Data Processing Report

for

Bass Strait Oil Company Limited

Level 25, 500 Collins Street,
Melbourne 3000, Victoria

Area: Moby 3D, VIC/P47
Gippsland Basin

WG Contract Number: AP23
Client Project Number: GAP04A
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1.0 Introduction

The report details the data processing of Moby 3D, VIC/P47 (Gippsland Basin) Marine Seismic Survey carried out by WesternGeco (WG) in Perth. The project was conducted in Bass Strait, Victoria, Australia under client project number GAP04A by Apache Energy Northwest Pty Ltd for Bass Strait Oil Company Limited (BSOC). The objectives of the project were to delineate the extent of the hydrocarbons encountered in the Moby-1 well drilled in October 2004, east of the producing Patricia / Baleen Fields and to map the identified reservoirs calibrated to the well. The target zone was shallow from 450-700 ms.

The project consisted of approximately 100.125 full fold km^2 or 7080 linear CMP kilometres of data. The area of coverage is shown in **Appendix 6.1**. The field data were acquired by WesternGeco (m/v Western Trident) on 9 - 15 January 2005. Data processing was carried out between 2 February and 11 May 2005. The entire processing was performed and coordinated in Perth office.

The processing parameters and sequences were optimized and established with BSOC representative Ian Reid. The project was managed for WesternGeco by Tony DeLorenzo and Ken Jayan with geophysical support from Richard Patenall.

The data were processed through a prestack sequence consisting of 2 passes of SWATT, Tau-p linear noise attenuation, F-K filter, Tau-p deconvolution before stack, 3D bin regularisation by interpolation, 3D PreStack Time Migration, Radon multiple attenuation. On the whole, three passes of velocity analyses were performed; 1st pass at 1 km x 1 km grid, 2nd and 3rd pass were at 0.5 km x 0.5 km grid. The data were full offset stacked and angle stacked with final (3rd pass) picked velocities then followed by poststack crossline trace interpolation from 25 m to 12.5 m.

Line GAP04A1200P1002 was chosen by BSOC as primary test line. Occasionally, additional testing for additional test lines were carried out to further improve the data quality when necessary. Testing was performed concurrently with the production. **Section 4** lists the significant tests that were run, including processes that were tested but not used in the production sequence.

2.0 Project Management

2.1 Reporting Procedure

Project progress reporting was done on a weekly basis covering the period Monday to Friday. This was accomplished each Friday via e-mail and included the following:

- Estimated completion date
- Action for client / processing group to date
- Data received to date
- Status summary with completion % to date
- Tests / confirmation to date
- Data sent to date

2.2 SuperVision

WesternGeco had setup a SuperVision website for this project in order to upload and download data. This was primarily utilised as for verification of production processing and to provide quality control examples that have been carried out during production, namely, noise analysis plot files, fold of coverage plot files and data quality examples. BSOC has access to this SuperVision site.

3.0 Seismic Data Processing

3.1 Reformat

The 8x 384 trace (38 accepted sequences) demultiplexed field data were reformatted from SEGD 8058 to an in-house source-gathered seismic file omega format.

Diagnostics from the transcription program list input and output record numbers, plus parity and block length errors. Each printout was checked against the observer logs to ensure that all the data had been correctly transcribed. Every 100th shot record and near trace sections were displayed for quality control on each sail-line (or all 16 sub-surface lines). All data were output to 6144 ms record length at 2 ms sample rate.

3.2 Navigation and Seismic Data Merge

The navigation data (UKOOA P1/90 format) supplied by field crew have the following information:

Projection type : Universal Transverse Mercator (UTM) Southern Hemisphere
Projection zone : 55 South
Geodetic datum : GDA94
Spheroid : GRS80
Central meridian : 147 Deg East

The navigation source & receiver XY co-ordinates were merged with the seismic data traces. Navigation and seismic data were matched using unique Field Shot Identifier (FSID), unique trace number and cable number.

3.3 Deterministic Designature

The conversion to minimum phase of the source signature embedded within the seismic dataset is often a prerequisite to the application of spiking or predictive deconvolution. Alternatively, converting the source signature to zero phase can be performed as the first stage in the process of converting the recorded seismic data to zero phase, particularly when long-gapped or no predictive deconvolution is being applied. The objective of dephase is to obtain an operator that will convert the recorded or model far field source signature to its minimum or zero phase equivalent.
In the conventional marine acquisition case, the far field source signature is assumed to be an accurate measure of the down-going source wavelet produced by the airgun array. The source signature can be determined either by measuring the far field airgun response, or by generating a synthetic signature using known source and array parameters.

The derivation of the dephase filter operator that applied to seismic data has the following sequence:

1) Far field source signature at 2 ms sample rate
2) Add cable ghost to (1)
3) Zero phase equivalent of (2)
4) Zero phasing operator to shape (2) into (3)

Parameter values:

Far field source signature	: Supplied by field crew
Desired output wavelet	: Zero phase equivalent
Number of coefficients	: 540
Sample index of time-zero of operator	: 270
Sample interval	: 2 ms

Coefficients: Refer to **Appendix 6.6**

3.4 Resample

An anti-alias filter was applied to whole survey and the data were re-sampled.

Parameter values:

Input trace length	: 6144 ms
Output trace length	: 6144 ms
Input sampling interval	: 2 ms
Output sampling interval	: 4 ms
Anti-alias filter:	
Phase type	: Zero
Cutoff frequency	: 105 Hz
Cutoff slope	: 60 dB/Octave

3.5 Trace Edits

Records flagged as bad in the observer's logs or as displayed in the near trace gathers and shot records were edited from the processing sequence.

3.6 Amplitude Recovery

A Time Squared Function Gain (with exponential value of 2) was applied to whole survey. Trace samples were scaled by the time of the sample raised to a user specified exponential value.

$$A_o(t) = A_i(t) * t^n$$

where:

$A_o(t)$	=	Amplitude of output sample at time t
$A_i(t)$	=	Amplitude of input sample at time t
t	=	Time in seconds
n	=	User supplied exponential value

3.7 Low Cut Filter

A zero phase band-pass filter described by low-cut frequencies and associated dB/octave cutoff slopes were applied to seismic data. The specified cutoff frequencies are located at the half-power (-3dB in amplitude) response points and the slopes at these frequencies are equal to the respective dB/octave values. The slope is an approximate cosine squared function in the amplitude domain. The filter was normalized so that output amplitudes were the same as input amplitudes for frequency components within the pass-band.

Parameter values:

Output phase	: Zero
Low cut frequency	: 3 Hz
Low cut slope	: 12 dB/octave

3.8 *Swell Noise Attenuation (SWATT)*

Swell noise is caused by data acquisition in rough sea conditions, particularly when the cables are being towed at a relatively shallow depth. SWATT aims to attenuate this noise by transforming the processing gather into the frequency domain and applying a spatial median filter. Frequency bands that deviate from the median amplitude by a specified threshold are either zeroed, or replaced by good frequency bands interpolated from neighbouring traces.

By applying the process in different domains improved noise attenuation can be achieved because the noise to signal relations are different in different domains. This means that noise might be anomalous in one domain, but not in another.

Two passes of SWATT in shot domains and two passes of SWATT in receiver domains were carried out as shown in the table below.

Parameter values:

Processing domain	: Shot (first-pass)
Width of spatial median filter	: 23 traces
Frequency range processed	: 0 - 30 Hz
Processing window start time	: Water bottom + 200 ms
Processing window length	: 500 ms
Processing window overlap	: 100 ms

Threshold values:

Time (ms)	Threshold (%)
0	6
1500	4
4000	2
6144	2

Processing domain	: Shot (second-pass)
Width of spatial median filter	: 25 traces
Frequency range processed	: 0 - 125 Hz
Processing window start time	: Water bottom + 200 ms
Processing window length	: 500 ms
Processing window overlap	: 100 ms

Threshold values:

Time (ms)	Threshold (%)
0	7
2000	5
4000	3
6144	2

Processing domain	: Receiver (first-pass)
Width of spatial median filter	: 29 traces
Frequency range processed	: 0 - 20 Hz
Processing window start time	: Water bottom + 200 ms
Processing window length	: 500 ms
Processing window overlap	: 100 ms

Threshold values:

Time (ms)	Threshold (%)
0	20
1500	17
2000	11
4000	6
6144	4

Processing domain	: Receiver (second-pass)
Width of spatial median filter	: 29 traces
Frequency range processed	: 20 - 125 Hz
Processing window start time	: Water bottom + 200 ms

Processing window length	: 500 ms
Processing window overlap	: 200 ms

Threshold values:

Time (ms)	Threshold (%)
0	17
1500	14
2000	11
4000	6
6144	4

3.9 First Pass Velocity Analysis

Velocity analysis was performed using WesternGeco's Interactive Velocity Analysis (InVa) system. This is an integrated velocity interpretation and QC system.

Pre-processed CMP gathers were selected across the whole survey at a regular interval before input to velocity analysis. From this data Multi-Velocity Function Stacks (MVFS) and velocity semblance displays were computed. For each velocity location, the gathers, MVFS data and semblances are displayed interactively allowing stacking velocities to be interpreted. Changes made to one window are automatically applied to all other windows. Velocities can be picked from either the MVFS or semblance display. When velocities are interpreted at a location a velocity database is updated and the CMP gather is displayed with the NMO correction.

The interpreted velocities, were QC'd using a range of tools available in InVa, including iso-velocity displays and horizontal contours, they were then used to generate a velocity model for subsequent processing.

First pass velocity analyses created at 1 km x 1 km grid were picked by WG.

These velocities were used for the Targeted PSTM Velocity Lines with a 3 km smoothing function applied. Both the interpolated stacking velocity field and interpolated/smoothed migration velocity field (in original WesternGeco VELF format) were archived to a CD-ROM for BSOC on 9 June 2005.

The input to first pass velocity analyses has the following steps applied concurrently with the production flow in order to obtain an appropriate set of picked velocities ready for subsequent processing:
K-filter / Trace reduction / DBS (36 ms gap, 200 ms operator length, 1 window) / 3D CMP Sort

Parameter values:

Central fan function : Single velocity (supplied from well Moby-1 down to approx. TD)
Number of fan functions : 15

Fan separation: Time (ms)	/ Separation (%)
0	/ 2
1500	/ 3
3000	/ 4
6000	/ 4

Analysis interval	: 1 km
Number of CMPs per analysis (MVFS display)	: 15
Number of CMPs per analysis (Semblance display)	: 7

3.10 Tau-p Linear Noise Attenuation

To eliminate linear noise within the data the source gathers were transformed into the Tau-p domain where unwanted linear noise was removed (muted). The resulting signal only Tau-p gathers were then subtracted from the original Tau-p gathers to produce noise only Tau-p gathers which were then transformed back to the T-X domain. The noise only T-X gathers were then subtracted from the original input gathers to result in noise filtered NMO corrected gathers.

This convoluted description of double subtraction (in the Tau-p and then the T-X domain) is based on the principal of only modeling the unwanted signal and not allowing the primary signal to be transformed into Tau-p space. This is due to the imperfection of the radon transform that will never return 100% of Tau-p transformed data back to T-X space.

Shot records were preconditioned prior to the transform. The gathers were applied with removable AGC to prevent transform aliasing gathers that were spatially interpolated then followed by linear moveout correction using velocity of 1510 m/s.

Parameter values:

Processing domain	: Tau-p
Removable AGC window length	: 256 ms
Moveout type	: Linear
Reference offset	: 4990 m
Moveout lower limit at reference offset	: -1500 ms
Moveout upper limit at reference offset	: 500 ms
Maximum frequency	: 125 Hz
Number of p-traces	: 400
Moveout type	: Pass
Moveout mute (low to high)	: -1400 ms to 300 ms
Moveout taper	: 32 ms

3.11 F-K Filter

A seismic section such as a shot gather, CMP gather or stack section is a two-dimensional array of samples representing the amplitude of the seismic signal as a function of reflection time (t) and trace position (x). Dipping events (including linear noise) which overlap in this time-offset (t-x) domain cannot often be easily separated. However, a Fourier transform can be used to convert the seismic signal to the f-k domain, that is, to a function of temporal frequency (f) and spatial frequency or wavenumber (k). In this domain, dipping events plot along straight lines radiating outwards from the point of zero frequency and zero wavenumber. Gently dipping events plot closer to the frequency (vertical) axis (horizontal events actually plot along this axis), while steeply dipping events plot closer to the wavenumber (horizontal) axis. Events with a positive dip (that is, where the reflection time increases as the trace position increases) have positive wavenumbers and events with negative dips have negative wavenumbers. The events are therefore more easily separated in the f-k domain and unwanted events such as linear noise rejected by applying a user-specified filter. The data are then inverse Fourier transformed to the t-x domain.

Parameter values:

Processing domain	: Shot records
Filter start time	: WB + 300 ms
Low dip cutoff	: -5.5 ms/trace
High dip cutoff	: 5.5 ms/trace
Low dip taper (centred on the low dip cutoff)	: 3 ms/trace
High dip taper (centred on the high dip cutoff)	: 3 ms/trace
Taper type	: Cosine
Fan origin	: Zero frequency + zero wavenumber

The dips were therefore attenuated by the same factor for all frequencies.

3.12 K-Filter

A seismic section such as a shot gather, CMP gather or stack section is a two-dimensional array of samples representing the amplitude of the seismic signal as a function of reflection time (t) and trace position (x). A Fourier transform can be used to convert trace position to the spatial frequency or wavenumber (k) domain. The filter can then pass a specified range of wavenumbers and a taper also applied to the filter boundaries to smooth the transition between the pass and the reject regions.

Later in the processing sequence, due to the application of K-filtering, the shot records can be reduced in size by dropping alternate traces in **Section 3.15 (Trace Reduction)**. Consequently, the k-filter was chosen to act as an anti-aliasing filter in the wavenumber domain, attenuating energy that would otherwise have become aliased when the trace separation was doubled by the dropping of alternate traces.

For convenience, the k-filter was implemented in the f-k domain. A 2-D Fourier transform was used to convert trace position to the wavenumber domain and reflection time to the frequency (f) domain. After implementation of the k-filter the data were inverse Fourier transformed back to the t-x domain.

Prior to the f-k transform, shot records were NMO corrected using first pass velocity (FPV) field and a data dependent scaling (typically AGC 120 ms) was applied to the data. This has the effect of reducing the impact on the transform of high amplitude events, particularly at the edges of the gather. After transformation back to the t-x domain the inverse of the scaling was applied, so largely preserving relative amplitudes. The NMO correction was also removed from the data.

Parameter values:

Processing domain	: Shot records (NMO corrected using FPV)
Pass wavenumber (k) values	: +/- 0.45
Taper	: 0.1

3.13 Tau-p Deconvolution Before Stack

When the offset is zero and the reflectors are horizontal, a first-order multiple has a two-way time that is twice the period of the primary. However, for non-zero offset this is not the case – the multiple time is less than twice the time of the primary. Consequently, the ability of conventional Wiener-Levinson deconvolution to attenuate longer period multiples, particularly on longer offset traces, is very limited. A regular periodicity for the multiples can be imposed on the data by applying normal moveout (NMO) with the multiple velocity, but this distorts the frequency spectrum of events so that, while the periodicity may be regular, the wavelet shape between successive repeats of the multiple is not. The deconvolution, therefore, is still only partially effective.

An alternative way of restoring a regular periodicity is via a linear tau-p transform of the shot-ordered data. As the intention is to apply deconvolution in the tau-p domain, only limited or no scaling is applied to this data to ensure that the amplitude relationship between successive repeats of a multiple is preserved. High amplitude, first-break energy is muted.

Wiener-Levinson least-squares predictive deconvolution operators were designed from autocorrelations of windows within each p-trace and were applied on a trace-by-trace basis. Start times were used to control the location of the design windows but application included all data earlier than the start time of the first window and later than the end time of the last window.

Two alternatives allow the final deconvolved (multiple attenuated) data to be produced. In “Full Modelling”, all useful data in the time-space (t-x) domain is tau-p transformed – inverse tau-p transform of deconvolved data then yields the final output gather. In “Multiple Modelling”, the tau-p transform can be limited to cover only the dips within the multiples. After deconvolution, while still in the tau-p domain, a subtraction of the deconvolved data from the input tau-p data yields ‘multiple only’ data – inverse tau-p transform and subtraction from the time-space input data yields the final output gather.

Parameter values:	
Method	: Full modelling
Number of p-traces	: 1100
Transform type	: Linear
Reference offset	: 5100 m
Moveout at reference offset – lower limit	: -2200 ms
Moveout at reference offset – upper limit	: 3300 ms
Deconvolution window (start-stop)	: 160 - 2560 ms
Deconvolution operator – minimum predictive lag	: 32 ms
Deconvolution operator – total operator length	: 240 ms

3.14 Tidal Static Correction

The data were corrected for tidal variations throughout the acquisition period. The compensation was corrected based on tidal information for the area supplied by company GEMS (Global Environmental Modelling Systems Pty Ltd) on 23 February 2005. The data were merged with the seismic data based on time of day.

3.15 Trace Reduction

The data volume was reduced in size by decimating the shot gathers. The near offset was retained and every second trace (even number) was removed. This was possible due to the application of a K-Filter in **Section 3.12** to prevent spatial aliasing.

The effective group interval was doubled to 25 m after trace reduction.

3.16 Trace Edits

Second round trace edits based on Tau-p DBS noise analysis was carried out prior to subsequent major processes like 3D bin regularisation by interpolation and 3D prestack time migration.

3.17 3D Grid Definition (PreStack)

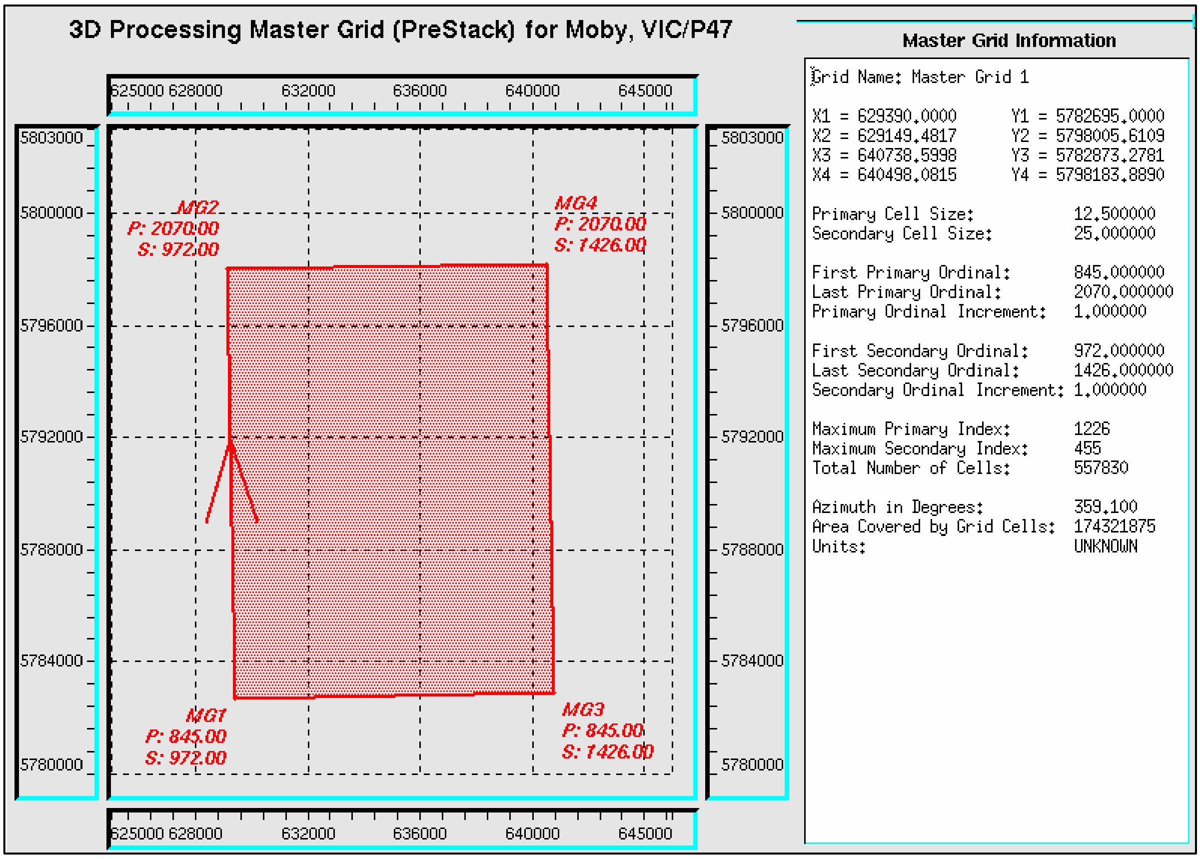
The 4 corner points of Processing Master Grid are defined as follows:

PreStack output grid = 12.5 m x 25 m, crosslines 845-2070 incr 1
inlines 972-1426 incr 1

	X-Coordinates	Y-Coordinates	Crossline	Inline
P1	629390.0000	5782695.0000	845	972
P2	629149.4817	5798005.6109	2070	972
P3	640738.5998	5782873.2781	845	1426
P4	640498.0815	5798183.8890	2070	1426

Crossline cell size: 12.5 m
Inline cell size: 25.0 m
Crossline increment: 1
Inline increment: 1

Primary axis azimuth: 359.10 degrees



3.18 Common Offset Sort

The data were sorted into 64 common offset planes and traces within each offset plane were then sorted into inline order. Prior to common offset sort, the inverse of time squared function gain was applied for later PSTM processing.

