9 APPENDIX III – FACTORS AFFECTING AVO

FUGRO SEISMIC IMAGING PTY LTD

SEISMIC DATA PROCESSING REPORT

FOR

GREAT SOUTH LAND MINERALS

Location : Tasmanian Basin, Tasmania
Permit : SEL 13/98
Surveys : 2007 2D Seismic Survey

Date : November 2007

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1 INTRODUCTION

The 2007 seismic data covered approximately 345 km and was acquired in 3 different areas. There were 11 lines in the Central Highlands, 4 lines in Thunderbolt and 5 lines in the Zeehan region. The Zeehan region was processed for Zeehan Zinc under the GSLM label.

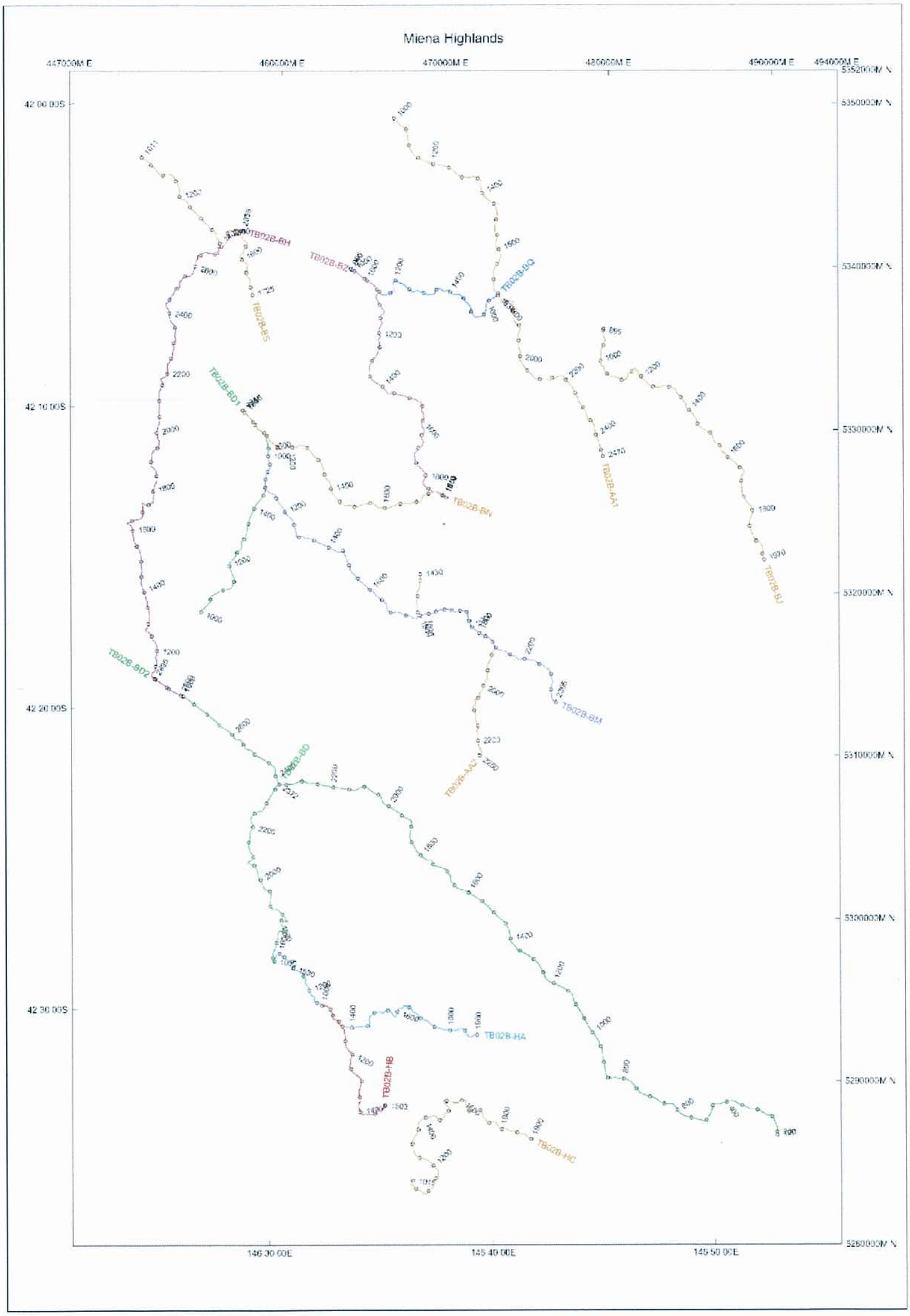
A line summary is given in section 3.0.

