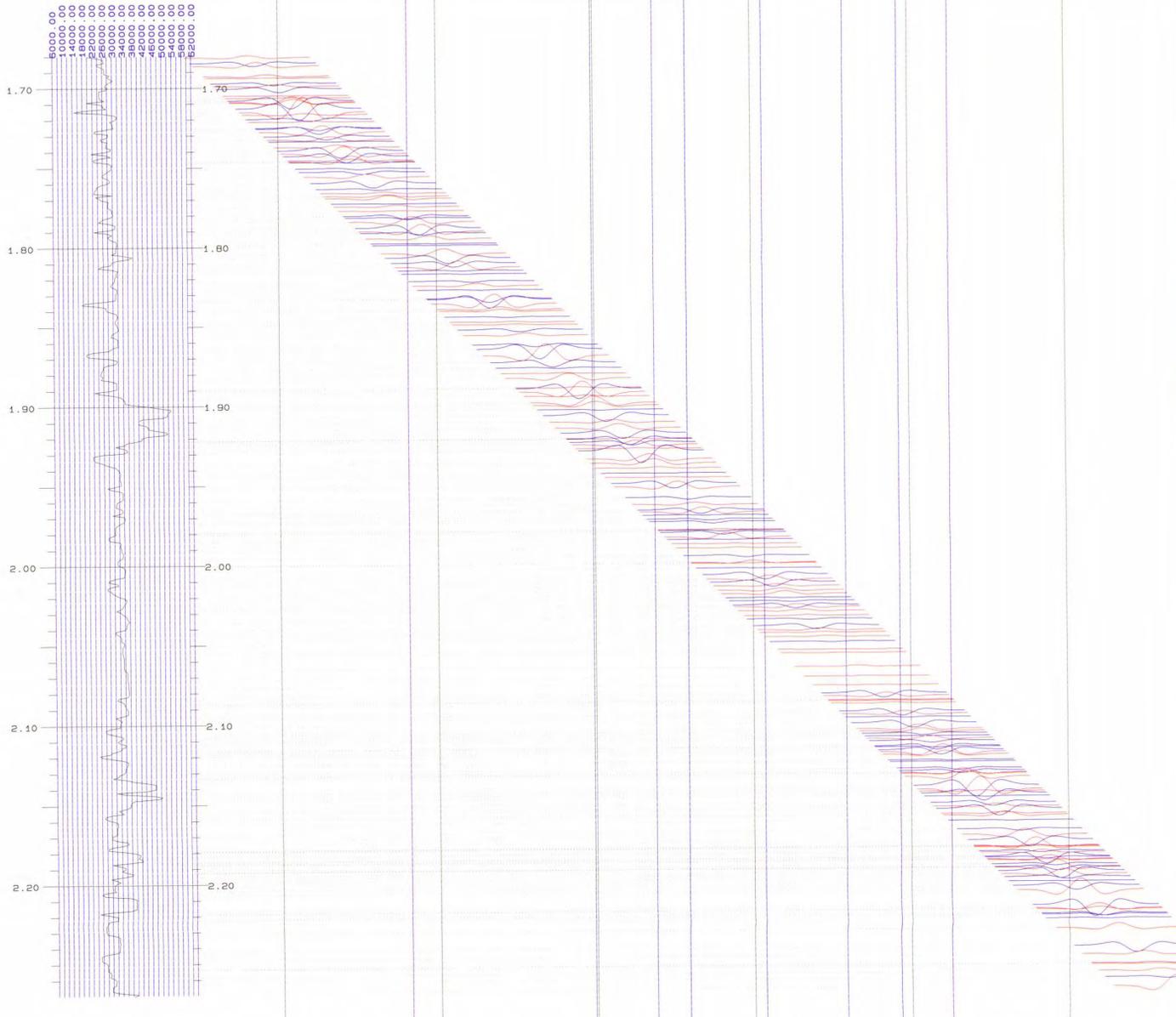
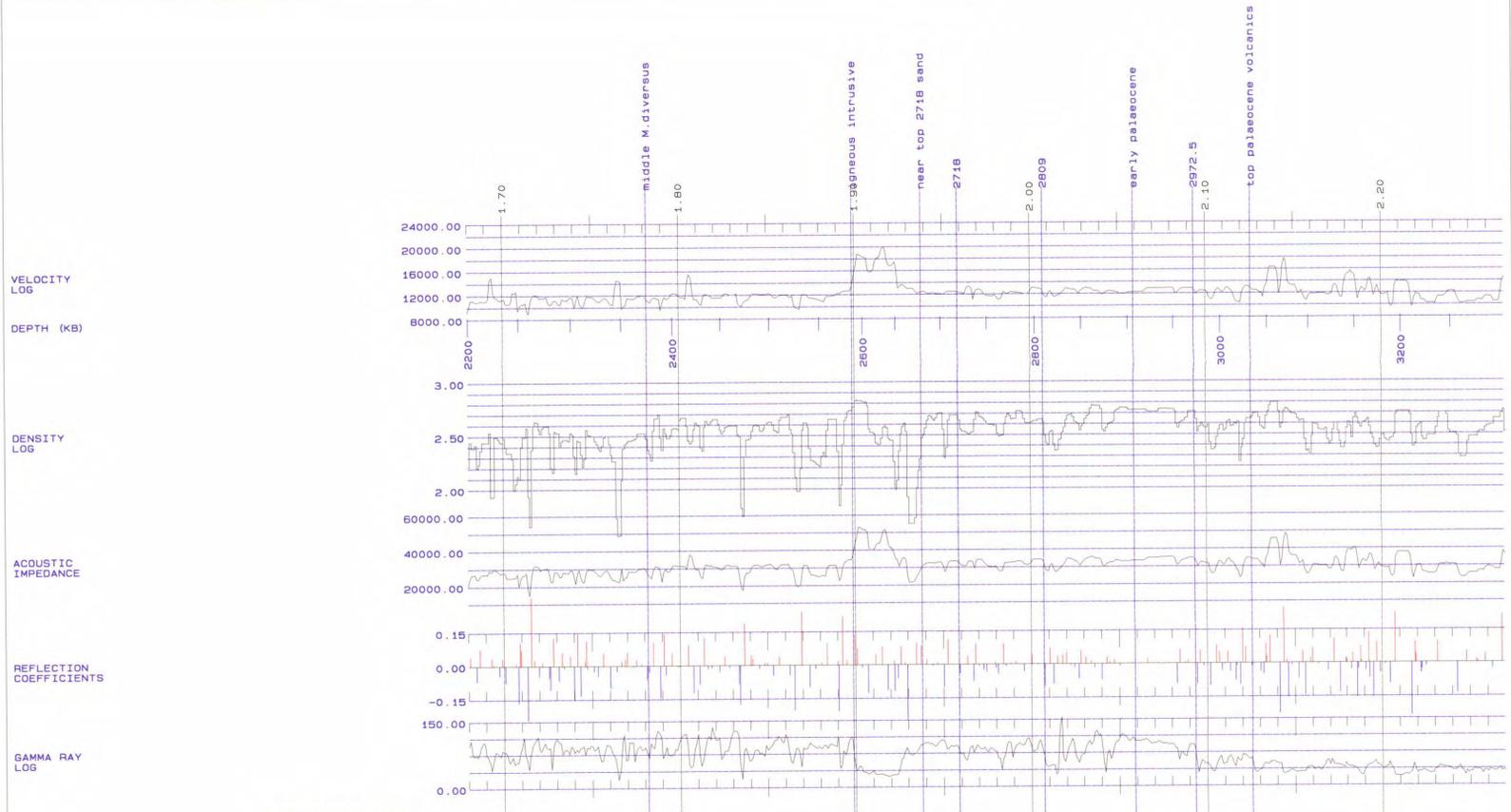
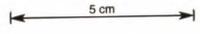


FORMATION	DEPTH m (KB)	DEPTH m (ASL)	TIME Seconds	AVG VEL m/s	RMS VEL m/s	INT VEL Seconds	INT TIME Seconds	INT DEN kg/mm
sea floor	79.7	-68.6	0.091	1503	1496	2379	0.411	0.0
mid-miocene	569.1	-598.0	0.903	2220	2260	2686	0.183	0.0
lower mid-miocene	815.1	-804.0	0.686	2344	2383	2090	0.387	0.0
top miocene volcanics [top volcanics (logs)]	1219.1	-1208.0	1.073	2293	2297	2170	0.019	0.0
[base volcanics (logs)]	1240.0	-1228.9	1.092	2251	2296	2398	0.023	0.0
base miocene volcanics	1268.0	-1256.9	1.115	2254	2298	2909	0.067	0.0
top even BRIGHT SPOT	1365.1	-1354.0	1.182	2291	2339	3016	0.288	0.0
early eocene	1799.1	-1788.0	1.470	2433	2495	3090	0.020	2385.0
middle M. diversus	2190.1	-2179.0	1.721	2532	2602	3091	0.232	2301.6
igneous intrusive	2375.1	-2364.0	1.841	2669	2854	3105	0.119	2372.8
base igneous intrusive near top 2718 sand	2584.1	-2573.0	1.950	2639	2755	3824	0.109	2511.5
2718	2650.9	-2639.8	1.978	2669	2814	4765	0.028	2559.8
2809	2779.1	-2768.0	1.982	2679	2825	4022	0.014	2172.4
early palaeocene	2718.0	-2706.9	2.013	2689	2837	3670	0.021	2615.3
2872.5	2809.0	-2797.9	2.052	2727	2889	4729	0.038	2616.9
top palaeocene volcanics	2906.1	-2895.0	2.109	2745	2908	3387	0.058	2648.1
td	2972.5	-2961.4	2.139	2769	2934	4423	0.030	2706.3
	3032.1	-3021.0	2.167	2789	2959	4375	0.027	2638.7
	3351.1	-3340.0	2.334	2862	3040	3911	0.187	2519.1

**GMA LOGM**  
**KB ELEVATION=11.1 M**  
 TIME DATUM =0.0 M  
 AGC LENGTH =0.0 MS  
 # OF TRACES =10  
 MULTIPLES =NONE  
 WAVELET # 1 RICKER :  
 PERIOD =31.2 MS  
 FREQUENCY =25.0 Hz  
 PHASE =0 deg

LOGS USED IN RC CALC. =SONIC & DENSITY  
 AMPLITUDE =0.8  
 INCHES PER SEC =20.00  
 TRAVEL TIME CURVE =CHECK SONIC

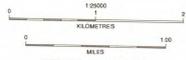
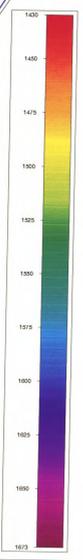
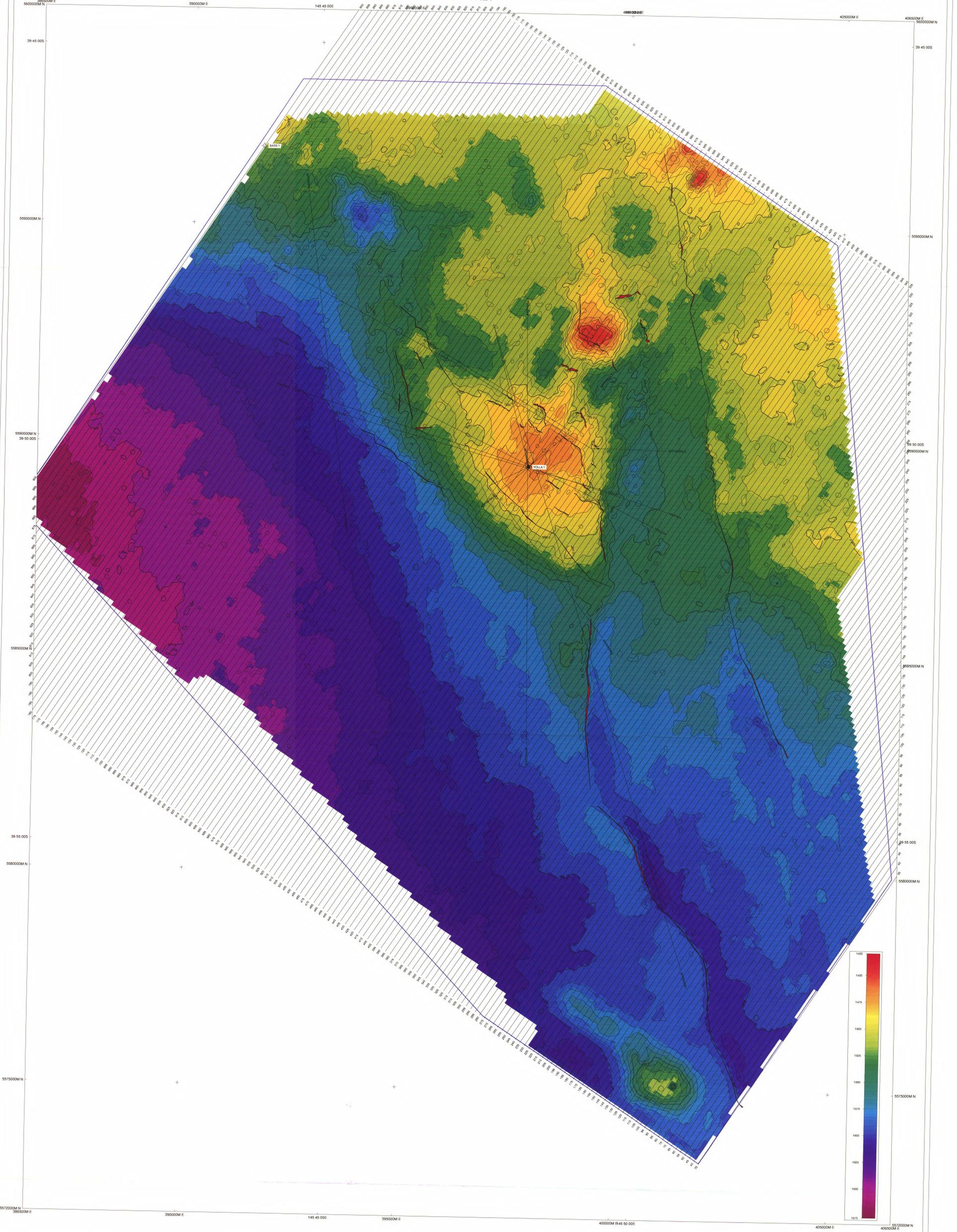
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 TRACES PER INCH =10.0  
 CHECK SHOT APPLIED =N



**YOLLA 1 BLOCKED**

FORMATION	DEPTH m (KB)	DEPTH m (ASL)	TIME Seconds	AVG VEL m/s	RMS VEL m/s	INT VEL m/s	INT TIME Seconds	INT DEN kg/mm
seafloor	79.7	-68.6	0.064	2142	2336	2948	0.332	0.0
mid-miocene	569.1	-568.0	0.396	2818	2932	2364	0.208	0.0
lower mid-miocene	815.1	-804.0	0.604	2662	2751	1917	0.421	0.0
top miocene volcanics	1219.1	-1208.0	1.026	2358	2445	2576	0.113	0.0
base miocene volcanics	1365.1	-1354.0	1.139	2378	2463	2980	0.291	0.0
top evcm	1799.1	-1788.0	1.430	2500	2579	3203	0.244	2307.5
early eocene	2190.1	-2179.0	1.674	2603	2685	3442	0.107	2372.8
middle M.diversus	2375.1	-2364.0	1.782	2654	2738	3572	0.117	2511.4
igneous intrusive	2584.1	-2573.0	1.899	2710	2797	4885	0.039	2445.6
near top 2718 sand	2679.1	-2668.0	1.938	2754	2856	3732	0.021	2514.4
2718	2718.0	-2706.9	1.959	2764	2867	3744	0.049	2616.9
2809	2809.0	-2797.9	2.007	2788	2891	3757	0.052	2628.4
early palaeocene	2906.1	-2895.0	2.059	2812	2916	3887	0.034	2704.6
2972.5	2972.5	-2961.4	2.093	2830	2934	3673	0.032	2540.0
top palaeocene volcanics	3032.1	-3021.0	2.126	2842	2947	3645	0.175	2515.1
td	3351.1	-3340.0	2.301	2903	3010			

TRL1



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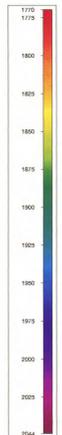
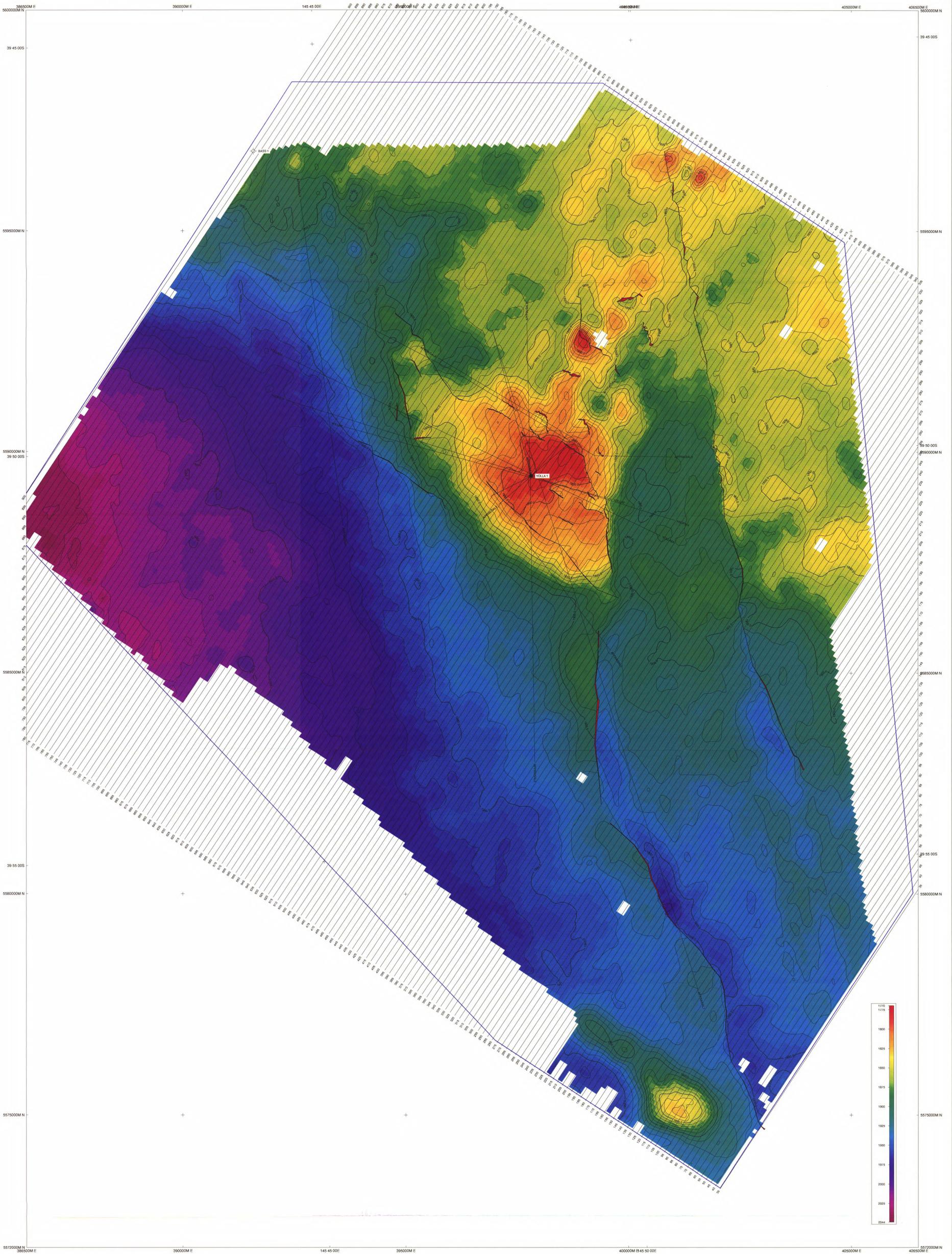
YOLLA 3D SEISMIC SURVEY  
 T/RL1 BASS BASIN  
 TOP EASTERNVIEW COAL MEASURES  
 TIME STRUCTURE

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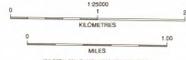
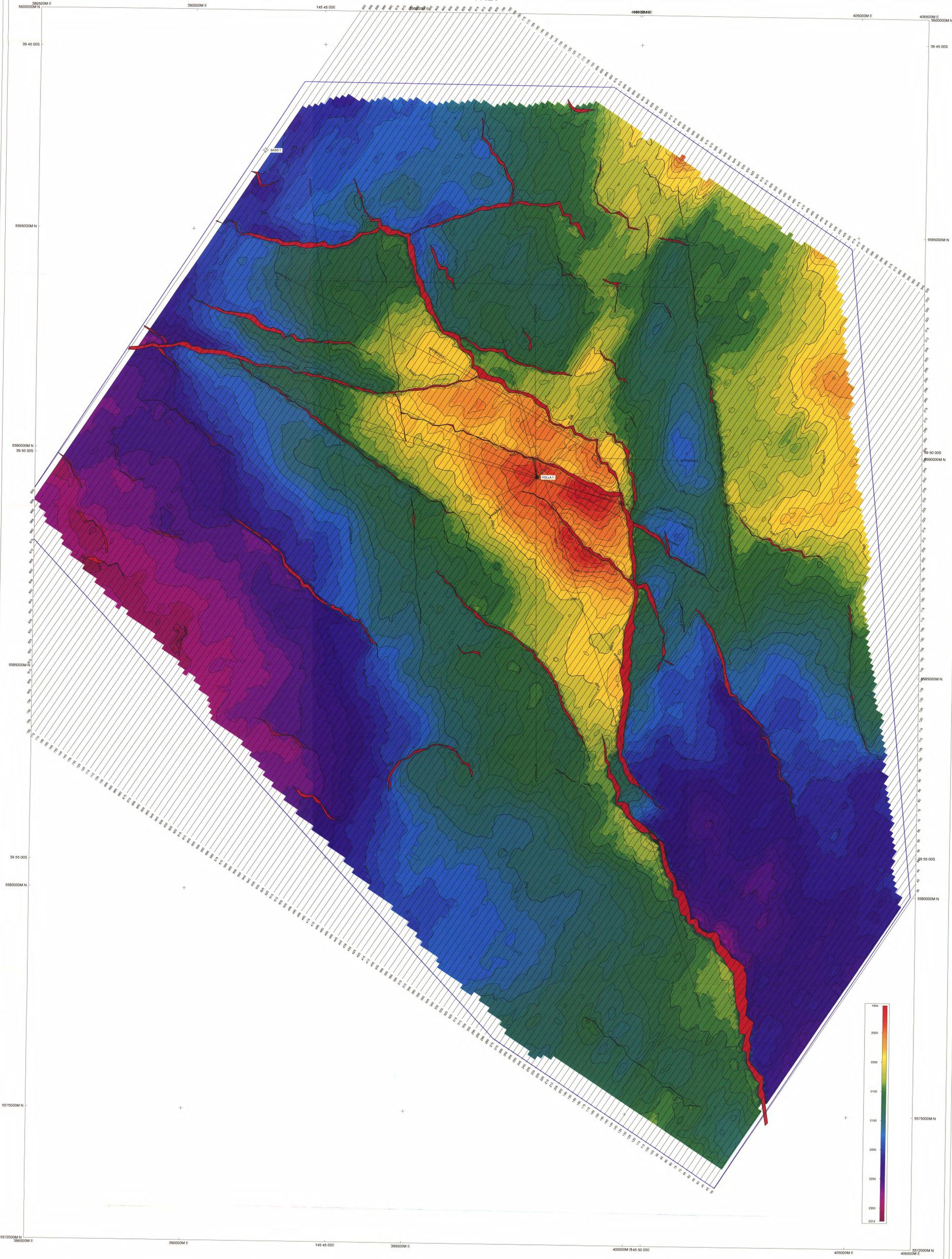


**BORAL ENERGY**

**YOLLA 3D SEISMIC SURVEY  
T/RL1 BASS BASIN  
TOP EASTERN VIEW COAL MEASURES  
DEPTH STRUCTURE**

SECTION TITLE	DATE	BY	CHECKED BY
DATE	BY	CHECKED BY	DATE

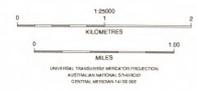
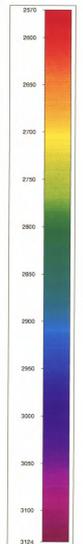
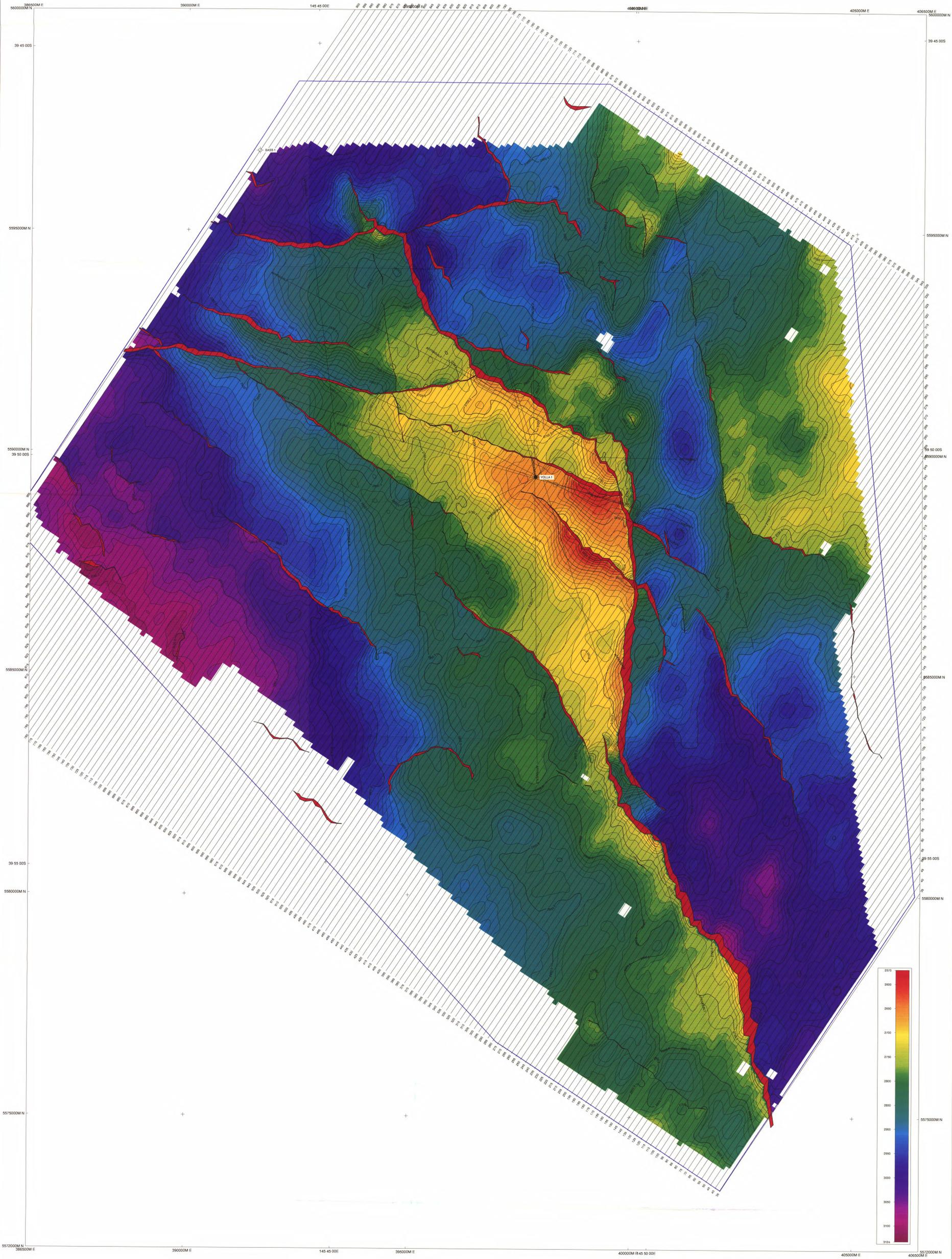
TRL1



**BORAL ENERGY**

YOLLA 3D SEISMIC SURVEY  
T/RL1 BASS BASIN  
NEAR TOP 2718 SAND  
TIME STRUCTURE

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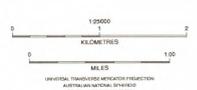
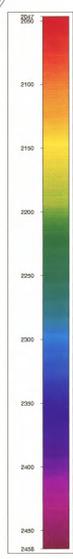
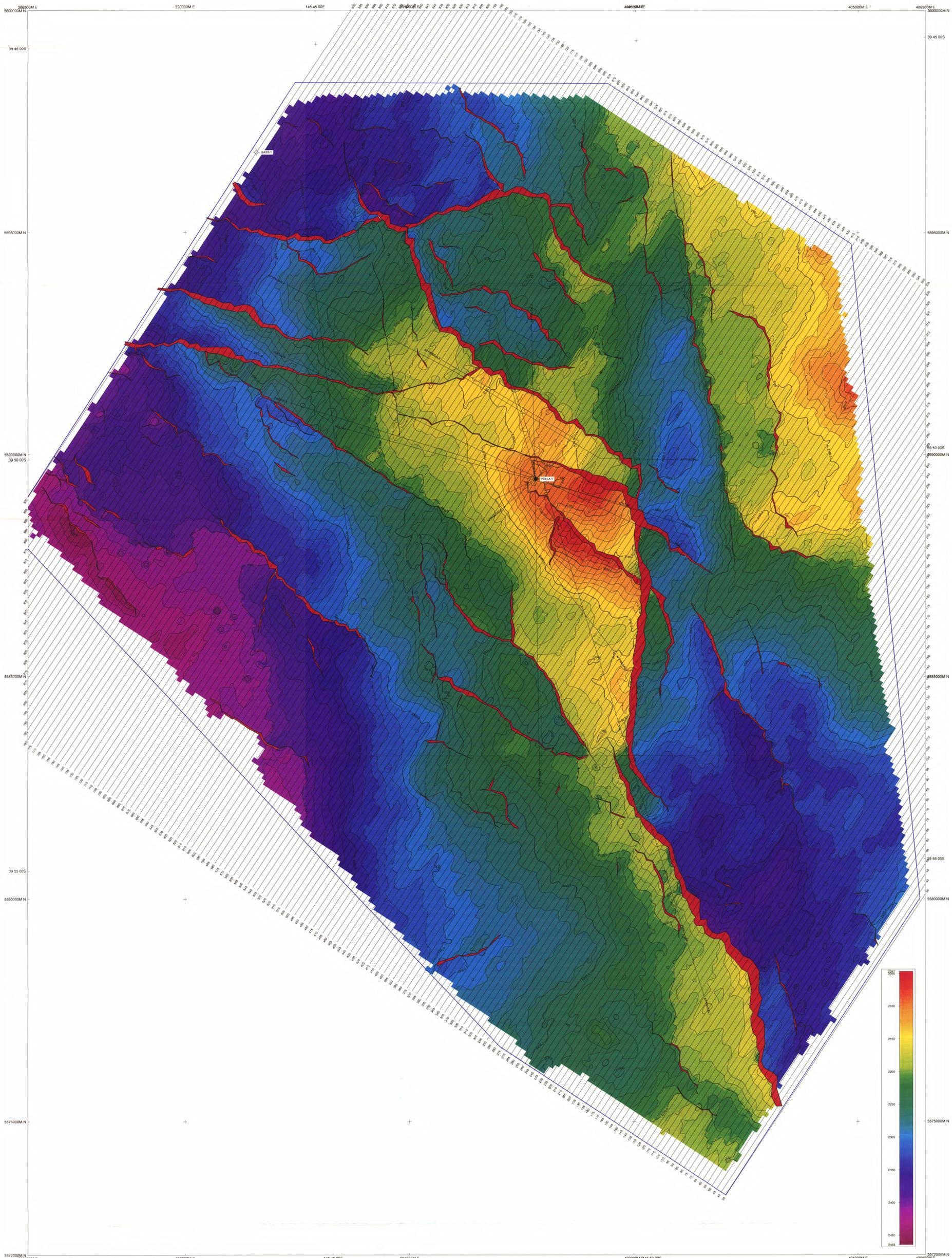
**BORAL ENERGY**

