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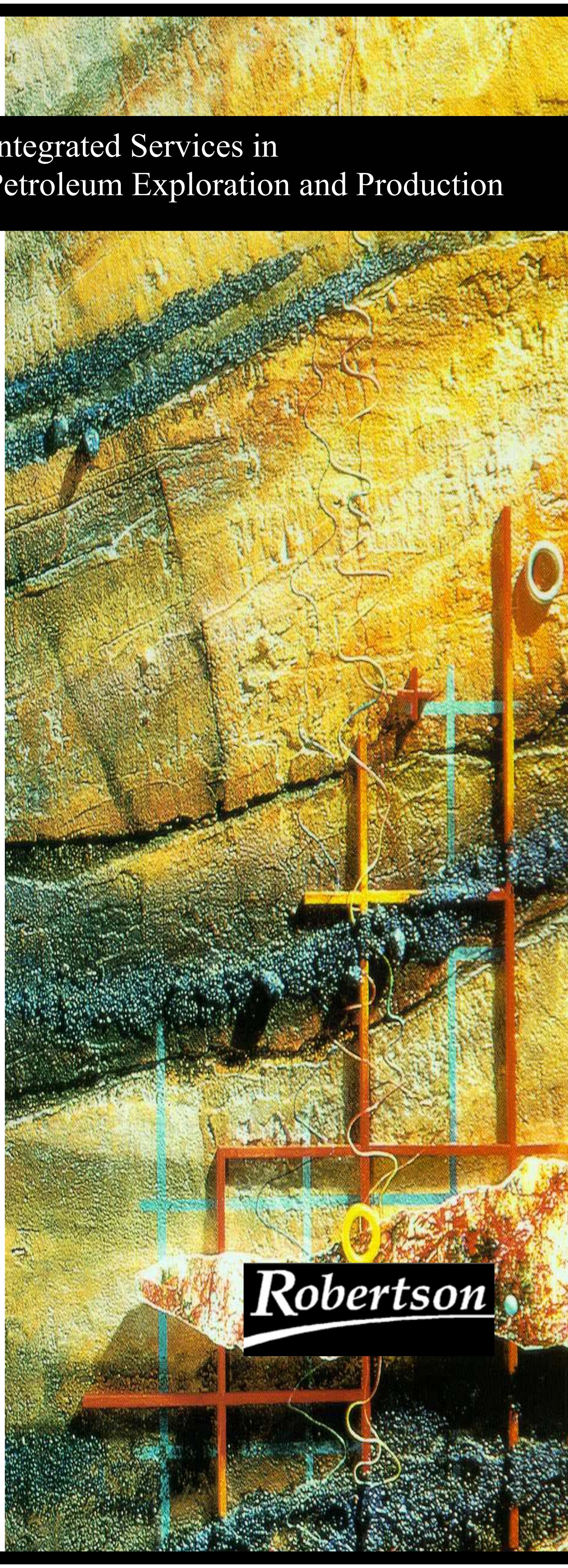

Processing Report

for

2002 Gippsland Basin Processing Survey GBS02 2D

Area:
Gippsland Basin, VIC/P41

May 2003

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1.0 INTRODUCTION

The 2002 Gippsland Basin 2D Processing consisted of 8 lines, totalling 221 km. The water bottom times varied from 150ms to 2300ms across all lines and as such all processing, that was sensitive to varying water depths, was referenced to water bottom times and interpolated accordingly. The data was recorded in January 2003 with the processing being completed in May 2003.