3.19 3D Bin Regularisation By Interpolation

This process is a seismic interpolation and regularisation tool for prestack 3D data that are irregularly sampled in space. It provides an improved method of regularising 3D fold coverage relative to the conventional flex binning approach of copy and move employed to fill gaps in coverage. The process also allows for the prestack regularisation of traces to move them (via interpolation) to their respective cell-centre positions.

In partial regularisation, the original data remain unaltered and traces are only interpolated to fill empty cells. Such partial regularisation can be useful prior to Prestack Time or Depth Migration where irregular subsurface fold can result in undesired amplitude variations.

Each interpolated output trace was calculated from a cluster of nearby input traces using adaptive interpolation. An optional dip map was computed to guide the interpolation and thus enable it to handle steeply dipping events. At each sample, the data were scanned over a range of dips to determine the local dominant dip. The dip-search was accomplished by computing the unnormalised semblance (correlation) between nearby traces for the range of dips of interest; peaks in the semblance indicate local dominant dips. The interpolated trace was then constructed by a weighted sum of input traces along the local dominant dip for each output sample.

The interpolation process was performed on common offset planes using a time-space (t-x) sinc interpolation that adapted to the local input cluster density and dominant dip. The traces were corrected with a differential moveout function which enabled data continuity without the over stretching involved with a full NMO correction. Limits were set for the maximum number of traces in an output cell. To accomplish this, redundancy editing was applied and the two traces closest to the cell centre were kept. This redundancy was based on full fold of the cell. After binning, the data were then inverse differential moveout with the same first pass velocity (FPV) field.

Parameter values:

Processing domain	: Common offset
Total common offset planes	: 64
Moveout correction	: Differential moveout using FPV
Operation mode	: Infill holes / trace regularisation
Maximum number of nearest trace in input cell	: 2
Interpolation length (inline x crossline)	: 11 x 11 cells
Maximum number of dip scans	: 11
Dip range	: -2 ms/cell to +2 ms/cell
Correlation width	: 31 cells
Correlation time length	: 48 ms
Maximum number of trace in output cell	: 1

3.20 Targeted PSTM Velocity Lines

Targeted 3D PreStack Time Migration (PSTM) to every 500 m velocity lines were processed for subsequent velocity analyses. The migrated data was obtained using the same parameters outlined in **Section 3.22 (3D PreStack Time Migration)**.

3.21 Second Pass Velocity Analysis

Most of the analysis parameters were identical to the first pass velocity analyses as detailed in **Section 3.9** except the critical change was to use the first pass velocity function as the centre velocity reference and a tighter fan separation.

Second pass velocity analyses created at 500 m x 500 m grid were picked by WG.

These velocities were used for the final 3D Prestack Time Migration with a 3 km smoothing function applied. This set of interpolated/smoothed migrated velocity field (in WesternGeco VELF format with original inline/crossline numbering) was archived to the CD-ROM for sending out to BSOC on 9 June 2005. In addition, the same set of final migrated velocity field was reformatted to BSOC preferred format for Petrosys loading (The inline numbering was doubled at BSOC request and inline & crossline fields were switched in the text file) was also archived to a CD-ROM for sending out to BSOC on 29 June 2005.

The input to second pass velocity analyses has applied with mild Radon multiple attenuation in order to assist with the velocity picking.

Parameter values:

Central fan function	: First pass velocity field
Number of fan functions	: 15
Fan separation: Time (ms)	/ Separation (%)
1	/ 2
1500	/ 3
3000	/ 4
6000	/ 4
Analysis interval	: 500 m
Number of CMPs per analysis (MVFS display)	: 15
Number of CMPs per analysis (Semblance display)	: 7

3.22 3D PreStack Time Migration (PSTM)

The Kirchhoff Time Migration Seismic Function Module (SFM) performs seismic time migration using the Kirchhoff summation method. The migrated image is constructed by summing weighted amplitudes along diffraction curves or curved surfaces for the 3D case. These diffraction curves are determined by two-way travel times from the surface to subsurface scatters that are computed from the user-supplied velocity field. In prestack mode, migration is performed on common offset volumes for 3D data.

Theoretical basis Kirchhoff Migration is based on Green's theorem, a mathematical equation that states a relationship between the observations of a wave field on a closed surface and the wave field at any point inside that surface (see Schneider, W.A., 1978). The name of Gustav Kirchhoff is associated with the method because of his work in 1882 on optical diffraction. The formula for migration that is derived from Green's theorem has the form of an integral (or a summation in the case of discretely sampled data) over observations made on the surface of the earth. The migrated image calculated by that summation represents the acoustic reflectance throughout a section of the earth beneath the surface observations.

Key parameters to the migration process are the maximum dip filter angle and spatial anti-aliasing factors. Kirchhoff Migration typically provides a better migration solution, compared with other time migration algorithms, when the velocities vary both laterally and temporally. One feature of the WesternGeco's Kirchhoff Migration is the ability to define an output location, line or volume independently of the input data. This allows the user to target the output of selected lines or locations that are fully 3D migrated without the associated time/cost of migrating the whole volume. This target output option is particularly useful when processing 3D prestack as it allows the generation of targeted velocity analyses prior to running the full migration. Under such circumstances, the process does not waste time migrating those input traces that do not contribute to the output profile.

Prestack time migration is achieved by migrating the sorted common-offset panels into individual zero-offset panels. During migration the traces are effectively NMO-corrected; however, inverse NMO using the migration velocity is typically applied prior to output of the data. This allows a final (third pass) velocity analyses and moveout to be performed on the data prior to final stacking the whole volume.

Parameter values:

Processing domain	: Common offset
Total common offset planes	: 64
Migration algorithm	: 3D Kirchhoff Migration
Travel time computation	: Ray bending
Maximum aperture radius	: 3000 m
Maximum dip limit	: 60 degrees
Migration velocity field	: 100% second pass velocity field smoothed over 3 km
Output area	: Full-fold only

3.23 3D CMP Sort

The PSTM data were re-sorted back to 3D Common Mid Point (CMP) gathers for subsequent processing.

3.24 Third (Final) Pass Velocity Analysis

Most of the analysis parameters were identical to the first or second pass velocity analyses in **Section 3.9 (First Pass Velocity Analysis) & Section 3.21 (Second Pass Velocity Analysis)** except the critical changes were to use the second pass velocity function as the centre velocity reference and a tighter fan separation.

Third (final) pass velocity analyses created at 500 m x 500 m grid were picked by WG and a general review was performed by BSOC.

The final set of stacking velocities was used for subsequent processes such as Radon multiple attenuation, final full offset stack and stacking of the angle gathers. This set of interpolated stacking velocity field (in WesternGeco VELF format with original inline/crossline numbering) was archived to the CD-ROM for sending out to BSOC on 9 June 2005. In addition, the same set of final stacking velocity field was reformatted to BSOC preferred format for Petrosys loading (The inline numbering was doubled at BSOC request and inline & crossline fields were switched in the text file) for archiving to the CD-ROM prior sending to BSOC on 29 June 2005.

The input to third pass velocity analyses has applied with mild Radon multiple attenuation in order to assist with the velocity picking.

Parameter values:

Central fan function : Second pass velocity field
Number of fan functions : 15

Fan separation:

Time (ms)	Separation (%)
2	2
1500	3
3000	4
6000	4

Analysis interval : 500 m
Number of CMPs per analysis (MVFS display) : 15
Number of CMPs per analysis (Semblance display) : 3

3.25 Radon Multiple Attenuation

Radon Multiple Attenuation is principally a modeling and subtraction process. CMP gathers are transformed to the Radon (Tau-p) domain, unwanted coherent noise is isolated in this domain, transformed back to the time-offset (t-x) domain, and then subtracted from the original data. The transform separates events according to moveout (or velocity), and hence multiple energy can be isolated in the Tau-p domain (by means of a mute) provided it has a different velocity to that of the primaries.

Effective separation of coherent signal (primaries) and noise (multiples) requires that both are adequately focused in the Radon domain. Conventionally this is achieved in two steps. For a parabolic Radon transform, the first step is to condition coherent signal and noise events such that their moveout is approximately parabolic, and their amplitude and phase are approximately constant across all offsets. The second step is to apply a geometry compensation filter during the transform, which attempts to reduce artefacts caused by the input gather geometry. A least-squares geometry compensation filter requires the moveout range for the transform to be adequate to model all coherent events. The transform minimizes the difference between the input and the forward and

reverse transformed data (the residual) and if a significant amount of coherent energy lies outside the modeled moveout range, artefacts will result.
In Radon Multiple Attenuation, normally two velocity fields are required:

- An estimate of the stacking velocity field, V_s.
- A maximum velocity for multiple attenuation, V_m. This is usually a percentage of V_s.

CMP gather data are conditioned prior to the transform. Typically the gathers are moveout corrected with velocity V_s, which ideally results in flattened primary reflections and under corrected multiples. For convenience we refer to over-corrected data as having negative dip (decreasing time with increasing offset), under-corrected data as having positive dip (increasing time with increasing offset) and flat data as having no discernible change in time with offset. To prevent transform aliasing the gathers can be spatially interpolated and the amplitudes may also be preconditioned, for example by using a reversible AGC.

The data are then transformed into the Tau-p (Radon) domain using a parabolic Radon transform. After hyperbolic normal moveout (or higher-order moveout correction), residual moveout has an approximately parabolic shape and hence a parabolic Radon transform is appropriate.

The range of moveouts to transform, measured in ms at a reference offset (X_{ref}), is chosen to cover the range of both primary and multiple energy. Following this, parts of Tau-p domain representing primary energy are zeroed by application of a mute. For this purpose 'primary energy' is usually assumed to be any data with a velocity faster than V_m. This allows for time-variance in the separation of primary and multiple events. V_m does not need to be the actual velocity of the multiples but rather a velocity that is as fast or faster than multiples of interest while being slower than the primary velocity. Primary energy is protected at late times by imposing a minimum moveout (p) value on the mute. Note that for some deep-water datasets, the mute may be safely defined by use of the minimum p value alone, without reference to V_m. The boundary between the zeroed and preserved regions is tapered in the p direction.

Inverse Tau-p transform and removal of the pre-transform conditioning produces a model of the multiple energy. This is subtracted from the original data to produce the multiple-attenuated output.

Parameter values:

Pre-transform conditioning	: NMO with primary velocity (final velocity field) 500 ms AGC
Reference offset (X_{ref})	: 5000 m
Moveouts (Δt) at the reference offset (X_{ref}):	
Minimum moveout (i.e. for the first p-trace)	: -400 ms
Maximum moveout (i.e. for the last p-trace)	: 3600 ms
Moveout type	: Parabolic
Number of p-traces	: 400
Maximum frequency	: 90 Hz
Multiple mute velocity (V_m)	: 90 % of final velocity field
Velocity mute taper	: 32 ms

Note: Moveouts used in making intermediate p-traces were linearly interpolated between the minimum and maximum moveouts.

3.26 Normal Moveout Correction / Outer Mute / Stack

Normal Moveout (NMO) correction was performed using final set of 3D velocity field.

After NMO, an outer trace mute was applied to remove first break noise, refractions and wide angle reflections and any data which NMO had stretched beyond acceptable limits. To prevent a rapid amplitude change between the muted and live parts of the trace in trace mute process, a typical 64 ms taper was applied from zero amplitude to full amplitude. This prevents distortion to the frequency spectrum of the stacked data, which would otherwise by introduced by an abrupt boundary.

The data were stacked and normalized sample by sample using the following function:

$$s(t) = \frac{1}{w(t)}$$

Where *w(t)* is the summed weight function for a given output trace

The nominal CMP fold was 64. Selected stack monitors (NMO-CMP gathers) at very 500 m interval were QC'd with the final outer trace mute pattern over-laid. Similarly, every 500 m interval of inline stacks were QC'd prior to loading the raw stack cube to OmegaVu system for inline / crossline / time-slice QC.

The final outer trace mute pattern applied to the data is as follows:

Parameter values:

Taper zone length: 32 ms (starting from the mute times detailed below)

Source-to-detector offset (m)	Mute time (ms)
340	4
360	48
410	200
490	400
1040	1000
2450	2100
4265	3290
5000	3940

Note: Mute times were linearly interpolated between the specified offsets and extrapolated for offsets larger than the last offset specified.

The final set of raw PSTM/RADON NMO-CMP gathers (with gun/cable static correction of +10 ms and without offset mute application) was SEGY archived to 16 x 3590B cartridges for delivery to BSOC on 7 July 2005.

3.27 Near, Mid and Far Angle Stacks

The velocity functions used to derive the angle mutes were calculated from the smoothed final velocity field. The mutes were calculated using bending rays, to compensate for refraction, with interval velocities calculated using Dix approximation. The resulting velocity function was finally modified by a Least Squares fit to prevent oscillations in interval velocities causing unstable mute patterns.

The 3 angle stack volumes generated were:

- Near 0^{O} - 14^{O}
- Mid 14^{O} - 28^{O}
- Far 28^{O} - 42^{O}

For the mid/far angle range stacks, the final outer trace offset mute was combined with the outer angle mute in hybrid mode to mute off some of the noisy data below 2 seconds.

The traces within each angle-muted gather are stacked to form a single output trace. The resultant trace is normalized sample by sample using the following function:

$$s(t) = \frac{1}{w(t)}$$

Where *w(t)* is the summed weight function for a given output trace

3.28 Post-Stack Crossline Trace Interpolation

A frequency-space (f-x-y) 3D interpolation algorithm is used to generate interpolated traces within each offset plane to yield the desired output trace spacing.

The stack volume is windowed in all 3 directions to create sub-volumes within which the interpolation takes place. These sub-volumes are overlapped to allow for blending of the interpolation results. This is done in order to conform to the premise of the algorithm that seismic events are linear or planar within each sub-volume.

Each sub-volume is Fourier transformed in time to form a cube of f-x-y data with each frequency slice then being interpolated separately.

The interpolated output data was re-grid to reflect the new bin size. The original inline numbers were doubled after interpolation at BSOC request.

Parameter values:

Input trace spacing (inline x crossline)	: 12.5 m x 25.0 m
Output trace spacing (inline x crossline)	: 12.5 m x 12.5 m
Time window length	: 1000 ms
Window width (inline x crossline)	: 21 x 21 traces
Operator width (inline x crossline)	: 5 x 5 traces

3.29 3D F-K Footprint Removal

Spatially periodic artefacts (footprint) caused by recording geometry in the 3D input volume (t-x-y) are transformed into peaks in frequency slices in the transform domain ($f\text{-}k_x\text{-}k_y$). These peaks are suppressed by use of notch filters. For a given geometry, the peaks occur at different locations depending on structural dip, and footprint character may change in the time direction, hence the data is spatially and temporally windowed into regions of similar structural dip and footprint character. The windowed regions are overlapped sufficiently to avoid windowing artefacts.

The notch filters can either be defined by the user or can be automatically derived. The automatic derivation works by summing the k_x-k_y slices over frequency then detecting peaks over a threshold percentage of the peak at the origin (which corresponds to flat events). In the case of a dominant structural dip within the t-x-y window, the slices are shifted before summation to compensate for that dip. The detected peaks are then suppressed on each frequency slice by application of tapered elliptical notch filters.

Parameter values:

In-line window width	: 100 traces
In-line window overlap	: 20 traces
Cross-line window width	: 130 traces
Cross-line window overlap	: 20 traces
Time window length	: 1000 ms
Time overlap	: 500 ms
Notch filter derivation	: Automatic

3.30 3D Grid Definition (PostStack)

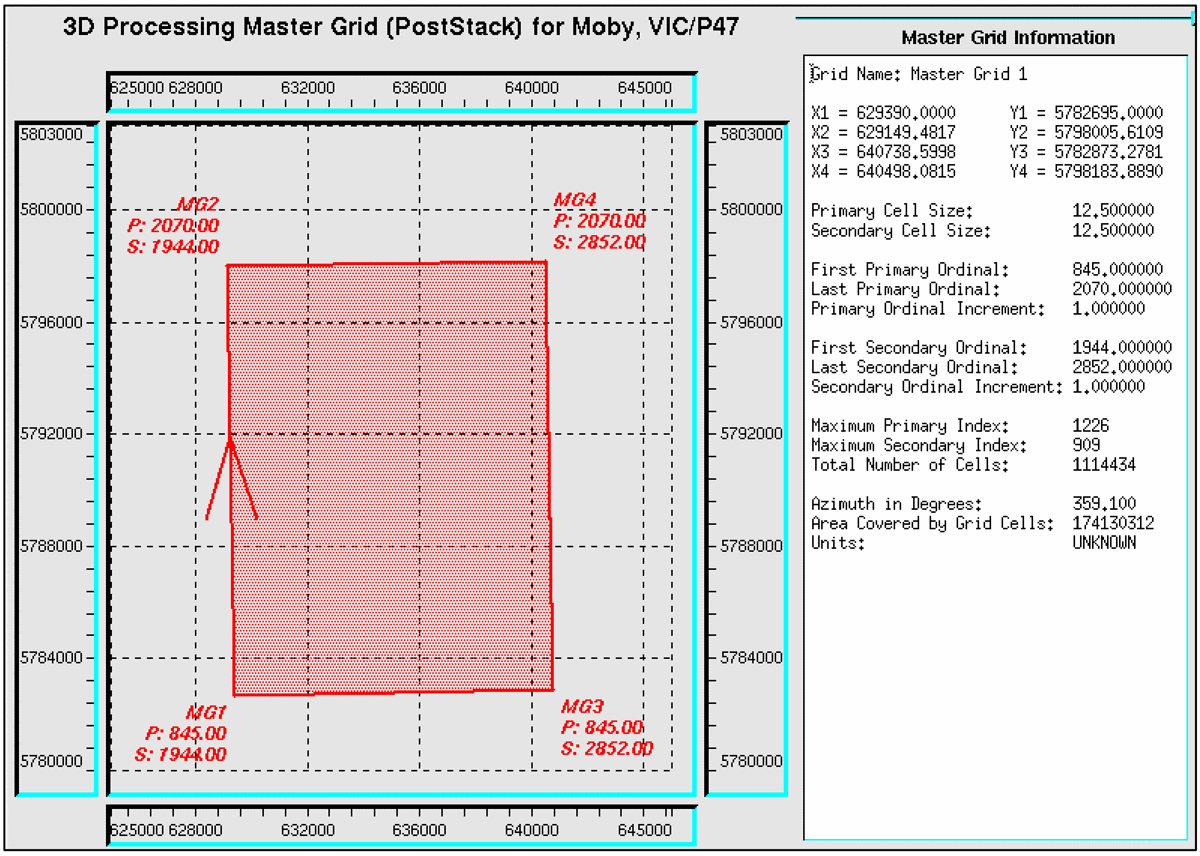
The above poststack 3D interpolated data were re-grid to reflect the new bin size as follows: (The inline numbering was doubled at BSOC request)

PostStack output grid = 12.5 m x 12.5 m, crosslines 845-2070 incr 1
inlines 1944-2852 incr 1

	X-Coordinates	Y-Coordinates	Crossline	Inline
P1	629390.0000	5782695.0000	845	1944
P2	629149.4817	5798005.6109	2070	1944
P3	640738.5998	5782873.2781	845	2852
P4	640498.0815	5798183.8890	2070	2852

Crossline cell size: 12.5 m
Inline cell size: 12.5 m
Crossline increment: 1
Inline increment: 1

Primary axis azimuth: 359.10 degrees



3.31 Gun and Cable Static Correction

The gun and cable depth corrections to mean sea level were applied to all final migrated full offset & angle stack volumes. With the averaged gun depth of 7 m & cable depth of 8 m and using the water velocity of 1500 m/s, a static correction of 10 ms was calculated and applied.