YOLLA 3D SEISMIC SURVEY  
TRL1 BASS BASIN  
NEAR TOP 2718 SAND  
DEPTH STRUCTURE

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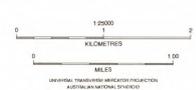
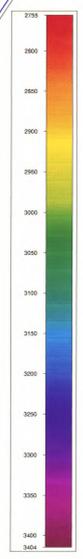
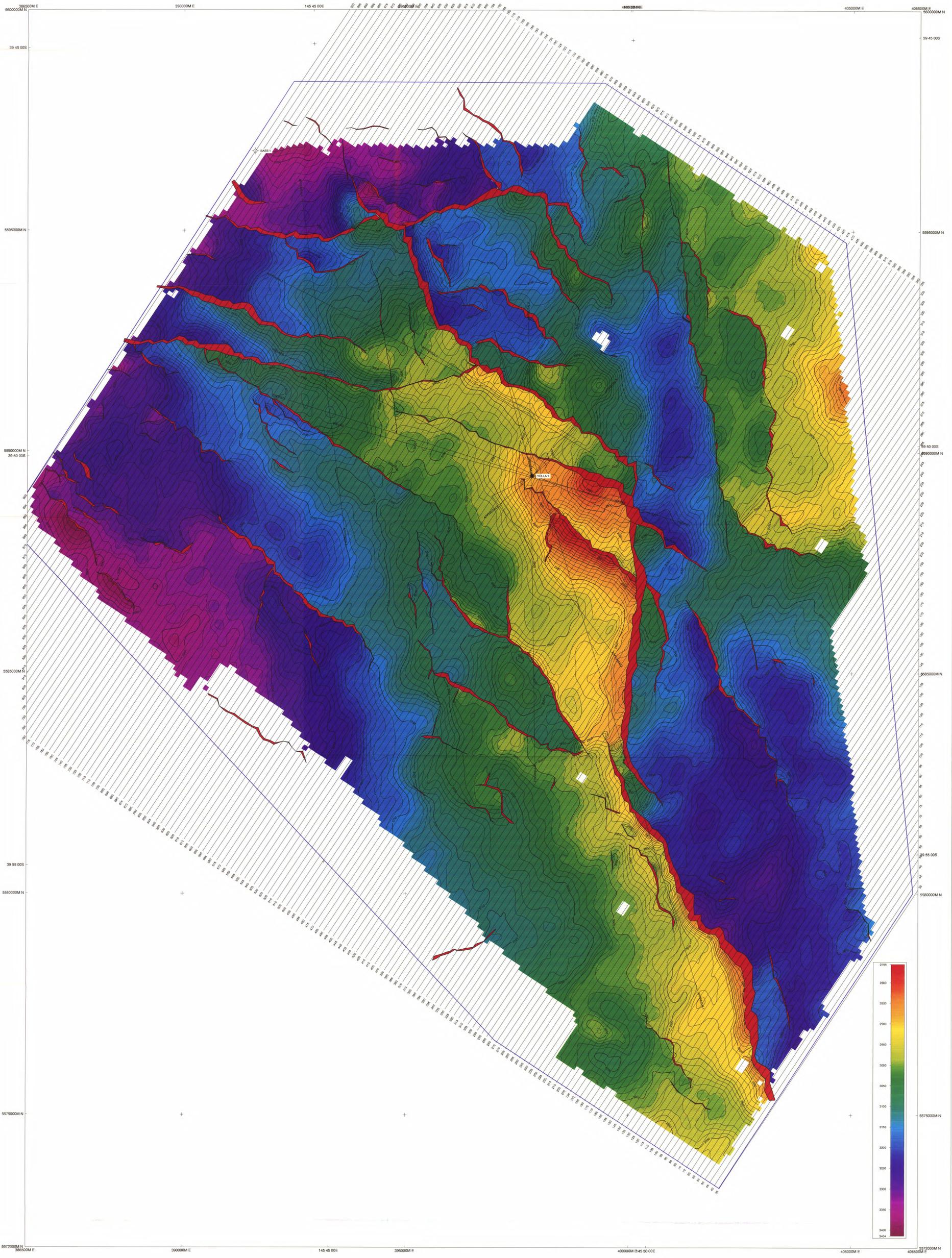
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EARLY PALAEOCENE  
TIME STRUCTURE

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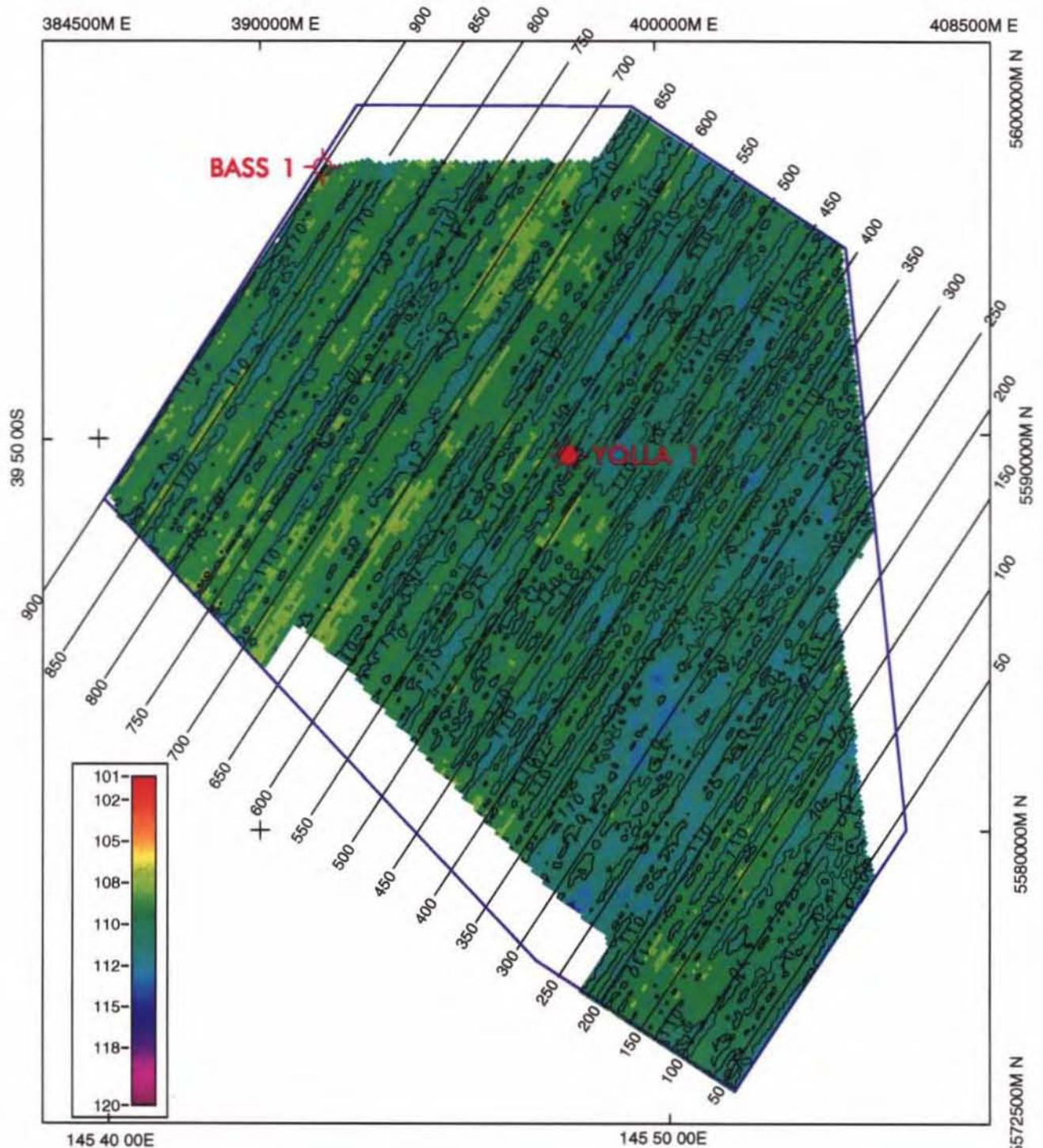
**BORAL ENERGY**

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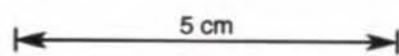


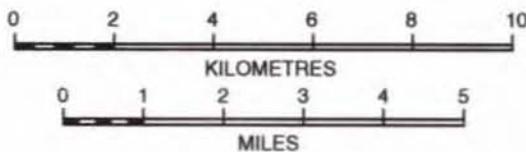
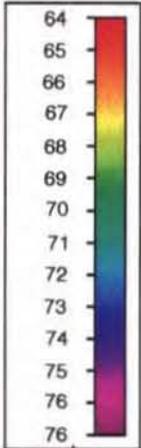
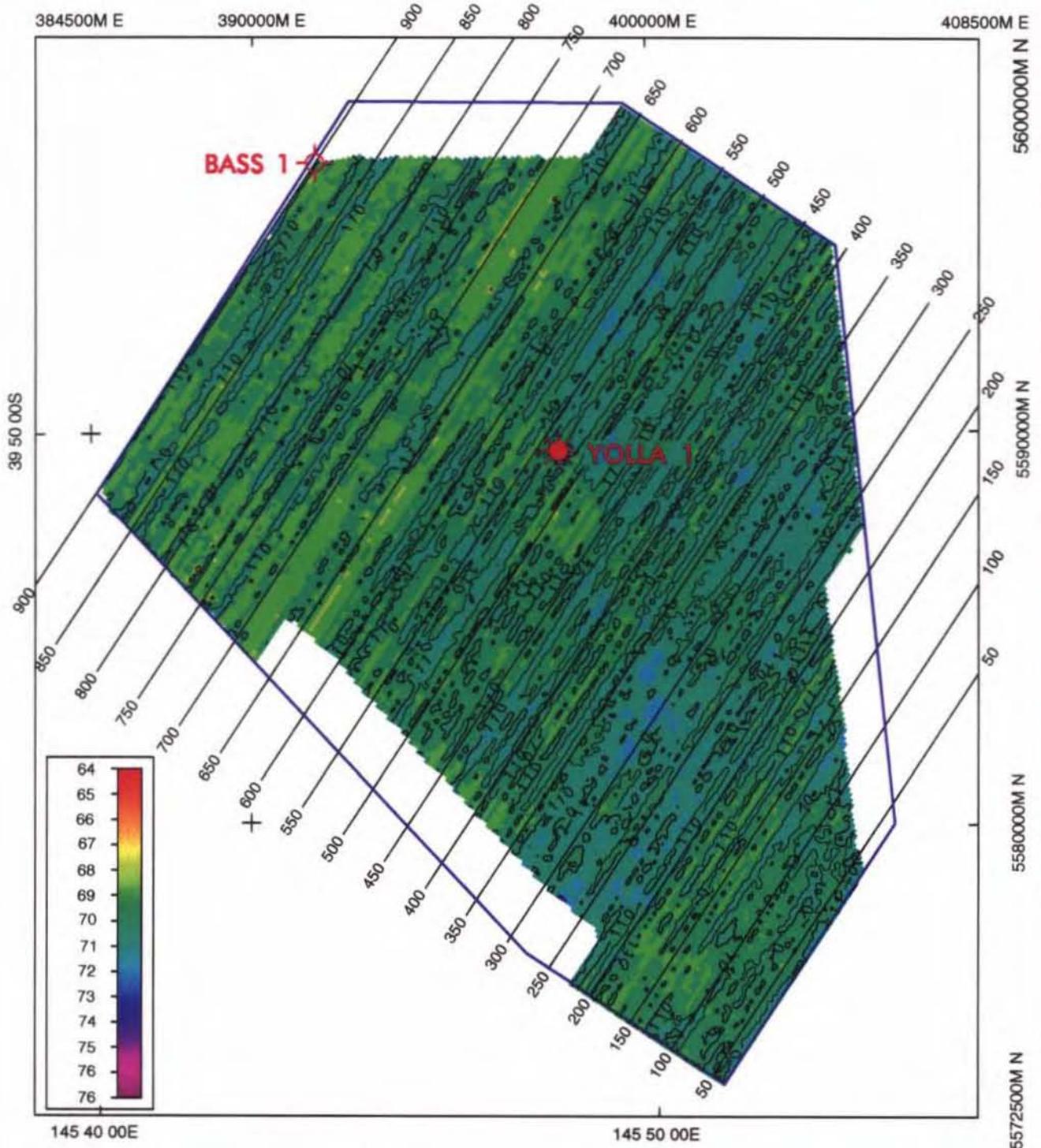
APPENDIX 1



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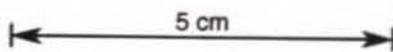
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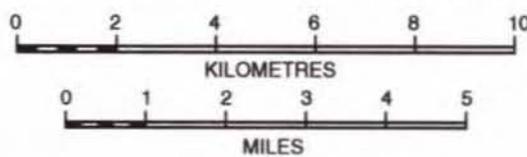
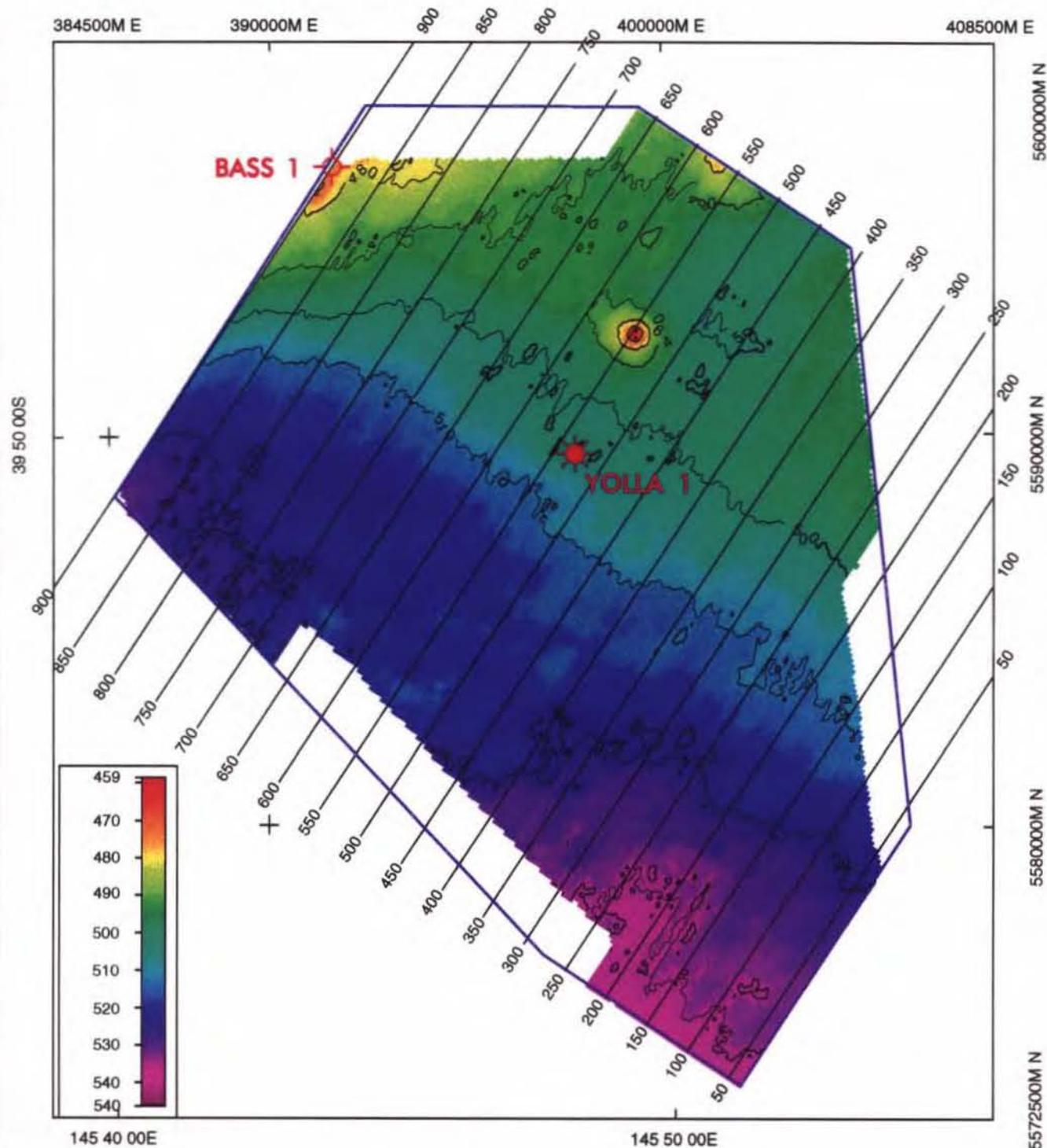




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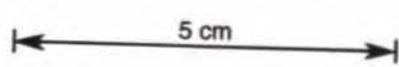
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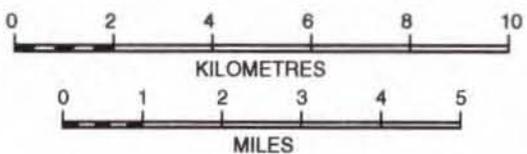
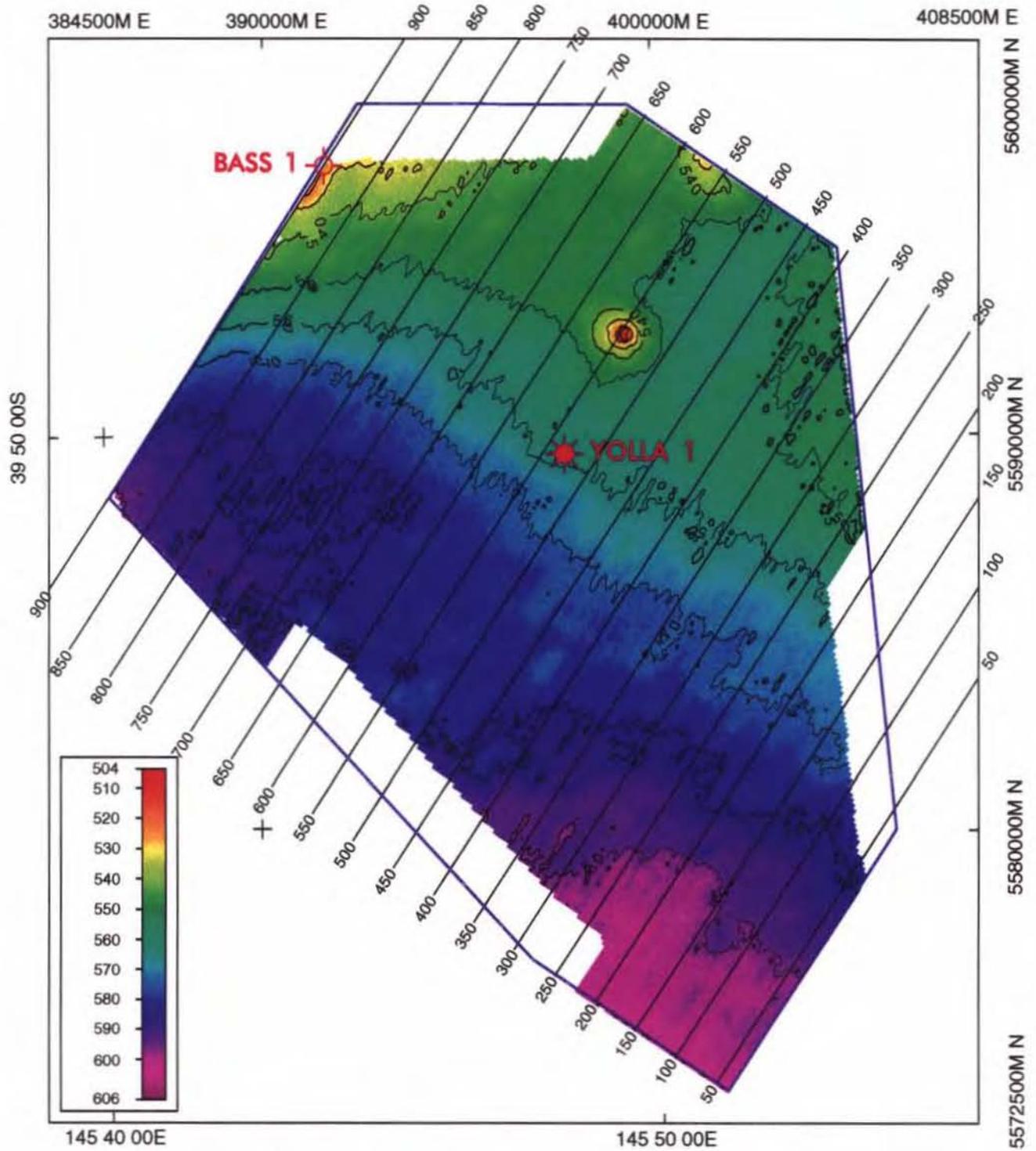




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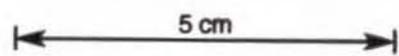
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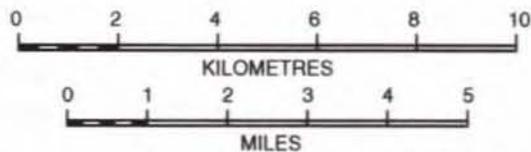
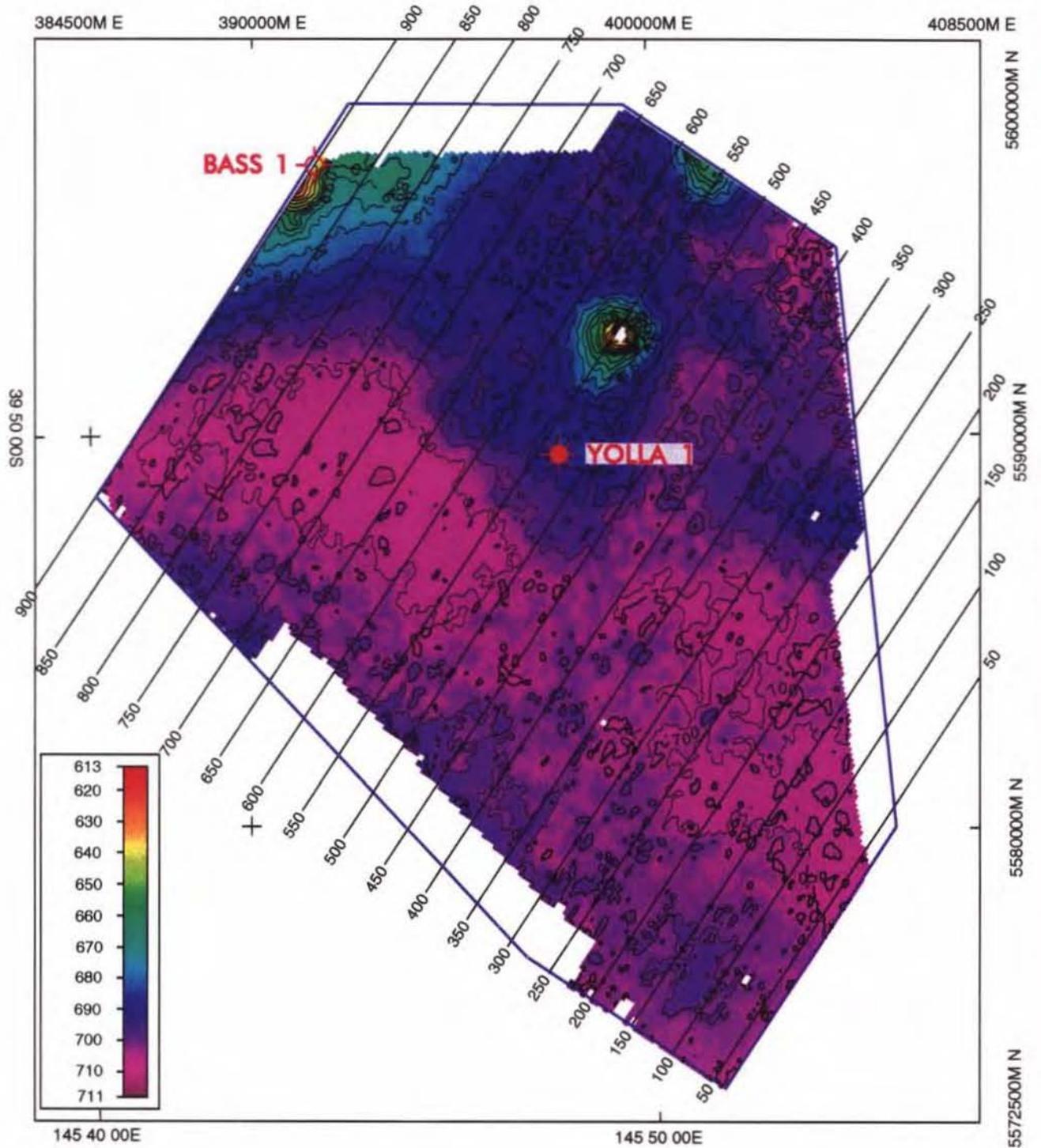




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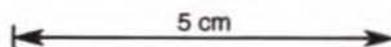


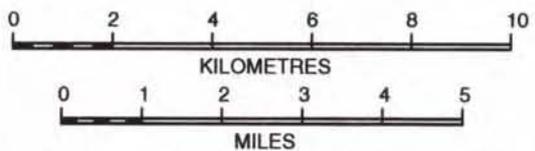
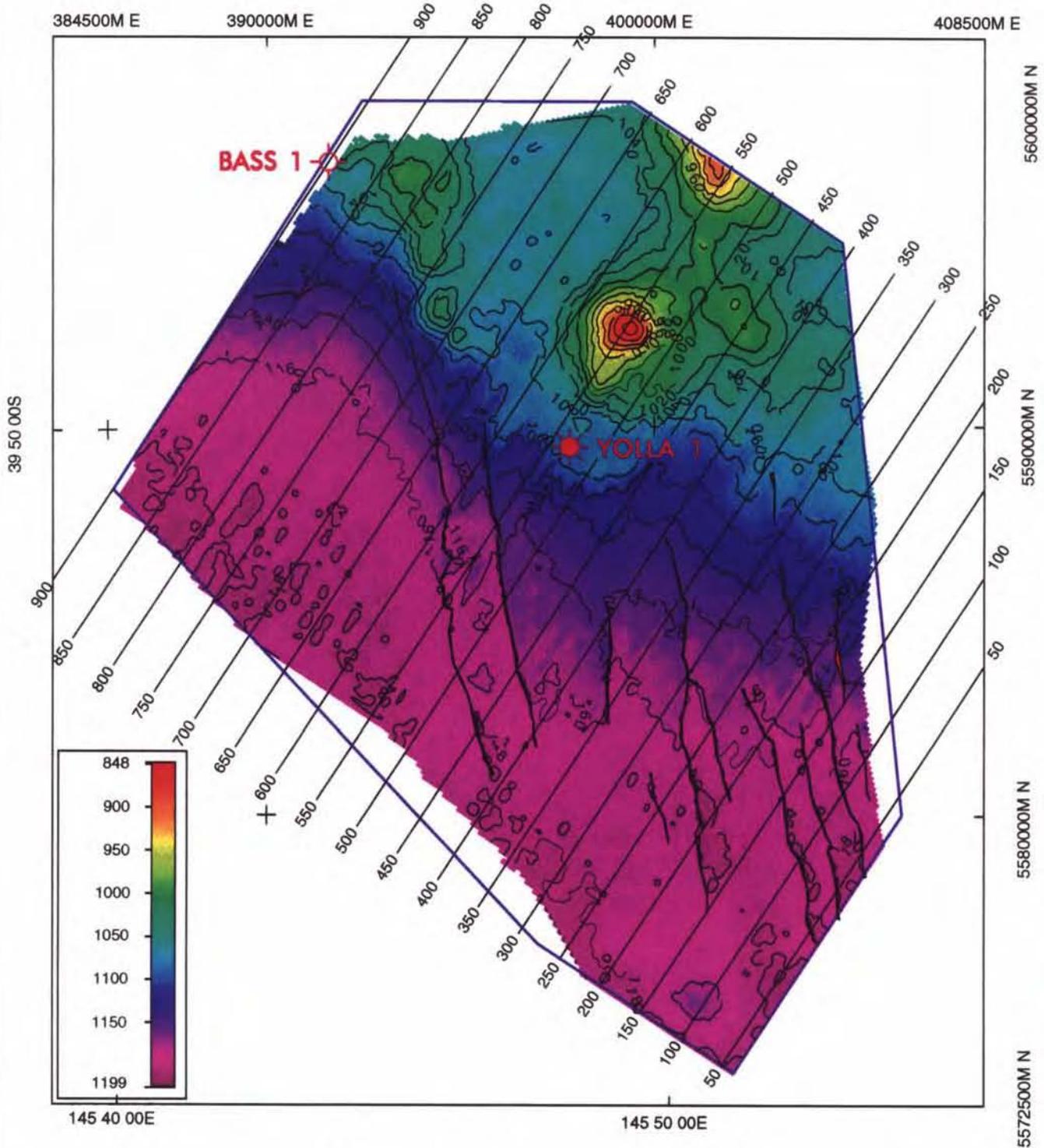


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TRL1 BASS BASIN TASMANIA

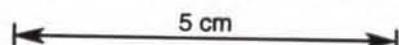
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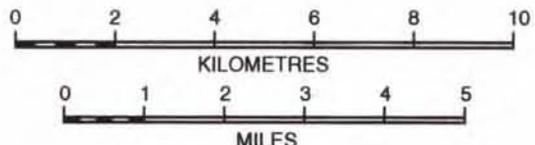
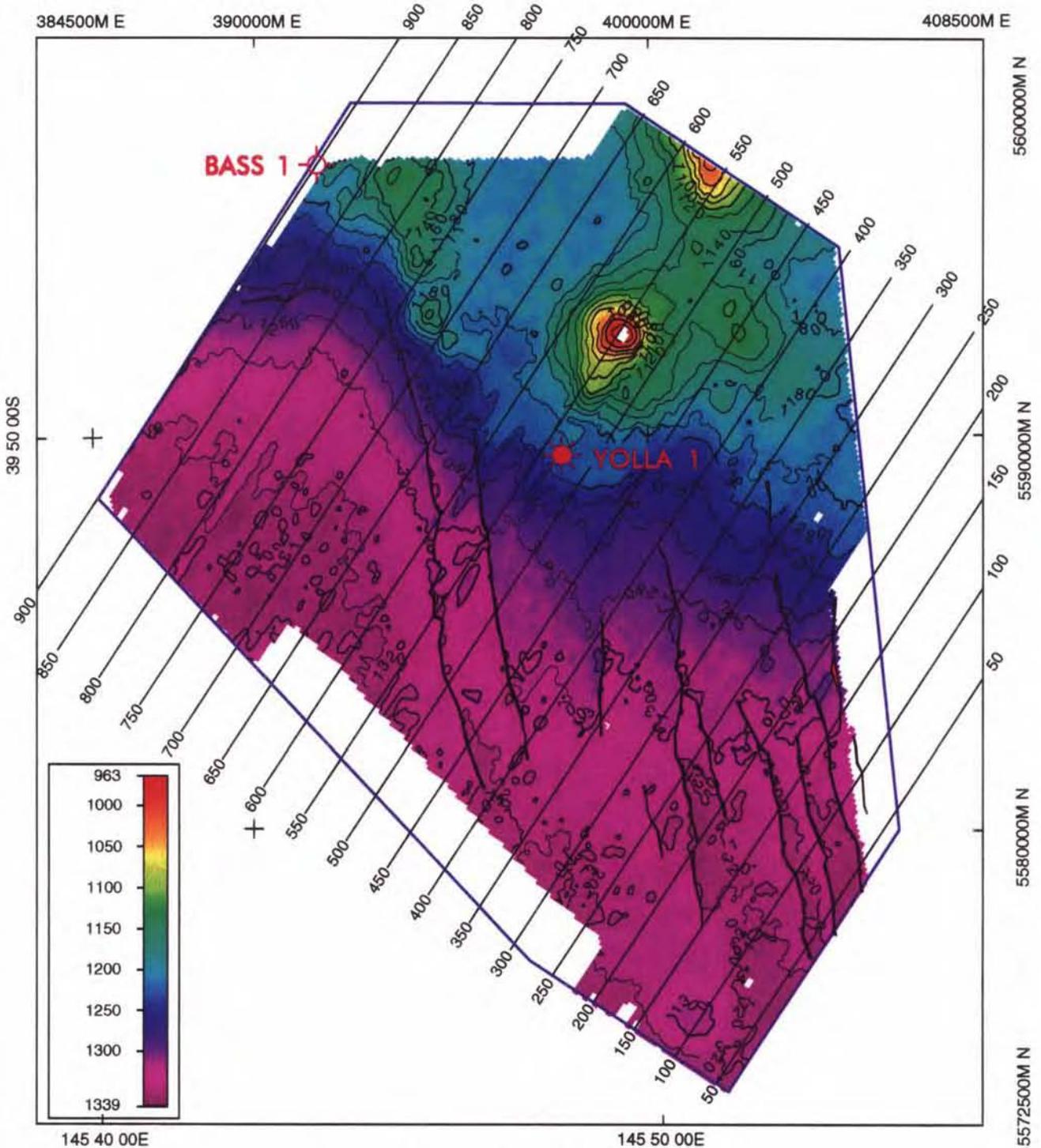