1.1 PERSONNEL

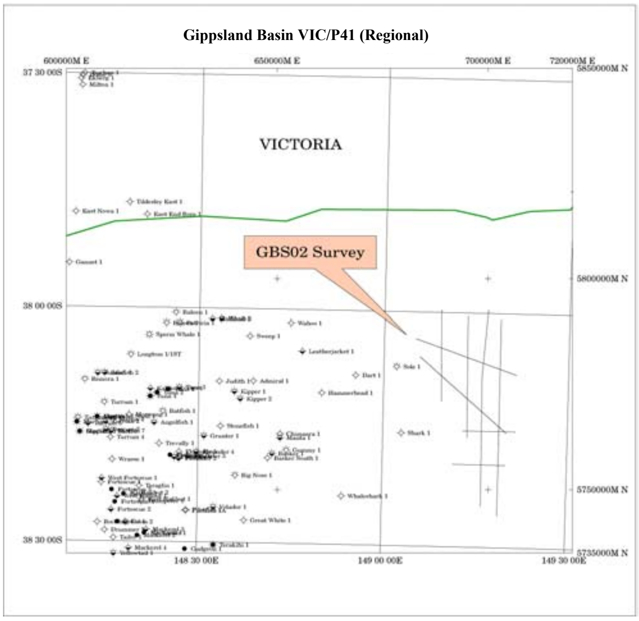
Robertson Research Australia

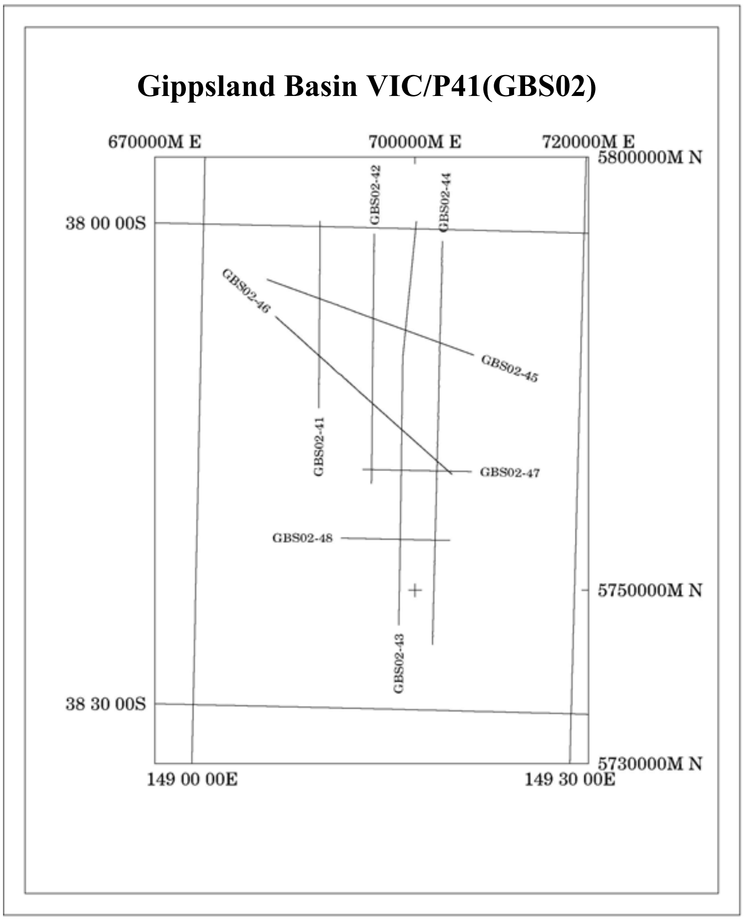
Kelly Beauglehole	Processing Manager
Simon Stewart	Marine Processing Manager
Paul Phythian	Geophysicist

Santos Limited (on behalf of Bass Strait Oil)

Stuart Brew	Senior Staff Geophysicist (Santos)
John Cant	Consulting Geophysicist

1.2 SURVEY MAP





2.0 PARAMETER TESTING

Line GBS02-43 was selected as the test line, with all pre stack and post stack testing done on this line.

Please refer to the table below for further details of the tests performed.

Test	Format		
	Shot Record	CDP Gather	STACK
Shot record displays	✔		
Gain recovery: Amplitude decay analysis	✔		
Gain recovery: exponential gain	✔		
F-K filter (shot domain, various cuts)	✔		✔
F-K filter with NMO (shot domain, various cuts)	✔		✔
F-K filter (shot and receiver domain)	✔		✔
F-K filter with NMO (shot and receiver domain)	✔		✔
Signature deconvolution	✔		✔
Tau-P deconvolution	✔		✔
Multiple attenuation: F-K method		✔	✔
Multiple attenuation: Radon method		✔	✔
Predictive deconvolution (before stack)			✔
Outer and inner trace mutes		✔	✔
Predictive deconvolution (after stack)			✔
Bandpass filter and Post stack scaling			✔
Noise attenuation (Tau-P Filter)			✔

3.0 COMMENTS & CONCLUSION

The Gippsland Basin 2002 VIC/P41 GBS02 2D survey was shot in January 2003 with the seismic processing being completed in May 2003. Water bottom times varied from approximately 150ms to 2300ms across all lines.

Data quality was good, however there was moderate swell noise across most lines. All lines responded well to the application of swell noise attenuation. There was also some anomalous random spiking at deep times on some lines. This also was easily taken care of during processing.

