# Data Processing Report

for

## ESSO Australia Pty Ltd

## Area: Tuskfish 3D VIC/L20



WG Contract Number: J2669
Client Project Number: #61560
Date: March 2nd 2004

WesternGeco

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# 1.0Introduction

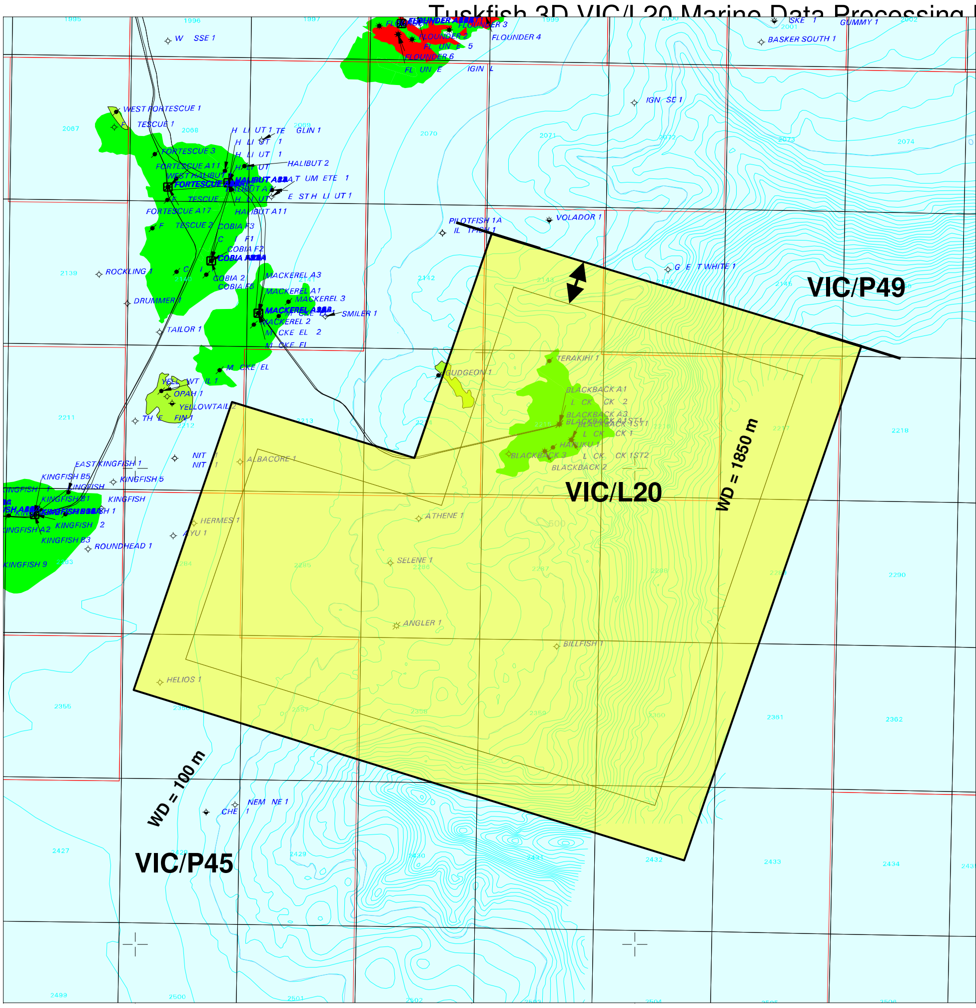
This report details the 2003 data processing by WesternGeco of the Tuskfish 3D marine seismic survey conducted over licensed acreage in the Blackback Field and adjacent open acreage, in block VIC/L20, Gippsland Basin, offshore Victoria, Australia

The acquired data consisted of approximately 1050 sq. km., full fold. The data was acquired between January 2003 and April 2003. The acquisition contractor provided partially pre-processed data tapes to WesternGeco for continued processing in house at the Perth processing centre.

### 1.1 Survey Area

**Figure 1. Tuskfish 3D survey map.**

Above is an outline map of the Tuskfish survey with bathymetry contours (Note: E-W trending channels cut deep into water bottom).




## 1.2 *Processing Objectives*

Producing fields in the Gippsland basin consist of shallow structures at the Top of Latrobe group. The depths of the structures vary between approximately 1.0 and 2.5 seconds (TWT). Maximum structural dips do not exceed 20 degrees. The fields in this area have previously been covered by a regional 2D grid and by small-localised 3D surveys.

Beneath the existing Top of Latrobe accumulations there are also smaller and more complex intra-Latrobe and Golden Beach traps. These deeper structures lie in a series of tilted fault blocks and are often overlain and sealed by volcanics. Depths of these structures vary between 3.0 and 5.0 seconds (TWT), with structural dips of up to 30 degrees.

The primary objectives of the survey are to:

- Aid in the identification of potential infill drilling programs within existing producing fields
- Delineate existing static resources
- Identify and firm up any commercial near-field wildcat potential

- Identify deeper intra-Latrobe and Golden Beach exploration potential

Key to achieving these objectives will be the regional mapping and attribute analysis of stratigraphic markers between the existing field areas, with emphasis on:

- Attribute analysis to resolve regional depositional patterns
- Accurate mapping of the WNW-ESE trending structural grain
- Map distribution of key sealing units

Accurate positioning of faults and identification flat spots and other DHI's are critical requirements. Identification of gas and oil water contacts within existing fields may allow reservoir depletion to be mapped.

| Primary Target Description | Top Latrobe | Intra-Latrobe |
|---|---|---|
| Depth range (ft) | 10,800 - 11,700 | 10,100 - 13,200 |
| Two-way time range (s) | 1.0-2.5 | 3.0-5.0 |
| Maximum structural dip (degrees) | 20 | 30 |
| Estimated recoverable bandwidth (Hz) | 40 Hz | 40 Hz |
| Average Interval Velocity (m/s) | 3500 (3200 - 4000) | 3500 (3200 - 4000) |
| Desired vertical resolution (m) | 23 | 33 |
| Desired horizontal resolution (m) | 70 | 377 |
| Minimum Significant Fault Throw (m) | | 10 |
| Maximum Significant Fault Throw (m) | | 500 |



## 1.3 Acquisition Parameters

| General Information | |
|---|---|
| Operating Company: | ESSO Australia Pty. Ltd. |
| Vessel(s): | Western Monarch |
| Location: | Tuskfish, Gippsland Basin |
| Type of Survey: | 3D Marine streamer survey |
| Line heading: | 108 degrees |
| Desired start date: | January 2003 |

| Survey Area Options | 1 | 2 | 3 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Nominal Full Fold Coverage Area | 1050 sq. km | | |
| Receiver line length: | ~30 to 35 km | | |

| 3D Acquisition Geometry | |
|---|---|
| Geometry Type | Inline swath |

| Cable Parameters | |
|---|---|
| Type of cable | Thomson Marconi Sentry Solid Streamer |
| Number of streamers | 8 |
| Cable separation | 100 m |
| Active cable length (each nominal) | 5 km per cable |
| No. Of channels (per cable) | 400 |
| Group interval | 12.5 m |
| Group Sensitivity | 197.3 dB re 1v/uPa |
| Type Geophones | N/A |
| Type Hydrophones | Thomson Marconi Sonar Seismic hydrophone |



| Recording Parameters | |
|---|---|
| Instrument type | I/O MSX |
| Record length | 6.5 secs |
| Sample rate | 2 milliseconds |
| Recording filter: Hi-cut | ¾ Nyquist |
| Recording filter: Lo-cut | Out (2 Hz) |
| Tape format | SEGD rev (2) 8058 |
| Recording media | IBM 3590 compatible |
| Dual recording required? | Yes |

| Source Parameters | |
|---|---|
| Source type | Sleeve Airgun array |
| Number of sources | 2 |
| Source separation | 50 m |

| | |
|---|---|
| Volume per source | 300 cu in. TBC |
| Primary Pulse to Bubble Pulse Ratio | 13.0 |
| Spectral Energy (minimum) | (Re: 1 micro-Pascal/Hz at 1 meter): 208 dB at 7 Hz rising to 210 dB at a centre frequency between 50-60 Hz with less than +/- 2 dB ripple across the spectrum |
| Source depth | 7 m +/- 0.5 m (TBC) |
| Source pressure | 2000 psi (TBC) |
| Shot to shot interval | 18.75 m |
| Allowable source drop out specifications | < 10% 0-peak change<br>< 15% P:B change<br>> 0.998 correlation coefficient |

| **Binning Requirements** | |
|---|---|
| Bin Size | 12.5 x 25 m |
| Nominal bin fold after duplicate offset rejection (4 azimuth quadrants) | 66 less missing near-offsets due to cable separation. Even offset distribution preferred. |



| **Infill** | |
|---|---|
| Estimated Infill | 25 % |

### *1.4 Geodetic Parameters*

| **Geodetic Parameters During Data Acquisition** | |
|---|---|
| Spheroid | GRS 80 |
| Semi-Major Axis | 6378137.0 |
| Reciprocal of Flattening | 298.257222101 |
| Datum | GDA 94 |
| Projection | UTM Zone 55S (CM 147$^0$E) |

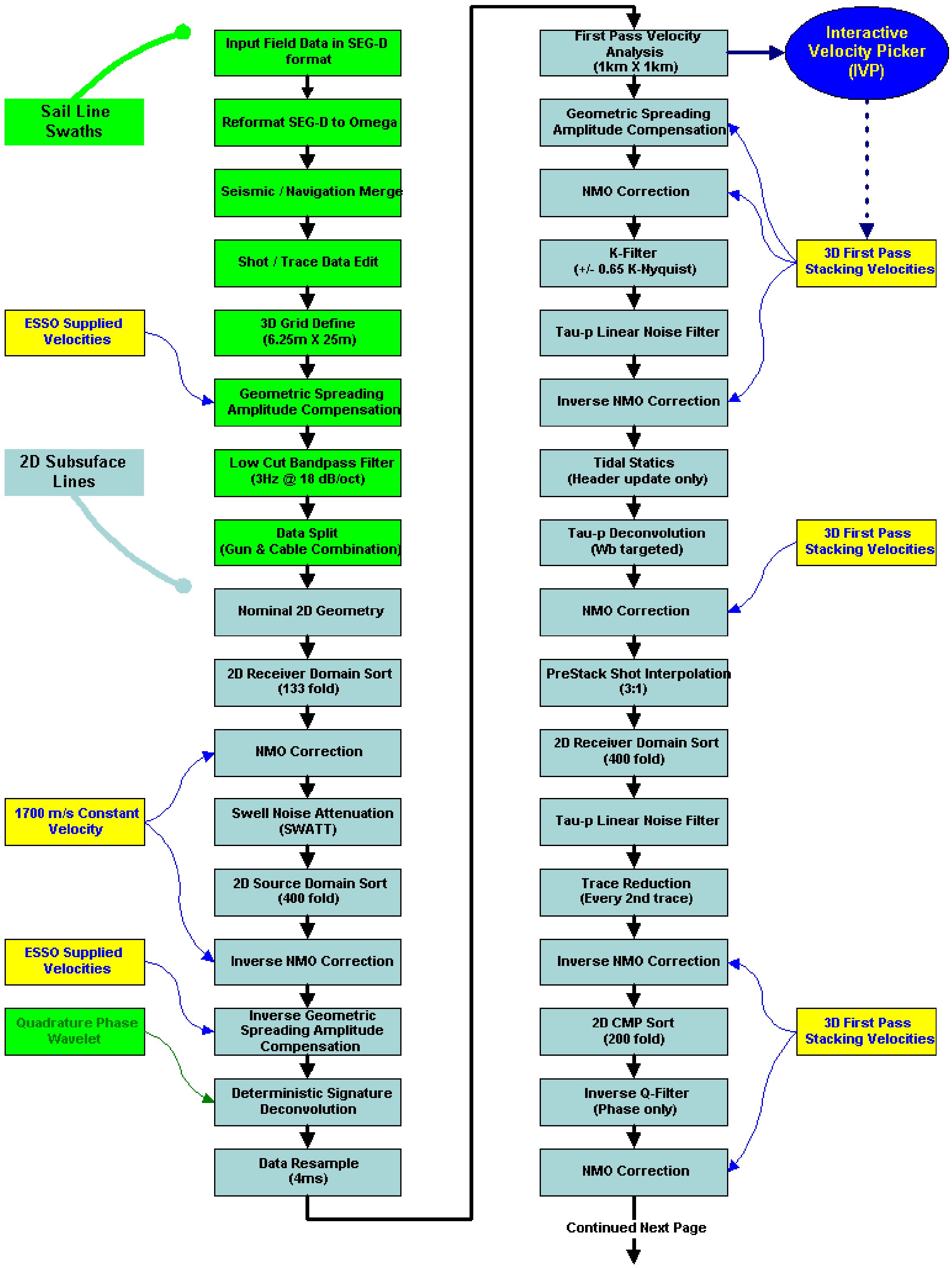
# 2.0Testing

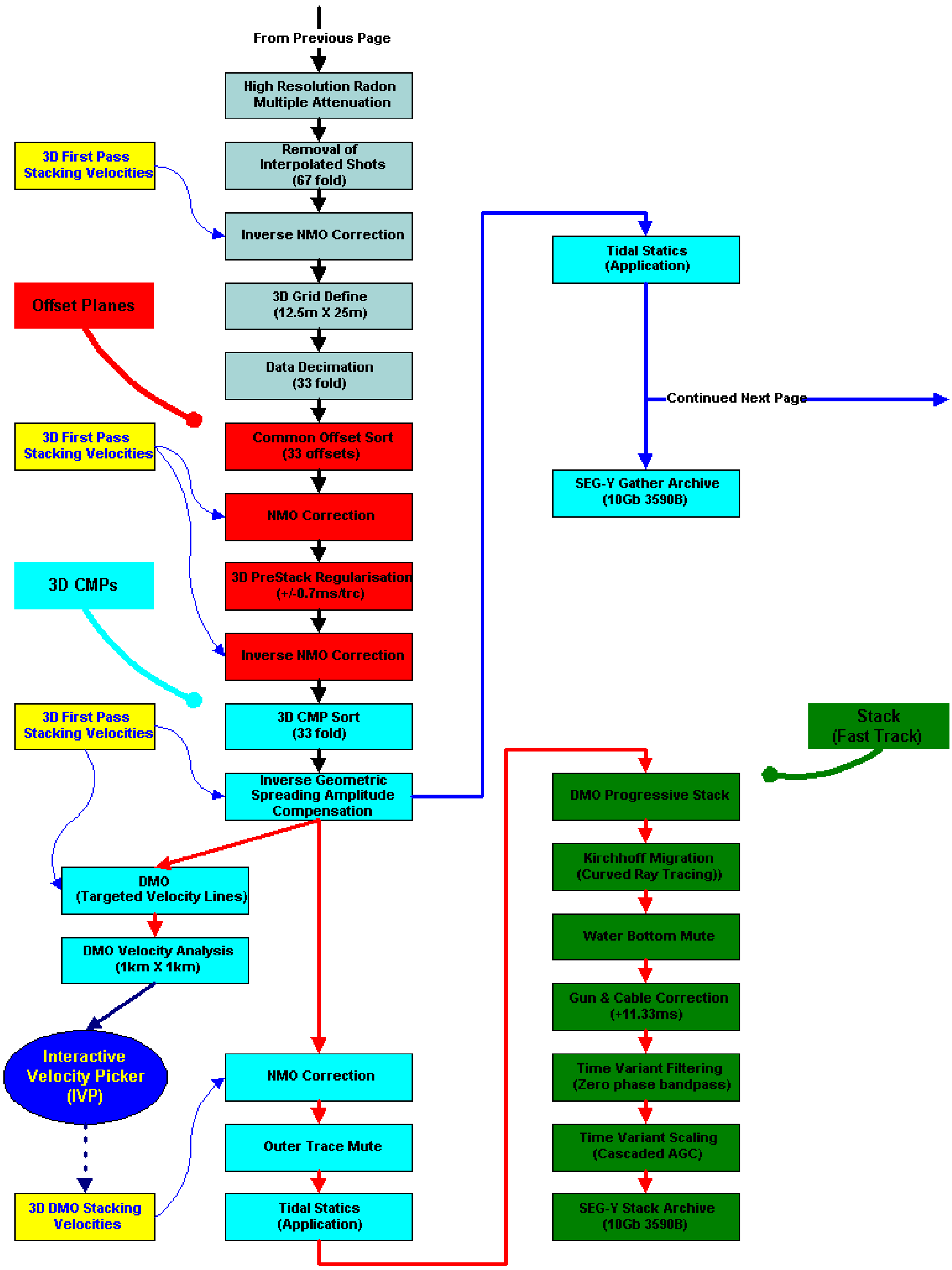
For testing purposes several lines were selected based on their suitability to demonstrate correct parameter selection. Initial acquisition line tests on the Tuskfish 3D dataset were performed on lines 1040J and 1248J in the northern portion of the survey. Later testing included southern acquisition lines 2000K and 2080A. Once that data passed into 3D inline and crossline ordered data the testing was confined to inline 1248, inline 2088 and crossline 4000.

As per the client's instructions the testing and resulting production stages followed a Controlled Amplitude / Controlled Phase (CA/CP) approach in the processing of the data. The processing flows preserved the relative spatial and temporal amplitude variations of the recorded primary wavefield and treated the amplitude and phase of the recorded wavelet in a deterministic sense. Only those processes, which were designed to alter amplitude and phase in a deterministic manner, were permitted.

To maintain the agreed delivery date the testing was performed concurrently with the production stages

# 3.0Processing Flow Diagram

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Inverse NMO Correction
3D Grid Define (12.5m X 25m)
Data Decimation (33 fold)
Common Offset Sort (33 offsets)
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3D First Pass Stacking Velocities
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3D First Pass Stacking Velocities
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Tidal Statics (Application)
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Gun & Cable Correction (+11.33ms)
Time Variant Filtering (Zero phase bandpass)
Time Variant Scaling (Cascaded AGC)
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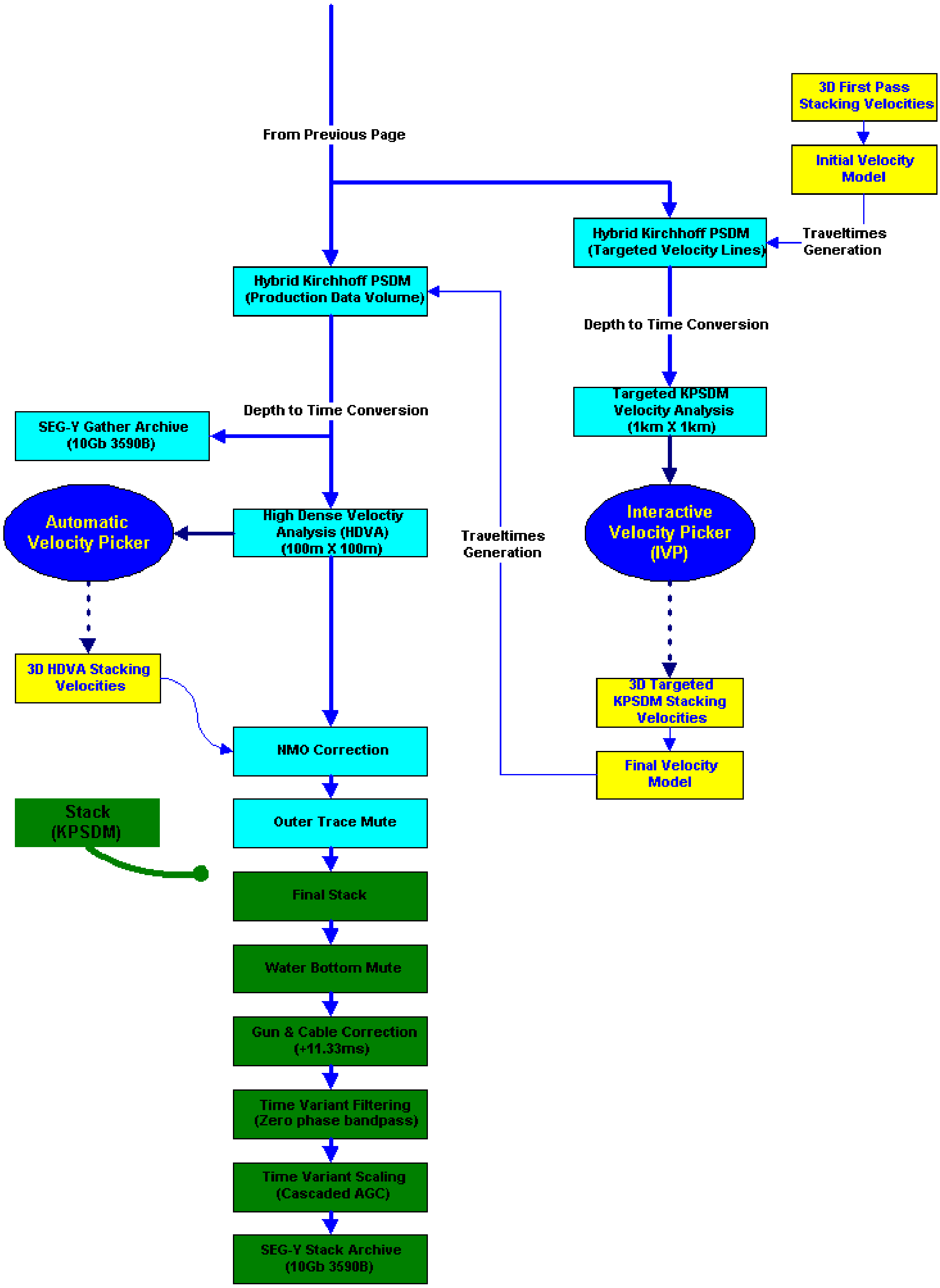

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Final Stack
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Gun & Cable Correction (+11.33ms)
Time Variant Filtering (Zero phase bandpass)
Time Variant Scaling (Cascaded AGC)
SEG-Y Stack Archive (10Gb 3590B)

# 4.0Production Processing Sequence (Pre-Migration)

Details of the pre-migration processing flow, in the order that they were applied, are described below. Steps 4.1 through to 4.4 were performed onboard the acquisition vessel and the output data was subsequently shipped to the processing facilities of WesternGeco's Perth office.

## 4.1 Polarity

Recording polarity was maintained throughout the processing sequence.

## 4.2 Reformat SEGD to OMEGA

The basic function of the tape transcription process was to reformat field tape data to WG Omega format. The 2 ms 3200 trace demultiplexed data, in SEG-D format, was converted to WG Omega format. Full word, 32 bit floating point data at hydrophone amplitude was maintained.

## 4.3 Seismic / Navigation Merge

Header information provided by the source/receiver location UKOOA datasets was merged with the seismic data.

## 4.4 Shot / Trace Data Edit

Records and traces flagged as bad in the observer's logs were edited from the processing sequence

## 4.5 3D Grid Define

A 6.25 m X 25 m grid was applied to the data using the navigation x-y coordinates

## 4.6 Geometric Spreading Amplitude Compensation

Time-variant trace scaling functions were applied to the data to compensate for the decay in amplitude resulting from the propagation of a seismic wave from a point source in a layered medium. The functions were calculated from formulae based on the equation:

where $V$ is the rms velocity associated with a reflection arriving at the two-way traveltime, $T$, associated with shot-to-receiver offset, $x$.

$V_1$ (the first velocity in the velocity function) is used as a normalisation factor.

The velocity and traveltime information was varied spatially using a smoothed velocity field.

Parameter values:

Example function:

| Two-way Traveltimes (ms) | RMS Velocities (m/s) |
|---|---|
| 0 | 1500 |
| 200 | 2280 |
| 400 | 2459 |
| 600 | 2466 |
| 800 | 2461 |
| 1000 | 2505 |
| 1200 | 2585 |
| 1400 | 2773 |
| 1600 | 3165 |
| 1800 | 3564 |
| 2000 | 3862 |
| 2200 | 4077 |
| 2400 | 4217 |
| 2600 | 4309 |
| 2800 | 4368 |
| 3000 | 4442 |
| 3200 | 4524 |
| 3400 | 4583 |
| 3600 | 4618 |
| 3800 | 4646 |
| 4000 | 4672 |
| 4200 | 4695 |
| 4400 | 4715 |
| 4600 | 4734 |
| 4800 | 4751 |
| 5000 | 4767 |
| 5200 | 4782 |
| 5400 | 4795 |

| | |
|---|---|
| 5600 | 4808 |
| 5800 | 4819 |
| 6000 | 4830 |
| 6200 | 4840 |
| 6400 | 4849 |
| 6600 | 4858 |
| 6800 | 4867 |
| 7000 | 4874 |
| 7200 | 4881 |
| 7400 | 4888 |
| 7600 | 4895 |
| 7800 | 4902 |

Velocity field smoothed over 3 km
Source of velocity field : ESSO regional velocities

### *4.7 Low Cut Band-Pass Filter*

A band-pass filter was 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 filter was normalised so that output amplitudes were the same as input amplitudes for frequency components within the passband.

Parameter values:

| | |
|---|---|
| Phase | : Zero |
| Low-cut Frequency | : 3 Hz |
| Low-cut Slope | : 18 dB/octave |
| High-cut Frequency | : Open |
| High-cut Slope | : N/A |

### *4.8 Data Split*

The acquired swaths of sail line data were split into gun and cable combinations that create individual subsurface lines.

### *4.9 Nominal 2D Geometry*

2D nominal geometry was applied to the subsurface lines assuming simple inline source to detector distances.

### *4.10 2D Receiver Domain Sort*

The 2D subsurface lines were sorted from source gathers to 2D common receiver gathers.

Parameter values:

| | |
|---|---|
| Input Domain | : Source |
| Input Fold | : 400 |
| | |
| Output Domain | : Receiver |
| Output Fold | : 133 |

### *4.11 NMO Correction*

Hyperbolic moveout was applied to the data using a constant velocity of 1700 m/s. This corrected the reflection events to their zero offset position by:

where:

*t* is the traveltime at offset *X*

is the zero offset traveltime

*X* is the absolute value of the source-to-detector offset distance

*V* is the moveout velocity (constant 1700 m/s)

As the input trace samples were moveout corrected, they were stretched across a longer output time, so distorting the original data. The effect of this distortion was limited by limiting the amount of moveout compensation applied to the data according to a limiting stretch value, that is (where this value is represented by the variable N) the output interval was restricted to stretching N/100 times the input interval when the output interval exceeded N% of the input interval.

Parameter values:

Mute:
Limiting Stretch Value : 150 ms

## *4.12 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.

Parameter values:

| | |
|---|---|
| Processing Domain | : Receiver |
| Width of Spatial Median Filter | : 11 Traces |
| Frequency Range Processed | : 0 to 10 Hz |
| Width of Frequency Bands to Process | : 5 Hz |

*Threshold Values:*

| Time (ms) | Threshold (%) |
|---|---|
| 2 | 400 |
| 6656 | 400 |

*Processing Window:*

| Offset (m) | Start Time (ms) | Stop Time (ms) |
|---|---|---|
| 0 | 2 | 6656 |
| 5220 | 2 | 6656 |

## *4.13 2D Source Domain Sort*

The 2D subsurface lines were sorted from 2D common receiver gathers back to source gathers.

Parameter values:

| | |
|---|---|
| Input Domain | : Receiver |
| Input Fold | : 133 |
| Output Domain | : Source |
| Output Fold | : 400 |

## *4.14 Inverse NMO Correction*

Inverse hyperbolic moveout was applied to the data using a constant velocity of 1700 m/s. This adjusted the zero offset reflection events to the times appropriate for data recorded at a defined, non-zero offset:

where:

*t* is the traveltime at offset *X*

is the zero offset traveltime

*X* is the absolute value of the source-to-detector offset distance

*V* is the moveout velocity

## 4.15 Inverse Geometric Spreading Amplitude Compensation

The Geometric Spreading applied in step 4.6 was removed with the inverse function derived from the same client supplied RMS velocities.

## 4.16 Deterministic Signature Deconvolution (Quadrature Dephase)

A quadrature phase source signature obtained from ESSO was applied to the data via Deterministic Signature Deconvolution.

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 ‘Deterministic Signature Deconvolution’ is to obtain an operator that will convert the recorded or modelled far field source signature to its minimum or zero phase equivalent, or to another target wavelet, in this case a quadrature phase wavelet.

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; however, by the time the seismic signal is recorded, the source wavelet has undergone phase and amplitude distortions. Some contributing factors to the distortion of the source wavelet are:

- Source and receiver ghosting

- Earth attenuation, Q
- Hydrophone impulse response
- Recording instrument impulse response

Often, supplied far field source signatures have a number of the above components ‘built-in’. If, however, these components have not been applied but are known or can be determined, then it is possible to apply them to the signature during the signature deconvolution procedure. Commonly, the earth attenuation, Q, is not compensated for during deterministic signature deconvolution, as it is time variant in nature. Processes applied later in the processing sequence, such as predictive deconvolution and inverse Q compensation may be designed to accommodate for this.

An additional process that may be included in the deterministic signature deconvolution procedure is the removal of the airgun bubble pulse. Dependent on the airgun array parameters, the bubble pulse may be observed at some lag-time away from the main energy of the source signature (usually of the order of 100 ms). The bubble pulse has the effect of introducing a ‘ripple’ in the low frequencies of the source signature's amplitude spectrum. The application of a ‘gapped’ deconvolution (using predictive distances of the order of 30 ms to 60 ms) to the conditioned signature has the effect of removing the bubble pulse energy without altering the main energy of the signature, and in turn a smoother amplitude spectrum is achieved.

Where the seismic data has had its sampling interval changed from its recorded interval, the conditioned signature is also resampled to the same interval using the same resampling parameters. Likewise, any other wavelet shaping processes that have been applied to the seismic data are also applied to the conditioned signature.

Having conditioned the recorded or modelled far field source, the resultant wavelet is assumed to be a reasonable measure of the wavelet contained within the near offset, shallow seismic data. Knowing the desired output target wavelet (minimum or zero phase equivalent or some other target wavelet), an operator is derived that will convert the conditioned signature to the appropriate target wavelet. This operator is then applied to the recorded seismic data.

Parameter values:

| | |
|---|---|
| Far-field Signature | : Determined by ESSO |
| Desired Output Wavelet | : Quadrature Phase |
| Coefficients of Signature Deconvolution Operator: | |
| Number of Coefficients | : 401 |
| Sample Index of Time-zero of Operator | : 201 |
| Sample Interval | : 2 ms |

### 4.17 Data Resample

The data was resampled and an antialias filter was applied.

| | |
|---|---|
| Parameter values: | |
| Input Trace Length | : 6656 ms |
| Output Trace Length | : 6656 ms |
| Input Sampling Interval | : 2 ms |
| Output Sampling Interval | : 4 ms |
| Antialias Filter: | |
| Phase | : Zero |
| Cutoff Frequency | : 100 Hz |
| Cutoff Slope | : 36 dB/octave |

### 4.18 First Pass Velocity Analysis

Velocity analysis was performed using **WesternGeco**'s Interactive Velocity Processing (IVP) package. At regular intervals across the survey CMP gather data were selected. From this data Multi-Velocity Function (MVF) stacks and velocity semblance values were computed. For each velocity location, MVF data, semblances and gathers are displayed interactively allowing stacking velocities to be interpreted.

The velocities were then qc'ed by the client to check the validity of the picks and any necessary changes made before the velocity field is output.

| | |
|---|---|
| Parameter Values: | |
| Analysis Spacing | : 1000 m X 1000 m |
| Number of CMPs per Analysis (MVF Stack) | : 15 |
| Number of CMPs per Analysis (Semblance Display) | : 6 |

### 4.19 3D Stack Velocity Field

3D interpolation of the first pass velocity functions was used to derive a full 3D field.

## *4.20 Geometric Spreading Amplitude Compensation*

Time-variant trace scaling functions were re-applied to the data to compensate for the decay in amplitude resulting from the propagation of a seismic wave from a point source in a layered medium. The functions were calculated from formulae based on the equation:

where *V* is the rms velocity associated with a reflection arriving at the two-way traveltime, *T*, associated with shot-to-receiver offset, *x*.

$V_1$ (the first velocity in the velocity function) is used as a normalisation factor.

The velocity and traveltime information was varied spatially using a smoothed velocity field.

Parameter values:

Example function:

| Two-way Traveltimes (ms) | RMS Velocities (m/s) |
|---|---|
| 0 | 1500 |
| 737 | 1502 |
| 913 | 1618 |
| 1130 | 1845 |
| 1306 | 2031 |
| 1549 | 2265 |
| 1766 | 2422 |
| 1955 | 2544 |
| 2368 | 2747 |
| 2754 | 2889 |
| 3171 | 3011 |
| 4220 | 3273 |
| 5007 | 3493 |
| 5869 | 3705 |
| 6695 | 3925 |

Velocity field smoothed over 3 km
Source of velocity field : First pass 3D velocity field

## *4.21 NMO Correction*

Hyperbolic moveout was applied to the data using the first pass 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : 200 ms

### 4.22 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 (step 4.31). 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. The input data is NMO corrected source gathers.

Prior to the f-k transform, a data dependent scaling was applied to the data (AGC). 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.

Parameter values:

| | |
|---|---|
| Input Shot Records | : 400 traces |
| High Wavenumber Cutoff | : +/-0.65 of k-Nyquist (relative to input trace separation) |
| Taper | : 0.1 of k-Nyquist (centred on the high wavenumber cutoff) |
| AGC | : 120 ms |

### 4.23 Tau-p Linear Noise Filter (shot domain)

To eliminate linear noise within the data the NMO corrected 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. Then these noise only T-X gathers were 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 modelling 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.

The Tau-p transform was as follows:

Parameter values:

| | |
|---|---|
| Method | : Linear Noise Modelling |
| Number of p-traces | : 480 |
| Transform Type | : Linear |
| Reference Offset | : 5184 m |
| Moveout at Reference Offset – Lower Limit | : -2000 ms |
| Moveout at Reference Offset – Upper Limit | : 4000 ms |
| Maximum Frequency | : 125 Hz |

Taper Zone Length: 64ms (prior to the mute times detailed below)

| Water Bottom Time (ms) | P Trace (delta-t ms) | Mute Time (ms) |
|---|---|---|
| 335 | -2000<br>+600<br>+1280<br>+2900<br>+4000 | 6500<br>6500<br>600<br>4<br>4 |
| 1000 | -2000<br>+540<br>+1020<br>+1460<br>+2780<br>+4000 | 6500<br>6500<br>1930<br>1074<br>4<br>4 |
| 2000 | -2000<br>+740<br>+1190<br>+1960<br>+3160<br>+4000 | 6500<br>6500<br>4000<br>2000<br>4<br>4 |

| | | |
|---|---|---|
| 3200 | -2000 | 6500 |
| | +2200 | 6500 |
| | +3000 | 1500 |
| | +4000 | 4 |

Note: Mute times were interpolated between the specified P-traces.

Mute times were interpolated between the specified water bottom times and extrapolated larger than the last time and smaller than the first time.

### *4.24 Inverse NMO Correction*

Inverse hyperbolic moveout was applied to the data using the first pass 3D velocity field.

### *4.25 Tidal Statics (Header update only)*

WesternGeco supplied a tidal height predictions table for the survey location. Static corrections were calculated from these tide prediction table with 1500 m/sec water velocity and were updated into the trace headers and applied later in the processing flow. The tidal static corrections for the survey were found to be less than 0.5ms.

### *4.26 Tau-p Deconvolution (with near offset extrapolation)*

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 trace-by-trace and centred around the location of the variable water bottom time (Wbt). 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.

**Advantage Of Extrapolating Near Traces Before Application of Tau-p Deconvolution**
In order to predict a multiple in the Tau-p domain at a given offset, you need to have recorded the primary or previous order multiple at a nearer offset. In general, this is only the case if we have receiver groups sampling the wavefield right up to zero offset. In practice, this is never the case, and the shallow multiples on the near traces will not have the corresponding primary or lower order multiple reflection recorded. The deconvolution operator is therefore unable to predict and remove that multiple. A solution to this problem is to extrapolate additional traces such that the near offset trace is as close to zero offset as possible. By extrapolating extra near offset traces you should see an improved Tau-p demultiple result.

Parameter Values:

Method : Multiple Modelling

| | |
|---|---|
| Number of p-traces | : 400 |
| Transform Type | : Linear |
| Reference Offset | : 5184 m |
| Moveout at Reference Offset – Lower Limit | : -300 ms |
| Moveout at Reference Offset – Upper Limit | : 4000 ms |
| Deconvolution Window(s) | : 1 |
| Deconvolution Window Length | : 6000 ms |
| Deconvolution Operator – Minimum Predictive Lag | : Wbt + 30 ms |
| Deconvolution Operator – Total Operator Length | : Wbt -30 ms |

## *4.27 NMO Correction*

Hyperbolic moveout was applied to the data using the first pass 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : 200 ms

### *4.28 Prestack Shot Interpolation (2.5 D)*

Input 2D source gathers are read and stored in the form of a cube where the x direction is receiver station number, the y direction is shot station number and the third direction is time. Interpolated shot gathers are then created by a '2.5 D' interpolation.

The cube of data 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.
NMO is also applied prior to interpolation to further conform to this assumption

In the '2.5 D' method, interpolation is then only carried out in the shot (or common detector) direction, after Fourier transform to the f-x-Ky domain. The operator used is then an average for all the receivers in the time-space window, which should produce more reliable operators than a simple 2D receiver domain interpolator.

Parameter values:

| | |
|---|---|
| Input source spacing | : 37.5 m |
| Output source spacing | : 12.5 m |
| | |
| Time window length | : 512 ms |
| Time overlap | : 256 ms |
| | |
| Maximum dip | : 40 ms/trace |
| | |
| Window width in the detector direction | : 20 traces |
| Window width in the source direction | : 20 traces |
| | |
| Window overlap in the detector direction | : 6 traces |
| Window overlap in the source direction | : 6 traces |

### *4.29 2D Receiver Domain Sort*

The 2D subsurface lines were sorted from interpolated source gathers to 2D common receiver gathers.

