

SEISMIC INTERPRETATION REPORT

T/30P and T/34P Aragorn 3D Marine Seismic Survey Otway Basin

Government Version



RESTRICTED

Revision: 0
November 2007

Woodside Energy Ltd. (Woodside) owns or is responsible for the copyright in this document. All rights reserved. Neither the whole nor any part of this document may be reproduced, stored in or transmitted in any form by any means (electronic, mechanical, reprographic, recording or otherwise) without the prior written consent of Woodside.

Uncontrolled when printed, unless stamped in Red to the contrary.

blank



**Title: Seismic Interpretation Report, T/30P and T/34P
Aragorn 3D Marine Seismic Survey, Otway Basin**

DOCUMENT INFORMATION			
CDC No: n/a	DRIMS#: 3803327	Rev: 0	DRIMS Classification (if applicable):
Prepared by: G. Spillane	Date: 14/11/2007	Signature: <i>G. Spillane</i>	
Supervised by (if applicable):	Date:	Signature:	
Approved by: Royd Bussell	Date: 14/11/07	Signature: <i>M.R. Bussell</i>	
Custodian: Greg Spillane	Date:	Signature:	

CONCURRENCE			
Name	Group	Date	Signature

REVISION HISTORY				
Revision	Description	Date	Prepared by	Approved by

RELEASE STATEMENT
(Check one box only)

Unclassified
(Shared without Restrictions)

Restricted
(Freely Shared within Woodside and Associated Companies)

Confidential
(Shared With Selected Personnel)

Most Confidential
(Strict Need-to-Know Basis)

REVIEW STATUS
(Check one box only)

Review Period 1 Year

Review Period 3 Years

Review Not Required

PREPARED
(Check one box only)

By WEL

For WEL
Under PO/Contract No:

DOCUMENT DISTRIBUTION			
Copy No.	Name	Hard Copy	Electronic Copy
00	New Ventures Library Attn: Lesley Johnson	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
01	Jenny Bauer, Origin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
02	Andy Whittle, Benaris	<input checked="" type="checkbox"/>	<input type="checkbox"/>
03	Rob Young, CalEnergy	<input checked="" type="checkbox"/>	<input type="checkbox"/>
04	Geoscience Australia	<input checked="" type="checkbox"/>	<input type="checkbox"/>
05	Mineral Resources Tasmania	<input checked="" type="checkbox"/>	<input type="checkbox"/>
06		<input checked="" type="checkbox"/>	<input type="checkbox"/>
07		<input type="checkbox"/>	<input type="checkbox"/>
08		<input type="checkbox"/>	<input type="checkbox"/>
09		<input type="checkbox"/>	<input type="checkbox"/>
10		<input type="checkbox"/>	<input type="checkbox"/>

TABLE OF CONTENTS

1	SUMMARY	1
2	INTRODUCTION	1
2.1	Acquisition & Processing	1
2.2	Data Loading & Topographic Projection Parameters	2
2.3	Data Quality	2
3	TIME INTERPRETATION.....	2
3.1	Correlations and Well Ties.....	2
3.2	Seismic Stratigraphy	2
3.3	Horizon Interpretation	3
3.3.1	Water Bottom (WB).....	3
3.3.2	Intra Tertiary Horizons	3
3.3.3	Top Dilwyn Formation (TE1).....	3
3.3.4	Intra Skull Creek Horizons	4
3.3.5	Top Belfast Formation (KS2)	4
3.3.6	Top Flaxman (KS1), Waarre Formation (KT) and Eumeralla Formations	4
3.4	Fault Interpretation.....	4
4	CONCLUSIONS	4
5	REFERENCES	4

Tables

1. TWT Horizons Interpreted over the Aragorn 3D

Figures

1. Aragorn 3D Location Map
2. Aragorn 3D Bathymetry Map
3. Aragorn 3D Trace 5700
4. Aragorn 3D Trace 5100
5. Aragorn 3D Trace 3400
6. Water Bottom Time Structure Map
7. Base Intra Tertiary Channel Event Time Structure Map
8. Top Intra Tertiary Progrades Time Structure Map
9. Top Dilwyn Formation Time Structure Map
10. Intra Skull Creek Formation Time Structure Map
11. Base Astrolabe Time Structure Map
12. Top Belfast Formation Time Structure Map
13. Top Flaxman Formation Time Structure Map
14. Top Waarre Formation Time Structure Map
15. Top Eumeralla Formation Time Structure Map

1 SUMMARY

The Aragon 3D Marine Seismic Survey was acquired by PGS Geophysical between 25 March and 30 May 2006. The survey was shot using the M/V Ramform Victory and covered an area of 1037km² across permits T/30P and T/34P of which 435km² was acquired within T/30P and 602km² within T/34P. The data was processed by PGS Geophysical both onboard the Ramform Victory and in their Perth Data Processing Centre. In addition to the Aragon 3D data, approximately 410km² of the vintage Investigator 3D (acquired December 1999 to April 2000) data adjoining the northern edge of the Aragon data was reprocessed to allow a tie to the Thylacine gas discovery. A priority fast-track post-stack time migrated volume covering an area of approximately 660km² over the deepwater area was delivered mid-June 2006. A final fast-track post-stack time migrated volume covering the entire Aragon 3D was delivered end July 2006. The final pre-stack time migrated data set including the Investigator 3D merged to the Aragon bin grid was delivered end October 2006. The seismic data quality varied from very good in the deep water area to very poor under the incised shelf slope break. Acquisition of the Aragon 3D fulfilled the Year 2 and 3 work commitments in T/30P and the Year 2 work commitments in T/34P.

The interpretation of the Aragon 3D was undertaken in two phases of mapping which were then merged into a final interpretation. The first phase of interpretation commenced on the priority fast-track post-stack time migrated data in June 2006. The second phase of interpretation was undertaken on the final pre-stack time migrated volume.

The Aragon 3D seismic survey provided seismic coverage along the T/30P and T/34P permit boundary and enabled mapping of the both the shallow and deep water prospectivity within the two permits.

2 INTRODUCTION

2.1 Acquisition & Processing

The Aragon 3D Marine Seismic Survey was acquired by PGS Geophysical between 25 March and 30 May 2006. The survey was shot using the M/V Ramform Victory and covered an area of 1037km² across permits T/30P and T/34P, of which 435km² was acquired within T/30P and 602km² within T/34P (Figure 1). During the survey extensive periods of bad weather were encountered, adding up to 52% of the survey time; as a result, a swath of data originally planned in the northwest corner of the survey area was not acquired (Figure 1). Nevertheless, the acquired data fulfilled the primary term work programme obligations of the permits.

The survey was acquired using dual source arrays, each with a gun capacity of 3090in³. The data were recorded with ten 4,500m long streamers towed at a nominal depth of 9m below surface. Acquisition bin size was 30 x 6.25m with a nominal fold of 60 and a record length of 6 seconds.

The Aragon 3D MSS was processed by PGS Geophysical both onboard the Ramform Victory and in their Perth Data Processing Centre. In addition to the Aragon 3D data, approximately 410km² of the vintage Investigator 3D (acquired December 1999 to April 2000) data adjoining the northern edge of the Aragon data was reprocessed to allow a tie to the Thylacine gas discovery.

A priority fast-track post-stack time migrated volume covering an area of approximately 660km² over the deepwater area was delivered mid-June 2006. A final fast-track post-stack time migrated volume covering the entire Aragon 3D was delivered end July 2006. The final pre-stack time migrated data set, including the Investigator 3D merged to the Aragon bin grid, was delivered for interpretation end October 2006.

Full details of the acquisition and processing of the Aragon 3D MSS can be found in the Aragon 3D acquisition and processing reports by PGS Geophysical (PGS, 2006a and 2006b).

2.2 Data Loading & Topographic Projection Parameters

The Aragorn 3D MSS data sets were loaded into a Landmark Seisworks project in 16-bit format. The data was loaded using geographical projection UTM Zone 54 South (Central Meridian 141° E). The geodetic datum used was GDA94.

2.3 Data Quality

The Aragorn 3D MSS was acquired over a heavily incised shelf slope break and into deep water (Figure 2). Although data quality in the deep water section is very good, the data quality deteriorates under the heavily incised shelf-slope break (Figures 3, 4 and 5). The Tertiary section is also heavily channelised. These steep and variable geometries, combined with rapid lateral velocity changes within this section, create complex ray paths which have resulted in poor seismic illumination, imaging and difficult velocity interpretation. Data quality in these areas is generally very poor.

Matching of the Investigator 3D data with the Aragorn 3D data was successful; however, a deterioration of the shallow data quality when compared with the original Investigator processing was noted. The main reason for this inferior shallow water data quality was the decimation of the Investigator data to match the acquisition geometry of the Aragorn data which was designed primarily for deep water.

The data is zero phase, with a blue reflector on variable density displays below representing a soft kick (peak, positive amplitude) and a yellow-red reflector representing a hard kick (trough, negative amplitude).