The most notable part of the processing sequence was the trace interpolation and double application of shot F-K filtering. The trace interpolation (324 – 647 channels) aided in reducing aliasing and allowed the F-K filtering to give a superior result. This was most obvious in the deep water areas (southern portion of the survey). The first pass of F-K filtering used a cut of +/-1500m/s without NMO and the second pass used a cut of +/-2000m/s with the application of NMO.

The other notable aspect of the processing was the absence of deconvolution, as either signature deconvolution or predictive (gap) deconvolution. From testing it was shown to degrade horizon continuity and was left out of the processing sequence.

Some possible DHI's were identified on the southern portions of lines 42, 43 and 44 (north-south lines). Please refer to section 6 for details on AVO analysis.

4.0 PROCESSING SEQUENCE

4.1 PRE-STACK TIME MIGRATION SEQUENCE

TRANSCRIPTION
|
LOW CUT FILTER
|
GAIN RECOVERY (t^2)
|
SWELL NOISE ATTENUATION / DE-SPIKING
|
TRACE INTERPOLATION (324 ch to 647 ch)
|
F-K FILTER (shot domain +/- 1500 m/s – without NMO)
|
F-K FILTER (shot domain +/- 2000 m/s – with NMO)
|
DROP INTERPOLATED TRACES (647 ch to 324 ch)
|
ADJACENT TRACE SUM (324 ch to 162 ch)
|
CDP GATHER
|
FIRST PASS VELOCITY ANALYSIS (2 km intervals)
|
MULTIPLE ATTENUATION (FK & Radon)
|
SECOND PASS (PSTM) VELOCITY ANALYSIS (1 km intervals)
|
KIRCHHOFF PRE-STACK TIME MIGRATION
|
THIRD PASS VELOCITY ANALYSIS (0.5 km intervals) (&)
|
NMO CORRECTION
| → PSTM Gather (*) (See section 4.2)
OUTER TRACE MUTE
|
PRE-STACK SCALING (Only Applied to Final PSTM)
|
INNER TRACE MUTE
|
CDP STACK
|
GUN & CABLE STATIC CORRECTIONS (#)
| → RAW ANGLE STACKS ($) (See section 4.3)
ZERO PHASING & PHASE MATCHING
|
BAND-PASS FILTER
|
POST STACK SCALING (%) → FINAL ANGLE STACKS (@) (See section 4.3)

(*) Pre-Stack Time Migrated Gather Archive. See section 5 for parameter details

(&) Final 0.5km PSTM Velocities (Western Format)

(# / $) Raw PSTM Stack (Full fold and Near/Far angle stacks respectively) See section 5 for parameter details

(% / @) Final PSTM Stack (Full fold and Near/Far angle stacks respectively) See section 5 for parameter details

4.2 PSTM GATHER ARCHIVE SEQUENCE

TRANSCRIPTION
|
LOW CUT FILTER
|
GAIN RECOVERY (t^2)
|
SWELL NOISE ATTENUATION / DE-SPIKING
|
TRACE INTERPOLATION (324 ch to 647 ch)
|
F-K FILTER (shot domain +/- 1500 m/s – without NMO)
|
F-K FILTER (shot domain +/- 2000 m/s – with NMO)
|
DROP INTERPOLATED TRACES (647 ch to 324 ch)
|
ADJACENT TRACE SUM (324 ch to 162 ch)
|
CDP GATHER
|
FIRST PASS VELOCITY ANALYSIS (2 km intervals)
|
MULTIPLE ATTENUATION (FK & Radon)
|
SECOND PASS (PSTM) VELOCITY ANALYSIS (1 km intervals)
|
KIRCHHOFF PRE-STACK TIME MIGRATION
|
THIRD PASS VELOCITY ANALYSIS (0.5 km intervals)
|
REMOVE GAIN RECOVERY (t^2)
|
APPLY TRANSMISSION LOSS
|
NMO CORRECTION
|
URSIN SPHERICAL DIVERGENCE
|
GUN & CABLE DEPTH CORRECTIONS (*)