3.32 Deconvolution After Stack (DAS)

A Wiener-Levinson least squares minimum phase inverse filter was applied to the final stack volume. A unique operator was designed from auto-correlation of each trace and applied to each trace. The relevant DAS design and application parameters used were:

Parameter values:

Auto-correlation window number	: 1
Window length (start time - stop time)	: 160 - 1660 ms
Prediction distance	: 48 ms
Operator length	: 180 ms
White noise	: 0.01 %

3.33 Time Variant Spectral Shaping (TVSS)

The primary purpose of spectral shaping is to modify the wavelet to achieve maximum vertical resolution. Optimum wavelet resolution is achieved by shaping the wavelet's amplitude spectrum to become broad and flat. The extent to which this may be usefully undertaken is limited by the signal to noise ratio of the data.

It is assumed prior processing has converted the data to zero-phase. This is maintained by making the spectral shaping operators also zero-phase.

The wavelet spectrum cannot be directly estimated from the data, without knowledge of the reflectivity spectrum. Spectra measured from seismic data are the combination of the wavelet spectrum and the earth reflectivity spectrum. To separate the earth reflectivity from the trace spectra a measurement of the reflectivity has to be made. This can be computed from well bore data. If this is ignored, general spectral shaping programs assume the reflectivity to be "white" or random - an unrealistic assumption. A reflectivity trace is constructed from well data utilizing the p-wave velocity and density logs and is converted to the time domain. A highly smoothed reflectivity spectrum is constructed which describes the overall trend of the earth's reflectivity spectrum. This is then used in the shaping operator design.

A spectral shaping operator is then derived that will produce an output trace spectrum with a spectrum equal to the well reflectivity trend. Having applied such an operator the trace spectrum is coloured, but the wavelet spectrum is flat, thus achieving maximum vertical resolution.
The beta factor specified below is a control on the 'flatness' of the coloured output trace spectrum. A larger beta value allows more whitening of the higher frequencies and less to the lower frequencies. A smaller beta factor gives a flatter trace spectrum with more equivalent boosting at both the low and high frequency ends of the trace spectrum. The output trace spectrum was also controlled between 10 and 40 Hz where no gain, or spectral boosting, was applied. This frequency range was determined by estimating the dominant frequency of the signal at target depth.

Parameter values:

Filter specification	: Automatic
Number of filters generated	: 9

Passband Corner frequencies (Hz)	Passband Amplitudes
1	0.001
8	1
60	1
85	0.001

Gain window length	: 512 ms
Percent white noise	: 10

Beta factor	: 0.5
Number time coefficients	: 128
No-gain low frequency	: 10 Hz
No-gain high frequency	: 40 Hz

3.34 Exponential Gain

The data were scaled with a time variant exponential gain function (that is, the trace sample at 2 seconds is multiplied by a value a specified amount higher in dB than the trace sample at 1 second). This scaling was applied from the trace's first time sample down to a time of t_{stop} after which the gain was held constant, according to the formulae:

$A_o(t) = A_i(t)$ $t \le 0$

$A_o(t) = A_i(t)\, e^{(t * PWR)}$ $t > 0,\ t \le t_{stop}$

$A_o(t) = A_i(t)\, e^{(t_{stop} * PWR)}$ $t > t_{stop}$

where

$A_o(t)$ is the output trace sample at time t
$A_i(t)$ is the input trace sample at time t
t is the time in seconds
PWR is the exponential gain function

Parameter values:

Exponential gain function	: 3 dB/sec
t_{stop}	: 6000 ms

3.35 Time Variant Filter (TVF)

A zero-phase Time Variant Filter (TVF) was applied to the data. The filter passbands were described by low- and high-cut frequencies and associated dB/octave cutoff slopes. The specified cutoff frequencies are located at the half-power (-3 dB in amplitude) response points and the slopes at these frequencies are equal to the respective dB/octave values. The slope is an approximate cosine squared function in the amplitude domain. The filters were normalized so that the output amplitudes were the same as the input amplitudes for frequency components within the passband.

Parameter values:

Filter Centre Time (ms)	Low-cut Frequency (Hz)	Low-cut Slope (dB/octave)	High-cut Frequency (Hz)	High-cut Slope (dB/octave)
4	6	36	70	72
2000	6	36	60	72
3500	5	36	50	72
5000	4	36	45	72
6000	4	36	35	72

Note: The times are those at the centre of the filter where the full effect of the filter is attained.
The first filter was applied from the beginning of the trace to the first filter centre time.
Intermediate filters were linearly tapered and blended with the preceding and succeeding filter between the filter centre times.
The last filter was applied from the last filter centre time to the end of the data.

3.36 Scaling (RMS)

RMS (root-mean-square) gain is a time variant scaling that computes scalars based on the rms amplitude of data within a window. Windows abut each other down the trace with the computed scale factor applied to the central sample within a window. Linear interpolation of scale factors is used to scale intermediate samples.

Parameter values:

RMS amplitude : 1
Window length : Constant

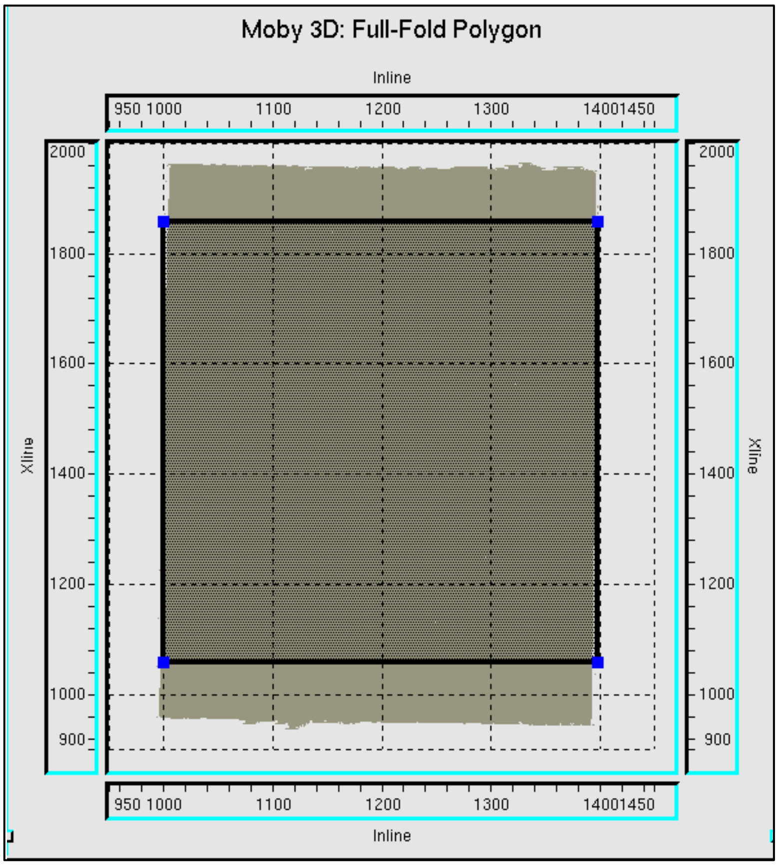
Window lengths (ms)	Start time (ms)	End time (ms)
1000	4	6000

Note: The times specified are the time of the first sample to be included in the first window and the time of the last sample to be included in the last window.
The multiplier for the first window was applied constantly back to the first sample on the trace. The last multiplier calculated was applied constantly until the last live sample.

3.37 Polygon Select Of Full-Fold Area

The 5 corner points of polygon select of full-fold area are as follows:

Point	Crossline	Inline(PreStack)	X-Coordinate	Y-Coordinate
1)	1056	1000	630048.49	5785343.17
2)	1857	1000	629891.22	5795354.43
3)	1857	1399	639864.99	5795511.16
4)	1056	1399	640022.26	5785499.85
5)	1056	1000	630048.49	5785343.17



4.0 Parameter Testing

To maintain the agreed delivery date the testing was performed concurrently with production stages.
Primary test line: GAP04A1200P1002

4.1 Deterministic Designature

Selected 8 shot records from test line 1200P1:

- No designature
- Zero phase designature

Confirmed on 9 Feb 2005: Apply zero phase designature in positive polarity (included de-dubble in designature operator).

4.2 Amplitude Recovery

Selected 8 shot records from test line 1200P1 with desig/resample applied:

- Raw shots
- Time squared function gain
- Geometric spreading gain (using single velocity derived from test line)
- Geometric spreading gain + exponential gain (1, 2, 3 or 4 dB/sec)

Confirmed on 10 Feb 2005: Apply time squared function gain.

4.3 Low Cut Filter

Selected 8 shot records from test line 1200P1 with desig/resample/T**2 gain applied:

- No low cut filter
- 2 Hz zero phase low cut filter
- 3 Hz zero phase low cut filter
- 4 Hz zero phase low cut filter
- 5 Hz zero phase low cut filter

Confirmed on 10 Feb 2005: Apply zero phase low cut filter of 3 Hz with 12 dB/octave slope.

4.4 Swell Noise Attenuation (SWATT)

Selected test line 1200P1 with desig/resample/T**2 gain/LCF applied:
<First-pass shot SWATT>

- No SWATT
- SWATT with 23 tr filter width, 500 ms window length
- SWATT with 23 tr filter width, 500 ms window length -- input to octave filter tests
- SWATT with 23 tr filter width, 500 ms window length, revised threshold % -----(best result sht1)

<Best result sht1 input to second-pass shot SWATT>

- SWATT with 25 tr filter width, 500 ms window length
- SWATT with 25 tr filter width, 500 ms window length -- input to octave filter tests
- SWATT with 25 tr filter width, 500 ms window length, revised threshold % -----(best result sht2)

<Best result sht1+sht2 input to first-pass receiver SWATT>

- SWATT with 29 tr filter width, 500 ms window length ---------------------------------(best result rcv1)

<Best result sht1+sht2+rcv1 input to second-pass receiver SWATT>

- SWATT with 29 tr filter width, 500 ms window length, revised threshold % -----(best result rcv2)

Compared brute stacks / nmo-cmps (with single vel derived from well Moby-1 supplied by BSOC) / shot records and their difference plots.
Confirmed on 24 Feb 2005: Apply 2 passes of SWATT in shot domain followed by another 2 passes of SWATT in receiver domain.

4.5 Tau-p Linear Noise Attenuation

Selected test line 1200P1 with desig/resample/T**2 gain/LCF/SWATT applied:

• No Tau-p LNA
<Tau-p LNA (LMO half shot record)>
• No reversible AGC, moveout range -1500to500 ms, 401 p-tr, moveout mute -1400to300 ms
• Reversible AGC, moveout range -1500to500 ms, 401 p-tr, moveout mute -1400to300 ms
Compared selected shot records, stacks / nmo-cmps (with first pass velocity) and their diff. plots.
Confirmed on 3 March 2005: Apply Tau-p LNA to whole survey.

4.6 F-K Filter

Selected test line 1200P1 with desig/resample/T**2 gain/LCF/SWATT/Tau-p LNA applied:
• No shot F-K filter
• Shot F-K filter: pass dips +-3.5 ms/tr, taper 2 ms/tr
• Shot F-K filter: pass dips +-4.5 ms/tr, taper 2.25 ms/tr
• Shot F-K filter: pass dips +-5.5 ms/tr, taper 3 ms/tr -----------------also tested without LNA input
• Shot F-K filter: pass dips +-6.5 ms/tr, taper 3.25 ms/tr -------------also tested without LNA input
Compared selected shot records, stacks / nmo-cmps (with first pass velocity) and their diff. plots.
Confirmed on 3 March 2005: Apply F-K filter +/- 5.5 ms/trace (2272 m/s) cosine tapered to full off at +/- 7.0 ms/tr (-36 dB at 1786 m/s) in shot domain immediately after Tau-p LNA. Note that 3 ms/trace taper is centred over the specified dip limit value of +/- 5.5 ms/trace.

4.7 K-Filter

Selected test line 1200P1 with desig/resample/T**2 gain/LCF/ SWATT/Tau-p LNA/F-K filter applied:
• No K-filter
• K-filter: pass wavenumber of +-0.45, taper 0.1
Compared selected shot records, stacks / nmo-cmps (with first pass velocity).
Confirmed on 3 March 2005: Apply K-filter before trace reduction.

4.8 Tau-p / T-X Deconvolution Before Stack

Selected test line 1200P1 with desig/resample/T**2 gain/LCF/SWATT/Tau-p LNA/F-K filter/K-filter applied:
• No T-X decon / Tau-p decon
<T-X decon, 1 window>
• tr-by-tr: 240 ms operator length, gap tests 20, 24, 28, 32, 36 & 48 ms
• tr-by-tr: 36 ms gap, operator length tests 120, 180, 240, 320 & 400 ms
• shot average: 36 ms gap, 240ms operator length
<Tau-p decon: constant 32 ms gap, 240 ms operator length, 1 window>
• Moveout range -3300to3300 ms, 1320 p-tr, time variant moveout mute
• Moveout range -2200to3300 ms, 1100 p-tr, time variant moveout mute
• Moveout range -2200to3300 ms, 1100 p-tr, no moveout mute
• Moveout range -1800to3300 ms, 1020 p-tr, no moveout mute
• Moveout range -1200to3300 ms, 900 p-tr, no moveout mute
<Tau-p decon: p-dependent gap-30 ms, operator length+30 ms, 1 window>
• Moveout range -3300to3300 ms, 1320 p-tr, time variant moveout mute
Compared selected shot records, stacks / nmo-cmps (with first pass velocity) and their difference plots. All qc have 500 ms autocorrelations appended below shot / stack / nmo-cmp.
Confirmed on 18 March 2005: Apply Tau-p decon using linear moveout range -2200 to 3300ms, 1100 p-tr, no moveout mute, 240 ms operator, 32 ms gap, 1 window.

4.9 Radon Multiple Attenuation Before PSTM

Selected test line 1200P1 with desig/resample/T**2 gain/LCF/SWATT/Tau-p LNA/F-K filter/K-filter/Tau-p DBS applied:
• No Radon multiple attenuation
• Radon multiple attenuation (no cmp-interpolation, reversible AGC): moveout mute -400to300ms
• Radon multiple attenuation (1:2 cmp-interpolation, reversible AGC): moveout mute -400to300ms

Selected PSTM cmp gathers from targeted vel-lines VL1080 & VL1360:
- Radon multiple attenuation (no cmp-interpolation, reversible AGC): moveout mute –400 to 300ms
- Radon multiple attenuation (no cmp-interpolation, reversible AGC): velocity mute 90% of FPV

Compared stacks / nmo-cmps (with first pass velocity, FPV) and their difference plots.
Confirmed on 22 March 2005: No cmp-interpolation for Radon multiple attenuation; and no application of Radon Demultiple before PSTM; re-assess requirement for multiple attenuation after full migration using residual stacking velocities picked from 500 x 500m grid.

4.10 3D Bin Regularisation By Interpolation

Selected near/mid/far common offset (OFF) planes with Tau-p DBS/tidal static correction/trace reduction applied:
- OFF01, OFF30, OFF64 without 3D bin regularisation by interpolation
- OFF01, OFF30, OFF64 with 3D bin regularisation by interpolation:
  Dip range tests +- 1, +-2, +-4, +-8 ms/cell

Compared selected inlines, xlines & time slices.
Confirmed on 1 April 2005: Apply 3D bin regularisation by interpolation with dip range of +- 2 ms/cell.

4.11 Radon Multiple Attenuation After PSTM

Selected final PSTM CMP gathers from vel-line VL1080:
- No Radon multiple attenuation
- Radon multiple attenuation (reversible AGC): velocity mute 90% of final velocity field

Compared selected inlines, xlines & time slices.
Confirmed on 5 April 2005: Apply Radon multiple attenuation after PSTM using velocity mute 90% of final stacking velocity field.

4.12 Outer Mute

Selected nav-seis merged CMP gathers from test line 1200P1:
- Preliminary outer mute pattern

Selected Swatt/Tau-p LNA CMP gathers from test line 1200P1:
- Preliminary outer mute pattern

Selected PSTM/Radon CMP gathers from vel-line VL1080:
- Preliminary outer mute pattern
- Final (or tighter) outer mute pattern

In all cases, the selected NMO-CMP gathers were overlaid with the preliminary/final outer mute patterns for reviewing. Stacks were also produced and compared.
Confirmed on 12 April 2005: Final set of tighter outer trace mute was applied to final stack cubes.

4.13 Post-Stack Crossline Trace Interpolation

Selected a small test cube (IL1080-1140, XL1100-1800) from final radon stack volume:
- No poststack crossline trace interpolation
- Poststack crossline trace interpolation

The test cube was loaded into OmegaVu for reviewing.
Confirmed on 15 April 2005: Apply poststack crossline trace interpolation (& re-grid with inline numbering doubled at BSOC request) to final stack volume.

4.14 3D F-K Footprint Removal

Selected the same test cube (IL1080-1140, XL1100-1800) from final radon stack volume with crossline trace interpolation applied:
- No 3D F-K footprint removal
- 3D F-K footprint removal: IL/XL window width 100x70 traces
- 3D F-K footprint removal: IL/XL window width 100x100 traces

- 3D F-K footprint removal: IL/XL window width 100x130 traces <-----final production parameters.
- 3D F-K footprint removal: IL/XL window width 100x200 traces

The test cubes were loaded into OmegaVu for reviewing.
Confirmed on 22 April 2005: Apply 3D F-K footprint removal after crossline trace interpolation.

4.15 Exponential Gain

Selected IL2200 from the same test cube with xl-interpolation/3D F-K footprint removal applied:

- No exponential gain
- Exponential gain tests: 2, 3, 4, 5 dB/sec
- Exponential gain tests: 2, 3, 4, 5 dB/sec and hold constant below 3sec

Confirmed on 22 April 2005: Apply an exponential gain of 3 dB/sec to the whole Raw Stack Cube prior to SEGY archive.

4.16 Deconvolution After Stack (DAS)

Selected portion of IL2200 (XL1130-1629) from production stack cube with crossline interpolation/3D F-K footprint removal applied:

- No DAS
- DAS (trace by trace): 36 ms gap, operator length tests 120, 180, 240, 320 & 400 ms
- DAS (trace by trace): 180 ms operator length, gap tests 24, 28, 32, 36 & 48 ms
- DAS (15 trace rolling mix): 48 ms gap, 180 ms operator length

All qc have 500 ms autocorrelations appended below stack.
Confirmed on 22 April 2005: Apply DAS with 48 ms gap, 180 ms operator length to the whole survey.

4.17 Time Variant Spectral Shaping (TVSS)

Selected whole line IL2200 from production stack cube with crossline interpolation/3D F-K footprint removal/DAS applied:

- No TVSS
- TVSS: 9 automated filters, 10% white noise, beta factor tests 0.4, 0.5 & 0.7
- TVSS: 9 automated filters, beta factor of 0.5, white noise tests 1, 10 & 20%

All qc have 500 ms autocorrelations appended below stack.
Confirmed on 29 April 2005: Apply TVSS (10% white noise, 0.5 beta factor) after DAS.