3 TIME INTERPRETATION

3.1 Correlations and Well Ties

The interpretation of the Aragorn 3D was undertaken in two phases which were then merged into a final interpretation. The first phase of interpretation commenced on the priority fast-track post-stack time migrated data in June 2006. This data set covered an area of approximately 660km² in the southwest corner of the Aragorn 3D area. This priority fast-track data set did not tie into any of the offset wells and the interpretation was based on seismic sequence stratigraphy and from ties to the existing regional 2D seismic interpretation. The interpretation was limited to the deep water, good data quality area on the downthrown side of a major northwest southeast trending fault system running under the current day shelf break.

The second phase of interpretation was undertaken on the final pre-stack time migrated volume which included the Investigator 3D data that provided well ties to the Thylacine wells. The key overburden and reservoir horizons were tied to the Thylacine wells and interpreted over the shallow water area of the Aragorn 3D. Correlation of these picks to the first phase of interpretation in the deep water area of the Aragorn 3D was made difficult due to the poor seismic data quality under the incised shelf slope break as well as correlation uncertainties across a major fault system.

3.2 Seismic Stratigraphy

Three key horizons have been interpreted over the entire Aragorn 3D volume, the water bottom, top Dilwyn Formation and the top Belfast Formation (Figures 3, 4 and 5). Over the survey area, the top Dilwyn Formation (Eocene) correlates approximately with the base Tertiary, with the Palaeocene Pebble Point Formation being thin or absent in the Shipwreck Trough. The top Dilwyn pick marks the base of the Tertiary prograding sequence and the top of the low seismic amplitude Timboon Formation.

The top Belfast Formation is the top of the primary reservoir section and is generally picked as the top of a high amplitude package beneath the low amplitude Skull Creek Formation. As the extent of the Belfast Formation is unknown due to lack of well control in the deep water, the interpreted top Belfast seismic horizon may represent the top Flaxman or top Waarre Formation equivalents in the deep water area.

Other horizons have been mapped on a more local basis due to poor data quality making interpretation over the entire dataset difficult. Over the northern part of the survey area two intra-tertiary have been mapped. These horizons have not been tied to well control but mark the base of channelling within the Tertiary and the top of an Early Tertiary prograding unit. The top Flaxman and Waarre Formations were also interpreted over the northern part of the Aragorn 3D as additional reservoir target levels. Both these events were tied to the Thylacine wells.

Two additional units have also been mapped in the southern, deep water portion of the Aragorn 3D. These were interpreted on the priority fast-track volume and were not tied to well control. The upper reflector was easy to correlate around the deep water area of the Aragorn 3D and was used to define the structure over the deep water area. The lower reflector has been interpreted as the base of a prograding unit which has notionally been called the base of the Astrolabe sandstone, identified in the Prawn-1A and Eric the Red-1 wells to the east of the survey area.

3.3 Horizon Interpretation

Horizons interpreted over the Aragorn 3D survey area are listed in Table 1. Figures 3, 4 and 5 are representative Aragorn 3D lines showing key interpreted horizons.

Table 1: TWT Horizons Interpreted over the Aragorn 3D

Pick Name	Age	Seismic Horizon	Polarity	Comment
Water Bottom	Present Day	WB	Trough	Excellent Pick
Base Intra Tertiary Channels	Mio/Oligocene	-	Peak	Good Pick
Top Intra Tertiary Progrades	Mio/Oligocene	-	Peak	Good Pick
Top Dilwyn Formation	Eocene	TE1	Peak	Good Pick
Intra Skull Creek Event	Campanian	-	Trough	Good Pick
Base Astrolabe	Campanian	-	Trough	Good Pick
Top Belfast Formation	Santonian	KS2	Peak	Good to Poor Pick
Top Flaxman Formation	Coniacian	KS1	Trough	Good to Poor Pick
Top Waarre Formation	Turonian	KT	Trough	Good to Poor Pick
Top Eumeralla	Albian	KC	Trough	Good to Poor Pick

3.3.1 Water Bottom (WB)

The water bottom time structure map (Figure 6) shows water depth increasing from 100 msec on the shelf to 2250 msec in the deep water. The map highlights the heavily incised shelf slope break running through the survey area.

3.3.2 Intra Tertiary Horizons

Figures 7 and 8 show time structure maps for two intra-Tertiary horizons interpreted over the northern part of the Aragorn 3D area. The upper horizon marks the base of channelling within the Tertiary section with the time structure map (Figure 7) showing the northeast to southwest trending channels. The lower horizon marks the top of an Early Tertiary prograding sequence. Although generally not cut by channels, the time structure map (Figure 8) shows northeast to southwest trends caused by velocity effects of the channelised overburden.

3.3.3 Top Dilwyn Formation (TE1)

The top Dilwyn Formation was interpreted across the entire Aragorn 3D area. The time structure map (Figure 9) shows dip to the southwest and shows severe distortion caused by the velocity effects of the channelised shelf-slope break. The top Dilwyn is largely unfaulted and could be correlated around the survey area with a high degree of confidence.

3.3.4 Intra Skull Creek Horizons

Two horizons have been mapped over the deep water area of the Aragorn 3D. These were interpreted on the priority fast track volume and consequently were not tied to well control but are interpreted to be within the Skull Creek Formation. The upper event was easy to correlate around the deep water area of the Aragorn 3D and was used to define the structure in this area (Figure 10).

The lower event has been interpreted as the base of a prograding unit which has been notionally called the Astrolabe sandstone. The time structure map (Figure 11) shows features similar to the upper intra Skull Creek event.

3.3.5 Top Belfast Formation (KS2)

The top Belfast Formation has generally been picked as the first high amplitude peak beneath a low seismic amplitude zone (Skull Creek Formation). In the shallow water area, seismic interpretation confidence is high, with well ties provided by the Thylacine wells. Data quality does deteriorate under the shelf-slope break, which increases interpretation uncertainty. Correlation across a major fault system under the present day shelf break is speculative given the lack of well control in the deepwater portion of the Otway Basin. Figure 12 is the time structure map of the top Belfast Formation.

3.3.6 Top Flaxman (KS1), Waarre Formation (KT) and Eumeralla Formations

The top Flaxman, Waarre and Eumeralla Formations have been interpreted over the northern part of the Aragorn 3D. The top Flaxman event has been picked as a moderate to high amplitude trough with downlaps of the overlying Belfast Formation clearly observed on the seismic data. The top Waarre Formation has been picked as the top of a low amplitude zone and is not as well defined as the top Flaxman Formation. The top Eumeralla Formation has been picked as a high amplitude trough that marks the top of a high amplitude package beneath the lower amplitude Waarre Formation. Time structure maps for the top Flaxman, Waarre and Eumeralla Formations are included as Figures 13, 14 and 15.

3.4 Fault Interpretation

The top Belfast Formation time structure map (Figure 12) highlights the regional structural interpretation. Two main structural trends have been mapped, a dominant northwest - southeast trend, and an east - west trend which is more evident west of the major northeast - southwest fault system. The dominant northwest - southeast trend is the result of extensional tectonism that began in the Turonian and continued until continental separation in the Maastrichtian.

The east - west fault trend is more evident in the western deep water portion of the Aragorn 3D and appears to be older than the more dominant northwest - southeast trend and may be a reactivation of extensional faulting that began in the Tithonian and continued through to the Albian.

Only minor faulting is evident in the Tertiary section through the survey area.

4 CONCLUSIONS

The Aragorn 3D seismic survey provided seismic coverage along the T/30P and T/34P permit boundary and enabled mapping of the both the shallow and deep water prospectivity within the two permits. The seismic data quality varied from very good in the deep water area to very poor under the incised shelf slope break. Acquisition of the Aragorn 3D fulfilled the Year 2 and 3 work commitments in T/30P and the Year 2 work commitments in T/34P.