Parameter values:

| | |
|---|---|
| Input Domain | : Source |
| Input Fold | : 400 |
| | |
| Output Domain | : Receiver |

| | |
|---|---|
| Output Fold | : 400 |

### 4.30 Tau-p Linear Noise Filter (receiver domain)

Due to the linear noise being unidirectional, if was found that the source domain Tau-p filter did not effectively remove it from all data in the volume. As it is customary during survey acquisition, the direction of each sail line would be either with an increasing shotpoint range (east to west) or a decreasing shotpoint range (west to east). As a result linear noise will appear predominantly in the shot domain when the data is acquired with a decreasing shotpoint range. Conversely data acquired with an increasing shotpoint range has linear noise predominantly in the receiver domain. Consequently it was necessary to pass the data through a second stage of Tau-p filtering, this time in the receiver domain. Here the NMO corrected receiver 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. Then these noise only T-X gathers were subtracted from the original input gathers to result in noise filtered NMO corrected receiver gathers.

The Tau-p transform was as follows:

Parameter values:

| | |
|---|---|
| Method | : Linear Noise Modelling |
| Number of p-traces | : 480 |
| Transform Type | : Linear |
| Reference Offset | : 5184 m |
| Moveout at Reference Offset – Lower Limit | : -2000 ms |
| Moveout at Reference Offset – Upper Limit | : 4000 ms |
| Maximum Frequency | : 125 Hz |

Taper Zone Length: 64ms (prior to the mute times detailed below)

| Water Bottom Time (ms) | P Trace (delta-t ms) | Mute Time (ms) |
|---|---|---|
| 335 | -2000<br>+600<br>+1280<br>+2900<br>+4000 | 6500<br>6500<br>600<br>4<br>4 |
| 1000 | -2000<br>+540<br>+1020<br>+1460 | 6500<br>6500<br>1930<br>1074 |

| | | |
|---|---|---|
| | +2780<br>+4000 | 4<br>4 |
| 2000 | -2000<br>+740<br>+1190<br>+1960<br>+3160<br>+4000 | 6500<br>6500<br>4000<br>2000<br>4<br>4 |
| 3200 | -2000<br>+2200<br>+3000<br>+4000 | 6500<br>6500<br>1500<br>4 |

Note: Mute times were interpolated between the specified P-traces.

Mute times were interpolated between the specified water bottom times and extrapolated larger than the last time and smaller than the first time.

### *4.31 Trace Reduction*

The data was decimated by removing every second trace within the gathers. This was possible due to the application of a K-Filter in step 4.22. The maximum number of traces within the 2D receiver gathers was reduced from 400 to 200.

### *4.32 Inverse NMO Correction*

Inverse hyperbolic moveout was applied to the data using the first pass 3D velocity field.

### *4.33 2D CMP Sort*

The data volume was sorted from 2D receiver gathers to 2D common midpoint gathers.

Parameter values:

Input Domain : Receiver
Input Fold : 200

Output Domain : CMP
Output Fold : 200

## 4.34 Inverse Q-Filter

To compensate for the earth Q-filter, that is, attenuation of higher frequencies and the frequency dependent variation of propagation velocity, a time-variant compensation was applied using an algorithm based on the Futterman frequency-constant Q model of earth attenuation.

Parameter values:

| | |
|---|---|
| Compensation Type | : Phase Only |
| Q Value | : 100 |
| Central Frequency | : 35 Hz |
| Start Application | : Water Bottom Time |
| Source of Q Value | : ESSO |

## 4.35 NMO Correction

Hyperbolic moveout was applied to the data using the first pass 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : Unlimited

## 4.36 High-resolution Radon Multiple Attenuation

Radon Multiple Attenuation is principally a subtraction process. Unwanted coherent noise is isolated in the Tau-p domain, inverse transformed to the x-t domain, and then subtracted from the original data. Multiple energy can be isolated in the Tau-p domain because events with different velocities map to different parts of the domain.

In Radon Multiple Attenuation, three velocity fields are required:

- An estimate of the stacking velocity field, $V_s$.
- A velocity representing the dominant train of multiples of interest, $V_d$.
- A maximum velocity for multiple attenuation, $V_m$. This can be the same as $V_d$ but is more usually a percentage of $V_s$ and lies between $V_d$ and $V_s$.

CMP gather data are first NMO corrected with velocity $V_d$ so that the primary reflections are over corrected while the multiples are broadly flat or under corrected after the NMO. For convenience we refer to over corrected data as having negative dip (decreasing time with increasing offset), under corrected data has positive dip (increasing time with increasing offset) and 'flat' means no change in time with increasing offset.

The data are then transformed into the Tau-p domain using a parabolic radon transform. After hyperbolic normal-moveout, residual NMO has an approximately parabolic shape and hence a parabolic radon transform is appropriate in these circumstances.

The range of moveouts to transform, measured in ms at a reference offset value, was chosen to cover the range of both primary and multiple energy. Following this, parts of Tau-p space representing primary energy were zeroed.

To further refine the construction of the model of the multiple energy, parts of Tau-p space representing primary energy were zeroed based on a knowledge of the velocity, $V_d$, used in the NMO and the multiple velocity, $V_m$. For this purpose 'primary energy' is assumed to be any data with a velocity faster than $V_m$. This allows for time-variance in the multiple velocity field that is not achieved by limiting the range of p-traces. $V_m$ 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.

Inverse Tau-p transform and inverse NMO produces a model of the multiple energy. This was subtracted from the original data to produce the multiple attenuated output.

High-resolution Radon transform seeks to improve the focusing of events in the Radon domain over that provided by the conventional transform. This improved resolution is achieved by including prior information about desirable characteristics of the model into the transform. The prior information usually takes the form of weights in the model domain, chosen to improve the sparseness of the model whilst still modelling all of the data. Improved focusing in the Radon domain improves identification and separation of signal and noise trends, with reduced artefact levels.

High-resolution transforms can also be made to reduce aliasing effects by imposing a slow frequency dependence onto the prior information (weights). This improved handling of aliased data may be sufficient to remove or reduce the level of interpolation that would be required by a conventional transform.

When the High-resolution Radon transform is used for multiple attenuation (using parabolic or pseudo-hyperbolic moveout functions) the Radon domain mute may be moved closer to the primary events, allowing separation of primary and multiple events with very little moveout discrimination.

Parameter values:

| | |
|---|---|
| Frequency range of multiple model | : 0-125 Hertz |
| Multiple Velocity ($V_m$) | : 100% of the primary velocity field |
| Number of p-traces generated | : 468 |

| | |
|---|---|
| Moveouts () at the reference offset (): | |
| Minimum moveout (i.e. for the first p-trace) | : -1500 ms |
| Maximum moveout (i.e. for the last p-trace) | : 3500 ms |
| | |
| Frequency range used in High-res training pass | : 40-60 Hertz |

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

## *4.37 Removal of Interpolated Shot Records*

The additional interpolated shot gathers created in step 4.28 were removed from the data volume. The maximum number of traces within the 2D CMP gathers was reduced from 200 to 67.

## *4.38 Inverse NMO Correction*

Inverse hyperbolic moveout was applied to the data using the first pass 3D velocity field.

## *4.39 3D Grid Define*

A 12.5 m X 25 m grid was applied to the data using the navigation x-y coordinates

## *4.40 Data Decimation*

The data volume was decimated from 67 fold 2D common midpoint gathers into 33 fold 2D common midpoint gathers to reduce the processing volume for prestack migration.

## *4.41 Common Offset Sort*

The data volume was sorted from 33 fold 2D common midpoint gathers into 33 offset planes. These offset planes were then sorted into inline order.

Parameter values:

| | |
|---|---|
| Input Domain | : CMP |
| Input Fold | : 33 |
| | |
| Output Domain | : Offset |
| Output Fold | : 33 |

### *4.42 NMO Correction*

Hyperbolic moveout was applied to the data using the first pass 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : Unlimited

### *4.43 3D Prestack Regularisation*

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 of 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.
Limits were set for the maximum number of traces in an output cell. To accomplish this, redundancy editing was applied and the trace (or traces) closest to the cell centre were kept.

Parameter Values:

| | |
|---|---|
| Operation Mode | : Infill holes / Trace Regularisation |
| Maximum no. of traces in output cell | : 1 (per offset plane) |
| Sinc Interpolation length (inline x crossline) | : 5 x 5 |
| Number of Dip Scans | : 11 |
| Dip Range | : +/-0.7ms/trace |
| Correlation Width | : 31 traces |
| Correlation Length | : 50ms |

## *4.44 Inverse NMO Correction*

Inverse hyperbolic moveout was applied to the data using the first pass 3D velocity field.

## *4.45 3D CMP Sort*

The data volume was sorted from offset gathers to 3D common midpoint gathers.

Parameter values:

| | |
|---|---|
| Input Domain | : Offset |
| Input Fold | : 33 |
| Output Domain | : CMP |
| Output Fold | : 33 |

# 5.0Production Processing Sequence (Post Stack Migration)

Details of the post stack migration processing flow that continues on from step 4.45 are described below.

## 5.1 Inverse Geometric Spreading Amplitude Compensation

The Geometric Spreading applied in step 4.20 was removed with the inverse function derived from the first pass 3D velocity field.

## 5.2 Targeted Dip Moveout (DMO)

Dip Moveout (DMO) is a process that attempts to take traces recorded at a non-zero offset and make them appear as if they had been recorded with zero offset. It can therefore be thought of as a prestack partial migration. After DMO has been applied several goals are achieved:

- Dip dependency of the Normal Moveout (NMO) velocity field is eliminated, thereby making the velocity field derived from DMO gathers a better starting point for the calculation of the migration velocity field.
- Mid-point smear on dipping events is eliminated.
- Events with conflicting dips within a CMP, e.g. reflections and diffractions, may be stacked with the same velocity (within the limitations of the 'constant-velocity' algorithm utilised).
- Under some circumstances, DMO can act as a noise attenuator.

DMO was applied using the Kirchhoff integral method in the X-T domain. This method works by spreading energy from one trace to its neighbours along the DMO ellipse (the input having had NMO applied). The shape of the ellipse was computed from a constant-velocity algorithm; truncating and tapering the ellipse produced the DMO operator that was applied along the shot-receiver azimuth.

The limbs of the DMO operator have progressively steeper dips, which results in spatial aliasing occurring at progressively lower frequencies, as one moves out along the operator. To reduce the impact of aliasing the limbs of the operator were time and space variantly high-cut filtered to remove aliased energy from the operator.

The DMO process was applied only to specific target velocity lines at 1km intervals using the following parameters.

Parameter values:

| | |
|---|---|
| Maximum Aperture | : 131 traces |
| Maximum Dip | : 90 degrees |
| Velocity used for Dip Calculation | : Spatially Varying Function |
| Number of Anti-alias Filters | : 1 |

## *5.3 Targeted DMO Velocity Analysis*

Velocity analysis was performed on the DMO velocity lines using **WesternGeco**'s Interactive Velocity Processing (IVP) package. At regular intervals across the survey CMP gather data were selected. From this data Multi-Velocity Function (MVF) stacks and velocity semblance values were computed. For each velocity location, MVF data, semblances and gathers are displayed interactively allowing stacking velocities to be interpreted.

The velocities were then qc'ed by the client to check the validity of the picks and any necessary changes made before the velocity field is output.

Parameter Values:

| | |
|---|---|
| Analysis Spacing | : 1000 m X 1000 m |
| Number of CMPs per Analysis (MVF Stack) | : 15 |
| Number of CMPs per Analysis (Semblance Display) | : 7 |

## *5.4 3D Stack Velocity Field*

3D interpolation of the targeted DMO velocity functions was used to derive a full 3D field.

## *5.5 NMO Correction*

Hyperbolic moveout was applied to the data using the DMO 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : Unlimited

## *5.6 Outer Trace Mute*

A spatially variant outer (long offset) trace mute was applied to the data in order to suppress direct arrivals, refractions and wide angle reflections. The mute was designed to vary with the water bottom time and allow up to approximately 30 – 40 degrees of reflection angle.

The data were tapered from zero to full amplitude over a taper zone.

Parameter values:

Taper Zone Length : 24 ms (starting from the mute times detailed below)

| Water Bottom Time (ms) | Constant Mute Maximum Offset (m) | Source-to-Detector Offset (m) | Mute Time (ms) |
|---|---|---|---|
| 250 | 350 | 418<br>590<br>1790<br>5180 | 260<br>500<br>1490<br>3540 |
| 755 | 700 | 750<br>2205<br>5174 | 756<br>1995<br>4178 |
| 2090 | 1550 | 1638<br>5180 | 2100<br>4900 |
| 3250 | 2650 | 2740<br>5147 | 3250<br>5714 |

Note: Mute times were interpolated between the specified offsets and extrapolated for offsets larger than the last offset specified.
Mute times were interpolated between the specified water bottom times and extrapolated larger than the last time and smaller than the first time.

## *5.7 Tidal Statics (Application)*

Stored tidal statics from step 4.25 were applied.

## *5.8 DMO Progressive Stack*

This is where the data was stacked progressively during the DMO process. That is, stack contributions to a cell, including DMO aperture contributions, are summed immediately with any previous contribution in the cell. Simultaneously, an auxiliary trace is maintained for every cell representing the cumulative time-variant fold of coverage of the cell. After all input data have been processed; the stacked cells are normalised by means of the auxiliary trace and output. In this case the stacked traces were normalised using the following function:

*w(t)* is the summed weight function for a given output trace (in this case N)

As with the DMO for the targeted velocity analysis in step 5.2, the parameters are the same for the DMO progressive stack.

Parameter values:

| | |
|---|---|
| Maximum Aperture | : 131 traces |
| Maximum Dip | : 90 degrees |
| Velocity used for Dip Calculation | : Spatially Varying Function |
| Number of Anti-alias Filters | : 1 |

## *5.9 Post Stack Kirchhoff Migration*

The DMO stacked data volume was then migrated using a Kirchhoff algorithm. The migration was performed using the DMO velocity field.
The migration parameters were as follows:

Parameter Values:

| | |
|---|---|
| Migration Type | : Kirchhoff Ray Tracing |
| Aperture Computation Type | : Straight Ray |
| Dip Limit | : 60 degrees |
| Maximum Aperture Time | : 3500 ms |
| Velocity Smoothing Radius | : 4000 m |

*Time variant frequency limits;*

| Time (ms) | Frequency (Hz) |
|---|---|
| 0 | 85 |
| 1000 | 75 |
| 2000 | 65 |
| 4000 | 60 |
| 6000 | 55 |

## *5.10 Water Bottom Mute*

The stacked data volume was then muted from zero time down to the water bottom to remove any unwanted signal and noise.

### *5.11 Gun and Cable Correction*

A gun and cable static correction was calculated using the following equation and then applied to the data:

*Correction = (Gun depth + Cable depth)/Water velocity*

Parameter values:

| | |
|---|---|
| Gun Depth | : 8 metres |
| Cable Depth | : 9 metres |
| Water Velocity | : 1500 m/s |
| | |
| Static Correction | : +11.33 ms |

### *5.12 Time Variant Filtering*

A zero-phase TVF (Time Variant Filter) 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 normalised 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) |
|---|---|---|---|---|
| 0 | 10 | 18 | 65 | 72 |
| 1000 | 10 | 18 | 55 | 72 |
| 2000 | 8 | 18 | 35 | 72 |
| 4000 | 6 | 18 | 30 | 72 |
| 6000 | 6 | 18 | 30 | 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.
All filter times are relative to the water bottom time of the data.

### 5.13 Time Variant Scaling

User-specified time windows were used to derive and apply scale factors to each data sample. These multipliers were calculated by centring the window over a sample, taking the average absolute amplitude of the window, defining a multiplier to make this average 0.9 times the desired output rms amplitude and applying it to the sample. The window centre was then moved down one sample and a new multiplier calculated and applied. In this way, multipliers were computed and applied to each sample from the first window application point to the last window application point.

Parameter values:

Scaling Type : Cascaded AGC

Primary RMS Amplitude : 2000
Primary Window length : Constant

| Window Length (ms) | Start Time (ms) | End Time (ms) |
|---|---|---|
| 1000 | 0 | 6000 |

Secondary RMS Amplitude : 1700 (residual amplification only)
Secondary Window length : Constant

| Window Length (ms) | Start Time (ms) | End Time (ms) |
|---|---|---|
| 400 | 0 | 6000 |

Note: Data output from the primary AGC with amplitudes less than 1700 rms are amplified up to 1700 rms by the secondary AGC.
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 tapered to zero at the first physical sample on the trace.
The last multiplier calculated was applied constantly until the last live sample.

### 5.14 SEG-Y Archive

The filtered and scaled migrated data volume was archive onto 10 Gb 3590B cartridge tapes for delivery to the client.

# 6.0Production Processing Sequence (Prestack Migration)

Details of the prestack migration processing flow that continues on from step 4.45 are described below.

## 6.1 NMO Correction

Hyperbolic moveout was applied to the data using the first pass 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : Unlimited

## 6.2 Unwanted Data Trace Clipping

Due to the nature of the variable water bottom in this survey there are a number of instances where high amplitude multiple energy could not be removed by regular methods of attenuation. This was a particular problem where the rugose seabed caused a focusing effect of the water column ray paths beneath the channels. These high amplitude events would cause major problems in the future with any planned prestack migration processes. Hence the only alternative was to remove these high amplitude events from the gathers by trace clipping the data.

The criterion for clipping these high amplitude events was a combination of three variables. The first was the peak absolute amplitude (PAA) of the entire trace that was automatically derived for all traces in the data volume. The second was the predicted multiple arrival time that in this case was simply 2 times the water bottom time in the data headers. This value was used as a start time for the clipping process. The third variable was simply a data sample threshold clipping value. Any data sample that was greater than this variable was clipped to a background level. The combination of these three parameters was able to successfully selectively remove the problem high amplitude multiple beneath the seabed channels.

Parameter values:

| | |
|---|---|
| Peak Absolute Amplitude | : 400 |
| Clipping Start Time | : 2 X Water bottom time |
| Clipping Threshold | : 80 millivolts |
| Background Level | : 20 millivolts |

## 6.3 Inverse NMO Correction

Inverse hyperbolic moveout was applied to the data using the first pass 3D velocity field.

## 6.4 Inverse Geometric Spreading Amplitude Compensation

The Geometric Spreading applied in step 4.20 was removed with the inverse function derived from the first pass 3D velocity field.

## 6.5 Tidal Statics (Application)

Stored tidal statics from step 4.25 were applied.

## 6.6 Hybrid Kirchhoff Prestack Depth Migration (KPSDM)

Deep-water marine seismic data often suffer from non-hyperbolic moveout distortions generated by highly variable seafloor topography, perhaps caused by sub-sea erosion processes across the continental shelf or at shelf edges.

The non-hyperbolic moveout is a result of lateral velocity variations across the rugose/dipping water bottom. Time migration assumes no lateral velocity variations and hence is unable to deal with these variations. The result of using a time migration algorithm is both a substandard image and perhaps more importantly, significant lateral movement of events. To overcome this limitation a depth migration algorithm coupled with a single iteration of time velocity model building was used to form a hybrid Kirchhoff Prestack Depth Migration (KPSDM) procedure. With this procedure the non-hyperbolic moveout distortions caused by highly variable seafloors is accounted for. It consists of the following eight stages:

### 6.6.1 Initial Velocity Model

The initial model for the Hybrid KPSDM was created from the first pass 3D velocity field (step 4.19). This velocity field was converted to interval velocities and was smoothed using a horizontal 5km radius. Then a digitised water bottom pick and an assigned velocity of 1500m/s were used to form an accurate water layer that was then merged with the smoothed velocity field (horizontal 5km radial smooth). This model was then converted to one-way depth and interval velocities and was then used to derive travel times tables for prestack depth migration.

### 6.6.2 Targeted Hybrid KPSDM

A Kirchhoff depth migration algorithm was then used to migrate the data on specified target velocity lines at 1km intervals using the following parameters. The output velocity lines from the migration were in depth and NMO corrected.

Parameter values:

| | |
|---|---|
| Traveltimes Grid | : 100 m X 100 m |
| Traveltimes Depth Step | : 100 m |
| Wavefront Maximum Time | : 3500 ms |
| Maximum Aperture | : 4000 m |
| Maximum Dip | : 70 degrees |
| Maximum Output Depth | : 10000 m |
| Output Depth Interval | : 5 m |
| Anti-aliasing Distance | : 25 m |
| Anti-aliasing Filter Type | : Boxcar |
| Offsets Migrated | : 33 |

### 6.6.3 Depth To Time Conversion

The output targeted depth migrated gathers were converted from depth to time and the NMO correction was removed using a time and velocity equivalent of the initial model migration traveltimes.

### 6.6.4 Targeted Hybrid KPSDM Velocity Analysis

Velocity analysis was performed using **WesternGeco**'s Interactive Velocity Processing (IVP) package. At regular intervals across the survey CMP gather data were selected. From this data Multi-Velocity Function (MVF) stacks and velocity semblance values were computed. For each velocity location, MVF data, semblances and gathers are displayed interactively allowing stacking velocities to be interpreted.

The velocities were then qc'ed by the client to check the validity of the picks and any necessary changes made before the velocity field is output.

Parameter Values:

| | |
|---|---|
| Analysis Spacing | : 1000 m X 1000 m |
| Number of CMPs per Analysis (MVF Stack) | : 15 |
| Number of CMPs per Analysis (Semblance Display) | : 7 |

### 6.6.5 3D Stack Velocity Field

3D interpolation of the targeted KPSDM velocity functions was used to derive a full 3D field.

#### 6.6.6 Final Velocity Model

A second model for the full production Hybrid KPSDM was created from the targeted KPSDM 3D velocity field in step 6.6.5 previously. As with the initial model this velocity field was converted to interval velocities and was smoothed using a horizontal 5km radius. Then a digitised water bottom picks and water velocity of 1500m/s was used to form an accurate water layer that was then merged with the smoothed targeted KPSDM velocity field. This new model was then converted to one-way depth and interval velocities and was used to derive new travel times tables for pre-stack depth migration.

#### 6.6.7 Production Hybrid KPSDM

A Kirchhoff depth migration algorithm was then used to migrate all of the data using the following parameters. Again the output gathers from the migration were in depth and NMO corrected.

Parameter values:

| | |
|---|---|
| Traveltimes Grid | : 100 m X 100 m |
| Traveltimes Depth Step | : 100 m |
| Wavefront Maximum Time | : 3500 ms |
| Maximum Aperture | : 4000 m |
| Maximum Dip | : 70 degrees |
| Maximum Output Depth | : 10000 m |
| Output Depth Interval | : 5 m |
| Anti-aliasing Distance | : 25 m |
| Anti-aliasing Filter Type | : Boxcar |
| Offsets Migrated | : 33 |

#### 6.6.8 Depth To Time Conversion

The output depth migrated gathers were again converted from depth to time and the NMO correction was removed using a time and velocity equivalent of the final model migration traveltimes.

### 6.7 3D High Dense Velocity Analysis (HDVA)

3D velocity analysis is typically performed on a sparse grid of data with 500m x 500m spacing. Whilst this analysis density is generally adequate to determine the general velocity trends in quite high detail, the High Dense Velocity Analysis process (HDVA) is a semi-automated approach to generate a velocity field with greater detail. This velocity field can then be used to perform final NMO correction.

The HDVA process was run in four stages:

### 6.7.1 High density velocity analyses generation

Velocity Analysis control points for Semblances and Gathers were generated at a dense spatial sampling interval in preparation for running the Automatic Velocity Picker.
Adjacent CMP Summing was performed in the generation of cross-correlation matrices that were sampled in time and velocity.

Parameter values:

| | |
|---|---|
| Velocity Analysis Density | : 100m x 100m |
| Adjacent CMP Sum | : 5 |
| Velocity Trace Sampling | : 10 m/sec |
| Time Sampling | : 12 ms |
| Output Trace Length | : 6500 ms |

### 6.7.2 Automatic Velocity Picking

The Automatic Velocity Picker generated time-velocity picks from input coherence tables plus additional velocity information that was used to determine the starting velocity functions for the iterative velocity picking algorithm. It was also used for constraining the final interval velocity models and for deleting unacceptable RMS velocities from the computations.

The automatic velocity picking algorithm is based upon the work of J.L Toldi (1985). A significant feature of Toldi's technique is that velocities are picked under the constraint of a realistic interval velocity model, ensuring that picked RMS velocities do not imply unrealistic interval velocity functions. The algorithm works best for horizontally stratified geology, with mild lateral velocity variations.
Toldi's method also performs automatic stacking velocity analysis by finding the observed stacking velocity that maximizes the data semblance. The resultant algorithm simultaneously maximizes the semblance and minimizes the stacking velocity differences.

In order to prevent unrealistic picking of RMS velocity values, the following constraints, or penalty functions, were included to guide the autopicking algorithm:

- Temporal smoothness weighting to reduce the effect of rapid fluctuations in interval velocity.
- Deviation tolerance from the initial model.
- Weight accorded to surrounding velocity functions.
- Maximum and minimum allowable interval velocity.

Parameter values:

| | |
|---|---|
| Steering Velocity Field Density | : 1000m x 1000m |
| Temporal Smoothness | : 0 (disabled) |
| Initial Model Derivation | : 0.5 (1/2 guide function and 1/2 previous |

| | |
|---|---|
| | location) |
| Final Model Deviation | : 0 (disabled) |
| Interval Velocity Range Limits | : 1500-8000m/s |

### 6.7.3 Velocity Interpolation

The raw auto-picked velocities were gridded to a regular spatial and temporal grid prior to smoothing

Parameter values:

| | |
|---|---|
| Output Velocity Field Grid Size | : 100m x 100m |
| Output temporal sample interval | : 20ms |

### 6.7.4 Velocity Field Smoothing

The final stage of the HDVA process involved the spatial and temporal smoothing of the raw time-velocity picks generated by the automatic velocity picking.
Temporal smoothing was performed using either a flat or triangular running average filter on the raw RMS velocity values.
Spatial smoothing was performed using a 3D Cosine Bell smoothing operator and can be applied to either the RMS or interval velocities, or both.

Parameter values:

| | |
|---|---|
| Velocity type smoothed | : RMS |
| Temporal smoothing filter shape | : Cosine |
| Temporal smoothing filter length | : 5 samples (200 m radius) |
| Spatial Filter Decay Rate | : 1 (where 0 represents a running average and 1 represents a linear weighting function from 0 to 1) |

## 6.8 NMO Correction

Hyperbolic moveout was applied to the data using the HDVA 3D velocity field.

Parameter values:

Mute:
Limiting Stretch Value : Unlimited

## 6.9 Outer Trace Mute

A spatially variant outer (long offset) trace mute was applied to the data in order to suppress direct arrivals, refractions and wide angle reflections. The mute was designed to vary with the water bottom time and allow up to approximately 30 – 40 degrees of reflection angle.

The data were tapered from zero to full amplitude over a taper zone.

Parameter values:

Taper Zone Length : 24 ms (starting from the mute times detailed below)

| Water Bottom Time (ms) | Constant Mute Maximum Offset (m) | Source-to-Detector Offset (m) | Mute Time (ms) |
|---|---|---|---|
| 250 | 350 | 418<br>590<br>1790<br>5180 | 260<br>500<br>1490<br>3540 |
| 755 | 700 | 750<br>2205<br>5174 | 756<br>1995<br>4178 |
| 2090 | 1550 | 1638<br>5180 | 2100<br>4900 |
| 3250 | 2650 | 2740<br>5147 | 3250<br>5714 |

Note: Mute times were interpolated between the specified offsets and extrapolated for offsets larger than the last offset specified.
Mute times were interpolated between the specified water bottom times and extrapolated larger than the last time and smaller than the first time.

## 6.10 Final Stack

The traces within each NMO corrected gather are stacked to form a single output trace. The resultant trace is normalised sample by sample using the following function;

*w(t)* is the summed weight function for a given output trace (in this case N)

## 6.11 Water Bottom Mute

The stacked data volume was then muted from zero time down to the water bottom to remove any unwanted signal and noise.

### *6.12 Gun and Cable Correction*

A gun and cable static correction was calculated using the following equation and then applied to the data:

*Correction = (Gun depth + Cable depth)/Water velocity*

Parameter values:

| | |
|---|---|
| Gun Depth | : 8 metres |
| Cable Depth | : 9 metres |
| Water Velocity | : 1500 m/s |
| | |
| Static Correction | : +11.33 ms |

### *6.13 Time Variant Filtering*

A zero-phase TVF (Time Variant Filter) 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 normalised 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) |
|---|---|---|---|---|
| 0 | 10 | 18 | 65 | 72 |
| 1000 | 10 | 18 | 55 | 72 |
| 2000 | 8 | 18 | 35 | 72 |
| 4000 | 6 | 18 | 30 | 72 |
| 6000 | 6 | 18 | 30 | 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.
All filter times are relative to the water bottom time of the data.

## *6.14 Time Variant Scaling*

User-specified time windows were used to derive and apply scale factors to each data sample. These multipliers were calculated by centring the window over a sample, taking the average absolute amplitude of the window, defining a multiplier to make this average 0.9 times the desired output rms amplitude and applying it to the sample. The window centre was then moved down one sample and a new multiplier calculated and applied. In this way, multipliers were computed and applied to each sample from the first window application point to the last window application point.

Parameter values:

Scaling Type : Cascaded AGC

Primary RMS Amplitude : 2000
Primary Window length : Constant

| Window Length (ms) | Start Time (ms) | End Time (ms) |
|---|---|---|
| 1000 | 0 | 6000 |

Secondary RMS Amplitude : 1700 (residual amplification only)
Secondary Window length : Constant

| Window Length (ms) | Start Time (ms) | End Time (ms) |
|---|---|---|
| 400 | 0 | 6000 |

Note: Data output from the primary AGC with amplitudes less than 1700 rms are amplified up to 1700 rms by the secondary AGC.
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 tapered to zero at the first physical sample on the trace.
The last multiplier calculated was applied constantly until the last live sample.

### 6.15 SEG-Y Archive

The filtered and scaled migrated data volume was archive onto 10 Gb 3590B cartridge tapes for delivery to the client.

# 7.0 Personnel

| Name (WesternGeco) | Title | Email |
|---|---|---|
| Lawrence Cho | Centre Manager | kcho@perth.westerngeco.slb.com |
| Paul Tredgett | Processing Supervisor | ptredgett@perth.westerngeco.slb.com |
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| Peter Griffin | Senior Geophysicist (Project Leader) | pgriffin1@melbourne.westerngeco.slb.com |
| Ryan Taylor-Walshe | Senior Geophysicist | walshe1@perth.westerngeco.slb.com |

| Name (Client) | Title | Email |
|---|---|---|
| John Hefti | Client Representative | john.hefti@exxonmobil.com |