4.18 Filter Tests

Selected a portion of stack from IL2187 (XL1370-1470) with final TVSS applied:

- No filter (applied AGC 2000 ms)
- Filter high-cut tests: out-30, 40, 50, 60, 70, 80, 90, 100, 110, 125 Hz
- Filter low-cut tests: 2, 3, 4, 5, 6, 7, 8 Hz - out

Confirmed on 10 May 2005: Final time variant filter (TVF) was picked as [time(ms) / freq(Hz)] follows:
0 / 6-70, 2000 / 6-60, 3500 / 5-50, 5000 / 4-45, 6000 / 4-35

4.19 Scaling Tests

Selected a portion of stack from IL2187 (XL1370-1470) with final TVSS/TVF applied:

- Raw stack
- AGC scaling tests: AGC 2000, 1500, 1000, 500 ms gate
- RMS scaling tests: RMS 2000, 1500, 1000, 500 ms gate

Selected whole line IL2187 from production TVSS cube with TVF applied:

- Raw stack
- AGC 1000 ms gate
- RMS 1000 ms gate

Confirmed on 10 May 2005: Apply RMS gain 1000 ms to Final Migrated Stack volume.

4.20 Angle Mutes / Stacks

Selected a few final PSTM/Radon NMO-CMP gathers from inlines 1010, 1203 & 1390:

- Angle (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60 deg) & preliminary outer mute overlay
- Angle 0-14 deg & preliminary outer mute overlay
- Angle 14-28 deg & preliminary outer mute (adjusted to suit this angle range) overlay
- Angle 28-42 deg & preliminary outer mute (adjusted to suit this angle range) overlay
- Angle 0-14 deg & preliminary outer mute applied
- Angle 14-28 deg & preliminary outer mute (adjusted to suit this angle range) applied
- Angle 28-42 deg & preliminary outer mute (adjusted to suit this angle range) applied
- Angle 0-14 deg & final tighter outer mute applied

Selected whole line IL2187 CMP gathers from production Radon for the following stacks with & without TVSS applied:

- Full offset (final tighter outer mute applied)
- Angle 0-14 deg & final tighter outer mute applied
- Angle 14-28 deg & final tighter outer mute (adjusted to suit this angle range) applied
- Angle 28-42 deg & final tighter outer mute (adjusted to suit this angle range) applied

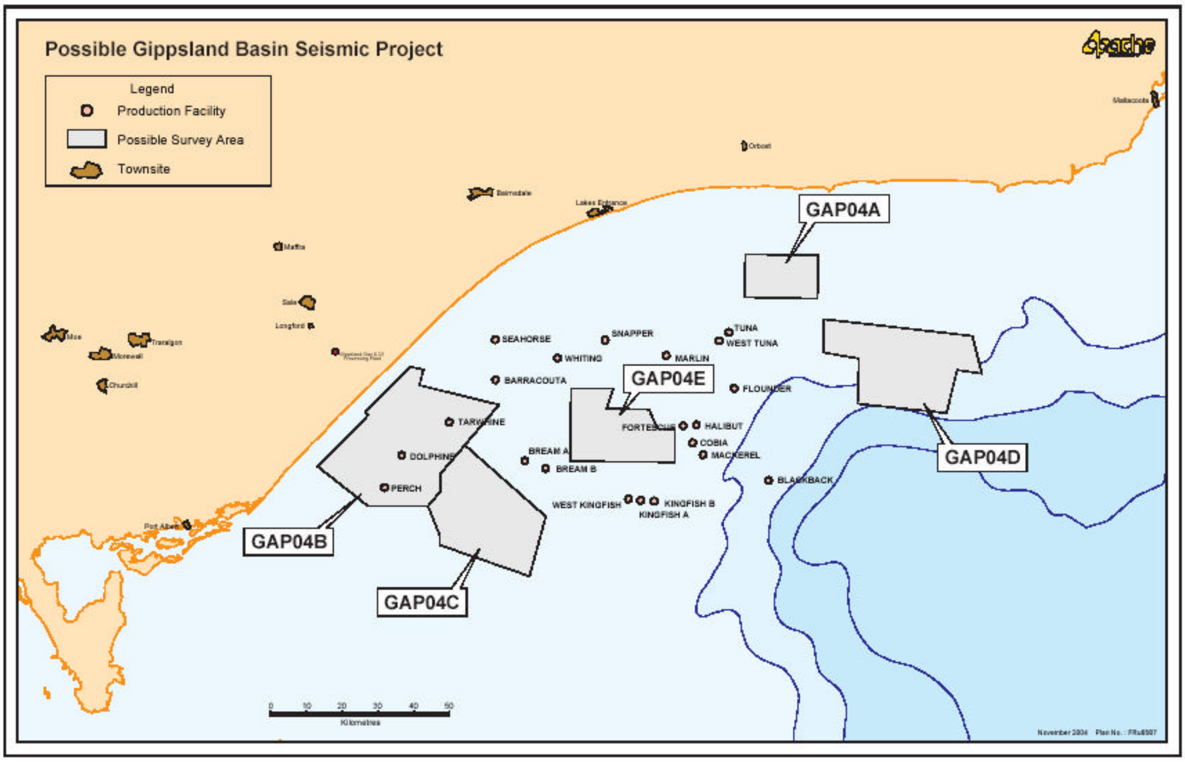
Confirmed on 13 May 2005: Produce 3 near/mid/far angle stack volumes then crossline trace interpolated (without TVSS) for final deliverables as per contract.

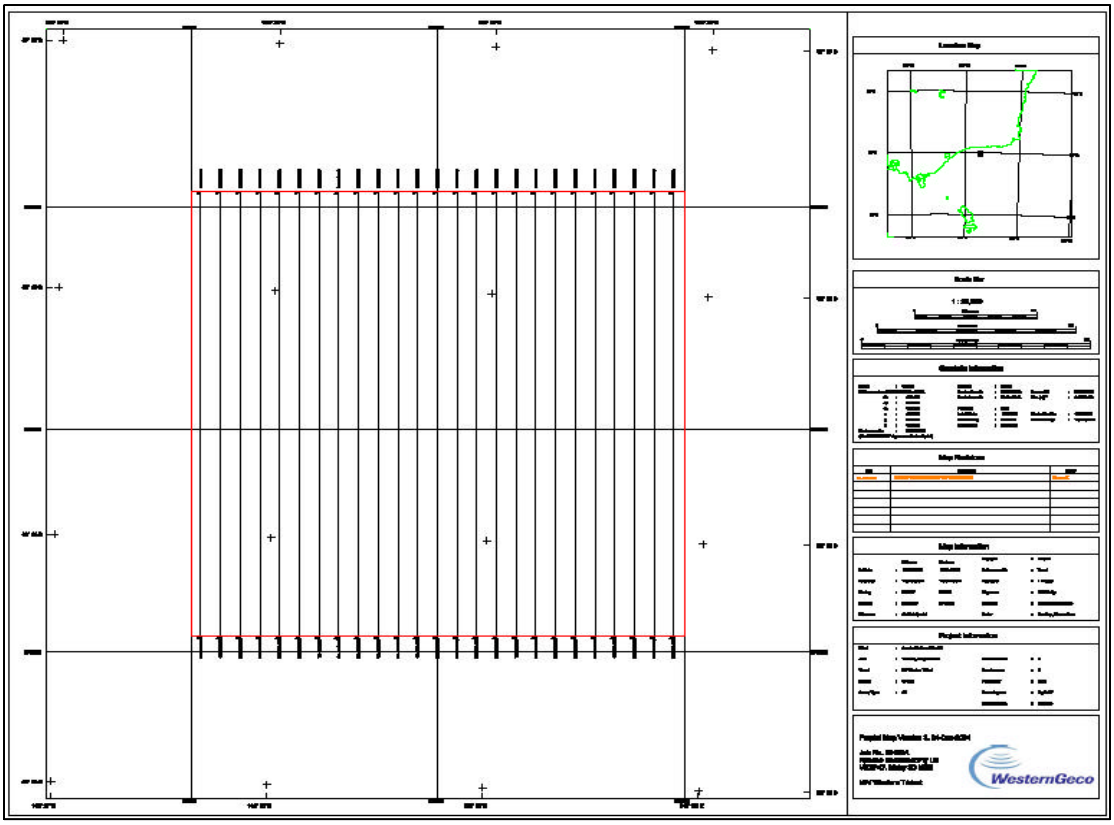
5.0 Personnel

Perth Personnel	
Paul Tredgett ptredgett@perth.westerngeco.slb.com	Senior Processing Supervisor
Tony DeLorenzo delorenzo1@perth.westerngeco.slb.com	Processing Supervisor
Ken Jayan kjayan@perth.westerngeco.slb.com	Project Leader
Richard Patenall rpatenall@perth.westerngeco.slb.com	Geo-Support Geophysicist
BSOC Representatives	
Ian Reid ian.reid@bassoil.com.au	General Manager, Exploration

6.0 Appendices

6.1 Map of Survey Location





6.2 *Acquisition Parameters*

General

Client	Apache Energy Northwest Pty Ltd
Contractor	WesternGeco
Vessel	M/V Western Trident
Location	Moby 3D, VIC/P47, Gippsland Basin, Australia
Total km^2 acquired	100.125
Date shot	9 - 15 January 2005

Recording

Recording type	MSX
Recording medium, format	3590B cartridge, SEG D 8058, Revision 1
Record length	6144 ms
Sample rate	2 ms
Low cut filter	2 Hz, 12 dB/octave
High cut filter	206 Hz, 264 dB/octave

Source

Source type	Tuned sleevegun array
Number of source arrays	2
Source array separation	50 m
Shotpoint interval	18.75 m flip/flop (37.5 m/array)
Array volume per source	3000 cu in
Operating pressure	2000 psi
Source depth	7 m
Number of sub-arrays/source	4
Sub-array separation	6 m
Number of airguns/sub-array	8
Sub-array length	15.1 m

Nominal CMP fold 64

Streamer

Streamer type	MSX solid streamer
Number of streamers	8
Group length	17.75 m
Number of hydrophones/group	14
Group interval	12.5 m
Hydrophone sensitivity	13.8 v / bar
Streamer length	4800 m
Streamer depth	8 m
Streamer separation	100 m
Number of groups/streamer	384
Nearest offset (nominal)	170 m

Navigation

Primary navigation system	Cnav
Secondary navigation system	Fugro Multifix 4
Tertiary navigation system	Trinav GPS 2.6

6.3 Acquisition Line Listing

No.	Seq	Dir	Sail-Line	FGSP	LGSP	No. Of Shots	Full Fold CMP Km (per ssl)
1	28	179.1	GAP04A1008J1028	1534	873	662	12.41
2	26	179.1	GAP04A1008P1026	1534	873	662	12.41
3	24	179.1	GAP04A1024P1024	1534	873	662	12.41
4	22	179.1	GAP04A1040P1022	1534	873	662	12.41
5	20	179.1	GAP04A1056P1020	1534	873	662	12.41
6	36	179.1	GAP04A1072J1036	1268	873	396	7.43
7	18	179.1	GAP04A1072P1018	1534	874	661	12.39
8	16	179.1	GAP04A1088P1016	1534	873	662	12.41
9	30	179.1	GAP04A1104J1030	1534	873	662	12.41
10	14	179.1	GAP04A1104P1014	1534	873	662	12.41
11	12	179.1	GAP04A1120P1012	1534	873	662	12.41
12	32	179.1	GAP04A1136J1032	1534	873	662	12.41
13	38	179.1	GAP04A1136J2038	1480	873	608	11.40
14	10	179.1	GAP04A1136P1010	1534	873	662	12.41
15	8	179.1	GAP04A1152P1008	1534	873	662	12.41
16	6	179.1	GAP04A1168P1006	1534	873	662	12.41
17	34	179.1	GAP04A1184J1034	1534	873	662	12.41
18	4	179.1	GAP04A1184P1004	1534	873	662	12.41
19	2	179.1	GAP04A1200P1002	1534	873	662	12.41
20	27	359	GAP04A1216J1027	1001	1662	662	12.41
21	37	359	GAP04A1216J2037	1001	1662	662	12.41
22	25	359	GAP04A1216P1025	1001	1662	662	12.41
23	23	359	GAP04A1232P1023	1001	1662	662	12.41
24	33	359	GAP04A1248J1033	1001	1662	662	12.41
25	21	359	GAP04A1248P1021	1001	1662	662	12.41
26	19	359	GAP04A1264P1019	1001	1662	662	12.41
27	17	359	GAP04A1280P1017	1001	1662	662	12.41

28	39	359	GAP04A1296A1039	1274	1308	35	0.66
29	15	359	GAP04A1296P1015	1001	1662	662	12.41
30	13	359	GAP04A1312P1013	1001	1662	662	12.41
31	35	359	GAP04A1328A1035	1291	1344	54	1.01
32	11	359	GAP04A1328P1011	1001	1662	662	12.41
33	1	359	GAP04A1392P1001	DNP	DNP	DNP	DNP
34	29	359	GAP04A1344J1029	1001	1662	662	12.41
35	9	359	GAP04A1344P1009	1001	1662	662	12.41
36	31	359	GAP04A1360J1031	1001	1662	662	12.41
37	7	359	GAP04A1360P1007	1001	1662	662	12.41
38	5	359	GAP04A1376P1005	1001	1662	662	12.41
39	3	359	GAP04A1392P2003	1001	1662	662	12.41
						Total (per ssl) =	**442.5**
						Total (x16 ssl) =	**7080**

6.4 Field Tape Listing and Supporting Data

A set of original field tapes (154 x 3590B media) for Moby 3D survey (VIC/P47) was sent to Kestrel Information Management in Melbourne for permanent storage on 17 October 2005.

Address: Kestrel Information Management
582-600 Somerville Road
Sunshine West
Victoria 3020

Attention: Diana Giordano (Account Manager)

The following supporting data were included in the same shipment:
1) 1 x 3590B tape with navigation data in P1/90 format
2) 1 x 3590B tape with navigation data in P2/94 format
3) 1 x 3590B tape with SEGY water bottom cube
4) 1 x 3590B tape with SEGY stack, CGM stack & LMO
5) 1 x CD with digital obs logs
6) 1 x CD with navigation VSE records
7) 41 x paper plots of brute stacks

Line Name	Dir	Field Tapes	FSP	LSP	FFile	LFile	Recorded Date
GAP04A1392P1001	359	V29904-V29907	971	1668	118	813	9/01/2005
GAP04A1200P1002	179.1	V29908-V29911	1564	870	48	742	9/01/2005
GAP04A1200PTEST	179.1	V29912	642	NONE	5	NONE	9/01/2005
GAP04A1392P2003	359	V29913-V29916	971	1666	89	782	9/01/2005
GAP04A1184P1004	179.1	V29917-V29920	1534	873	34	745	9/01/2005
GAP04A1376P1005	359	V29921-V29924	1001	1662	60	721	10/01/2005
GAP04A1168P1006	179.1	V29925-V29928	1534	873	56	717	10/01/2005
GAP04A1360P1007	359	V29929-V29933	1001	1665	55	429	10/01/2005
GAP04A1360P1007	359	V29931	NONE	NONE	NONE	NONE	10/01/2005
GAP04A1152P1008	179.1	V29934-V29937	1564	871	59	742	10/01/2005
GAP04A1344P1009	359	V29938-V29942	971	1664	86	969	10/01/2005
GAP04A1136P1010	179.1	V29943-V29946	1564	873	87	778	11/01/2005
GAP04A1328P1011	259	V29947-V29950	971	1663	30	698	11/01/2005
GAP04A1120P1012	179.1	V29951-V29954	1564	923	50	741	11/01/2005
GAP04A1312P1013	359	V29955	0	0	1	2	11/01/2005
GAP04A1312P1013	359	V29956-V29959	971	1667	72	765	11/01/2005
GAP04A1104P1014	179.1	V29960-V29962	1564	864	41	699	11/01/2005
GAP04A1296P1015	359	V29963-V29966	971	1669	130	810	11/01/2005
GAP04A1088P1016	179.1	V29967-V29970	1564	870	23	717	12/01/2005

GAP04A1280P1017	359	V29971	0	0	0	0	12/01/2005
GAP04A1280P1017	359	V29972-V29975	971	1664	50	740	12/01/2005
GAP04A1072P1018	179.1	V29976-V29979	1564	872	29	712	12/01/2005
GAP04A1264P1019	359	V29980-V29983	971	1666	45	739	12/01/2005
GAP04A1056P1020	179.1	V29984-V29987	1564	871	61	754	12/01/2005
GAP04A1248P1021	359	V29988-V29991	971	1665	79	762	12/01/2005
GAP04A1040P1022	179.1	V29992-V29995	1564	871	61	754	13/01/2005
GAP04A1232P1023	359	V29996-V29999	1001	1663	54	716	13/01/2005
GAP04A1024P1024	179.1	V30000-V30003	1564	869	27	722	13/01/2005
GAP04A1216P1025	359	V30004-V30007	971	1669	79	775	13/01/2005
GAP04A1008P1026	179.1	V30008-V30011	1534	867	75	740	13/01/2005
GAP04A1216J1027	359	V30012-V30015	971	1669	69	765	13/01/2005
GAP04A1008J1028	179.1	V30016-V30020	1564	863	56	776	14/01/2005
GAP04A1344J1029	359	V30021-V30024	971	1672	25	727	14/01/2005
GAP04A1104J1030	179.1	V30025-V30028	1564	863	27	733	14/01/2005
GAP04A1360J1031	359	V30029	0	0	1001	1006	14/01/2005
GAP04A1360J1031	359	V30030-V30033	971	1663	49	741	14/01/2005
GAP04A1136J1032	379.1	V30034-V30037	1564	868	64	758	14/01/2005
GAP04A1248J1033	359	V30038-V30041	971	1668	55	749	14/01/2005
GAP04A1184J1034	179.1	V30042-V30045	1564	871	65	758	14/01/2005
GAP04A1328A1035	359	V30046	1261	1354	32	131	15/01/2005
GAP04A1072J1036	179.1	V30047-V30048	1298	872	13	439	15/01/2005
GAP04A1216J2037	359	V30049-V30052	971	1666	29	724	15/01/2005
GAP04A1136J2038	179.1	V30053-V30056	1510	868	63	704	15/01/2005
GAP04A1296A1039	359	V30057	1244	1315	68	137	15/01/2005

6.5 Data Processing Flow

<u>Moby 3D, VIC/P47: Final Data Processing Flow</u>

```
                                   Conversion
                                       |
                        Navigation & Seismic Data Merge
                          Deterministic Designature
                                       |
                              Resample to 4 ms
                                 Trace Edits
                              Amplitude Recovery
                                Low Cut Filter
                                       |
  First Pass--------←-----------Swell Noise Attenuation (SWATT)
Velocity Analysis (1x1km grid)         |
       |                     Tau-p Linear Noise Attenuation
       |                               F-K Filter
       |                    Tau-p Deconvolution Before Stack
       |-------------→-------------------------K-Filter
       |                                   |
       |                        Tidal Static Correction
       |                            Trace Reduction
       |                              Trace Edits
       |                                   |
       |                       3D Grid Definition (PreStack)
       |                           Common Offset Sort
       |---------------→-----3D Bin Regularisation by Interpolation
                                           |
  Second Pass--------←----------Targeted PSTM Velocity Lines
 Velocity Analysis  (500x500 m grid)       |
        |                                  |
        |----------------→-------3D PreStack Time Migration (PSTM)
                                           |
 Third (Final) Pass-----←---------------3D CMP Sort
 Velocity Analysis (500x500 m grid)        |
       |-----------------→--------Radon Multiple Attenuation
       |                                   |
       |----------------→---------Normal Moveout Correction
                                 |         |
                                 |  Gun/Cable Static-→Archive: Raw PSTM/RADON NMO-CMP Gathers
                                 |    Correction              (1set  x 3590B cartridges)
                                 |----→----Outer Mute / Stack
                                 |         Crossline Interpolation
                                 |         3D F-K Footprint Removal
                                 |         3D Grid Definition (PostStack)
                                 |         Gun/Cable Static Correction
                                 |          |        |
                                 |          | Exponential Gain
                                 |          | Polygon Select Full-Fold Area→Archive: Raw PSTM Stk  Vol
                                 |          |                                        (1 x DVD)
                                 |  Deconvolution After Stack (DAS)
                                 |  Time Variant Spectral Shaping (TVSS)
                                 |  Time Variant Filter (TVF)
                                 |  Scaling (RMS 1000 ms)
                                 |  Polygon Select Of Full-Fold Area----→Archive: Final PSTM Stk Vol
                                 |                                           (1 x DVD)
                Near / Mid / Far Angle Stack Volumes (0-14, 14-28, 28-42 deg)
                Crossline Interpolation
                3D Grid Definition (PostStack)
                Gun/Cable Static Correction
                Time Variant Filter (TVF)
                Exponential Gain
                Polygon Select Of Full-Fold Area------------→Archive: Filtered PSTM Angle Stack Volumes
                                                                  (1 x DVD per volume)
```