Field data was acquired by Terrex seismic crew 401 in April and May 2007.

2 ACQUISITION PARAMETERS

2006 Tasmanian Seismic Survey	
Data recorded by:	Terrex seismic crew 401
Date recorded:	April 2007
Seismic source:	3 vibrators in line
Source type:	Paystar
Vibe spacing:	12.5 m pad to pad
Vibe move up:	Standing sweeps
Sweeps per vp:	2
Sweep frequency:	6-140 Hz
Sweep type:	Linear 200 ms taper
Vp interval:	20 m
Recording system:	Sercels sn 388
Record length:	5 sec sweep + 6 sec listen
Sample rate:	2 milliseconds
Tape format:	SEG-D 3490 zero phase
Field filters:	6-140 Hz
Data channels:	300
Coverage:	150 fold
Geophone type:	SM4 10 Hz
Geophone array:	12 in line over 18.3 m
Element spacing:	1.125 m
Group interval:	20 m
Split spread:	2990-10-vp-10-2990m

3 SURVEY MAP


Miena Highlands
TB02B-BH
TB02B-BS
TB02B-BQ
TB02B-BD1
TB02B-BN
TB02B-AA1
TB02B-BJ
TB02B-BM
TB02B-BD2
TB02B-AA2
TB02B-HA
TB02B-HB
TB02B-HC

4 LINE SUMMARY

CENTRAL HIGHLANDS

line	sp's	cdp's
TB02B-AA1	1000-2470	2-2698
TB02B-AA2	2250-1776	2-843
TB02B-BD1	1746-1000	1-1390
TB02B-BD2	2791-1530	1-2453
TB02B-BH	2855-1000	1-3227
TB02B-BJ	895-1970	2-1938
TB02B-BM	1000-2395	1-2578
TB02B-BN	1810-1340	2-1223
TB02B-BQ	995-1634	1-1056
TB02B-BS	1725-1011	2-1189
TB02B-BZ	1914-950	2-1678

THUNDERBOX

line	sp's	cdp's
TB02B-HA	1000-1900	3-1491
TB02B-HB	1000-1503	2-853
TB02B-HC	1900-1015	1-1301

ZEEHAN

line	sp's	cdp's
TB02B-ZA	1000-1864	2-1652
TB02B-ZB	1000-1000	1-732
TB02B-ZC	1000-2002	2-1803
TB02B-ZD	900-1400	1-922
TBO2B-ZF	1000-1570	1-969

5 PARAMETER TESTING

The lines were processed as for the 2001 and 2006 surveys to keep the surveys similar. Pre stack time migration was looked at but it was felt that the data was more smeared with this process when compared to the normal post stack migration.
Filters, scaling and muting were tested to ensure the previous values were accurate especially as the frequencies were expanded to 140 Hz.

6 PROCESSING SEQUENCE

6.1 TRANSCRIPTION

Field data were converted from SEG-D format to Fugro's internal format .

6.2 GAIN RECOVERY

Spherical divergence gain function was used.
Gain (db) = 3.0t + 26Log(t) + 110

6.3 PHASE CONVERSION

Convert zero phase to minimum phase.

6.4 CDP GATHER

Shot records were sorted into common depth point gathers.
Nominal fold = 150 CDP interval = 10m

6.5 DECONVOLUTION

16 msec gapped deconvolution using two windows

Operator		120	120	ms
Gaps		2	2	ms
White noise		0.1	0.1	%
Design	near	150-2400	2000-4000	ms
	far	1000-3000	2800-4200	ms

6.6 REFRACTION STATICS

Refraction first breaks were picked using Green Mountain Refraction Statics Delay Time Method which estimates the refractor velocities to model the weathering thickness.

6.7 FIRST PASS VELOCITY ANALYSIS

First pass velocities were interpreted using Fugro's interactive velocity analyses program "MGIVA". Each analysis comprised a 20 CDP stacked panel, repeated 15 times with a different NMO velocity functions. The velocity function displayed at +/-3 %, +/-6%, +/-9%, +/-12%, +/-16%, +/-20% and +25% increments from a central velocity function which was based on a regional velocity function. The MGIVA velocity analysis is a 'map driven' package, where the user can instantly see modifications to the velocity field in map or section view. Neighbouring velocity functions are superimposed on the current location for easy recognition of velocity trends. Velocity interpretation is performed on the pre-computed stack suite, or on a colour contoured semblance display. Semblance interpretation is assisted with markers illustrating the position of potential multiples, and with an interval velocity curve. Analyses were performed at 1.5 km intervals.