# 8.0 Appendices

## 8.1 Acquisition Line Listing

| LINE NAME | LINE | SEQUENCE | PRIMARY / INFILL | FSP | LSP | #SP | KM | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| G03A1136A002 | 1440A | 001 | P | 2622 | 4019 | 1394 | 26.14 | |
| G03A1440A001 | 1136A | 002 | P | 3886 | 2489 | 1370 | 25.69 | |
| G03A1456A003 | 1456A | 003 | P | 2622 | 3743 | 1122 | 21.04 | |
| G03A1152A004 | 1152A | 004 | P | 3855 | 2489 | 1364 | 25.58 | |
| G03A1472A005 | 1472A | 005 | P | 2622 | 4019 | 1392 | 26.10 | |
| G03A1168A006 | 1168A | 006 | P | 3886 | 2489 | 1398 | 26.21 | |
| G03A1424A007 | 1424A | 007 | P | 2622 | 4019 | 1397 | 26.19 | |
| G03A1184A008 | 1184A | 008 | P | 3886 | 2489 | 1398 | 26.21 | |
| G03A1488A009 | 1488A | 009 | P | 2622 | 3400 | 777 | 14.57 | |
| G03A1120A010 | 1120A | 010 | | 3886 | 2489 | 1398 | | DNP |
| G03A1408A011 | 1408A | 011 | | 2622 | 4019 | 1398 | | DNP |
| G03A1200A012 | 1200A | 012 | P | 3886 | 3400 | 481 | 9.02 | |
| G03A1200B013 | 1200B | 013 | P | 3410 | 2489 | 920 | 17.25 | |
| G03A1488B014 | 1488B | 014 | P | 3391 | 4019 | 624 | 11.70 | |
| G03A1216A015 | 1216A | 015 | P | 3886 | 2489 | 1389 | 26.04 | |
| G03A1408B016 | 1408B | 016 | P | 2622 | 4019 | 1385 | 25.97 | |
| G03A1232A017 | 1232A | 017 | P | 3886 | 3447 | 434 | 8.14 | |
| G03A1232B018 | 1232B | 018 | P | 3456 | 2489 | 967 | 18.13 | |
| G03A1504A019 | 1504A | 019 | P | 2622 | 4018 | 1375 | 25.78 | |
| G03A1120B020 | 1120B | 020 | P | 3886 | 2489 | 1381 | 25.89 | |
| G03A1392A021 | 1392A | 021 | P | 2622 | 4019 | 1392 | 26.10 | |
| G03A1248A022 | 1248A | 022 | P | 3886 | 2489 | 1398 | 26.21 | |
| G03A1504J023 | 1504J | 023 | I | 2622 | 4019 | 1388 | 26.03 | |
| G03A1104A024 | 1104A | 024 | P | 3886 | 2489 | 1398 | 26.21 | |
| G03A1376A025 | 1376A | 025 | P | 2622 | 4019 | 1391 | 26.08 | |
| G03A1104J026 | 1104J | 025 | | 3886 | 3686 | 201 | | DNP |
| G03A1104K027 | 1104K | 027 | | 3886 | 3356 | 531 | | DNP |
| G03A1456B028 | 1456B | 028 | P | 3390 | 4019 | 628 | 11.78 | |
| G03A1104L029 | 1104L | 029 | I | 3886 | 3424 | 460 | 8.63 | |
| G03A1104M030 | 1104M | 030 | I | 2930 | 2489 | 439 | 8.23 | |
| G03A1520A031 | 1520A | 031 | P | 2622 | 4018 | 977 | 18.32 | |
| G03A1248J032 | 1248J | 032 | I | 3886 | 2489 | 1393 | 26.12 | |
| G03A1360A033 | 1360A | 033 | P | 2622 | 4019 | 1398 | 26.21 | |
| G03A1104N034 | 1104N | 034 | | 3433 | 2921 | 513 | | DNP |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| G03A1360J035 | 1360J | 035 | I | 2646 | 4019 | 837 | 15.69 | |
| G03A1088A036 | 1088A | 036 | P | 3886 | 2489 | 1388 | 26.03 | |
| G03A1360K037 | 1360K | 037 | I | 2622 | 3705 | 652 | 12.23 | |
| G03A1072A038 | 1072A | 038 | P | 3854 | 3409 | 438 | 8.21 | |
| G03A1072B039 | 1072B | 039 | P | 3050 | 2489 | 553 | 10.37 | |
| G03A1344A040 | 1344A | 040 | P | 2622 | 4019 | 1393 | 26.12 | |
| G03A1104O041 | 1104O | 041 | I | 3433 | 2921 | 510 | 9.56 | |
| G03A1072C042 | 1072C | 042 | P | 3886 | 3041 | 485 | 9.09 | |
| G03A1520B043 | 1520B | 043 | P | 3293 | 3728 | 436 | 8.18 | |
| G03A1056A044 | 1056A | 044 | P | 3885 | 3293 | 580 | 10.88 | |
| G03A1056B045 | 1056B | 045 | P | 3302 | 2622 | 677 | 12.69 | |
| G03A1328A046 | 1328A | 046 | P | 2622 | 4019 | 1398 | 26.21 | |
| G03A1040A047 | 1040A | 047 | P | 3886 | 2765 | 1116 | 20.93 | |
| G03A1536A048 | 1536A | 048 | P | 2622 | 4019 | 1397 | 26.19 | |
| G03A1040J049 | 1040J | 049 | I | 3886 | 2489 | 1398 | 26.21 | |
| G03A1312A050 | 1312A | 050 | P | 2870 | 3700 | 830 | 15.56 | |
| G03A1024A051 | 1024A | 051 | P | 3886 | 2489 | 1395 | 26.16 | |
| G03A1488J052 | 1488J | 052 | I | 2688 | 4019 | 700 | 13.13 | |
| G03A1008A053 | 1008A | 053 | P | 3778 | 2489 | 1283 | 24.06 | |
| G03A1552A054 | 1552A | 054 | P | 2622 | 4019 | 1396 | 26.18 | |
| G03A1264A055 | 1264A | 055 | P | 3886 | 2489 | 1394 | 26.14 | |
| G03A1552X056 | 1552X | 056 | P | 2622 | 4019 | 1390 | 26.06 | |
| G03A1008J057 | 1008J | 057 | I | 3886 | 3288 | 599 | 11.23 | |
| G03A1056C058 | 1056C | 058 | P | 2633 | 2489 | 144 | 2.70 | |
| G03A1568A059 | 1568A | 059 | | 2622 | 2753 | 132 | | DNP |
| G03A1312B060 | 1312B | 060 | P | 3691 | 4019 | 326 | 6.11 | |
| G03A1008B061 | 1008B | 061 | P | 3886 | 3769 | 115 | 2.16 | |
| G03A1008K062 | 1008K | 062 | I | 3297 | 2489 | 733 | 13.74 | |
| G03A1040B063 | 1040B | 063 | P | 2774 | 2489 | 285 | 5.34 | |
| G03A1312J064 | 1312J | 064 | I | 2622 | 3287 | 663 | 12.43 | |
| G03A1008C065 | 1008C | 065 | P | 3120 | 2555 | 566 | 10.61 | |
| G03A1312C066 | 1312C | 066 | P | 2622 | 2879 | 257 | 4.82 | |
| G03A1312K067 | 1312K | 067 | I | 3278 | 4019 | 736 | 13.80 | |
| G03A1008M068 | 1008M | 068 | I | 3300 | 2489 | 804 | 15.08 | |
| G03A1568B069 | 1568B | 069 | P | 2622 | 4019 | 1395 | 26.16 | |
| G03A1264X070 | 1264X | 070 | P | 3886 | 3600 | 572 | 10.73 | |
| G03A1264Y071 | 1264Y | 071 | P | 3324 | 2489 | 833 | 15.62 | |
| G03A1584A072 | 1584A | 072 | P | 2622 | 4019 | 1392 | 26.10 | |
| G03A1280A073 | 1280A | 073 | P | 3886 | 2489 | 1394 | 26.14 | |
| G03A1296A074 | 1296A | 074 | P | 2622 | 4019 | 1398 | 26.21 | |
| G03A1296J075 | 1296J | 075 | I | 2622 | 4018 | 1398 | 26.21 | |
| G03A1152B076 | 1152B | 076 | P | 3886 | 2980 | 424 | 7.95 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| G03A1536J077 | 1536J | 077 | I | 2655 | 3040 | 386 | 7.24 | |
| G03A1216J078 | 1216J | 078 | I | 3850 | 3450 | 401 | 7.52 | |
| G03A2352A079 | 2352A | 079 | | 3886 | 2699 | 1188 | | DNP |
| G03A2160A080 | 2160A | 080 | | 2001 | 4019 | 2019 | | DNP |
| G03A2352B081 | 2352B | 081 | P | 3786 | 1868 | 1915 | 35.91 | 7 Cables only |
| G03A2144A082 | 2144A | 082 | | 2001 | 3292 | 1292 | | DNP |
| G03A2336A083 | 2336A | 083 | P | 3886 | 1868 | 1692 | 31.73 | 7 Cables only |
| G03A2320A084 | 2320A | 084 | | 3886 | 2981 | 906 | | DNP |
| G03A2144B085 | 2144B | 085 | | 2001 | 4019 | 2019 | | DNP |
| G03A2320B086 | 2320B | 086 | P | 3886 | 1868 | 2012 | 37.73 | 7 Cables only |
| G03A2160B087 | 2160B | 087 | P | 2001 | 4019 | 2016 | 37.80 | 7 Cables only |
| G03A2320J088 | 2320J | 088 | I | 3886 | 1868 | 2017 | 37.82 | 7 Cables only |
| G03A2144C089 | 2144C | 089 | P | 2001 | 4019 | 2011 | 37.71 | 7 Cables only |
| G03A2304A090 | 2304A | 090 | P | 3886 | 1868 | 2016 | 37.80 | 7 Cables only |
| G03A2128A091 | 2128A | 091 | P | 2001 | 4019 | 2015 | 37.78 | 7 Cables only |
| G03A2288A092 | 2288A | 092 | P | 3886 | 1868 | 2002 | 37.54 | 7 Cables only |
| G03A2112A093 | 2112A | 093 | P | 2990 | 4019 | 2016 | 37.80 | 7 Cables only |
| G03A2272A094 | 2272A | 094 | P | 3886 | 1868 | 2019 | 37.86 | 7 Cables only |
| G03A2112X095 | 2112X | 095 | P | 2001 | 4019 | 2018 | 37.84 | 7 Cables only |
| G03A2272J096 | 2272J | 096 | I | 3886 | 1868 | 1420 | 26.63 | 7 Cables only |
| G03A2096A097 | 2096A | 097 | P | 2001 | 4019 | 2017 | 37.82 | 7 Cables only |
| G03A2256A098 | 2256A | 098 | P | 3886 | 1868 | 2018 | 37.84 | 7 Cables only |
| G03A2080A099 | 2080A | 099 | P | 2001 | 4019 | 2013 | 37.74 | 7 Cables only |
| G03A2240A100 | 2240A | 100 | P | 3886 | 1868 | 959 | 17.98 | 7 Cables only |
| G03A2064A101 | 2064A | 101 | P | 2001 | 4019 | 2019 | 37.86 | 7 Cables only |
| G03A1840A102 | 1840A | 102 | P | 3885 | 2500 | 1344 | 25.20 | 7 Cables only |
| G03A1584J103 | 1584J | 103 | I | 2770 | 3150 | 381 | 7.14 | 7 Cables only |
| G03A1840B104 | 1840B | 104 | P | 2509 | 1868 | 640 | 12.00 | 7 Cables only |
| G03A1600A105 | 1600A | 105 | P | 2001 | 4019 | 2019 | 37.86 | 7 Cables only |
| G03A1856A106 | 1856A | 106 | P | 3886 | 1868 | 2019 | 37.86 | 7 Cables only |
| G03A1616A107 | 1616A | 107 | P | 2001 | 4019 | 2013 | 37.74 | 7 Cables only |
| G03A1872A108 | 1872A | 108 | P | 3886 | 3202 | 685 | 12.84 | 7 Cables only |
| G03A1840C109 | 1840C | 109 | P | 3756 | 3717 | 40 | 0.75 | 7 Cables only |
| G03A1872B110 | 1872B | 110 | P | 3211 | 1868 | 1344 | 25.20 | 7 Cables only |
| G03A1632A111 | 1632A | 111 | P | 2001 | 4019 | 2016 | 37.80 | 7 Cables only |
| G03A1888A112 | 1888A | 112 | P | 3886 | 1868 | 1723 | 32.31 | 7 Cables only |
| G03A1648A113 | 1648A | 113 | P | 2001 | 4019 | 2015 | 37.78 | 7 Cables only |
| G03A1888X114 | 1888X | 114 | P | 3886 | 1868 | 2012 | 37.73 | 7 Cables only |
| G03A1664A115 | 1664A | 115 | P | 2001 | 4019 | 2001 | 37.52 | 7 Cables only |
| G03A1904A116 | 1904A | 116 | P | 3886 | 1887 | 1931 | 36.21 | 7 Cables only |
| G03A1680A117 | 1680A | 117 | P | 2262 | 4019 | 1753 | 32.87 | 7 Cables only |
| G03A1920A118 | 1920A | 118 | P | 3886 | 1868 | 2014 | 37.76 | 7 Cables only |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| G03A1680X119 | 1680X | 119 | P | 2001 | 4019 | 2018 | 37.84 | 7 Cables only |
| G03A1920J120 | 1920J | 120 | I | 3886 | 1868 | 1940 | 36.38 | 7 Cables only |
| G03A1696A121 | 1696A | 121 | P | 2001 | 4018 | 1865 | 34.97 | 7 Cables only |
| G03A1936A122 | 1936A | 122 | | 3886 | 2347 | 1540 | | DNP |
| G03A1712A123 | 1712A | 123 | | 2001 | 3829 | 1829 | | DNP |
| G03A1936B124 | 1936B | 124 | P | 3886 | 1868 | 2015 | 37.78 | 7 Cables only |
| G03A1712B125 | 1712B | 125 | P | 2001 | 4019 | 2004 | 37.58 | 7 Cables only |
| G03A1952A126 | 1952A | 126 | P | 3886 | 1869 | 1998 | 37.46 | 7 Cables only |
| G03A1712J127 | 1712J | 127 | I | 2001 | 4019 | 2019 | 37.86 | 7 Cables only |
| G03A1968A128 | 1968A | 128 | P | 3886 | 1868 | 2017 | 37.82 | 7 Cables only |
| G03A1728A129 | 1728A | 129 | P | 2001 | 4019 | 2018 | 37.84 | 7 Cables only |
| G03A1968J130 | 1968J | 130 | I | 3886 | 1868 | 1979 | 37.11 | 7 Cables only |
| G03A1744A131 | 1744A | 131 | P | 2001 | 4019 | 2016 | 37.80 | 7 Cables only |
| G03A1984A132 | 1984A | 132 | P | 3886 | 1868 | 2015 | 37.78 | 7 Cables only |
| G03A1744X133 | 1744X | 133 | P | 2001 | 4019 | 2016 | 37.80 | 7 Cables only |
| G03A1824A134 | 1824A | 134 | P | 2342 | 1868 | 1673 | 31.37 | 7 Cables only |
| G03A1344J135 | 1344J | 135 | I | 2622 | 4019 | 1234 | 23.14 | 6 Cables only |
| G03A1808A136 | 1808A | 136 | P | 3886 | 1868 | 2019 | 37.86 | 6 Cables only |
| G03A1440J137 | 1440J | 137 | I | 2622 | 4019 | 959 | 17.98 | 6 Cables only |
| G03A2000A138 | 2000A | 138 | P | 3886 | 3489 | 397 | 7.44 | 6 Cables only |
| G03A2000B139 | 2000B | 139 | P | 3488 | 1868 | 1279 | 23.98 | 6 Cables only |
| G03A1760A140 | 1760A | 140 | P | 2001 | 4019 | 2018 | 37.84 | 6 Cables only |
| G03A2000J141 | 2000J | 141 | I | 3886 | 1868 | 2018 | 37.84 | 6 Cables only |
| G03A1776A142 | 1776A | 142 | P | 2001 | 4019 | 1871 | 35.08 | 6 Cables only |
| G03A2000X143 | 2000X | 143 | | 3886 | 3191 | 696 | | DNP |
| G03A1904B144 | 1904B | 144 | P | 2831 | 1868 | 654 | 12.26 | 7 Cables only |
| G03A1776J145 | 1776J | 145 | I | 2001 | 4019 | 2019 | 37.86 | 7 Cables only |
| G03A2000Y146 | 2000Y | 146 | P | 3886 | 1868 | 2019 | 37.86 | 7 Cables only |
| G03A1808J147 | 1808J | 147 | I | 3886 | 1868 | 2019 | 37.86 | 7 Cables only |
| G03A1792A148 | 1792A | 148 | P | 2001 | 4019 | 2014 | 37.76 | 7 Cables only |
| G03A2000K149 | 2000K | 149 | I | 3886 | 1868 | 2017 | 37.82 | 7 Cables only |
| G03A1792J150 | 1792J | 150 | I | 2001 | 4019 | 2013 | 37.74 | 7 Cables only |
| G03A1856J151 | 1856J | 151 | I | 3886 | 2074 | 861 | 16.14 | 7 Cables only |
| G03A1792K152 | 1792K | 152 | I | 2001 | 4019 | 1697 | 31.82 | 7 Cables only |
| G03A1808K153 | 1808K | 153 | I | 3886 | 2255 | 1623 | 30.43 | 7 Cables only |
| G03A1888B154 | 1888B | 154 | P | 2169 | 1868 | 302 | 5.66 | 7 Cables only |
| G03A1680B155 | 1680B | 155 | P | 2001 | 2271 | 271 | 5.08 | 7 Cables only |
| G03A1808L156 | 1808L | 156 | I | 2690 | 1868 | 822 | 15.41 | 7 Cables only |
| G03A1696B157 | 1696B | 157 | P | 2001 | 2980 | 980 | 18.38 | 7 Cables only |
| G03A1968K158 | 1968K | 158 | I | 3195 | 1868 | 1064 | 19.95 | 7 Cables only |
| G03A1776B159 | 1776B | 159 | P | 2001 | 2585 | 585 | 10.97 | 7 Cables only |
| G03A1792L160 | 1792B | 160 | P | 2230 | 2831 | 602 | 11.29 | 7 Cables only |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| G03A2240B161 | 2240B | 161 | P | 3535 | 1868 | 1377 | 25.82 | 7 Cables only |
| G03A2176A162 | 2176A | 162 | P | 2001 | 4019 | 2019 | 37.86 | 7 Cables only |
| G03A2224A163 | 2224A | 163 | P | 3886 | 2120 | 832 | 15.60 | 7 Cables only |
| G03A2048A164 | 2048A | 164 | P | 2001 | 4019 | 2019 | 37.86 | 7 Cables only |
| G03A2224I165 | 2224I | 165 | I | 3886 | 1868 | 1195 | 22.41 | 7 Cables only |
| G03A2048J166 | 2048J | 166 | | 2001 | 4019 | 2019 | | DNP |
| G03A2208A167 | 2208A | 167 | | 3886 | 3834 | 53 | | DNP |
| G03A2336B168 | 2336B | 168 | | 2952 | 2862 | 91 | | DNP |
| G03A2048K169 | 2048K | 169 | I | 2001 | 4019 | 1994 | 37.39 | 7 Cables only |
| G03A2208B170 | 2208B | 170 | P | 3886 | 1868 | 2016 | 37.80 | 7 Cables only |
| G03A2032A171 | 2032A | 171 | P | 2001 | 4019 | 1887 | 35.38 | 7 Cables only |
| G03A2208I172 | 2208I | 172 | I | 3886 | 3330 | 557 | 10.44 | 7 Cables only |
| G03A2208J173 | 2208J | 173 | I | 2585 | 1868 | 717 | 13.44 | 7 Cables only |
| G03A2032I174 | 2032I | 174 | I | 2001 | 4019 | 589 | 11.04 | 7 Cables only |
| G03A2240J175 | 2240J | 175 | I | 3740 | 2593 | 1057 | 19.82 | 7 Cables only |
| G03A2144J176 | 2144J | 176 | I | 3000 | 3325 | 326 | 6.11 | 7 Cables only |
| G03A2272K177 | 2272K | 177 | I | 3042 | 2432 | 610 | 11.44 | 7 Cables only |
| G03A2032K178 | 2032K | 178 | I | 2982 | 4019 | 1038 | 19.46 | 7 Cables only |
| G03A2192A179 | 2192A | 179 | P | 3886 | 1868 | 2019 | 37.86 | 7 Cables only |
| G03A2032L180 | 2032L | 180 | I | 2001 | 4019 | 2011 | 37.71 | 7 Cables only |
| G03A2192J181 | 2192J | 181 | | 2600 | 2589 | 12 | | DNP |
| G03A2032M182 | 2032M | 182 | I | 2001 | 4019 | 2017 | 37.82 | 7 Cables only |
| G03A2192K183 | 2192K | 183 | I | 3886 | 1868 | 1523 | 28.56 | 7 Cables only |
| G03A2016A184 | 2016A | 184 | P | 2001 | 4019 | 2017 | 37.82 | 7 Cables only |
| G03A2192X185 | 2192X | 185 | P | 3886 | 1868 | 2018 | 37.84 | 7 Cables only |
| G03A2016J186 | 2016J | 186 | I | 2001 | 4019 | 1712 | 32.10 | 7 Cables only |
| G03A2192Y187 | 2192Y | 187 | P | 3886 | 1868 | 1904 | 35.70 | 7 Cables only |
| G03A2160J188 | 2160J | 188 | I | 2067 | 3633 | 789 | 14.79 | 7 Cables only |
| G03A2352C189 | 2352C | 189 | P | 3886 | 3781 | 116 | 2.18 | 7 Cables only |
| G03A1968B190 | 1968B | 190 | P | 3195 | 3146 | 60 | 1.13 | 7 Cables only |
| G03A2192L191 | 2192L | 191 | I | 3170 | 1868 | 1303 | 24.43 | 7 Cables only |
| G03A2176J192 | 2176J | 192 | I | 2001 | 3879 | 1875 | 35.16 | 7 Cables only |
| G03A2224J193 | 2224J | 193 | I | 3401 | 2764 | 634 | 11.89 | 7 Cables only |
| G03A2240C194 | 2240C | 194 | | 2963 | 2911 | 53 | | DNP |
| G03A2192Z195 | 2192Z | 195 | P | 2223 | 2108 | 120 | 2.25 | 7 Cables only |
| G03A2176K196 | 2176K | 196 | I | 2001 | 3185 | 1182 | 22.16 | 7 Cables only |
| G03A2240K197 | 2240K | 197 | I | 3430 | 3067 | 364 | 6.83 | 7 Cables only |
| G03A2192L198 | 2192M | 198 | I | 2815 | 1968 | 846 | 15.86 | 7 Cables only |
| G03A2176L199 | 2176L | 199 | | 2290 | 3610 | 1321 | | DNP |
| G03A2336C200 | 2336C | 200 | P | 2952 | 2607 | 346 | 6.49 | 7 Cables only |
| G03A2240D201 | 2240D | 201 | | 3020 | 2710 | 311 | | DNP |
| G03A2176M202 | 2176M | 202 | | 2290 | 3610 | 1321 | | DNP |

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|---|---|---|---|---|---|---|---|---|
| G03A1904J203 | 1904J | 203 | I | 3563 | 3514 | 50 | 0.94 | 7 Cables only |
| G03A1920J204 | 1920X | 204 | P | 2506 | 2450 | 57 | 1.07 | 7 Cables only |
| G03A1744J205 | 1744J | 205 | I | 2001 | 2230 | 230 | 4.31 | 7 Cables only |
| G03A2000L206 | 2000L | 206 | | 2440 | 1968 | 473 | | DNP |
| G03A2000M207 | 2000M | 207 | | 2440 | 1968 | 473 | | DNP |
| G03A2000N208 | 2000N | 208 | I | 2440 | 1968 | 450 | 8.44 | 7 Cables only |
| G03A2032B209 | 2032B | 209 | P | 2260 | 2400 | 150 | 2.81 | 7 Cables only |
| G03A2000P210 | 2000P | 210 | I | 2300 | 2092 | 208 | 3.90 | 7 Cables only |
| G03A2176N211 | 2176N | 211 | I | 2290 | 3609 | 1214 | 22.76 | 7 Cables only |
| G03A2240E212 | 2240E | 212 | P | 3020 | 2710 | 311 | 5.83 | 7 Cables only |



## 8.2 *Field Tape List*

The following field tape listing was acquired for ESSO:

| Line Name | Tape No. | Line Name | Tape No. | Line Name | Tape No. | Line Name | Tape No. |
|---|---|---|---|---|---|---|---|
| G03A1440A001 | W60213 | G03A1552X056 | W60541 | G03A1872A108 | W60879 | G03A2000K149 | W61212 |
| G03A1440A001 | W60214 | G03A1552X056 | W60542 | G03A1872A108 | W60880 | G03A2000K149 | W61213 |
| G03A1440A001 | W60215 | G03A1008J057 | W60543 | G03A1872A108 | W60881 | G03A1792J150 | W61214 |
| G03A1440A001 | W60216 | G03A1008J057 | W60544 | G03A1840C109 | W60882 | G03A1792J150 | W61215 |
| G03A1440A001 | W60217 | G03A1008J057 | W60545 | G03A1872B110 | W60883 | G03A1792J150 | W61216 |
| G03A1440A001 | W60218 | G03A1056C058 | W60546 | G03A1872B110 | W60884 | G03A1792J150 | W61217 |
| G03A1440A001 | W60219 | G03A1568A059 | W60547 | G03A1872B110 | W60885 | G03A1792J150 | W61218 |
| G03A1440A001 | W60220 | G03A1312B060 | W60548 | G03A1872B110 | W60886 | G03A1792J150 | W61219 |
| G03A1136A002 | W60221 | G03A1312B060 | W60549 | G03A1872B110 | W60887 | G03A1792J150 | W61220 |
| G03A1136A002 | W60222 | G03A1008B061 | W60550 | G03A1872B110 | W60888 | G03A1792J150 | W61221 |
| G03A1136A002 | W60223 | G03A1008K062 | W60551 | G03A1632A111 | W60889 | G03A1792J150 | W61222 |
| G03A1136A002 | W60224 | G03A1008K062 | W60552 | G03A1632A111 | W60890 | G03A1856J151 | W61223 |
| G03A1136A002 | W60225 | G03A1008K062 | W60553 | G03A1632A111 | W60891 | G03A1856J151 | W61224 |
| G03A1136A002 | W60226 | G03A1008K062 | W60554 | G03A1632A111 | W60892 | G03A1856J151 | W61225 |
| G03A1136A002 | W60227 | G03A1040B063 | W60555 | G03A1632A111 | W60893 | G03A1856J151 | W61226 |

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|---|---|---|---|---|---|---|---|
| G03A1456A003 | W60228 | G03A1040B063 | W60556 | G03A1632A111 | W60894 | G03A1856J151 | W61227 |
| G03A1456A003 | W60229 | G03A1312J064 | W60557 | G03A1632A111 | W60895 | G03A1856J151 | W61228 |
| G03A1456A003 | W60230 | G03A1312J064 | W60558 | G03A1632A111 | W60896 | G03A1856J151 | W61229 |
| G03A1456A003 | W60231 | G03A1312J064 | W60559 | G03A1632A111 | W60897 | G03A1856J151 | W61230 |
| G03A1456A003 | W60232 | G03A1312J064 | W60560 | G03A1888A112 | W60898 | G03A1792K152 | W61231 |
| G03A1456A003 | W60233 | G03A1008C065 | W60561 | G03A1888A112 | W60899 | G03A1792K152 | W61232 |
| G03A1152A004 | W60234 | G03A1008C065 | W60562 | G03A1888A112 | W60900 | G03A1792K152 | W61233 |
| G03A1152A004 | W60235 | G03A1008C065 | W60563 | G03A1888A112 | W60901 | G03A1792K152 | W61234 |
| G03A1152A004 | W60236 | G03A1312C066 | W60564 | G03A1888A112 | W60902 | G03A1792K152 | W61235 |
| G03A1152A004 | W60237 | G03A1312C066 | W60565 | G03A1888A112 | W60903 | G03A1792K152 | W61236 |
| G03A1152A004 | W60238 | G03A1312C066 | W60566 | G03A1888A112 | W60904 | G03A1792K152 | W61237 |
| G03A1152A004 | W60239 | G03A1312C066 | W60567 | G03A1888A112 | W60905 | G03A1792K152 | W61238 |
| G03A1152A004 | W60240 | G03A1312K067 | W60568 | G03A1888A112 | W60906 | G03A1792K152 | W61239 |
| G03A1152A004 | W60241 | G03A1312K067 | W60569 | G03A1648A113 | W60907 | G03A1808K153 | W61240 |
| G03A1472A005 | W60242 | G03A1312K067 | W60570 | G03A1648A113 | W60908 | G03A1808K153 | W61241 |
| G03A1472A005 | W60243 | G03A1312K067 | W60571 | G03A1648A113 | W60909 | G03A1808K153 | W61242 |
| G03A1472A005 | W60244 | G03A1312K067 | W60572 | G03A1648A113 | W60910 | G03A1808K153 | W61243 |
| G03A1472A005 | W60245 | G03A1312K067 | W60573 | G03A1648A113 | W60911 | G03A1808K153 | W61244 |
| G03A1472A005 | W60246 | G03A1312K067 | W60574 | G03A1648A113 | W60912 | G03A1808K153 | W61245 |
| G03A1472A005 | W60247 | G03A1312K067 | W60575 | G03A1648A113 | W60913 | G03A1808K153 | W61246 |
| G03A1472A005 | W60248 | G03A1312K067 | W60576 | G03A1648A113 | W60914 | G03A1888B154 | W61247 |
| G03A1168A006 | W60249 | G03A1312K067 | W60577 | G03A1648A113 | W60915 | G03A1888B154 | W61248 |
| G03A1168A006 | W60250 | G03A1312K067 | W60578 | G03A1888X114 | W60916 | G03A1680B155 | W61249 |
| G03A1168A006 | W60251 | G03A1312K067 | W60579 | G03A1888X114 | W60917 | G03A1680B155 | W61250 |
| G03A1168A006 | W60252 | G03A1312K067 | W60580 | G03A1888X114 | W60918 | G03A1808L156 | W61251 |
| G03A1168A006 | W60253 | G03A1312K067 | W60581 | G03A1888X114 | W60919 | G03A1808L156 | W61252 |
| G03A1168A006 | W60254 | G03A1008M068 | W60582 | G03A1888X114 | W60920 | G03A1808L156 | W61253 |
| G03A1168A006 | W60255 | G03A1008M068 | W60583 | G03A1888X114 | W60921 | G03A1808L156 | W61254 |
| G03A1424A007 | W60256 | G03A1008M068 | W60584 | G03A1888X114 | W60922 | G03A1696B157 | W61255 |
| G03A1424A007 | W60257 | G03A1008M068 | W60585 | G03A1888X114 | W60923 | G03A1696B157 | W61256 |
| G03A1424A007 | W60258 | G03A1008M068 | W60586 | G03A1888X114 | W60924 | G03A1696B157 | W61257 |
| G03A1424A007 | W60259 | G03A1008M068 | W60587 | G03A1664A115 | W60925 | G03A1696B157 | W61258 |
| G03A1424A007 | W60260 | G03A1568B069 | W60588 | G03A1664A115 | W60926 | G03A1696B157 | W61259 |
| G03A1424A007 | W60261 | G03A1568B069 | W60589 | G03A1664A115 | W60928 | G03A1968K158 | W61260 |
| G03A1424A007 | W60262 | G03A1568B069 | W60590 | G03A1664A115 | W60929 | G03A1968K158 | W61261 |
| G03A1184A008 | W60263 | G03A1568B069 | W60591 | G03A1664A115 | W60930 | G03A1968K158 | W61262 |
| G03A1184A008 | W60264 | G03A1568B069 | W60592 | G03A1664A115 | W60931 | G03A1968K158 | W61263 |
| G03A1184A008 | W60265 | G03A1568B069 | W60593 | G03A1664A115 | W60932 | G03A1968K158 | W61264 |
| G03A1184A008 | W60266 | G03A1568B069 | W60594 | G03A1664A115 | W60933 | G03A1968K158 | W61265 |
| G03A1184A008 | W60267 | G03A1264X070 | W60595 | G03A1664A115 | W60934 | G03A1776B159 | W61266 |
| G03A1184A008 | W60268 | G03A1264X070 | W60596 | G03A1904A116 | W60935 | G03A1776B159 | W61267 |
| G03A1184A008 | W60269 | G03A1264X070 | W60597 | G03A1904A116 | W60936 | G03A1776B159 | W61268 |
| G03A1488A009 | W60270 | G03A1264X070 | W60598 | G03A1904A116 | W60937 | G03A1792L160 | W61269 |
| G03A1488A009 | W60271 | G03A1264X070 | W60599 | G03A1904A116 | W60938 | G03A1792L160 | W61270 |
| G03A1488A009 | W60272 | G03A1264Y071 | W60600 | G03A1904A116 | W60939 | G03A1792L160 | W61271 |
| G03A1488A009 | W60273 | G03A1264Y071 | W60601 | G03A1904A116 | W60940 | G03A2240B161 | W61272 |
| G03A1488A009 | W60274 | G03A1264Y071 | W60602 | G03A1904A116 | W60941 | G03A2240B161 | W61273 |
| G03A1488A009 | W60275 | G03A1264Y071 | W60603 | G03A1904A116 | W60942 | G03A2240B161 | W61274 |
| G03A1488A009 | W60276 | G03A1264Y071 | W60604 | G03A1680A117 | W60943 | G03A2240B161 | W61275 |
| G03A1120A010 | W60277 | G03A1584A072 | W60605 | G03A1680A117 | W60944 | G03A2240B161 | W61276 |
| G03A1120A010 | W60278 | G03A1584A072 | W60606 | G03A1680A117 | W60945 | G03A2240B161 | W61277 |
| G03A1120A010 | W60279 | G03A1584A072 | W60607 | G03A1680A117 | W60946 | G03A2240B161 | W61278 |
| G03A1120A010 | W60280 | G03A1584A072 | W60608 | G03A1680A117 | W60947 | G03A2176A162 | W61279 |
| G03A1120A010 | W60281 | G03A1584A072 | W60609 | G03A1680A117 | W60948 | G03A2176A162 | W61281 |
| G03A1120A010 | W60282 | G03A1584A072 | W60610 | G03A1680A117 | W60949 | G03A2176A162 | W61282 |

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|---|---|---|---|---|---|---|---|
| G03A1120A010 | W60283 | G03A1584A072 | W60611 | G03A1680A117 | W60950 | G03A2176A162 | W61283 |
| G03A1408A011 | W60284 | G03A1280A073 | W60612 | G03A1920A118 | W60951 | G03A2176A162 | W61284 |
| G03A1408A011 | W60285 | G03A1280A073 | W60613 | G03A1920A118 | W60952 | G03A2176A162 | W61285 |
| G03A1408A011 | W60286 | G03A1280A073 | W60614 | G03A1920A118 | W60953 | G03A2176A162 | W61286 |
| G03A1408A011 | W60287 | G03A1280A073 | W60615 | G03A1920A118 | W60954 | G03A2176A162 | W61287 |
| G03A1408A011 | W60288 | G03A1280A073 | W60616 | G03A1920A118 | W60955 | G03A2176A162 | W61288 |
| G03A1408A011 | W60289 | G03A1280A073 | W60617 | G03A1920A118 | W60956 | G03A2224A163 | W61289 |
| G03A1408A011 | W60290 | G03A1280A073 | W60618 | G03A1920A118 | W60957 | G03A2224A163 | W61290 |
| G03A1200A012 | W60291 | G03A1296A074 | W60619 | G03A1920A118 | W60958 | G03A2224A163 | W61291 |
| G03A1200A012 | W60292 | G03A1296A074 | W60620 | G03A1920A118 | W60959 | G03A2224A163 | W61292 |
| G03A1200A012 | W60293 | G03A1296A074 | W60621 | G03A1680X119 | W60960 | G03A2224A163 | W61293 |
| G03A1200A012 | W60294 | G03A1296A074 | W60622 | G03A1680X119 | W60961 | G03A2224A163 | W61294 |
| G03A1200B013 | W60296 | G03A1296A074 | W60623 | G03A1680X119 | W60962 | G03A2224A163 | W61295 |
| G03A1200B013 | W60297 | G03A1296A074 | W60624 | G03A1680X119 | W60963 | G03A2224A163 | W61296 |
| G03A1200B013 | W60298 | G03A1296A074 | W60625 | G03A1680X119 | W60964 | G03A2224A163 | W61297 |
| G03A1200B013 | W60299 | G03A1296J075 | W60626 | G03A1680X119 | W60965 | G03A2048A164 | W61298 |
| G03A1200B013 | W60300 | G03A1296J075 | W60627 | G03A1680X119 | W60966 | G03A2048A164 | W61299 |
| G03A1488B014 | W60301 | G03A1296J075 | W60628 | G03A1680X119 | W60967 | G03A2048A164 | W61300 |
| G03A1488B014 | W60302 | G03A1296J075 | W60629 | G03A1680X119 | W60968 | G03A2048A164 | W61301 |
| G03A1488B014 | W60303 | G03A1296J075 | W60630 | G03A1920J120 | W60969 | G03A2048A164 | W61302 |
| G03A1488B014 | W60304 | G03A1296J075 | W60631 | G03A1920J120 | W60970 | G03A2048A164 | W61303 |
| G03A1216A015 | W60305 | G03A1296J075 | W60632 | G03A1920J120 | W60971 | G03A2048A164 | W61304 |
| G03A1216A015 | W60306 | G03A1152B076 | W60633 | G03A1920J120 | W60972 | G03A2048A164 | W61305 |
| G03A1216A015 | W60307 | G03A1152B076 | W60634 | G03A1920J120 | W60973 | G03A2048A164 | W61306 |
| G03A1216A015 | W60308 | G03A1152B076 | W60635 | G03A1920J120 | W60974 | G03A2224I165 | W61308 |
| G03A1216A015 | W60309 | G03A1152B076 | W60636 | G03A1920J120 | W60975 | G03A2224I165 | W61309 |
| G03A1216A015 | W60310 | G03A1152B076 | W60637 | G03A1920J120 | W60976 | G03A2224I165 | W61310 |
| G03A1216A015 | W60311 | G03A1536J077 | W60638 | G03A1696A121 | W60977 | G03A2224I165 | W61311 |
| G03A1216A015 | W60312 | G03A1536J077 | W60639 | G03A1696A121 | W60978 | G03A2224I165 | W61312 |
| G03A1408B016 | W60313 | G03A1216J078 | W60640 | G03A1696A121 | W60979 | G03A2224I165 | W61313 |
| G03A1408B016 | W60314 | G03A1216J078 | W60641 | G03A1696A121 | W60980 | G03A2224I165 | W61314 |
| G03A1408B016 | W60315 | G03A2352A079 | W60642 | G03A1696A121 | W60981 | G03A2224I165 | W61315 |
| G03A1408B016 | W60316 | G03A2352A079 | W60642 | G03A1696A121 | W60982 | G03A2224I165 | W61316 |
| G03A1408B016 | W60317 | G03A2160A080 | W60643 | G03A1696A121 | W60983 | G03A2048J166 | W61317 |
| G03A1408B016 | W60318 | G03A2160A080 | W60644 | G03A1696A121 | W60984 | G03A2048J166 | W61318 |
| G03A1408B016 | W60319 | G03A2160A080 | W60645 | G03A1696A121 | W60985 | G03A2048J166 | W61319 |
| G03A1232A017 | W60320 | G03A2160A080 | W60646 | G03A1936A122 | W60986 | G03A2048J166 | W61320 |
| G03A1232A017 | W60321 | G03A2160A080 | W60647 | G03A1936A122 | W60987 | G03A2048J166 | W61321 |
| G03A1232A017 | W60322 | G03A2160A080 | W60649 | G03A1936A122 | W60988 | G03A2048J166 | W61322 |
| G03A1232A017 | W60323 | G03A2160A080 | W60650 | G03A1936A122 | W60989 | G03A2048J166 | W61323 |
| G03A1232B018 | W60324 | G03A2160A080 | W60651 | G03A1936A122 | W60990 | G03A2048J166 | W61324 |
| G03A1232B018 | W60325 | G03A2160A080 | W60652 | G03A1936A122 | W60991 | G03A2048J166 | W61325 |
| G03A1232B018 | W60326 | G03A2352B081 | W60653 | G03A1936A122 | W60992 | G03A2048J166 | W61326 |
| G03A1232B018 | W60327 | G03A2352B081 | W60654 | G03A1712A123 | W60993 | G03A2208A167 | W61327 |
| G03A1232B018 | W60328 | G03A2352B081 | W60655 | G03A1712A123 | W60994 | G03A2336B168 | W61330 |
| G03A1232B018 | W60329 | G03A2352B081 | W60656 | G03A1712A123 | W60995 | G03A2048K169 | W61331 |
| G03A1504A019 | W60330 | G03A2352B081 | W60657 | G03A1712A123 | W60996 | G03A2048K169 | W61332 |
| G03A1504A019 | W60331 | G03A2352B081 | W60658 | G03A1712A123 | W60997 | G03A2048K169 | W61333 |
| G03A1504A019 | W60332 | G03A2352B081 | W60659 | G03A1712A123 | W60998 | G03A2048K169 | W61334 |
| G03A1504A019 | W60333 | G03A2352B081 | W60660 | G03A1712A123 | W60999 | G03A2048K169 | W61335 |
| G03A1504A019 | W60334 | G03A2352B081 | W60661 | G03A1936B124 | W61000 | G03A2048K169 | W61336 |
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| G03A1040J049 | W60495 | G03A2064A101 | W60829 | G03A1904B144 | W61167 | G03A2192L198 | W61497 |
| G03A1312A050 | W60496 | G03A2064A101 | W60830 | G03A1904B144 | W61168 | G03A2176L199 | W61498 |
| G03A1312A050 | W60497 | G03A2064A101 | W60832 | G03A1776J145 | W61169 | G03A2176L199 | W61499 |
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| G03A1312A050 | W60499 | G03A2064A101 | W60834 | G03A1776J145 | W61171 | G03A2176L199 | W61501 |
| G03A1312A050 | W60500 | G03A2064A101 | W60835 | G03A1776J145 | W61172 | G03A2176L199 | W61502 |
| G03A1312A050 | W60501 | G03A2064A101 | W60836 | G03A1776J145 | W61173 | G03A2176L199 | W61503 |
| G03A1312A050 | W60502 | G03A2064A101 | W60837 | G03A1776J145 | W61174 | G03A2176L199 | W61504 |
| G03A1024A051 | W60503 | G03A1840A102 | W60838 | G03A1776J145 | W61175 | G03A2176L199 | W61505 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| G03A1024A051 | W60504 | G03A1840A102 | W60840 | G03A1776J145 | W61176 | G03A2336C200 | W61506 |
| G03A1024A051 | W60505 | G03A1840A102 | W60841 | G03A1776J145 | W61177 | G03A2336C200 | W61507 |
| G03A1024A051 | W60506 | G03A1840A102 | W60842 | G03A2000Y146 | W61178 | G03A2240D201 | W61508 |
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| G03A1024A051 | W60508 | G03A1840A102 | W60844 | G03A2000Y146 | W61180 | G03A2176M202 | W61510 |
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| G03A1488J052 | W60510 | G03A1584J103 | W60846 | G03A2000Y146 | W61182 | G03A2176M202 | W61512 |
| G03A1488J052 | W60511 | G03A1840B104 | W60847 | G03A2000Y146 | W61183 | G03A2176M202 | W61513 |
| G03A1488J052 | W60512 | G03A1840B104 | W60848 | G03A2000Y146 | W61184 | G03A2176M202 | W61514 |
| G03A1488J052 | W60513 | G03A1840B104 | W60849 | G03A2000Y146 | W61185 | G03A2176M202 | W61515 |
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| G03A1008A053 | W60518 | G03A1600A105 | W60854 | G03A1808J147 | W61190 | G03A1744J205 | W61520 |
| G03A1008A053 | W60519 | G03A1600A105 | W60855 | G03A1808J147 | W61191 | G03A2000L206 | W61521 |
| G03A1008A053 | W60520 | G03A1600A105 | W60856 | G03A1808J147 | W61192 | G03A2000L206 | W61522 |
| G03A1008A053 | W60521 | G03A1600A105 | W60857 | G03A1808J147 | W61193 | G03A2000L206 | W61523 |
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| G03A1552A054 | W60524 | G03A1856A106 | W60860 | G03A1792A148 | W61196 | G03A2000M207 | W61526 |
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| G03A1264A055 | W60529 | G03A1856A106 | W60866 | G03A1792A148 | W61201 | G03A2032B209 | W61531 |
| G03A1264A055 | W60530 | G03A1856A106 | W60867 | G03A1792A148 | W61202 | G03A2000P210 | W61532 |
| G03A1264A055 | W60531 | G03A1856A106 | W60868 | G03A1792A148 | W61203 | G03A2000P210 | W61533 |
| G03A1264A055 | W60532 | G03A1616A107 | W60869 | G03A1792A148 | W61204 | G03A2176N211 | W61534 |
| G03A1264A055 | W60533 | G03A1616A107 | W60871 | G03A2000K149 | W61205 | G03A2176N211 | W61535 |
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| G03A1264A055 | W60535 | G03A1616A107 | W60873 | G03A2000K149 | W61207 | G03A2176N211 | W61537 |
| G03A1552X056 | W60536 | G03A1616A107 | W60874 | G03A2000K149 | W61208 | G03A2176N211 | W61538 |
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| G03A1552X056 | W60538 | G03A1616A107 | W60876 | G03A2000K149 | W61210 | G03A2240E212 | W61540 |
| G03A1552X056 | W60539 | G03A1616A107 | W60877 | G03A2000K149 | W61211 | G03A2240E212 | W61541 |
| G03A1552X056 | W60540 | G03A1616A107 | W60878 | | | | |

## 8.3 Testing Log

All processes were run in a controlled amplitude / controlled phase method (CA/CP).

### 8.3.1 Amplitude Compensation

Numerous methods for compensation for spherical divergence and Earth attenuation were tested. These included time-function gain correction (linear and squared), exponential gain, and geometric spreading compensation factor. These methods were tested on shot and near trace gathers for both temporal and spatial validity.

The geometric spreading compensation correction referenced to water-bottom time was used in production.