(*) PSTM Gather Archive. See section 5 for parameter details

4.3 PSTM ANGLE STACK SEQUENCE

TRANSCRIPTION
|
LOW CUT FILTER
|
GAIN RECOVERY (t^2)
|
SWELL NOISE ATTENUATION / DE-SPIKING
|
TRACE INTERPOLATION (324 ch to 647 ch)
|
F-K FILTER (shot domain +/- 1500 m/s – without NMO)
|
F-K FILTER (shot domain +/- 2000 m/s – with NMO)
|
DROP INTERPOLATED TRACES (647 ch to 324 ch)
|
ADJACENT TRACE SUM (324 ch to 162 ch)
|
CDP GATHER
|
FIRST PASS VELOCITY ANALYSIS (2 km intervals)
|
MULTIPLE ATTENUATION (FK & Radon)
|
SECOND PASS (PSTM) VELOCITY ANALYSIS (1 km intervals)
|
KIRCHHOFF PRE-STACK TIME MIGRATION
|
THIRD PASS VELOCITY ANALYSIS (0.5 km intervals)
|
NMO CORRECTION
|
OUTER TRACE MUTE (NEAR/FAR)
|
PRE-STACK SCALING (Only Applied to Final PSTM)
|
INNER TRACE MUTE (NEAR/FAR)
|
CDP STACK
|
GUN & CABLE STATIC CORRECTIONS (*)
|
ZERO PHASING & PHASE MATCHING
|
BAND-PASS FILTER
|
POST STACK SCALING (#)

(*) Raw PSTM Angle Stack (Near and Far). See section 5 for parameter details

(#) Final PSTM Angle Stack (Near and Far). See section 5 for parameter details

5.0 PROCESSING TECHNIQUES

A brief description of each of the processes used in the processing sequence follows:

5.1 TRANSCRIPTION

Field data were converted to Robertson's internal format for processing. RRA's internal processing format is trace sequential, with samples in 32 bit IEEE floating point. At intermediate processing stages the data is stored on magnetic tape in sixteen-bit integer with a gain ranging scalar for each trace.

5.2 LOW-CUT FILTER

A low-cut filter of 4/18 Hz/dB/Octave was applied to the shot records.

5.3 GAIN RECOVERY

A gain function was applied to the data set to compensate for inelastic attenuation and spherical divergence losses.

Gain functions applied were as follows :

Survey	Gain Function (dB)
All	t^2

where t = two way travel time in milliseconds.

5.4 SWELL NOISE ATTENUATION

A symmetrical "velocity" filter was designed in the F-K domain to preserve the Swell noise attenuation is achieved by normalization of the amplitude spectra of selected "swell" traces.

To determine which traces are affected by swell noise the shot record is passed through an fx transform after an appropriate gain function has been applied to the data. Although swell noise is predominantly low frequency it also has a significant proportion of high frequency energy which can be more successfully predicted. The user can limit the range of frequencies they wish to perform analysis on by defining a low cut frequency with the upper limit being restricted to 3/4 of the nyquist frequency. For this data a low cut of 32 hz was defined and analysis performed up to 187.5 hz.

Swell traces are then chosen as those whose amplitude are greater than double a user defined percentile less the minimum amplitude. For this data a value of

30% was used for the user defined percentile. A scalar is then computed to normalize frequencies of the "swell" traces to the mean of the "non swell" traces. None of the calculated scalars are allowed to exceed 1 and they are smoothed with a user defined n point filter before application. For these data a nine point filter was used. The scalar is then fully applied to the amplitude spectra of the "swell" trace up to 1/2 of the user defined low cut frequency. For these data the scalar was fully applied from 0 to 16 hz. The scalar is then tapered to no scaling at the cut off frequency (32hz). The data is then passed on for further processing.

For data that exhibits strong swell noise the scalar values applied will be small, significantly changing the low frequency end of the amplitude spectra for the selected "swell" traces. For data with minimal swell noise the scalars will be close to 1 and result in little change to the low frequency end of the amplitude spectra for the selected "swell" traces. Only the selected "swell" traces are altered, all other traces are passed on for further processing unchanged.

5.5 TRACE INTERPOLATION

An extra trace was interpolated in between the given traces within each shot record. The aim of this was to increase spatial sampling with the objective of reducing aliasing during the F-K filtering.

Interpolation Details :

Input Traces	Input Trace Interval	Output Traces	Output Trace Interval
324	12.5m	647	6.25m

5.6 MULTI CHANNEL FILTER (SHOT DOMAIN)

A symmetrical “velocity” filter was designed in the F-K domain to preserve the primary reflection signal and to discriminate against coherent dipping noise trains. The filter employs a cosine-squared taper from k = 0 to the velocity intercept at each frequency. The input data was conditioned with a 300 ms AGC, and the scalars preserved for removal subsequent to the application of the F-K filter. A cut off velocity of 1500 m/sec was used for the shot domain. No NMO was applied during the F-K filtering.