6.8 FIRST PASS RESIDUAL STATICS

Fugro "NEBULA" Surface-consistent Residual Statics Package computes statics based on summed cross-correlations at source and receiver locations. A pilot trace is constructed at each CDP using a weighted mix of stacked traces. Cross-correlations of the pilot trace with traces in the respective CDP gather are summed into buffers for each source and receiver station number before being resampled and picked to derive a static value.

6.9 SECOND PASS VELOCITY ANALYSIS

Second pass velocity analysis was performed on gathers with first pass residuals statics applied. The first pass velocity field was used as centre function for Fugro's interactive velocity analysis package, MGIVA. Analyses were performed at 1.0km intervals.

6.10 SECOND PASS RESIDUAL STATICS

Second pass residual statics was run using the picked second pass velocity field as input to NMO corrections.

6.11 DMO

Log stretch DMO using Hale algorithm.

6.12 THIRD PASS VELOCITY ANALYSIS

Third pass velocity analysis was performed on DMO gathers with both first and second pass residuals statics applied. The second pass velocity field was used as centre function for Fugro's interactive velocity analysis package, MGIVA. Analyses were performed at 0.5km intervals.

6.13 NMO CORRECTION

Fourth order NMO correction was performed using the third pass velocity functions.

6.14 MUTE

Testing comparisons between outer trace mute and stretch muting was carried out. It was decided to use a stretch mute of 60% for processing.

6.15 PRE-STACK SCALING

The CDP gather traces were modulated to compensate for amplitude irregularities by scaling each trace using 500 ms AGC .

6.16 STATICS

Floating datum to final seismic reference component of the statics is applied prior to stack. This corrects the data from floating datum to a final datum at mean sea level. To avoid losing data above datum, data was time shifted by 500ms prior to static correction to datum and a new time origin of -500ms was established.

6.17 COMMON DEPTH POINT STACK

The traces within each common depth point gather were summed using 1/root(N) stack compensation with 150 fold coverage and CDP interval of 10 m.

6.18 CDP TRIM STATICS

Fugro's "PASTA" package was used to compute cdp consistent residual statics. "PASTA" is an automatic residual statics program which applies static shifts on a CDP consistent basis, using cross-correlations of NMO-corrected CDP gather traces with a CDP pilot trace for each depth point.

6.19 SPECTRAL BALANCE

Spectral balance is a zero phase deconvolution after stack. The frequencies for the desired output were 10 – 90 Hz.

6.20 MIGRATION

Dual Finite Difference Migration uses the technique of downward continuation in order to map reflectors to their true time position. It is performed in the frequency – space domain. Steep dip second order solution (65 degrees) and depth step of 12m were used.

6.21 BAND PASS FILTER

Unwanted noise that lay outside the frequency range of the desired reflection and diffraction data were removed by the application of a series of time variant filters.

Time (ms)	Frequency (Hz)
500	10 / 14 - 95/110
1000	10 / 14 - 95/110
3000	10 / 14 - 65/80
4000	10 / 14 - 55/70

6.22 POST STACK SCALING

Dual window AGC with window lengths of 1000 ms and 400 ms.
Equalisation applied : 50%

6.23 TAUP

Time variant dip and coherency filter. Mix back : 60%

7 PROCESSING SEQUENCE DIAGRAM

TRANSCRIPTION

|

GAIN RECOVERY

|

PHASE CONVERSION

|

CDP SORT

|

DECONVOLUTION

|

FLOATING DATUM CORRECTION

|

VELOCITY ANALYSIS (1st pass)

|

RESIDUAL STATICS (1st pass)

|

VELOCITY ANALYSIS (2nd pass)

||

RESIDUAL STATICS (2nd pass)

|

DMO

|

VELOCITY ANALYSIS (3rd pass)

|

NMO CORRECTION

|

MUTE

|

PRE-STACK EQUALISATION

|

FLOATING DATUM TO FINAL DATUM

|

CDP TRIM STATICS

|

CDP STACK

|

SPECTRAL BALANCE

|

F.D. MIGRATION

|

BANDPASS FILTER

|

POST STACK SCALING

8 FINAL DISPLAYS

Final displays of final & migrated stack were produced on paper and a CD of CGM+ format files with cdp coordinates.