5 REFERENCES

- PGS, 2006a. M/V Ramform Victory Aragorn 3D Survey Bass Strait Tasmania (drims#3174230)
- PGS, 2006b. Data Processing Report 3D Seismic Survey Aragorn 3D PreSTM 2006, Otway Basin (drims#3360052)

Figure 1: Aragorn 3D Location Map

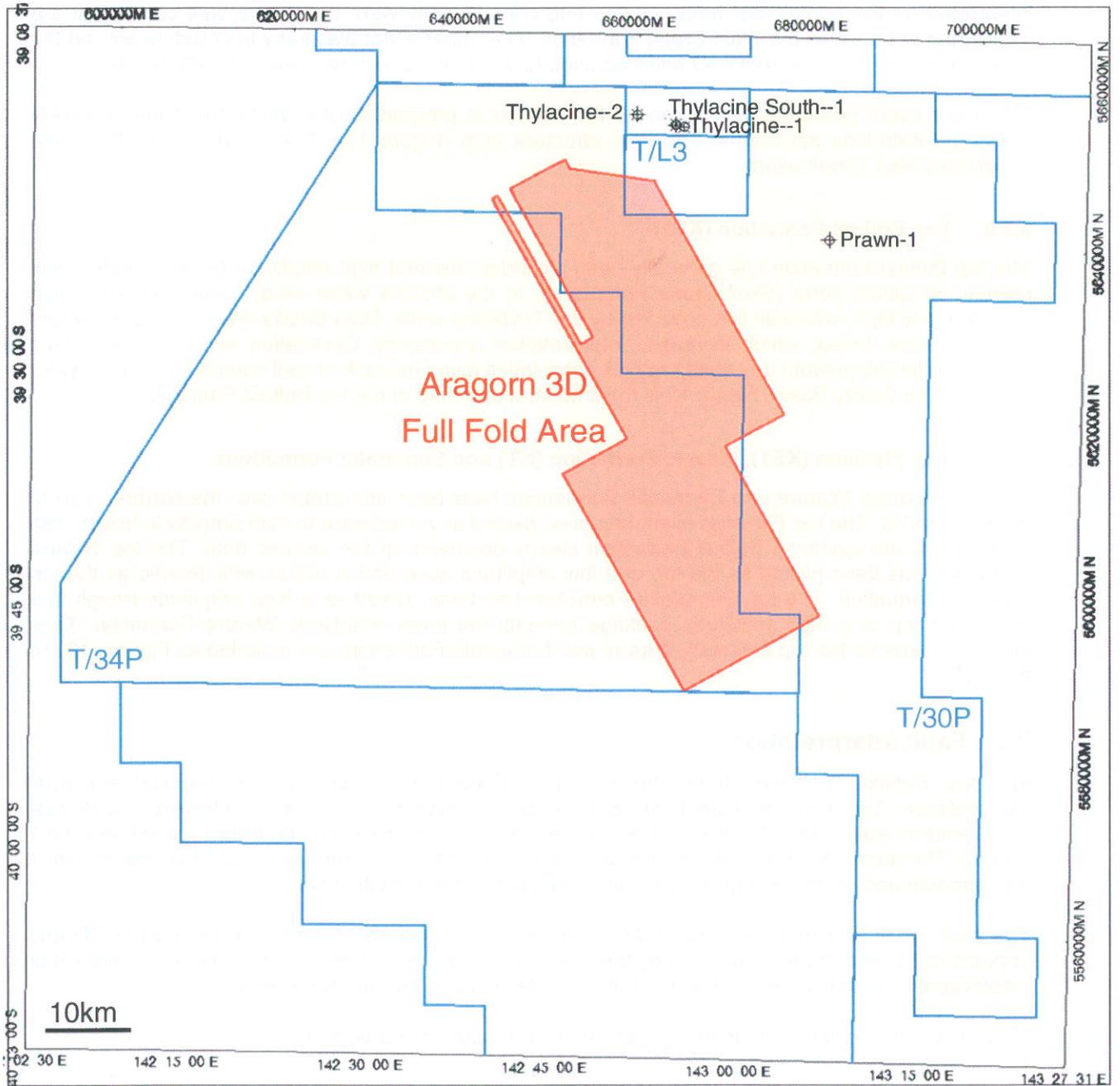


Figure 2: Aragorn 3D Bathymetry Map

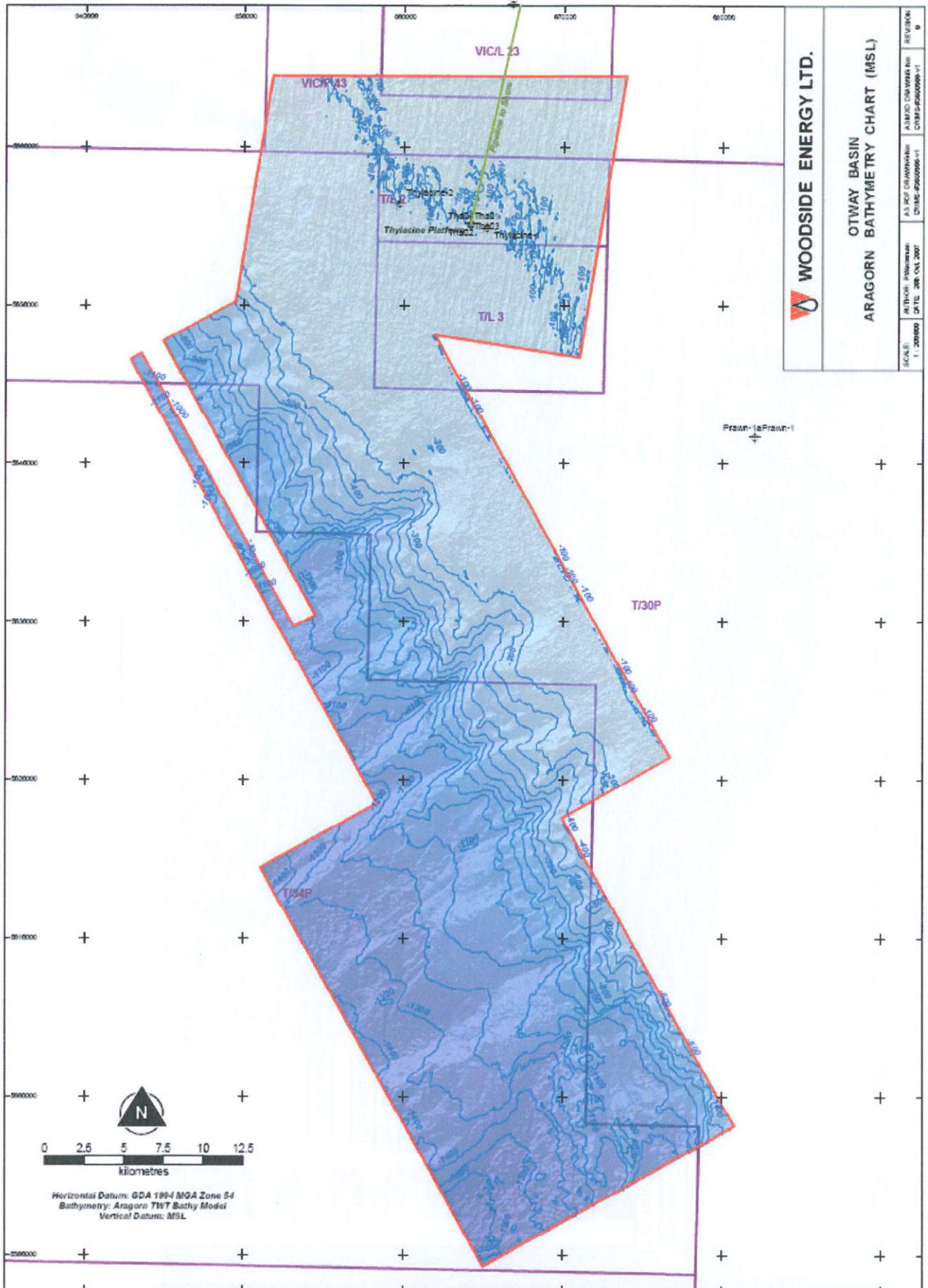


Figure 3: Aragon 3D Trace 5700

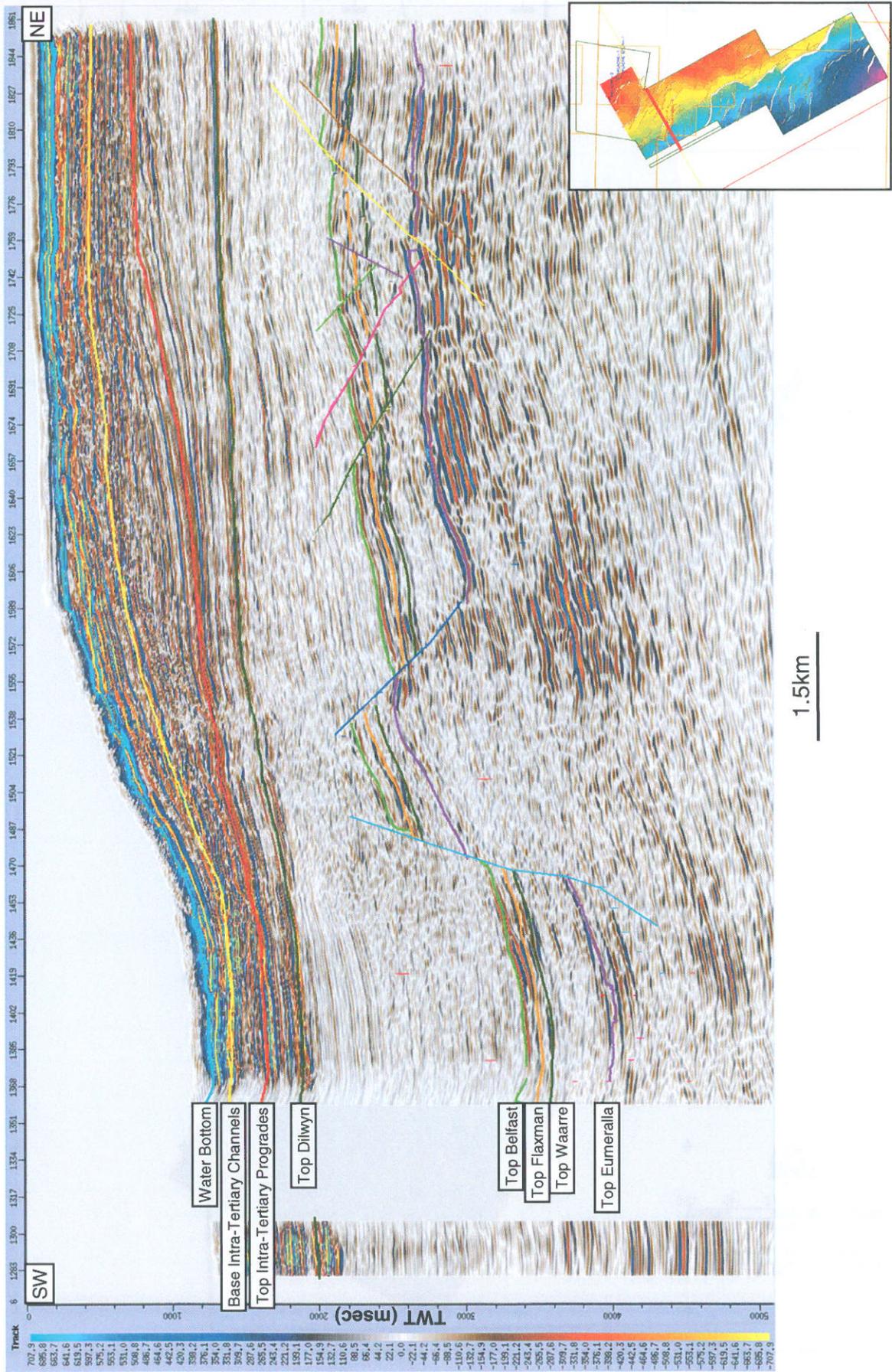


Figure 4: Aragon 3D Trace 5100

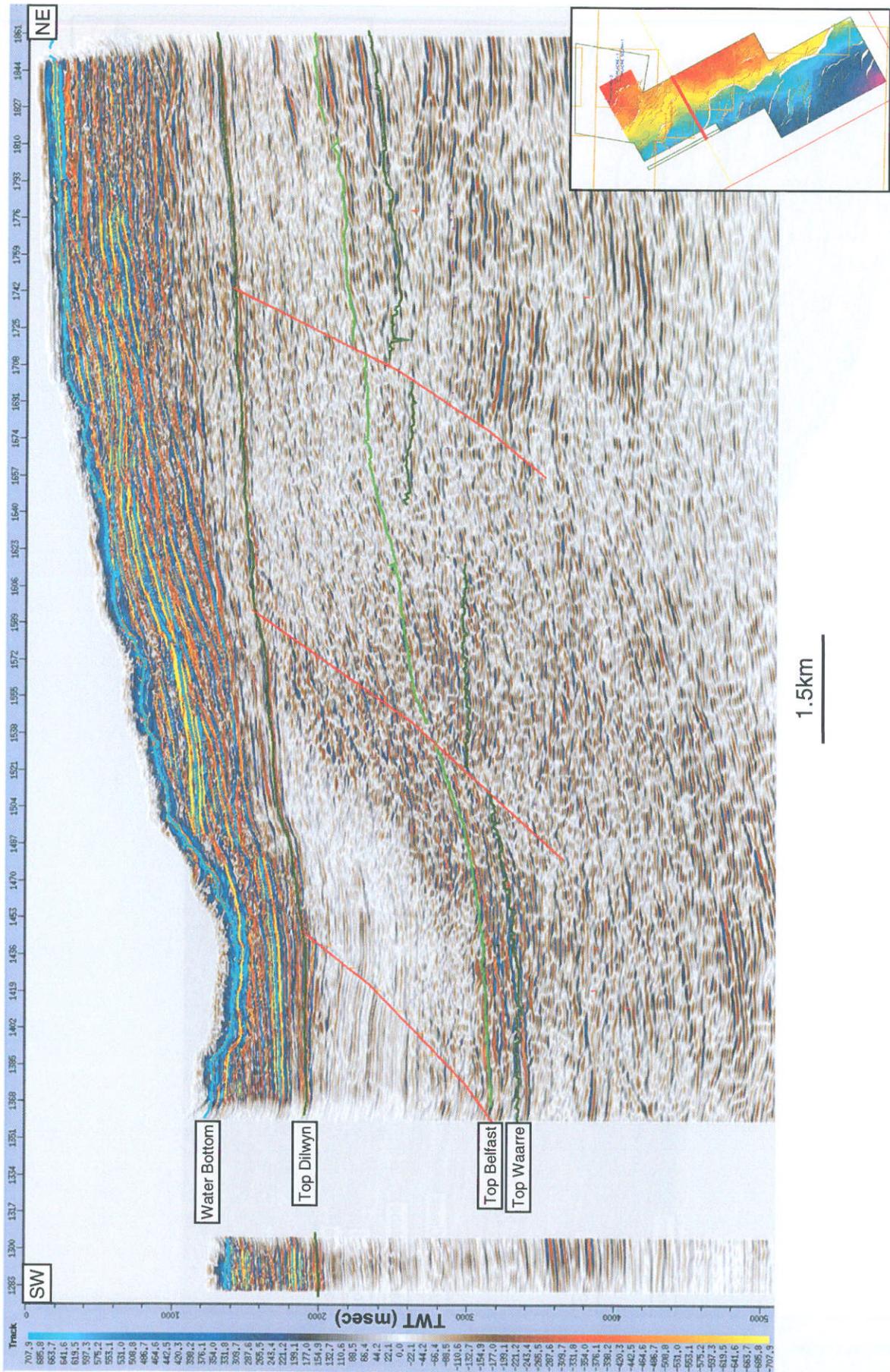