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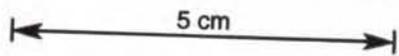
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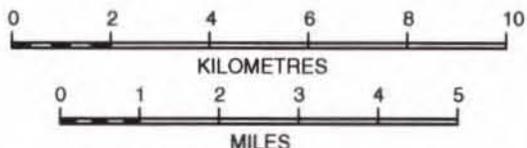
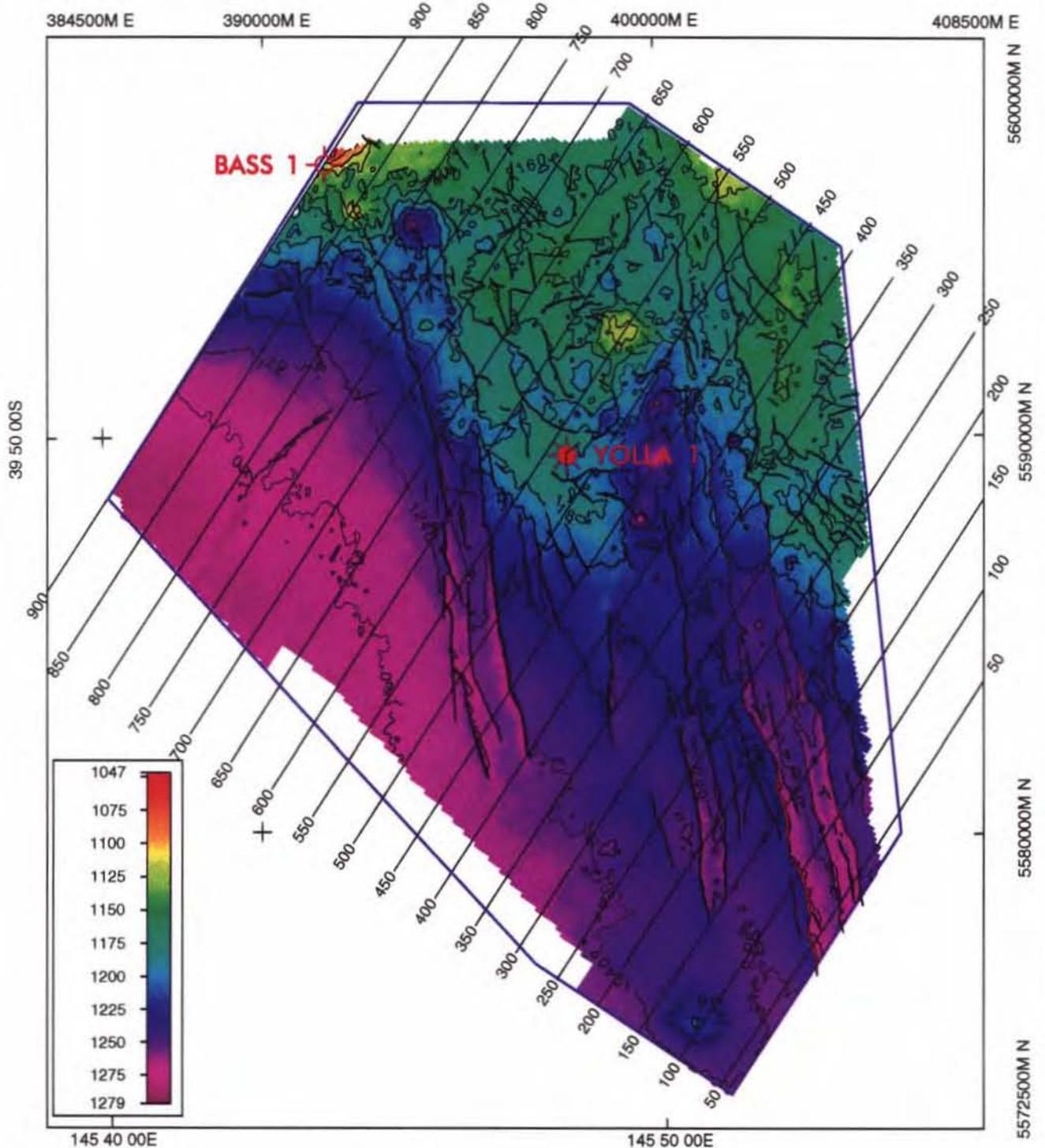




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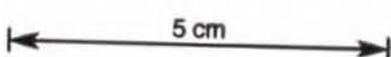
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**TOP MIOCENE VOLCANICS, DEPTH STRUCTURE**

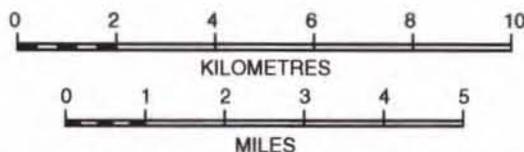
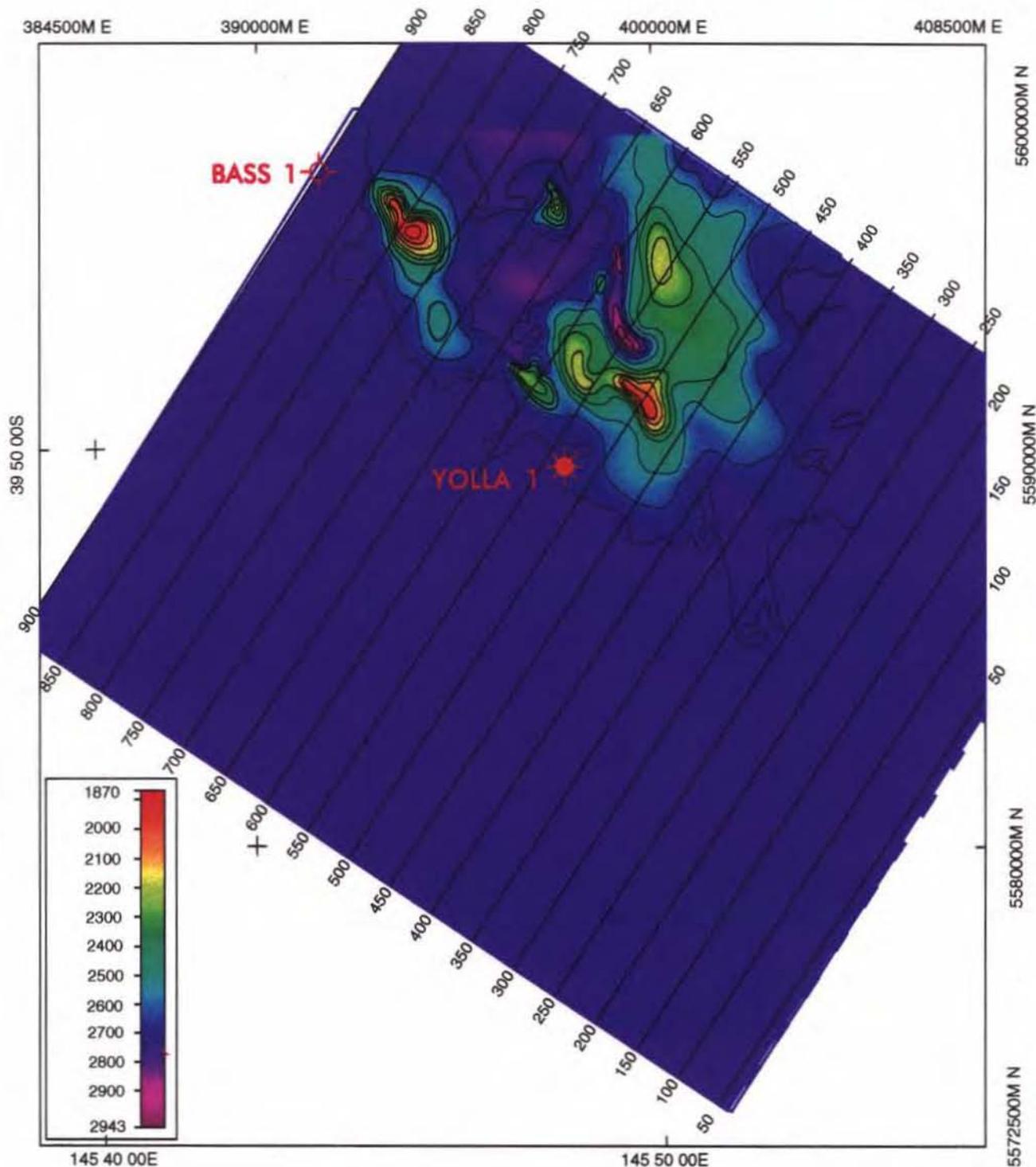




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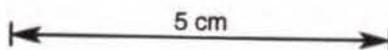
**TRL1 BASS BASIN TASMANIA**  
**BASE MIOCENE VOLCANICS, TIME STRUCTURE**

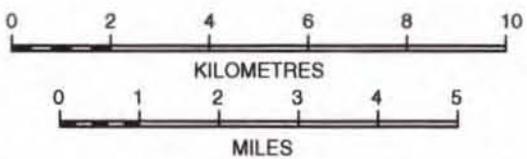
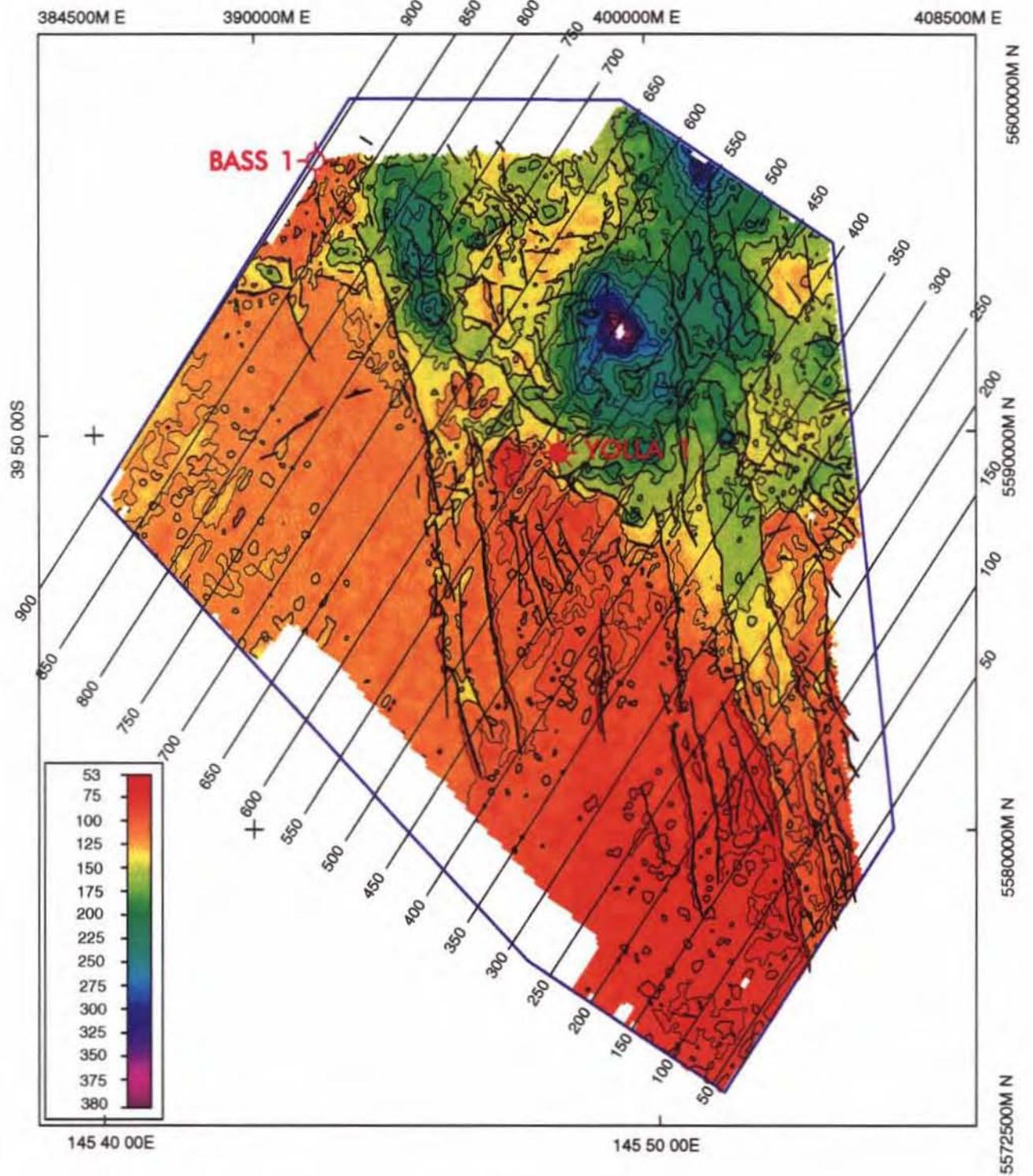




UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
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 CENTRAL MERIDIAN 147 00 00E

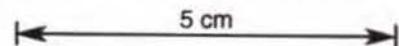
**TRL1 BASS BASIN TASMANIA**  
**MIOCENE VOLCANICS, INTERVAL VELOCITY FIELD**

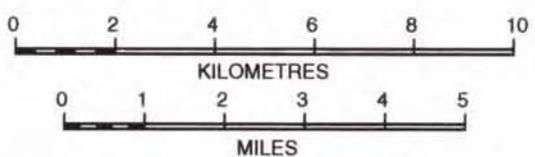
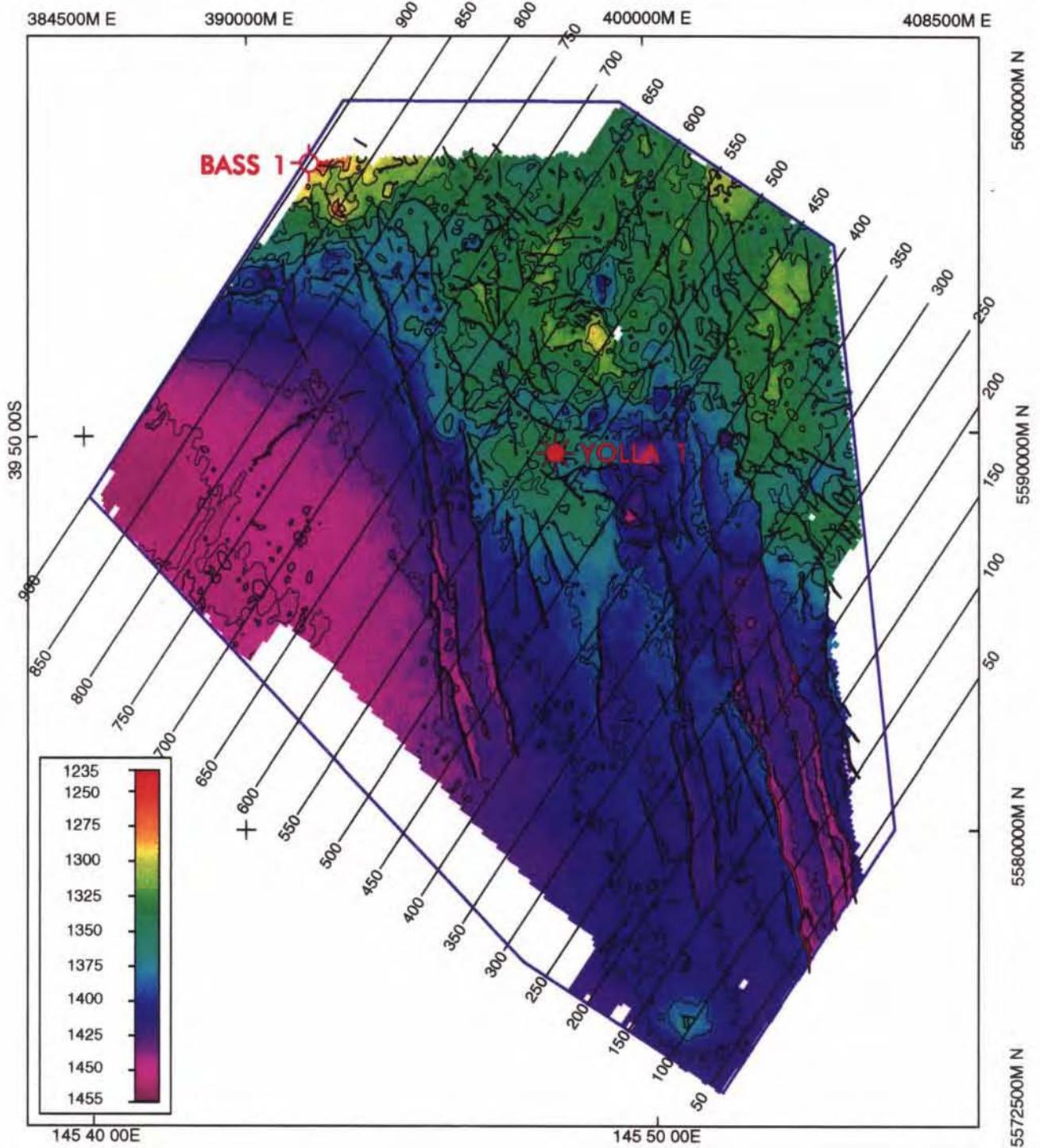




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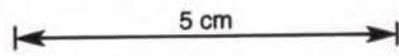
**TRL1 BASS BASIN TASMANIA**  
**MIOCENE VOLCANICS, THICKNESS MAP**

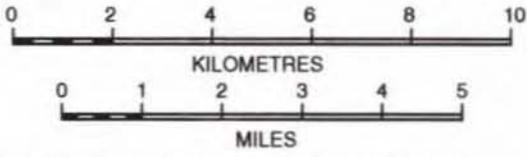
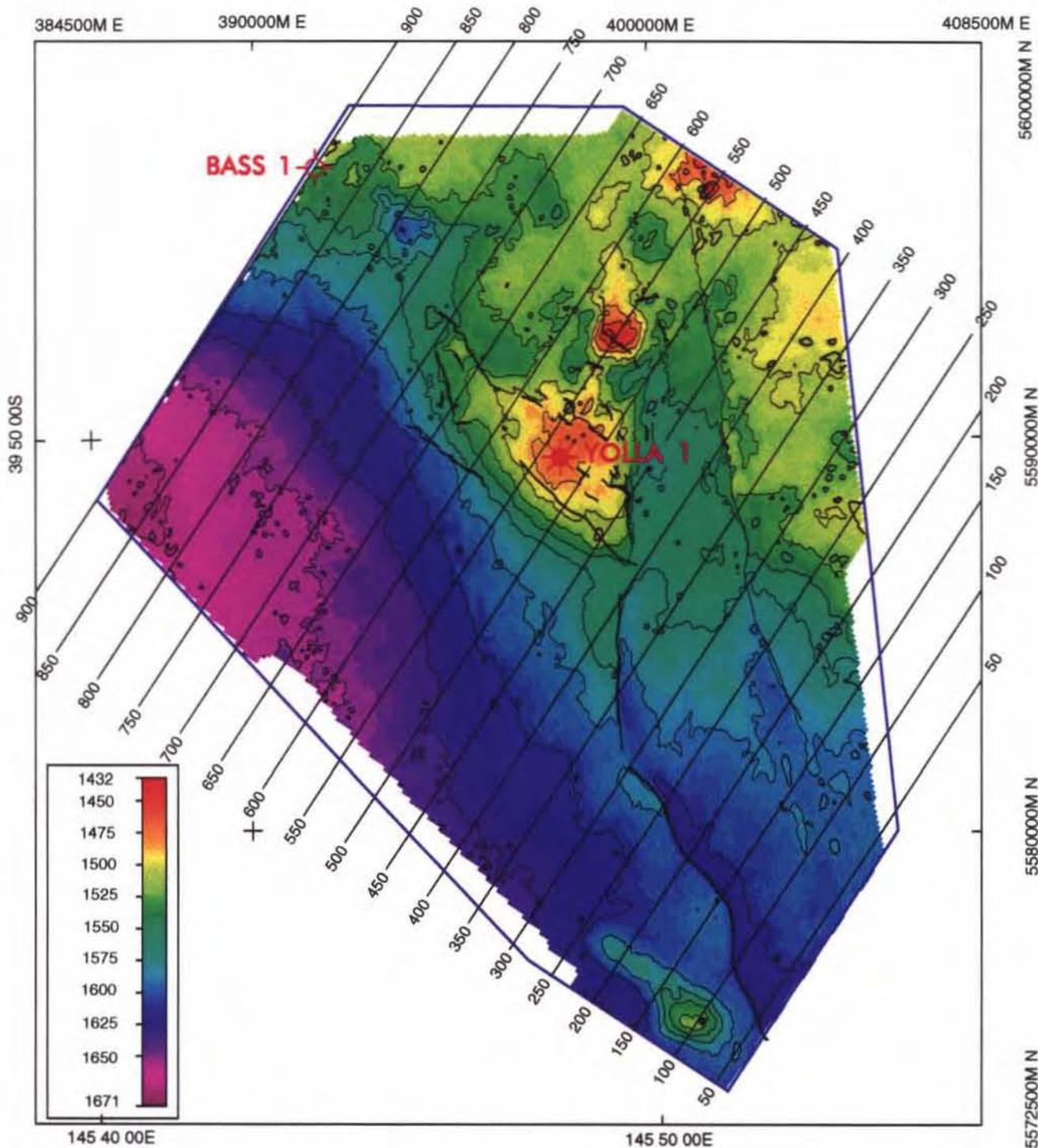




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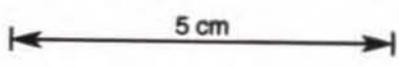
**T/RL1 BASS BASIN TASMANIA**  
**BASE MIOCENE VOLCANICS. DEPTH STRUCTURE**

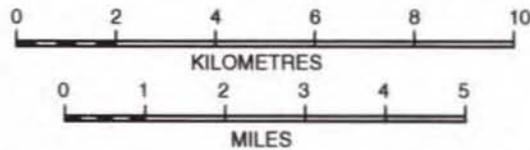
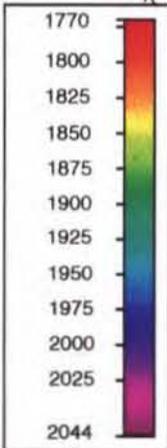
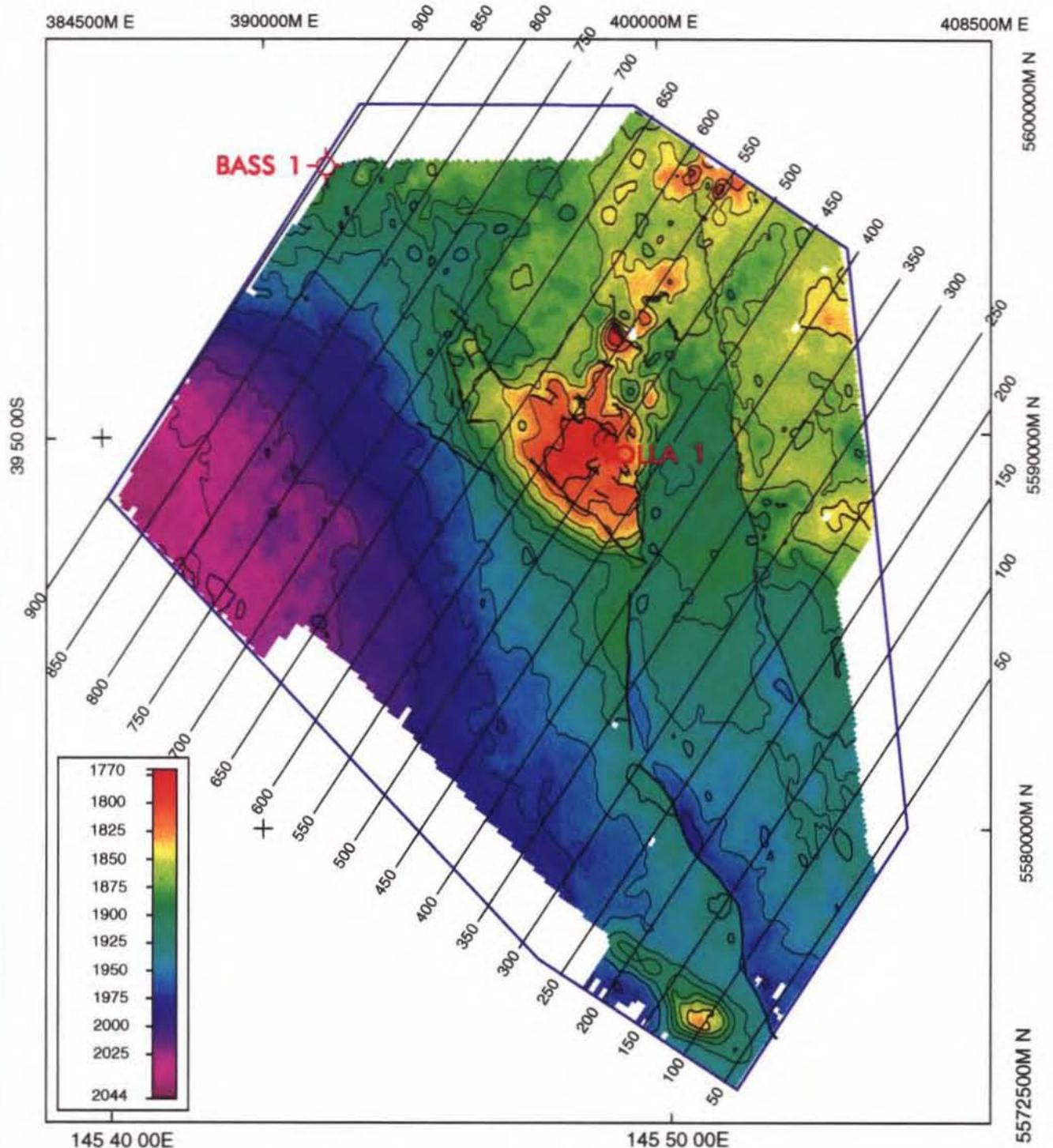




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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**TOP EASTERN VIEW COAL MEASURES, TIME STRUCTURE**



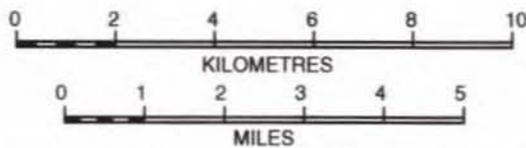
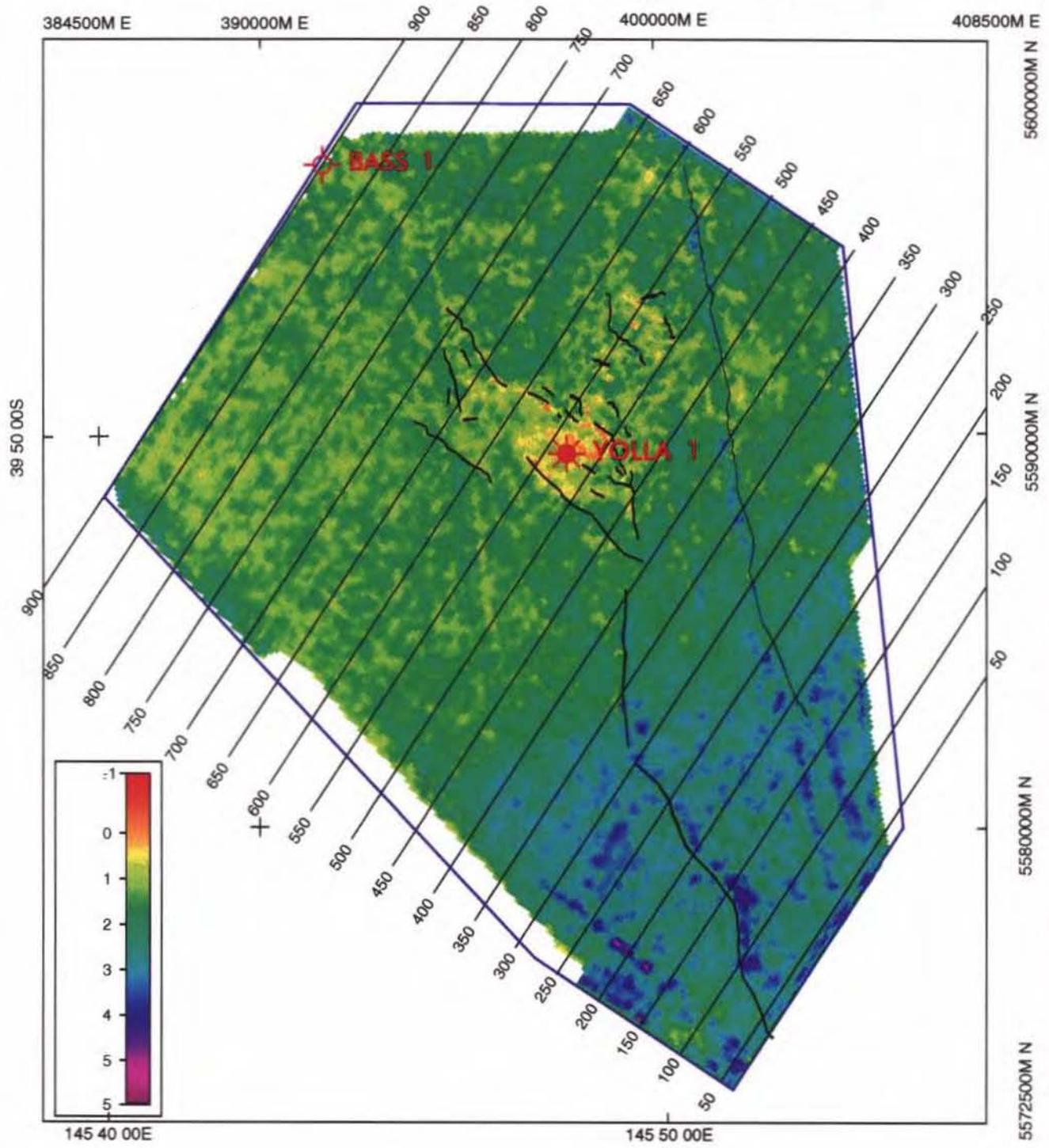


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 CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**TOP EASTERN VIEW COAL MEASURES, DEPTH STRUCTURE**

← 5 cm →

516073



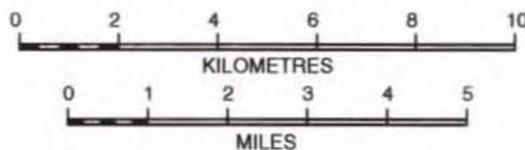
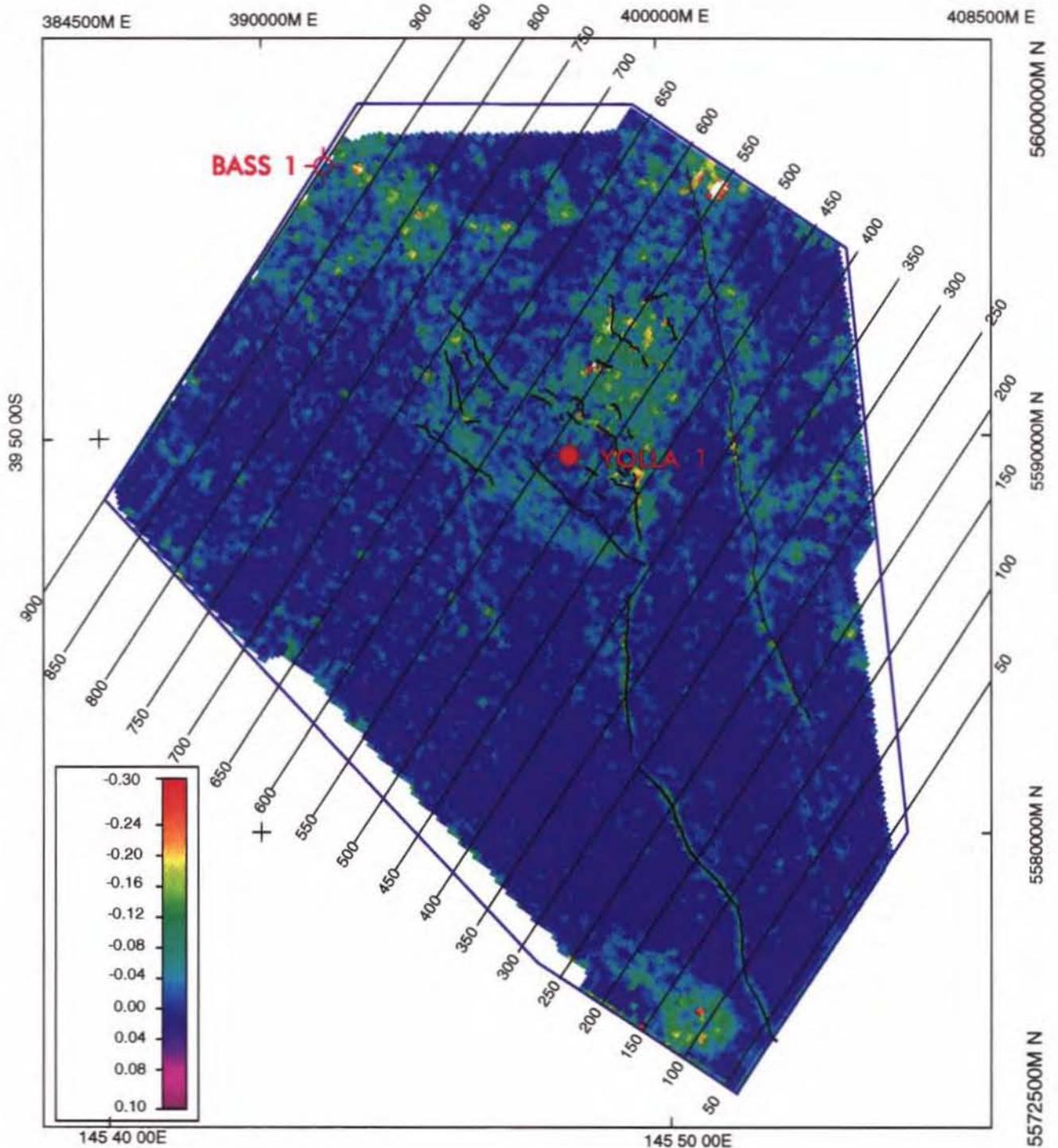
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