### *8.3.2 Low Cut Filter*

Filter panels (narrow frequency bands) were examined of a few shot gathers on the test lines to determine if any low cut filtering was necessary.

A low cut frequency filter of 3Hz with an 18dB/Oct slope using a zero phase operator was used in production. This low cut filter removes the dominant low frequency noise.

### *8.3.3 Swell Noise Attenuation*

A set of bandpass filter panels (increasing frequency pass band) was run on a few test line shots showing obvious swell noise. This enabled the frequency range of in which to apply SWATT to be determined. Initially SWATT was tested in the shot domain with difference displays showing exactly what this process was removing. SWATT was also tested in the offset domain and receiver domain - the latter producing the best results for the data. Apart from the application domain, threshold v time values and offset v application time were also tested.

SWATT was applied in the receiver domain with an amplitude threshold of 400%, and when it was preceded by the low cut filter, removed all traces of acquisition swell noise. The SWATT application was restricted to frequencies of 0-10HZ.

### *8.3.4 Quadrature Dephase*

A quadrature phase source signature obtained from ESSO was applied to both a selection of shot gathers and the near trace gather for each of the test lines via Deterministic Signature Deconvolution.

The client chose in preference to applying the quadrature phase wavelet to the data.

### *8.3.5 K-Filter*

The K-filter was tested on selected test line shot gathers using three main variations. Firstly the K-filter was applied on uncorrected gathers, then on NMO corrected gathers and finally on NMO corrected gathers with every alternate trace dropped. FK Spectra and shot gathers before and after were used to compare the methods. NMO correction was preferred on the data prior to the application of the K-filter. The resulting F-K spectrums showed that there was significant aliasing when the traces were dropped. As a result the limits of the K-filter were set to the wavenumber range of the decimated gather spectrum to remove this aliased noise prior to data reduction through trace decimation.

For production the K-filter was applied to the data on NMO corrected shot gathers.

#### *8.3.6 Tau-p Linear Noise Removal (shot domain)*

Transformation of the data from shot gathers to radon p-traces enabled the removal of linear noise via muting in the Tau-p domain. The testing of the process involved the display of shot gathers, Tau-p transforms and resulting stack responses of the test lines to establish the best result for linear noise removal. Apart from determining the appropriate radon transform parameters the only significant variable is the severity of the mute applied to the p-trace gathers. This mute was varied according to the water bottom time.

Overall a significant amount of linear noise was removed with the application of a shot ordered Tau-p domain mute on the production data.

#### *8.3.7 Tau-p Deconvolution*

Testing of deconvolution in the Tau-p domain consisted of radon transformed test line shot gathers being passed through a series on deconvolution routines where the parameters of gap width and operator length were varied systematically. Both gather (in T-X and Tau-p domain) and stack displays before and after Tau-p deconvolution was produced. Being that the client did not want to alter the amplitude and phase of the data the favoured result was the long gap operator which attenuated water bottom derived multiples. As an additional step the gathers were extrapolated to allow attenuation of any shallow multiples where the primary water bottom exists between the nearest trace and the zero offset.

Consequently water bottom targeted Tau-p deconvolution was applied to the production data to work in assistance to any future multiple attenuation processes.

#### *8.3.8 Tau-p Linear Noise Removal (receiver domain)*

Linear noise removal in the Tau-p domain was revisited due to failure of the shot domain Tau-p filter to remove noise that occurred when the acquisition direction changed from an increasing shot point range to a decreasing shot point range.

This time the testing of the process involved the display of receiver gathers, Tau-p transforms and resulting stack responses of the test lines to establish the best result for linear noise removal. To prevent data aliasing in the receiver domain the testing also included a 3:1 interpolation of the shot gathers resulting in 300% increase in the receiver gather fold. It was found that the same mute applied in the shot domain Tau-p filter could be used here in the receiver domain Tau-p filter.

Receiver domain Tau-p linear noise filtering was applied to all data regardless of acquisition direction. The 3:1 shot interpolation was also included in the production flow.

#### *8.3.9 High Resolution Radon Multiple Attenuation*

By maintaining the interpolated shot data after receiver domain processing the resulting CMP fold was 200 rather than 67. The improved CMP domain sampling improves the parabolic radon transform separation of primary and multiple energy due to reduced aliasing. Applying radon demultiple to 200 fold CMP gathers was also less harmful to primary reflectors. Consequently testing of the radon multiple attenuation involved producing CMP gather, Tau-p transform and stack displays of both the standard radon and the high resolution radon demultiple on both 200 fold and the original 67 fold data of the test lines. These were compared to the equivalent non-demultiple displays to assess the best option.

In the end the selection for production was to apply high resolution radon multiple attenuation on 200 fold CMP gather data.

#### *8.3.10 Hybrid Kirchhoff Prestack Depth Migration – Final Model*

Despite the untried and unproven nature of the hybrid Kirchhoff prestack depth migration (KPSDM) the only testing issue encountered in this entire stage of processing was to determine the most suitable way to create the final model to use in the full production migration.

At this stage of the processing the initial model had been create, targeted velocity lines had been migrated and a full set of prestack depth migrated velocity analyses has been produced and subsequent time-velocity pairs were picked. The final model was created the same way as the initial model with the merge of a detailed water layer and a smoothed 3D stacking velocity field.

The only testing variation was how to smooth the picked migrated velocities. Several smoothing versions were tried from a single horizontal fixed radius of different sizes, a radius parallel to the water bottom, an inline oriented elliptical radius and even a residual difference smooth plus several combinations of more that one smoothing option. For each model, two targeted lines were prestack depth migrated and the results were stacked and displayed for comparison.

In the end the simplest model was chosen which involved a fixed horizontal radial smooth of 5km merged with a detailed water layer. This model was used in the full production hybrid KPSDM.

#### 8.3.11 High Dense Velocity Analysis

Testing of the high dense velocity analysis (HDVA) involved firstly the CMP interval at which to create the analyses and secondly the best parameters that enabled the autopicker to produce acceptable velocity picks without the need for human intervention. The most suitable autopicker parameters were derived from trial and error on several test inlines. Once they were established then the HDVA was performed on the test inlines at CMP intervals of 100m x 100m, 50m x 50m and 25m x 25m.

Final production HDVA interval was set at 100m x 100m CMP intervals.

#### 8.3.12 Time Variant Filter

Zero phase octave bandpass filter display panels were examined to determine the frequency ranges of signal at various times. This was performed on select stack data inlines. From these displays a time variant zero phase bandpass filter was derived for the production final stack volume.

#### 8.3.13 Time Variant Scaling

Visual displays of various methods of scaling (AGC, RMS gain, exponential gain, linear gain, raac scaling, time function scaling) were applied to the stack section of the test inlines. These were used to determine the final display gain to be applied on the full offset stacks.

The final deliverable stacked volume was applied with a two pass cascaded AGC consisting of a first pass 1000ms gate AGC (2000 RMS) followed by a 400ms gate AGC (1700 RMS residual amplification)

### 8.4 Signatures/Wavelets

Time coefficients for the Quadrature Wavelet filter, derived from the far field signature supplied by ESSO are as follows:

```
*TIME_DOMAIN
   ZERO_INDEX = 201
   SCALE_FACTOR = 1
   WV_SAMPLINT = 2
   SCALING = 'UNNORMALISED'

  <    COEFFS
   -7.33962e-10
     0.00122788
    -0.00900378
     0.00387954
     0.00507363
    -0.00334829
```