5.7 MULTI CHANNEL FILTER (SHOT DOMAIN)

A symmetrical "velocity" filter was designed in the F-K domain to preserve the primary reflection signal and to discriminate against coherent dipping noise trains. The filter employs a cosine-squared taper from k = 0 to the velocity intercept at each frequency. The input data was conditioned with a 300 ms AGC, and the scalars preserved for removal subsequent to the application of the F-K filter. A cut off velocity of 2000 m/sec was used for the shot domain. NMO was applied and reversed before and after the F-K filtering.

5.8 DROP INTERPOLATED TRACES

The extra trace that was interpolated earlier was dropped for further processing.

Interpolation Details :

Input Traces	Input Trace Interval	Output Traces	Output Trace Interval
647	6.25m	324	12.5m

5.9 ADJACENT TRACE SUM

A 2:1 adjacent trace sum was applied to form a 25m shot/group interval geometry. This was applied after NMO correcting the shots with a water bottom dependent regional velocity function. A trace mix was also applied during the summation process:

Trace Mix Details :

Time (ms)	Trace Mix
0 - 3000	0 - 1 - 2 - 1 - 0
5000 - 6144	1 - 2 - 3 - 2 - 1

Summation Details :

Input Traces	Input Trace Interval	Output Traces	Output Trace Interval
324	12.5m	162	25m

5.10 CDP GATHER

The shot records were sorted into common depth point gathers. Nominal fold is 81.

5.11 FIRST PASS VELOCITY ANALYSIS

First pass velocities were determined using Robertson's "MGIVA" interactive velocity analysis program. Each velocity analysis comprised a semblance display, a 30 CDP stacked panel repeated 14 times with a suite of velocity functions, and a central CDP gather. The suite of functions were generated using 0%, +/-4 %, +/-8%, +/-13%, +/-19 %, +/-25%, +/-32%, and +40% increments from a central velocity function. The central function was derived from a brute velocity that varied according to water depth.

A mild F-K multiple attenuation was applied to enhance the primary energy of the data before the analyses using the following percentages of the brute velocity function: -8% at 0ms, -10% at 800ms, -12% at 2500, -18% at 4500 and -20% at 6000ms. This was applied for the purpose of the analyses only.

The velocity analysis incorporated a map of all velocity locations, and the semblance display included functions from proximate lines. This enabled the velocities to be picked with knowledge of areal velocity trends. Velocity QC could be performed more effectively when discordant velocities could be recognised on the map.

5.12 DEMULTIPLE (FK / Radon Combination)

Due to the low fold and therefore potential instability and ineffectiveness of Radon in the shallow section, F-K demultiple was employed. Multiple attenuation was performed in the F-K domain, using NMO corrected gathers with scaled primary velocity functions. F-K demultiple was fully applied from 0ms to 900ms, with zero application at 1700ms.

Time (ms)	*Velocity Percentage*
0	95
400	94
1300	92
3500	90
5000	88

In the deeper part of the data, multiples were attenuated with a parabolic Radon transform. Normal moveout corrections were performed using 100% first pass velocities. The CDP gathers were then transformed into the Tau-P domain (using 300 p values between maximum offset delta t values of -1000 ms and +3000 ms. In the Tau-p domain the primaries were muted out, leaving the multiple energy to be transformed back into the T-X domain before subtraction from the original CDP gather. Moveouts greater than 190ms (reference offset approx. 5665m) were modelled and subtracted from the data. The commencement time of multiple modelling and subtraction was 850 ms.

Adjacent CDP's were merged to form supergathers (thus reducing the potential for aliasing). After demultiple the supergathers were split back to their original component CDP's. A 300ms AGC was applied prior to, and removed after, multiple attenuation.

5.13 SECOND PASS VELOCITY ANALYSIS

The second pass of velocities were picked at 1km intervals on fully Pre-stack Time Migrated gathers using Robertson's "MGIVA" interactive velocity analysis program. Each velocity analysis comprised a semblance display, a 30 CDP stacked panel repeated 13 times with a suite of velocity functions, and a central CDP gather. The suite of functions were generated using 0%, +/-2 %, +/-4%, +/-7%, +/-11 %, +/-15% and +/-20% increments from a central velocity function. The first pass of velocities were used as the central function for this suite of velocity variant functions.