6.6 Coefficients of Zero Phasing Filter Operator

Time coefficients for the zero phasing filter derived from source signature, are as follows:

	Coefficients		Coefficients		Coefficients		Coefficients		Coefficients		Coefficients
1	0.000694357	91	-0.0025247	181	0.0120337	271	-0.0805515	361	0.00599496	451	-0.0028381
2	-0.00219574	92	0.00638742	182	0.0135619	272	0.135954	362	0.00350092	452	-0.005011
3	0.00583011	93	0.00663555	183	0.0021281	273	0.124708	363	0.00169097	453	-0.0075675
4	0.00594792	94	0.00278493	184	-0.00342117	274	-0.140092	364	-0.00501822	454	-0.0032162
5	0.00315448	95	-0.00483749	185	0.00536758	275	-0.0163955	365	0.000575189	455	-0.0014539
6	-0.00124261	96	-0.00060708	186	0.0152194	276	-0.0447667	366	0.00101432	456	-0.0017245
7	0.00268215	97	0.00564486	187	0.0106669	277	0.108249	367	0.00108184	457	-0.0056105
8	0.0050555	98	0.00491002	188	-0.00145423	278	0.0448023	368	-0.00429778	458	-0.0049938
9	0.00648851	99	-0.00157659	189	-0.00267195	279	-0.0695524	369	-0.00608676	459	-0.0012491
10	0.00254824	100	-0.00660912	190	0.00918101	280	-0.0537138	370	-0.00120193	460	-0.0001039
11	0.000601862	101	0.00132103	191	0.0145368	281	-0.0145593	371	-0.0020018	461	-0.0017372
12	0.0040559	102	0.00436475	192	0.00553361	282	0.0696961	372	-3.91E-05	462	-0.0055381
13	0.00771515	103	0.00334264	193	-0.00610902	283	0.00637913	373	-0.00715149	463	-0.0022709
14	0.0134819	104	-0.00685131	194	-0.00118486	284	-0.0398765	374	-0.00221164	464	-0.0001949
15	0.005978	105	-0.00494218	195	0.0103162	285	-0.0588806	375	-0.00401123	465	0.00148076
16	0.00697063	106	0.000856206	196	0.0109093	286	0.00234215	376	-0.00123908	466	-0.0030295
17	0.0101585	107	0.00470361	197	-0.00293826	287	0.0280074	377	-0.00667797	467	-0.0035573
18	0.0155376	108	-0.00166359	198	-0.0108578	288	-0.0062151	378	-0.00883753	468	-0.0011181
19	0.0107514	109	-0.00899781	199	-0.00164755	289	-0.0341981	379	-0.0078261	469	0.00153153
20	0.00751973	110	-0.00407457	200	0.00726987	290	-0.0405732	380	-0.010051	470	0.000798
21	0.00794266	111	0.00122441	201	0.00105212	291	0.00282221	381	-0.0026655	471	-0.0037895
22	0.0133845	112	0.00378074	202	-0.017922	292	0.00295967	382	-0.0064431	472	-0.0021479
23	0.0154758	113	-0.00738931	203	-0.0226789	293	-0.0141001	383	-0.0043627	473	-0.0005587
24	0.00887452	114	-0.00829545	204	-0.0153165	294	-0.0291979	384	-0.0094553	474	0.00296509
25	0.008553	115	-0.0047337	205	-0.00978953	295	-0.0206483	385	0.00042512	475	-0.0014945
26	0.00871465	116	0.00379243	206	-0.0217522	296	-0.00296228	386	-0.0059135	476	-0.0027897
27	0.017265	117	-0.00147124	207	-0.0321288	297	-0.0113601	387	-0.0049699	477	-0.0022439
28	0.0124612	118	-0.00939235	208	-0.0238129	298	-0.0221421	388	-0.0054774	478	0.0015344
29	0.0102251	119	-0.00946406	209	-0.00658464	299	-0.0206888	389	-0.0086927	479	0.0020176
30	0.00682034	120	-0.00246131	210	-0.00245726	300	-0.00807495	390	0.00239208	480	-0.0023975
31	0.0133038	121	0.00337808	211	-0.019821	301	-0.00642415	391	-0.0112905	481	-0.0023306
32	0.0163962	122	-0.00650429	212	-0.0291872	302	-0.0205063	392	-0.0019993	482	-0.0017658
33	0.0121698	123	-0.010348	213	-0.022133	303	-0.0242912	393	-0.0107358	483	0.0034033
34	0.00904568	124	-0.0106496	214	-0.00597478	304	-0.0112392	394	-0.002674	484	-0.0003525
35	0.00799903	125	0.00209317	215	-0.00945123	305	0.00101593	395	-0.0030839	485	-0.001618
36	0.0168367	126	-0.00166428	216	-0.0201233	306	-0.00670005	396	-0.0104476	486	-0.0034196
37	0.0150893	127	-0.00732478	217	-0.0181413	307	-0.022561	397	-0.0038582	487	0.0009119
38	0.0130795	128	-0.0146444	218	0.00153841	308	-0.0181163	398	-0.0119966	488	0.0023456
39	0.0069653	129	-0.00558033	219	0.0136295	309	0.00196811	399	0.00079708	489	-0.0009408
40	0.0125193	130	0.00131993	220	0.000326315	310	0.016066	400	-0.0097549	490	-0.0022707
41	0.0167057	131	-0.00310916	221	-0.0128671	311	0.00591235	401	-0.0068389	491	-0.0031788
42	0.0160008	132	-0.0107175	222	-0.0085459	312	-0.00557939	402	-0.0096303	492	0.002849
43	0.0106222	133	-0.0150567	223	0.0131171	313	-0.00048187	403	-0.0074652	493	1.87E-05
44	0.00802158	134	0.000400624	224	0.0137639	314	0.015792	404	-0.002262	494	-0.0004859
45	0.0147479	135	-0.00223077	225	-0.00114528	315	0.017253	405	-0.0109117	495	-0.0047476
46	0.016767	136	-7.48E-05	226	-0.0113831	316	0.000905881	406	-0.0069063	496	-0.000472

47	0.0153237	137	-0.0202844	227	0.00534728	317	-0.008084	407	-0.0117467	497	0.0012166
48	0.0079872	138	-0.0029877	228	0.0232487	318	0.00423132	408	-0.0034211	498	-0.0002184
49	0.0103858	139	-0.00658322	229	0.0158763	319	0.0237237	409	-0.0066643	499	-0.0025604
50	0.015062	140	0.00942223	230	-0.00259125	320	0.0229848	410	-0.0087653	500	-0.0050145
51	0.0173142	141	-0.0146607	231	-0.00346275	321	0.00784815	411	-0.0096469	501	0.0009322
52	0.0120224	142	-0.0088915	232	0.02391	322	-0.00246793	412	-0.008634	502	-0.0008943
53	0.00744428	143	-0.00805358	233	0.0338253	323	0.00545128	413	-0.0033076	503	3.17E-05
54	0.0114406	144	0.00457748	234	0.0184567	324	0.0112368	414	-0.0073415	504	-0.0063425
55	0.0157917	145	0.00626033	235	-0.00454372	325	0.00450787	415	-0.0081472	505	-0.0024262
56	0.01604	146	-0.0164762	236	0.0120601	326	-0.00906029	416	-0.009663	506	-0.0011013
57	0.00878575	147	-0.00127293	237	0.0427606	327	-0.00891488	417	-0.0050242	507	7.60E-05
58	0.00768679	148	-0.0105089	238	0.047587	328	0.00288935	418	-0.003815	508	-0.0026941
59	0.0119991	149	0.0193832	239	0.0164098	329	0.00807916	419	-0.0064303	509	-0.006332
60	0.0162356	150	-0.0180653	240	-0.0024508	330	0.00168947	420	-0.008609	510	-0.0012007
61	0.0129251	151	-0.00848448	241	0.0275364	331	-0.00737054	421	-0.007245	511	-0.0017171
62	0.00646266	152	-0.0145809	242	0.0617225	332	-0.00146944	422	-0.0035067	512	0.0028477
63	0.00786495	153	0.00190296	243	0.0576793	333	0.00615101	423	-0.0034243	513	-0.0031121
64	0.012687	154	0.0067227	244	0.0082723	334	0.00848493	424	-0.006772	514	-0.0007522
65	0.0155536	155	-0.0151631	245	0.00245212	335	-0.00131607	425	-0.0075437	515	0.0009957
66	0.00910733	156	-0.00657866	246	0.0371088	336	-0.00341004	426	-0.0049345	516	0.0057645
67	0.00521648	157	-0.0124614	247	0.0836043	337	0.00245499	427	-0.0016932	517	0.0018641
68	0.00792438	158	0.0135763	248	0.0582269	338	0.00893042	428	-0.0033036	518	-0.0061491
69	0.013524	159	-0.00601718	249	0.00278142	339	0.00567425	429	-0.0066675	519	-0.0002779
70	0.0131401	160	-0.00465796	250	0.00367712	340	-0.00271074	430	-0.0061538	520	0.0009428
71	0.00567161	161	-0.0164009	251	0.0459681	341	-0.00049566	431	-0.0033763	521	0.0036914
72	0.00449486	162	0.00364614	252	0.0957591	342	0.00518799	432	-0.0010427	522	-0.0037627
73	0.00814612	163	0.0037241	253	0.051142	343	0.0102432	433	-0.0048133	523	-0.0035172
74	0.0139592	164	-0.00097803	254	-0.00081879	344	0.00198525	434	-0.0062747	524	-0.001035
75	0.00905909	165	-0.0118227	255	-0.0023428	345	-0.00119597	435	-0.0055428	525	0.002485
76	0.00359945	166	-0.00744073	256	0.0483554	346	0.00102827	436	-0.0012903	526	0.0017473
77	0.00331916	167	0.0053843	257	0.0638729	347	0.00930012	437	-0.0019328	527	-0.0018223
78	0.00952763	168	0.00448894	258	0.0169408	348	0.00871649	438	-0.0053859	528	-0.0021403
79	0.0121742	169	-0.0037423	259	-0.0374081	349	0.00162995	439	-0.0067059	529	2.80E-05
80	0.00531345	170	-0.0115821	260	0.0256482	350	0.000202083	440	-0.0047015	530	0.004759
81	0.00163638	171	-0.00033659	261	0.074223	351	0.00421876	441	-0.0012226	531	-0.00089
82	0.0027898	172	0.00737144	262	-0.273273	352	0.0119818	442	-0.004123	532	-0.0017989
83	0.0108275	173	0.00572657	263	-0.568311	353	0.0066085	443	-0.0063876	533	-0.002111
84	0.00821065	174	-0.00626635	264	-0.11064	354	0.00283318	444	-0.0075636	534	0.0032126
85	0.00271465	175	-0.00525141	265	0.118087	355	-0.00013316	445	-0.0030415	535	0.003271
86	-0.00134181	176	0.00592061	266	-0.223467	356	0.00759814	446	-0.002435	536	-0.0008553
87	0.00438281	177	0.0124382	267	0.260794	357	0.00869834	447	-0.0047007	537	-0.0017224
88	0.00940808	178	0.00475229	268	0.239797	358	0.00442406	448	-0.0075459	538	-0.0006276
89	0.00494117	179	-0.00463795	269	-0.203221	359	-0.00078694	449	-0.0060833	539	0.0059126
90	-0.00057294	180	0.00067589	270	0.044445	360	-0.00087937	450	-0.0019985	540	0.0010273

6.7 List of Final Deliverables

Summary of SEGY archived data (6 sec trace length, 4 ms sample rate) to various medias, bin centre XY-coordinates, final velocities & final processing report sent to BSOC office in Melbourne is as follows:

No.	Process & Filename	First Inline	Last Inline	Format	Media Type & No.	Date Sent
1	**Raw PSTM Stack Volume (preliminary)** P0141_02_STACK_RAW_SEGY	**2000**	**2798**	**SEG Y**	**1 x DVD**	**12 April 2005**
2	**Final PSTM Stack Volume (preliminary)** P0141_01_STACK_PRELIM_FINAL_SEGY	**2000**	**2798**	**SEG Y**	**1 x DVD**	**12 April 2005**
3	**Raw PSTM Stack Volume** P0145_02_STACK_RAW_SEGY	**2000**	**2798**	**SEG Y**	**1 x DVD**	**11 May 2005**
4	**Final PSTM Stack Volume** P0145_01_STACK_FINAL_SEGY	**2000**	**2798**	**SEG Y**	**1 x DVD**	**11 May 2005**
5	**4 Sets of Stacking/Migration Velocities** P0148_01_500m_stacking_vels.velf P0149_01_1km_stacking_vels.velf P0802_01_500m_Mig_vels.velf V0201_15_1km_target_Mig_vels.velf	**972**	**1426**	**WG VELF**	**1 x CD**	**9 June 2005** (hand carried by Ian Reid)
	2 Sets of Stacking/Migration Velocities P0148_01_500m_stacking_vels.BSOC_VELF P0802_01_500m_Mig_vels.BSOC_VELF	**2000**	**2798**	**BSOC**	**1 x CD**	**29 June 2005**
6	**Filtered PSTM Angle Stack Volumes** P0147_01_ANGLE_STACK_0-14deg_SEGY P0147_01_ANGLE_STACK_14-28deg_SEGY P0147_01_ANGLE_STACK_28-42deg_SEGY	**2000**	**2798**	**SEG Y**	**1 x DVD per vol**	**9 June 2005** (hand carried by Ian Reid)
7	**Bin Centre XY-Coordinates** P0150_01_UKOOA_Bin_Center_Moby	**2000**	**2798**	**ascii file** (in modified UKOOA P1/90)	**1 x CD**	**12 Aug 2005**
8	**Raw PSTM/RADON NMO-CMP Gathers**	**1000**	**1399**	**SEG Y**	**16 x 3590B**	**7 July 2005**
		1000	1025		Q04008	
		1026	1051		Q04009	
		1052	1077		Q04010	
		1078	1103		Q04011	
		1104	1128		Q04012	
		1129	1154		Q04013	
		1155	1179		Q04014	
		1180	1205		Q04015	

		1206	1230		Q04016	
		1231	1256		Q04017	
		1257	1281		Q04018	
		1282	1307		Q04019	
		1308	1332		Q04020	
		1333	1358		Q04021	
		1359	1384		Q04022	
		1385	1399		Q04023	
9	**Final Processing Report** Final_Processing_Report_Moby.pdf	**N/A**	**N/A**	**Adobe Acrobat**	**1 x CD** and bound hard copy	**04 April 2006**

6.8 *PostStack / PreStack Data Load Sheet*

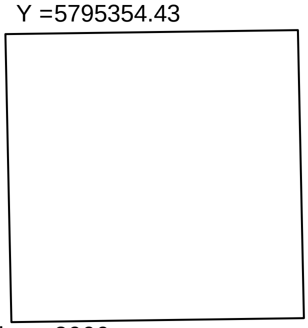
<u>PostStack Data Load Sheet</u>

Project:	AP23	
Area:	Moby 3D, VIC/P47	
Client:	Bass Strait Oil Company	
Data:	3D PreSTM Stack Volume	
Projection System:	UTM South	
Spheroid:	GRS80	
Datum:	GDA94	
Central Meridian:	147 degrees East	
Tape Number:	Raw PSTM Stack Volume	Media: 1 x DVD
	Final PSTM Stack Volume	Media: 1 x DVD
	Filtered PSTM Angle Stack Volumes	Media: 3 x DVDs

Number of Inlines:	799	
Number of Crosslines:	802	
Total number live traces:	640798	
Inline spacing (interval):	12.500	m
Crossline spacing (interval):	12.500	m
Record Length:	6.000	secs
Sample Rate:	4	ms
Azimuth:	359.100	degrees
(from due North clockwise)		

Trace Header Byte Locations		**Bytes**
Trace Number	Integer	1
Inline	Integer	9
Crossline	Integer	13
CMP	Integer	21
Cell Center X-Coord	Integer	73
Cell Center Y-Coord	Integer	77
Cell Center X-Coord	Real	81
Cell Center Y-Coord	Real	85
Inline	Integer	197
Crossline	Integer	201
Water bottom time at midpoint	Integer	205

Inline =2000	Inline=2798
Crossline =1857	Crossline = 1857
X =629891.22	X = 639864.99
Y =5795354.43	Y = 5795511.12



Inline =2000	Inline = 2798
Crossline =1056	Crossline = 1056
X =630048.49	X = 640022.26
Y =5785343.17	Y = 5785499.85

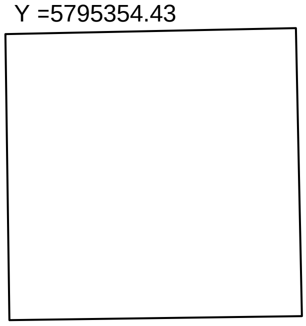
PreStack Data Load Sheet

Project:	AP23	
Area:	Moby 3D, VIC/P47	
Client:	Bass Strait Oil Company	
Data:	3D PreSTM CMP Gathers	
Projection System:	UTM South	
Spheroid:	GRS80	
Datum:	GDA94	
Central Meridian:	147 degrees East	
Tape Number:	Raw PSTM/RADON NMO-CMP Gathers	Media: 16 x 3590B (Q04008-Q04023)

Number of Inlines:	400	
Number of Crosslines:	802	
Total number live traces:	approx. 20,000,000	
Inline spacing (interval):	25.000	m
Crossline spacing (interval):	12.500	m
Record Length:	6.000	secs
Sample Rate:	4	ms
Azimuth: (from due North clockwise)	359.100	degrees

Trace Header Byte Locations		**Bytes**
Inline	Integer	9
Crossline	Integer	13
CMP	Integer	21
Offset distance	Integer	37
Water depth at source	Integer	61
Cell Center X-Coord	Integer	73
Cell Center Y-Coord	Integer	77
Cell Center X-Coord	Real	81
Cell Center Y-Coord	Real	85
Inline	Integer	197
Crossline	Integer	201
Water bottom time at midpoint	Integer	205

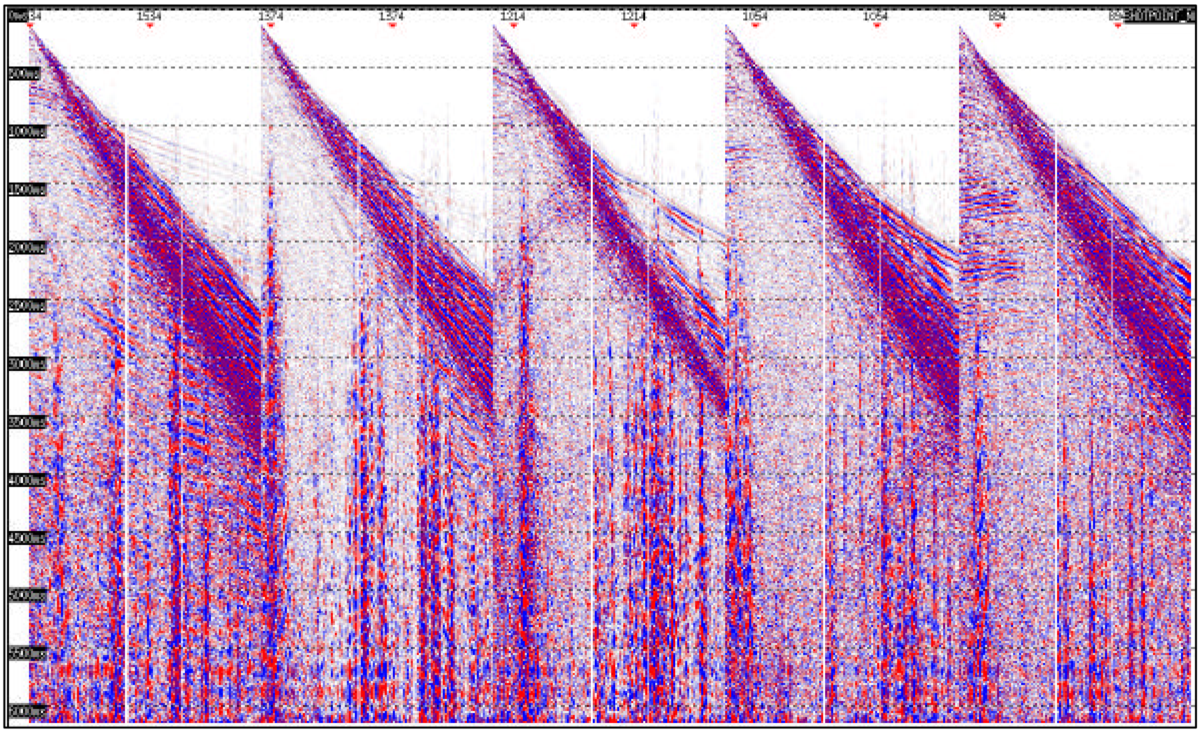
Inline =1000 Crossline =1857 X =629891.22 Y =5795354.43	Inline=1399 Crossline = 1857 X = 639864.99 Y = 5795511.12