Horizontal scale: 1 : 20,000 (50.8 traces per inch)
Vertical scale: 5 cm/sec

9 ARCHIVES

Final migrated stacks, final stacks, raw stacks, and raw migrated stacks of each line were written onto DVD in SEGY format for workstation interpretation and archival.

Trace headers summary

BYTE	DESCRIPTION	BYTE	DESCRIPTION
17-20 (32-bit)	SPNO	97-98 (16-bit)	source residual static
21-24 (32-bit)	CDP number	99-100 (16-bit)	receiver residual static
41-44 (32-bit)	Elevation	101-102 (16-bit)	Receiver static
81-84 (32-bit)	CDP easting	103-104 (16-bit)	Datum static applied
85-88 (32-bit)	CDP northing	109-110 (16-bit)	Time of first sample
91-92 (16-bit)	weathering vel	115-116 (16-bit)	Number of samples
93-94 (16-bit)	refractor vel	117-118 (16-bit)	Sample interval
		189-192 (32-bit)	SP number

10 CONCLUSION

Line TB02-BD2 was reprocessed from the start as the incorrect coordinates and elevations were supplied.

The data was processed rather quickly for its complexities. The previous processing sequence proved the best with the exception of the stretch mute which when tested, gave some improvements in the more shallow levels and did not affect the deeper data.

There was a lot of attention given to pre and post stack migration with the pre stack time migration rejected due to its smearing effect on the data. Probably cause of this was the "crookedness" of the lines and an inability to create consistency in the binning process. This was coupled with the very fast velocities to create an undesibable result so post stack migration proved the way to go.

There were some inconsistencies between the observed seismic velocities and some borehole data that was available in the Thunderbolt region. Generally when we pick velocities we look for 3 things - a strong bullseye on the semblance, flat gathers, and a good stack response. All three of these criteria pointed to a velocity about 3360 at 60ms. The borehole data suggested a velocity in the vicinity of 6000 m/sec at this level. This discrepancy was investigated via some extra velocity analyses aimed specifically to identify if possible a velocity of about 6000 m/sec at 50 ms (as per the borehole data). It was not really evident but a trial was performed placing a velocity close to 6000 m/sec at zero time (avoiding negative interval velocities) and then basically picking an event at 200 to 250 ms below floating datum a bit faster than previously (around the high 4000's to low 5000's) then returning to the original pick around 350 to 400 ms which was generally around 5000 m/sec. There was no real evidense of the expected dolarite at 50 ms but there was perhaps something stacking in a bit better at the 200 - 250ms level. This trend of course misses the event at 100ms at 3500 m/sec. There are some effects on the data at 400ms not all of them good but below that things were pretty much the same. The gathers look under corrected above 200 ms. Stacks and Migrations with these faster shallow velocities were produced and compared with the original versions. After consultaion with Diego it was decided to employ the original velocities.

Mick Curran

Seismic Overview of Oil & Gas Prospects
Great South Land Minerals (GSLM)
License Area (SEL 13/98) in Tasmanian Onshore Basin

Geoffrey J. Hicks - July, 2008

The seismic was mainly acquired along roads and tracks. Although it is rather unlikely that these roads and tracks coincide with subsurface structural highs (especially pre Permian), the mapped structural highs are mainly controlled by single seismic lines.

I. Bellevue Anticline

The structuring is predominantly pre-Tertiary, increasing the chance that earlier migrating hydrocarbons would be trapped.

Top of Ordovician structure as mapped is constrained to the west by the interpretation of Lines TB02b-BZ and TB01-TD and to the east by the interpretation of Line TB02b-BQ. ***Figure1. Bellevue - TWT Map for Upper Limestone Member of the Gordon Group.***

However, the structure's extent and integrity to the north and south-east of the mapped culmination is more problematic.

As the interpretation of Line TB02b-AA ceases near its intersection with Line TB02b-BQ, the contouring to the south-east of the mapped culmination, beyond the 0.850 TWT contour, is not based on actual data. Thus, it is possible that the 0.850 TWT contour opens toward the south-east and that the structural high is also to the south-east of where it is currently mapped. The possibility is reduced by the presence of a topographic low to the south-east of the mapped culmination, assuming that this relative low is due to draping of the younger section over a pre-Permian high.