5.14 PRE-STACK TIME MIGRATION

Kirchhoff PreSTM was applied using a maximum half aperture of 300 traces (3750m). Apertures were muted with a 50% stretch mute to avoid operator aliasing. Smoothed first pass velocities were scaled (see table below) and used in the migration. Migration was performed on all 81 offset planes.

Time (ms)	*Velocity Percentage*
WB	100
WB+2500	100
WB+5000	96
WB+10000	85

5.15 THIRD PASS VELOCITY ANALYSIS

The third and final pass of velocities, picked at 0.5km intervals on the final Pre-stack Time Migrated gathers were again determined using Robertson's "MGIVA" interactive velocity analysis program. Each velocity analysis comprised a semblance display, a 30 CDP stacked panel repeated 13 times with a suite of velocity functions, and a central CDP gather. The suite of functions were generated using 0%, +/-2 %, +/-4%, +/-7%, +/-11 %, +/-15% and +/-20% increments from a central velocity function. The central function was derived from the second pass velocities picked earlier.

5.16 PSTM GATHER ARCHIVE

After the 3rd pass velocity analysis the t^2 gain recovery was removed and a transmission loss was applied (Time(ms)/Gain (dB): 0/0, 1000/8, 2000/15, 3000/15, 6000/15). The gathers were then NMO corrected using the 0.5km PSTM velocities, an Ursin spherical divergence and the gun and cable depth correction were applied and the PSTM gathers were then archived.

5.17 NMO CORRECTION

Fourth order NMO correction was performed using the final picked 0.5km PSTM velocity functions.

5.18 OUTER TRACE MUTE (Full Fold Stacks)

A post-NMO outer trace mute was applied for two main reasons :

- to remove any coherent noise on the outer traces and
- to reduce contamination from the effect of NMO stretch on the far offsets.

Water Bottom Time : 100ms		*Water Bottom Time : 500ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
286	0	169	200
581	506	520	200
546	723	832	600
741	1055	3120	1775
1976	2106	5460	2975
3601	3010	7995	4300
5291	3298	9295	4900

Water Bottom Time : 1000ms		*Water Bottom Time : 2000ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
169	800	169	1800
832	800	1134	1800
1296	1600	1556	2600
3376	2500	3441	3500
5424	3750	5392	4350
7995	4900	7995	5600
9295	5500	9295	6000

5.19 OUTER TRACE MUTE (Near & Far Angle Stacks)

A post-NMO outer trace mute was applied for two main reasons :

- to remove any coherent noise on the outer traces and
- to reduce contamination from the effect of NMO stretch on the far offsets.

Water Bottom Time : 100ms		*Water Bottom Time : 500ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
352	0	208	200
592	506	640	200
672	723	1024	600
912	1055	3840	1775
2432	2106	6720	2975
4432	3010	9840	4300
6512	3298	11440	4900

Water Bottom Time : 1000ms		*Water Bottom Time : 2000ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
208	800	208	1800
1024	800	1395	1800
1595	1600	1915	2600
4155	2500	4235	3500
6675	3750	6637	4350
9840	4900	9840	5600
11440	5500	11440	6000

5.20 PRE-STACK SCALING

A post-NMO outer trace mute was applied for two main reasons :
General Parameter Summary

Window lengths of 1200 ms and 400 ms
Equalization applied : 60
Short window stopped 4000 ms

Note: Only applied to the Final Pre-Stack Time Migrations (Full, Near & Far)

5.21 INNER TRACE MUTE

A post NMO inner trace mute was applied to help remove remnant multiple energy still apparent on the inner traces following the demultiple.

Water Bottom Time : 100ms		*Water Bottom Time : 500ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
60	900 - 6144	60	1300 – 6144
370	2100 - 6144	850	2000 – 6144
420	3000 - 6144	1100	2500 – 6144

Water Bottom Time : 1000ms		*Water Bottom Time : 2000ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
60	1800 – 6144	60	3000 – 6144
1050	2400 – 6144	1150	3900 – 6144
1300	3000 – 6144	1400	4200 –6144

5.22 COMMON DEPTH POINT STACK

The traces within each common depth point gather were summed using 1/root(N) stack compensation. Nominal fold is 81.

5.23 STATICS

A static compensation for gun and cable depths was applied. The static value applied was calculated using average gun and cable depths supplied in the observer's reports. A 8ms static correction was applied to all lines.