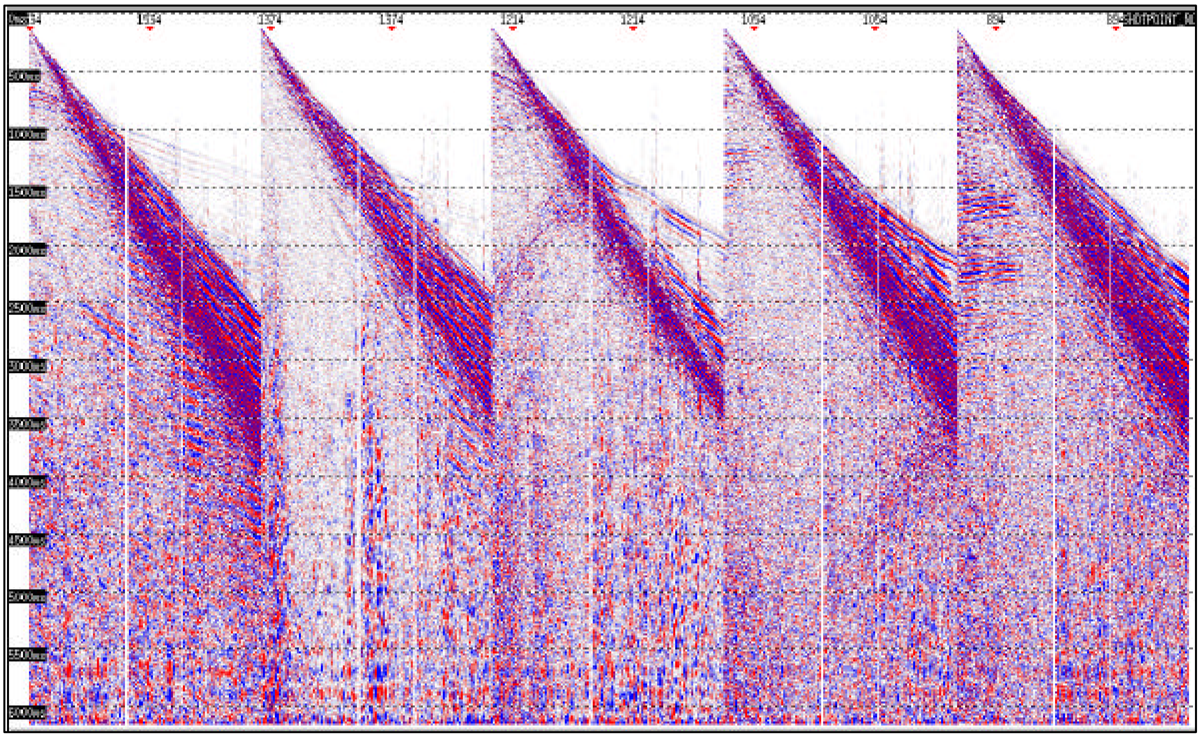
Inline =1000 Crossline =1056 X =630048.49 Y =5785343.17	Inline = 1399 Crossline = 1056 X = 640022.26 Y = 5785499.85

7.0 Enclosures

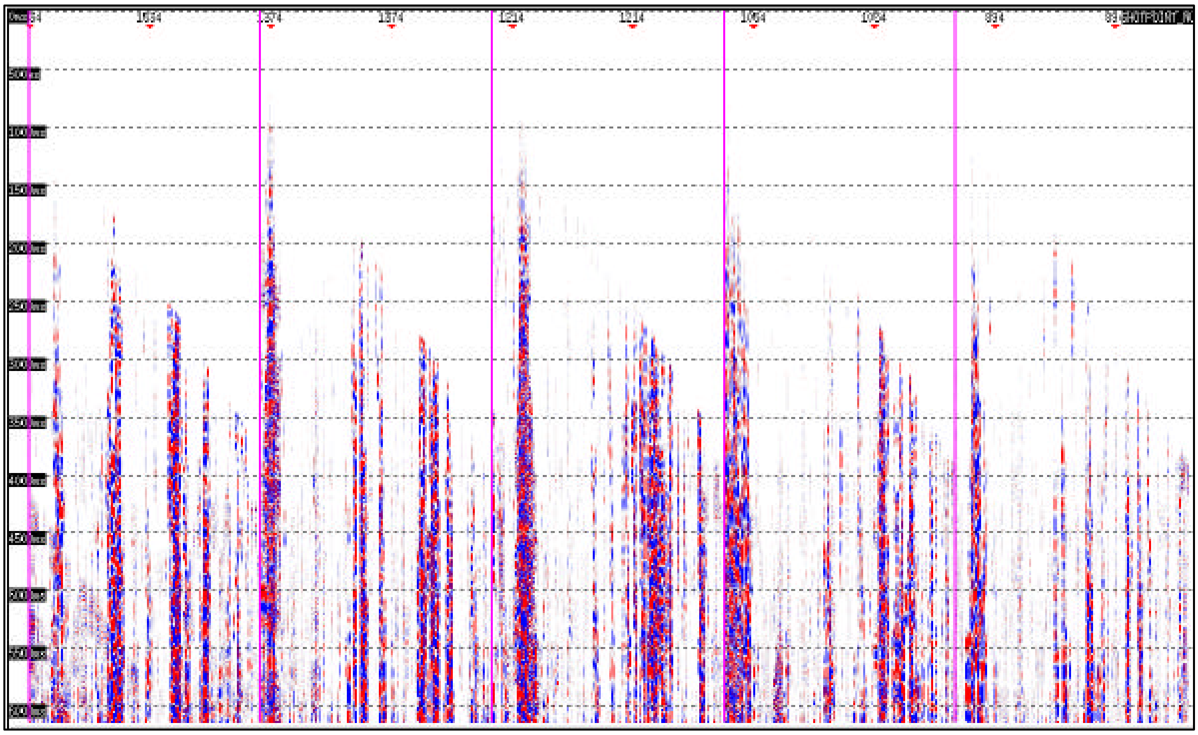
7.1 Shot records before SWATT applied



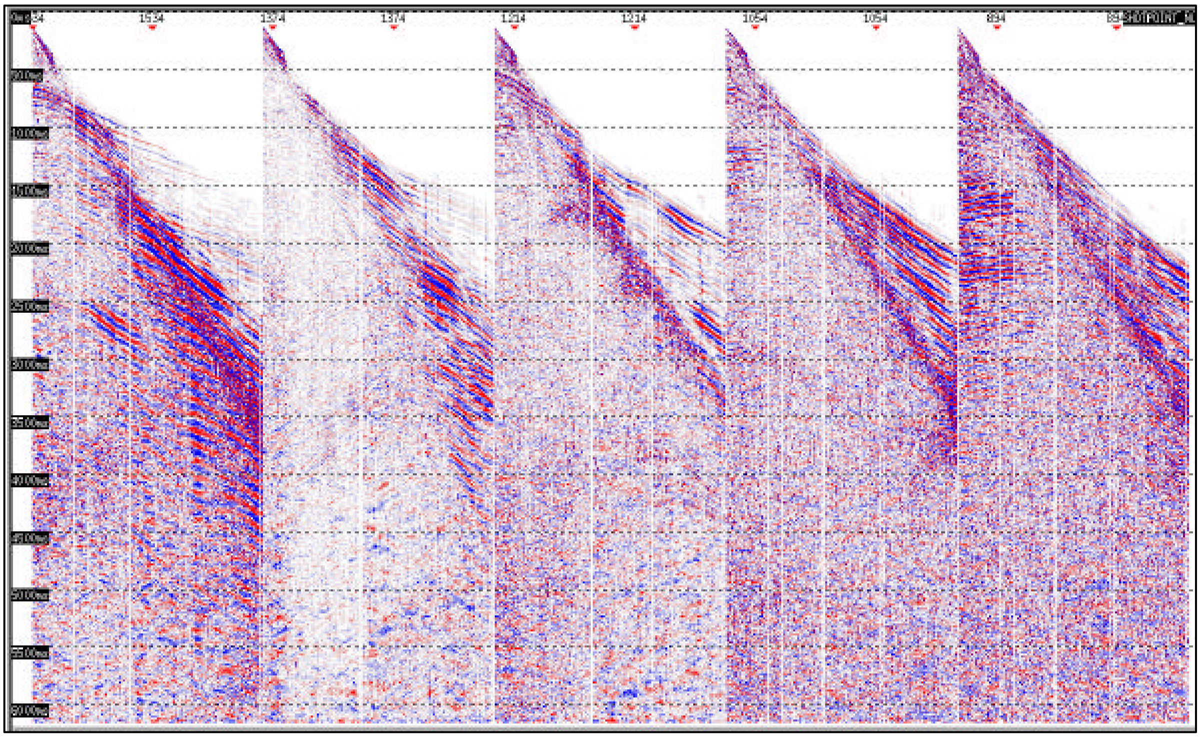
7.2 Shot records after SWATT applied



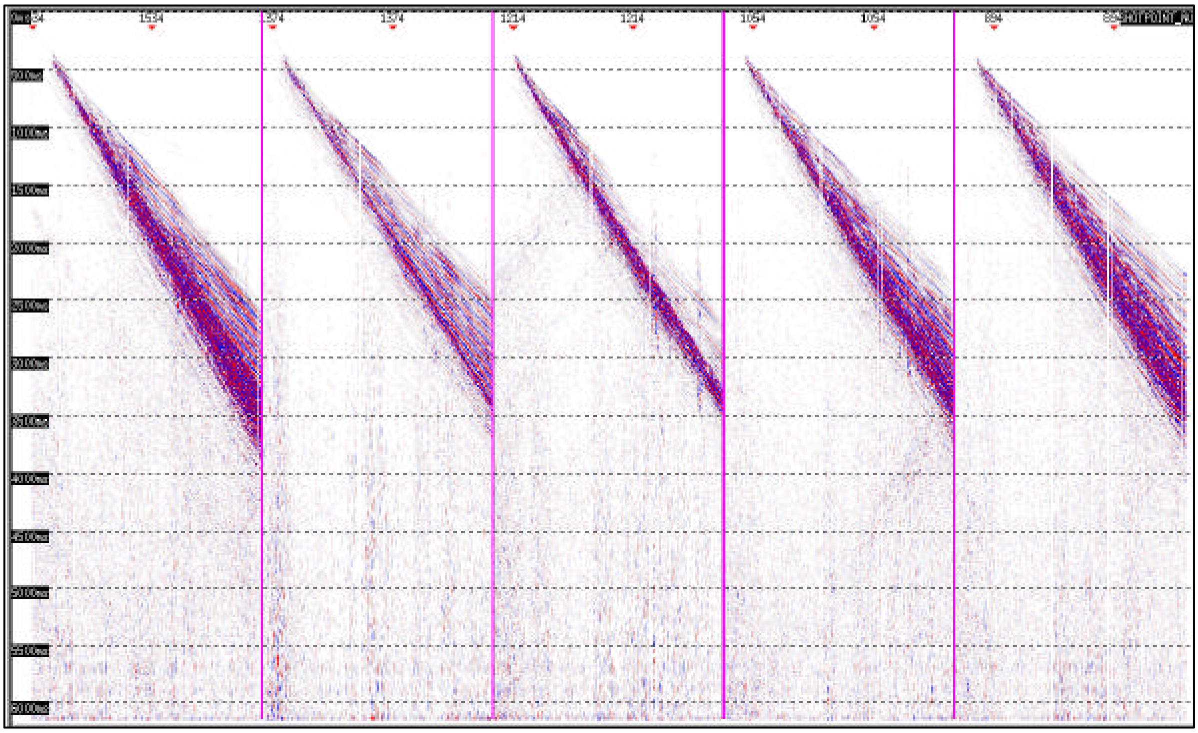
7.3 Shot records SWATT difference plot



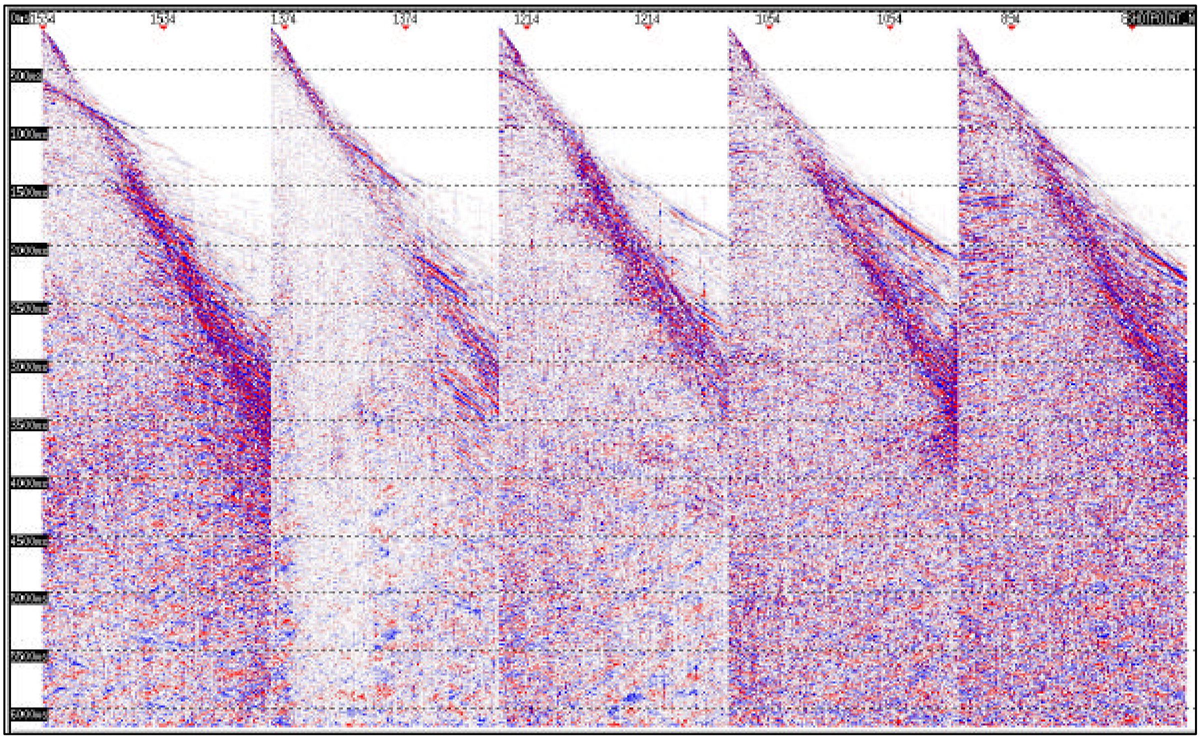
7.4 Shot records with Tau-p LNA / F-K filter applied



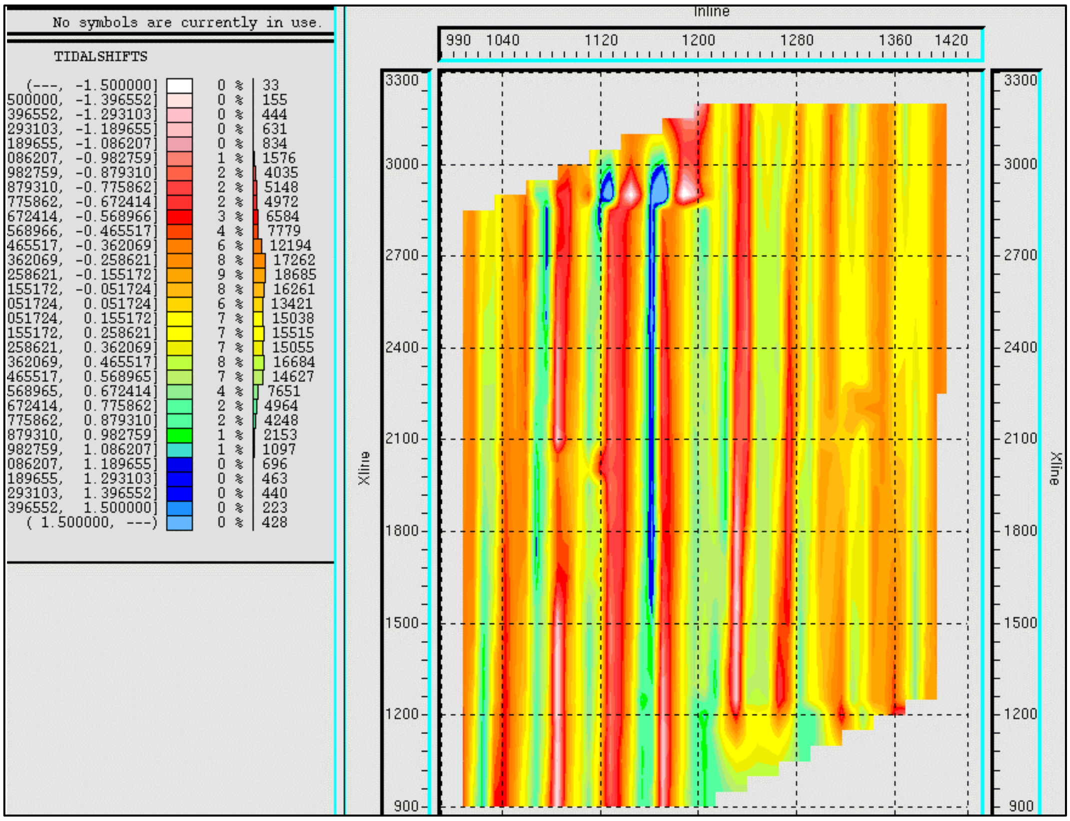
7.5 Shot records Tau-p LNA / F-K filter difference plot