0.000670034
-0.00896417
-0.00520078
0.00721991
-0.00857131
-0.000165913
-0.0124104
-0.0102976
0.00040286
-0.00595522
-0.0102263
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  1.1687e-10
```

### 8.5 Grid Definition

The following is the parameters for the 6.25m X 25m survey grid.

**Master Grid Boundary** 6.25m x 12.5m

| X-coordinates | Y-coordinates | Inline | Crossline |
|---|---|---|---|
| 618570.84 | 5754100.39 | 2501 | 808 |
| 658129.52 | 5741249.28 | 9156 | 808 |
| 605099.86 | 5712633.62 | 2501 | 2552 |
| 644658.54 | 5699782.51 | 9156 | 2552 |

**Processing Grid Boundary** 6.25m x 12.5m

| X-coordinates | Y-coordinates | Inline | Crossline |
|---|---|---|---|
| 617360.02 | 5749604.52 | 2539 | 994 |
| 656354.00 | 5736936.86 | 9099 | 994 |
| 606592.51 | 5716459.64 | 2539 | 2388 |
| 645586.49 | 5703791.98 | 9099 | 2388 |

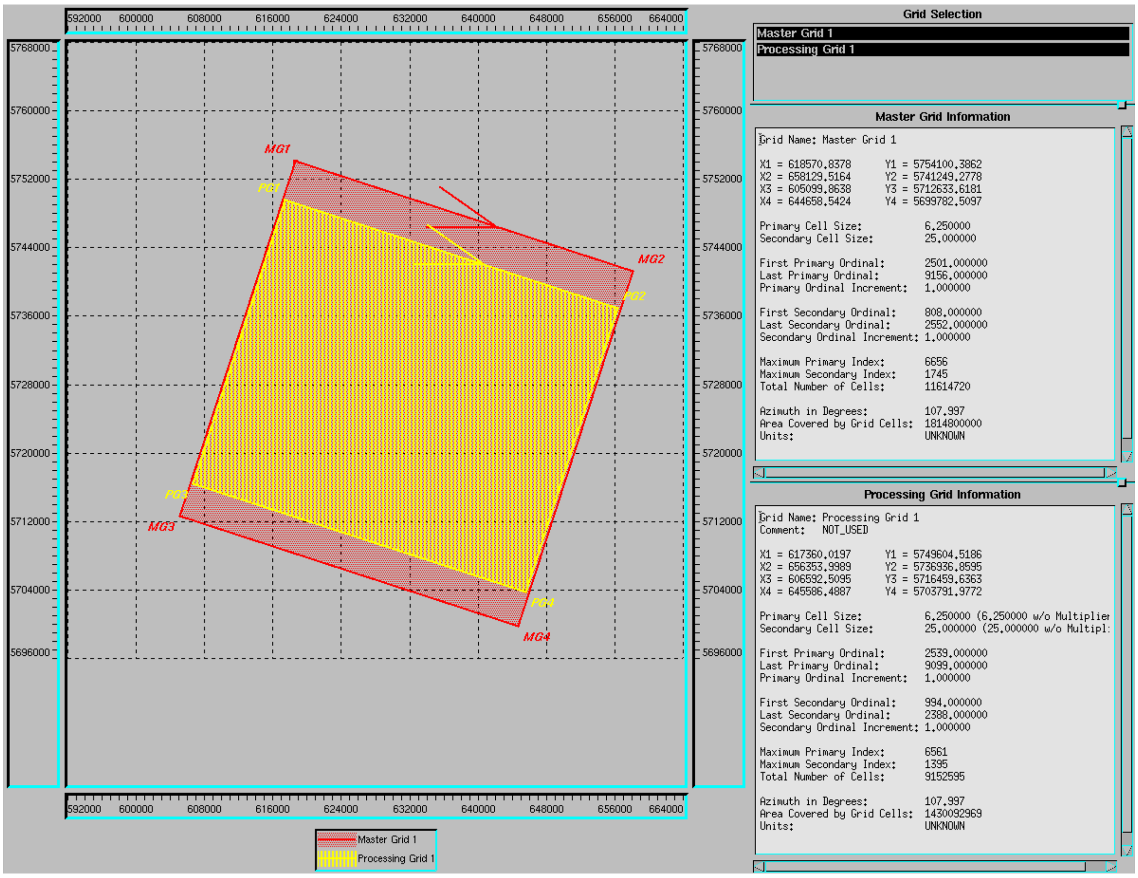


**Figure 2. 6.25m X 25m 3D grid definition.**

The following is the parameters for the 12.5m X 25m survey grid.

**Master Grid Boundary** 12.5m x 12.5m

| X-coordinates | Y-coordinates | Inline | Crossline |
|---|---|---|---|
| 616254.95 | 5755063.02 | 2301 | 800 |
| 660230.17 | 5740777.14 | 6000 | 800 |
| 602660.39 | 5713215.82 | 2301 | 2560 |
| 646635.61 | 5698929.95 | 6000 | 2560 |

**Processing Grid Boundary** 12.5m x 12.5m

| X-coordinates | Y-coordinates | Inline | Crossline |
|---|---|---|---|
| 617360.02 | 5749604.52 | 2520 | 994 |
| 656354.00 | 5736936.86 | 5800 | 994 |
| 606592.51 | 5716459.64 | 2520 | 2388 |
| 645586.49 | 5703791.98 | 5800 | 2388 |

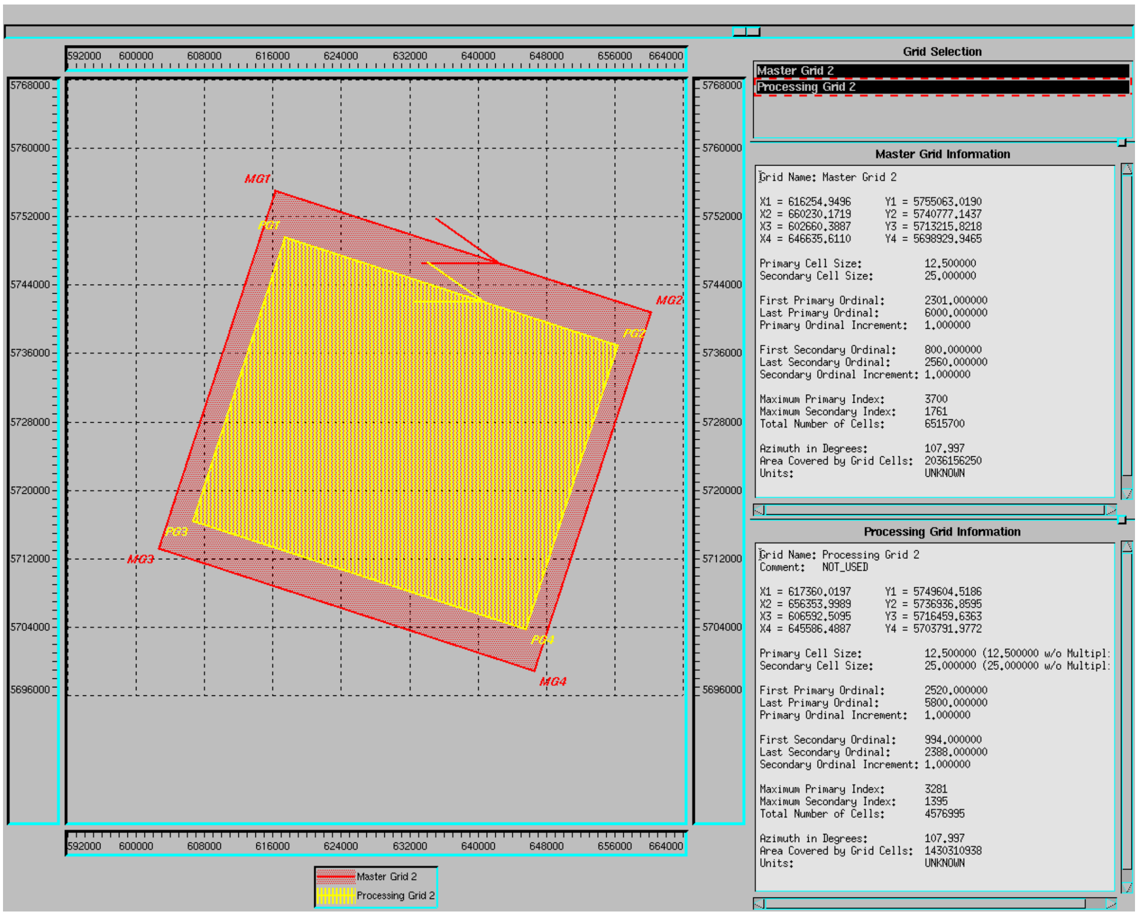


**Figure 3. 12.5m X 25m 3D grid definition.**

## 8.6 Archive Datasets

### 8.6.1 Stack Datasets

The following post-stack archive products were produced for ESSO:

| Tape Number | Media / Format | Description | Data Range |
|---|---|---|---|
| **POST STACK TIME MIGRATION (step 5.14)** | | | |
| Q01124 | 3590B SEGY | Filter/Scale Migrated Stack | 995-1585 |
| Q01125 | 3590B SEGY | Filter/Scale Migrated Stack | 1586-2007 |
| Q01126 | 3590B SEGY | Filter/Scale Migrated Stack | 2008-2382 |
| **PRESTACK DEPTH MIGRATION (step 6.15)** | | | |
| Q02613 | 3590B SEGY | Filter/Scale Migrated Stack | 994-1567 |
| Q02614 | 3590B SEGY | Filter/Scale Migrated Stack | 1568-1633 |
| Q02612 | 3590B SEGY | Filter/Scale Migrated Stack | 1634-2050 |
| Q02470 | 3590B SEGY | Filter/Scale Migrated Stack | 2051-2388 |
| DL0525 | DLT40 SEGY | Filter/Scale Migrated Stack | 994-2388 |
| Q02723 | 3590B SEGY<br>994-1478 | Filter/Scale Migrated Stack (Depth Converted) | |
| Q02724 | 3590B SEGY<br>1479-1848 | Filter/Scale Migrated Stack (Depth Converted) | |
| Q02725 | 3590B SEGY<br>1849-2197 | Filter/Scale Migrated Stack (Depth Converted) | |
| Q02726 | 3590B SEGY<br>2198-2388 | Filter/Scale Migrated Stack (Depth Converted) | |
| Q03581 | 3590B SEGY | Raw Migrated Stack | 994-1567 |
| Q03582 | 3590B SEGY | Raw Migrated Stack | 1568-1984 |
| Q03583 | 3590B SEGY | Raw Migrated Stack | 1985-2388 |

The following post-stack archive products were produced for BHP:

| Tape Number | Media / Format | Description | Data Range |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **POST STACK TIME MIGRATION (step 5.14)** | | | |
| Q02217 | 3590B SEGY | Filter/Scale Migrated Stack | 995-1675 |
| Q02218 | 3590B SEGY | Filter/Scale Migrated Stack | 1676-1830 |
| **PRE STACK TIME MIGRATION (step 6.15)** | | | |
| Q02615 | 3590B SEGY | Filter/Scale Migrated Stack | 994-1674 |
| Q02616 | 3590B SEGY | Filter/Scale Migrated Stack | 1675-1830 |

### *8.6.2 Velocity Datasets*

The following velocity archive products were produced for ESSO:

| Tape Number | Media / Format | Description | Data Range |
|---|---|---|---|
| **FIRST PASS VELOCITIES** | | | |
| Q02733 | 3590B SEGY | Seismic Velocity Traces | 996-2388 (inc 4) |
| X00905 | 8MM SEGY | Seismic Velocity Traces | 996-2388 (inc 4) |
| **FINAL MIGRATION MODEL** | | | |
| Q02732 | 3590B SEGY | Seismic Velocity Traces | 996-2388 (inc 4) |
| X00906 | 8MM SEGY | Seismic Velocity Traces | 996-2388 (inc 4) |
| **HDVA VELOCITIES** | | | |
| Q02731 | 3590B SEGY | Seismic Velocity Traces | 996-2388 (inc 4) |
| X00907 | 8MM SEGY | Seismic Velocity Traces | 996-2388 (inc 4) |
| **ALL VELOCITIES (2 copies)** | | | |
| CD1/2 | CD-ROM Western Format | First Pass Velocity Picks | 1008-2328 (inc 40) |
| CD1/2 | CD-ROM Western Format | DMO Velocity Picks | 1008-2328 (inc 40) |
| CD1/2 | CD-ROM Western Format | Targeted KPSDM Velocity Picks | 1008-2368 (inc 40) |
| CD1/2 | CD-ROM Western Format | HDVA Velocity Picks | 1000-2380 (inc 4) |

### *8.6.3 Gather Datasets*

The following prestack gather archive products were produced for ESSO:

| Tape Number | Media / Format | Description | Data Range |
|---|---|---|---|

| PRESTACK DEPTH MIGRATION (After step 6.6.8) | | | |
|---|---|---|---|
| Q03166 | 3590B SEGY | KPSDM CMP Gathers | 994-1009 |
| Q03167 | 3590B SEGY | KPSDM CMP Gathers | 1010-1025 |
| Q03168 | 3590B SEGY | KPSDM CMP Gathers | 1026-1041 |
| Q03169 | 3590B SEGY | KPSDM CMP Gathers | 1042-1057 |
| Q03170 | 3590B SEGY | KPSDM CMP Gathers | 1058-1073 |
| Q03171 | 3590B SEGY | KPSDM CMP Gathers | 1074-1089 |
| Q03172 | 3590B SEGY | KPSDM CMP Gathers | 1090-1105 |
| Q03173 | 3590B SEGY | KPSDM CMP Gathers | 1106-1121 |
| Q03174 | 3590B SEGY | KPSDM CMP Gathers | 1122-1137 |
| Q03175 | 3590B SEGY | KPSDM CMP Gathers | 1138-1153 |
| Q03176 | 3590B SEGY | KPSDM CMP Gathers | 1154-1169 |
| Q03177 | 3590B SEGY | KPSDM CMP Gathers | 1170-1185 |
| Q03178 | 3590B SEGY | KPSDM CMP Gathers | 1186-1201 |
| Q03179 | 3590B SEGY | KPSDM CMP Gathers | 1202-1217 |
| Q03180 | 3590B SEGY | KPSDM CMP Gathers | 1218-1233 |
| Q03181 | 3590B SEGY | KPSDM CMP Gathers | 1234-1249 |
| Q03182 | 3590B SEGY | KPSDM CMP Gathers | 1250-1265 |
| Q03183 | 3590B SEGY | KPSDM CMP Gathers | 1266-1281 |
| Q03184 | 3590B SEGY | KPSDM CMP Gathers | 1282-1297 |
| Q03185 | 3590B SEGY | KPSDM CMP Gathers | 1298-1313 |
| Q01814 | 3590B SEGY | KPSDM CMP Gathers | 1314-1329 |
| Q01815 | 3590B SEGY | KPSDM CMP Gathers | 1330-1345 |
| Q01816 | 3590B SEGY | KPSDM CMP Gathers | 1346-1361 |
| Q01817 | 3590B SEGY | KPSDM CMP Gathers | 1362-1377 |
| Q01818 | 3590B SEGY | KPSDM CMP Gathers | 1378-1393 |
| Q01819 | 3590B SEGY | KPSDM CMP Gathers | 1394-1409 |