T/RL1 BASS BASIN TASMANIA

TOP EASTERN VIEW COAL MEASURES, AMPLITUDE



5 cm



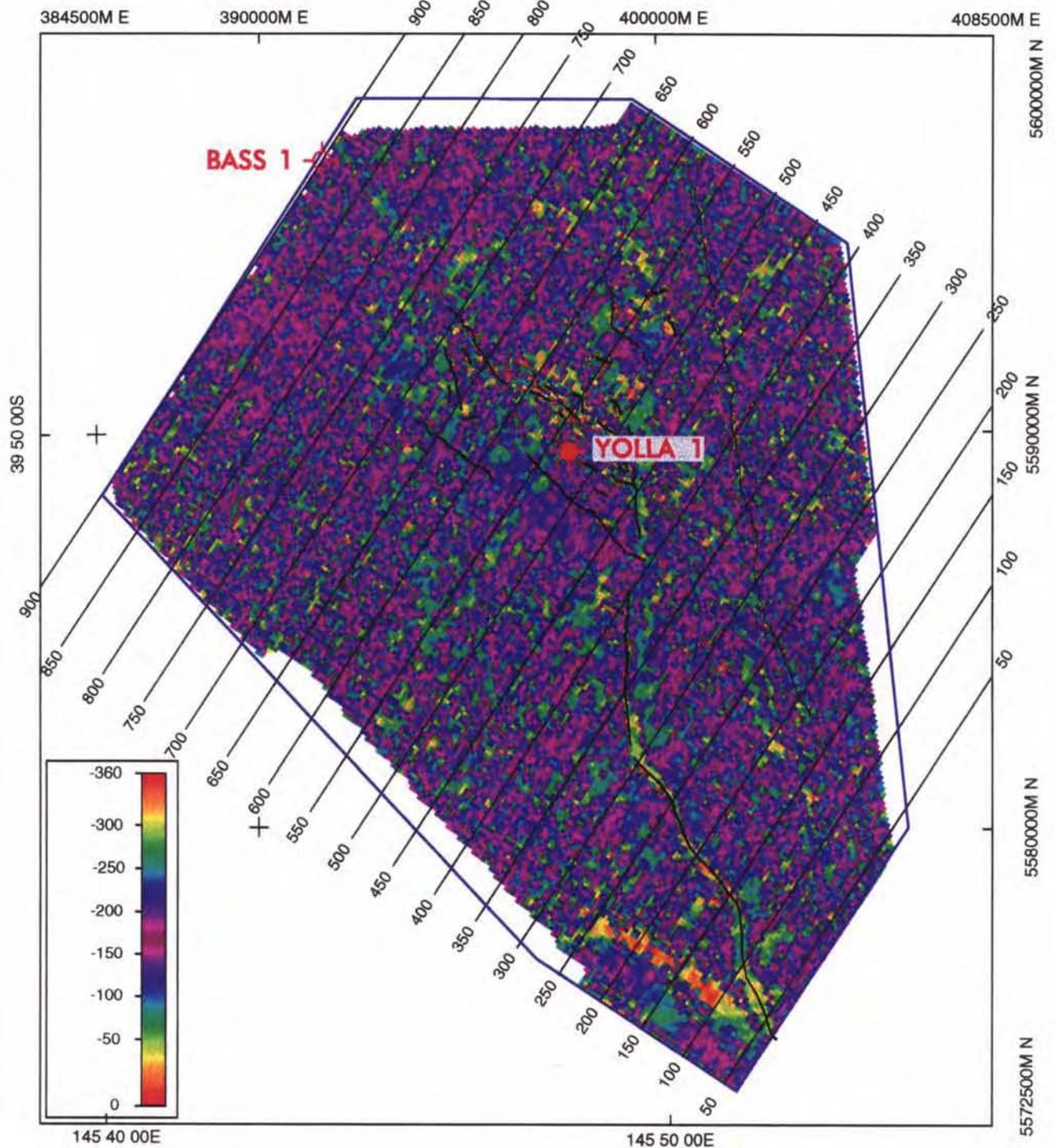
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA  
TOP EASTERN VIEW COAL MEASURES,  
DIP MAGNITUDE (DEGREES)**

5 cm

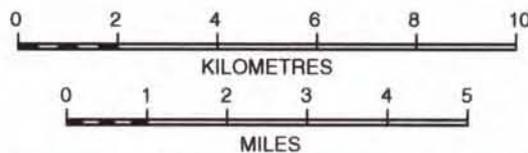
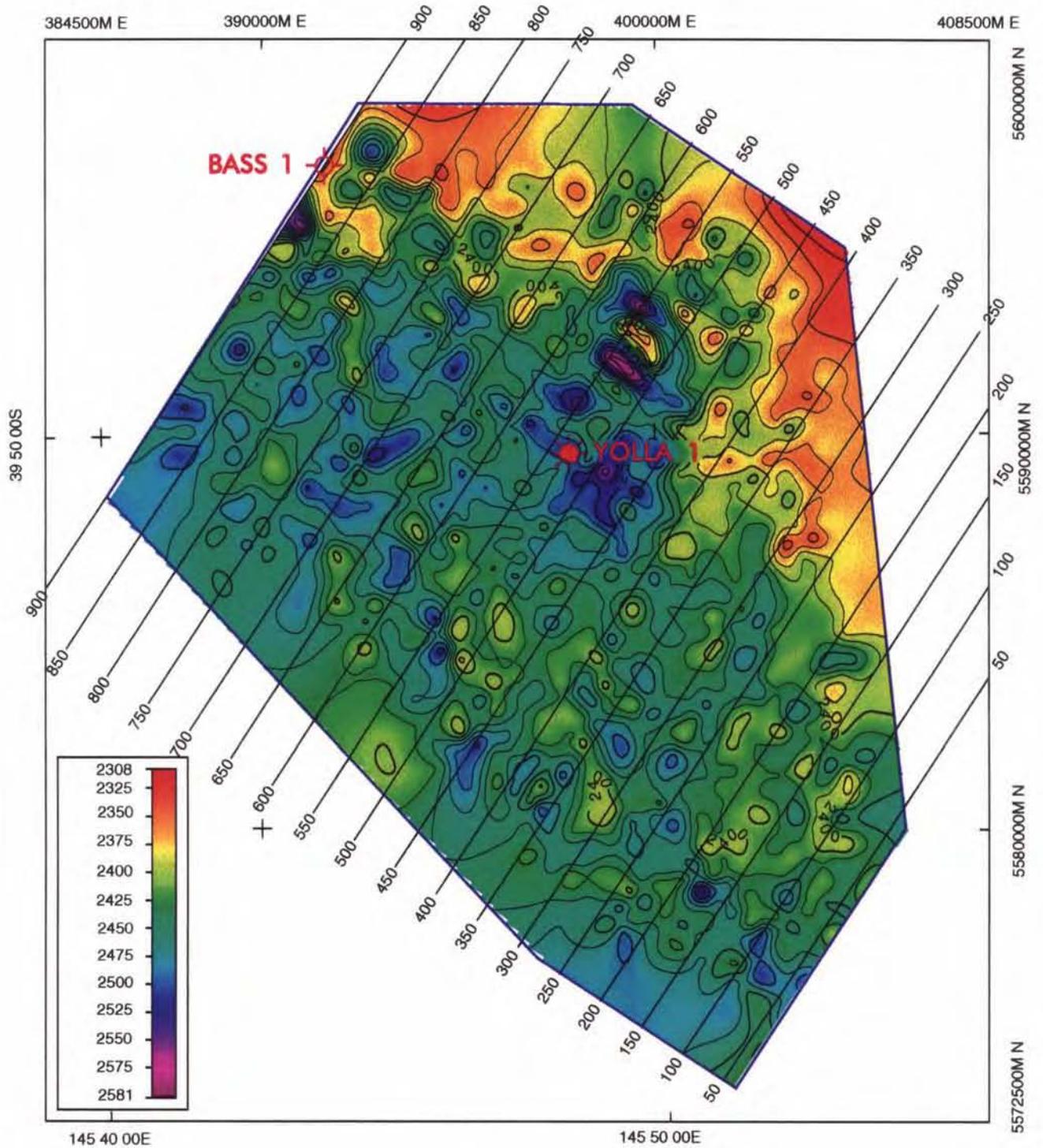


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UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

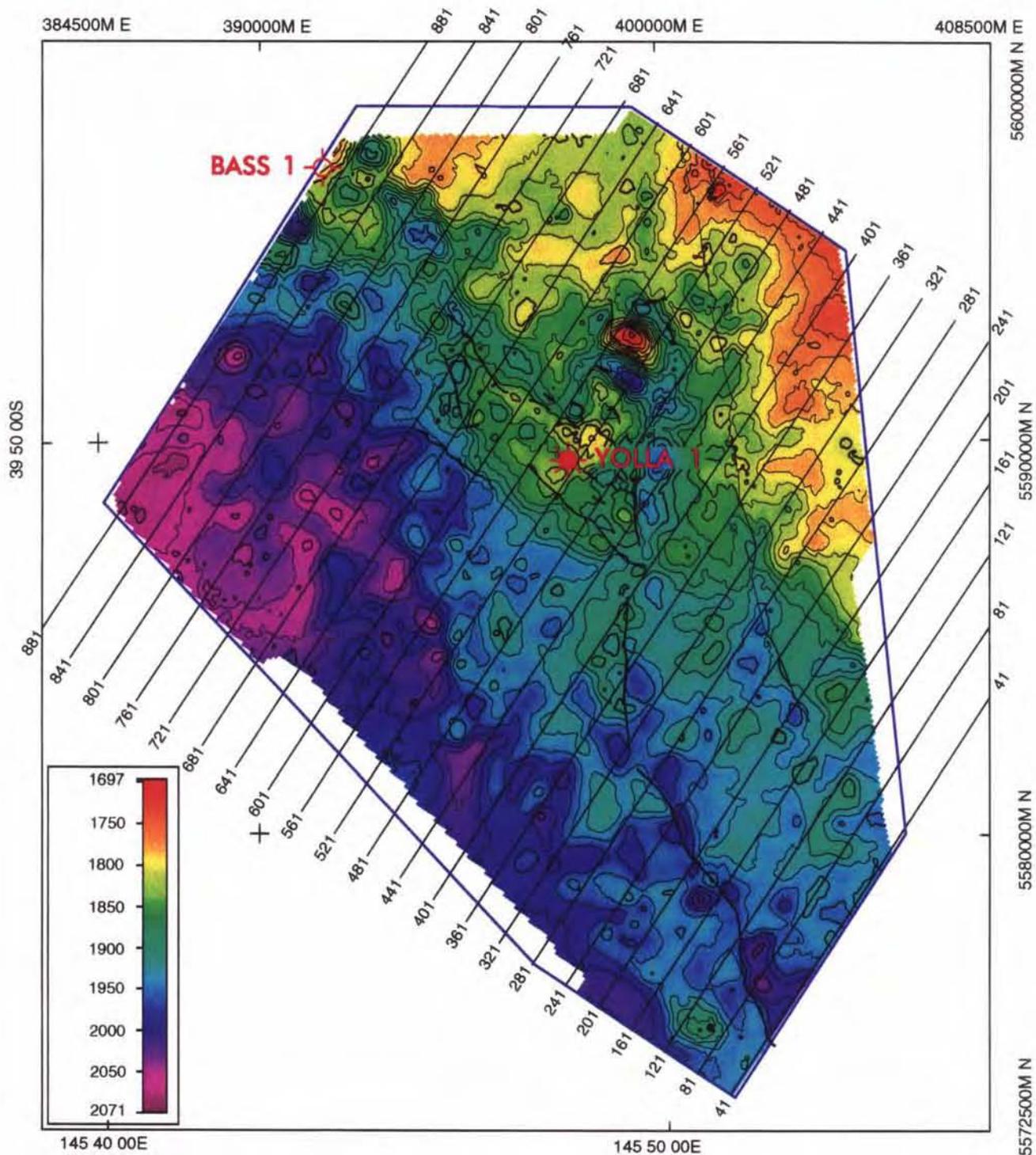
**TRL1 BASS BASIN TASMANIA**  
**TOP EASTERN VIEW COAL MEASURES,**  
**DIP AZIMUTH (DEGREES)**



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AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

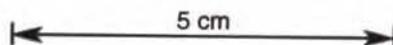
**T/RL1 BASS BASIN TASMANIA  
TOP EASTERN VIEW COAL MEASURES  
RMS STACKING VELOCITY FIELD**

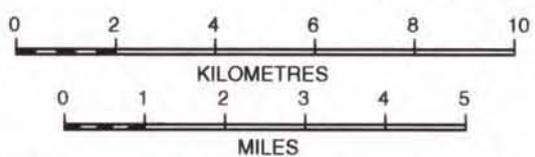
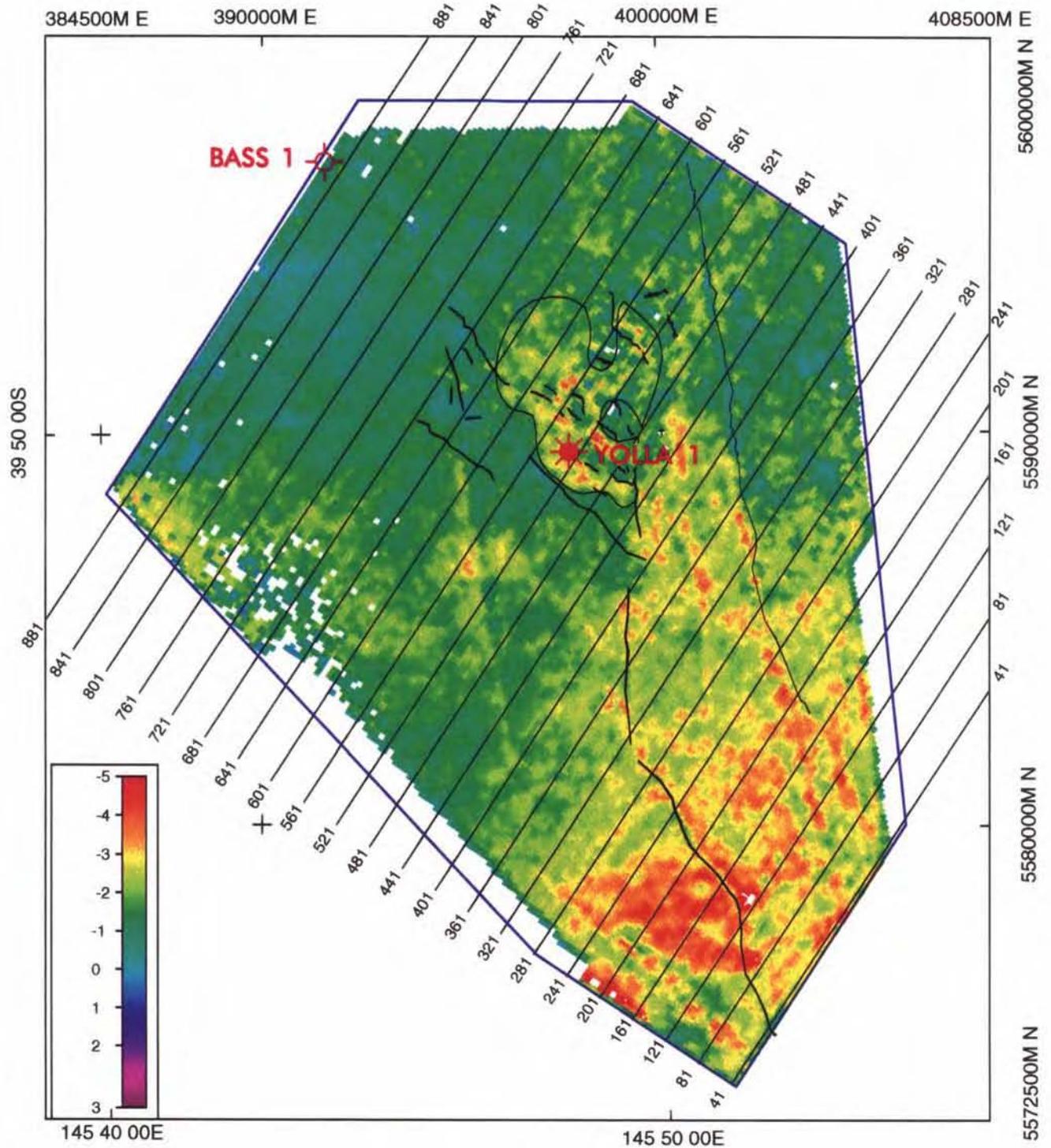
5 cm



UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
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CENTRAL MERIDIAN 147 00 00E

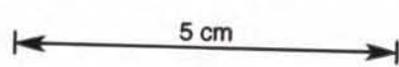
**TRL1 BASS BASIN    TASMANIA**  
**TOP EASTERN VIEW COAL MEASURES**  
**(RMS STACKING VELOCITY DERIVED) DEPTH STRUCTURE**



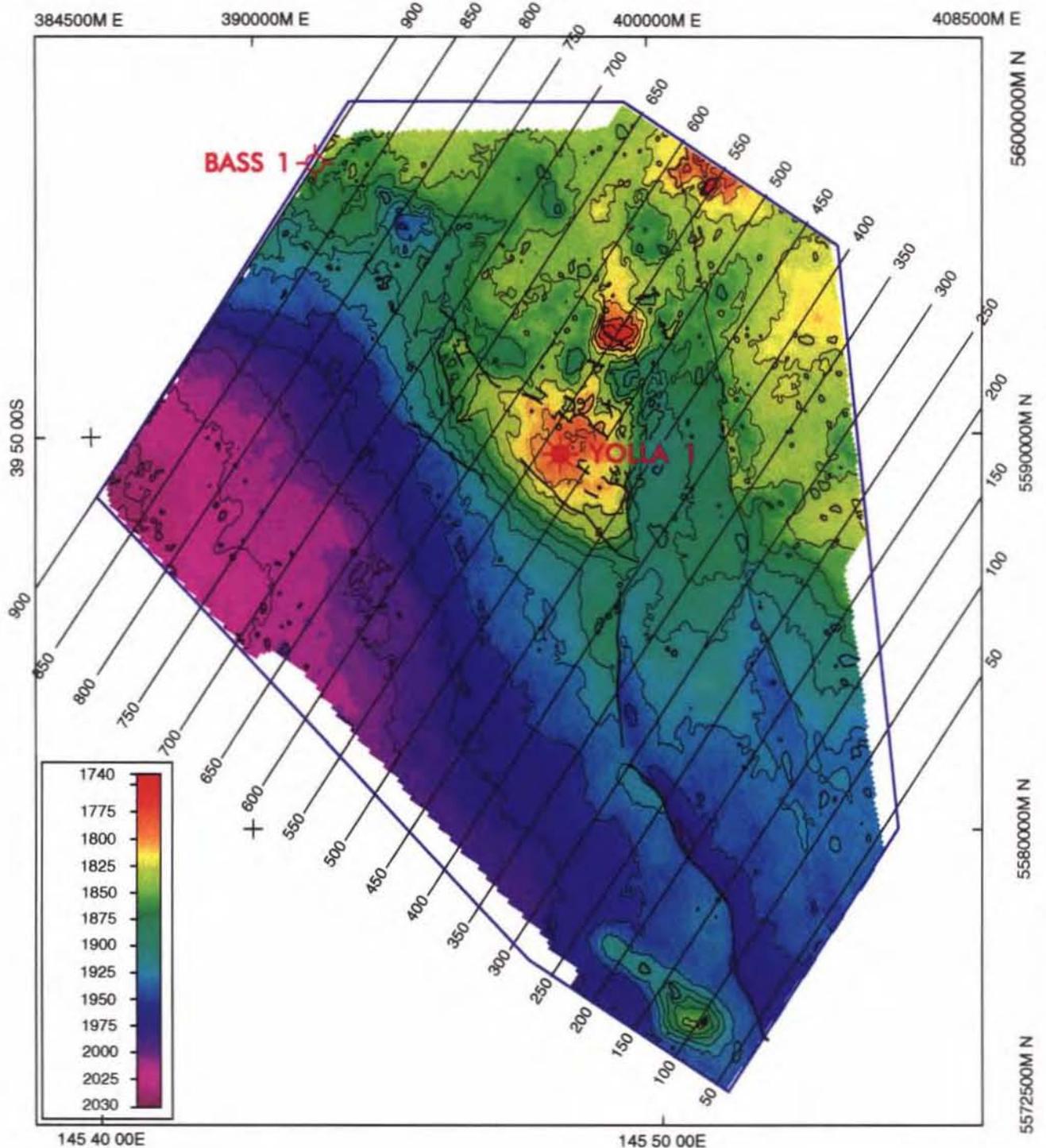


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AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**TOP EASTERN VIEW COAL MEASURES**  
**+15 MSECS, AMPLITUDE**

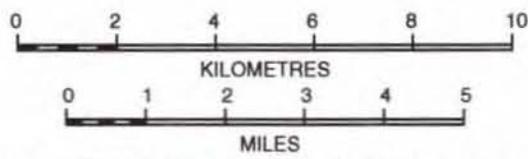
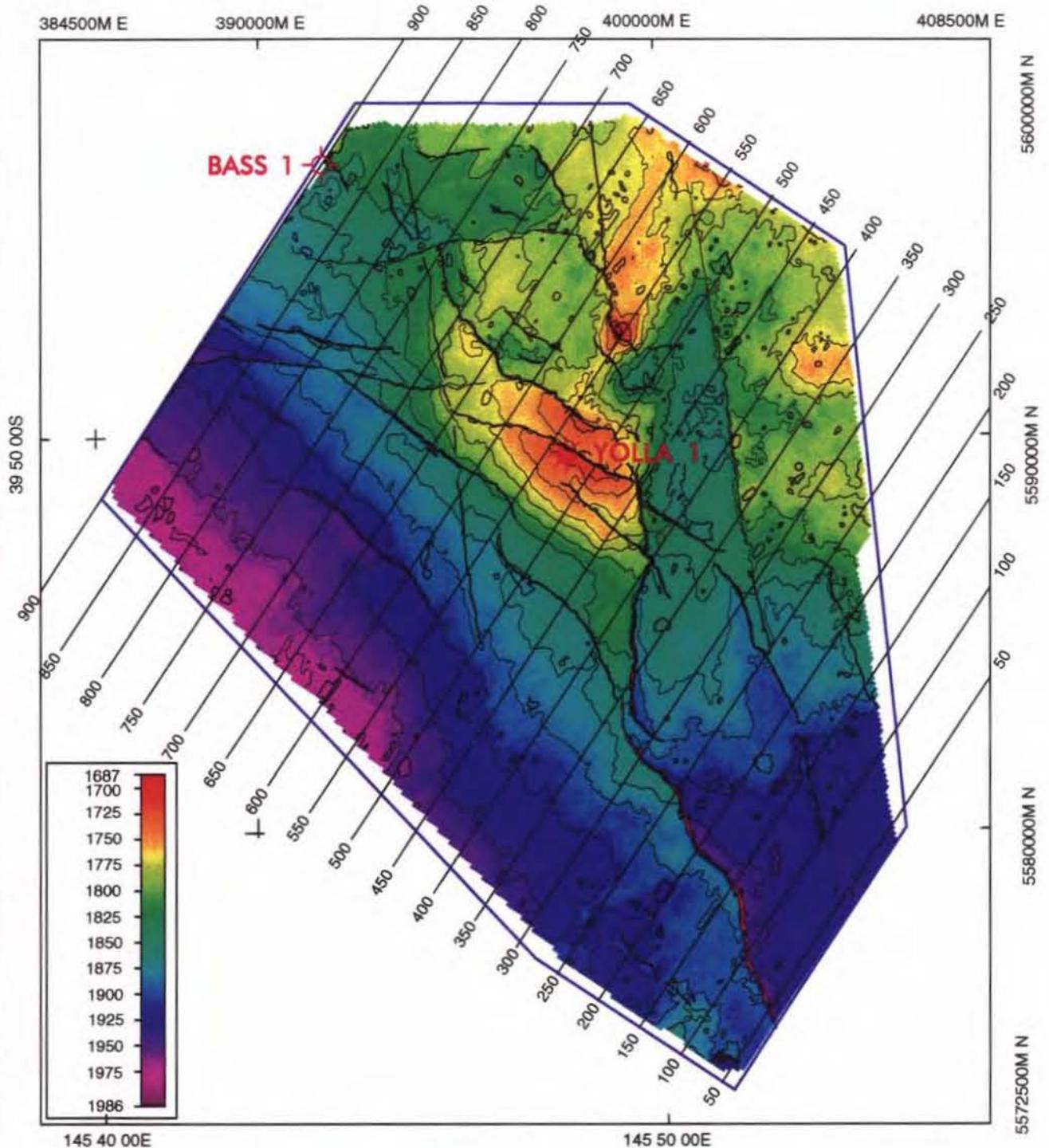


5 cm



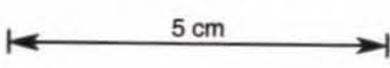
**T/RL1 BASS BASIN TASMANIA  
TOP EASTERN VIEW COAL MEASURES, (AVERAGE  
VELOCITY DERIVED) DEPTH STRUCTURE**

516080

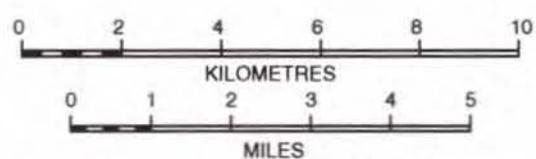
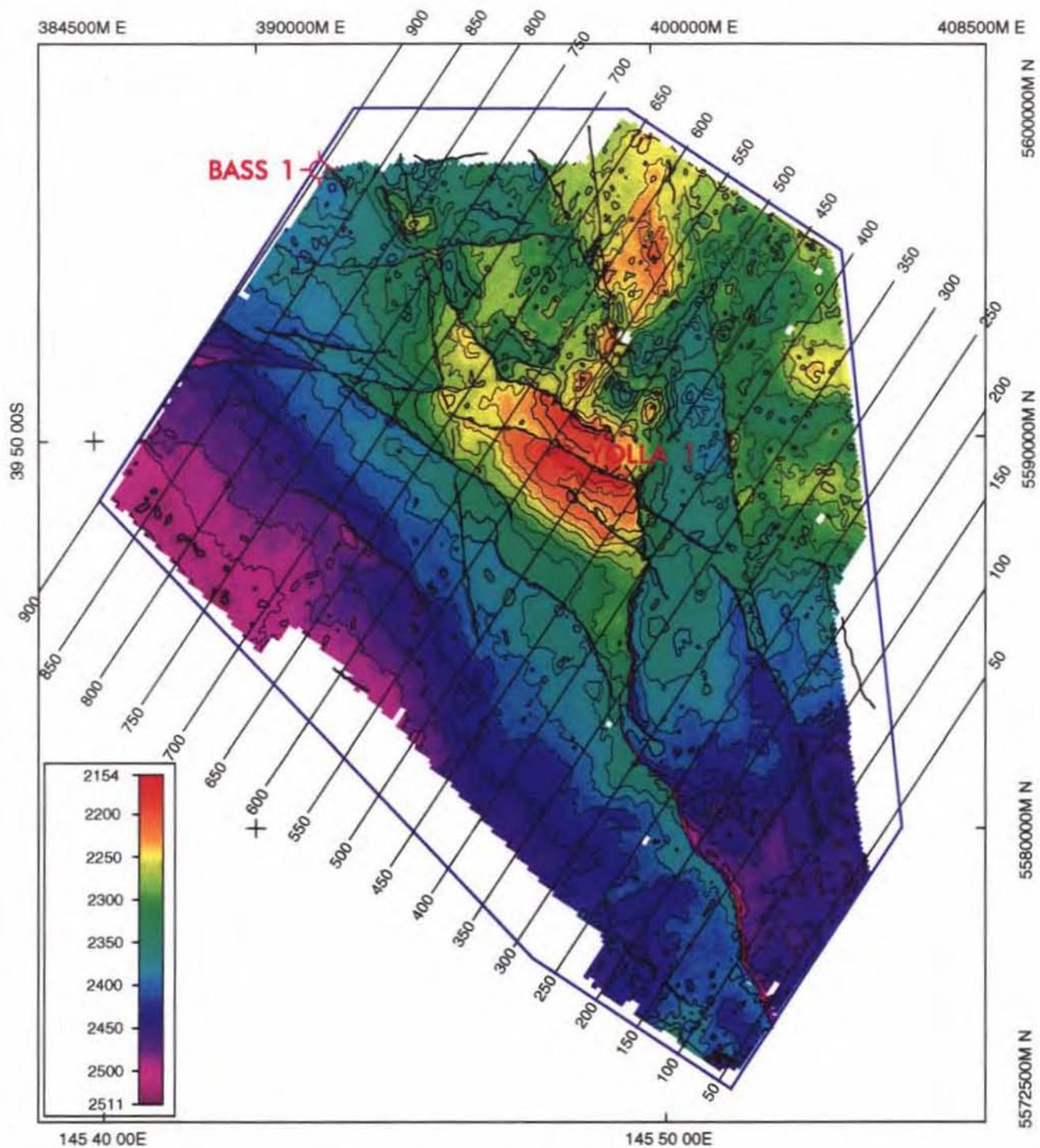


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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA**  
**EARLY EOCENE, TIME STRUCTURE**

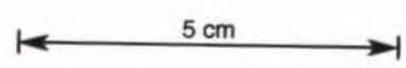


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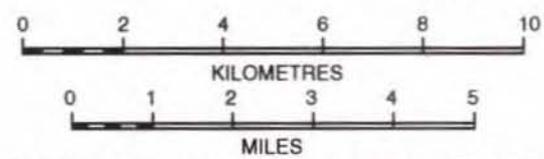
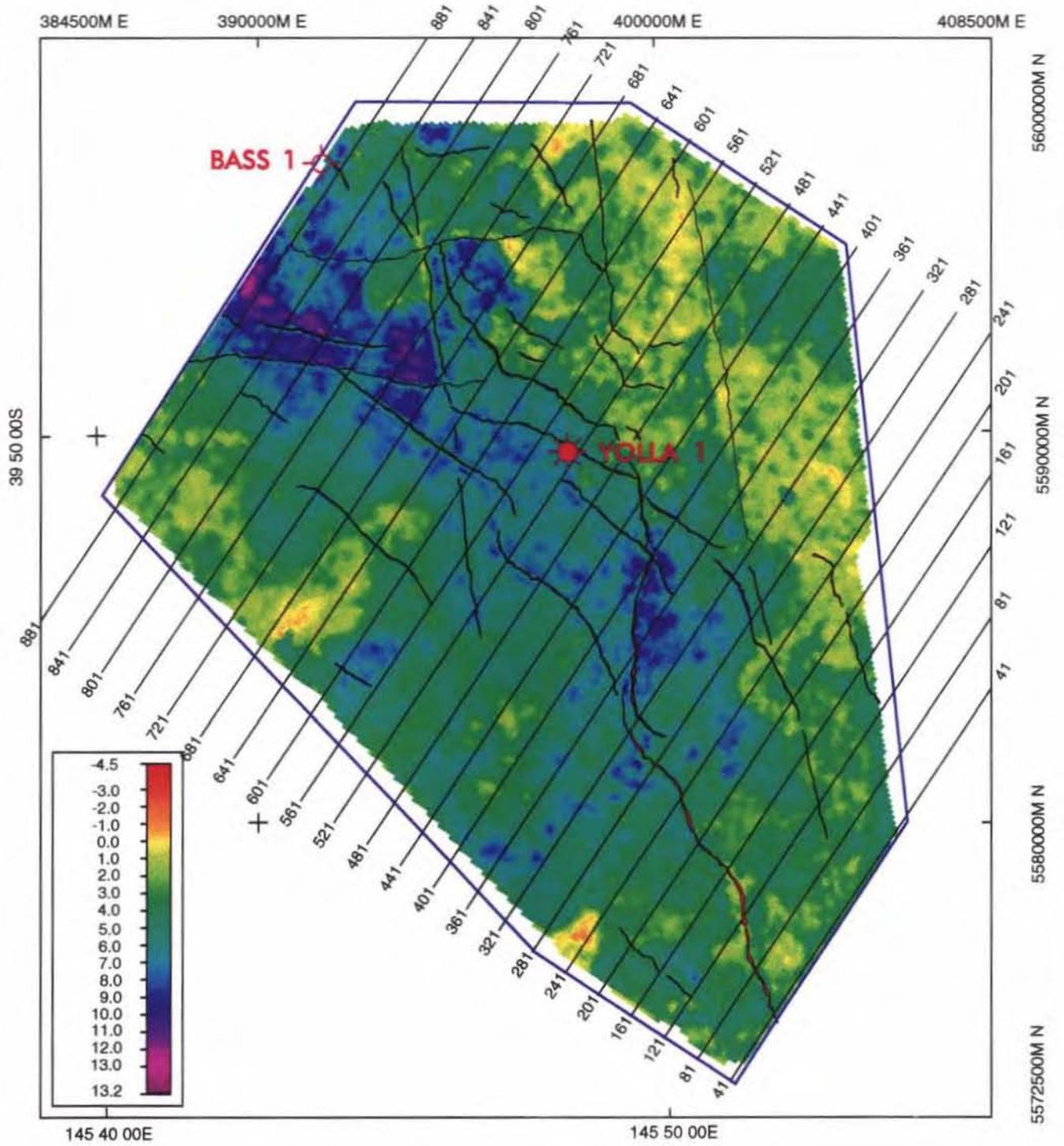


UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA  
 EARLY EOCENE, DEPTH STRUCTURE**

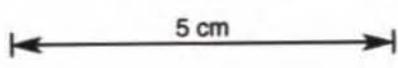


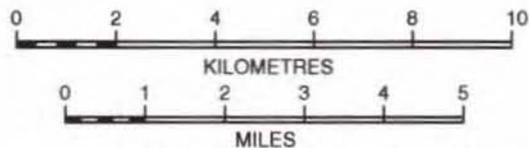
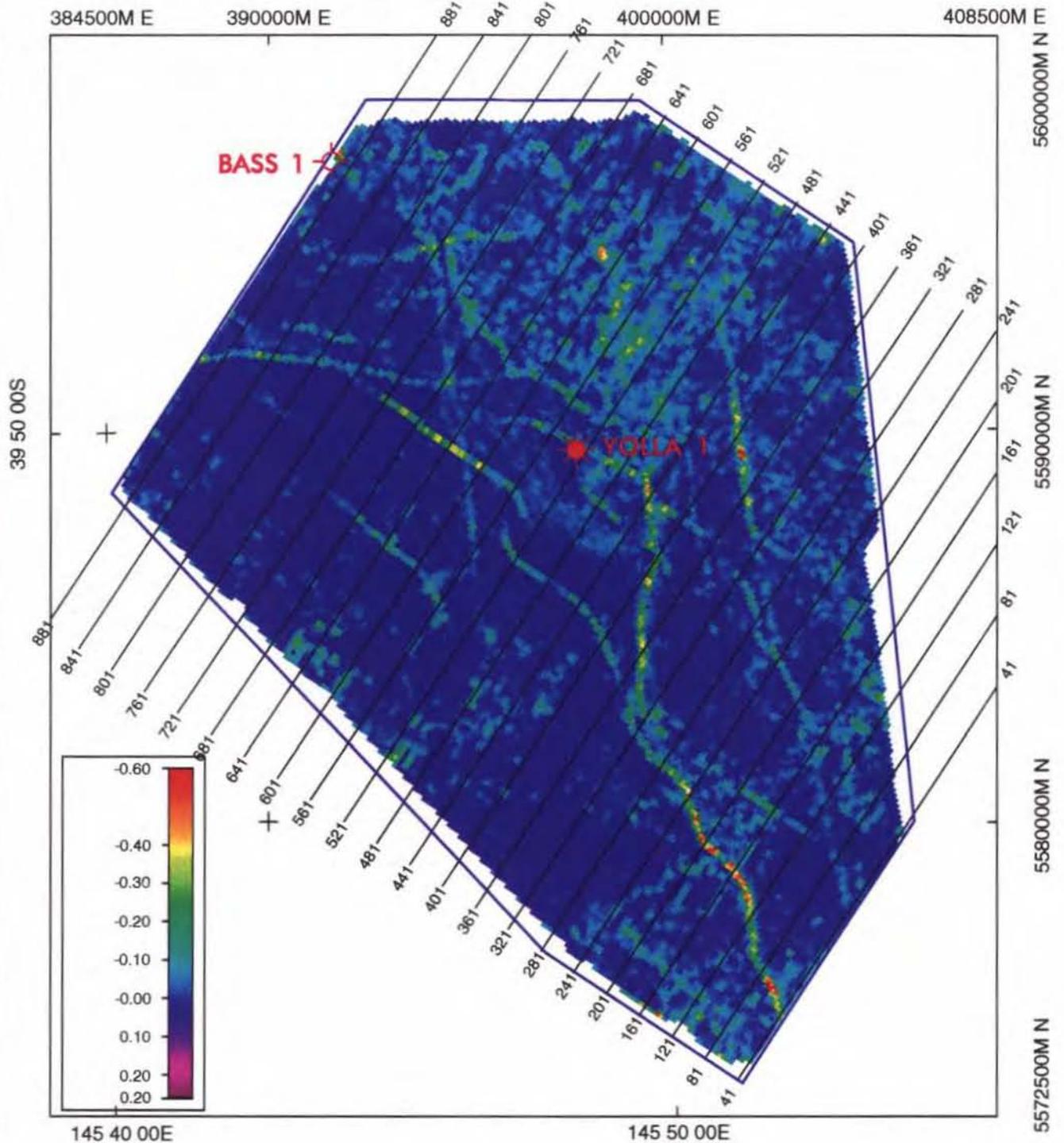
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 CENTRAL MERIDIAN 147 00 00E

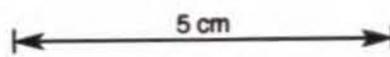
**T/RL1 BASS BASIN TASMANIA**  
**EARLY EOCENE, AMPLITUDE**



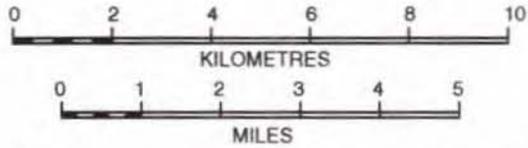
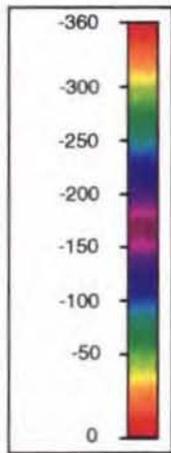
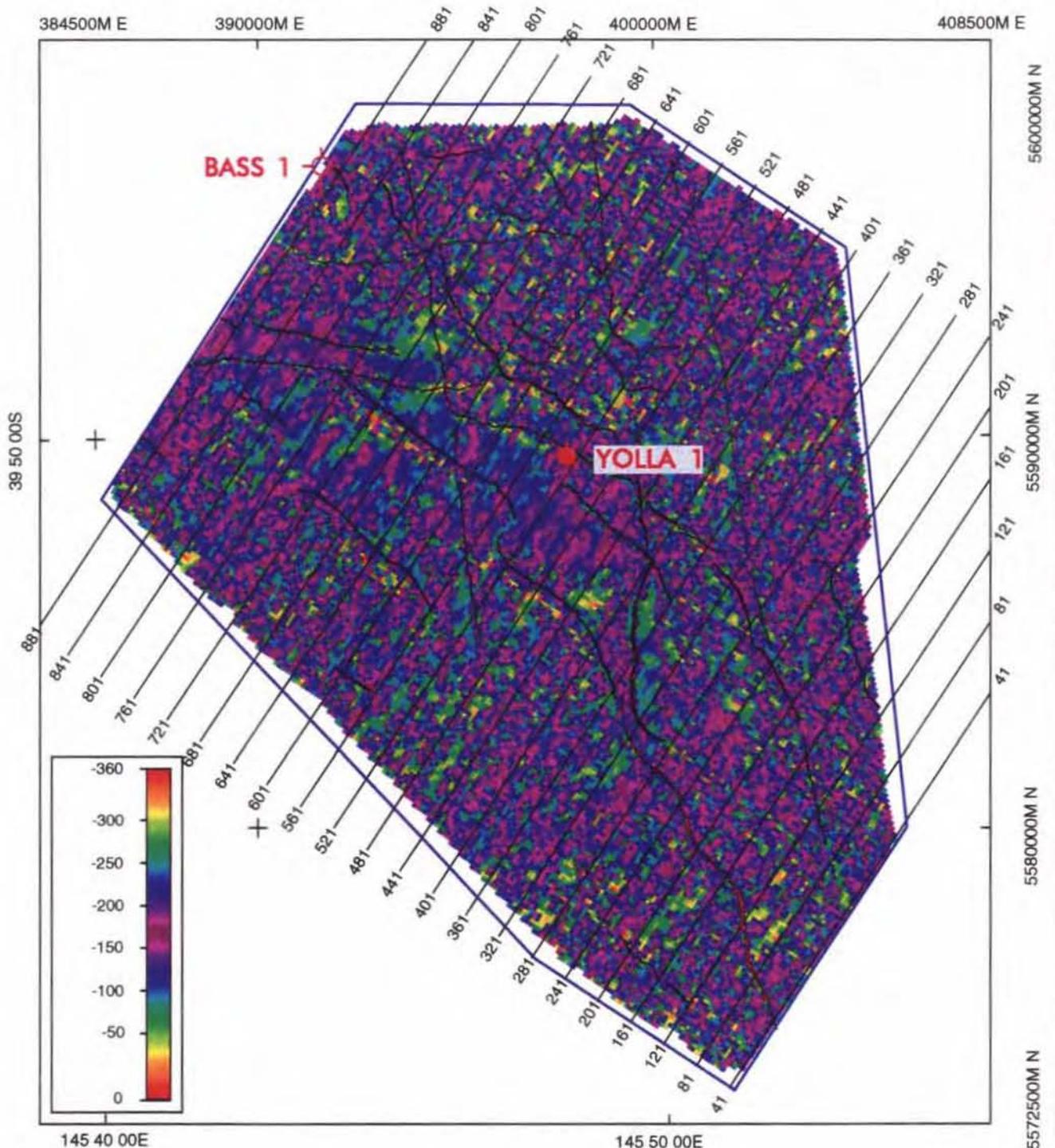


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 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA**  
**EARLY EOCENE, DIP MAGNITUDE (DEGREES)**



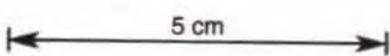
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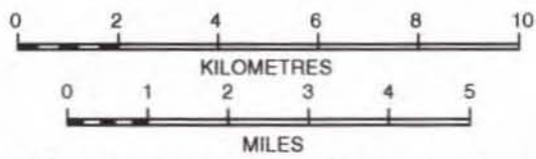
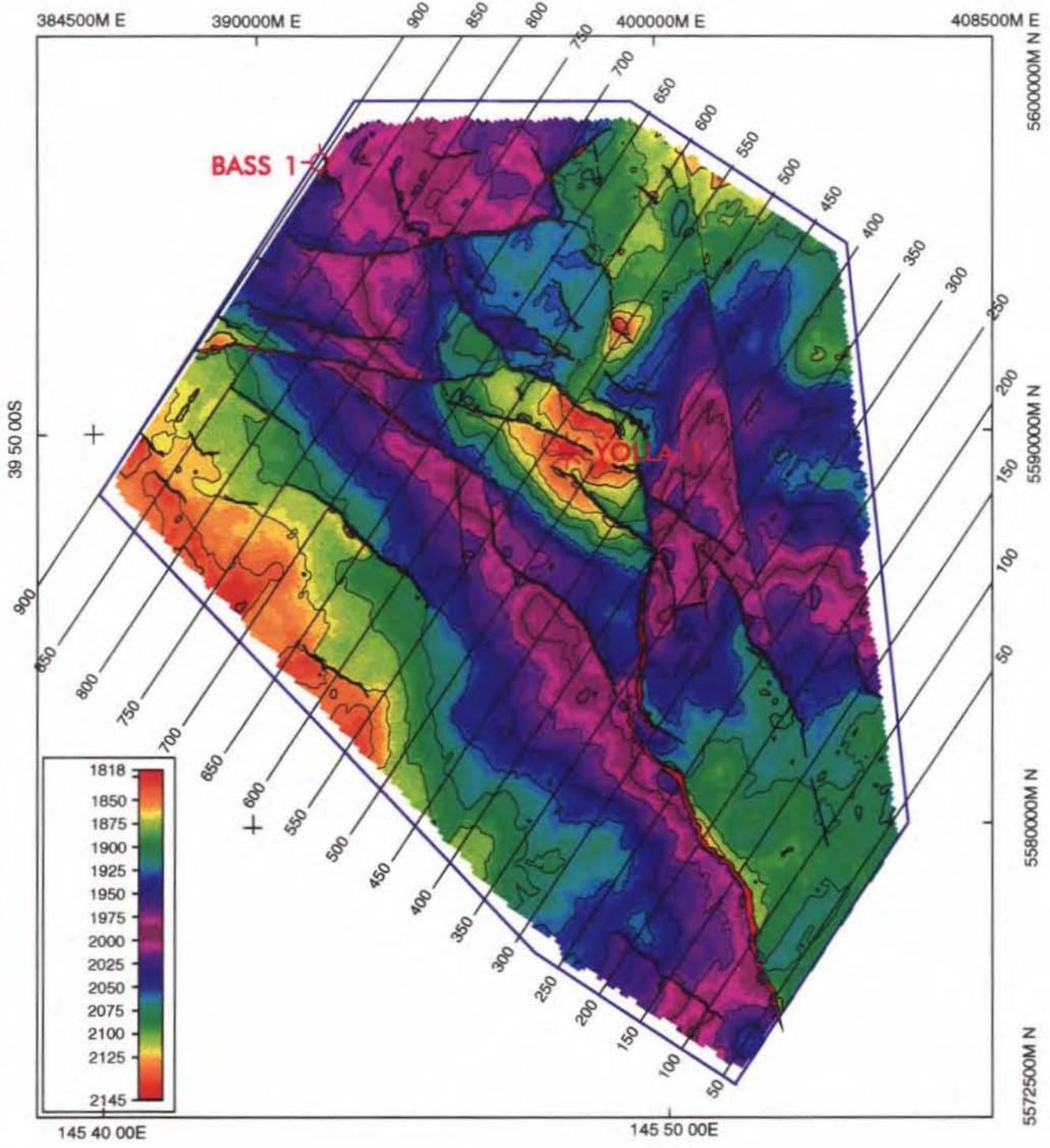
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 CENTRAL MERIDIAN 147 00 00E

T/RL1 BASS BASIN TASMANIA

EARLY EOCENE, DIP AZIMUTH (DEGREES)

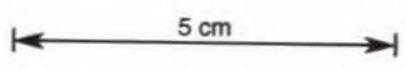


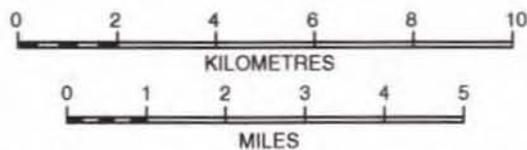
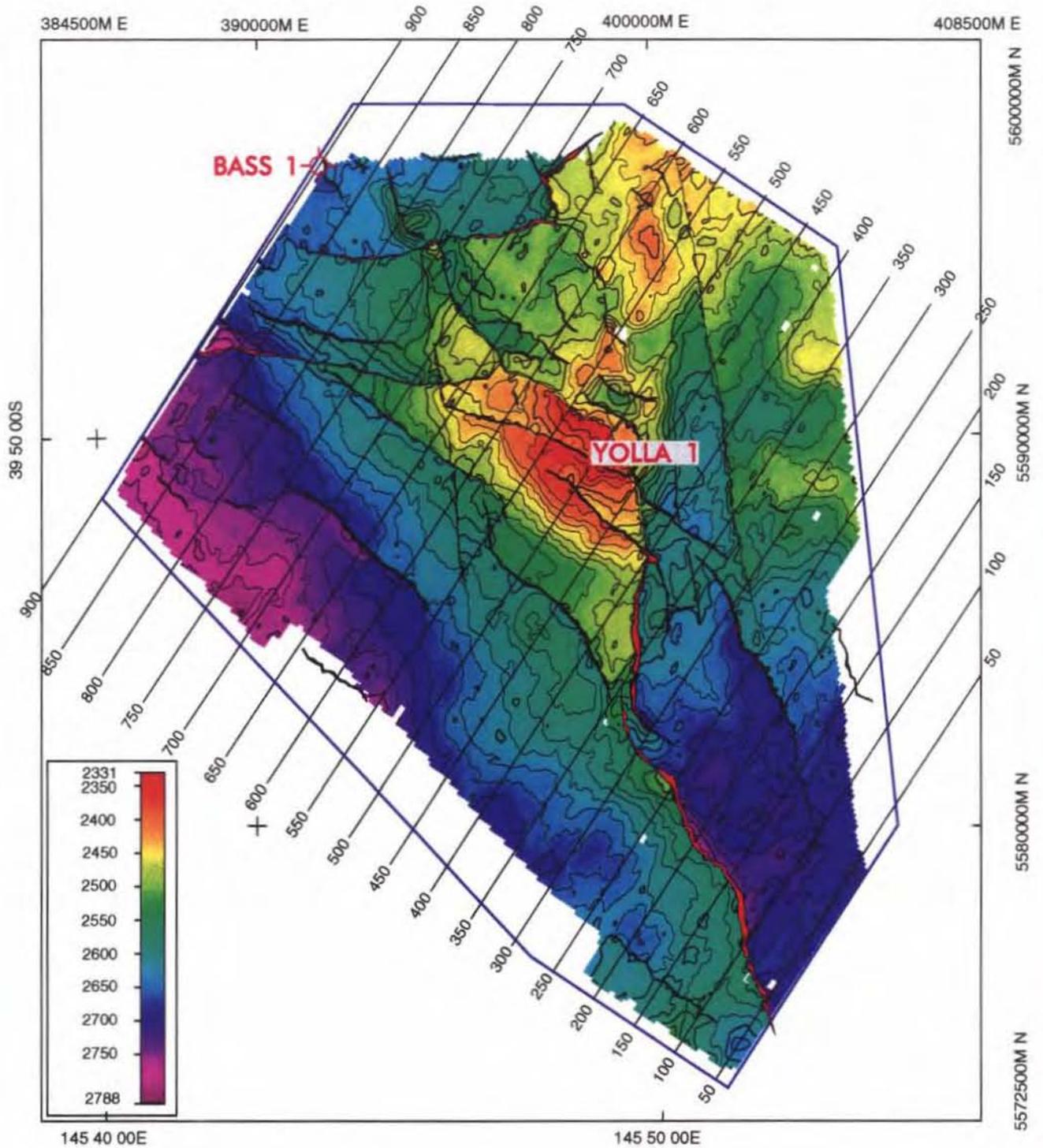
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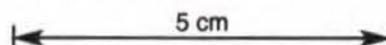
**TRL1 BASS BASIN TASMANIA**  
**MIDDLE M.DIVERSUS, TIME STRUCTURE**



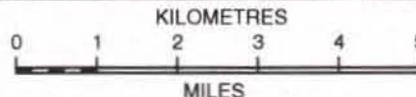
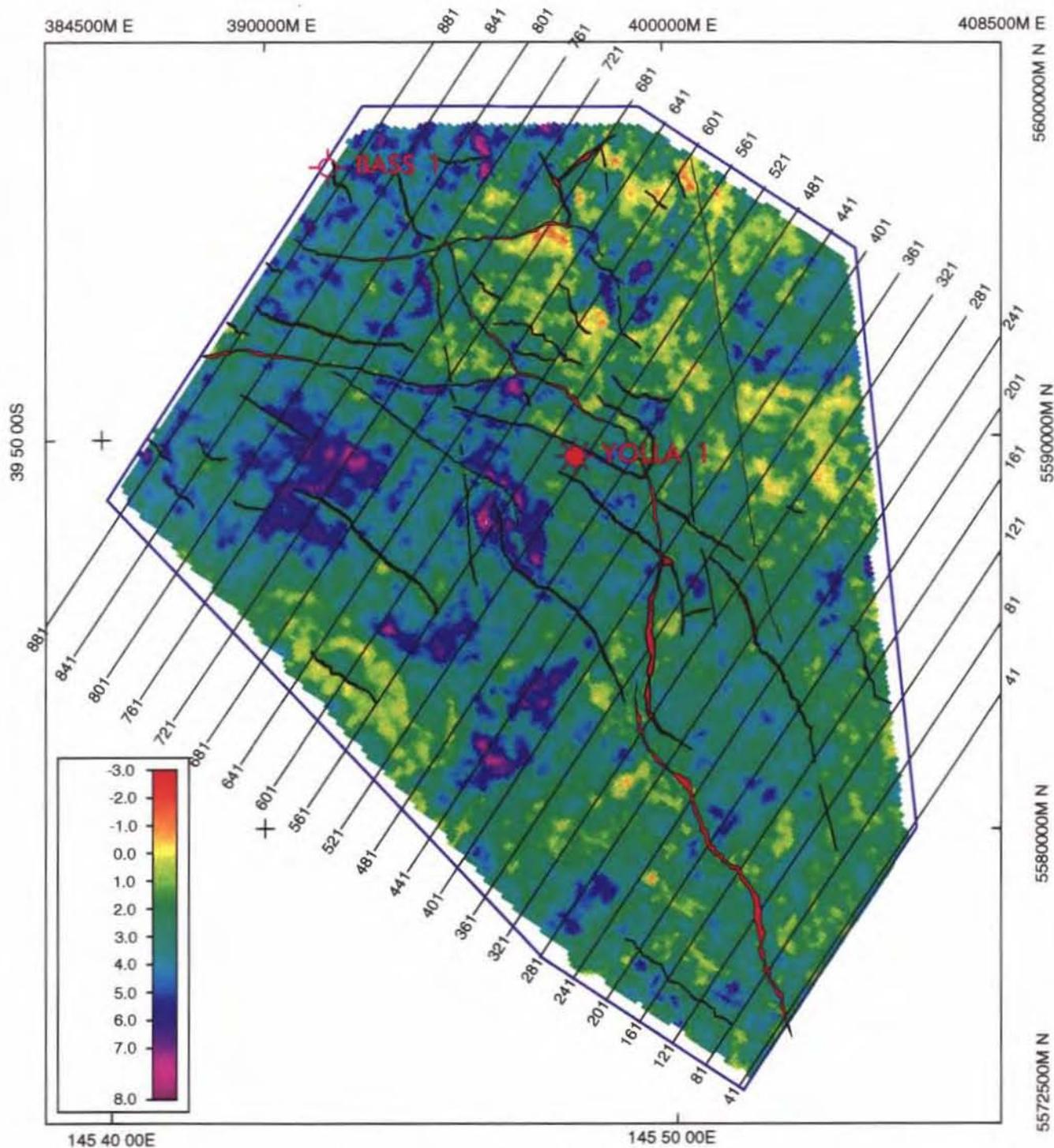


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**TRL1 BASS BASIN TASMANIA**  
**MIDDLE M.DIVERSUS, DEPTH STRUCTURE**

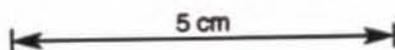


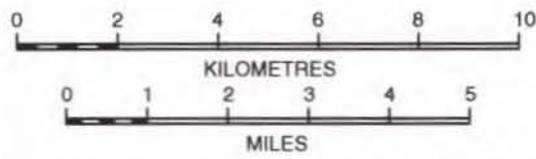
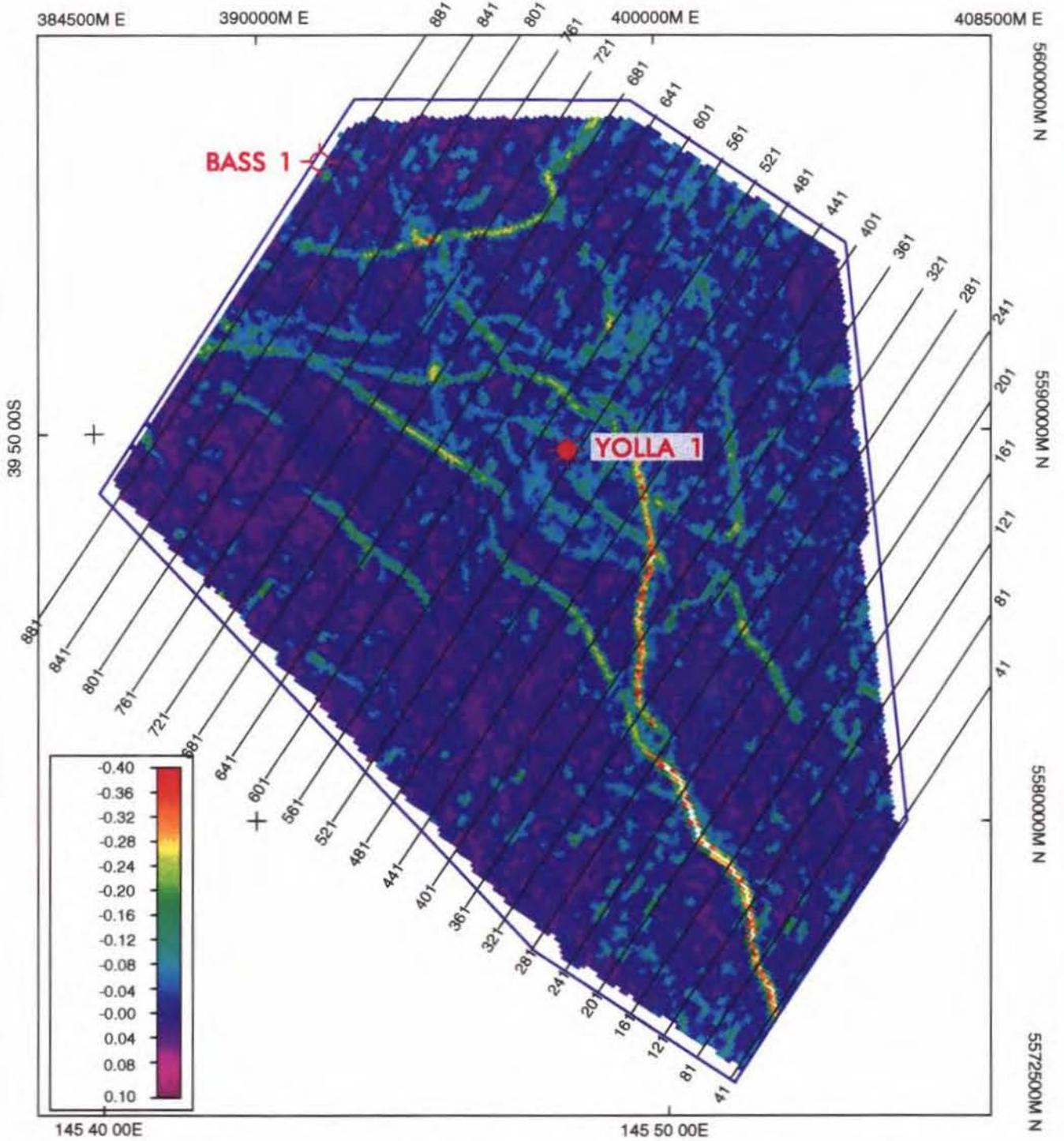
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AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**MIDDLE M.DIVERSUS, AMPLITUDE**

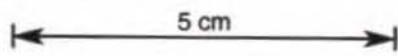


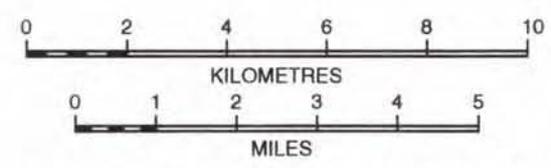
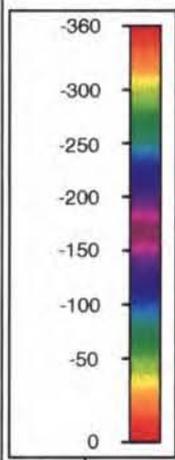
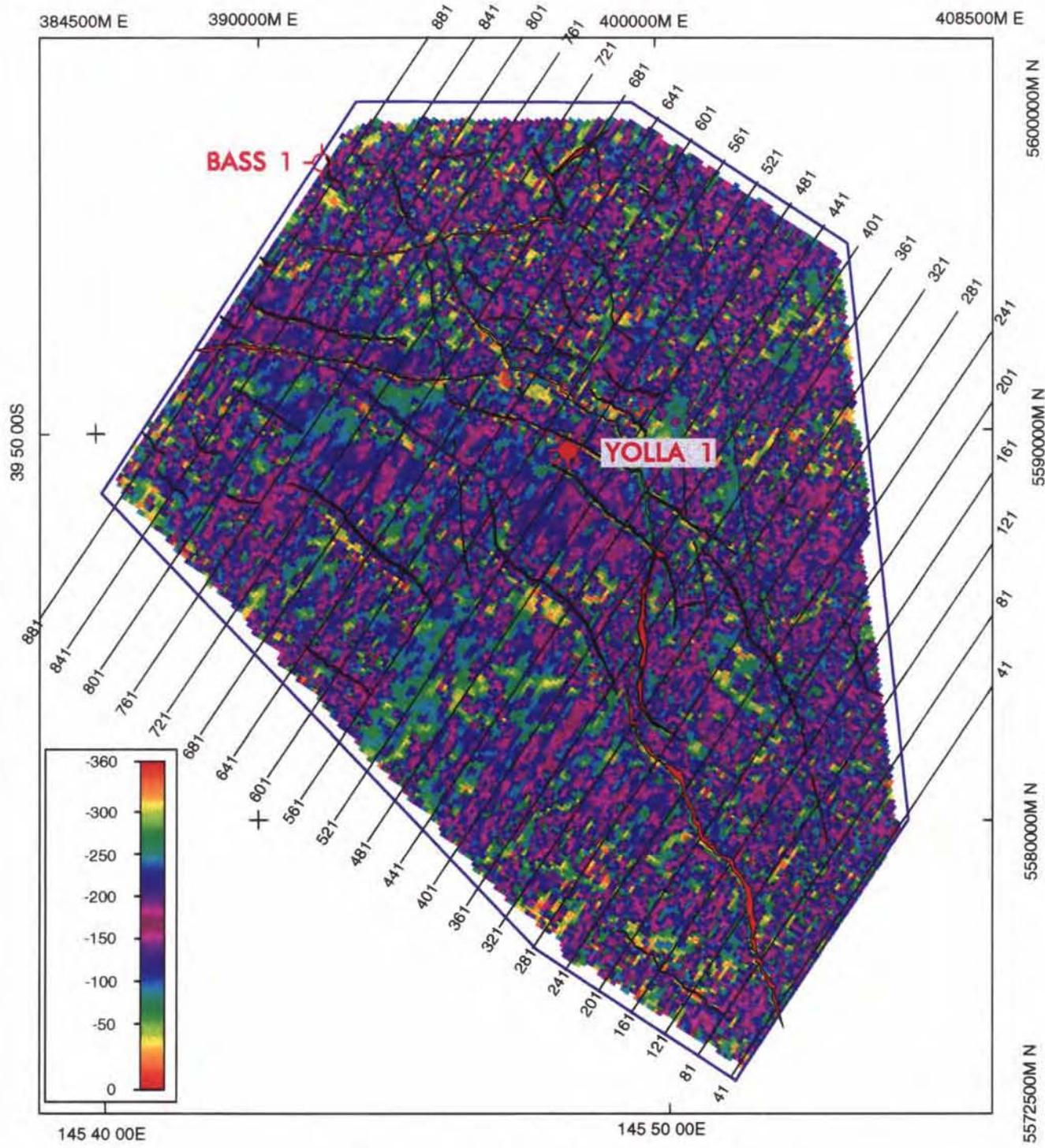


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T/RL1 BASS BASIN TASMANIA

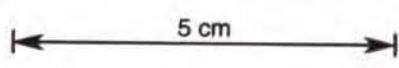
MIDDLE M.DIVERSUS, DIP MAGNITUDE (DEGREES)