There is little basis in actual data for the contouring to the north of the mapped culmination, with a greater than 10km gap between the interpretations on Lines TB02b-AA and TB01-PB. Of concern is the significance of the high plateau to the north of the mapped culmination. This unusually flat plateau is about 250m higher than the proposed drill site. By similar logic to that above, such a high plateau may indicate draping of the younger section over a pre-Permian high, indicating that the structural high is to the north.

If a well must be drilled at the current proposed location before additional seismic data is available, the potential up-dip hydrocarbon volume should be calculated.

Lastly, the thickness of the section below the Permian unconformity, as seen on the southern ends of Lines TB02b-BZ and TB02b-AA, indicates that the Top Upper Limestone Member, prognosed at 2,425m, may well have been buried to more than 6,000m. The effect of such burial depth should be taken into account in the estimation of reservoir parameters.

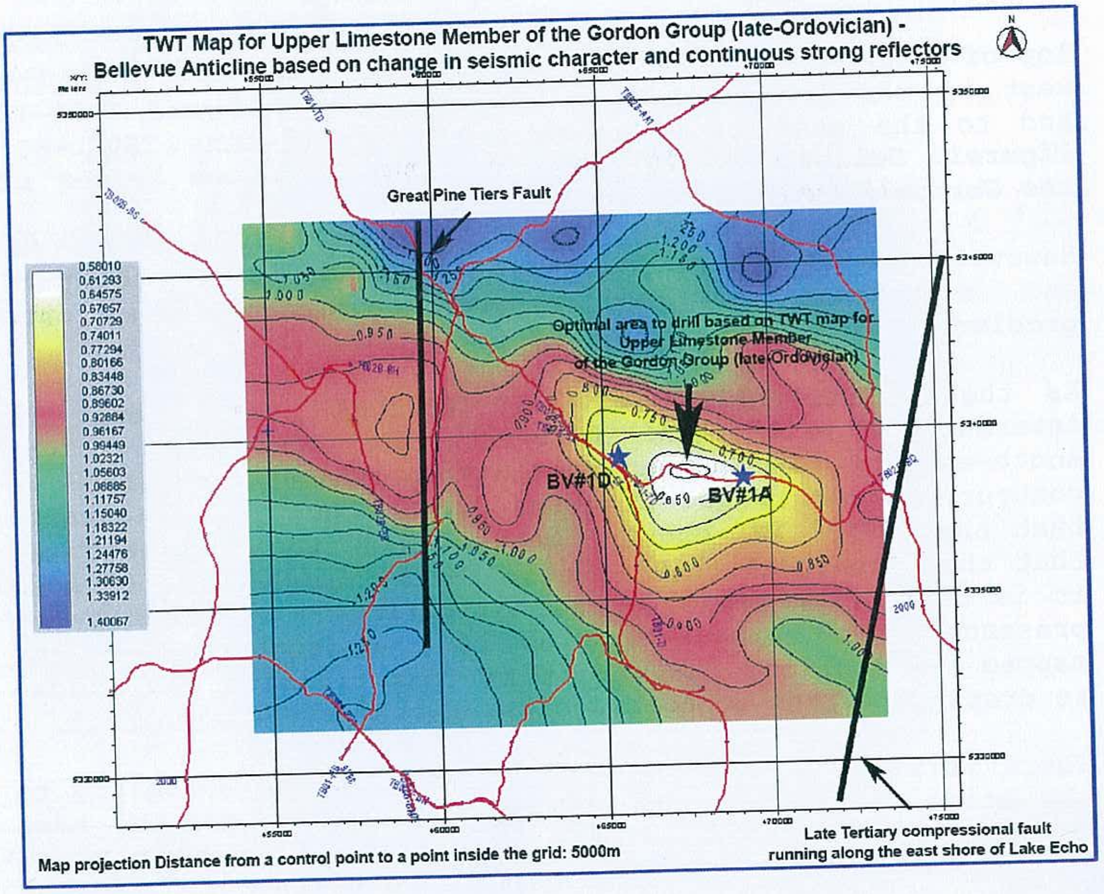


Figure1. Bellevue - TWT Map for Upper Limestone Member of the Gordon Group.

II. Thunderbolt Anticline

A fair proportion of the structuring is pre-Tertiary.

Top of Ordovician structure is likely to be an elongate anticline, trending northwest-southeast, plunging toward the northwest, from a structural high in the southeast.