| Q01820 | 3590B SEGY | KPSDM CMP Gathers | 1410-1425 |
| Q01821 | 3590B SEGY | KPSDM CMP Gathers | 1426-1441 |
| Q01822 | 3590B SEGY | KPSDM CMP Gathers | 1442-1457 |
| Q01823 | 3590B SEGY | KPSDM CMP Gathers | 1458-1473 |
| Q01824 | 3590B SEGY | KPSDM CMP Gathers | 1474-1489 |
| Q01825 | 3590B SEGY | KPSDM CMP Gathers | 1490-1505 |
| Q01826 | 3590B SEGY | KPSDM CMP Gathers | 1506-1521 |
| Q01827 | 3590B SEGY | KPSDM CMP Gathers | 1522-1537 |

| | | | |
|---|---|---|---|
| Q01828 | 3590B SEGY | KPSDM CMP Gathers | 1538-1553 |
| Q01829 | 3590B SEGY | KPSDM CMP Gathers | 1554-1565 |
| Q01830 | 3590B SEGY | KPSDM CMP Gathers | 1566-1577 |
| Q01831 | 3590B SEGY | KPSDM CMP Gathers | 1578-1589 |
| Q01832 | 3590B SEGY | KPSDM CMP Gathers | 1590-1601 |
| Q01833 | 3590B SEGY | KPSDM CMP Gathers | 1602-1613 |
| Q01834 | 3590B SEGY | KPSDM CMP Gathers | 1614-1625 |
| Q01835 | 3590B SEGY | KPSDM CMP Gathers | 1626-1637 |
| Q01836 | 3590B SEGY | KPSDM CMP Gathers | 1638-1649 |
| Q01837 | 3590B SEGY | KPSDM CMP Gathers | 1650-1661 |
| Q01838 | 3590B SEGY | KPSDM CMP Gathers | 1662-1673 |
| Q01839 | 3590B SEGY | KPSDM CMP Gathers | 1674-1685 |
| Q01840 | 3590B SEGY | KPSDM CMP Gathers | 1686-1697 |
| Q01841 | 3590B SEGY | KPSDM CMP Gathers | 1698-1709 |
| Q01842 | 3590B SEGY | KPSDM CMP Gathers | 1710-1721 |
| Q01843 | 3590B SEGY | KPSDM CMP Gathers | 1722-1733 |
| Q01844 | 3590B SEGY | KPSDM CMP Gathers | 1734-1745 |
| Q01845 | 3590B SEGY | KPSDM CMP Gathers | 1746-1757 |
| Q01846 | 3590B SEGY | KPSDM CMP Gathers | 1758-1769 |
| Q01847 | 3590B SEGY | KPSDM CMP Gathers | 1770-1781 |
| Q01848 | 3590B SEGY | KPSDM CMP Gathers | 1782-1793 |
| Q01849 | 3590B SEGY | KPSDM CMP Gathers | 1794-1805 |
| Q01850 | 3590B SEGY | KPSDM CMP Gathers | 1806-1817 |
| Q01851 | 3590B SEGY | KPSDM CMP Gathers | 1818-1829 |
| Q01852 | 3590B SEGY | KPSDM CMP Gathers | 1830-1841 |
| Q01853 | 3590B SEGY | KPSDM CMP Gathers | 1842-1853 |
| Q01854 | 3590B SEGY | KPSDM CMP Gathers | 1854-1865 |
| Q01855 | 3590B SEGY | KPSDM CMP Gathers | 1866-1877 |
| Q01856 | 3590B SEGY | KPSDM CMP Gathers | 1878-1889 |
| Q01857 | 3590B SEGY | KPSDM CMP Gathers | 1890-1901 |
| Q01858 | 3590B SEGY | KPSDM CMP Gathers | 1902-1913 |
| Q01859 | 3590B SEGY | KPSDM CMP Gathers | 1914-1925 |
| Q01860 | 3590B SEGY | KPSDM CMP Gathers | 1926-1937 |
| Q01861 | 3590B SEGY | KPSDM CMP Gathers | 1938-1949 |
| Q01862 | 3590B SEGY | KPSDM CMP Gathers | 1950-1961 |

| | | | |
|---|---|---|---|
| Q01863 | 3590B SEGY | KPSDM CMP Gathers | 1962-1973 |
| Q01864 | 3590B SEGY | KPSDM CMP Gathers | 1974-1985 |
| Q01865 | 3590B SEGY | KPSDM CMP Gathers | 1986-1997 |
| Q01866 | 3590B SEGY | KPSDM CMP Gathers | 1998-2009 |
| Q01867 | 3590B SEGY | KPSDM CMP Gathers | 2010-2021 |
| Q01868 | 3590B SEGY | KPSDM CMP Gathers | 2022-2033 |
| Q01869 | 3590B SEGY | KPSDM CMP Gathers | 2034-2045 |
| Q01870 | 3590B SEGY | KPSDM CMP Gathers | 2046-2057 |
| Q01871 | 3590B SEGY | KPSDM CMP Gathers | 2058-2069 |
| Q01872 | 3590B SEGY | KPSDM CMP Gathers | 2070-2081 |
| Q01873 | 3590B SEGY | KPSDM CMP Gathers | 2082-2093 |
| Q01874 | 3590B SEGY | KPSDM CMP Gathers | 2094-2105 |
| Q01875 | 3590B SEGY | KPSDM CMP Gathers | 2106-2117 |
| Q01876 | 3590B SEGY | KPSDM CMP Gathers | 2118-2139 |
| Q01877 | 3590B SEGY | KPSDM CMP Gathers | 2130-2141 |
| Q01878 | 3590B SEGY | KPSDM CMP Gathers | 2142-2153 |
| Q01879 | 3590B SEGY | KPSDM CMP Gathers | 2154-2165 |
| Q01880 | 3590B SEGY | KPSDM CMP Gathers | 2166-2177 |
| Q01881 | 3590B SEGY | KPSDM CMP Gathers | 2178-2189 |
| Q01882 | 3590B SEGY | KPSDM CMP Gathers | 2190-2201 |
| Q01883 | 3590B SEGY | KPSDM CMP Gathers | 2202-2213 |
| Q01884 | 3590B SEGY | KPSDM CMP Gathers | 2214-2225 |
| Q01885 | 3590B SEGY | KPSDM CMP Gathers | 2226-2237 |
| Q01886 | 3590B SEGY | KPSDM CMP Gathers | 2238-2259 |
| Q01887 | 3590B SEGY | KPSDM CMP Gathers | 2250-2261 |
| Q01888 | 3590B SEGY | KPSDM CMP Gathers | 2262-2273 |
| Q01889 | 3590B SEGY | KPSDM CMP Gathers | 2274-2285 |
| Q01890 | 3590B SEGY | KPSDM CMP Gathers | 2286-2297 |
| Q01891 | 3590B SEGY | KPSDM CMP Gathers | 2298-2309 |
| Q01892 | 3590B SEGY | KPSDM CMP Gathers | 2310-2321 |
| Q01893 | 3590B SEGY | KPSDM CMP Gathers | 2322-2333 |
| Q01894 | 3590B SEGY | KPSDM CMP Gathers | 2334-2345 |
| Q01895 | 3590B SEGY | KPSDM CMP Gathers | 2346-2357 |
| Q01896 | 3590B SEGY | KPSDM CMP Gathers | 2358-2379 |
| Q01897 | 3590B SEGY | KPSDM CMP Gathers | 2370-2381 |

| | | | |
|---|---|---|---|
| Q01898 | 3590B SEGY | KPSDM CMP Gathers | 2382-2388 |
| **PRE-MIGRATION (After step 6.5)** | | | |
| Q03186 | 3590B SEGY | Pre-KPSDM CMP Gathers | 994-1009 |
| Q03187 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1010-1025 |
| Q03188 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1026-1041 |
| Q03189 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1042-1057 |
| Q03190 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1058-1073 |
| Q03191 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1074-1089 |
| Q03192 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1090-1105 |
| Q03193 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1106-1121 |
| Q03194 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1122-1137 |
| Q03195 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1138-1153 |
| Q03196 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1154-1169 |
| Q03197 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1170-1185 |
| Q03198 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1186-1201 |
| Q03199 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1202-1217 |
| Q03200 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1218-1233 |
| Q03201 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1234-1249 |
| Q03202 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1250-1265 |
| Q03203 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1266-1281 |
| Q03204 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1282-1297 |
| Q03205 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1298-1313 |
| Q03206 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1314-1329 |
| Q03207 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1330-1345 |
| Q03208 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1346-1361 |
| Q03209 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1362-1377 |