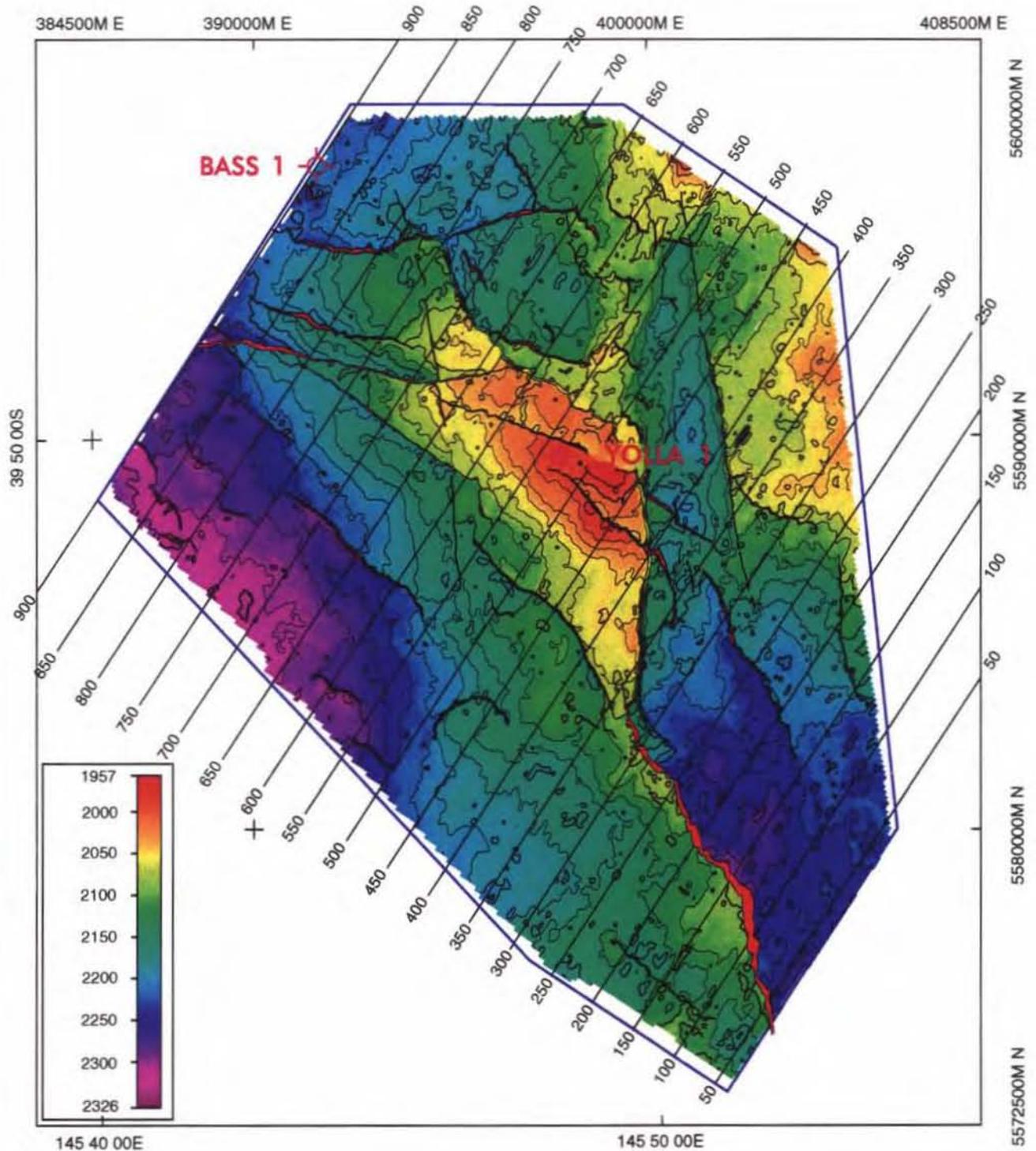


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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**MIDDLE M.DIVERSUS, DIP AZIMUTH (DEGREES)**



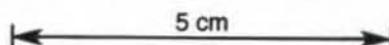
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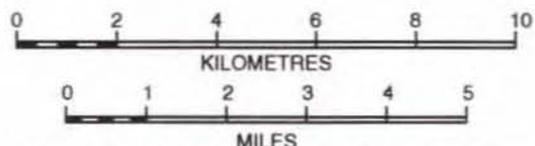
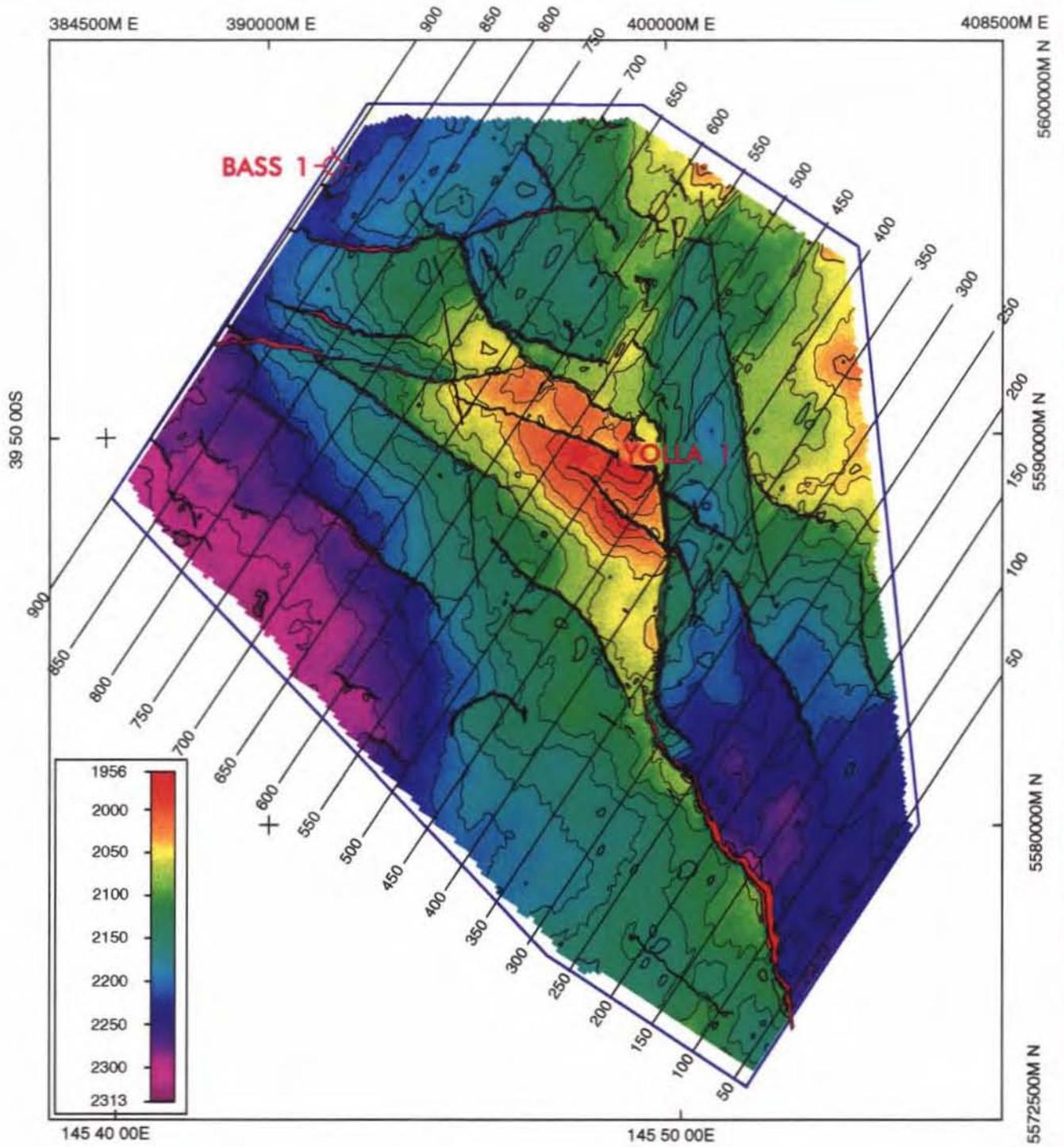
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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA**

**NEAR TOP 2718 SAND, DETAILED TIME STRUCTURE**

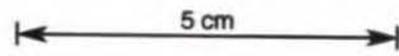


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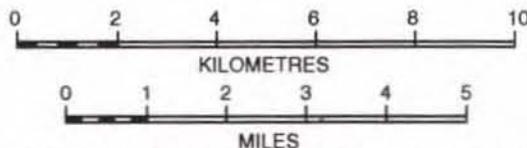
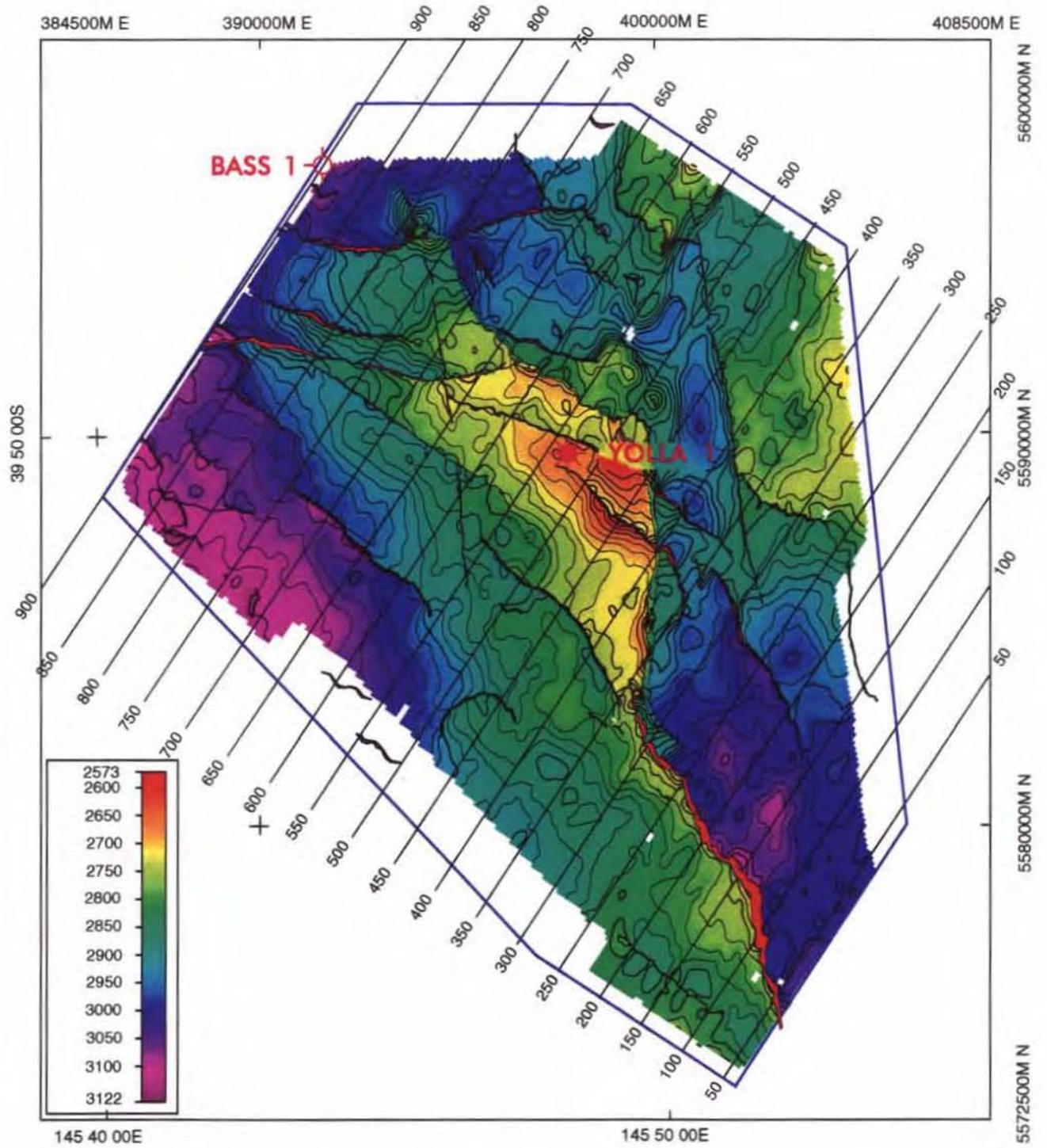


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AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA**  
**NEAR TOP 2718 SAND, TIME STRUCTURE**

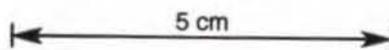


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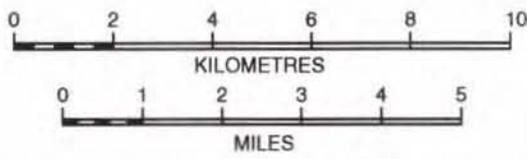
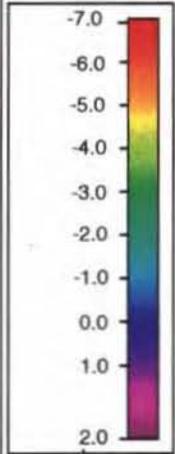
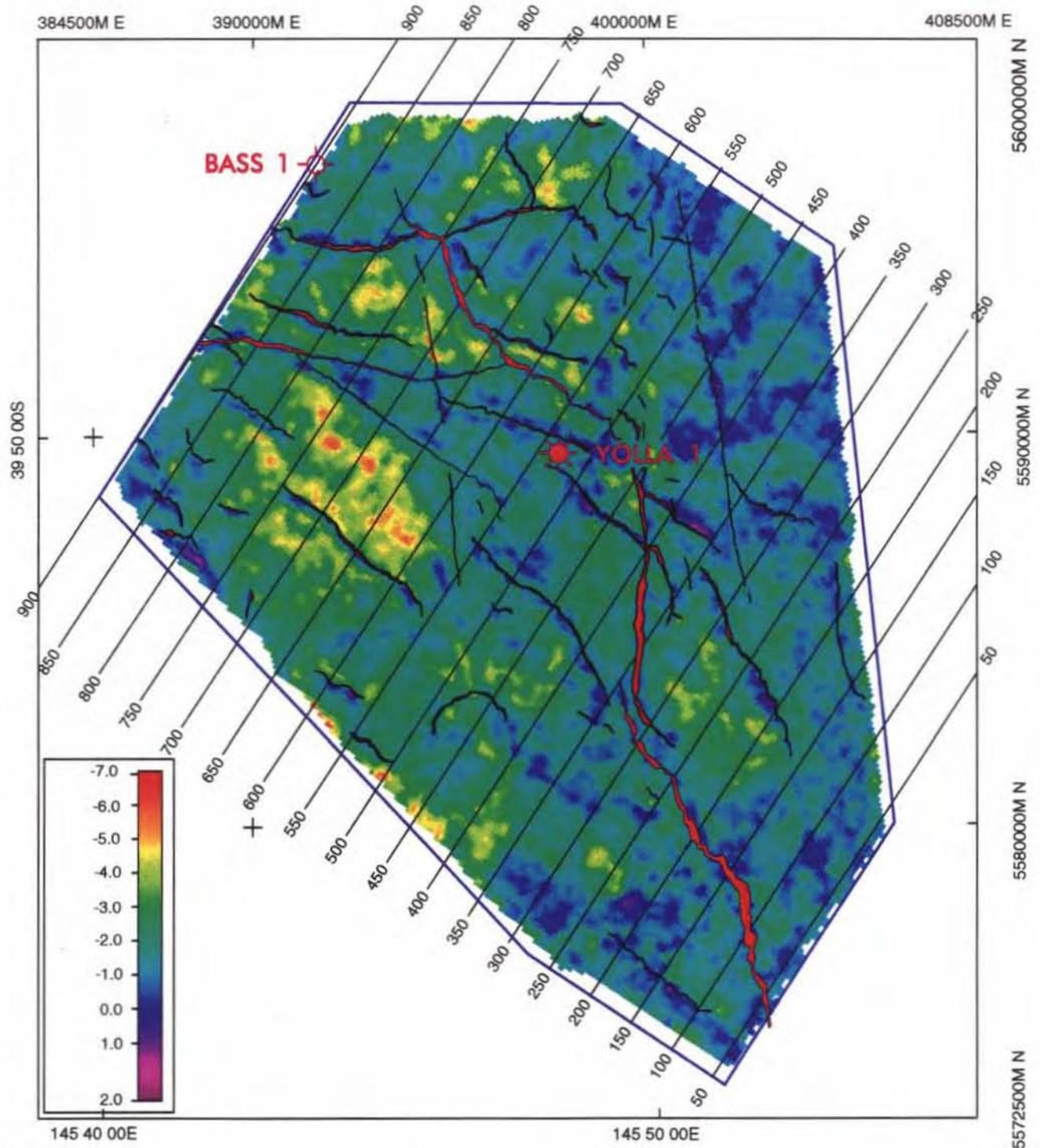


UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA  
NEAR TOP 2718 SAND, DEPTH STRUCTURE**

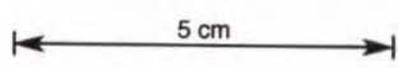


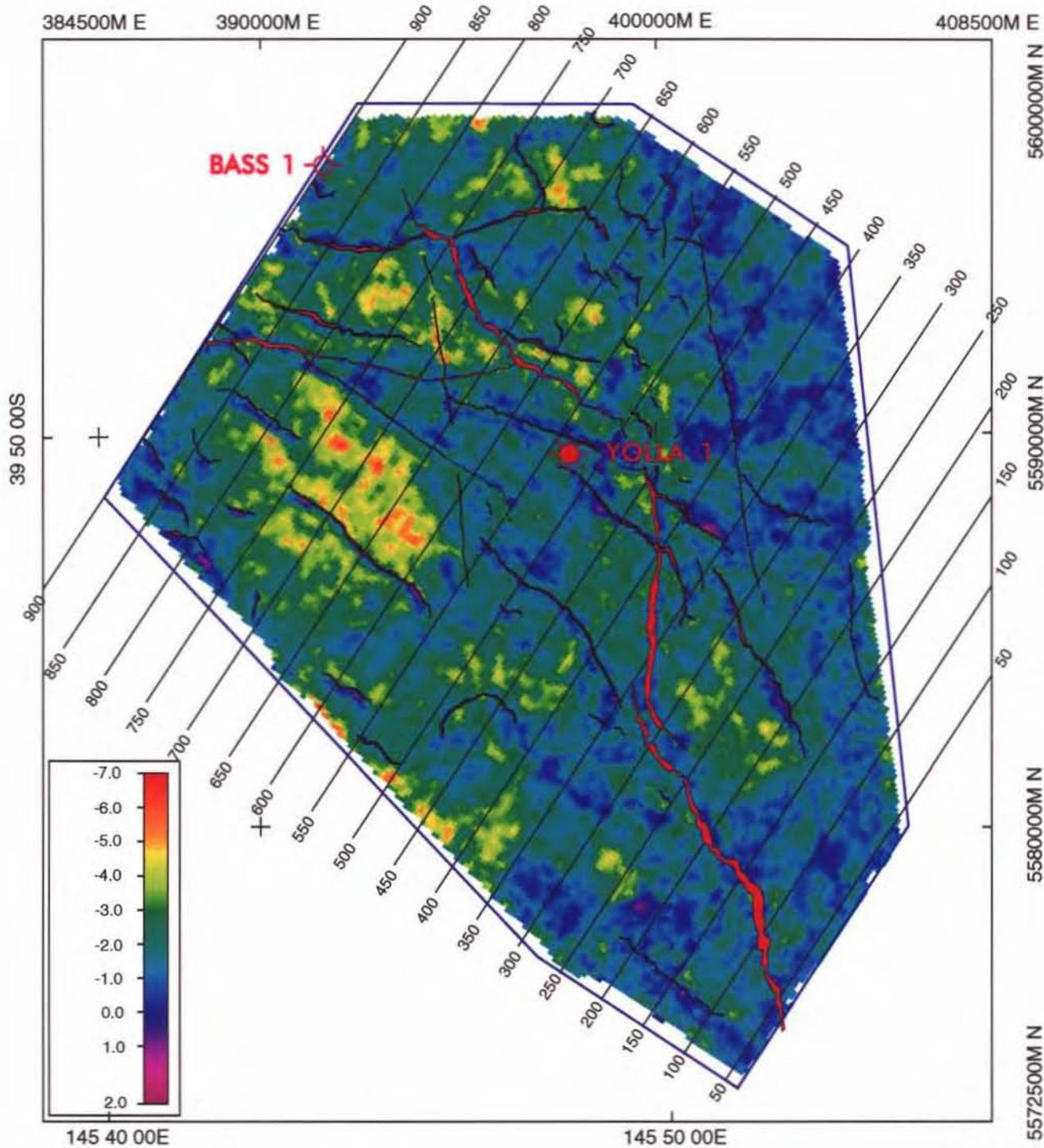
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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN    TASMANIA**  
**NEAR TOP 2718 SAND, AMPLITUDE**

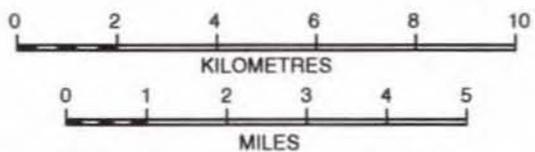
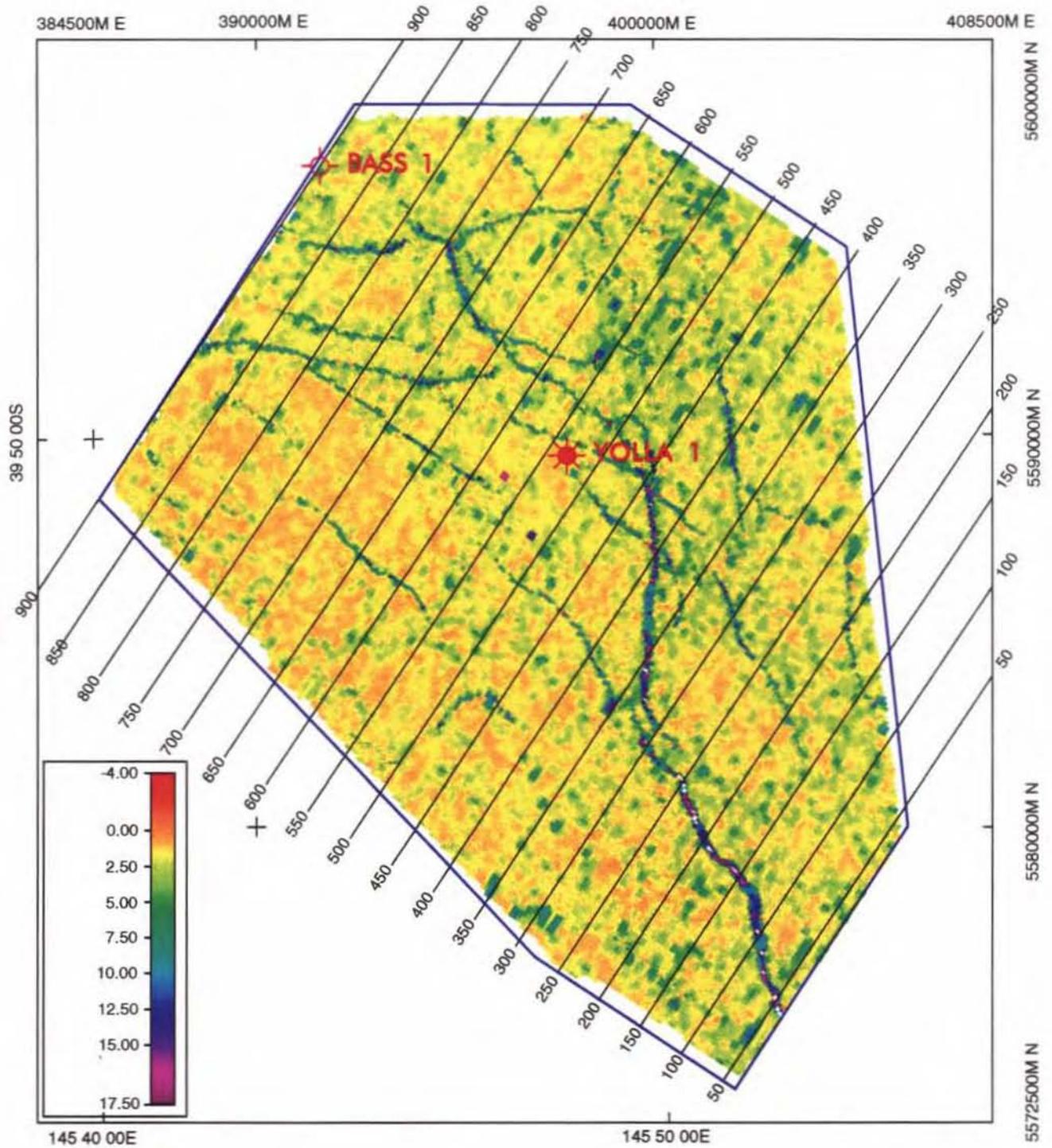




UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

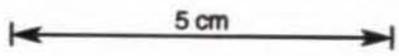
**T/RL1 BASS BASIN TASMANIA**  
**NEAR TOP 2718 SAND, DETAILED AMPLITUDE**

5 cm

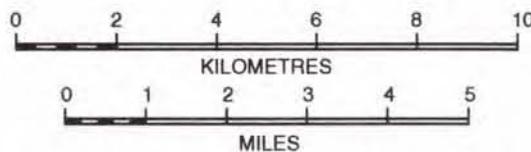
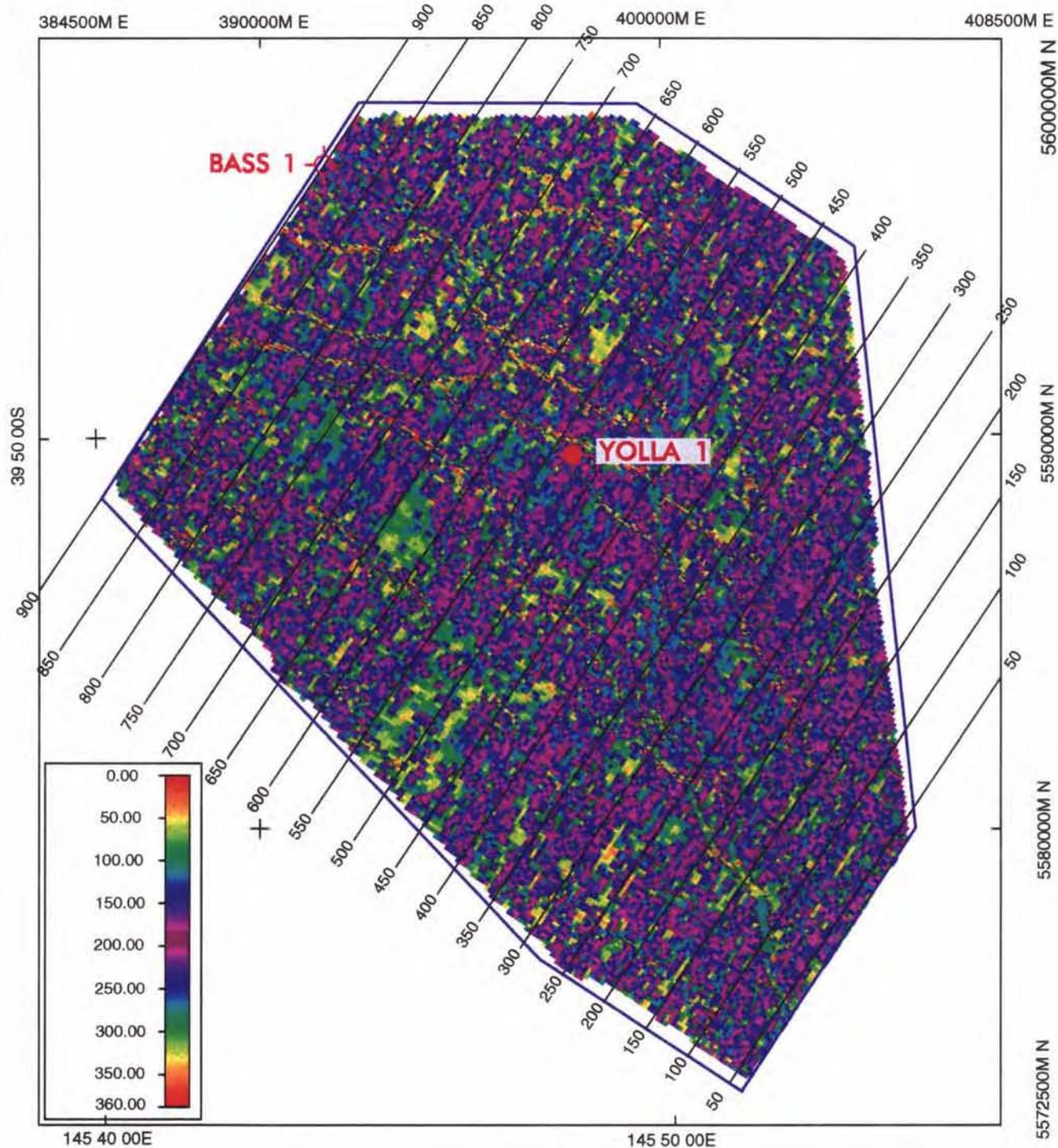


UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA  
 NEAR TOP 2718 SAND,  
 DETAILED DIP MAGNITUDE (DEGREES)**

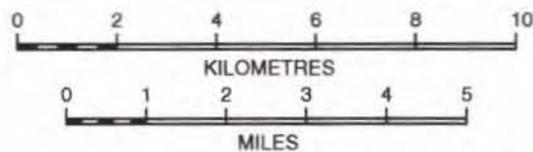
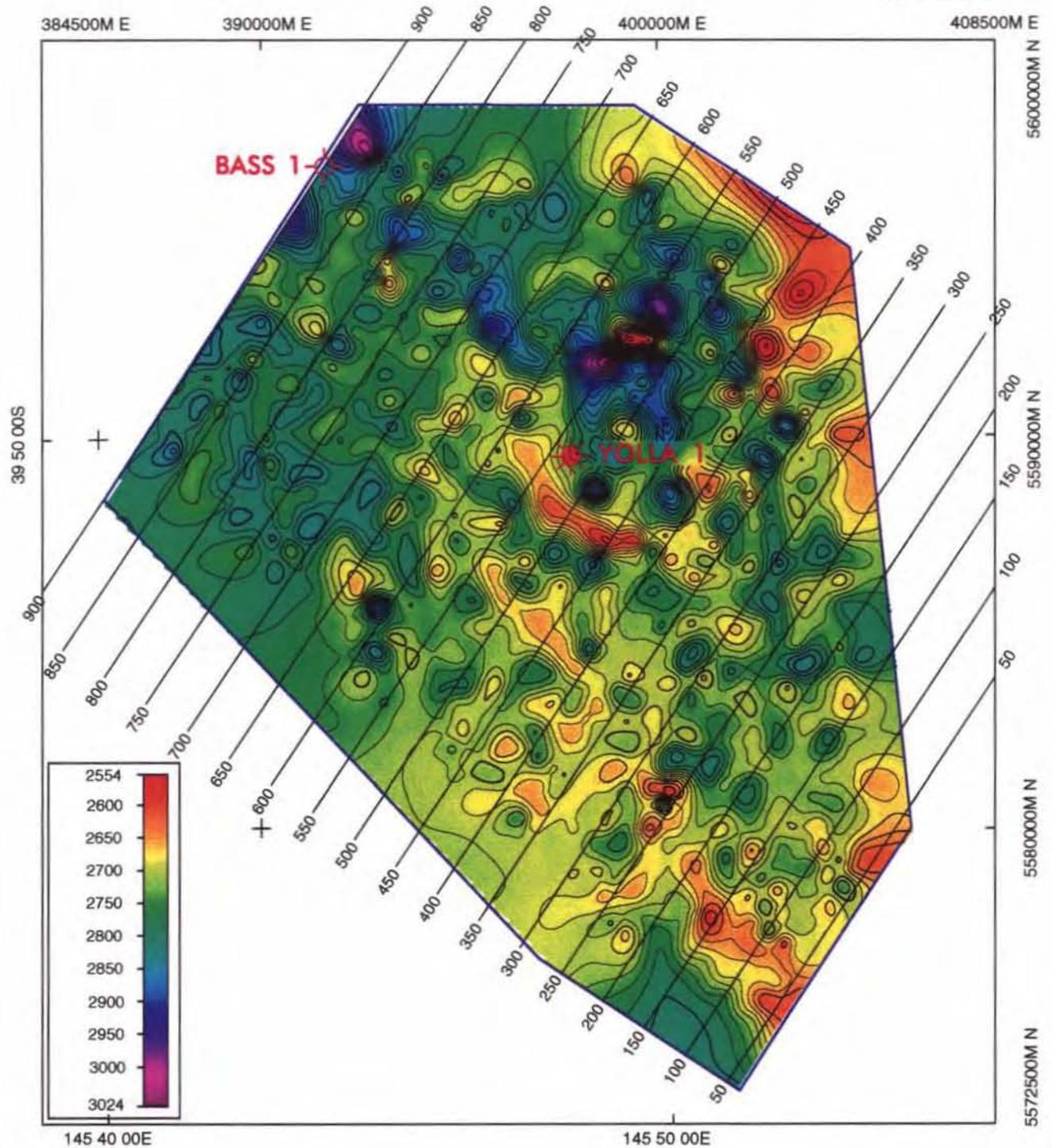