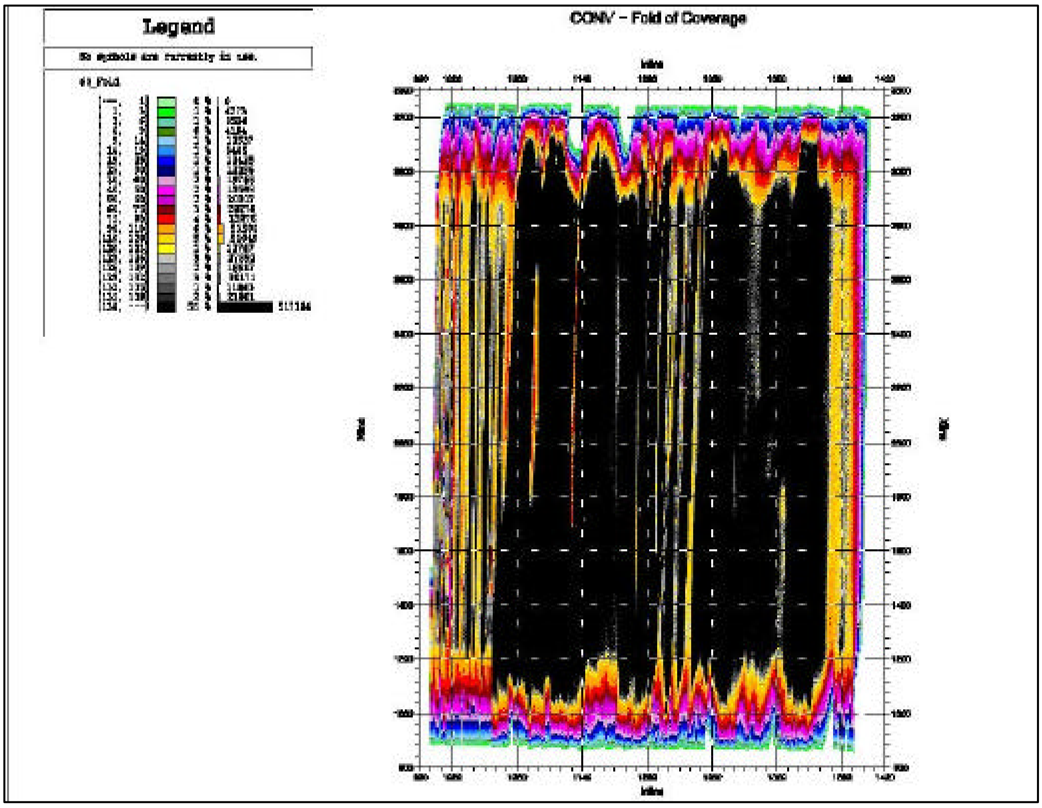
7.6 Shot records with Tau-p DBS applied



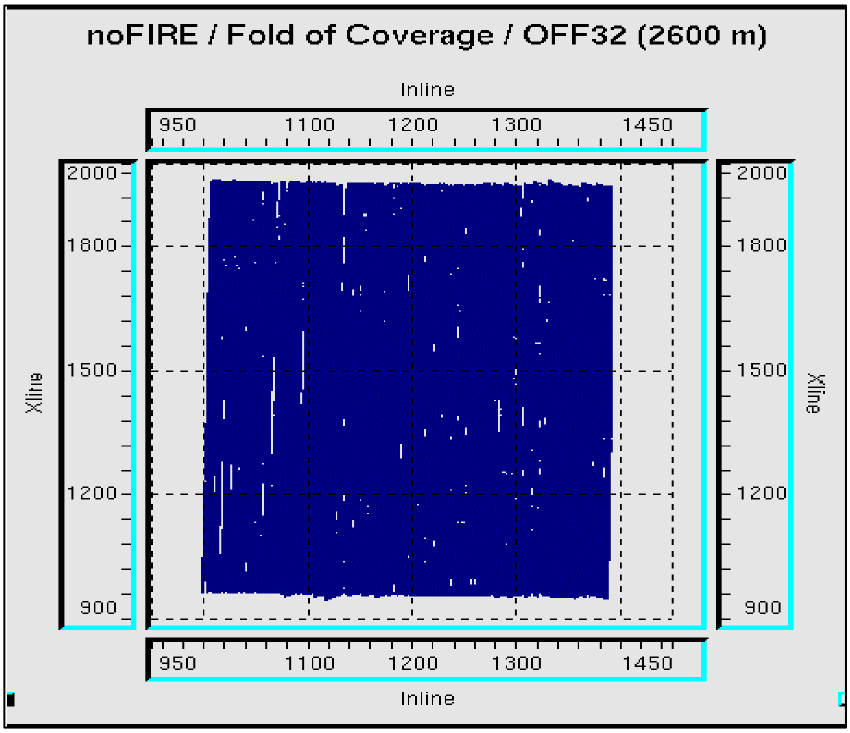
7.7 Tidal static plot



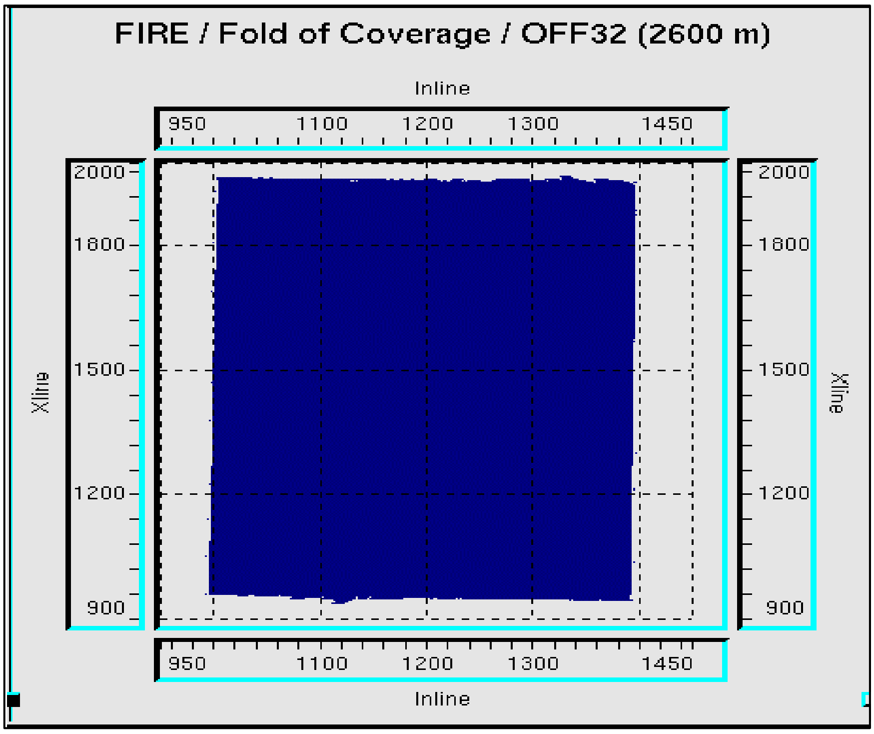
7.8 Fold of coverage plot



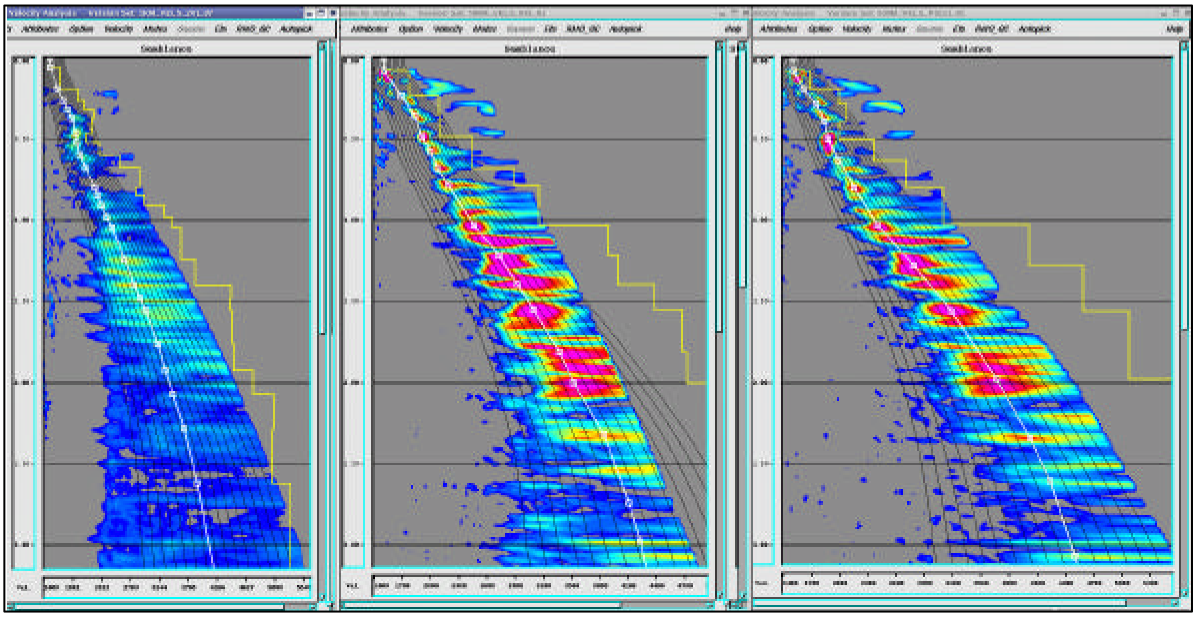
7.9 Fold of coverage plot before 3D bin regularisation by interpolation



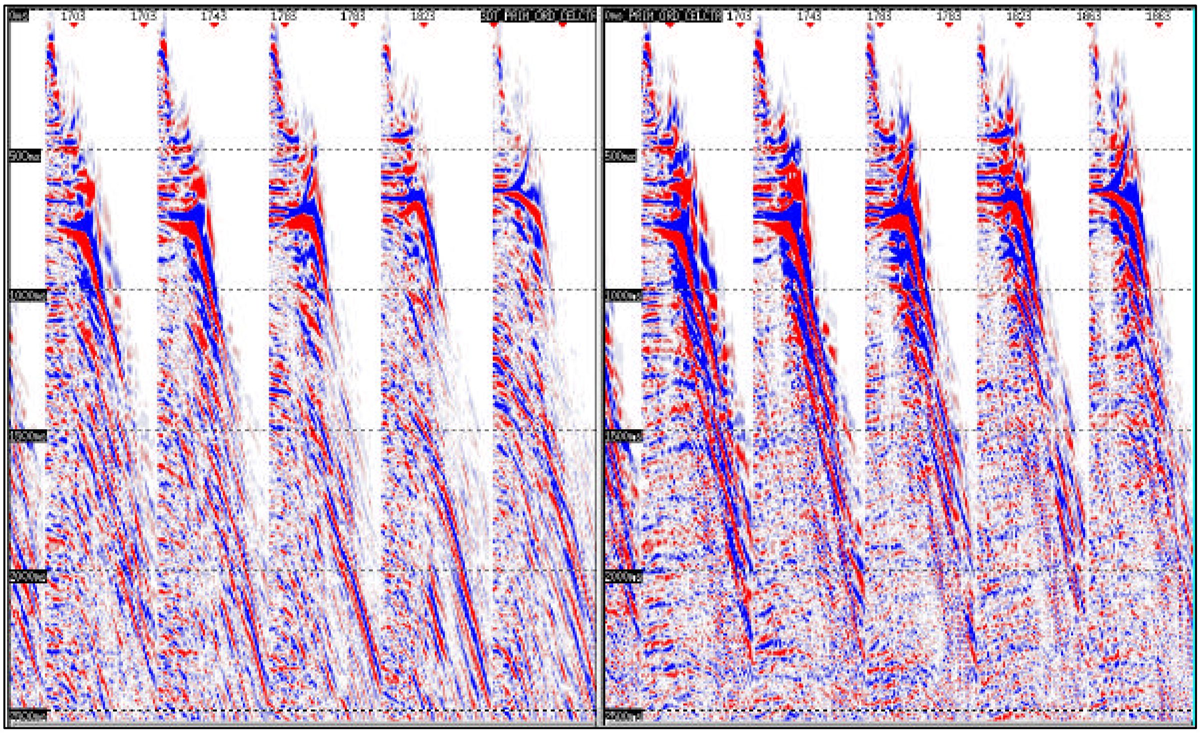
7.10 Fold of coverage plot after 3D bin regularisation by interpolation



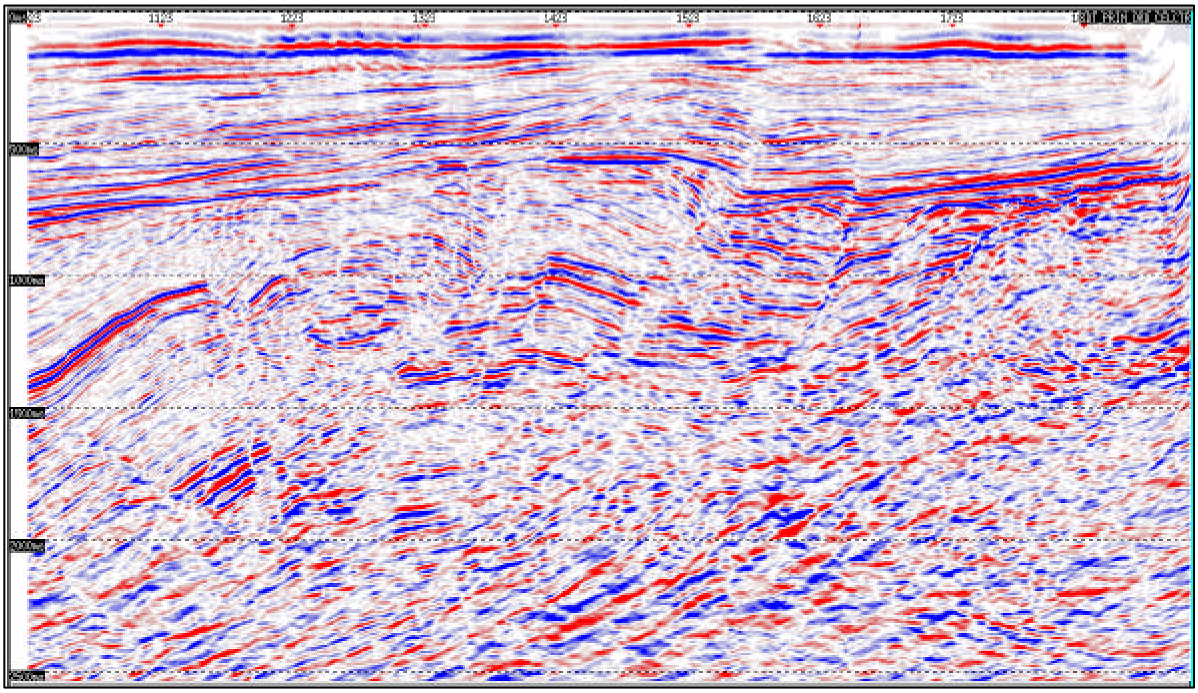
7.11 Sample of first pass, second pass, third pass velocity trend



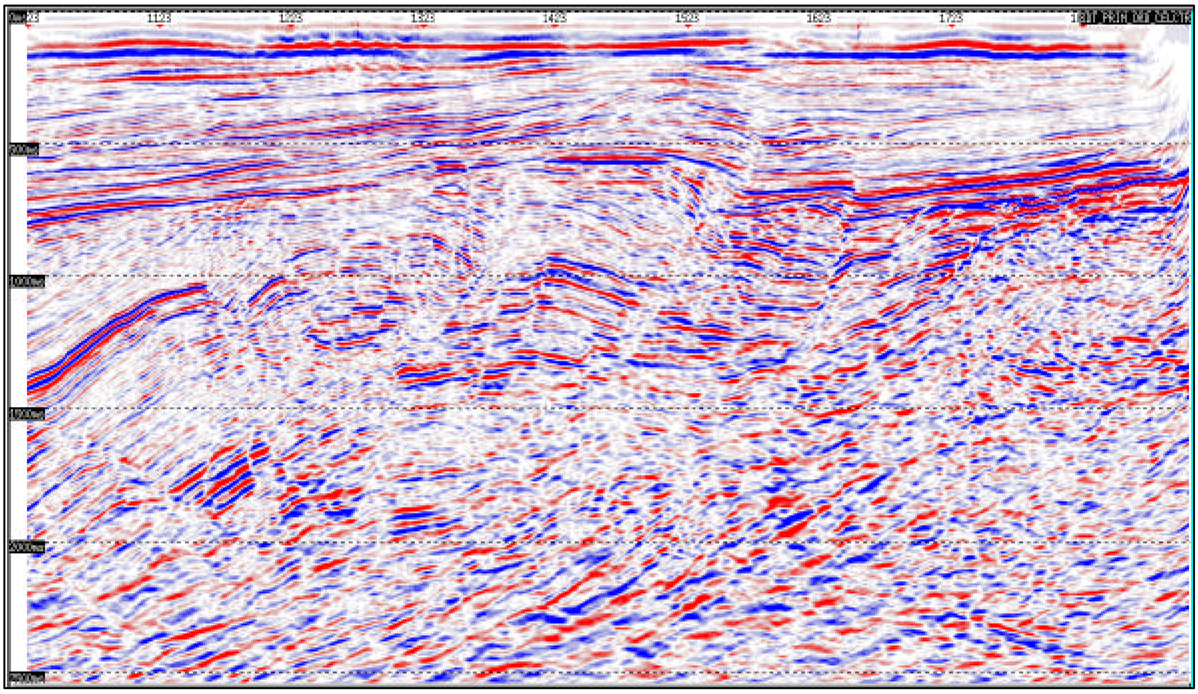
7.12 NMO-CMP gathers before (L) & after (R) Radon multiple attenuation



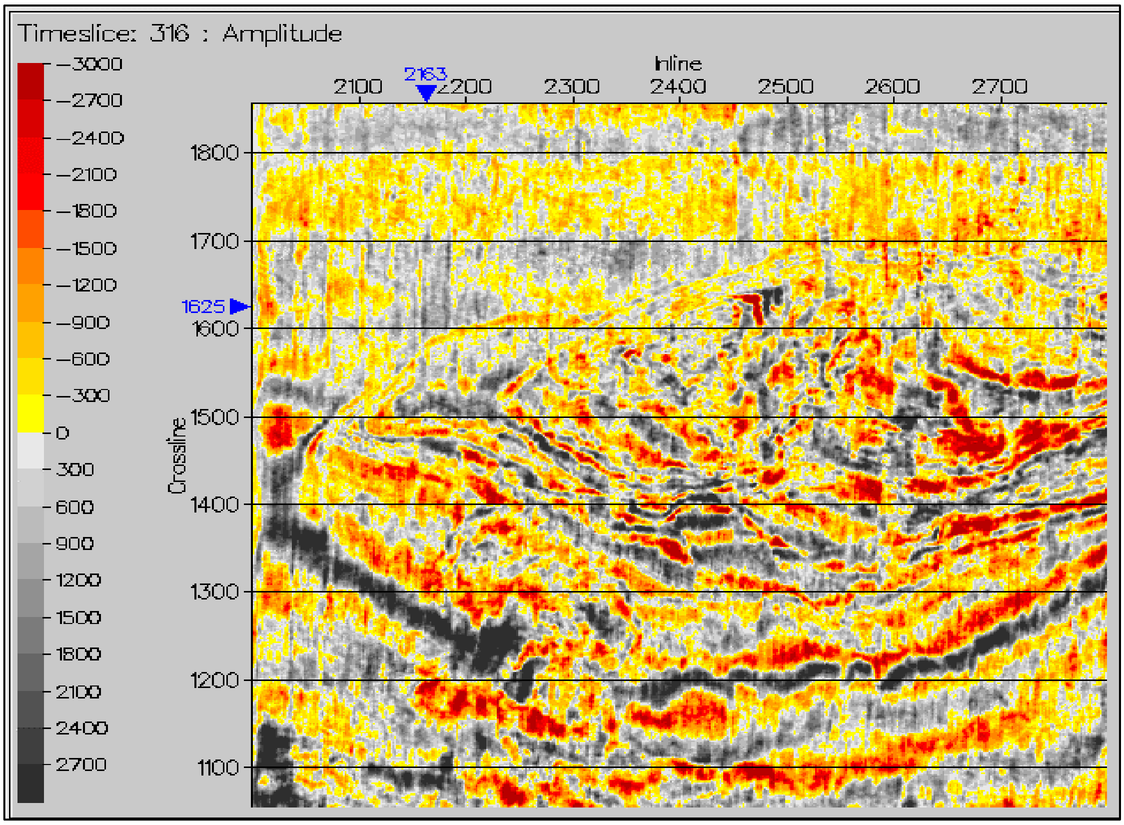
7.13 Stack before Radon multiple attenuation