Figure 5: Aragon 3D Trace 3400

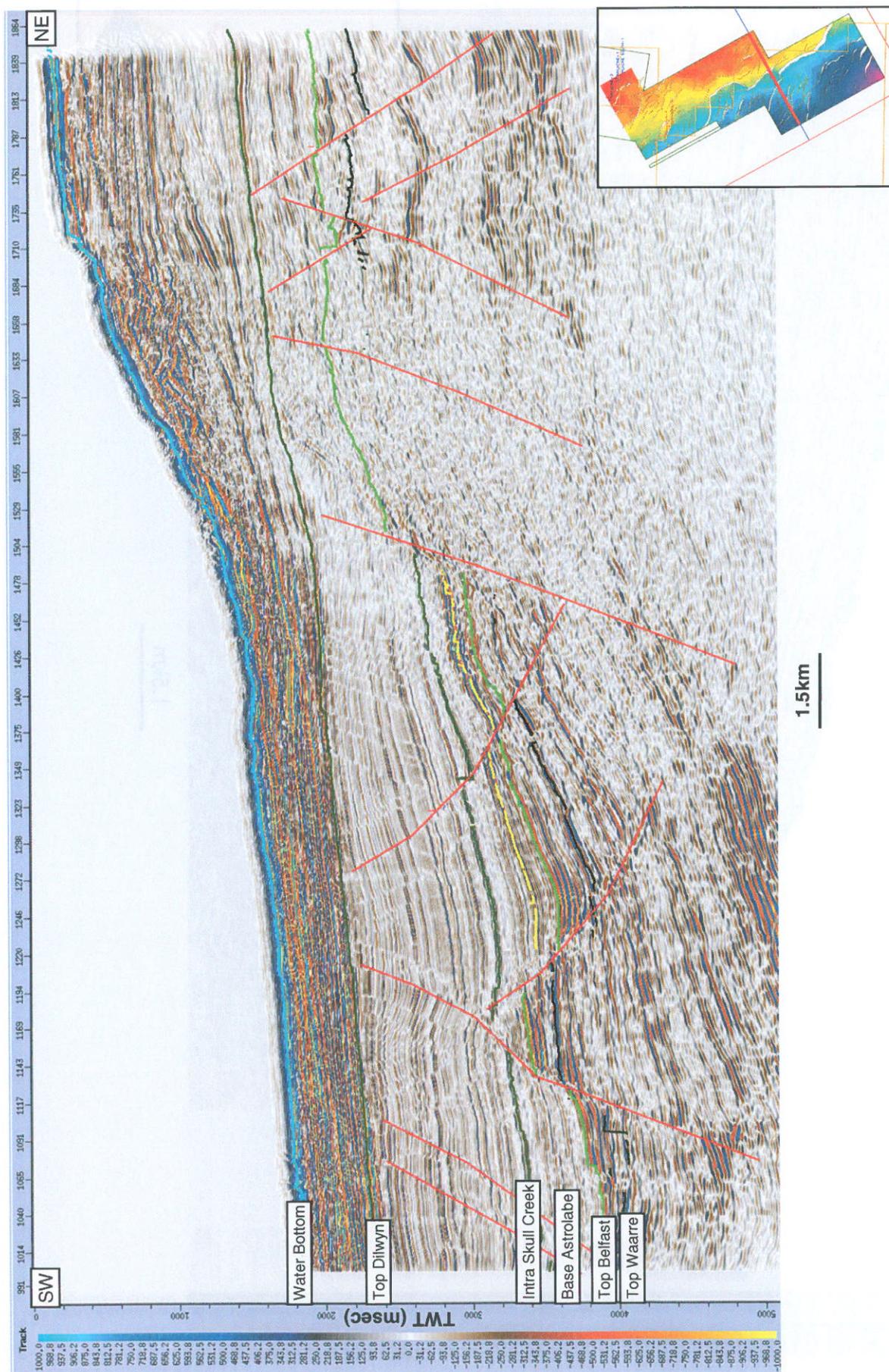


Figure 6: Water Bottom Time Structure Map

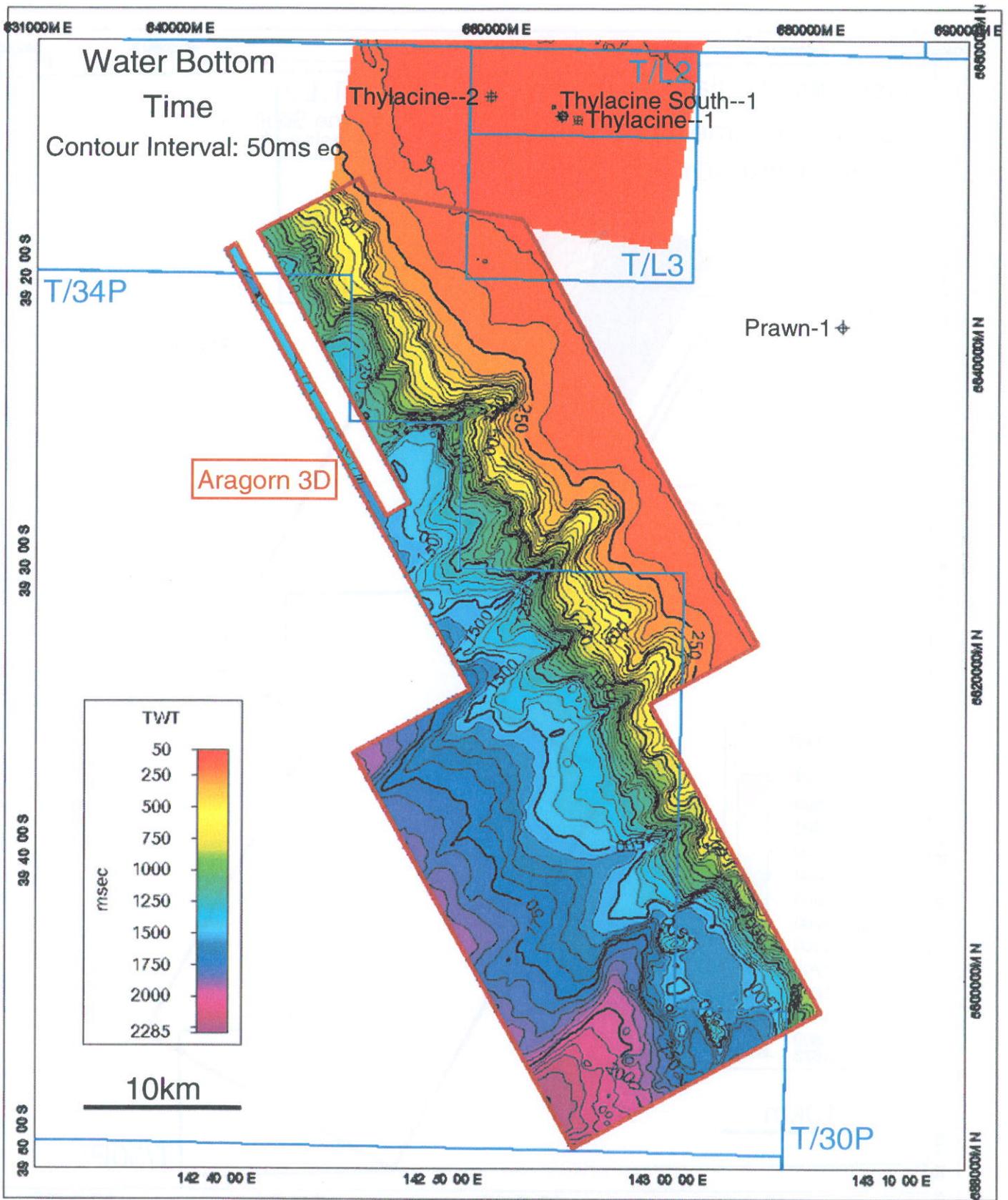


Figure 7: Base Intra Tertiary Channels Time Structure Map