5 cm



UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

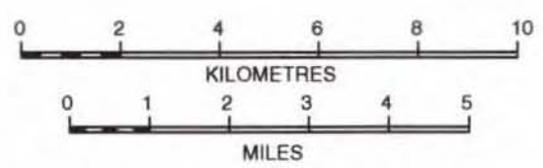
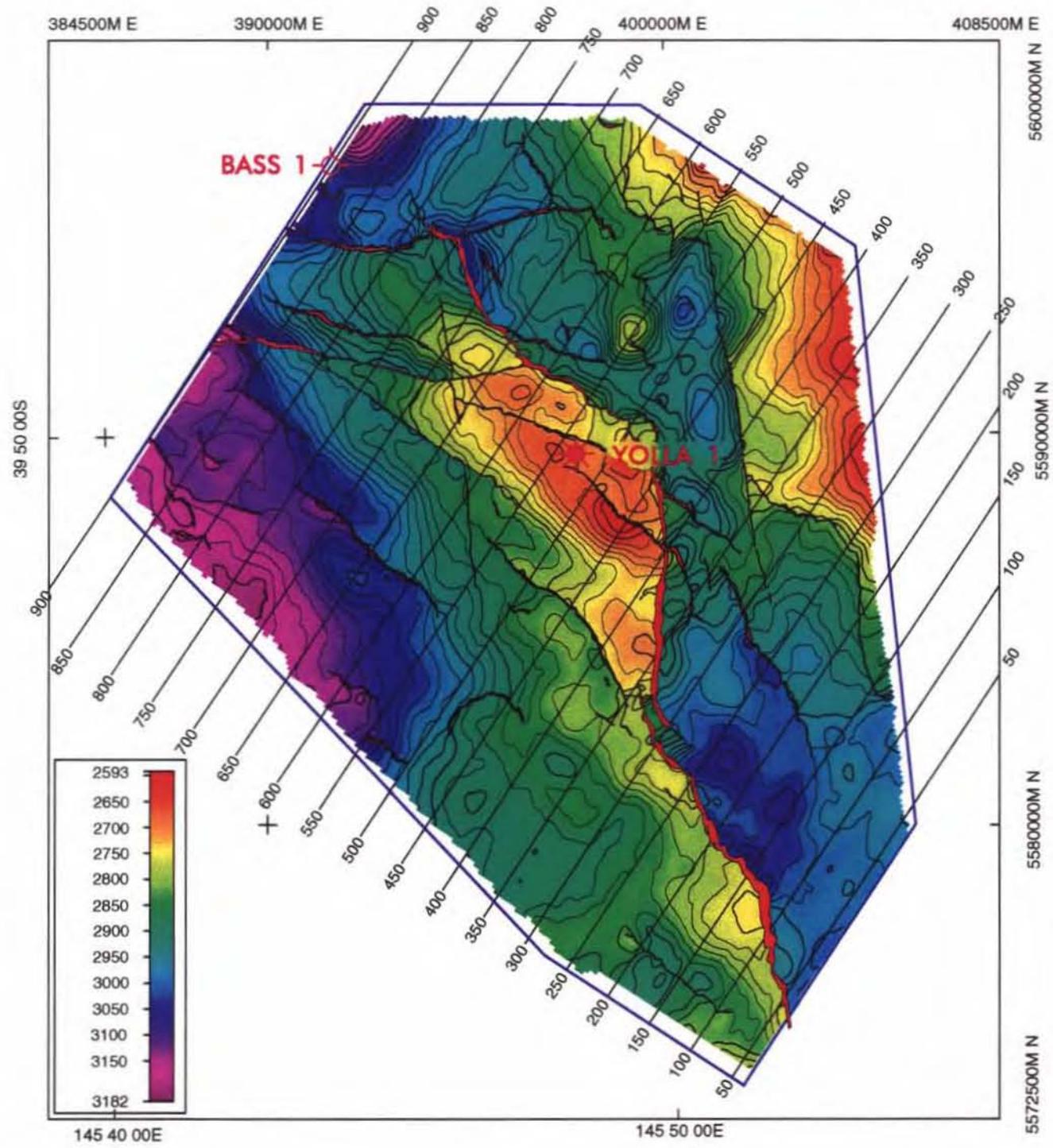
**TRL1 BASS BASIN TASMANIA  
NEAR TOP 2718 SAND,  
DETAILED DIP AZIMUTH (DEGREES)**



UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

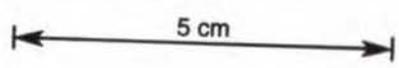
**TRL1 BASS BASIN TASMANIA**  
**NEAR TOP 2718 SAND,**  
**RMS STACKING VELOCITY FIELD**

5 cm

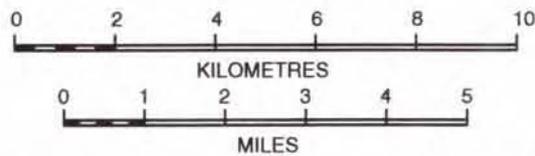
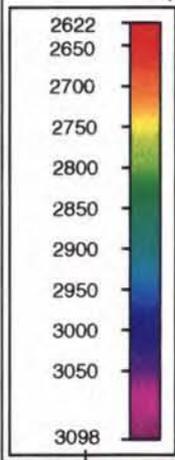
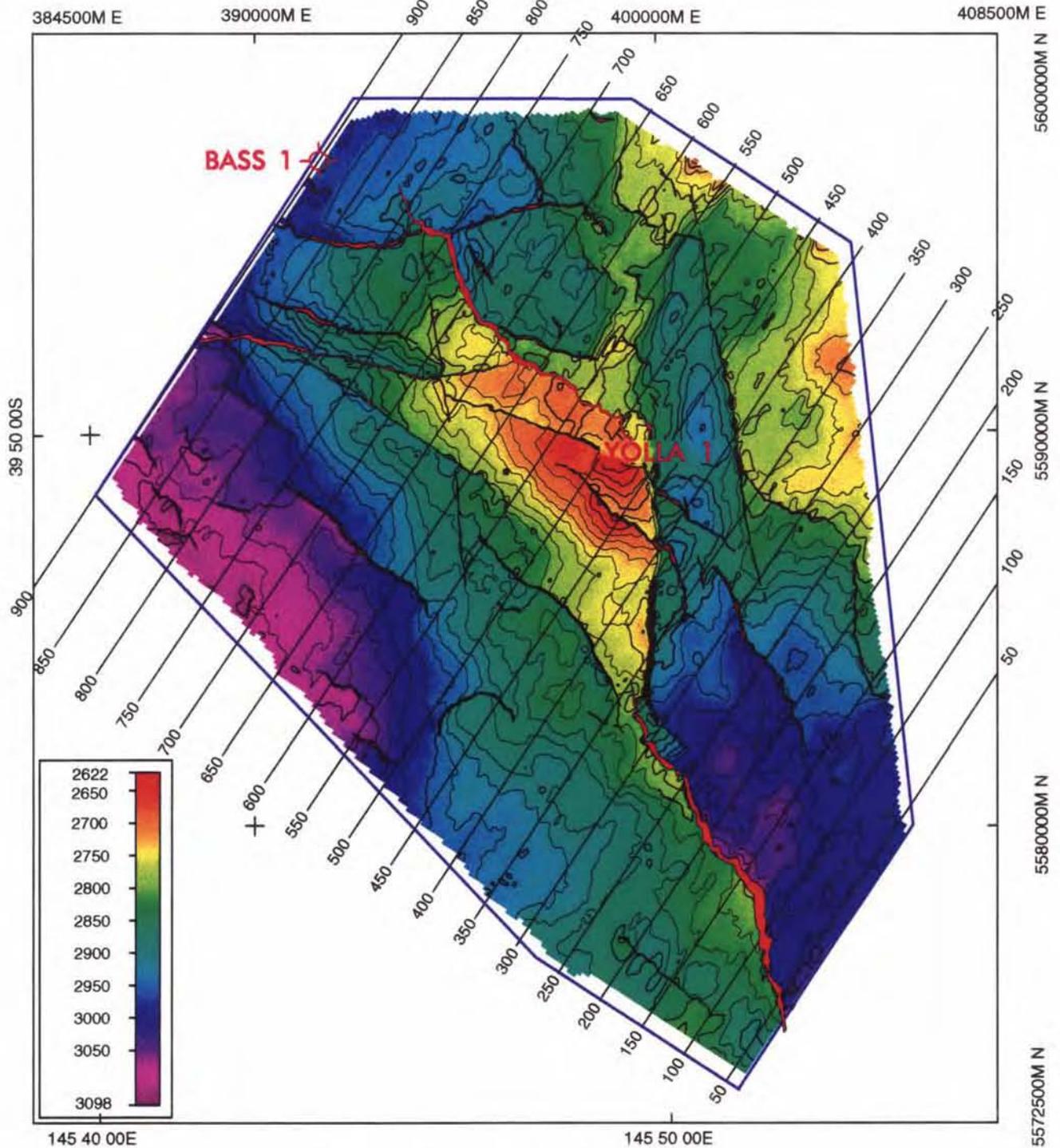


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AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**NEAR TOP 2718 SAND, (RMS STACKING**  
**VELOCITY DERIVED), DEPTH STRUCTURE**

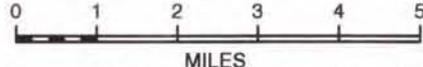
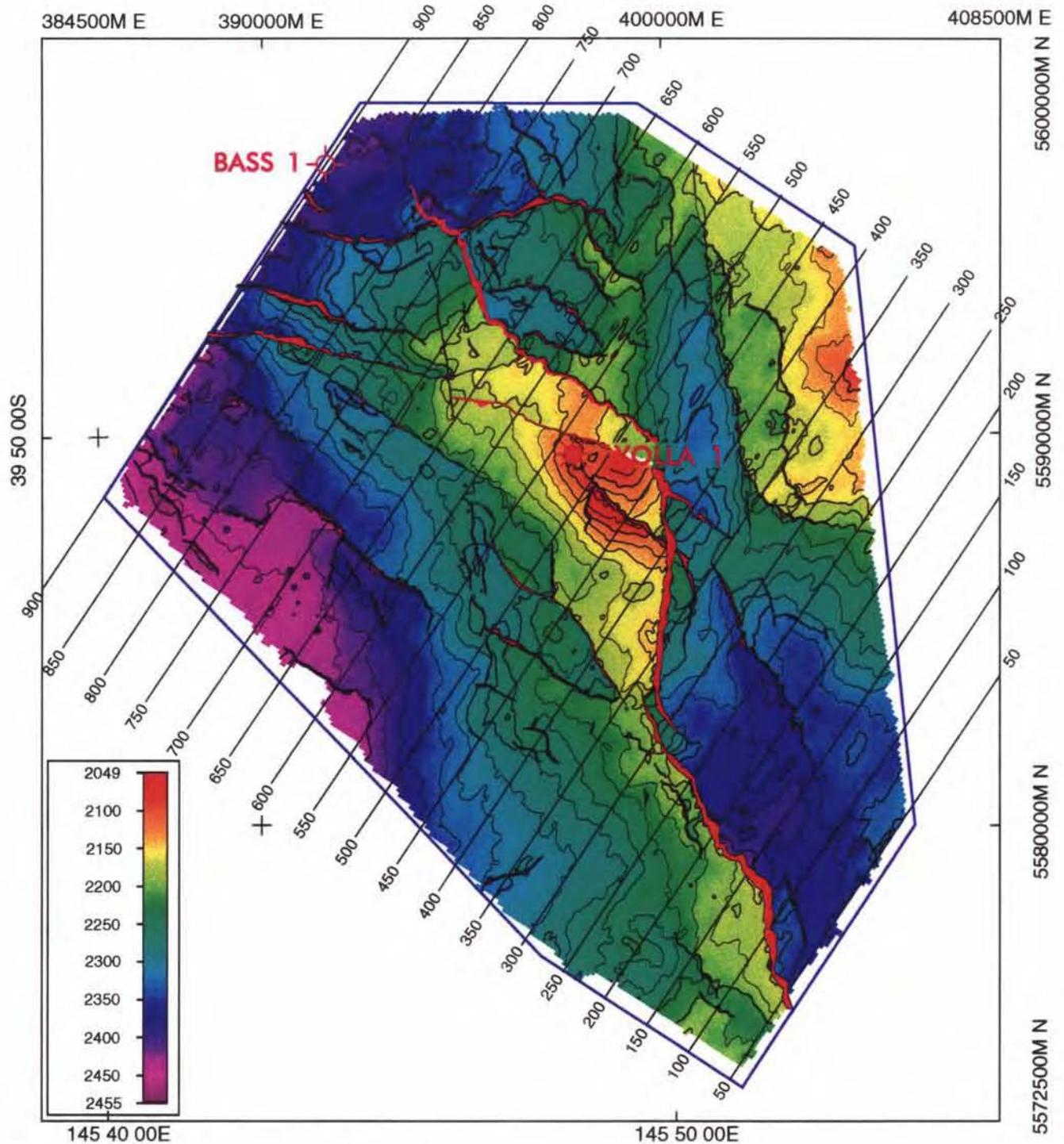


5 cm



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AUSTRALIAN NATIONAL SPHEROID  
CENTRAL MERIDIAN 147 00 00E

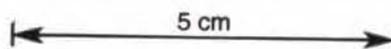
**T/RL1 BASS BASIN TASMANIA**  
**NEAR TOP 2718 SAND, (AVERAGE VELOCITY DERIVED), DEPTH STRUCTURE**

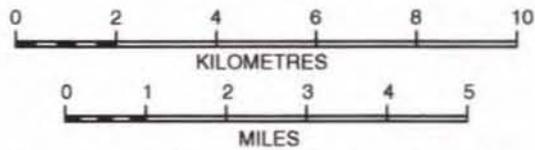
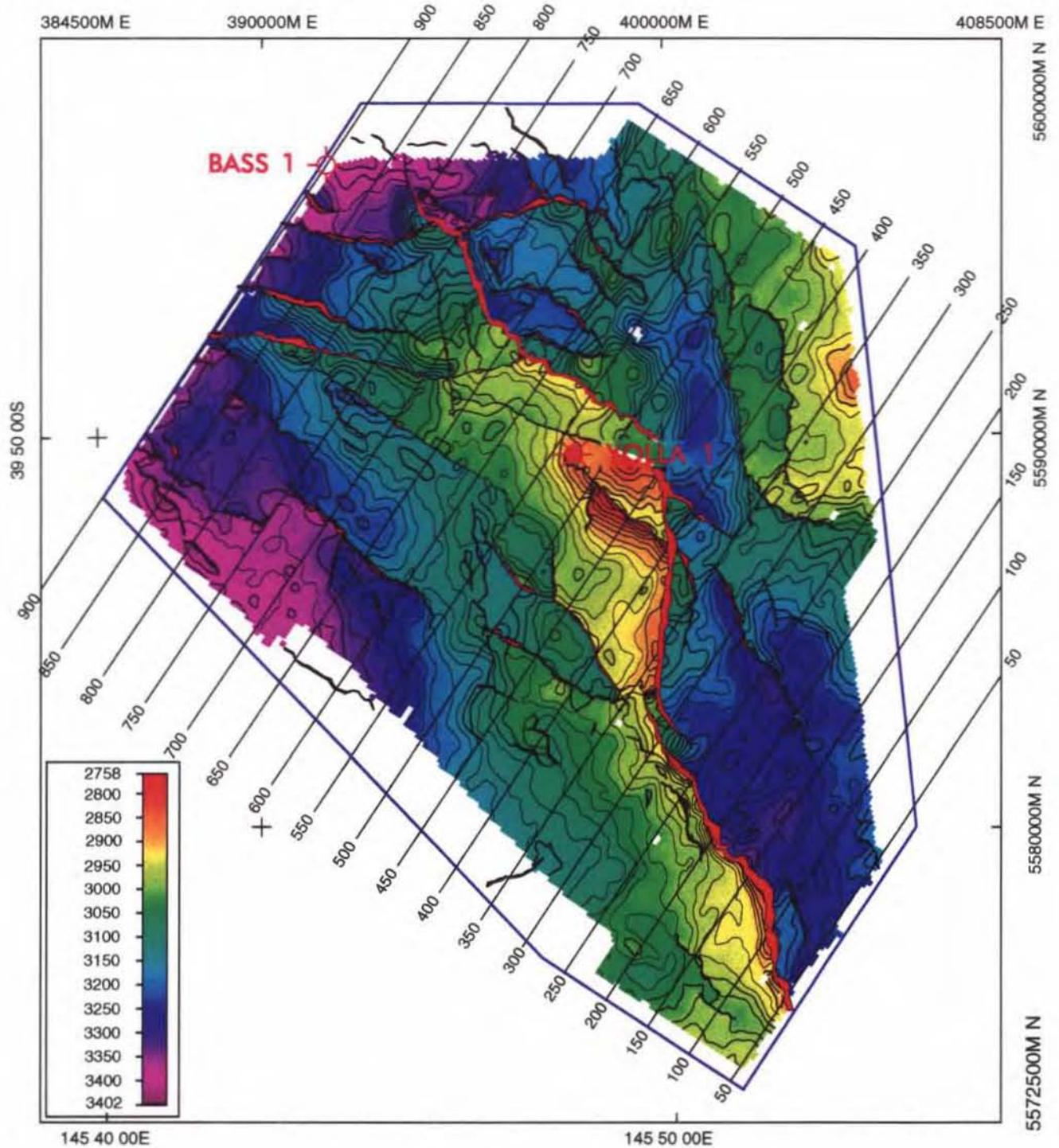


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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA**

**EARLY PALAEOCENE, TIME STRUCTURE**

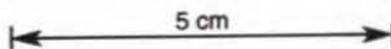


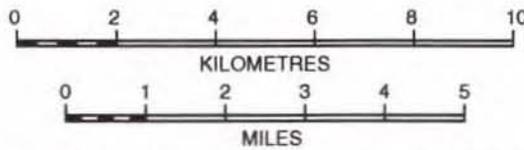
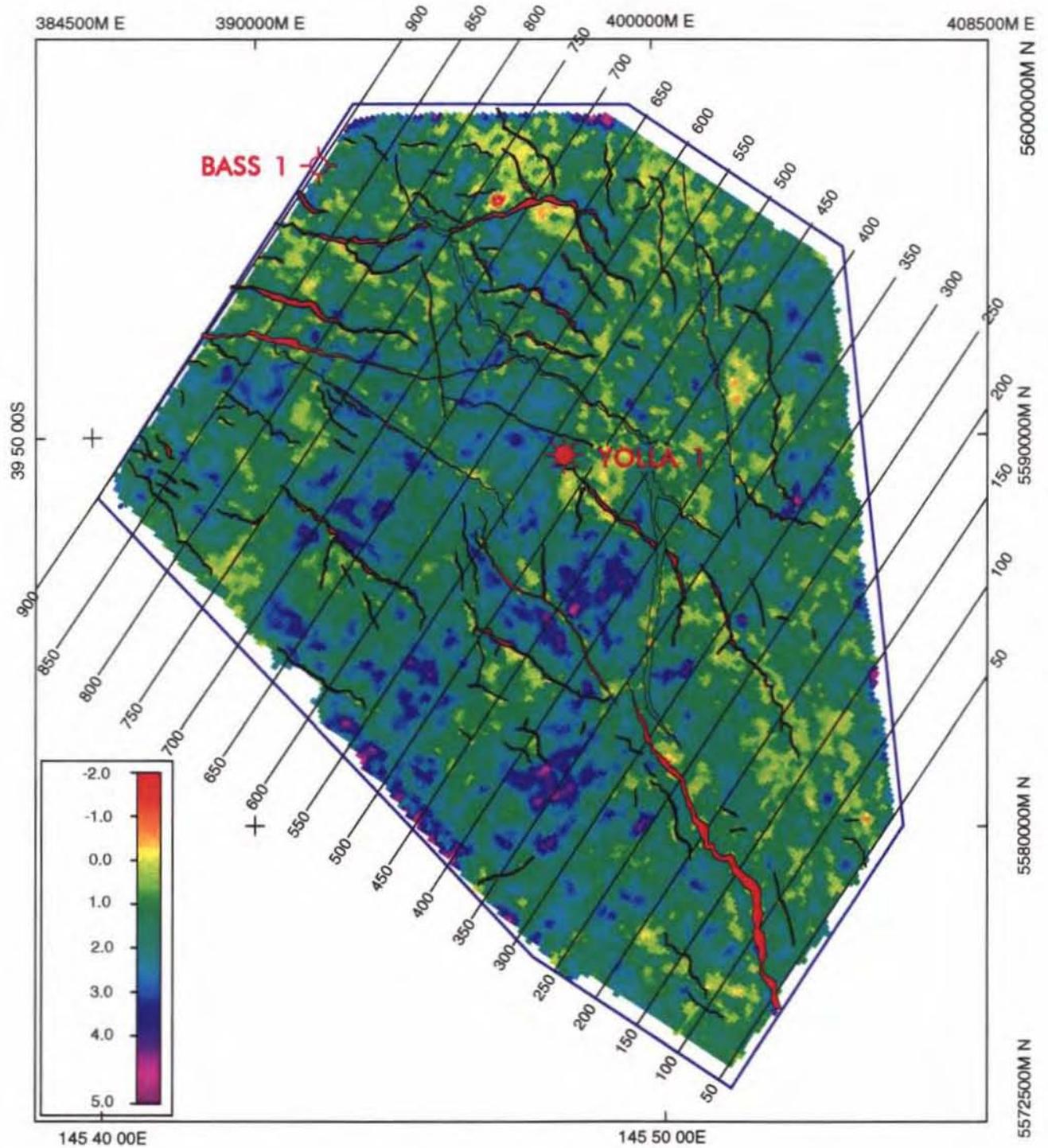


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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

TRL1 BASS BASIN TASMANIA

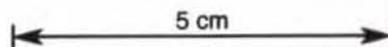
EARLY PALAEOCENE, DEPTH STRUCTURE

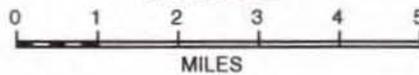
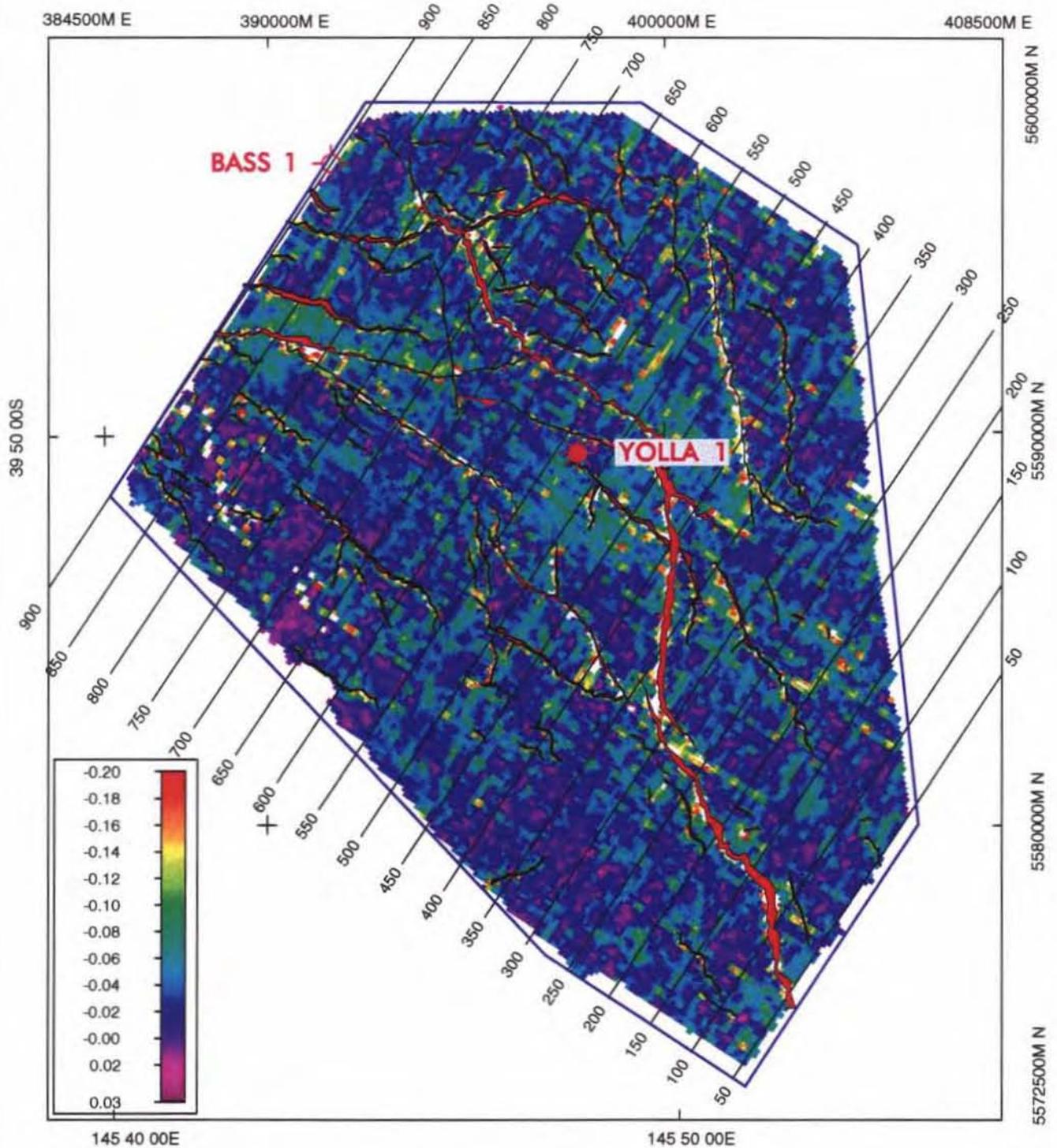




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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN TASMANIA**  
**EARLY PALAEOCENE, AMPLITUDE**

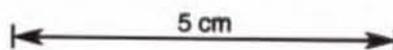




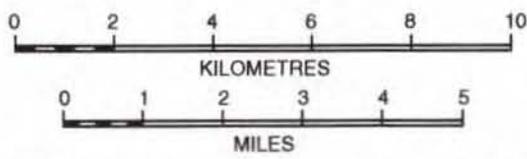
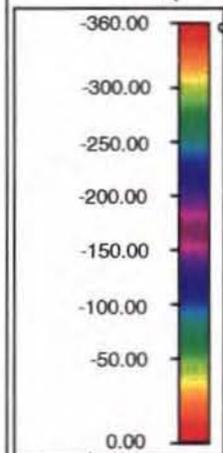
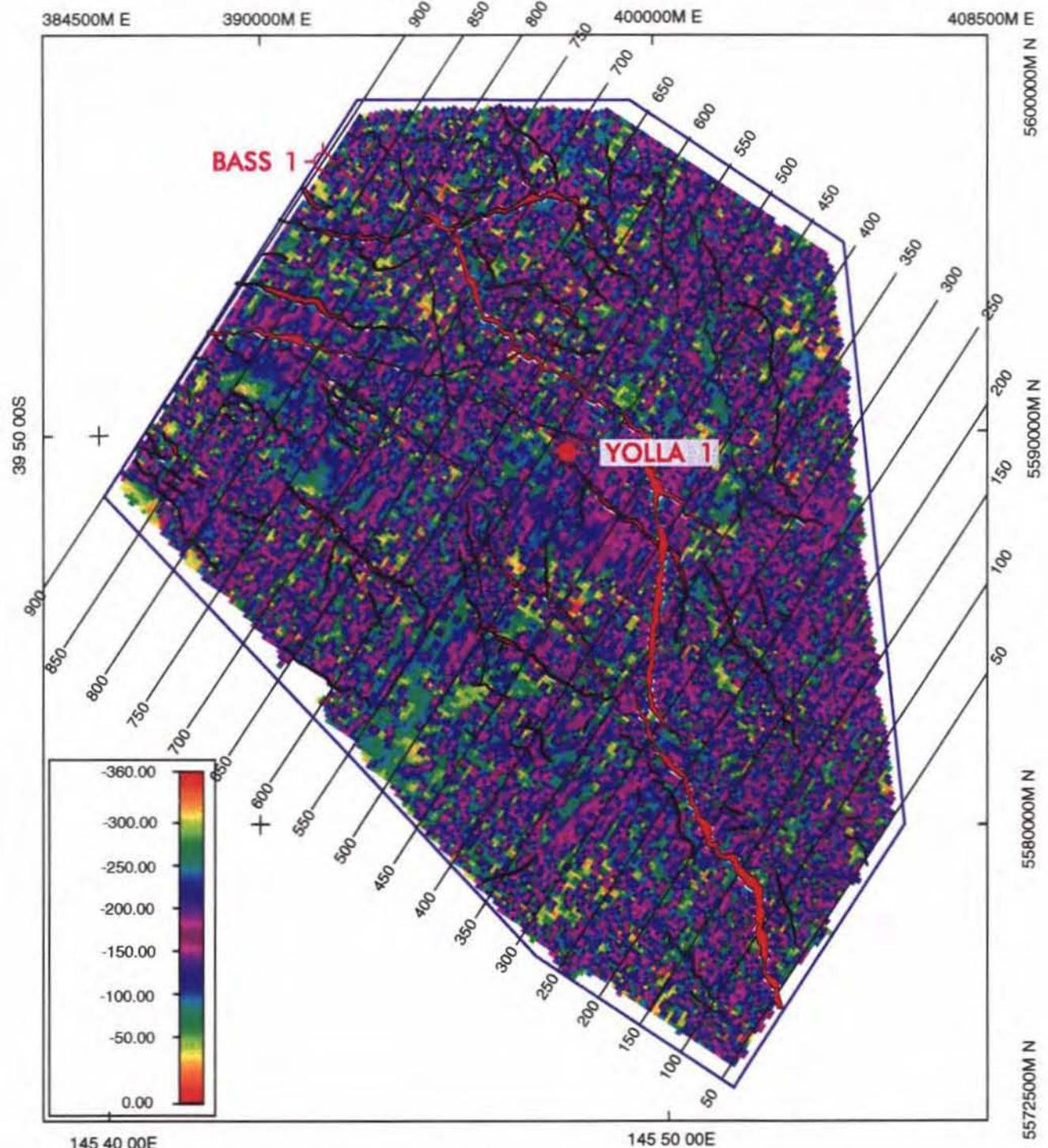
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

TRL1 BASS BASIN TASMANIA

EARLY PALAEOCENE, DIP MAGNITUDE (DEGREES)

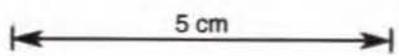


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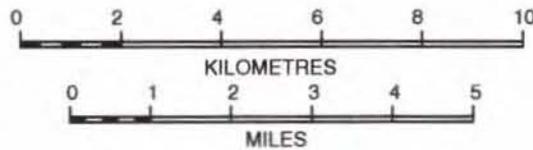
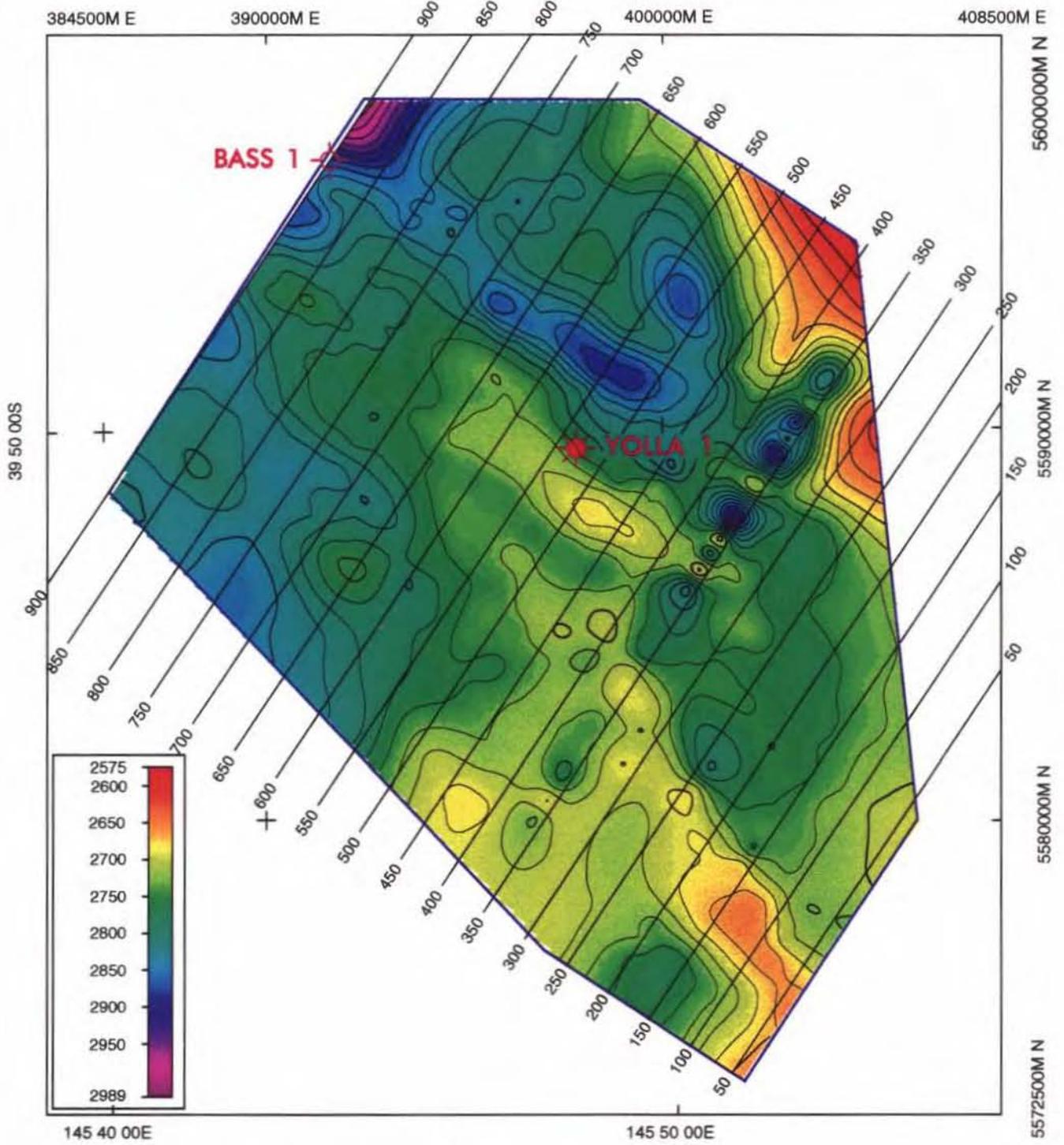


UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN TASMANIA**  
**EARLY PALAEOCENE, DIP AZIMUTH (DEGREES)**



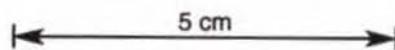
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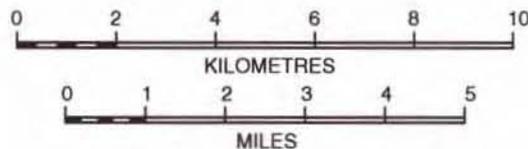
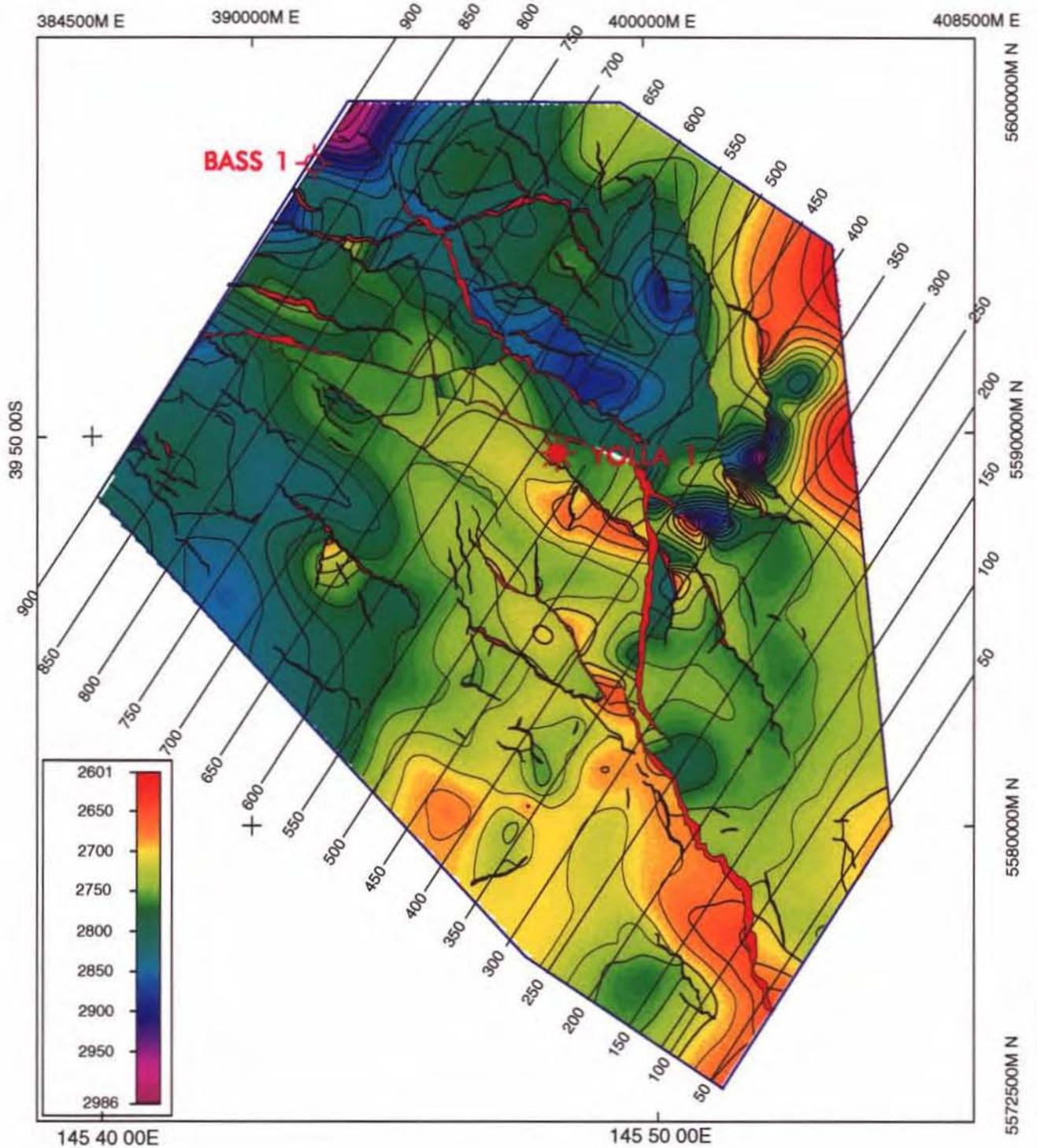


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 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

T/RL1 BASS BASIN TASMANIA

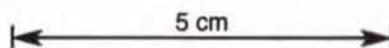
**EARLY PALAEOCENE, RMS STACKING VELOCITY FIELD 2**

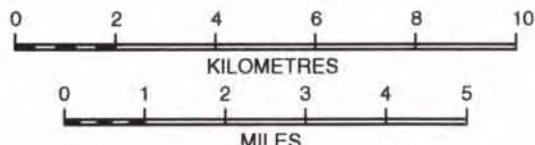
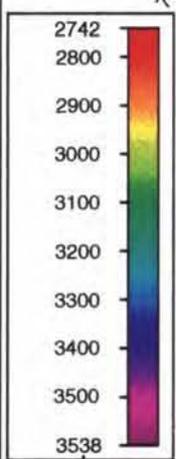
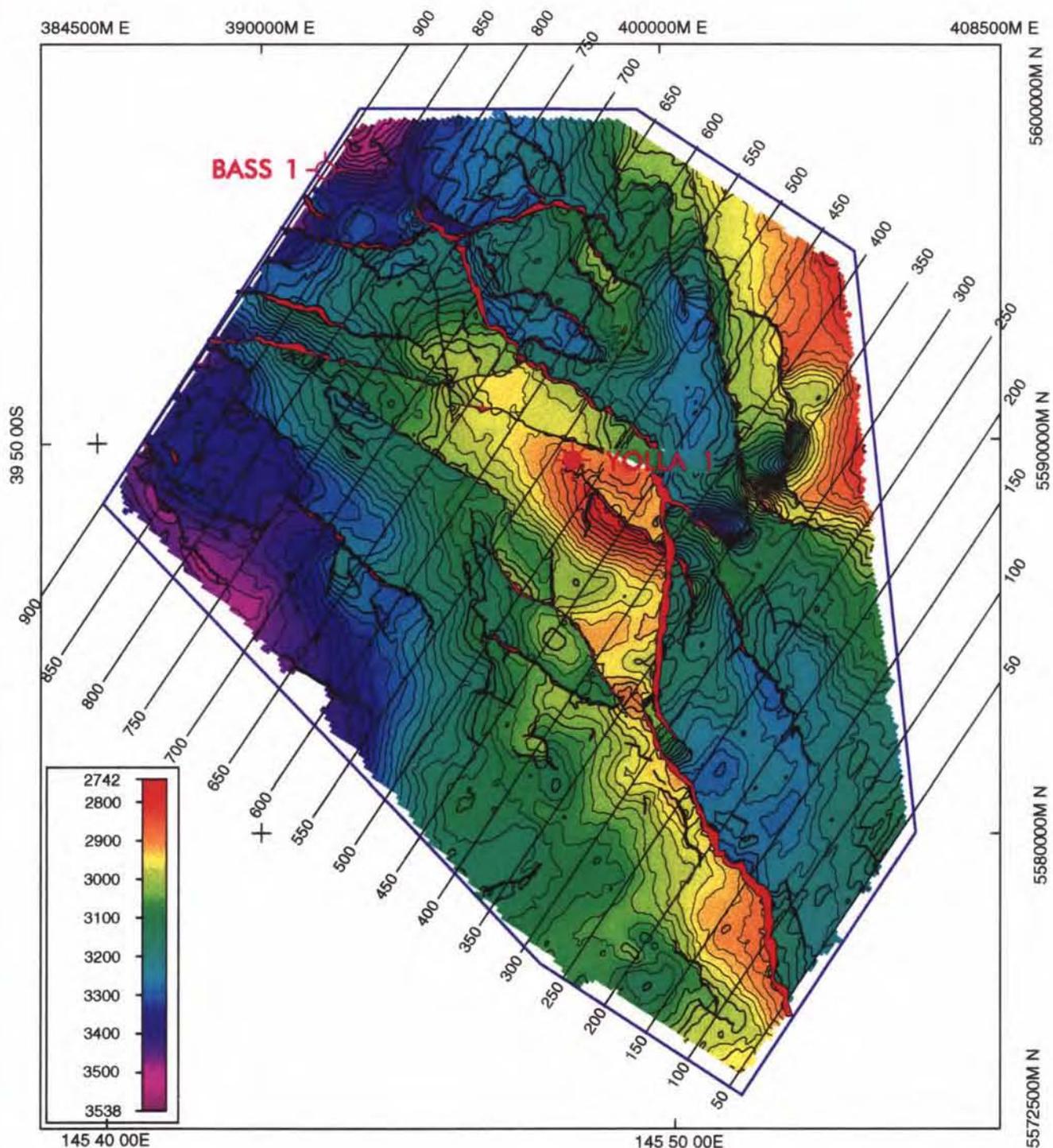




UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**T/RL1 BASS BASIN    TASMANIA**  
**EARLY PALAEOCENE, RMS STACKING VELOCITY FIELD 1**  
**(INCLUDING FAULT INTERPRETATION)**

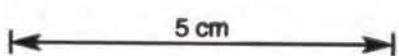




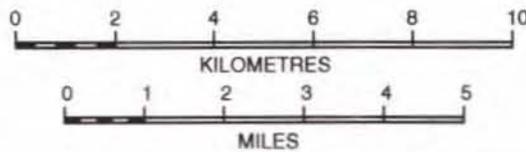
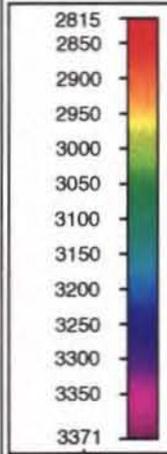
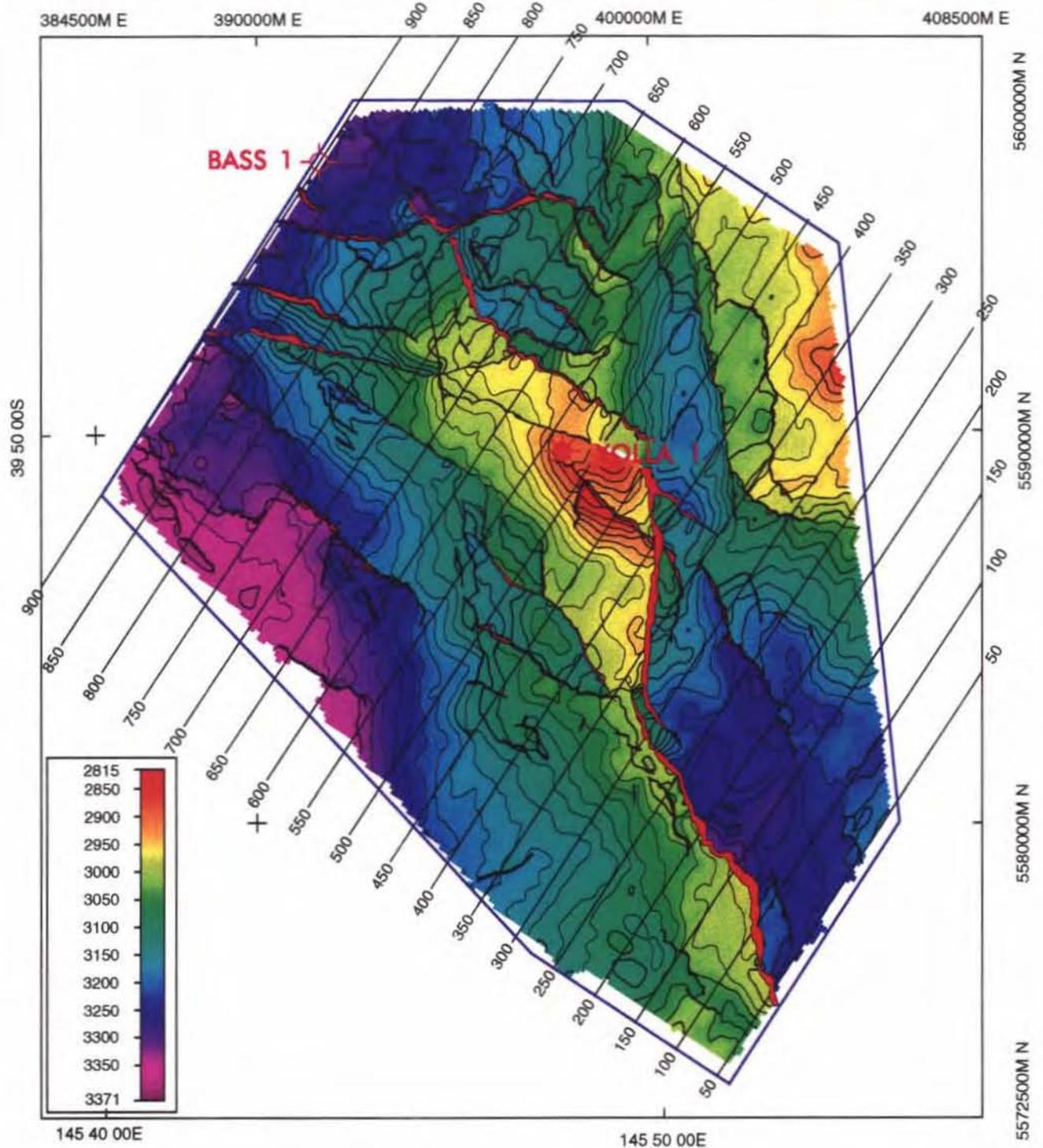
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

**TRL1 BASS BASIN    TASMANIA**

**EARLY PALAEOCENE, (RMS STACKING VELOCITY DERIVED), DEPTH STRUCTURE**

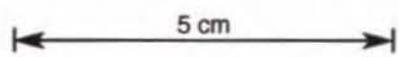


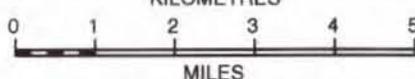
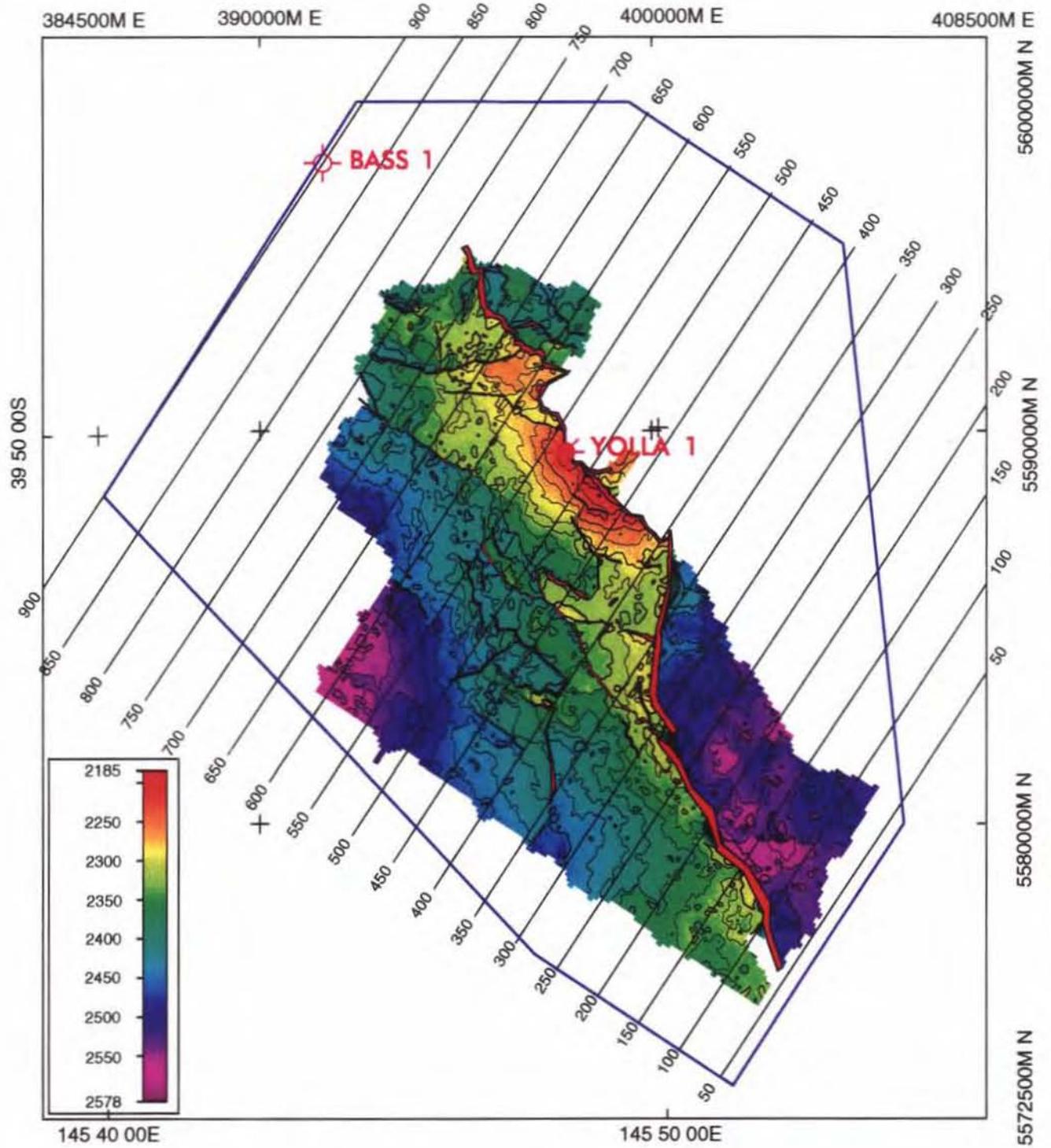
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 AUSTRALIAN NATIONAL SPHEROID  
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**T/RL1 BASS BASIN TASMANIA**  
**EARLY PALAEOCENE, (AVERAGE VELOCITY DERIVED), DEPTH STRUCTURE**

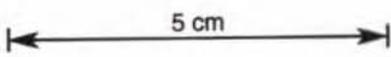




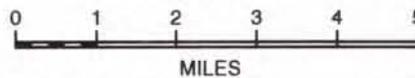
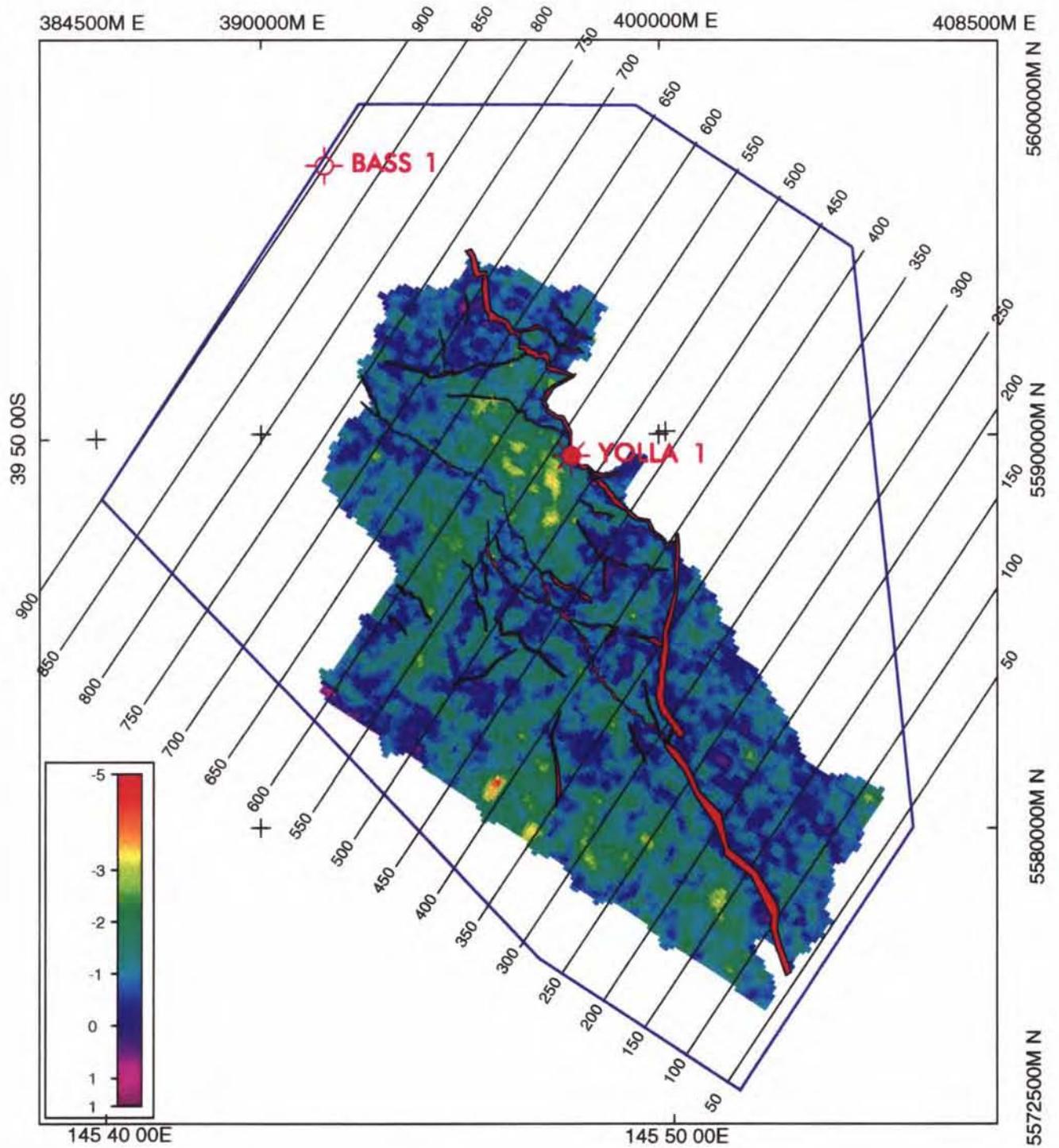
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 AUSTRALIAN NATIONAL SPHEROID  
 CENTRAL MERIDIAN 147 00 00E

TRL1 BASS BASIN    TASMANIA

DEEP SEISMIC ONLAP EVENT, TIME STRUCTURE



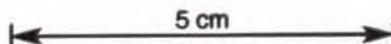


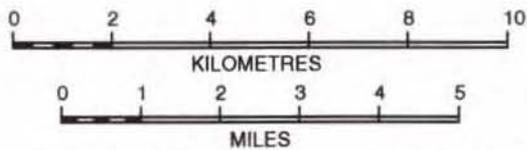
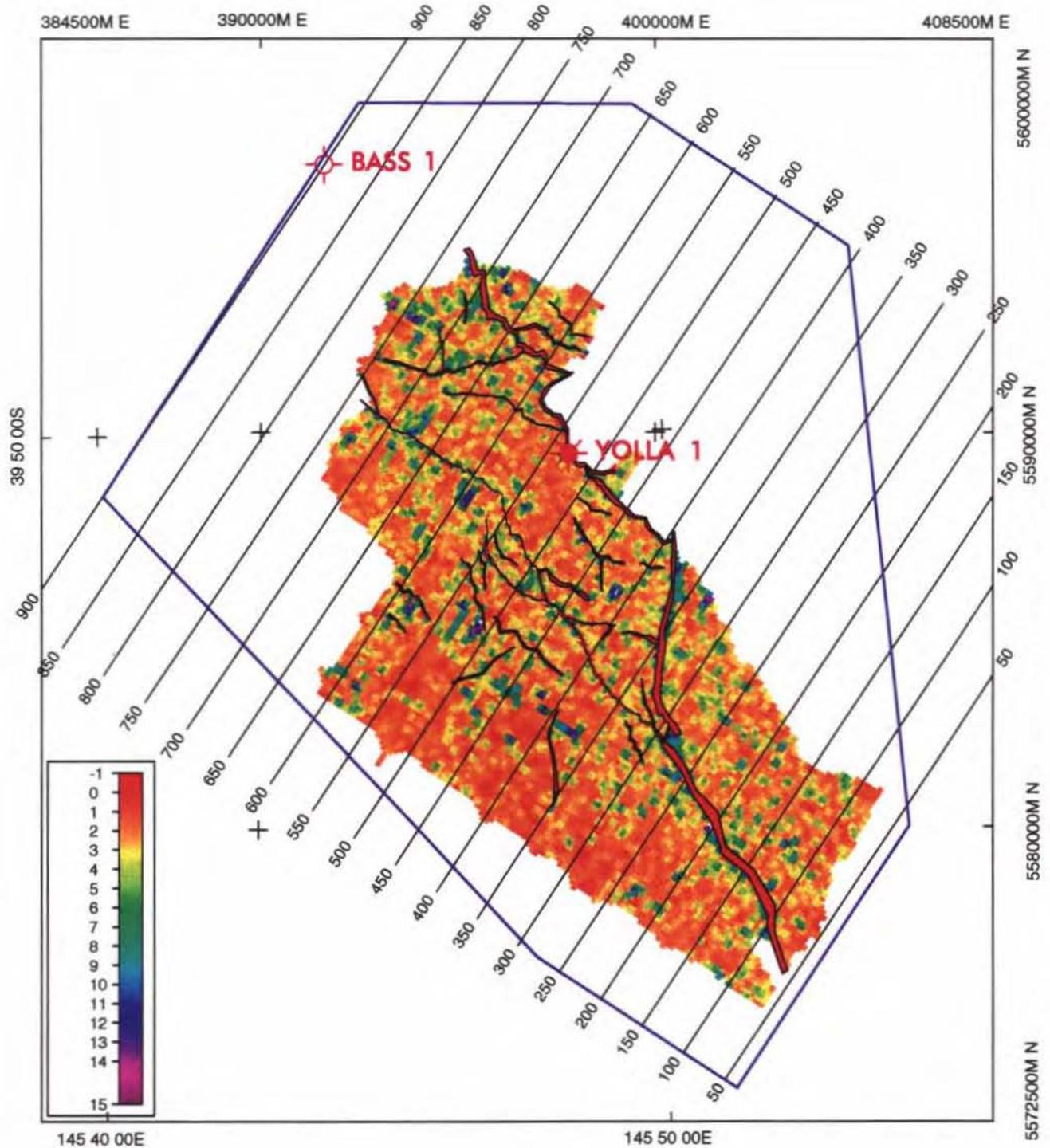


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 CENTRAL MERIDIAN 147 00 00E

T/RL1 BASS BASIN TASMANIA

DEEP SEISMIC ONLAP EVENT, AMPLITUDE

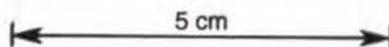


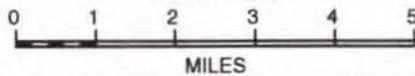
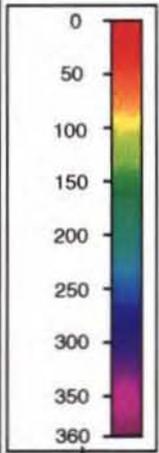
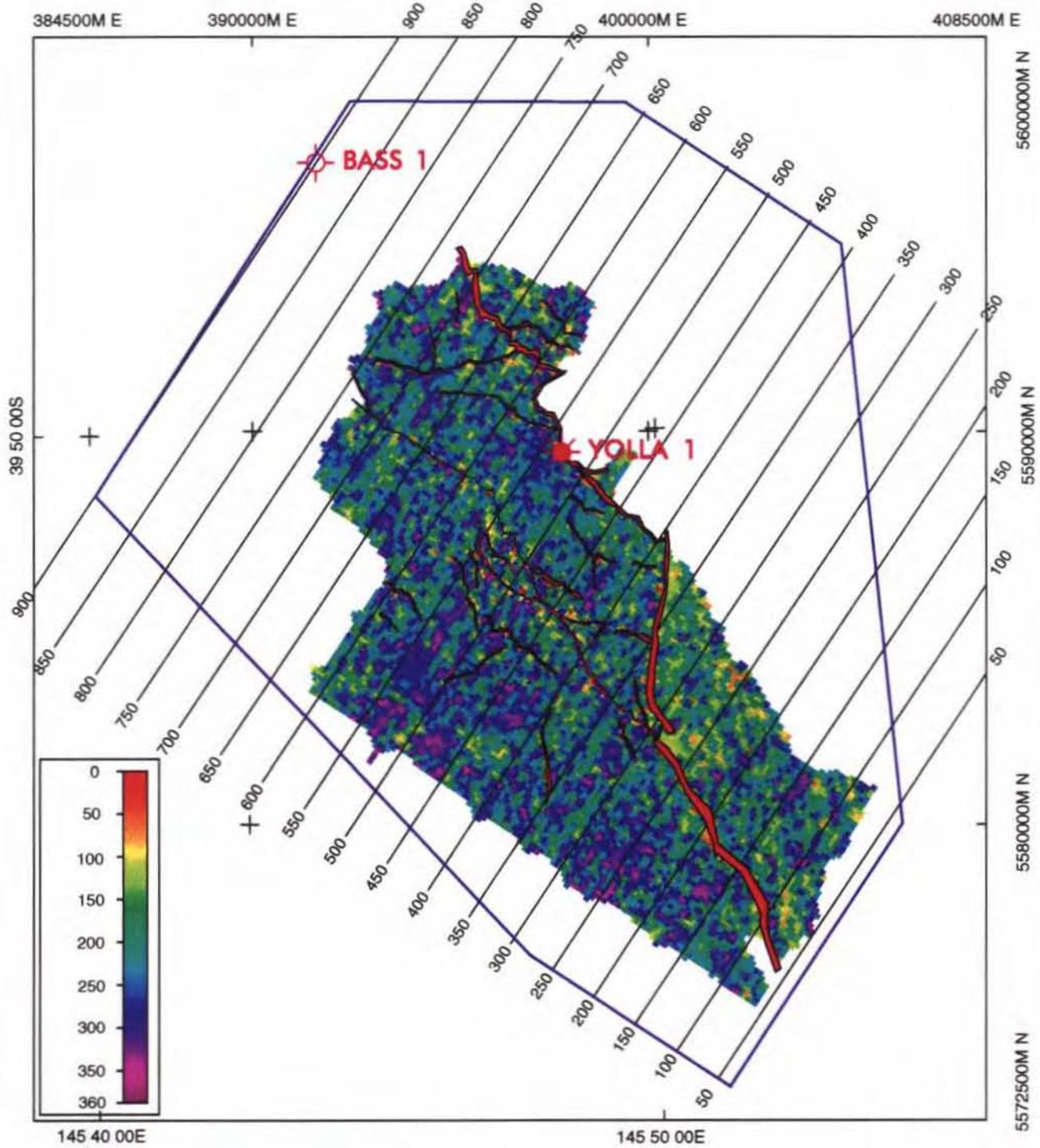


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TRL1 BASS BASIN TASMANIA

DEEP SEISMIC ONLAP EVENT, DIP MAGNITUDE (DEGREES)





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 CENTRAL MERIDIAN 147 00 00E

T/RL1 BASS BASIN    TASMANIA

DEEP SEISMIC ONLAP EVENT, DIP AZIMUTH (DEGREES)