The southeastern high is constrained by the interpretation of Line TB02b-HC. A lesser structural high, mapped on Line TB02b-HA, near the intersection with Line TB02b-HB, in conjunction with the deeper and almost flat nature of the same horizon on most of Line TB02b-HB, indicates that the strike of the structure may be to the east of Line TB02b-HB. ***Figure 2. Thunderbolt - TWT Map for the Upper Limestone of the Gordon Group.***

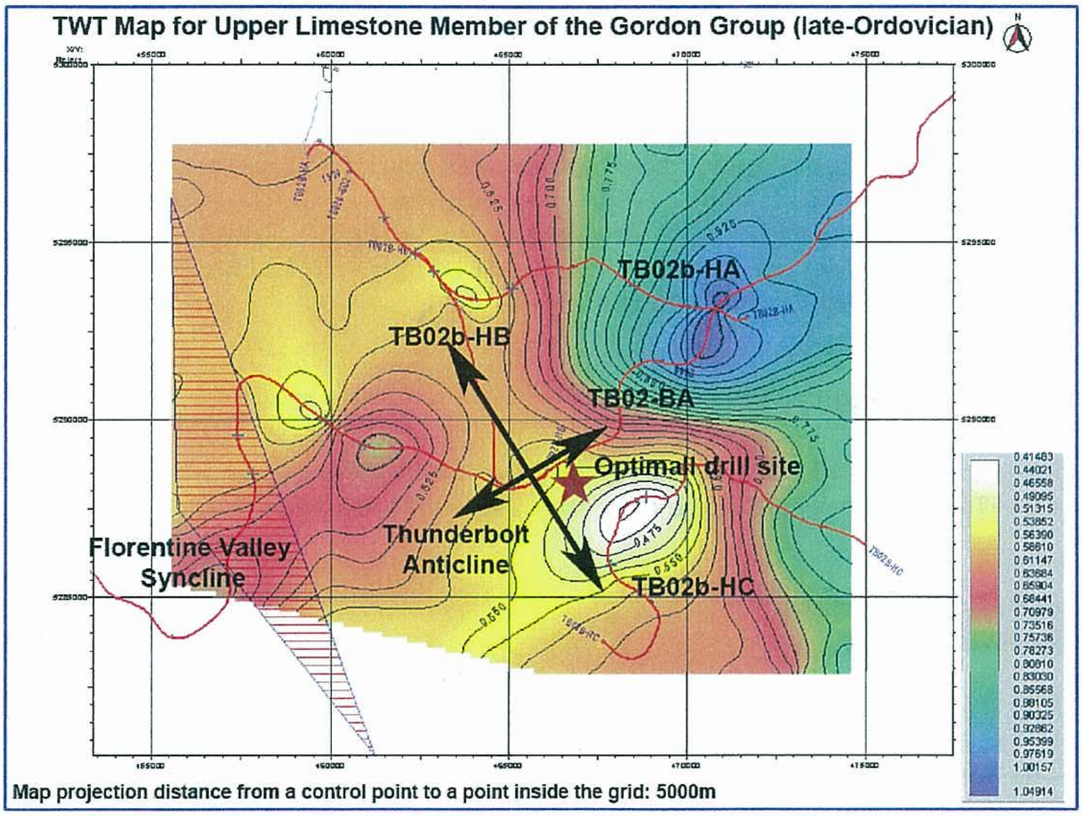


Figure 2. Thunderbolt - TWT Map for the Upper Limestone of the Gordon Group.

The structure is well constrained to the northeast by the interpretation of Lines TB02b-HA, TB02b-HC and TB02-BA.

However, aside from the area near the interpreted low on Line TB02-BA, the structural constraint to the southwest is more problematic. The Florentine Valley Syncline and its associated fault system most likely provides overall closure for the structure. Of most concern is the lack of data for the area to the southwest from between the southwest end of Line TB02b-HC and the southern end of Line TB02b-HB.

If a well has to be drilled before additional seismic data is available, given the uncertainty of the structural interpretation, such a well should be targeted as close as possible to the crest of the high mapped on Line TB02b-HC.

As the track on which Line TB02b-HC was acquired is unsuitable, the Line TB02-BA track will be used to transport the drilling rig and equipment. The topographic map indicates a reasonably flat spur, extending to the southeast, from near the intersection of Lines TB02-BA and TB02b-HB. It may be possible to locate the accommodation/offices, material storage, tubular laydown racks, etc near the track but site the drilling rig toward the southeastern end of the spur.

III. Stockwell Fault Block

The structuring is mostly very young. There is insufficient seismic data to interpret a closed structure.

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