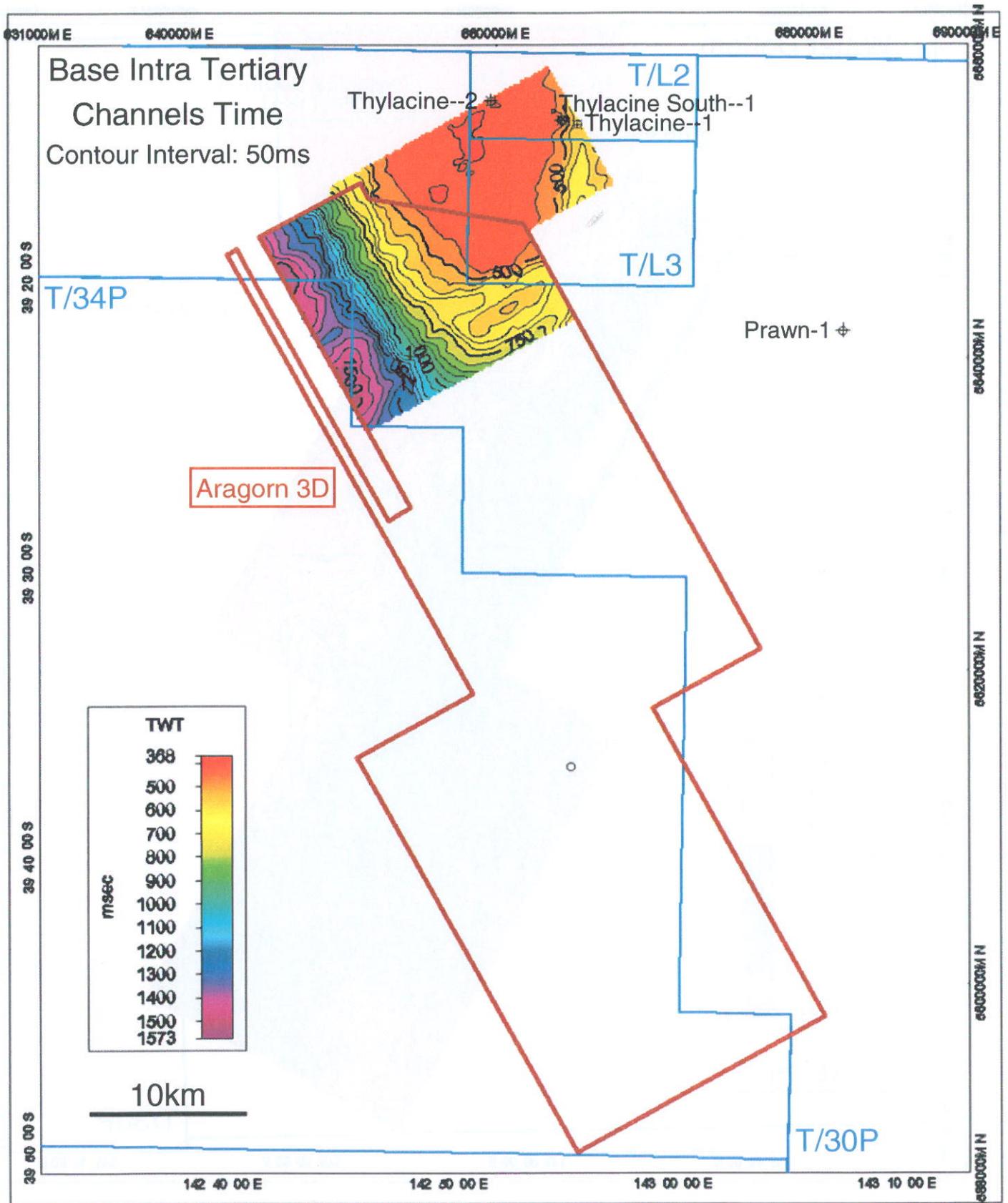


Figure 8: Top Intra Tertiary Progrades Time Structure Map

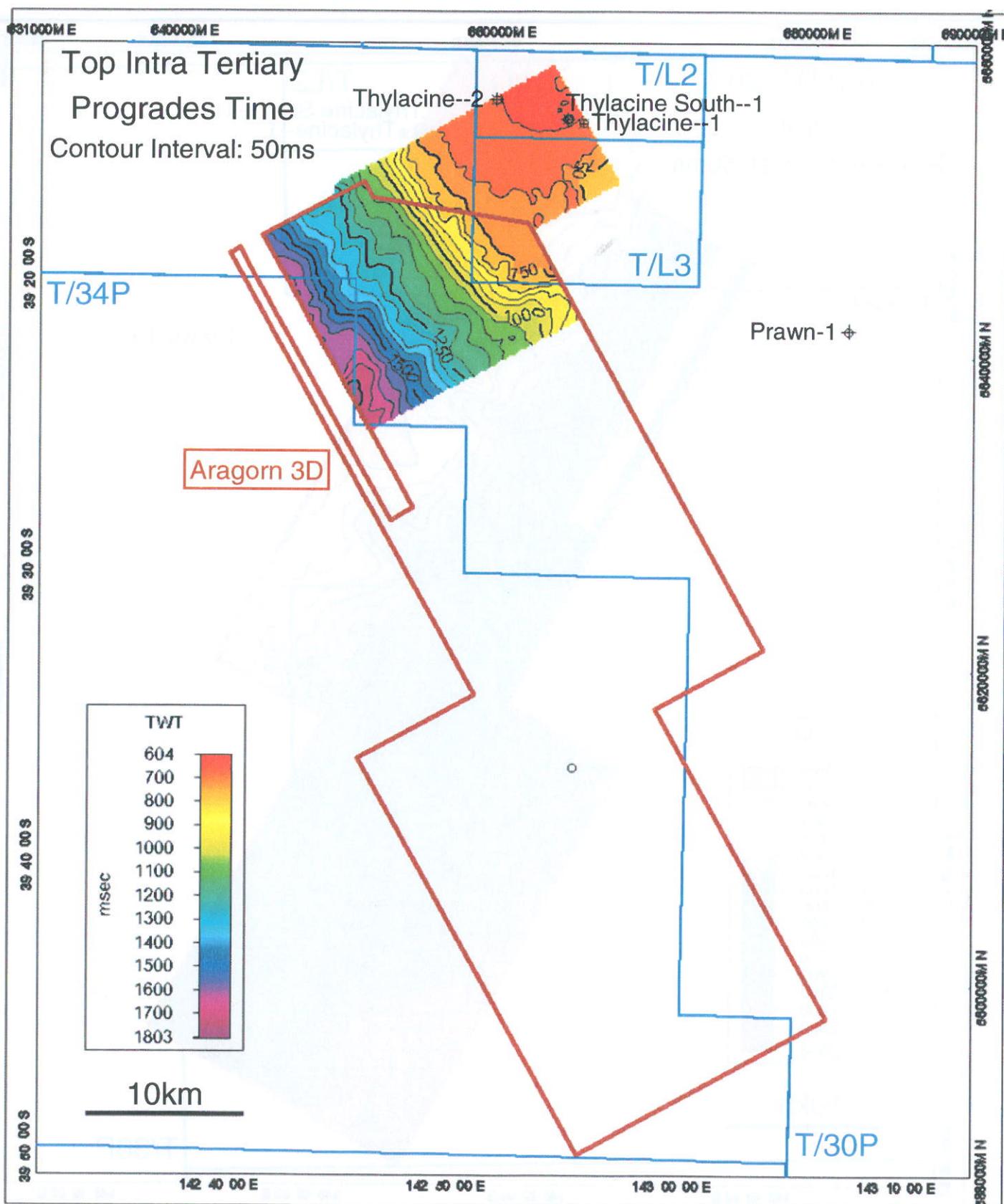


Figure 9: Top Dilwyn Formation Time Structure Map

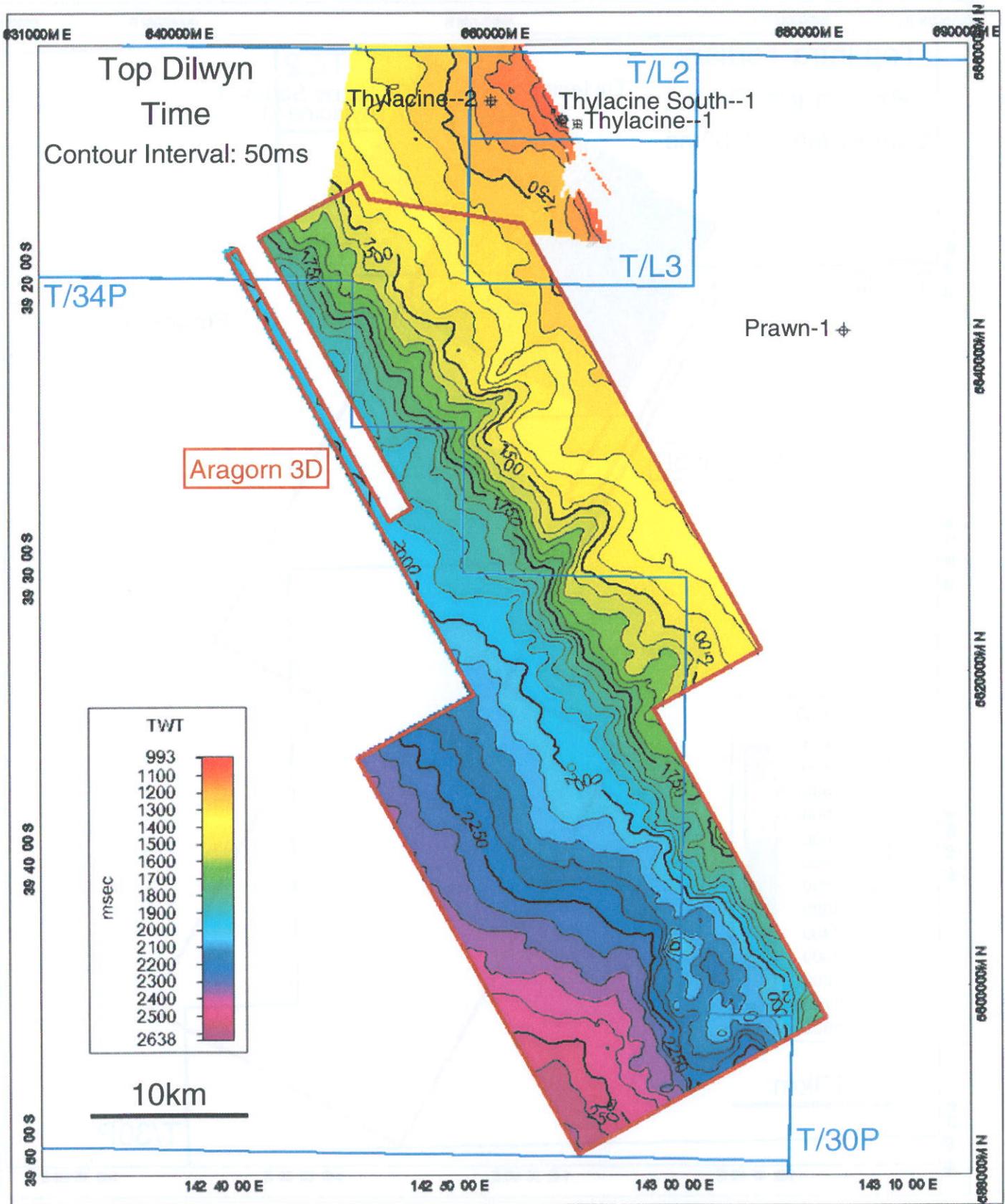