| Q03210 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1378-1393 |
| Q03211 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1394-1409 |
| Q03212 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1410-1425 |
| Q03213 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1426-1441 |
| Q03214 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1442-1457 |
| Q03215 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1458-1473 |
| Q03216 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1474-1489 |
| Q03217 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1490-1505 |
| Q03218 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1506-1521 |

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|---|---|---|---|
| Q03219 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1522-1537 |
| Q03220 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1538-1553 |
| Q03221 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1554-1565 |
| Q03222 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1566-1577 |
| Q03223 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1578-1589 |
| Q03224 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1590-1601 |
| Q03225 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1602-1613 |
| Q03226 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1614-1625 |
| Q03227 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1626-1637 |
| Q03228 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1638-1649 |
| Q03229 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1650-1661 |
| Q03230 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1662-1673 |
| Q03231 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1674-1685 |
| Q03232 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1686-1697 |
| Q03233 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1698-1709 |
| Q03234 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1710-1721 |
| Q03235 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1722-1733 |
| Q03236 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1734-1745 |
| Q03237 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1746-1757 |
| Q03238 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1758-1769 |
| Q03239 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1770-1781 |
| Q03240 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1782-1793 |
| Q03241 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1794-1805 |
| Q03242 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1806-1817 |
| Q03243 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1818-1829 |
| Q03244 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1830-1841 |
| Q03245 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1842-1853 |
| Q03246 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1854-1865 |
| Q03247 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1866-1877 |
| Q03248 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1878-1889 |
| Q03249 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1890-1901 |
| Q03250 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1902-1913 |
| Q03251 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1914-1925 |
| Q03252 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1926-1937 |
| Q03253 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1938-1949 |

| | | | |
|---|---|---|---|
| Q03254 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1950-1961 |
| Q03255 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1962-1973 |
| Q03256 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1974-1985 |
| Q03257 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1986-1997 |
| Q03258 | 3590B SEGY | Pre-KPSDM CMP Gathers | 1998-2009 |
| Q03259 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2010-2021 |
| Q03260 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2022-2033 |
| Q03261 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2034-2045 |
| Q03262 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2046-2057 |
| Q03263 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2058-2069 |
| Q03264 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2070-2081 |
| Q03265 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2082-2093 |
| Q03266 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2094-2105 |
| Q03267 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2106-2117 |
| Q03268 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2118-2139 |
| Q03269 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2130-2141 |
| Q03270 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2142-2153 |
| Q03271 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2154-2165 |
| Q03272 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2166-2177 |
| Q03273 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2178-2189 |
| Q03274 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2190-2201 |
| Q03275 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2202-2213 |
| Q03276 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2214-2225 |
| Q03277 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2226-2237 |
| Q03278 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2238-2259 |
| Q03279 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2250-2261 |
| Q03280 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2262-2273 |
| Q03281 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2274-2285 |
| Q03282 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2286-2297 |
| Q03283 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2298-2309 |
| Q03284 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2310-2321 |
| Q03285 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2322-2333 |
| Q03286 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2334-2345 |
| Q03287 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2346-2357 |
| Q03288 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2358-2379 |

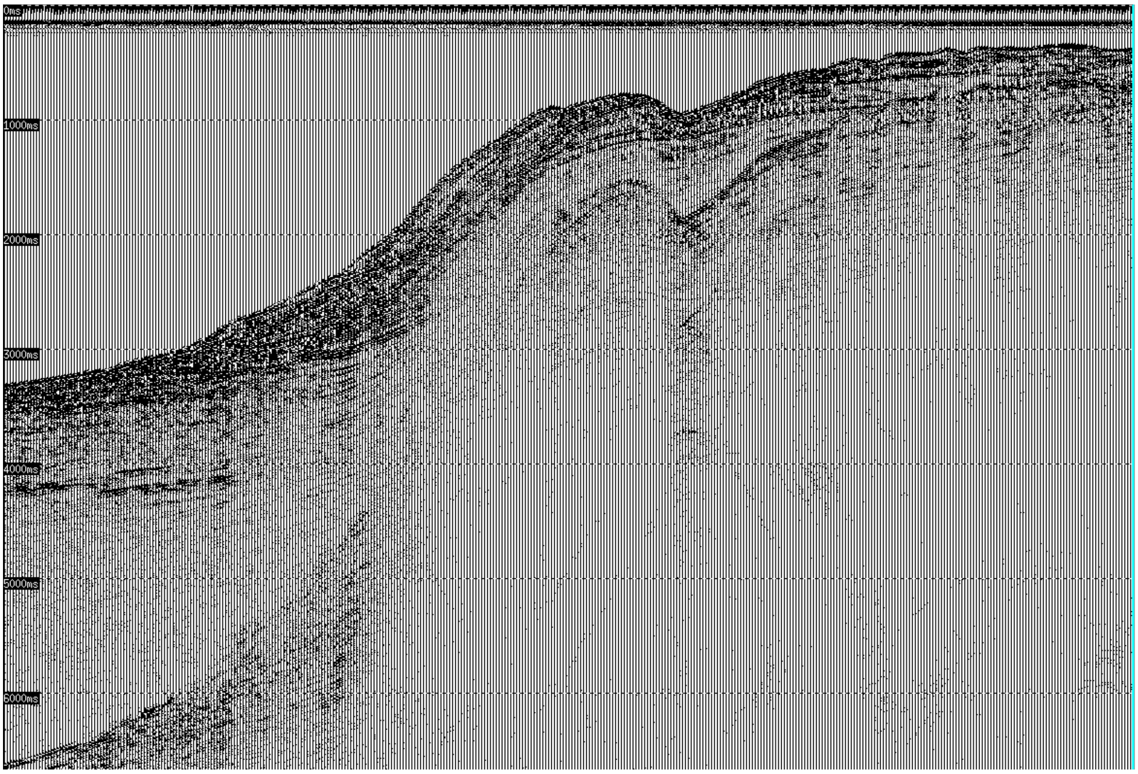
| | | | |
|---|---|---|---|
| Q03289 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2370-2381 |
| Q03290 | 3590B SEGY | Pre-KPSDM CMP Gathers | 2382-2388 |

### *8.6.4 Other Datasets*

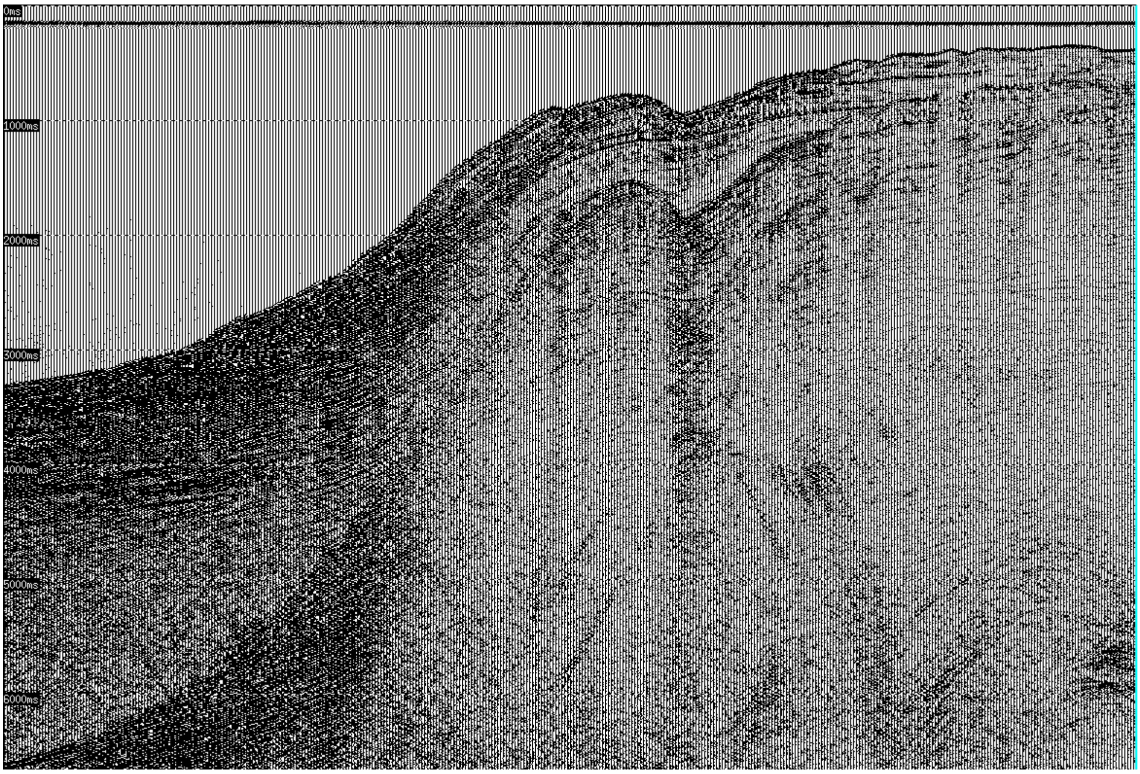
The following additional archive products were produced for ESSO:

| Tape Number | Media / Format | Description | Data Range |