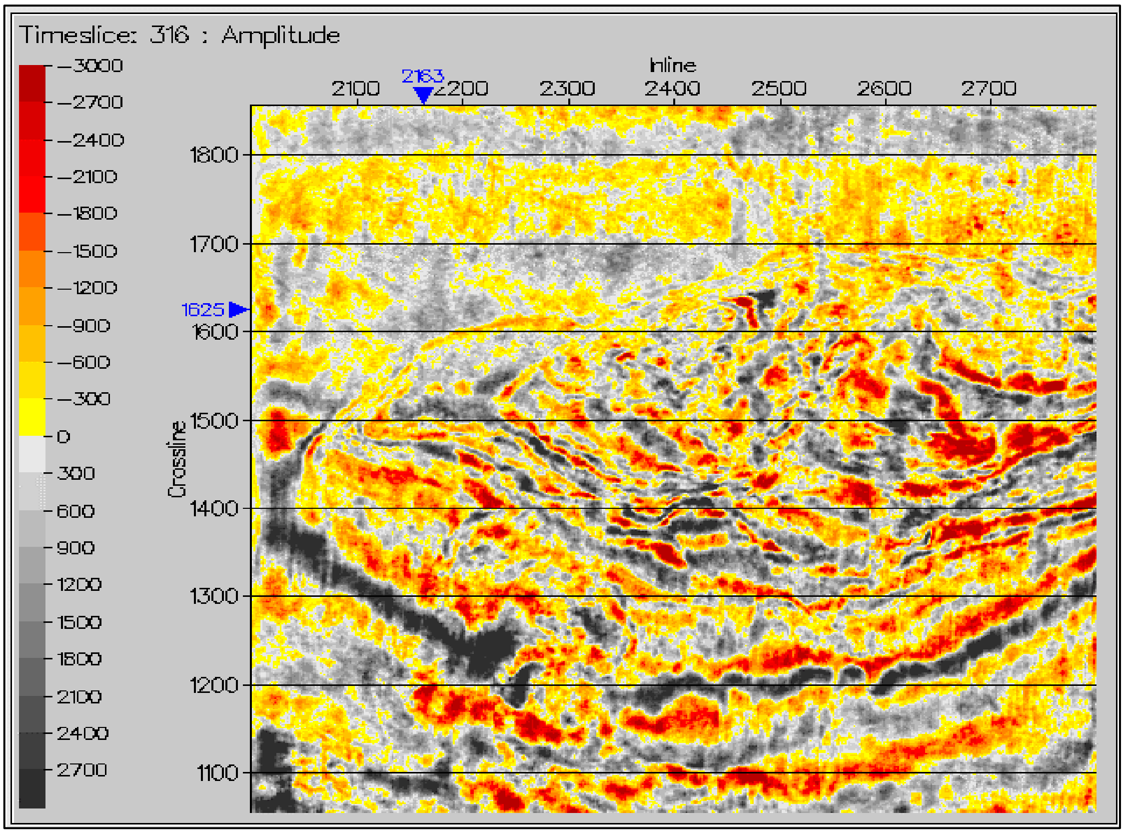
7.14 Stack after Radon multiple attenuation



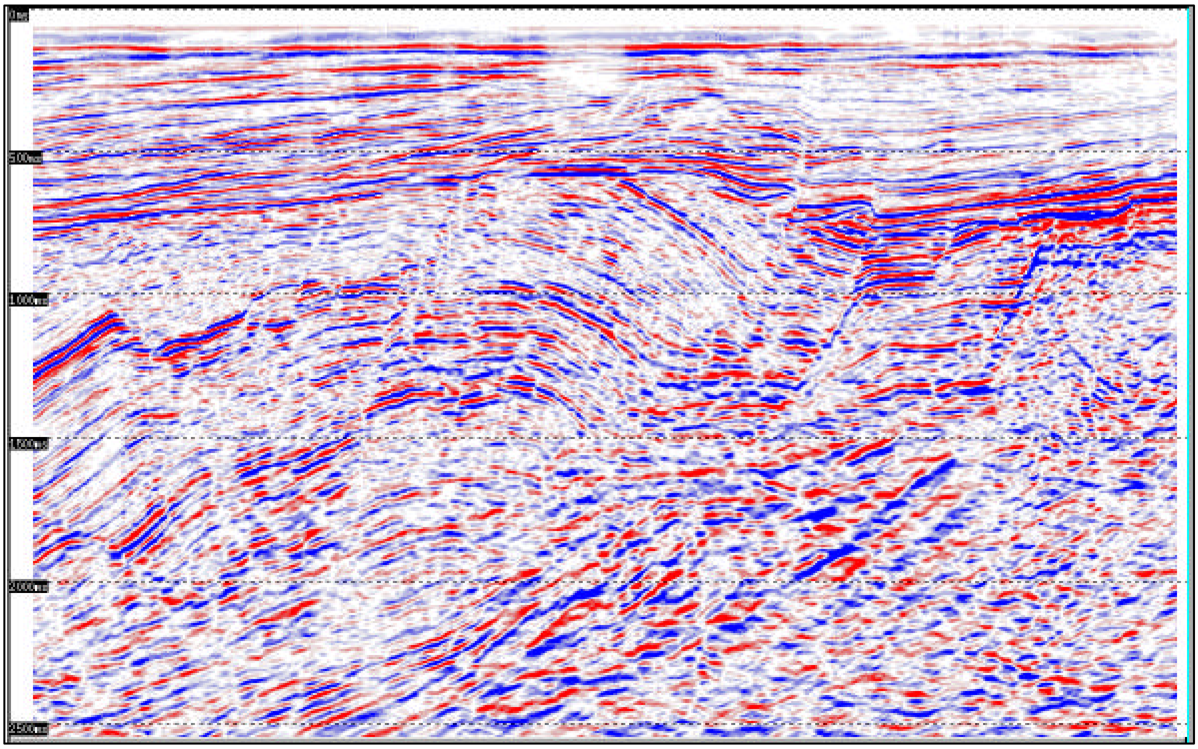
7.15 Stack before 3D F-K footprint removal (time slice 316 ms)



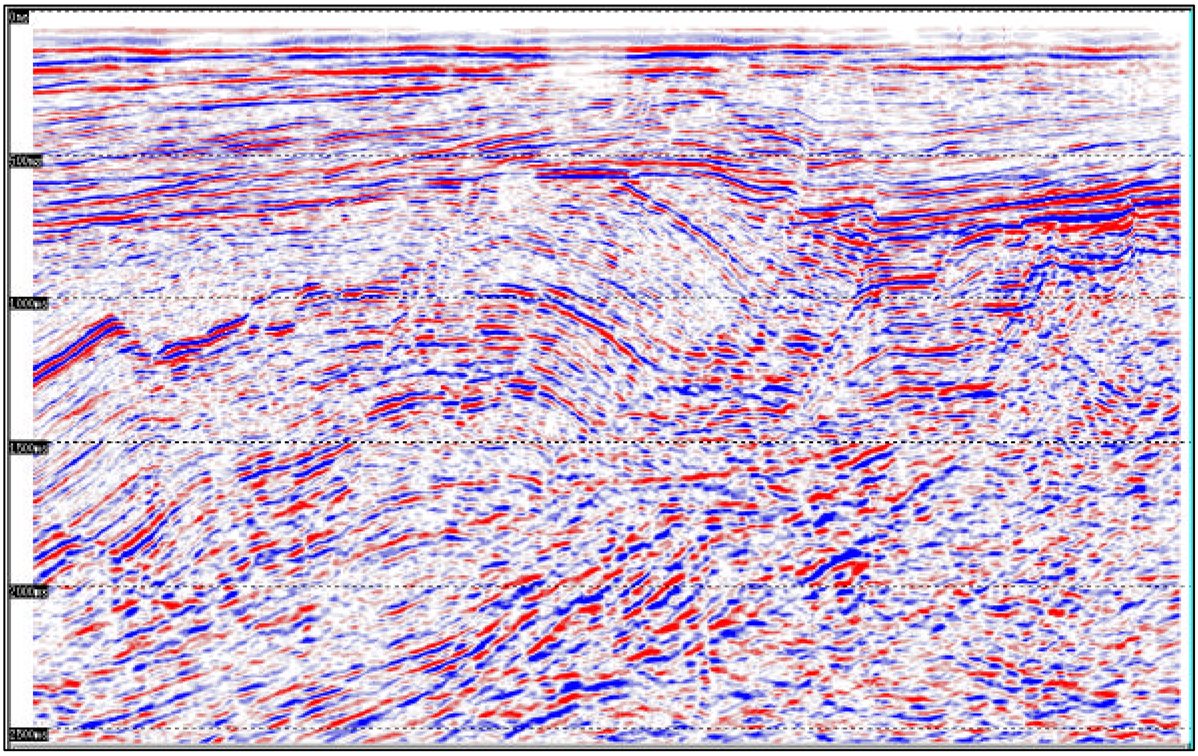
7.16 Stack after 3D F-K footprint removal (time slice 316 ms)



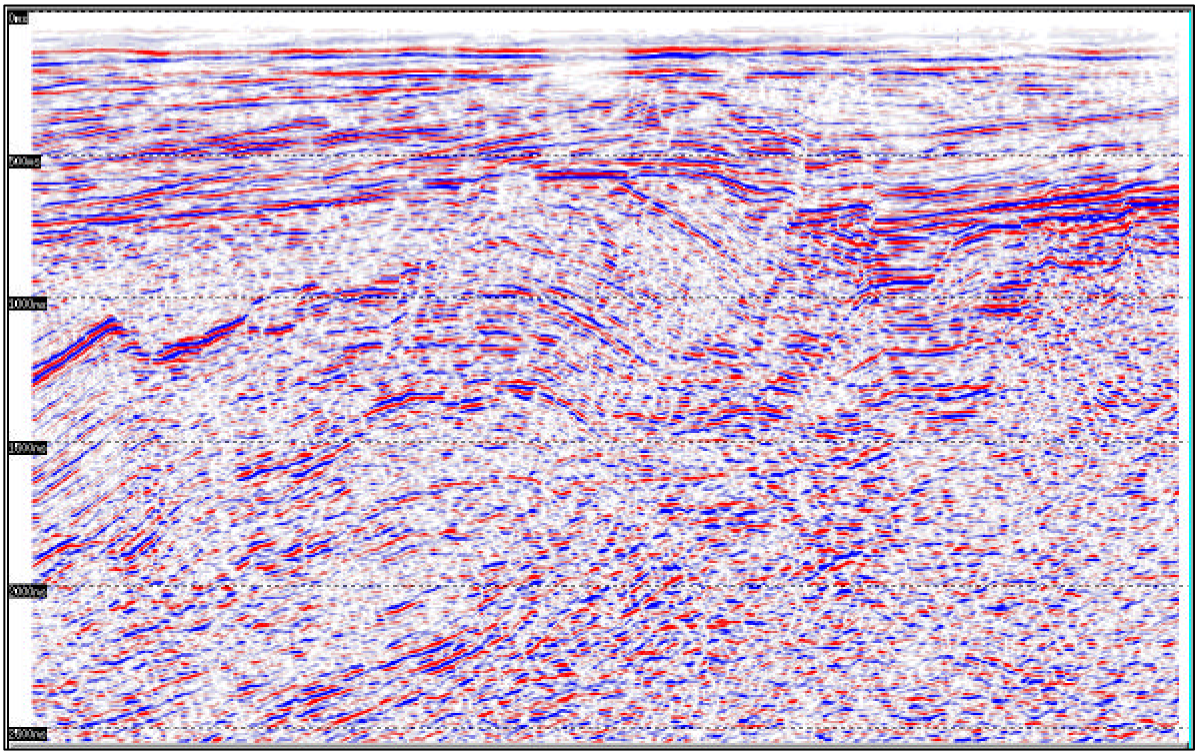
7.17 Stack without deconvolution after stack (DAS) applied



7.18 Stack with deconvolution after stack (DAS) applied

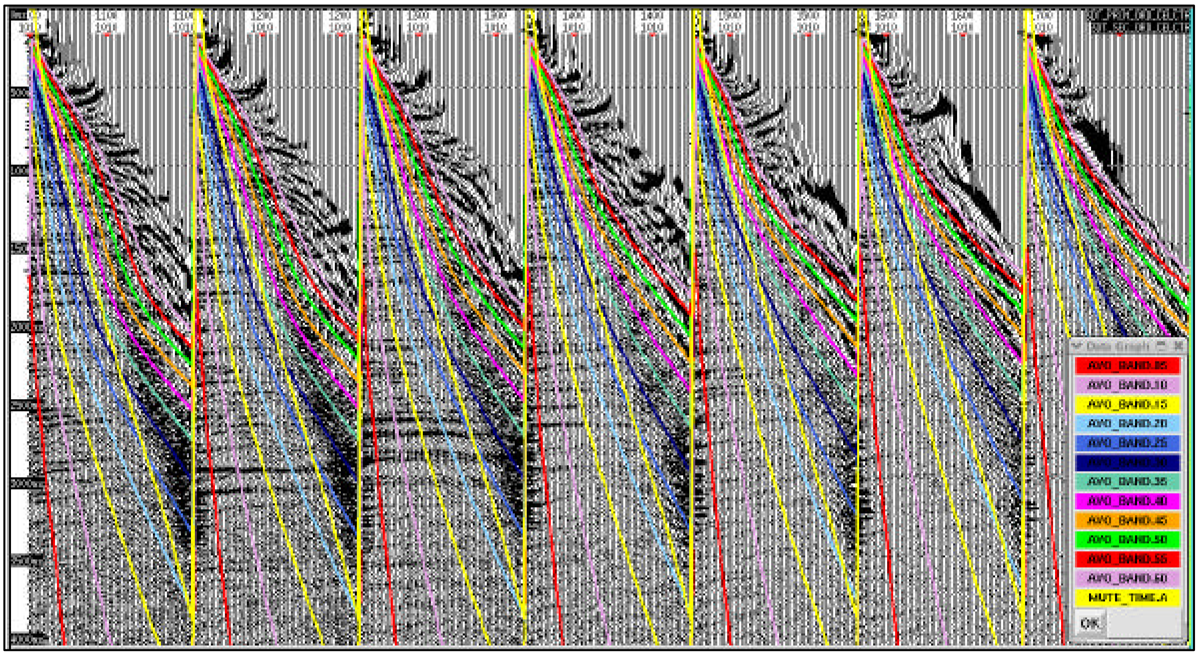


7.19 Stack with time variant spectral shaping (TVSS) applied

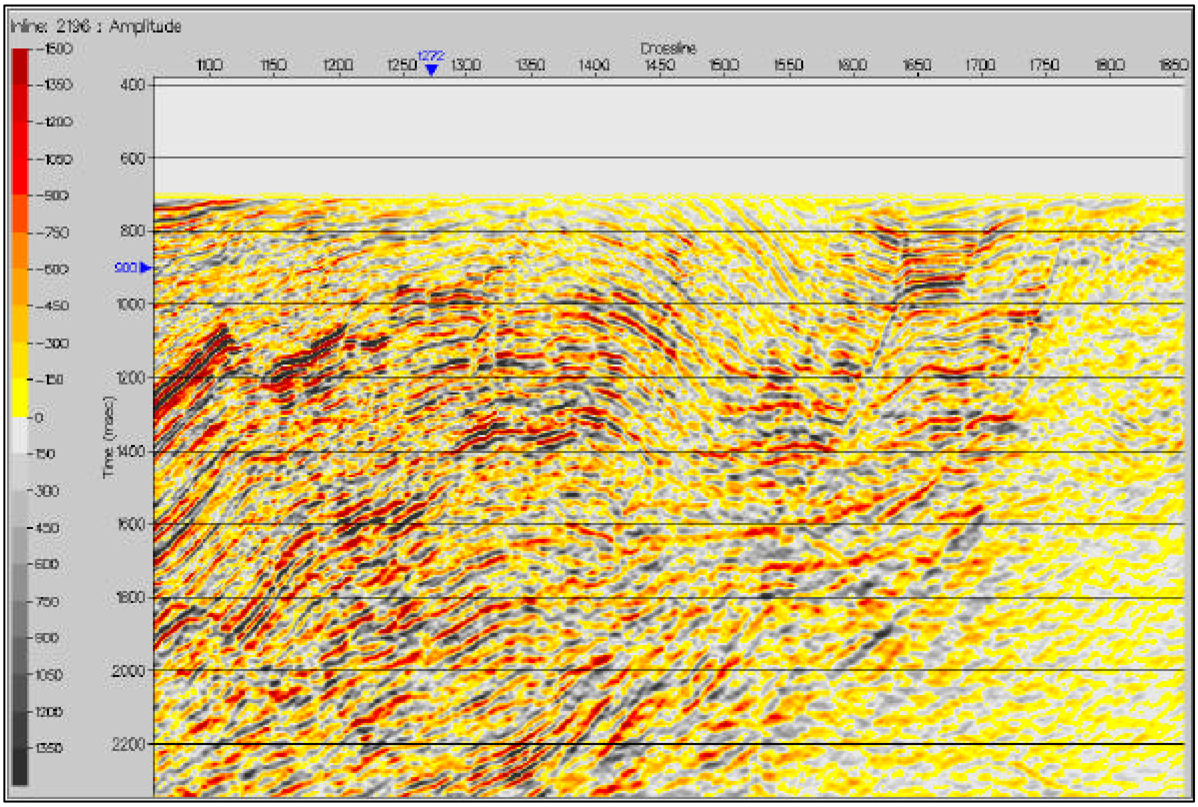


7.20 Final NMO-CMP gathers overlaid with angle & final outer mute pattern

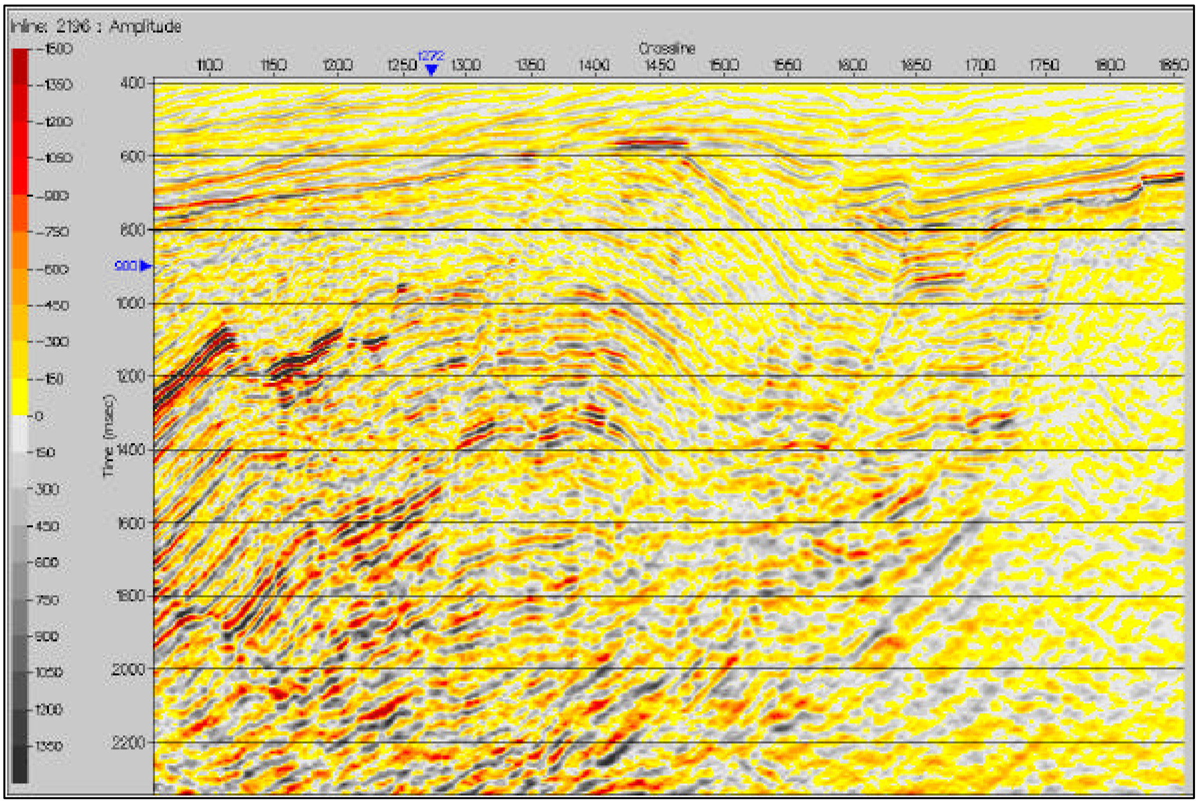
(angle 5-60 deg with every 5 deg increment)



7.21 Near angle (0-14 deg) stack



7.22 Mid angle (14-28 deg) stack



7.23 Far angle (28-42 deg) stack