5.24 ZERO PHASING / PHASE MATCHING

Data were converted from minimum phase to zero phase. The spectral estimate was made using the Wiener-Levinson double inverse method.

The data was then phase matched to lines G92A-3047 and GEBR99-04 using a –60 degree phase rotation and a +4 ms bulk shift.

5.25 BAND PASS FILTER

Unwanted noise that lay outside the frequency range of the desired reflection and diffraction data was removed by the application of a series of zero phase time variant cosine squared tapered filters. This was not applied to the raw Pre-Stack Time Migrated stacks (Full, Near and Far).

General parameter summary:

Water Bottom Time : 100ms		*Water Bottom Time : 1000ms*	
Time (ms)	Frequency limits (Hz)	*Time (ms)*	Frequency limits (Hz)
100	7-10-85-100	1000	7-10-85-100
1100	6-9-78-92	2000	6-9-78-92
2100	3-6-65-78	3000	3-6-65-78
3100	2-5-50-62	4000	2-5-50-62
4100	2-5-40-50	5000	2-5-40-50
5100	2-5-36-45	6000	2-5-36-45

Water Bottom Time : 2000ms	
Time (ms)	Frequency limits (Hz)
2000	7-10-85-100
3000	6-9-78-92
4000	3-6-65-78
4700	2-5-50-62
5400	2-5-40-50
6100	2-5-36-45

5.26 POST STACK SCALING

A dual window, time variant AGC method was used for post stack scaling. The negative effects normally associated with AGC are avoided by employing two different length windows to determine the amplitude model (using the minimum of the two mean amplitudes determined at each sample), then conditioning the model by a weighted mix with the amplitude model derived from a single window per trace.

General parameter summary

Window lengths of 1200 ms and 400 ms
Equalization applied : 60
Short window stopped 4000 ms

Note: Only applied to the Final Pre-Stack Time Migrations (Full, Near & Far)

5.27 ANGLE STACKS

After applying the outer trace mute (5.18) and the inner trace mute (5.20) the remaining "live" data was split into equal fold near and far angle stacks. This outer trace mute was some 30% more open than the full fold outer trace mute (5.17). The pre and post stack scaling (2-gate AGC) was applied to the Final Filtered and Scaled near and far angle stacks but was not used on the Raw near and far angle stacks. The raw near and far angle stacks had the gun and cable depth correction applied but were not zero phased and phase matched.

6.0 AVO ANALYSIS

The AV0 processing sequence was identical to the regular processing up to and including pre-stack migration. The subsequent processing is described below.

6.1 NMO CORRECTION

Fourth order NMO correction was performed using the final picked 0.5km PSTM velocity functions.

6.2 SPHERICAL DIVERGENCE

Removal of t-squared gain (prior to NMO) and application of spherical divergence using the Ursin (Geophysics, 1990) approximation. In addition a 12 dB/s gain was applied to 1500 ms.

6.3 PRE-STACK SCALING

Trace by trace, 2000 ms window Equalisation (using overlapping windows) was applied to the data. We assume that the average overall AVO effect over the window of data will be negligible since it contains reflections from a large number of interfaces with both amplitude increases and decreases with offset.

6.4 CONVERSION TO ZERO PHASE

Data were converted from minimum phase to zero phase as described in section 5.23. An additional phase rotation of 180 degrees was then applied to the data to achieve SEG positive polarity.

6.5 OUTER TRACE MUTING

A post-NMO outer trace mute was applied for two main reasons :

- to remove any coherent noise on the outer traces and
- to reduce contamination from the effect of NMO stretch on the far offsets.

Water Bottom Time : 100ms		*Water Bottom Time : 500ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
208	0	208	200
370	506	400	200
570	723	640	600
870	1055	2400	1775
2120	2106	4200	2975
3870	3010	6150	4300

Water Bottom Time : 1000ms		*Water Bottom Time : 2000ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
208	800	208	1900
790	800	1472	1900
1650	1600	2047	2700
2897	2500	3447	3500
4472	3750	4248	4350
6150	4900	6150	5600

6.6 INNER TRACE MUTING

A post NMO inner trace mute was applied to help remove remnant multiple energy still apparent on the inner traces following the demultiple.