Figure 10: Intra Skull Creek Formation Time Structure Map

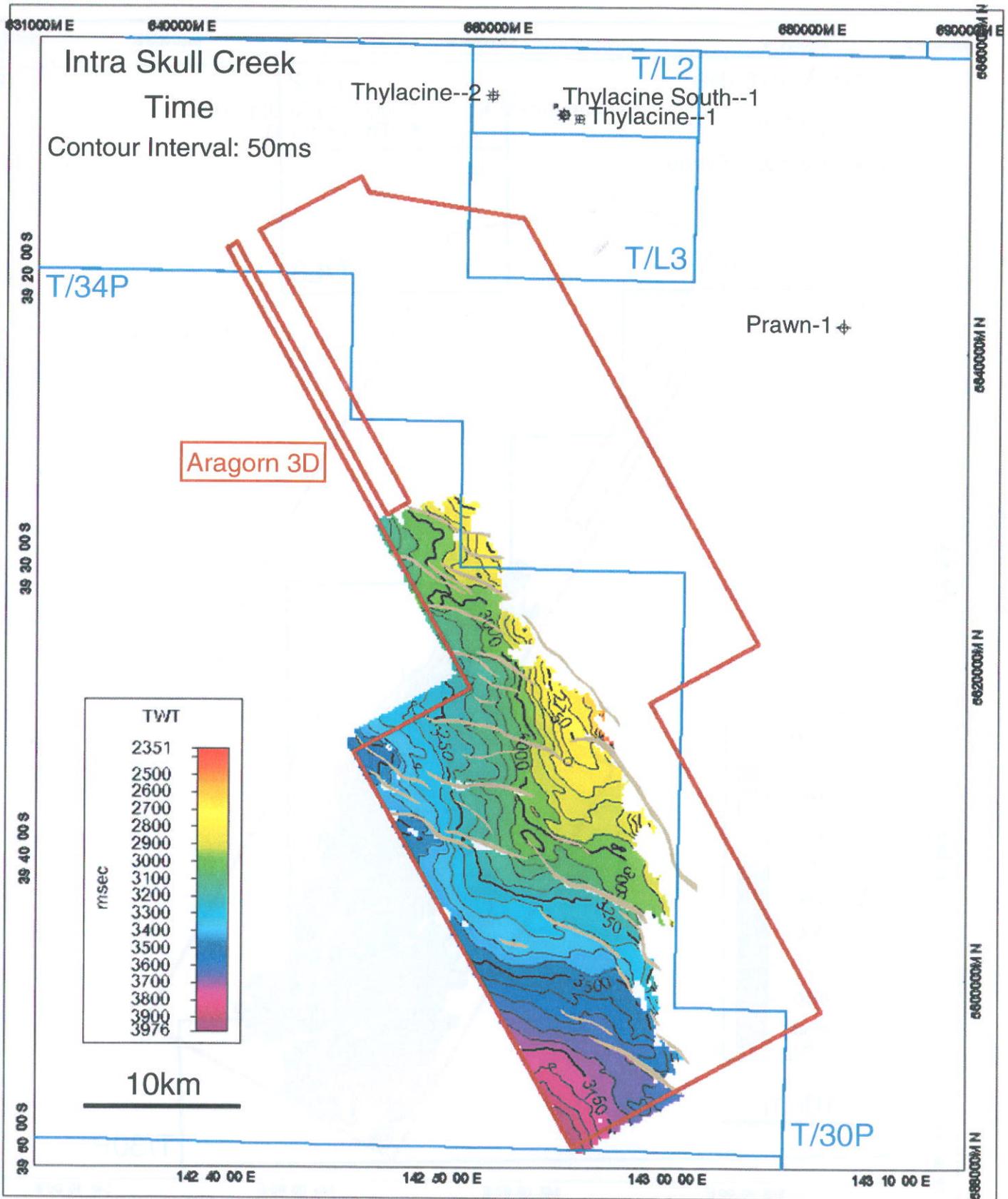


Figure 11: Base Astrolabe Time Structure Map

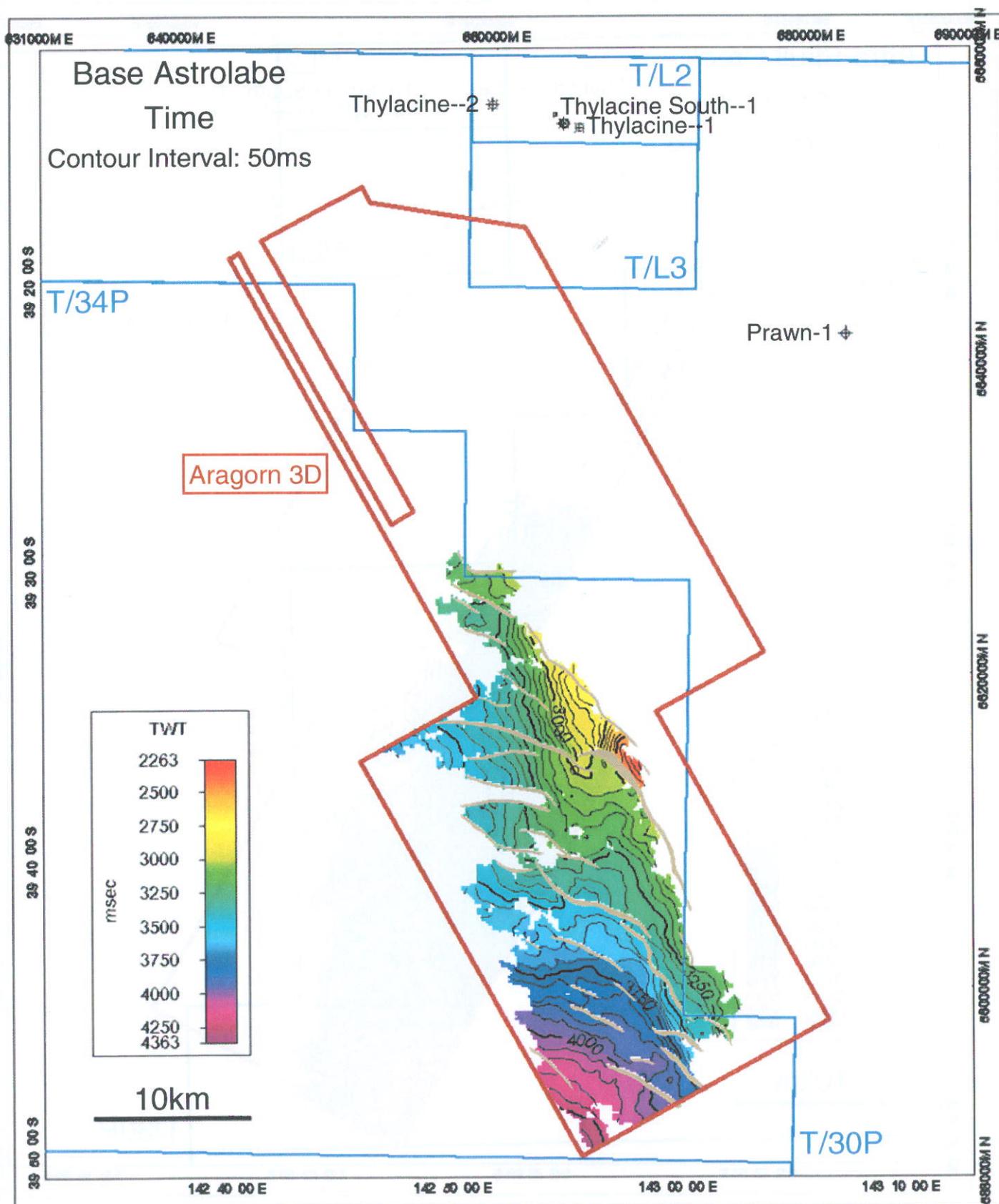


Figure 12: Top Belfast Formation Time Structure Map

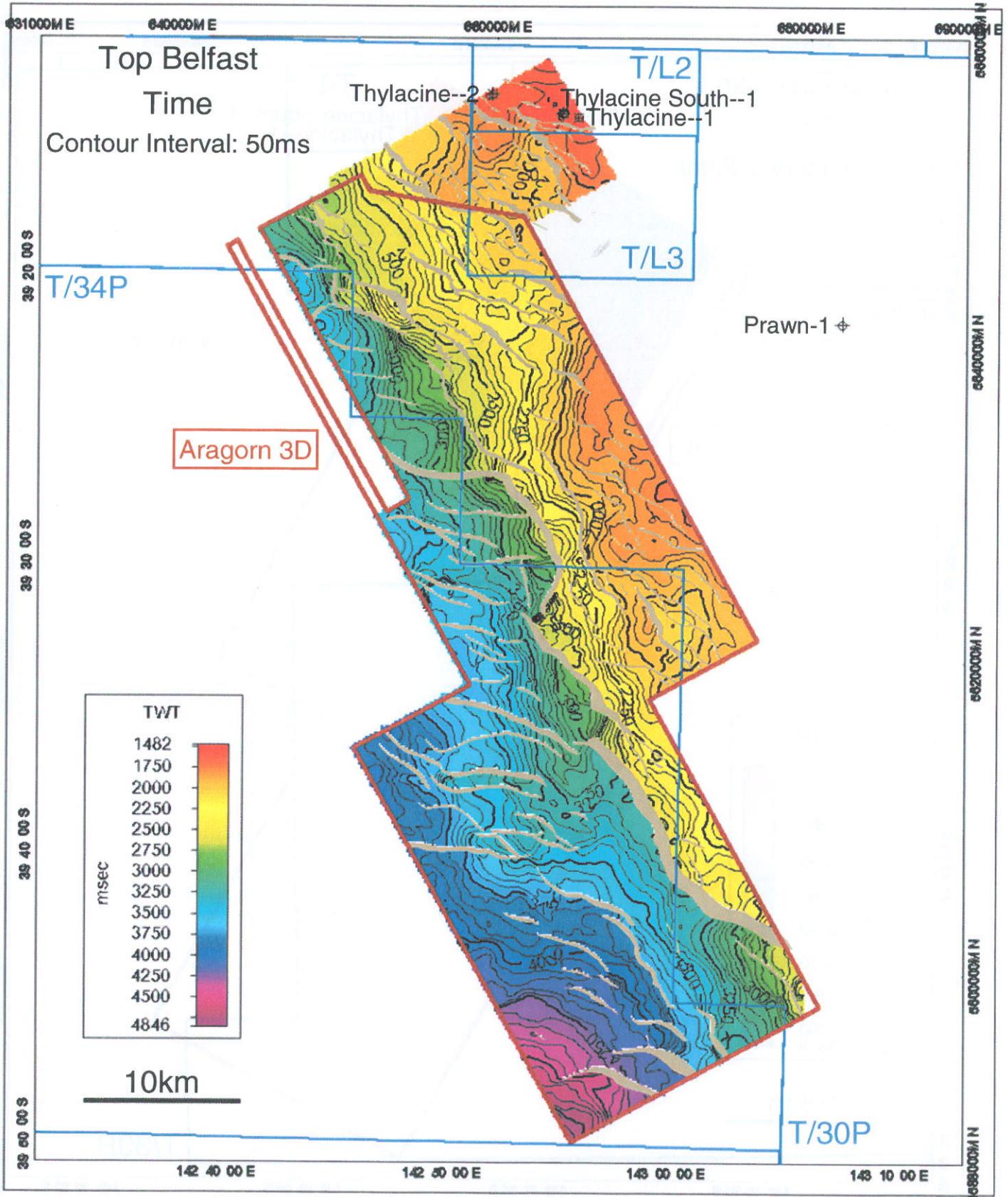