Water Bottom Time : 100ms		*Water Bottom Time : 500ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
60	900 - 6144	60	1300 – 6144
350	2100 - 6144	400	2000 – 6144
400	3000 - 6144	450	2500 – 6144

Water Bottom Time : 1000ms		*Water Bottom Time : 2000ms*	
Offset (m)	*Application times (ms)*	*Offset (m)*	*Application times (ms)*
60	1800 – 6144	60	3000 – 6144
450	2400 – 6144	450	3900 – 6144
500	3000 – 6144	500	4200 –6144

6.7 BAND PASS FILTER

Unwanted noise that lay outside the frequency range of the desired reflection and diffraction data was removed by the application of a series of zero phase time variant cosine squared tapered filters. Parameters were selected as described in section 5.24.

6.8 AVO ANALYSIS

AVO analysis was then applied using the Shuey Approximation. A velocity function was used to calculate the angle of incidence at each layer boundary and then interpolated to produce the angle of incidence at each time sample and offset. A robust linear regression was used to calculate the intercept and gradient of the amplitudes at each time sample (Walden, 1991). Angle ranges in the order of 0 to 35 degrees were examined. Four types of attributes were produced from this analysis; Intercept, Gradient, Product (Intercept times Gradient) and Fluid Factor. These attributes are plotted with SEG positive standard polarity.

6.9 COMMON DEPTH POINT STACK

The attribute generated for each gather was stacked using 1/N stack compensation.

6.10 STATICS

A static compensation for gun and cable depths was applied. The static value applied was calculated using average gun and cable depths supplied in the observer's reports. A 8ms static correction was applied to all lines.

7.0 ACQUISITION PARAMETERS

Data recorded by:	Multiwave Geophysical Company
Date recorded:	2003
Vessel:	R/V Polar Duke
Seismic Source:	
Type:	Sleeve Airgun
Pressure/Volume:	2000 psi / 3500 cu.in.
Depth:	5m
Shot interval:	25m
Gun delay:	0
Recording System:	
Record length:	6144 ms
Sample interval:	2 ms
Filters:Low	3 Hz - 6 dB / Octave
:High	206 Hz – 276 dB / Octave
Streamer:	
Streamer length:	4037.5 m
Streamer depth:	7 m
No. of groups:	324
Near group no:	324
Group interval:	12.5 m
Near group offset:	70 m
Antenna-source:	130.3 m
SP annotation:	SHOTPOINT

APPENDICES

A.1 LINE LISTING

Line	1st SP	Lst SP	SP Int	Kms
GBS02-41	1001	1864	25	21.60
GBS02-42	2064	912	25	28.83
GBS02-43	1001	2867	25	46.68
GBS02-44	2774	912	25	46.58
GBS02-45	1001	2015	25	25.38
GBS02-46	2004	912	25	27.33
GBS02-47	1001	1503	25	12.58
GBS02-48	1412	912	25	12.53
			Total Kms	221.48

A.2 PHASE MATCHING

All lines where statistically zero phased with the spectral estimate made using the Wiener-Levinson double inverse method. The data was then phase matched to lines G92A-3047 and GEBR99-04. A –60 degree phase rotation and a +4 ms bulk shift was applied to match this data.

A.3 DELIVERABLES

Item	Format	Media	Tape No.
Raw Migration and Final Filtered/Scaled Migrations (Original)	SEGY	Exabyte	237FM001E
Raw Migration and Final Filtered/Scaled Migrations (Copy 1)	SEGY	Exabyte	237FM002E
Raw Migration and Final Filtered/Scaled Migrations (Copy 2)	SEGY	Exabyte	237FM003E
Raw and Final PSTM Angle Stacks (Original)	SEGY	Exabyte	237AS004E
Raw and Final PSTM Angle Stacks (Copy 1)	SEGY	Exabyte	237AS005E
Pre-Stack Time Migration gathers (Original)	SEGY	3590	237GA006C-237GA007C
Pre-Stack Time Migration gathers (Copy 1)	SEGY	3590	237GA008C-237GA009C
Final (PSTM) Velocities 0.5km Intervals (Original)	Western	CD	237FV010CD
Final (PSTM) Velocities 0.5km Intervals (Copy 1)	Western	CD	237FV011CD
Final Processing Report (Original & 2 Copies)	PDF	CD	237FR012CD-237FR014CD
Final Migrations(CGM+ display files) (Original & 2 Copies)	CGM+	CD	237FD015CD-237FD017CD
AVO Analysis	SEGY	CD	905AV001CD
AVO Analysis	SEGY	CD	905AV002CD
Final Migrations (Paper displays)	Paper (1:50,000 scale, 10cm/sec)		