Figure 13: Top Flaxman Formation Time Structure Map

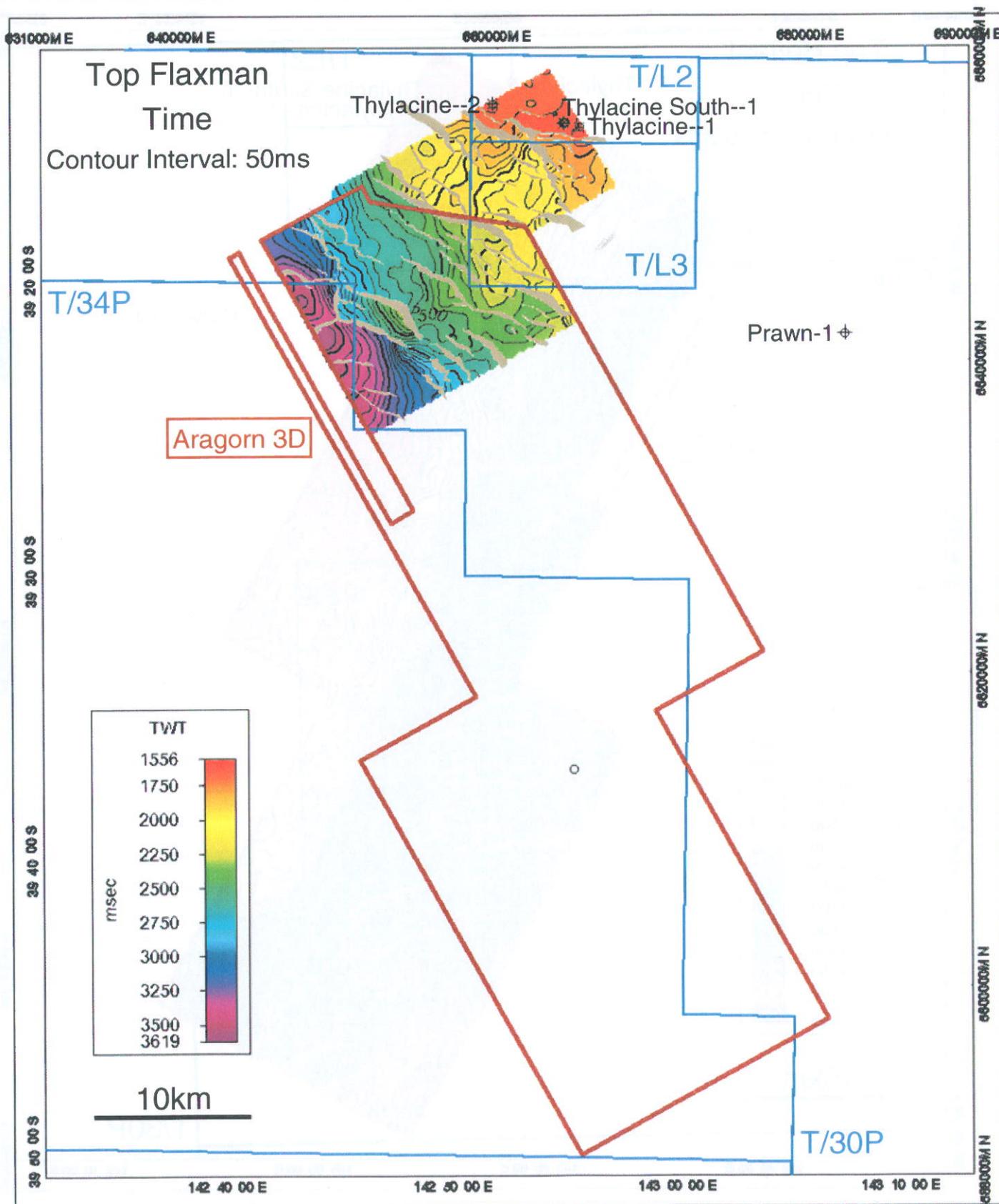


Figure 14: Top Waarre Formation Time Structure Map

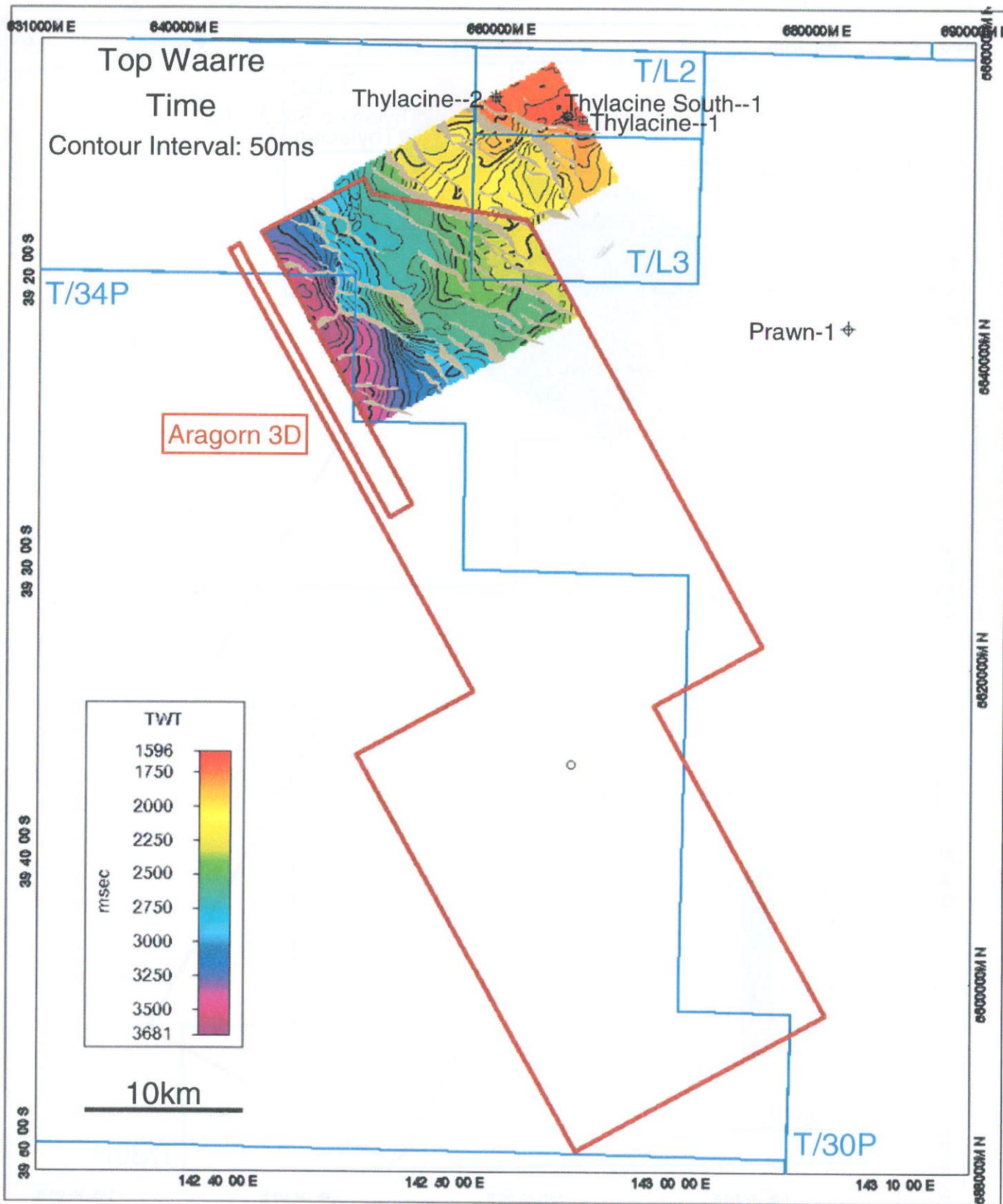


Figure 15: Top Eumeralla Formation Time Structure Map