|---|---|---|---|
| **POST STACK CMP BIN CENTRES** | | | |
| Q02730 | 3590B Ukooa P190 | Lat/Long of Stack CMP bins | 994-2388 |

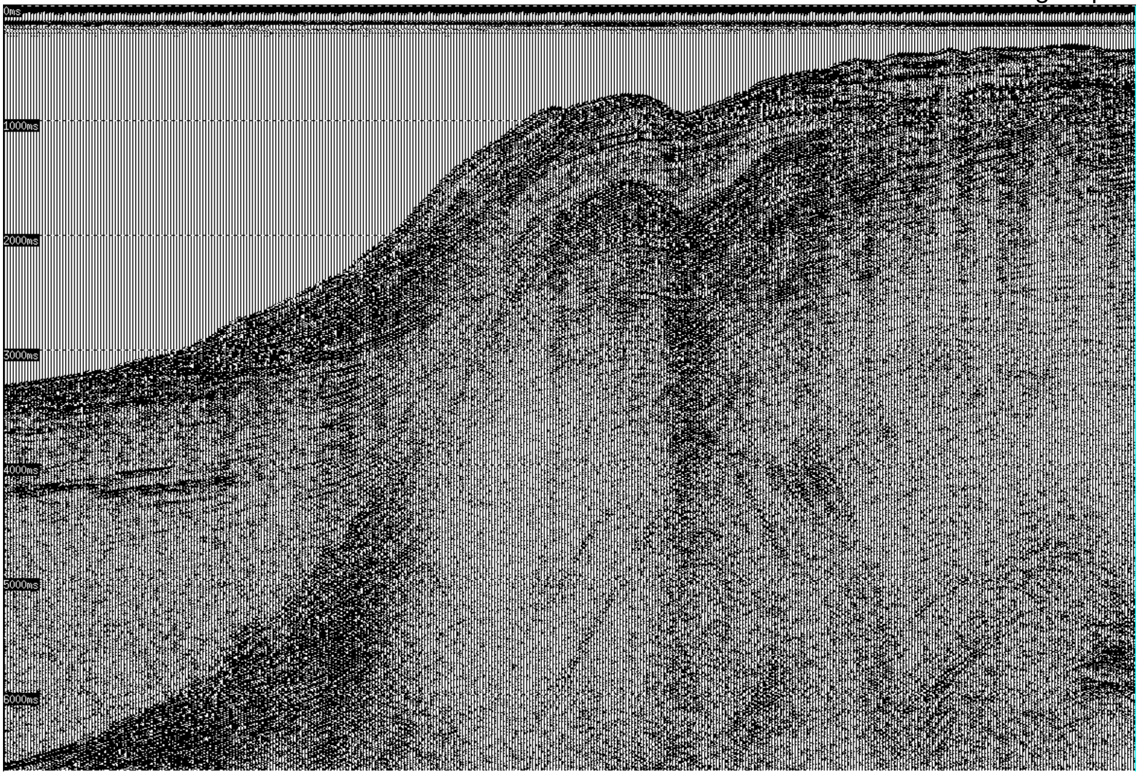
## *9.0Enclosures*



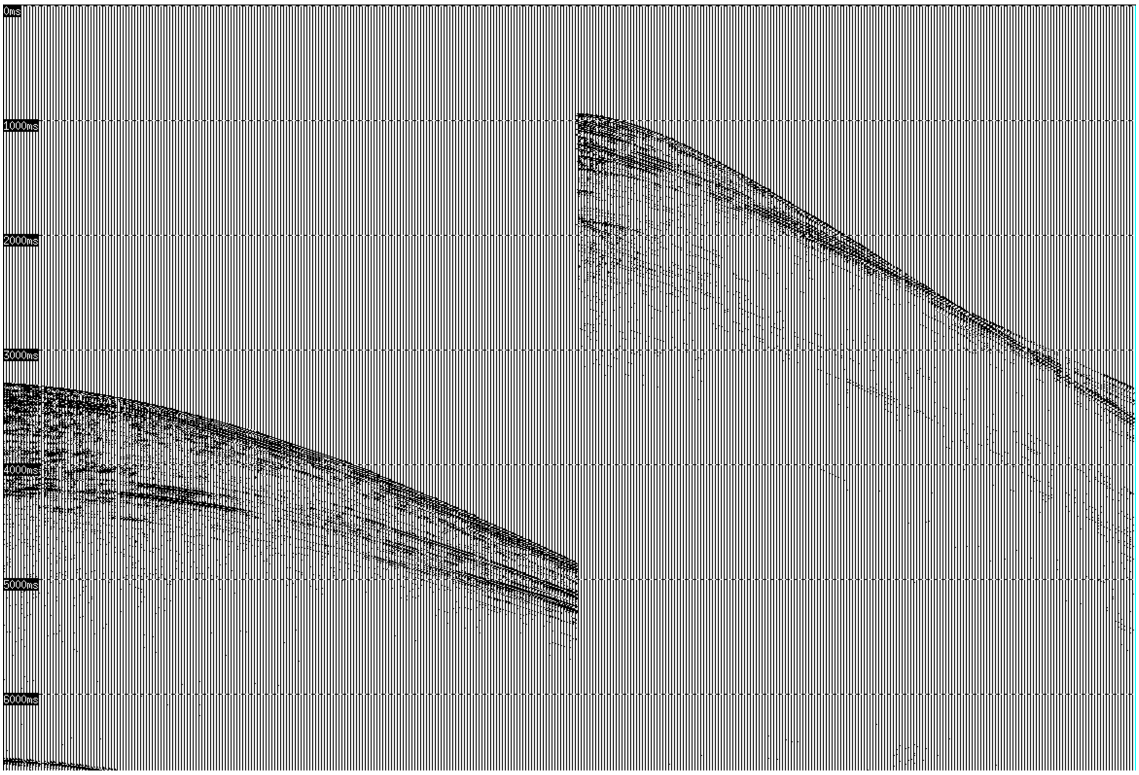

**Enclosure 1: Near trace gather – linear time gain applied.**



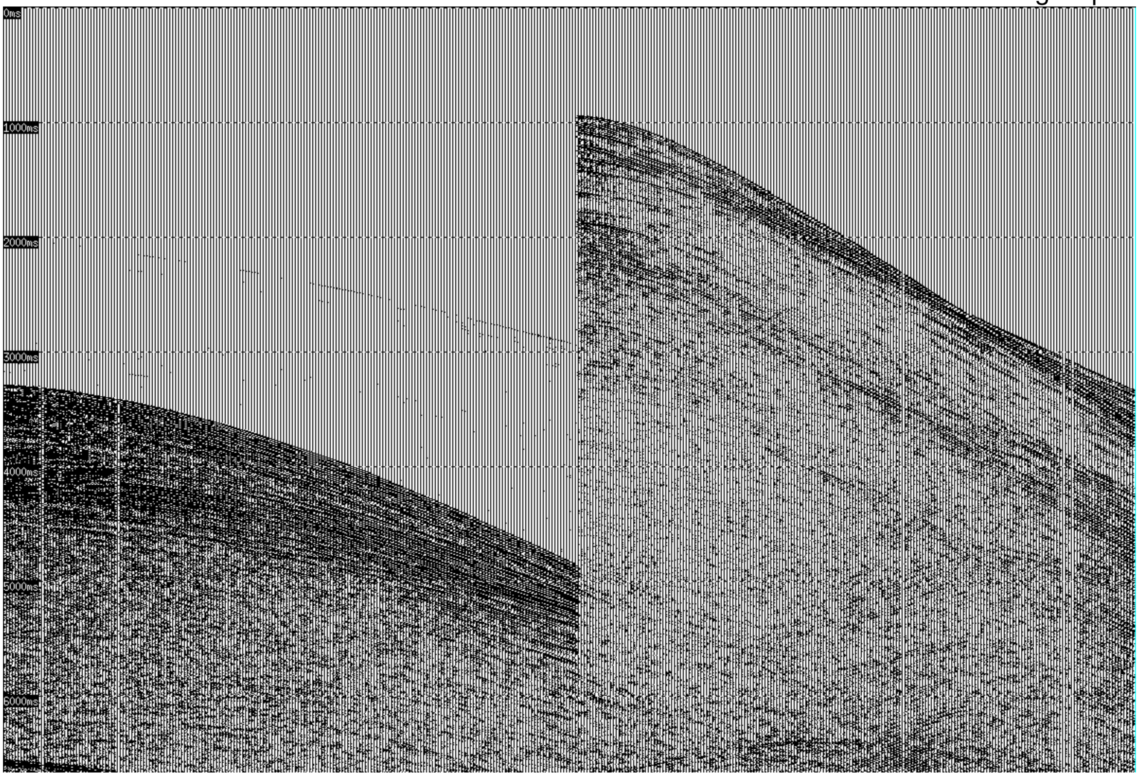

**Enclosure 2: Near trace gather – time squared gain applied.**



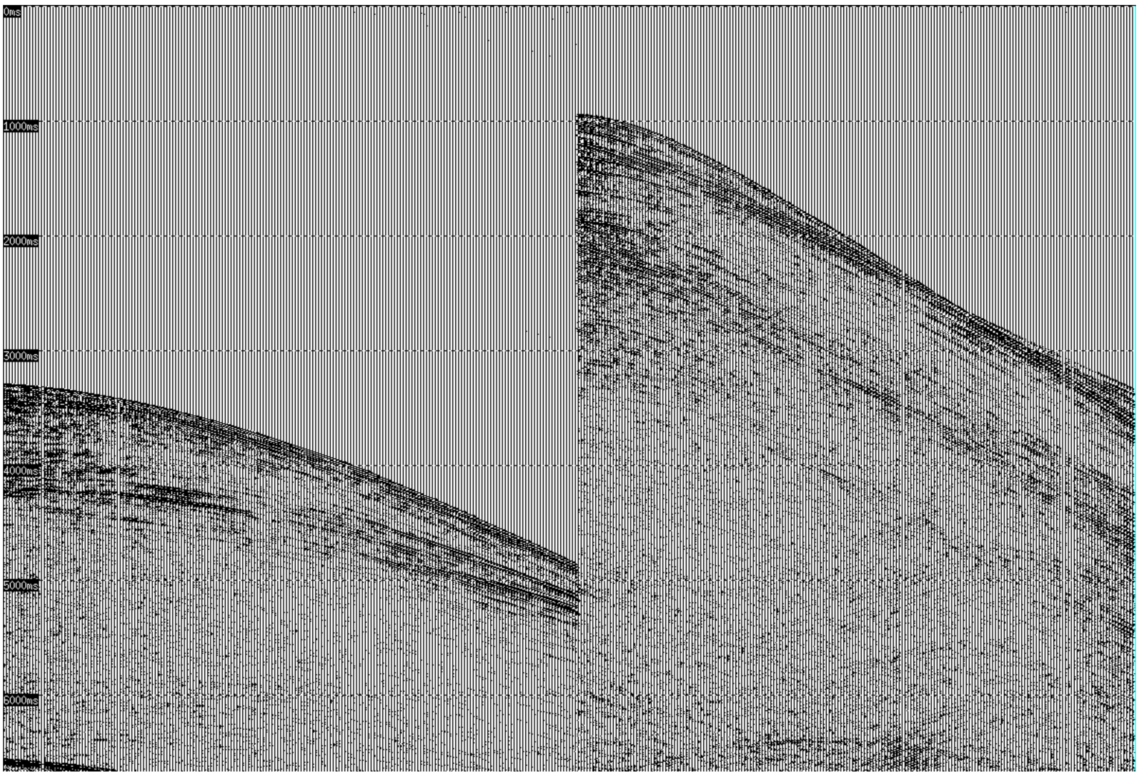
**Enclosure 3: Near trace gather – geometric spreading gain applied.**



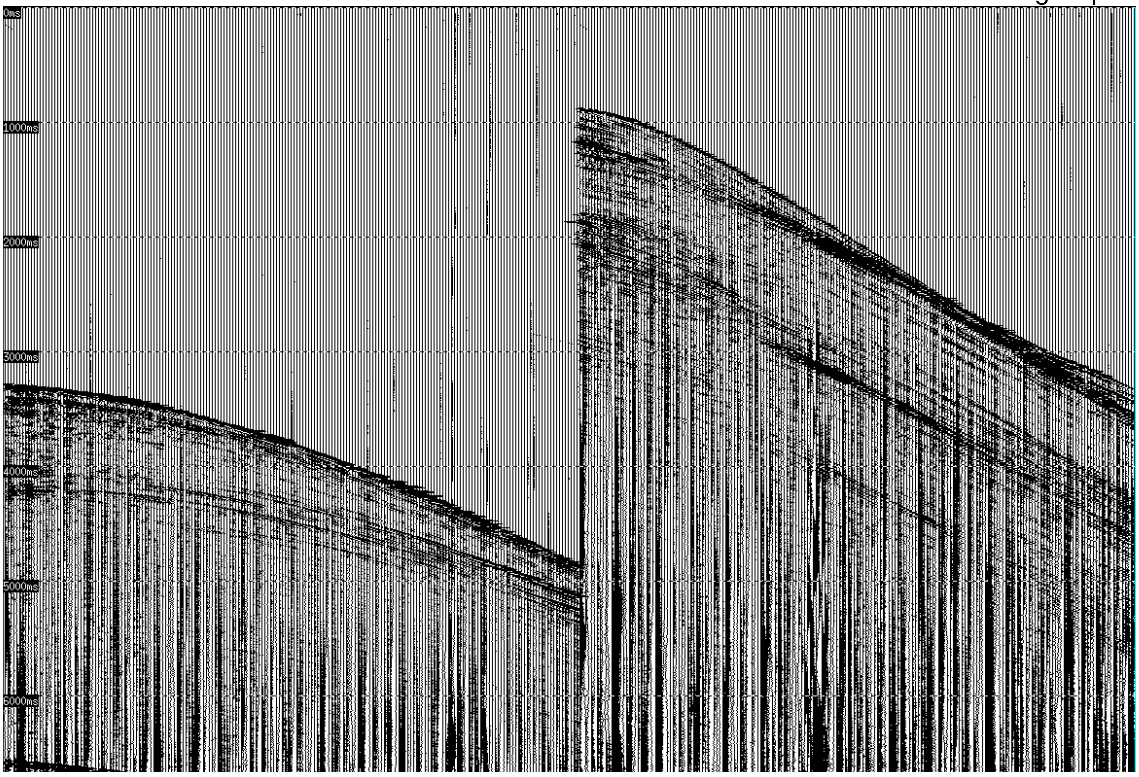
**Enclosure 4: Shot gathers – linear time gain applied.**



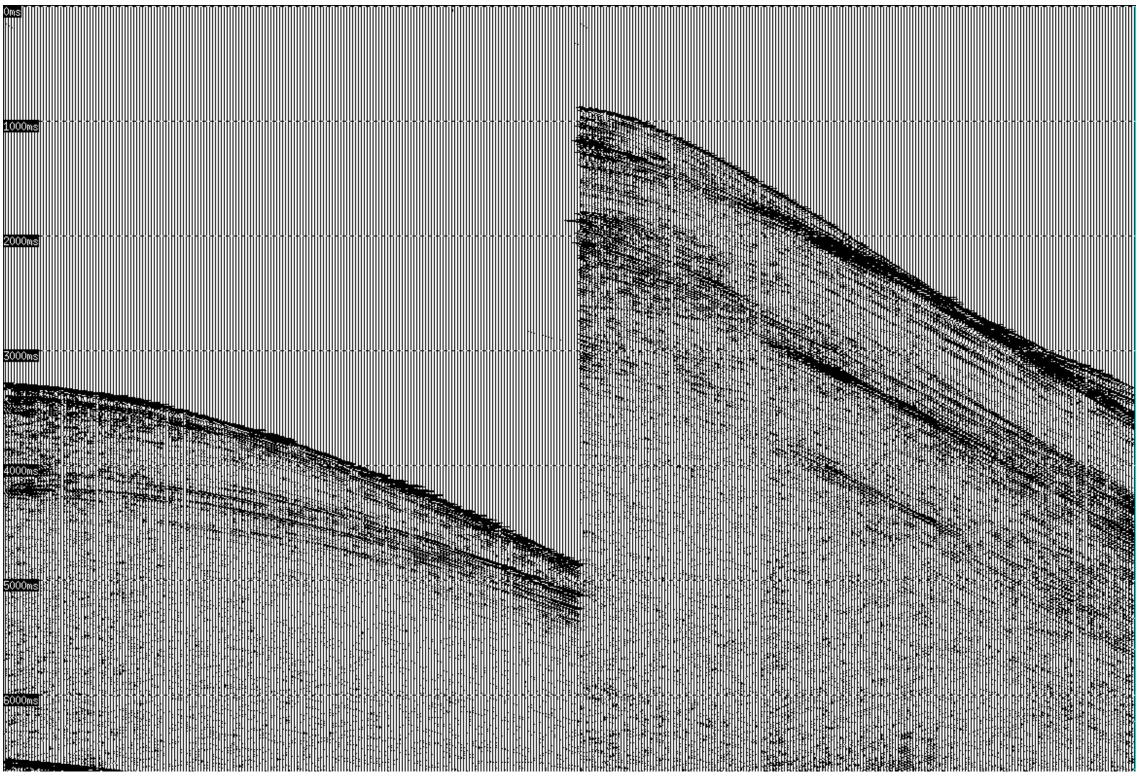
**Enclosure 5: Shot gathers –time squared gain applied.**



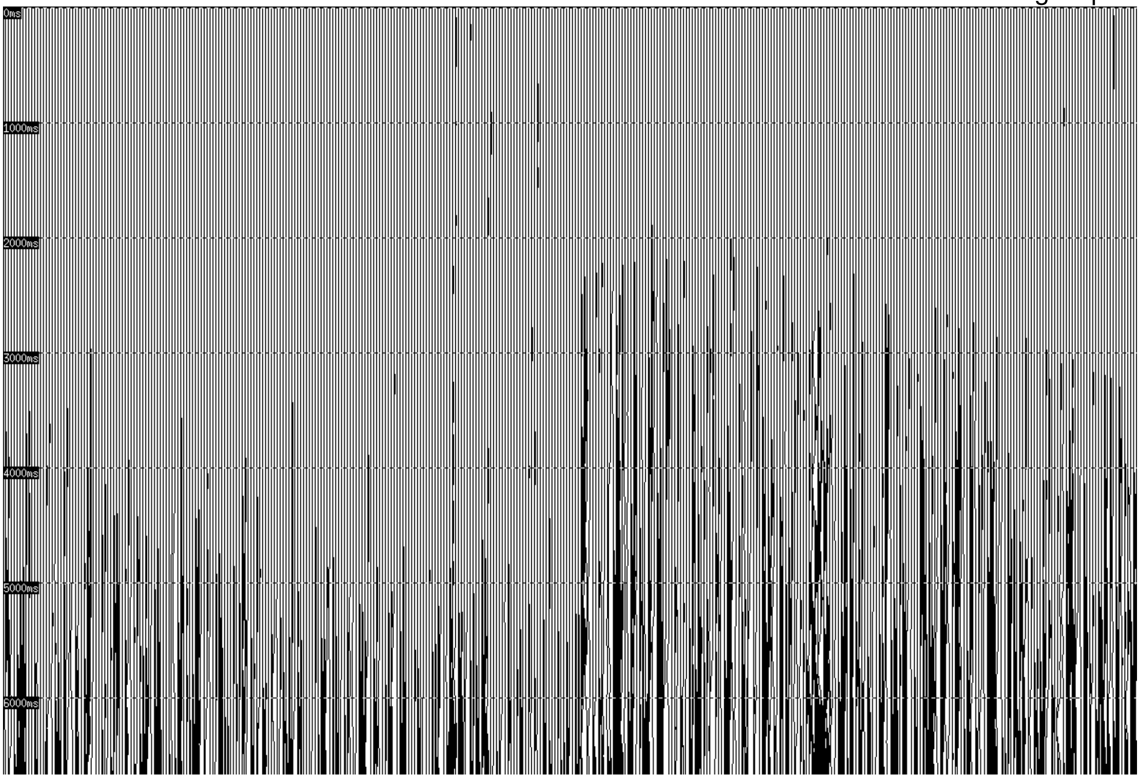
**Enclosure 6: Shot gathers – geometric spreading gain applied.**



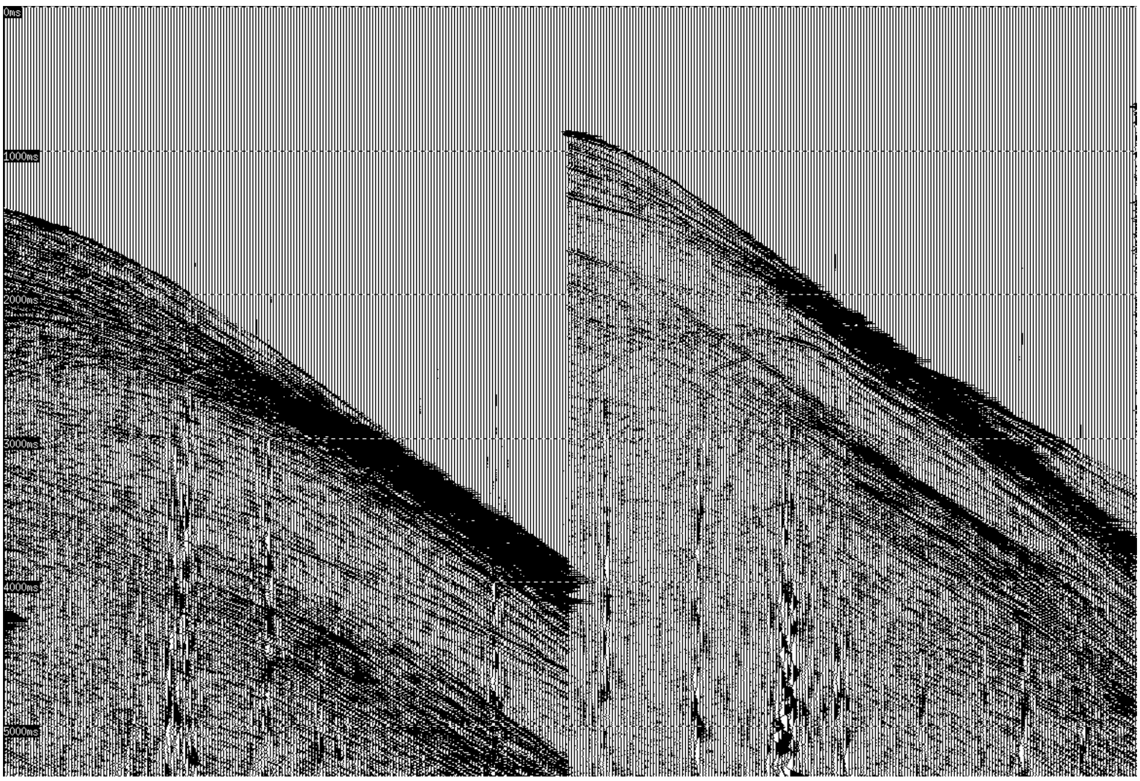
**Enclosure 7: Shot gathers – no low cut filter.**



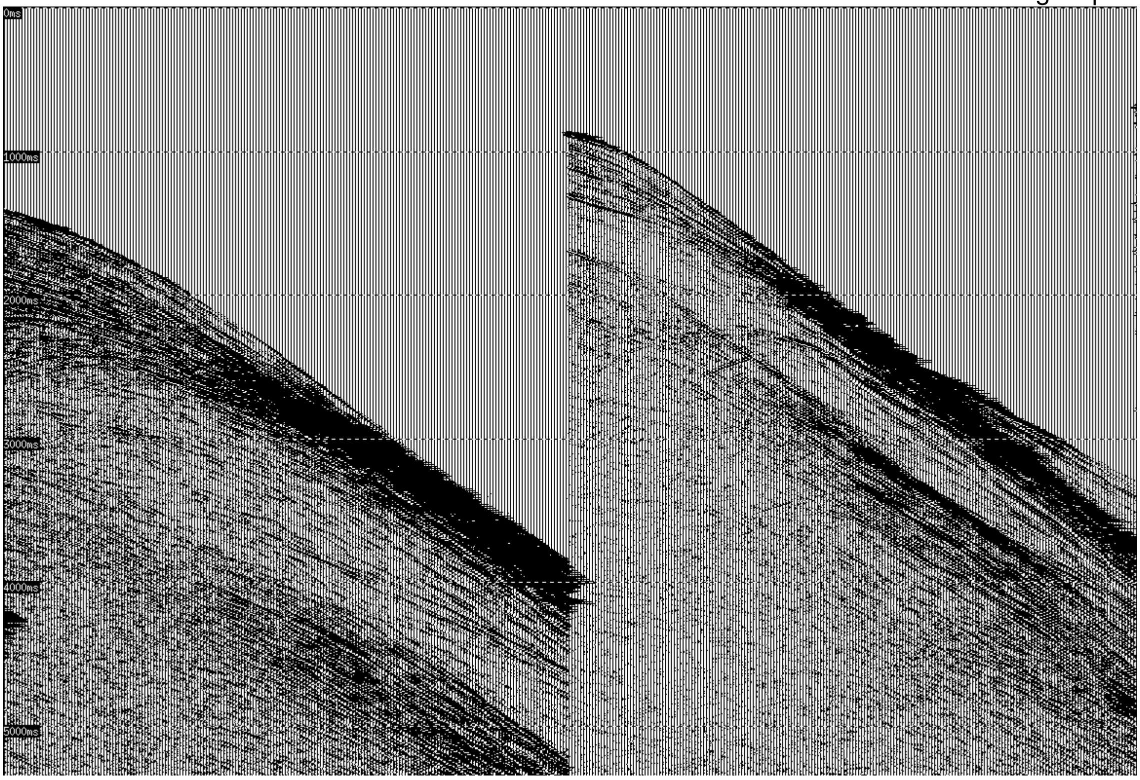
**Enclosure 8: Shot gathers – low cut filter applied (3Hz @ 18dB/Oct).**



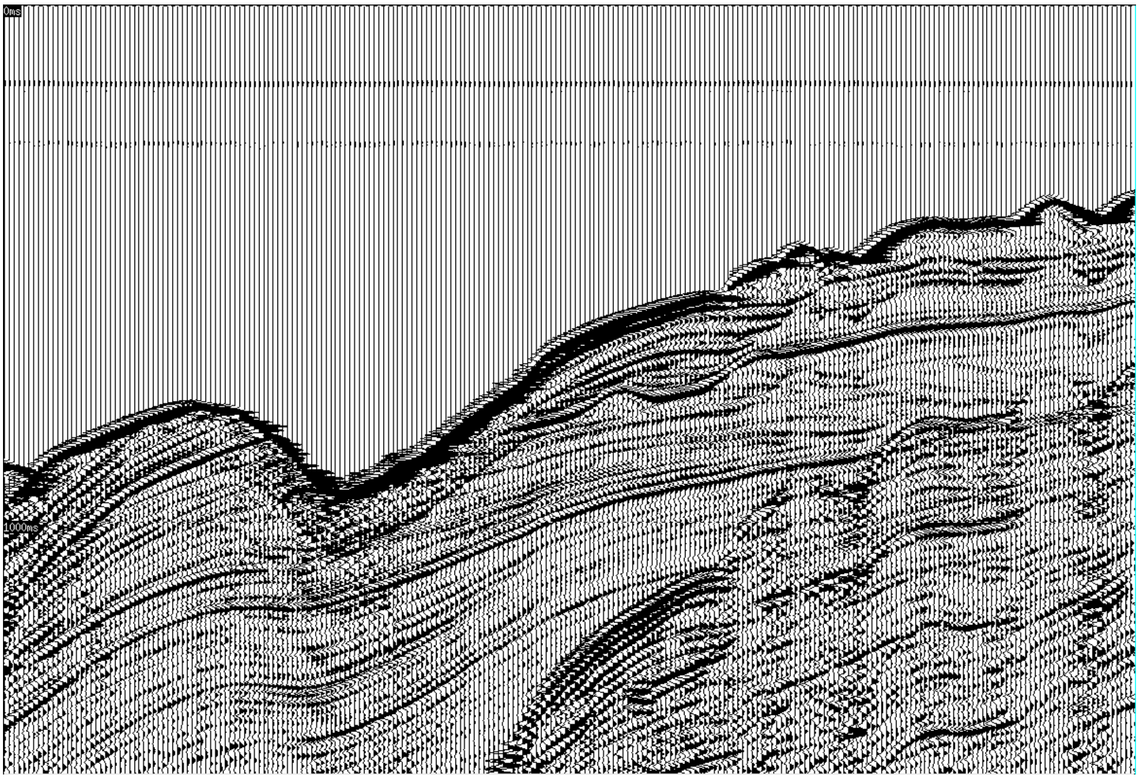
Enclosure 9: Shot gathers – low cut filter difference.



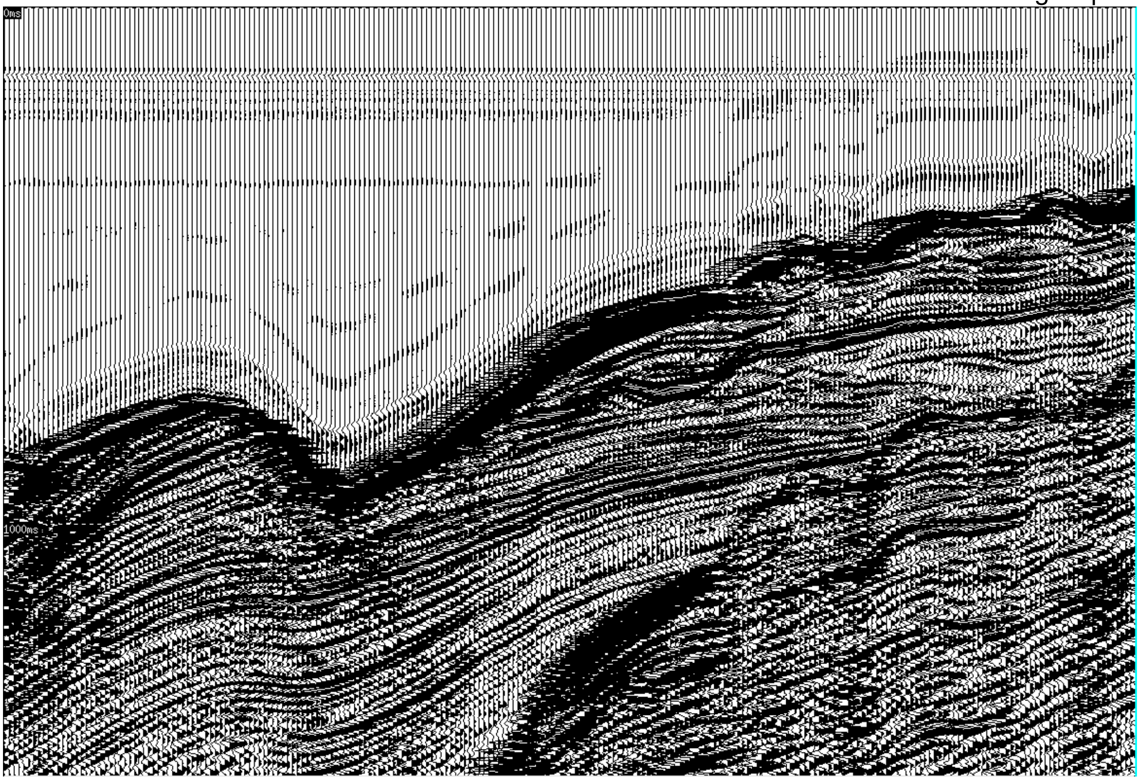
Enclosure 10: Shot gathers – no swell noise attenuation (SWATT).



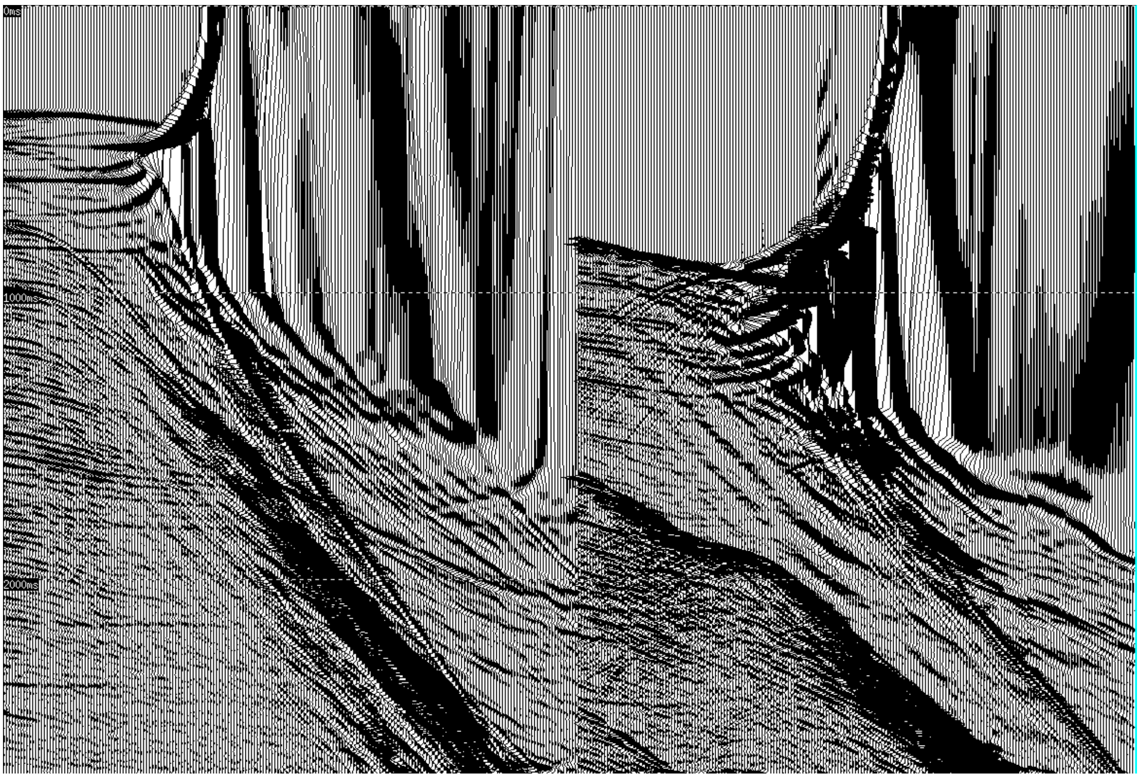

**Enclosure 11: Shot gathers – swell noise attenuation applied.**



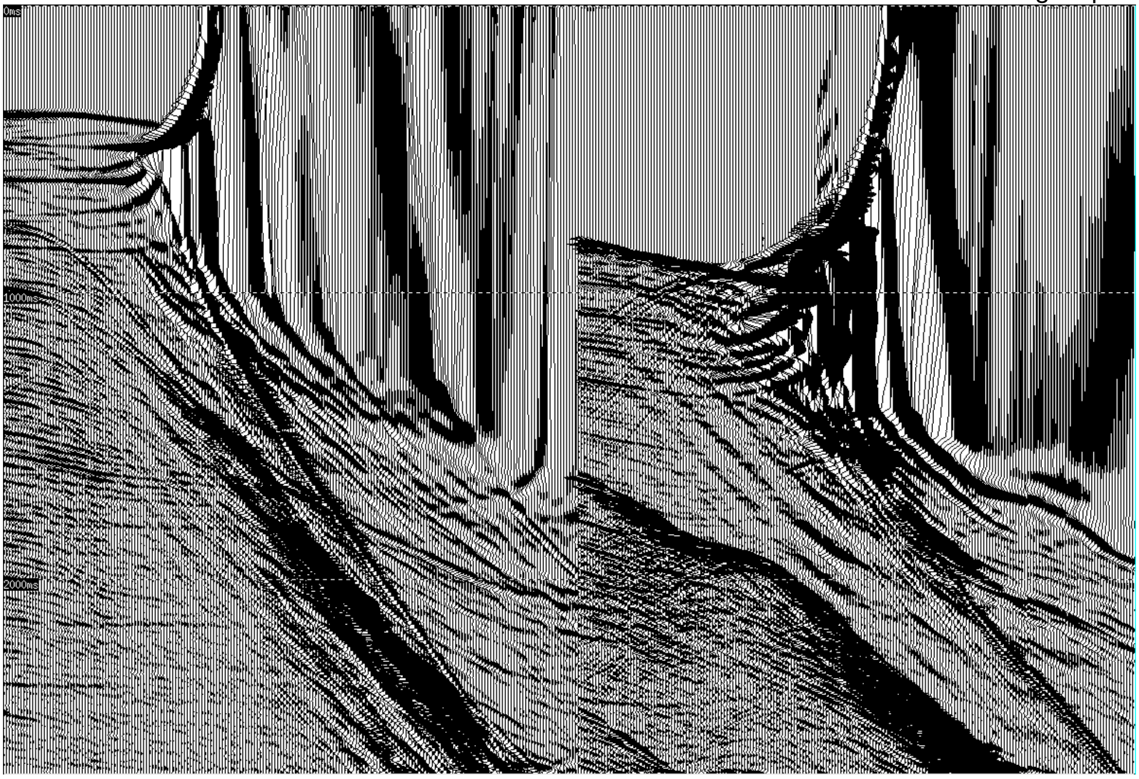

**Enclosure 12: Near trace gather – no dephase applied.**



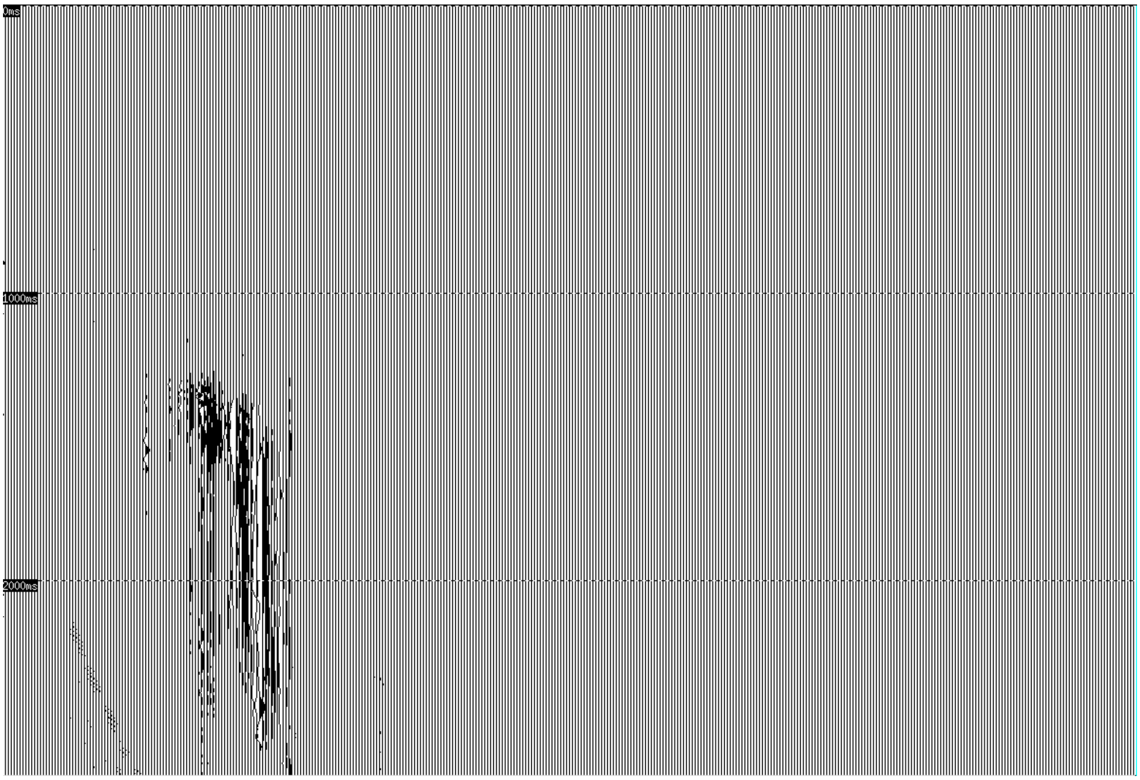
**Enclosure 13: Near trace gather – dephase applied (quadrature wavelet).**



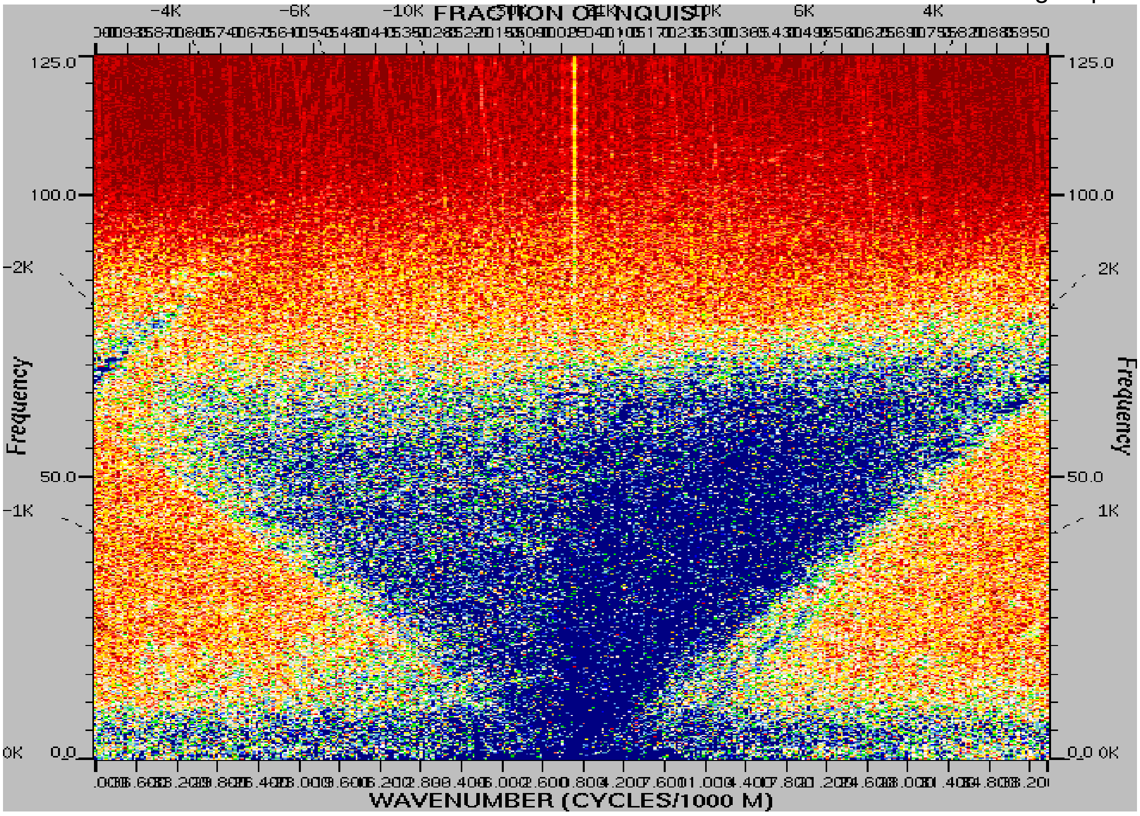
**Enclosure 14: NMO corrected shot gathers – no K-filter.**



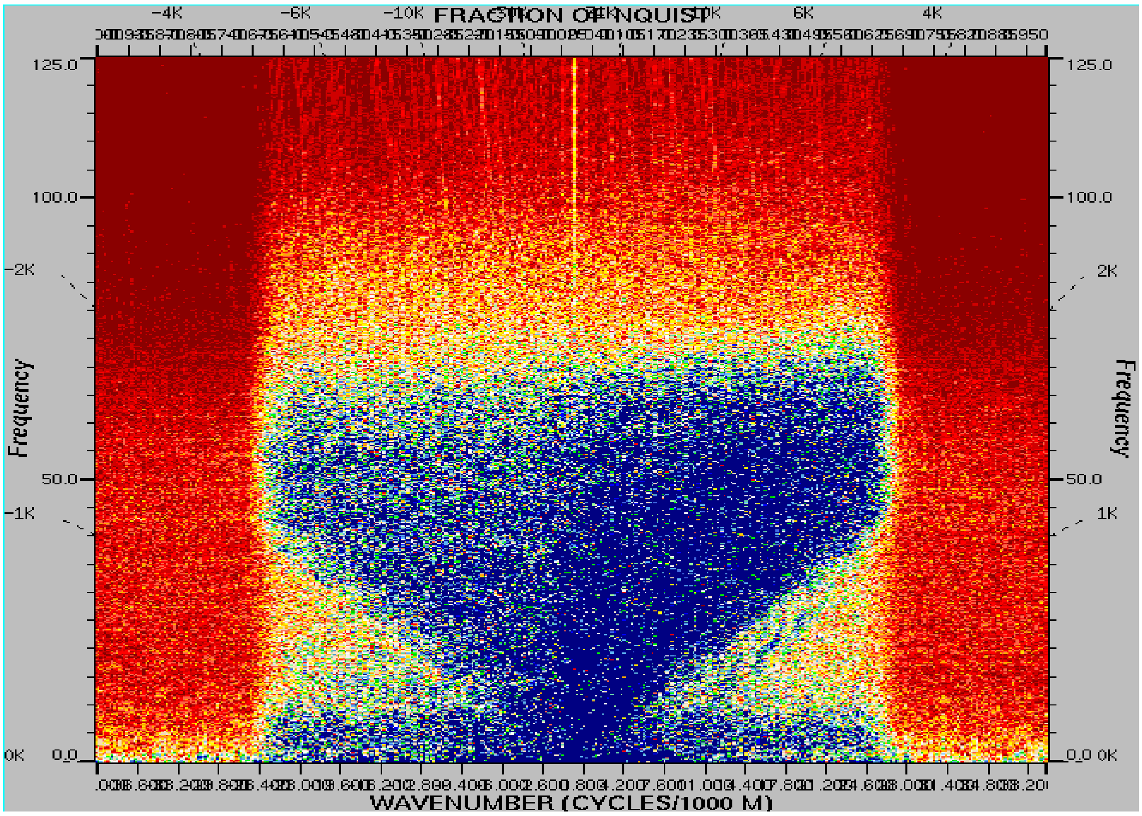
**Enclosure 15: NMO corrected shot gathers – K-filter applied.**



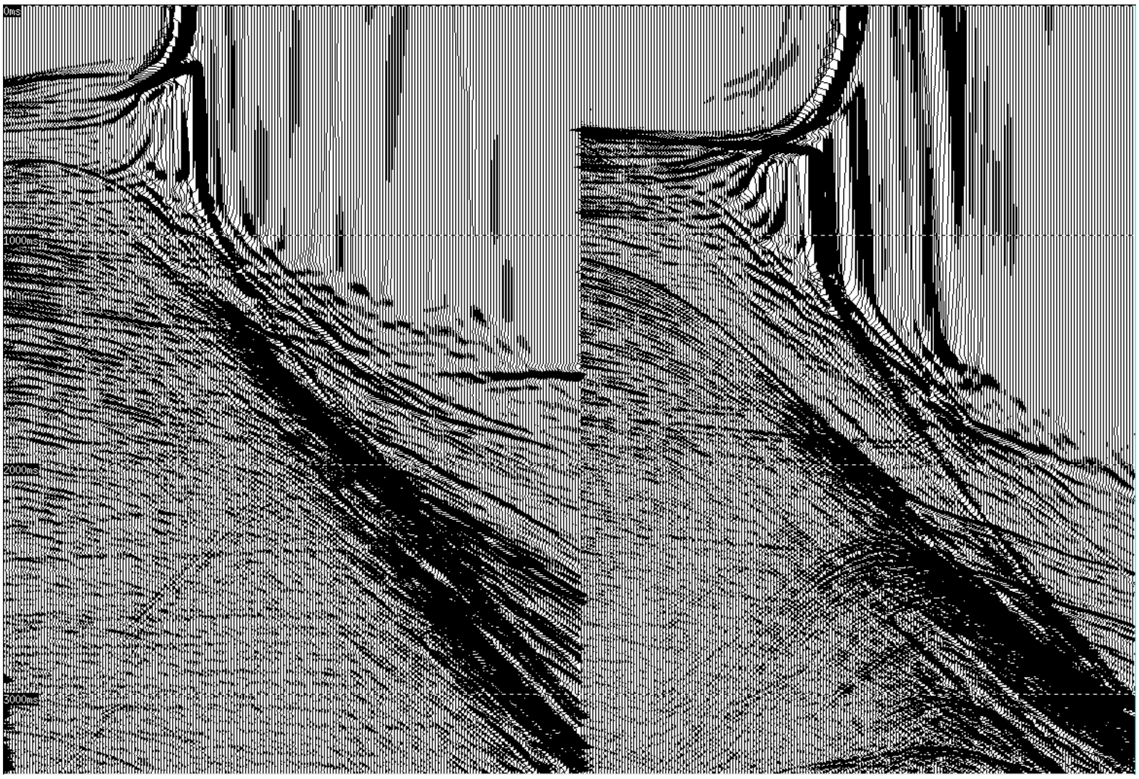
**Enclosure 16: NMO corrected shot gathers – K-filter difference.**



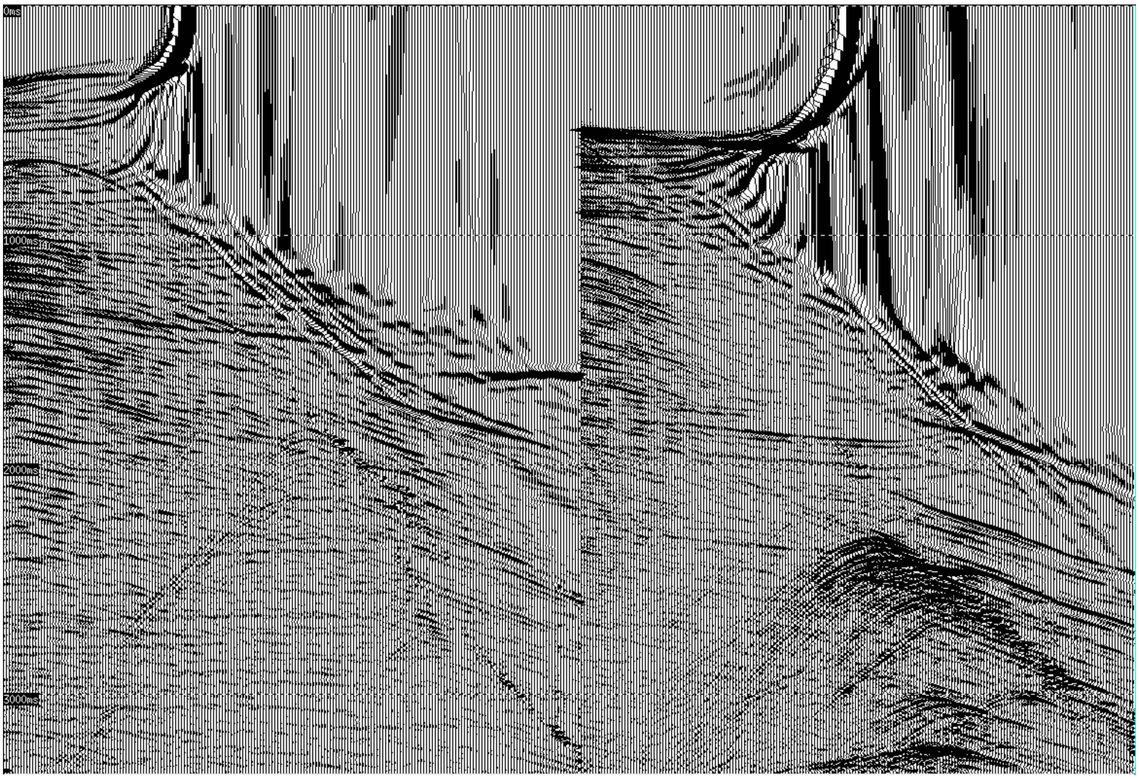

**Enclosure 17: Shot gather FK spectrum – no K-filter.**



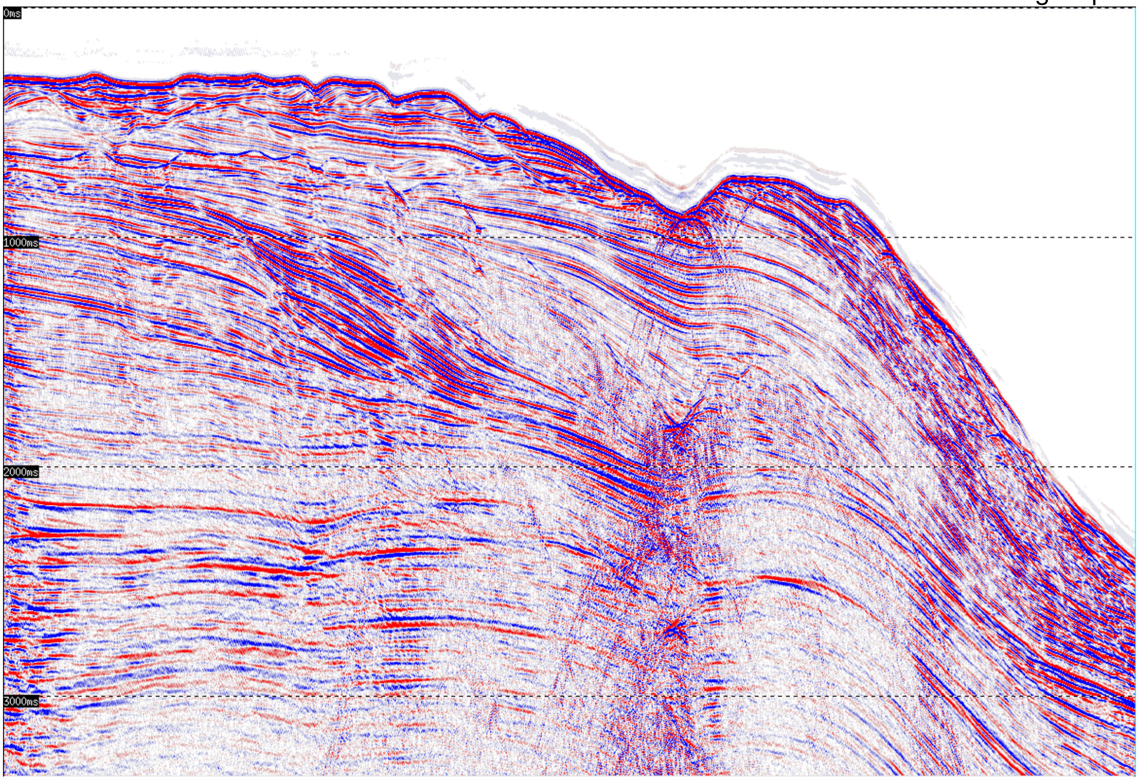

**Enclosure 18: Shot gather FK spectrum – K-filter applied.**



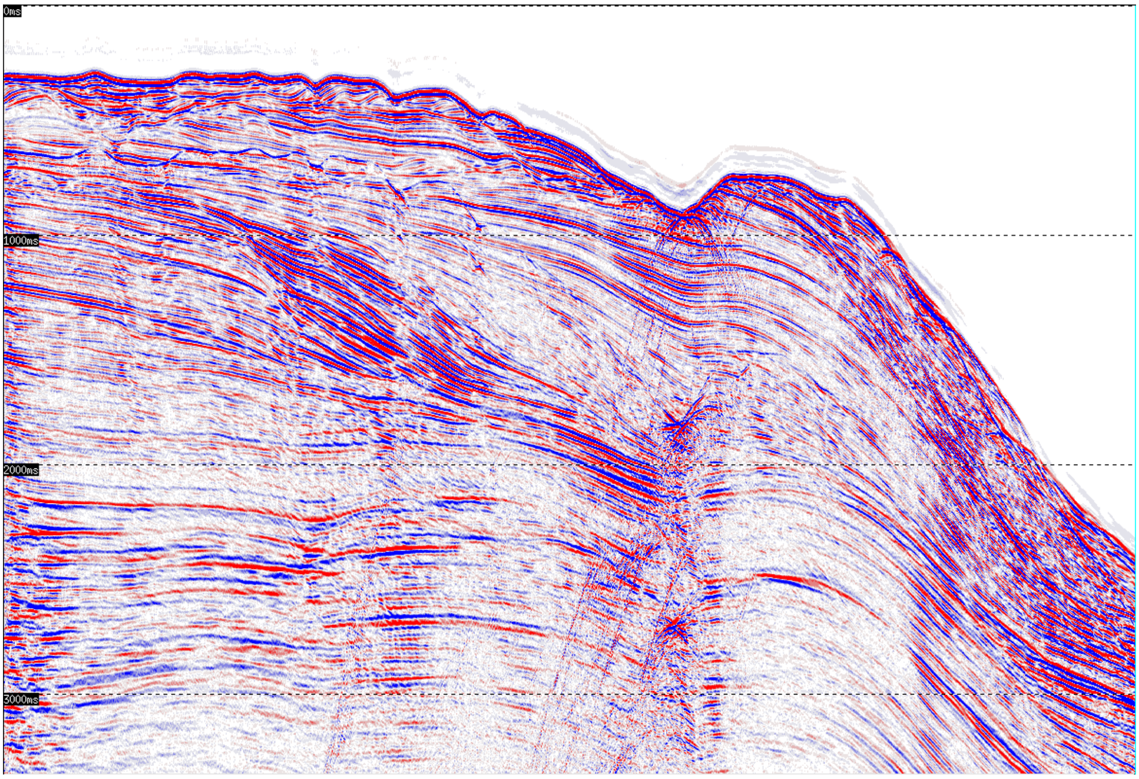
**Enclosure 19: NMO corrected shot gathers – no Tau-p linear filter.**



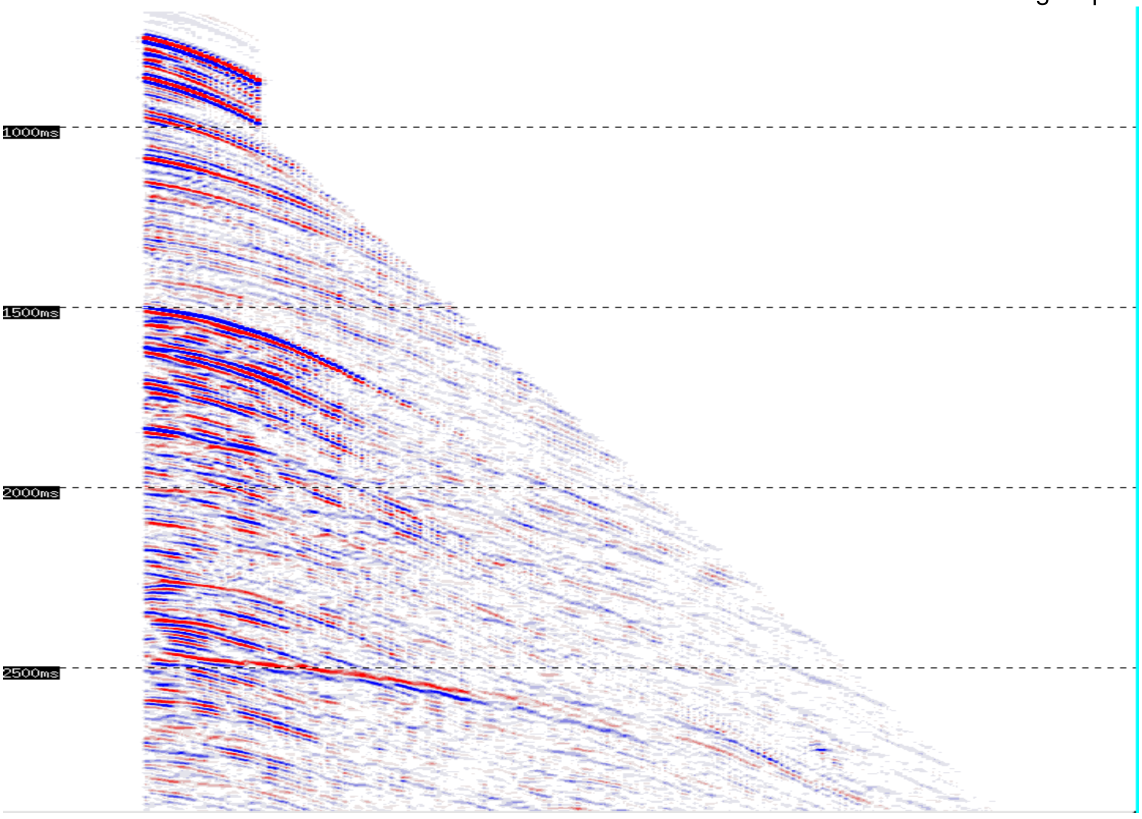
**Enclosure 20: NMO corrected shot gathers – Tau-p linear filter applied.**



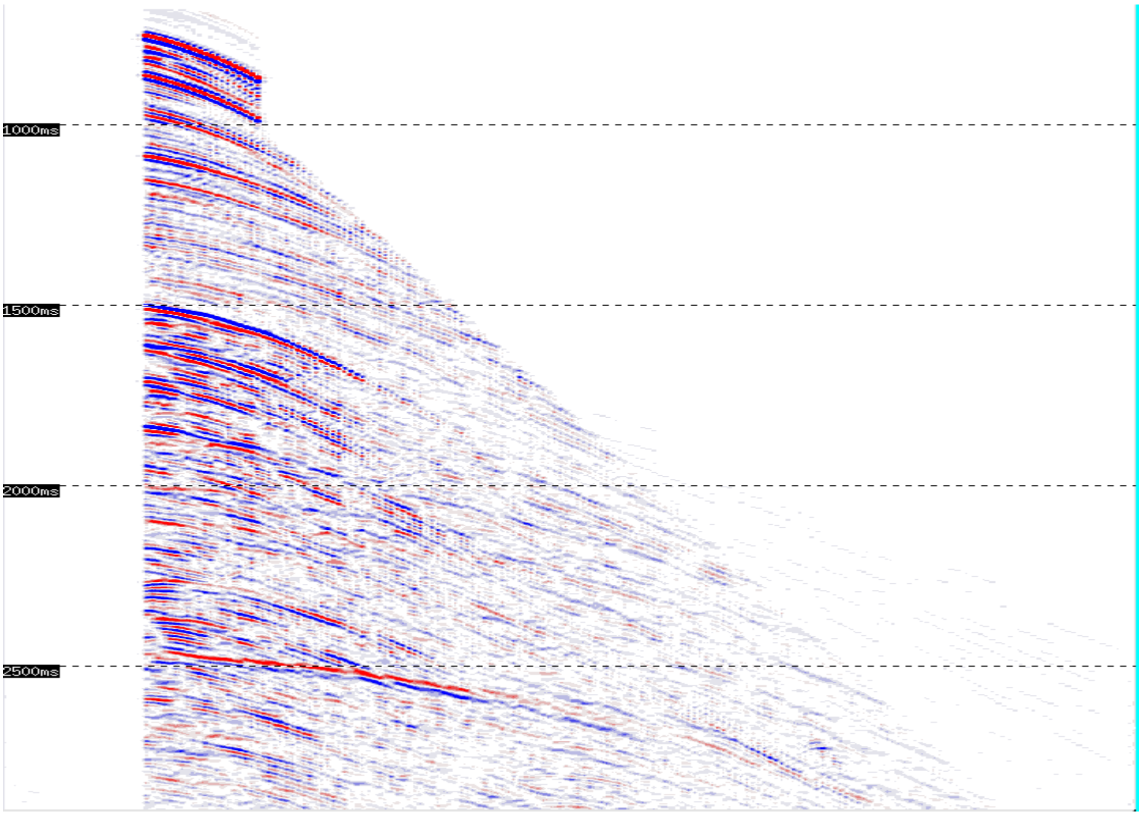
**Enclosure 21: Stack section – no Tau-p linear filter.**



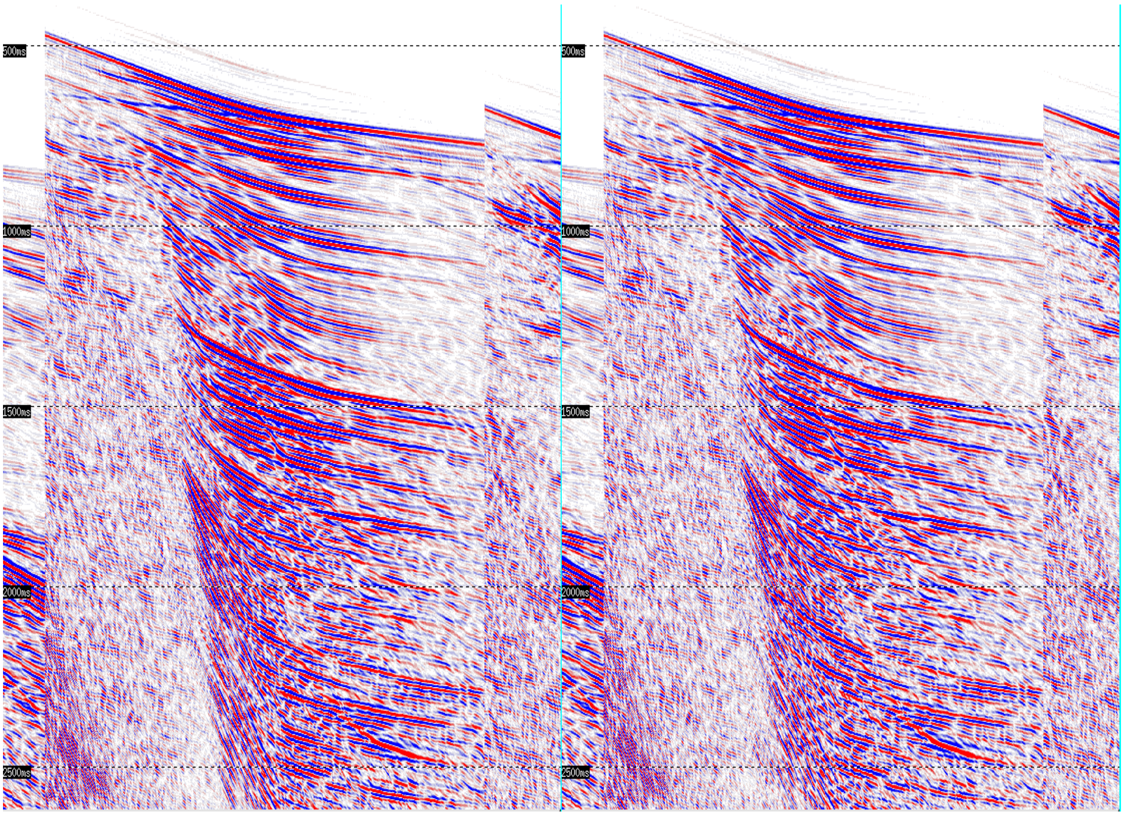
**Enclosure 22: Stack section – Tau-p linear filter applied.**



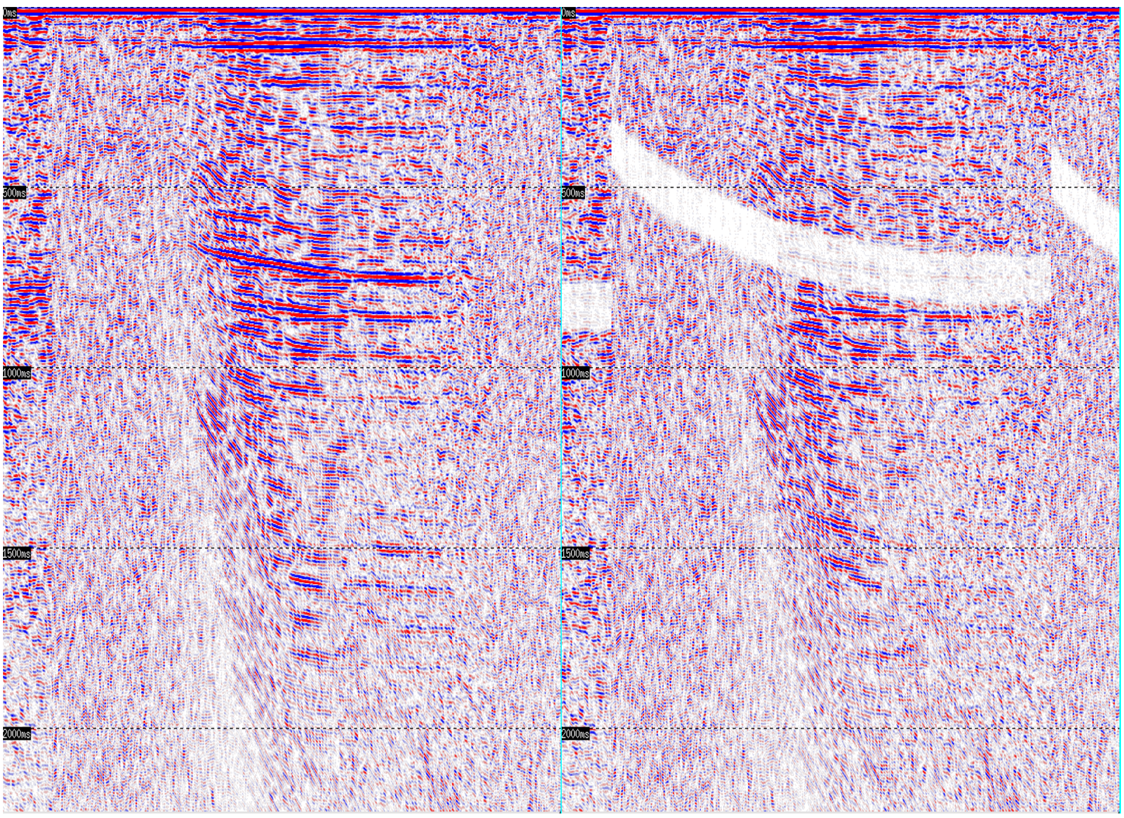

**Enclosure 23: Shot gather – no Tau-p deconvolution.**



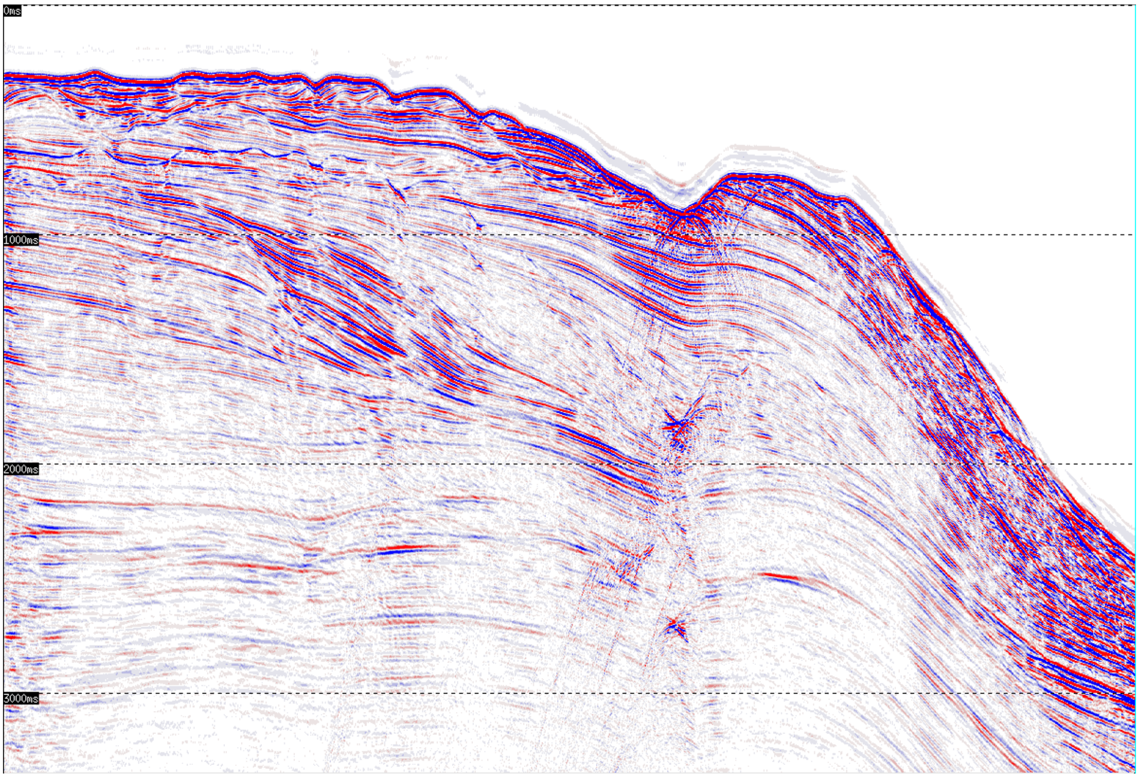

**Enclosure 24: Shot gather – Tau-p deconvolution applied.**



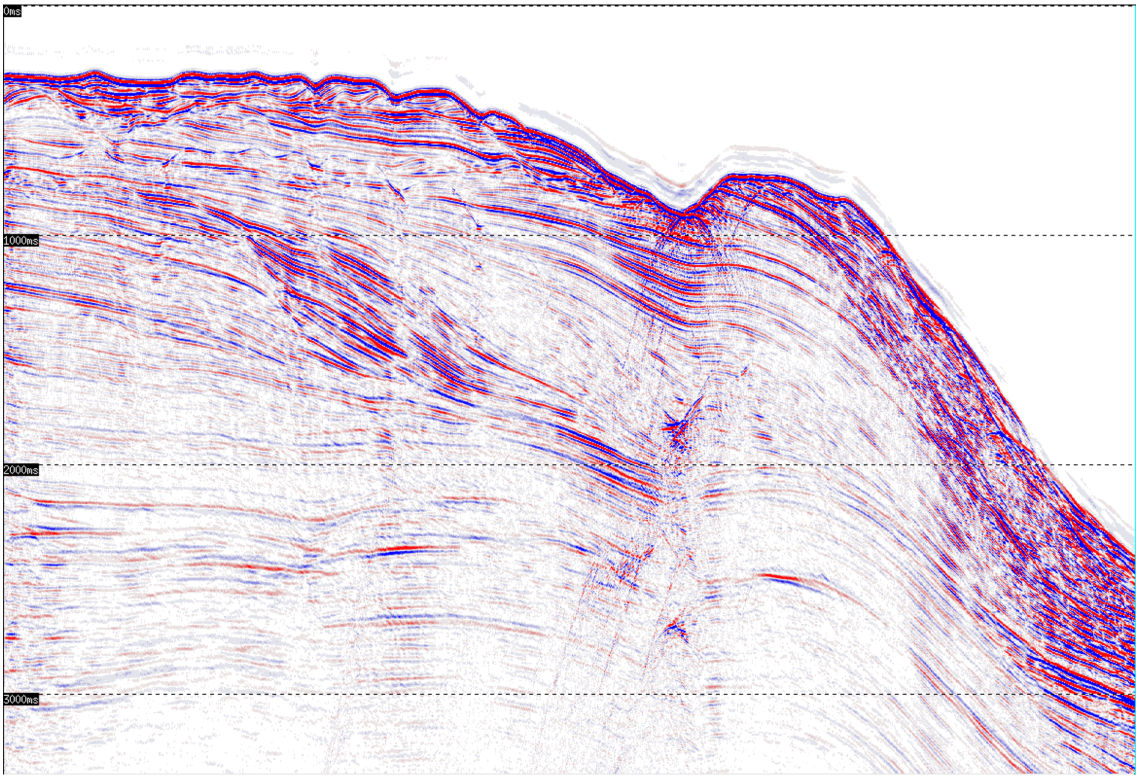
**Enclosure 25 & Enclosure 26: Radon Transform – without and with Tau-p deconvolution.**



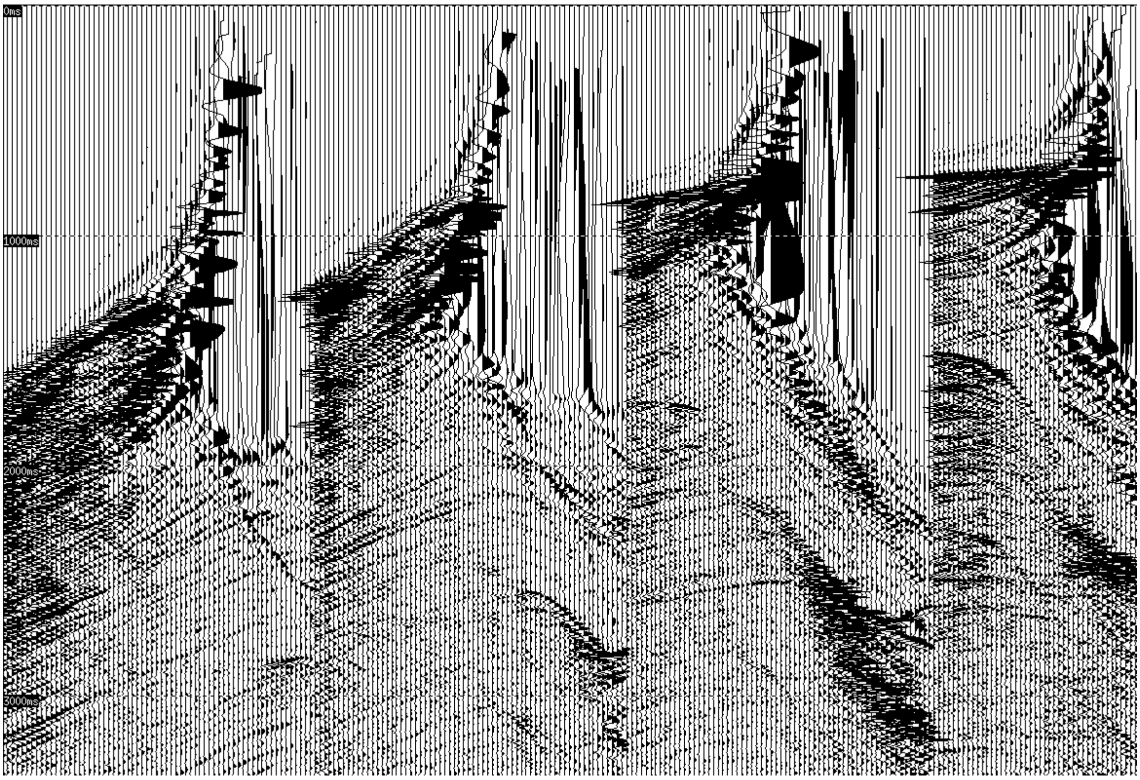
**Enclosure 27 & Enclosure 28: Auto correlation – without and with Tau-p deconvolution.**



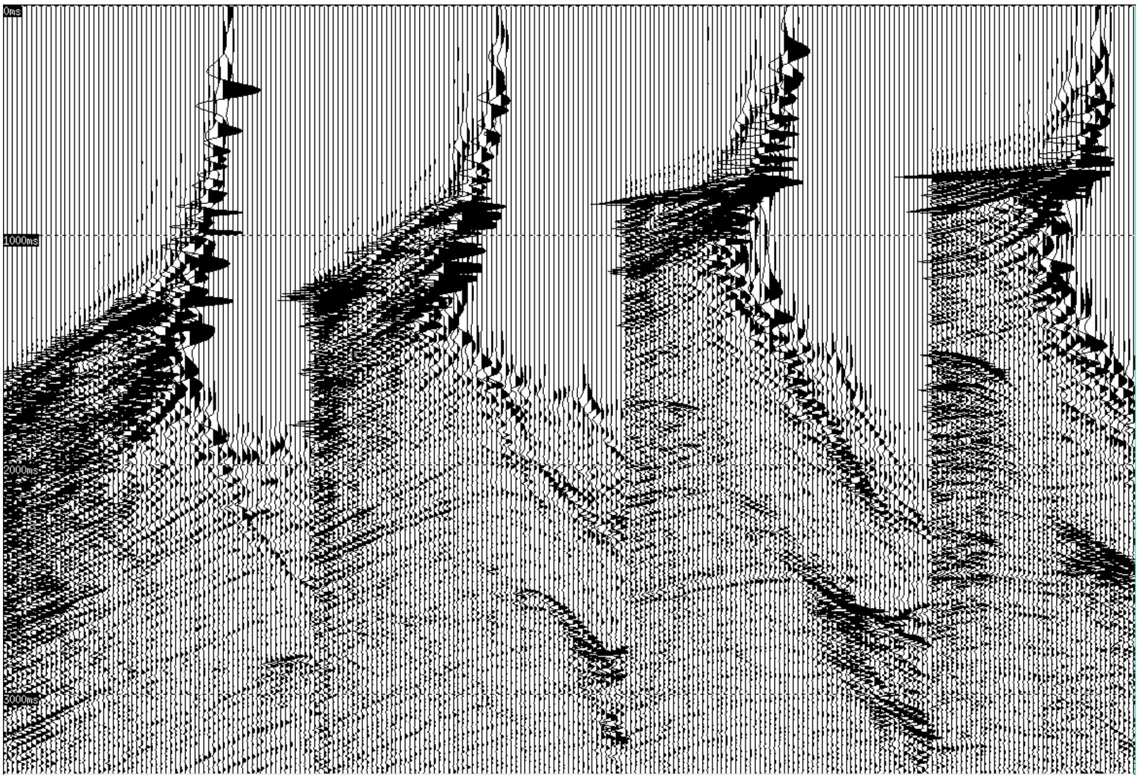

**Enclosure 29: Stack section – no Tau-p deconvolution.**



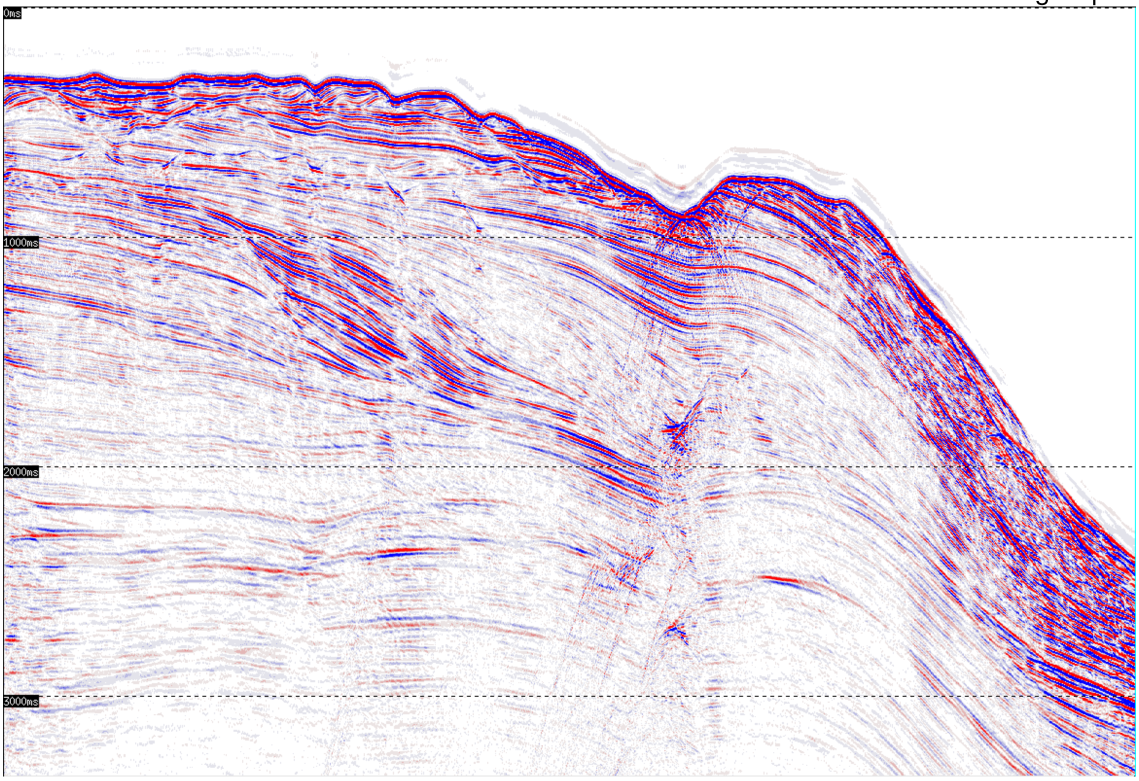

**Enclosure 30: Stack section – Tau-p deconvolution applied.**



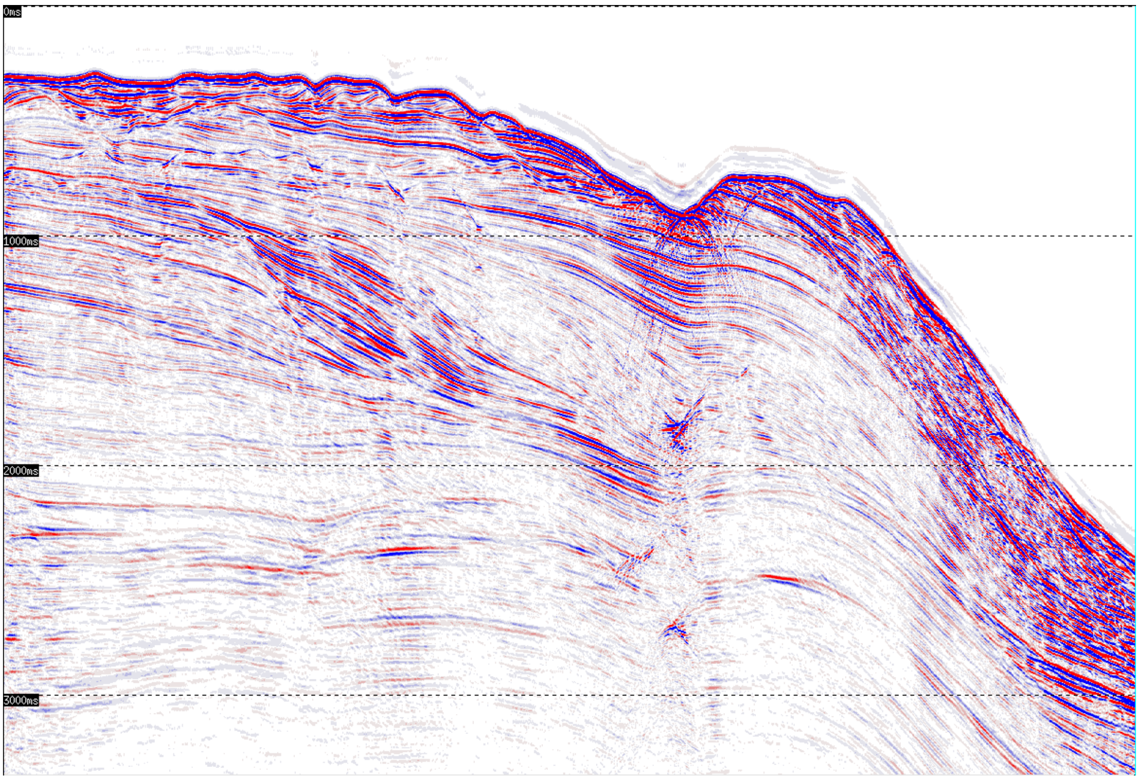
**Enclosure 31: NMO corrected receiver gathers – no receiver Tau-p linear filter.**



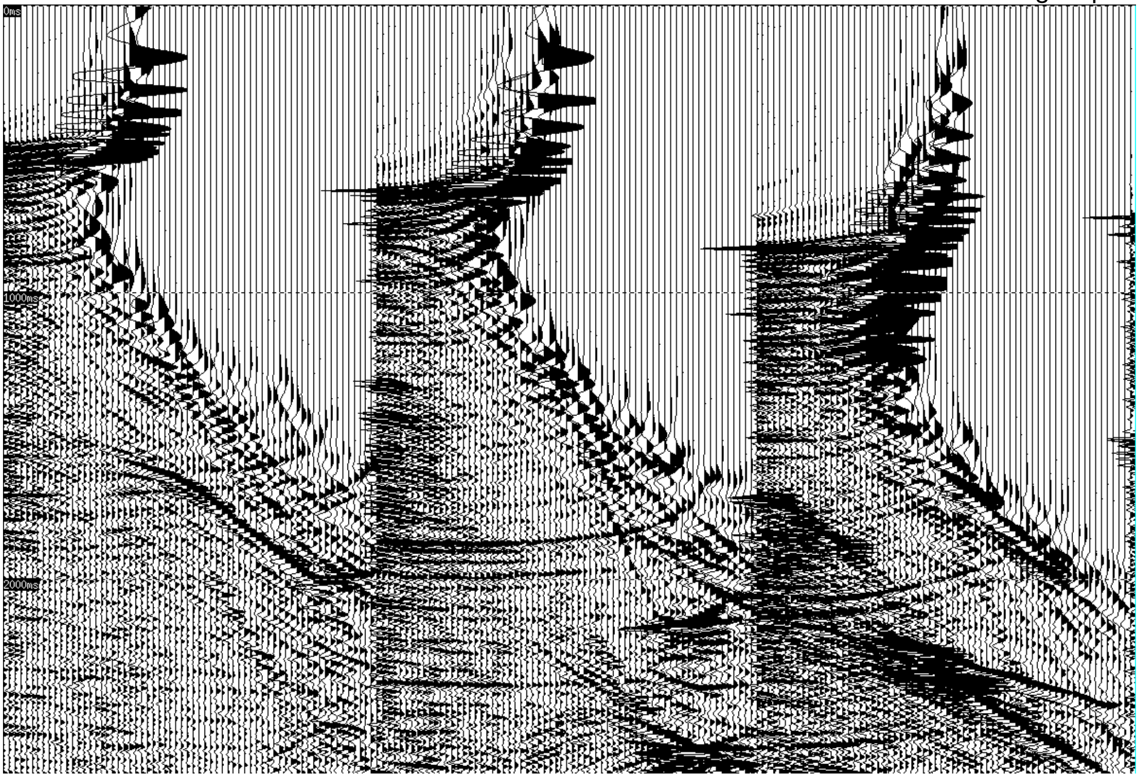
**Enclosure 32: NMO corrected receiver gathers – receiver Tau-p linear filter applied.**



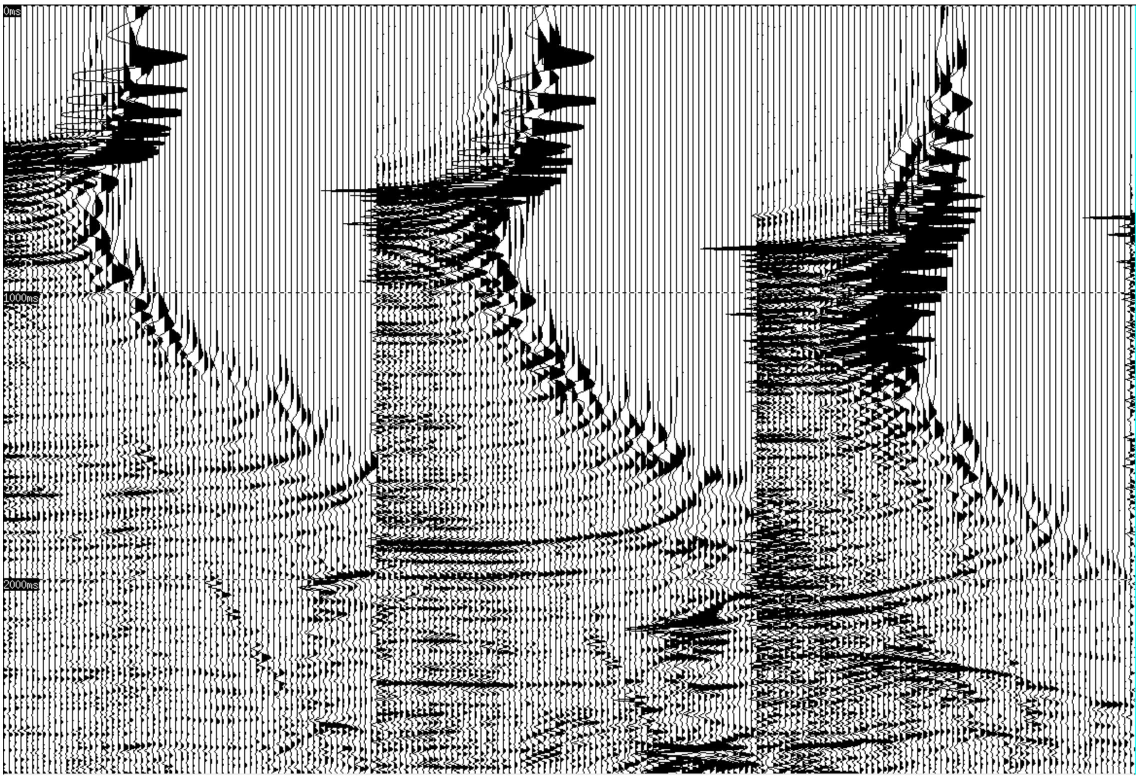

**Enclosure 33: Stack section – no receiver Tau-p linear filter.**



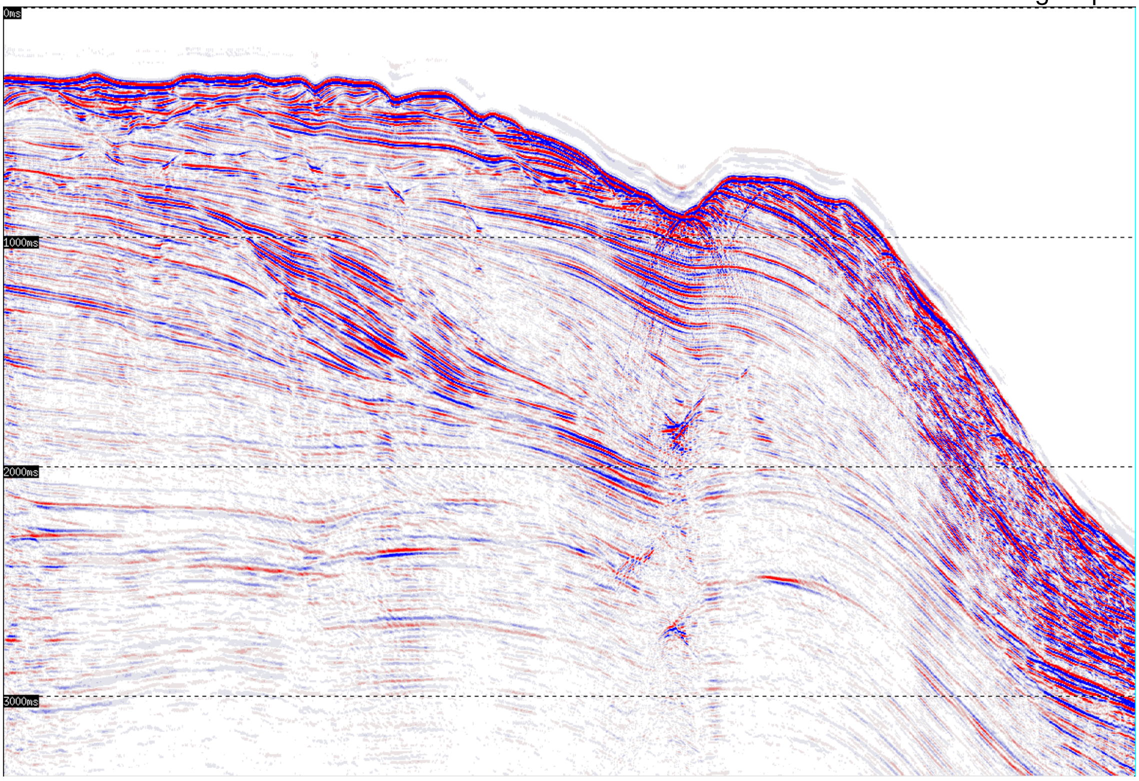

**Enclosure 34: Stack section – receiver Tau-p linear filter applied.**



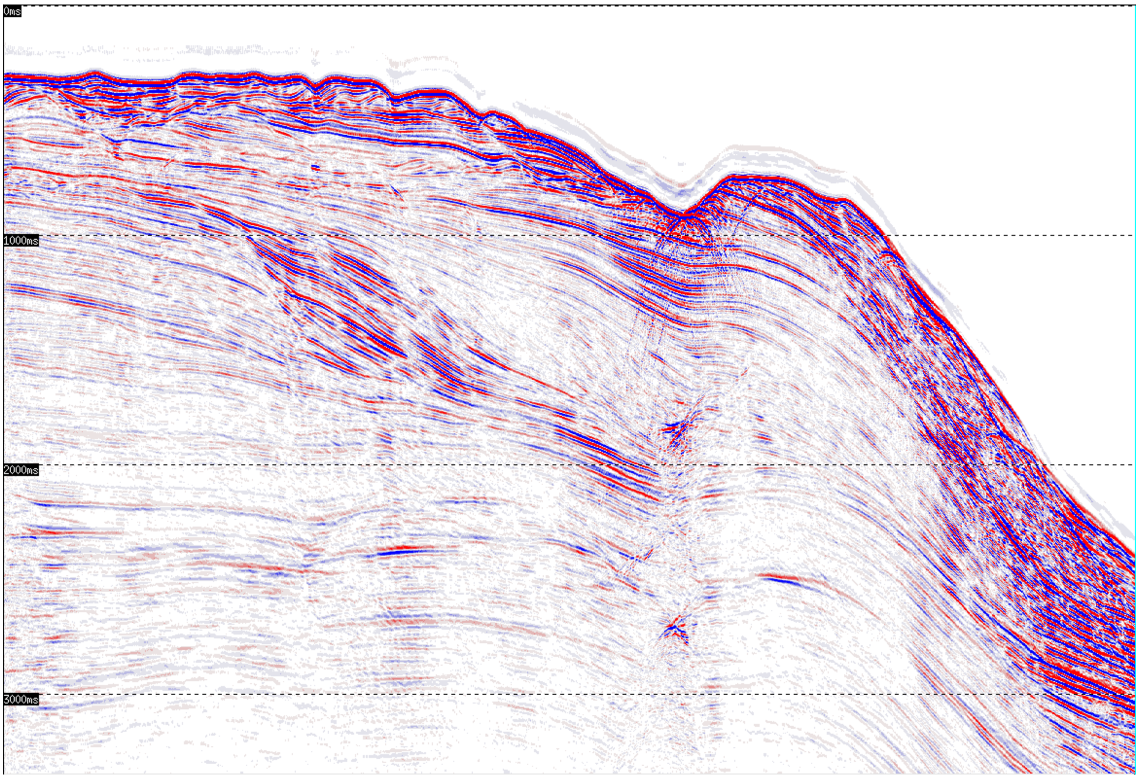

**Enclosure 35: NMO corrected cmp gathers – no high resolution radon demultiple.**



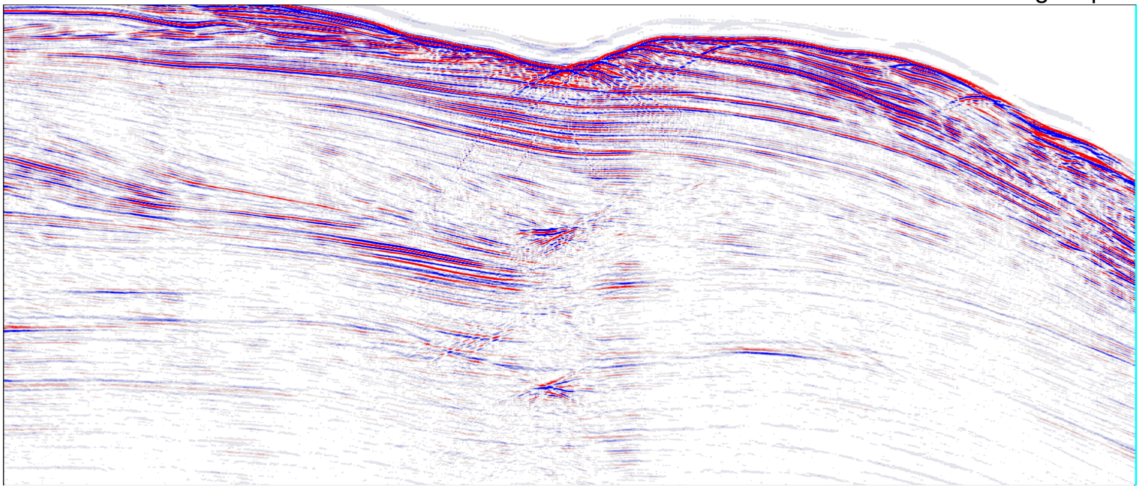

**Enclosure 36: NMO corrected cmp gathers – high resolution radon demultiple applied.**



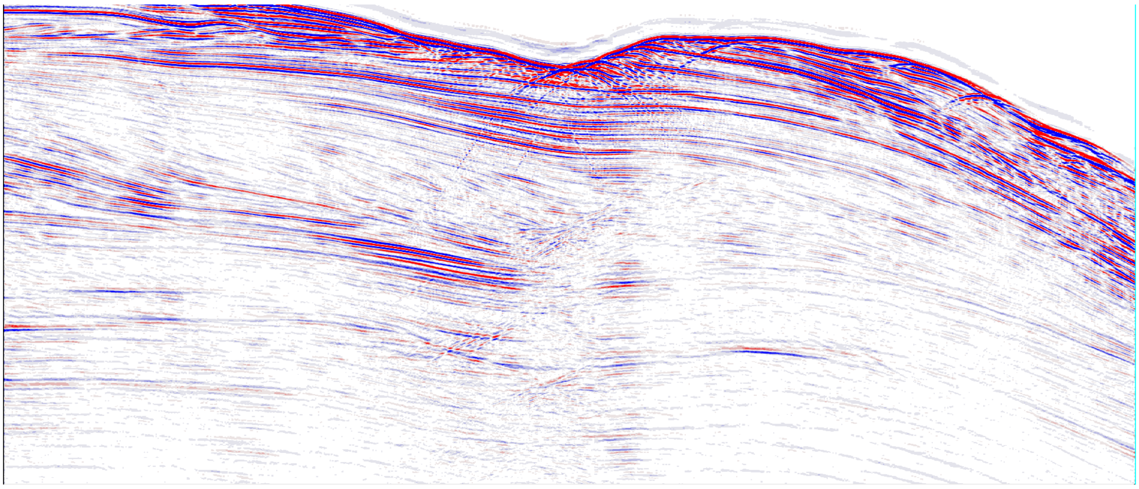

**Enclosure 37: Stack section – no high resolution radon demultiple.**



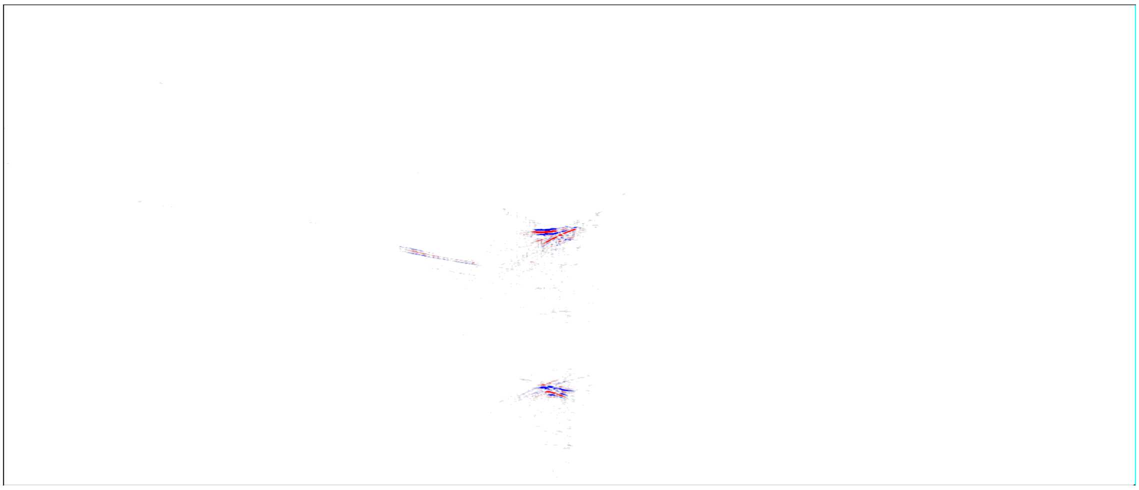

**Enclosure 38: Stack section – high resolution radon demultiple applied.**



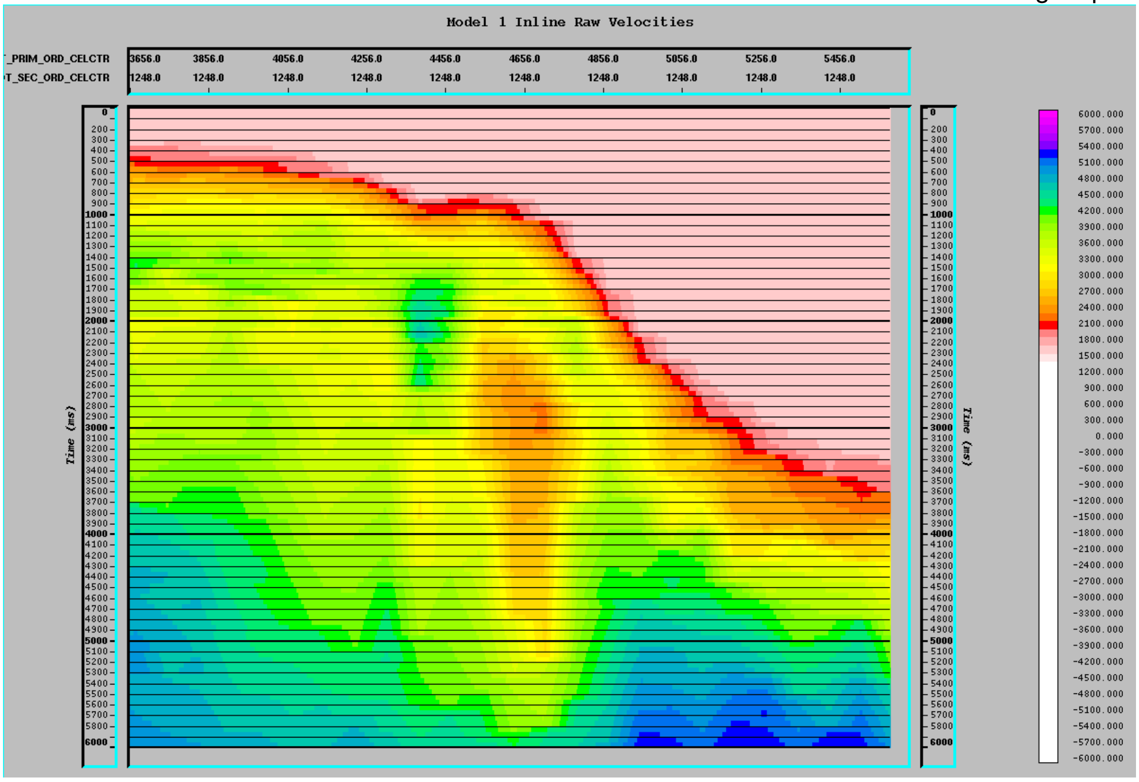
**Enclosure 39: Stack section – no unwanted data trace clipping.**



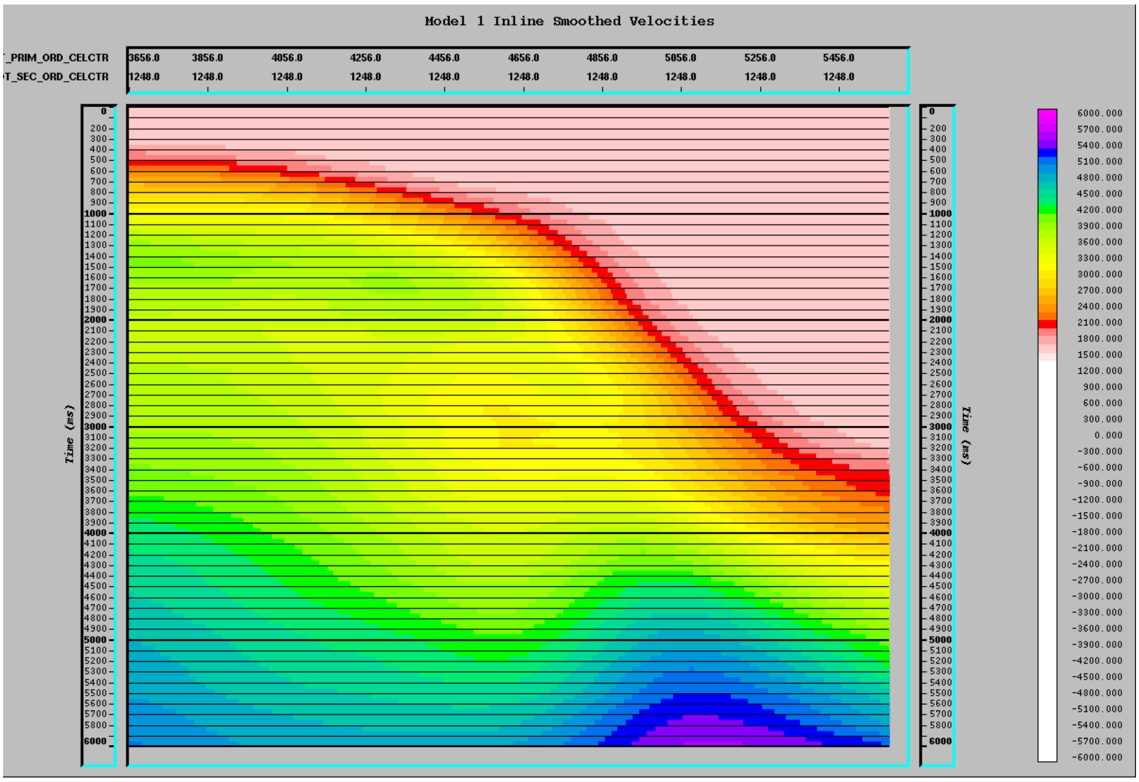
**Enclosure 40: Stack section – unwanted data trace clipping applied.**



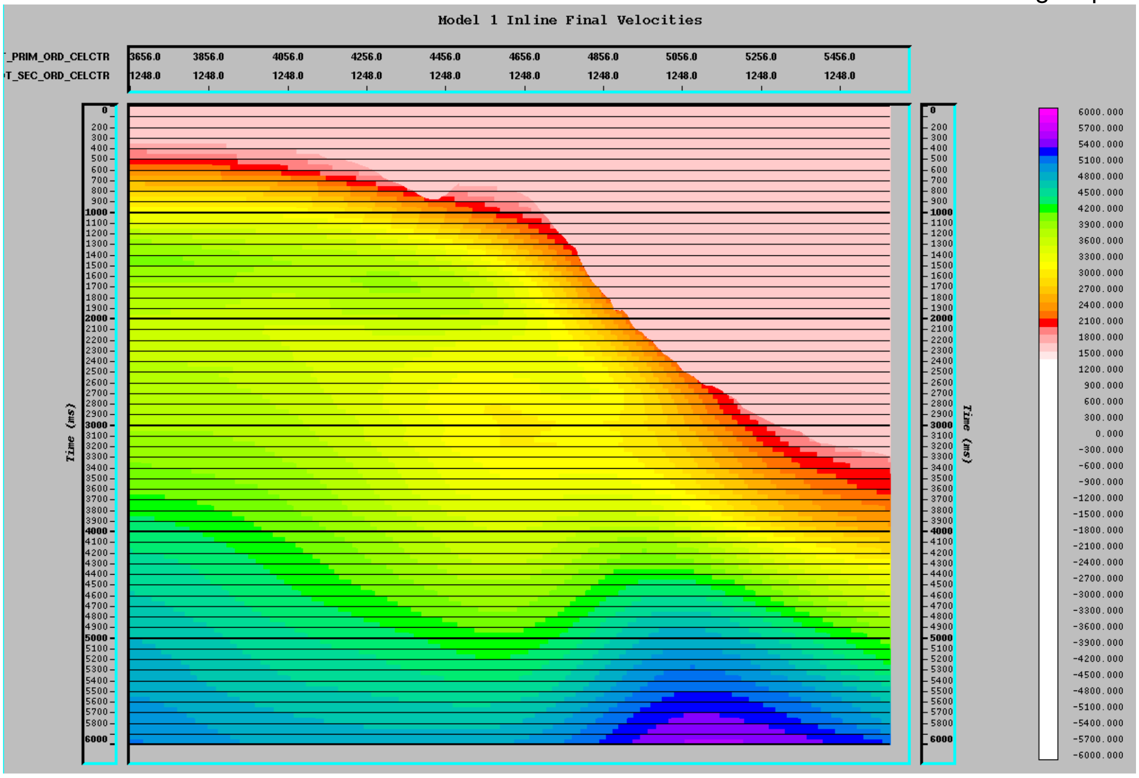
**Enclosure 41: Stack section – unwanted data trace clipping difference.**



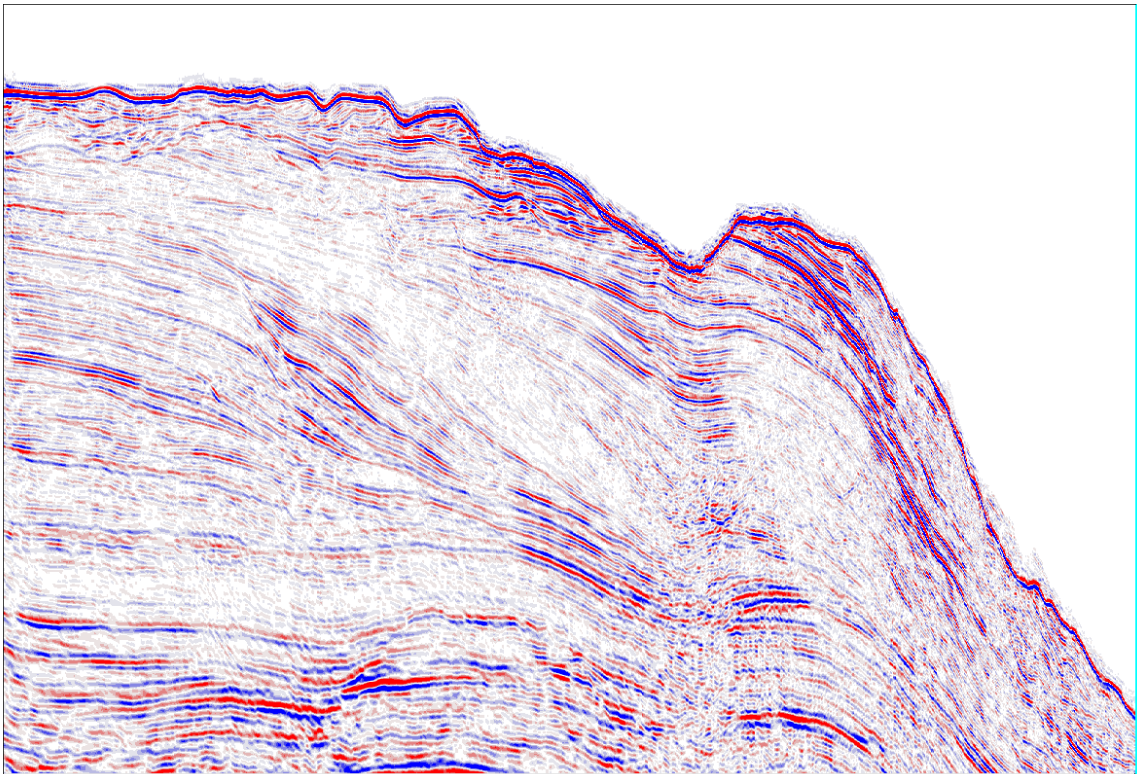

**Enclosure 42: Hybrid KPSDM – initial model first pass velocities (raw).**



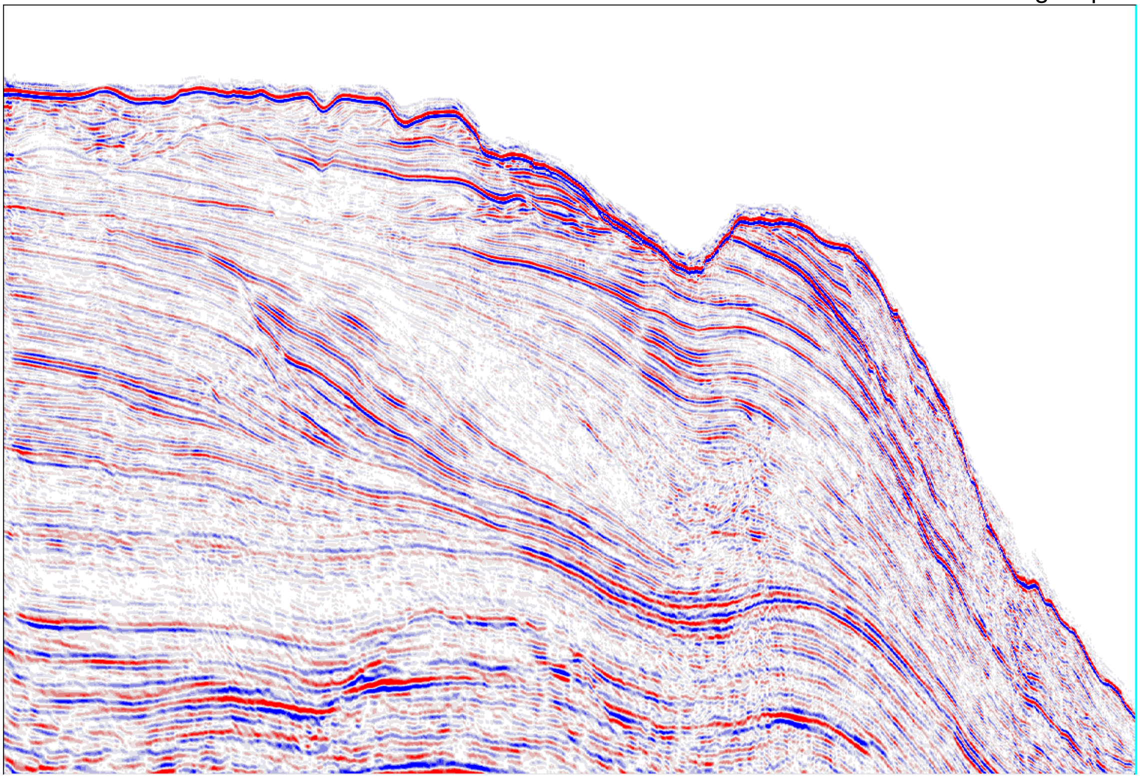

**Enclosure 43: Hybrid KPSDM – initial model first pass velocities (smoothed).**



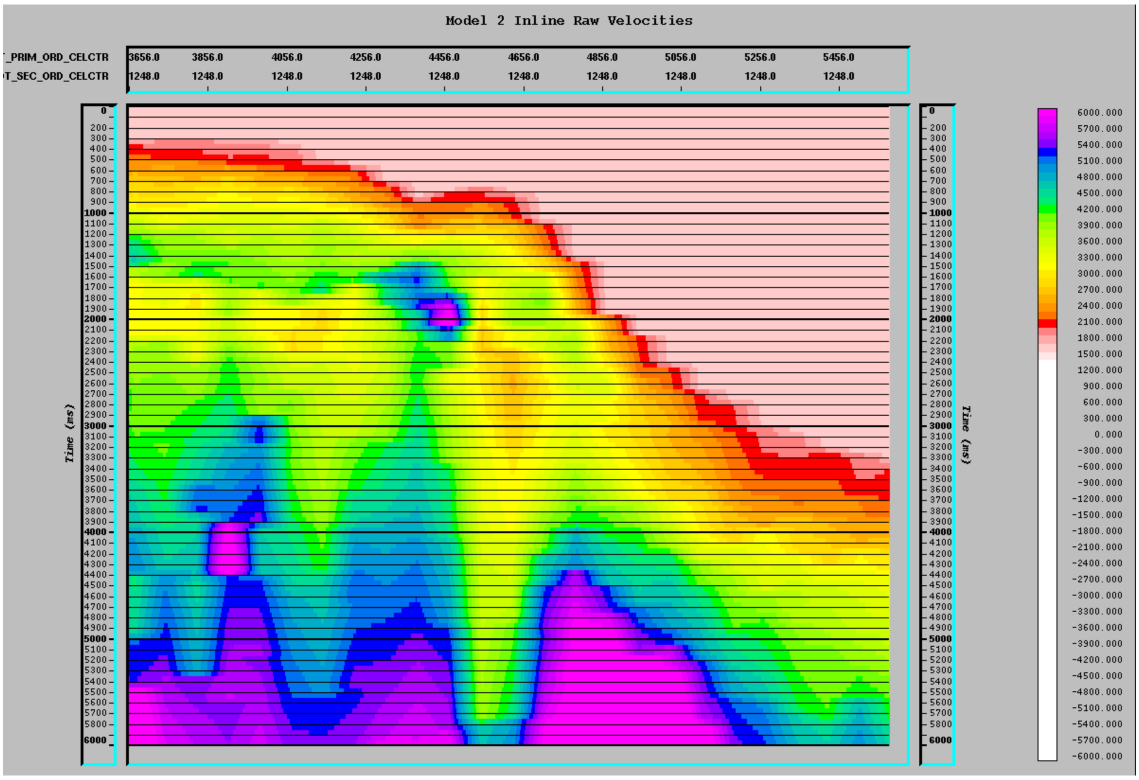

**Enclosure 44: Hybrid KPSDM – initial model with water layer added.**



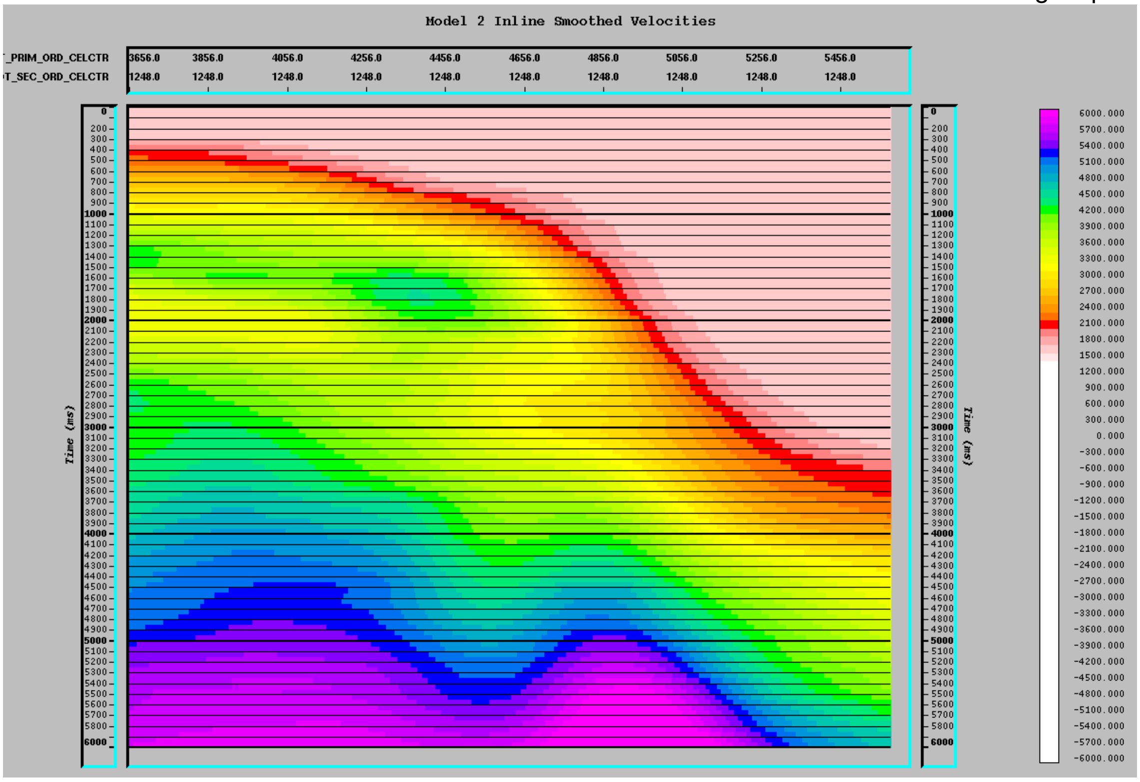
**Enclosure 45: Hybrid KPSDM – targeted migration stack (with migration velocities).**



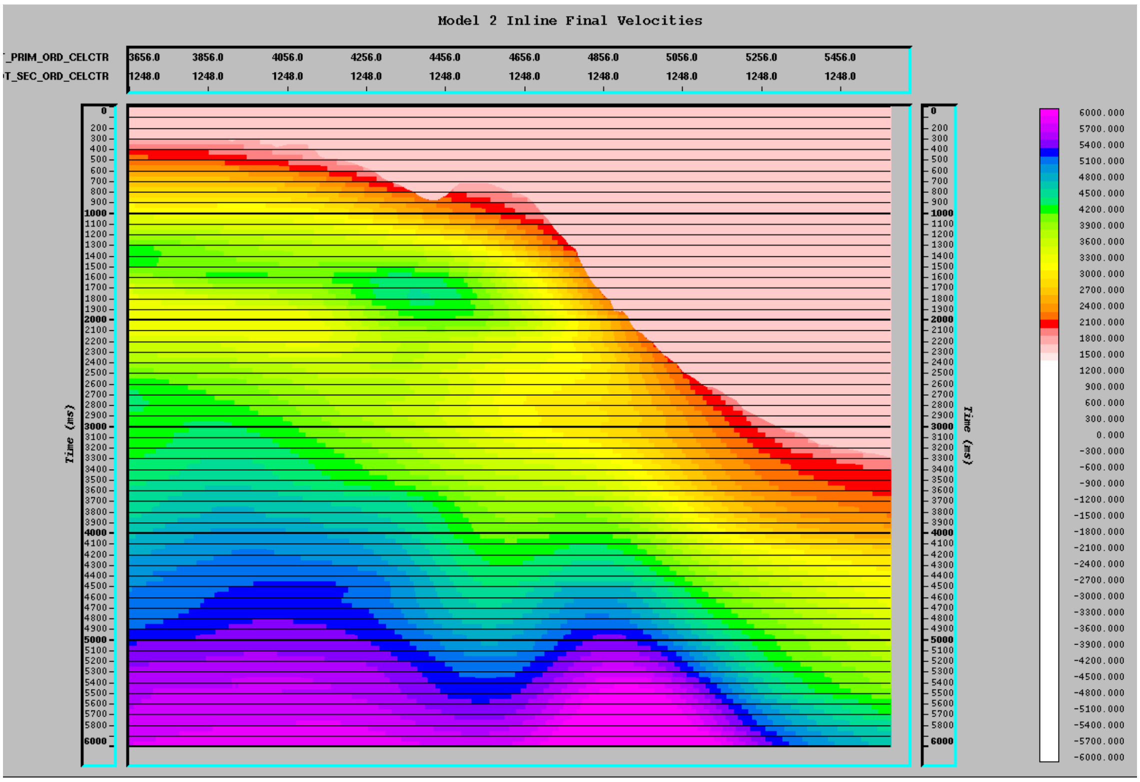
**Enclosure 46: Hybrid KPSDM – targeted migration stack (with repicked velocities).**



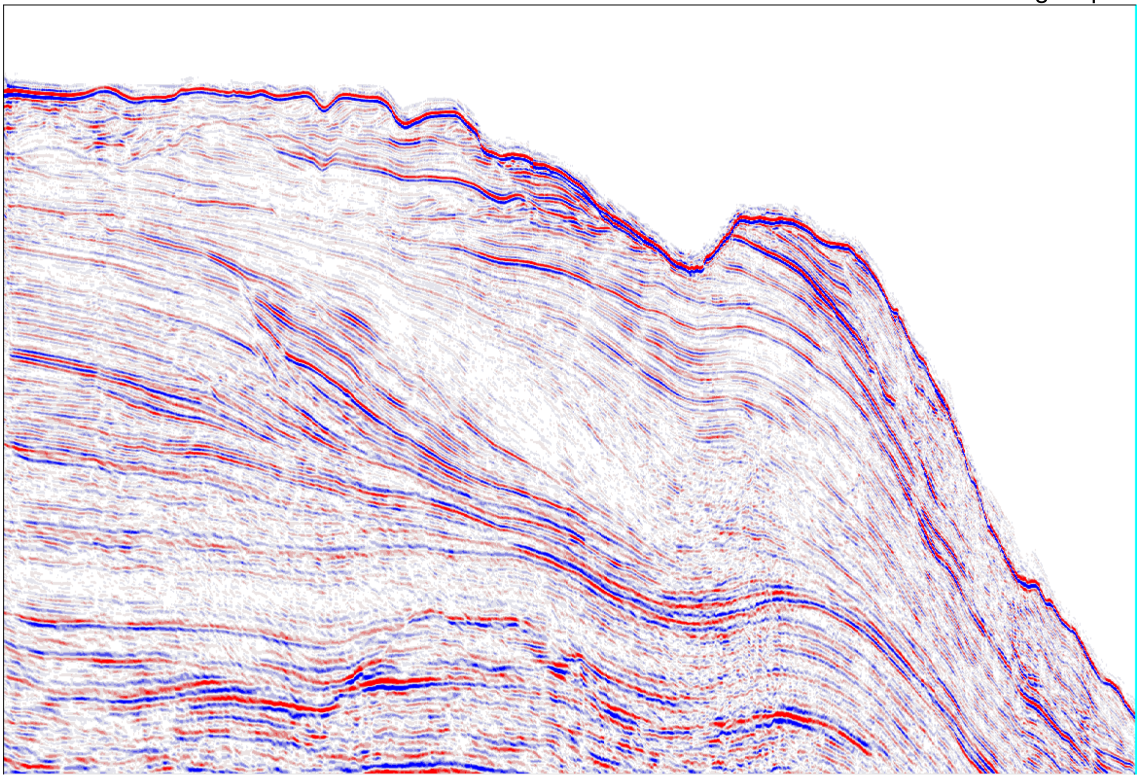

**Enclosure 47: Hybrid KPSDM – final model targeted migration velocities (raw).**



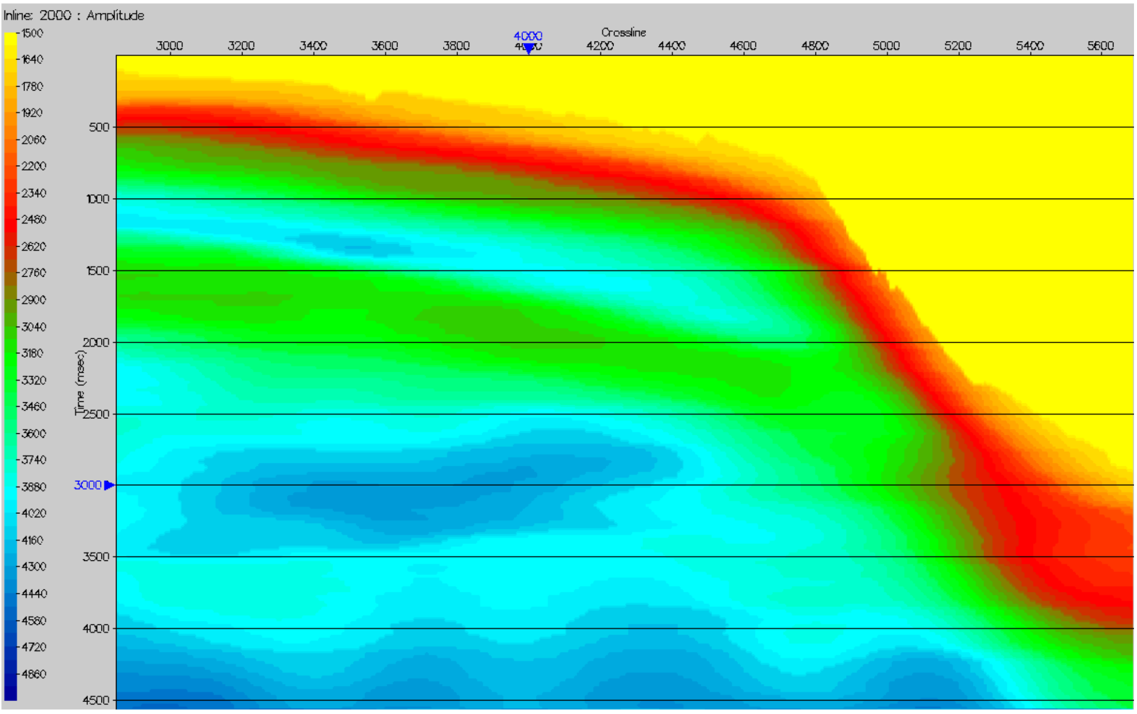

**Enclosure 48: Hybrid KPSDM – final model targeted migration velocities (smoothed).**



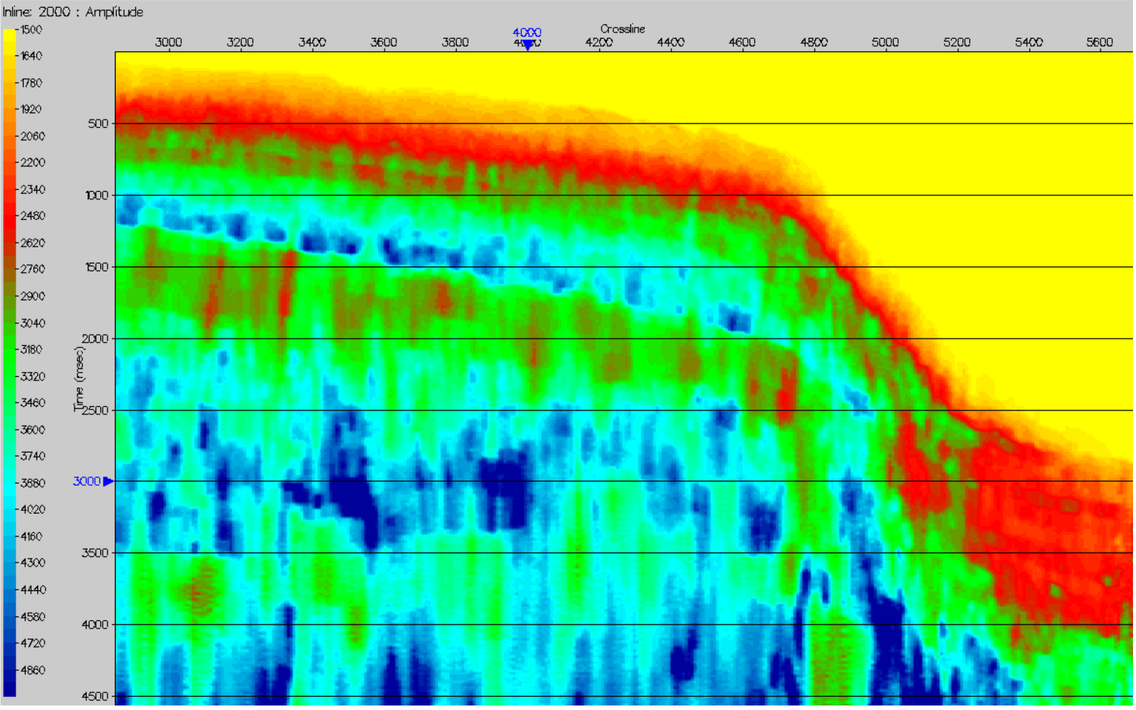

**Enclosure 49: Hybrid KPSDM – final model with water layer added.**



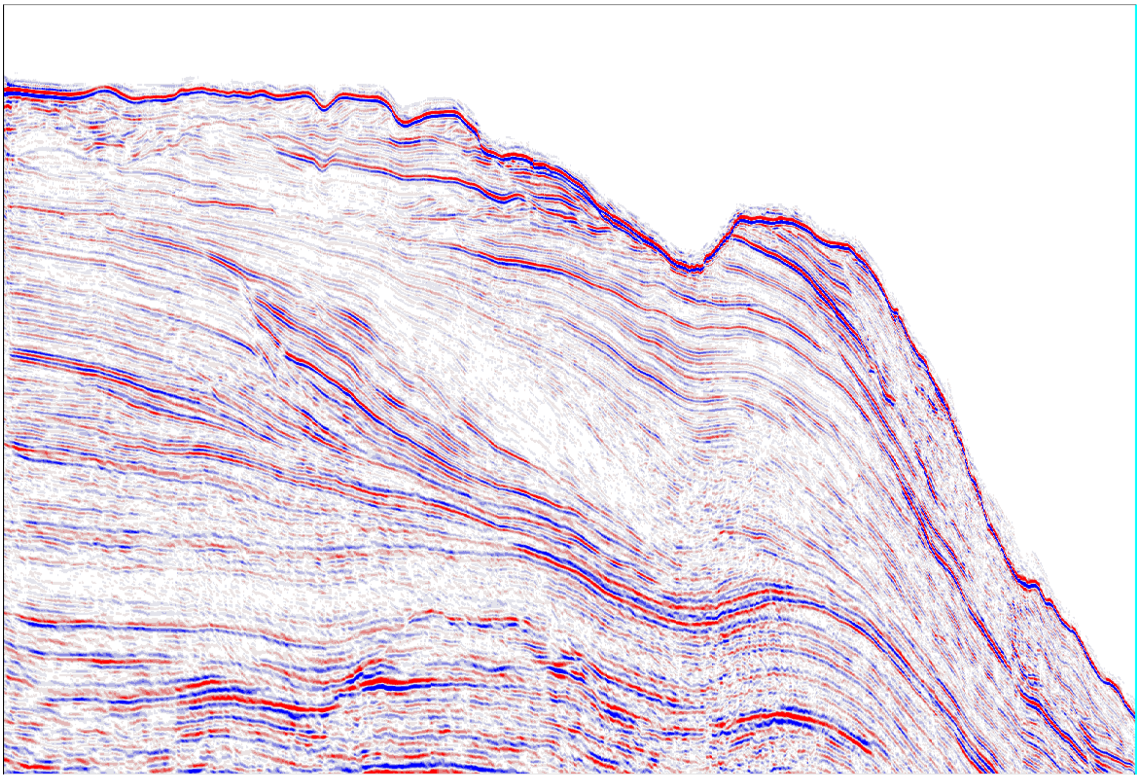
**Enclosure 50: Hybrid KPSDM – production migration stack (with migration velocities).**



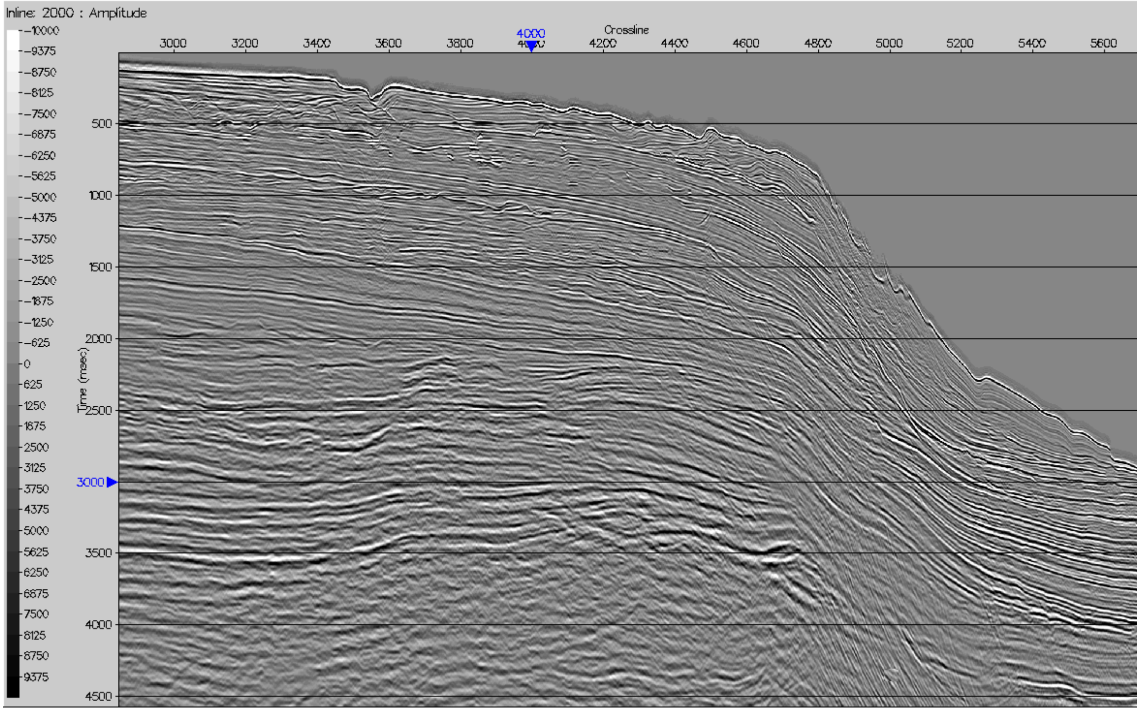

**Enclosure 51: Hybrid KPSDM – final model migration velocities.**



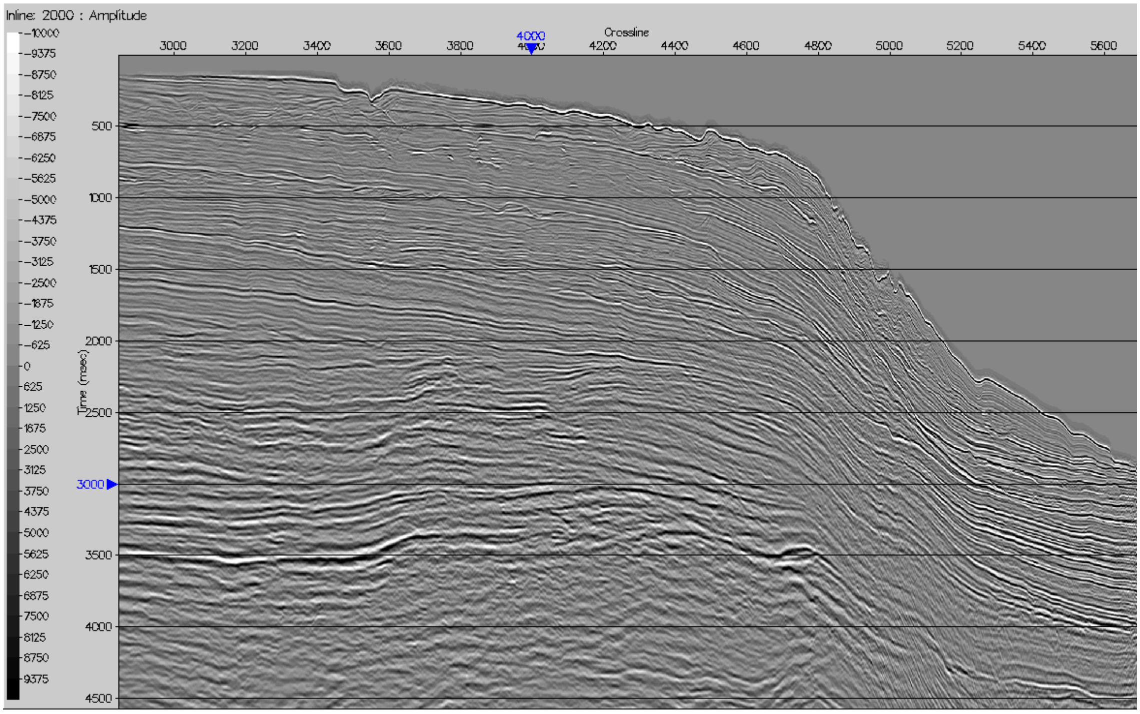

**Enclosure 52: Hybrid KPSDM – high density velocity analyses (HDVA).**



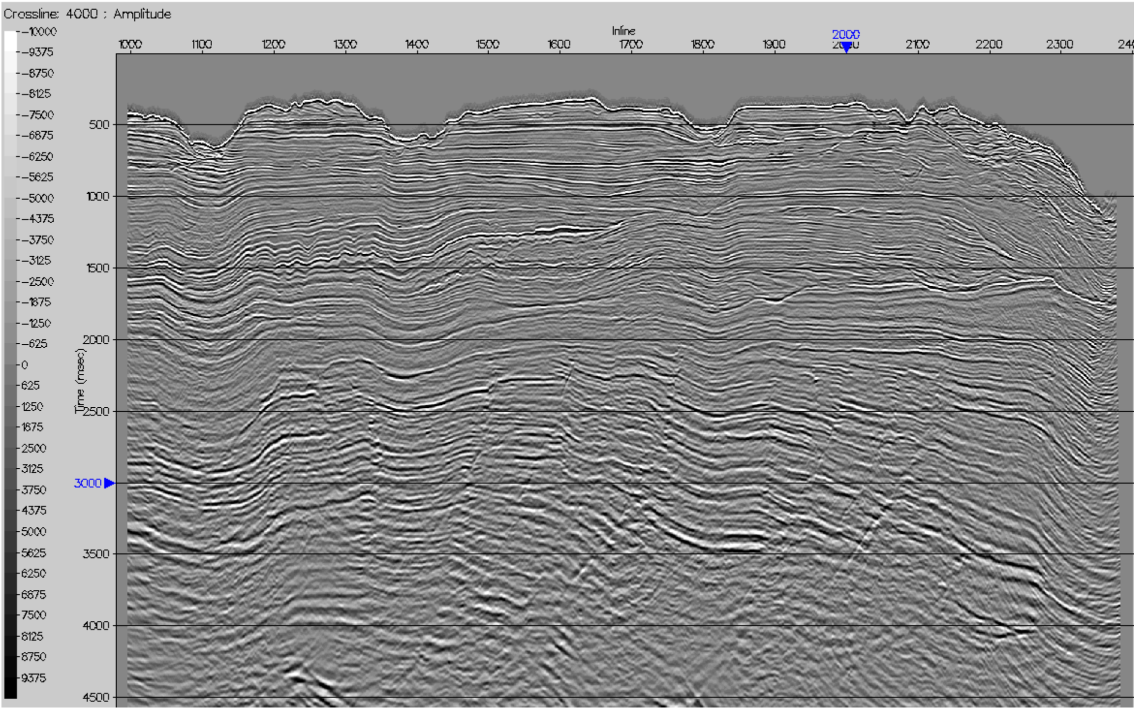
**Enclosure 53: Hybrid KPSDM – production migration stack (with HDVA).**



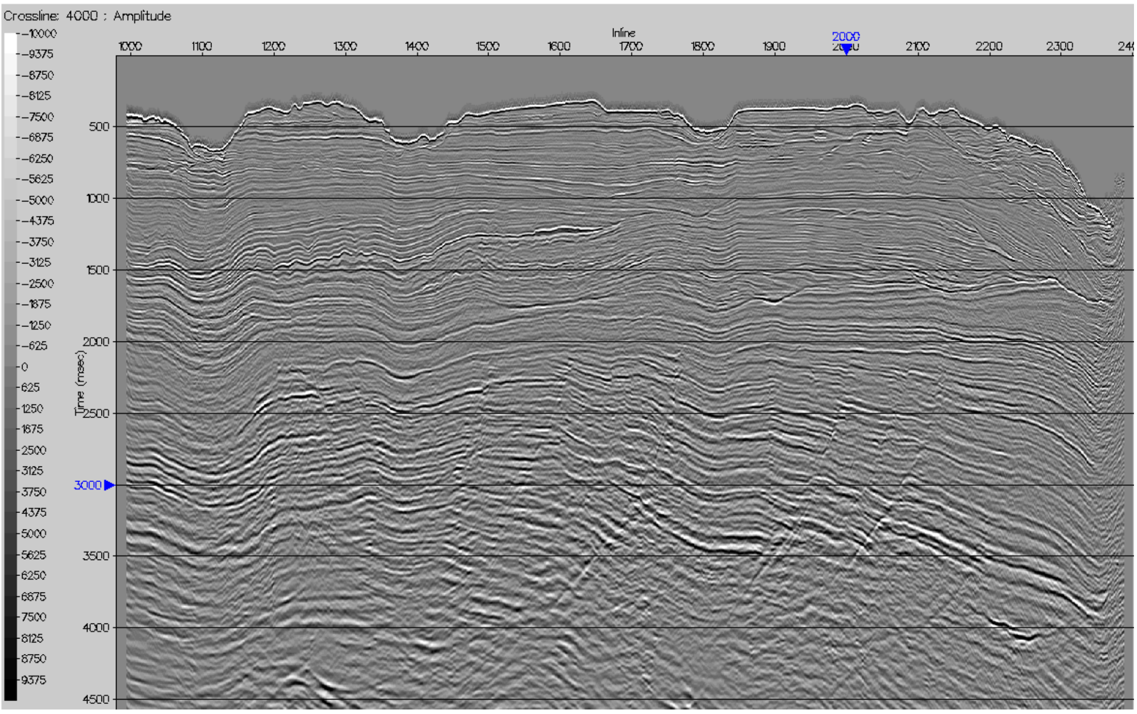

**Enclosure 54: Fast track kirchhoff post stack time migration – example inline.**



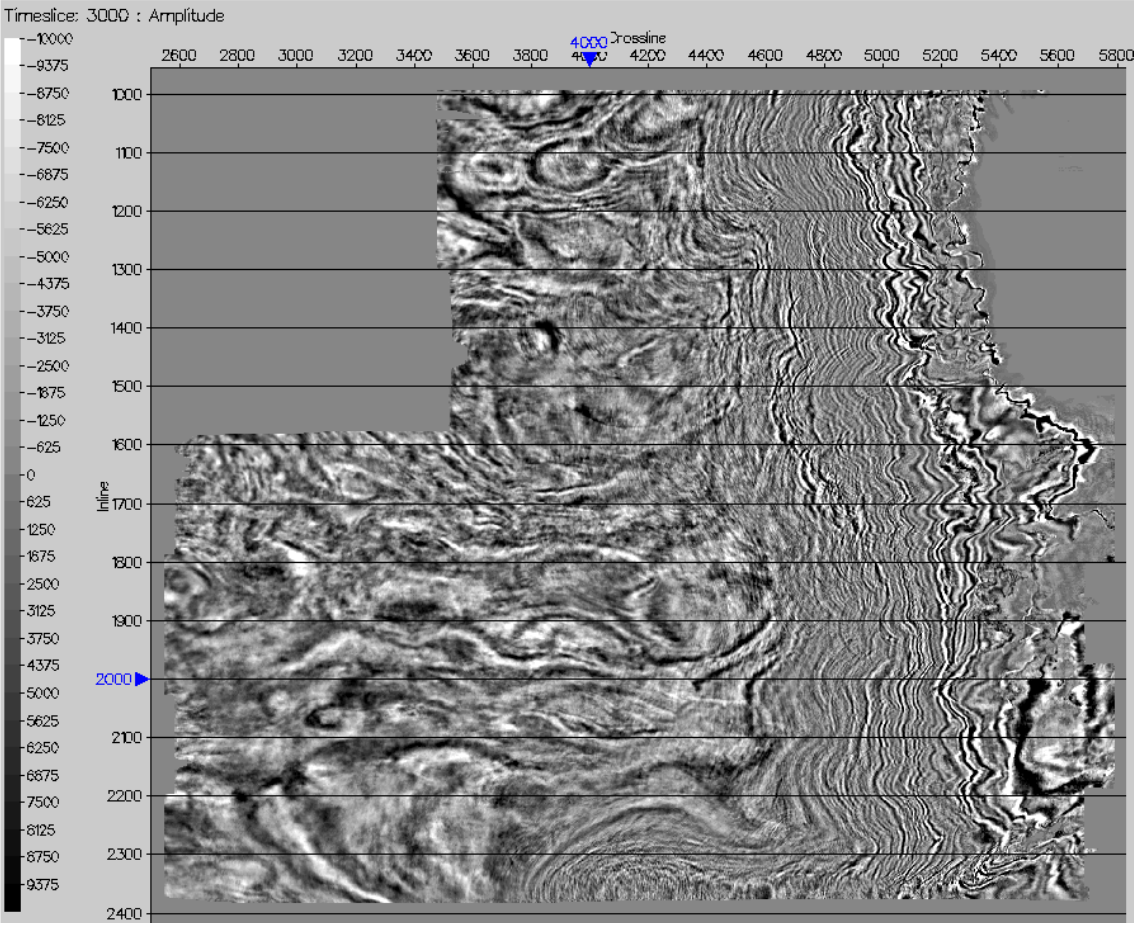

**Enclosure 55: Hybrid KPSDM time scaled migration– example inline.**



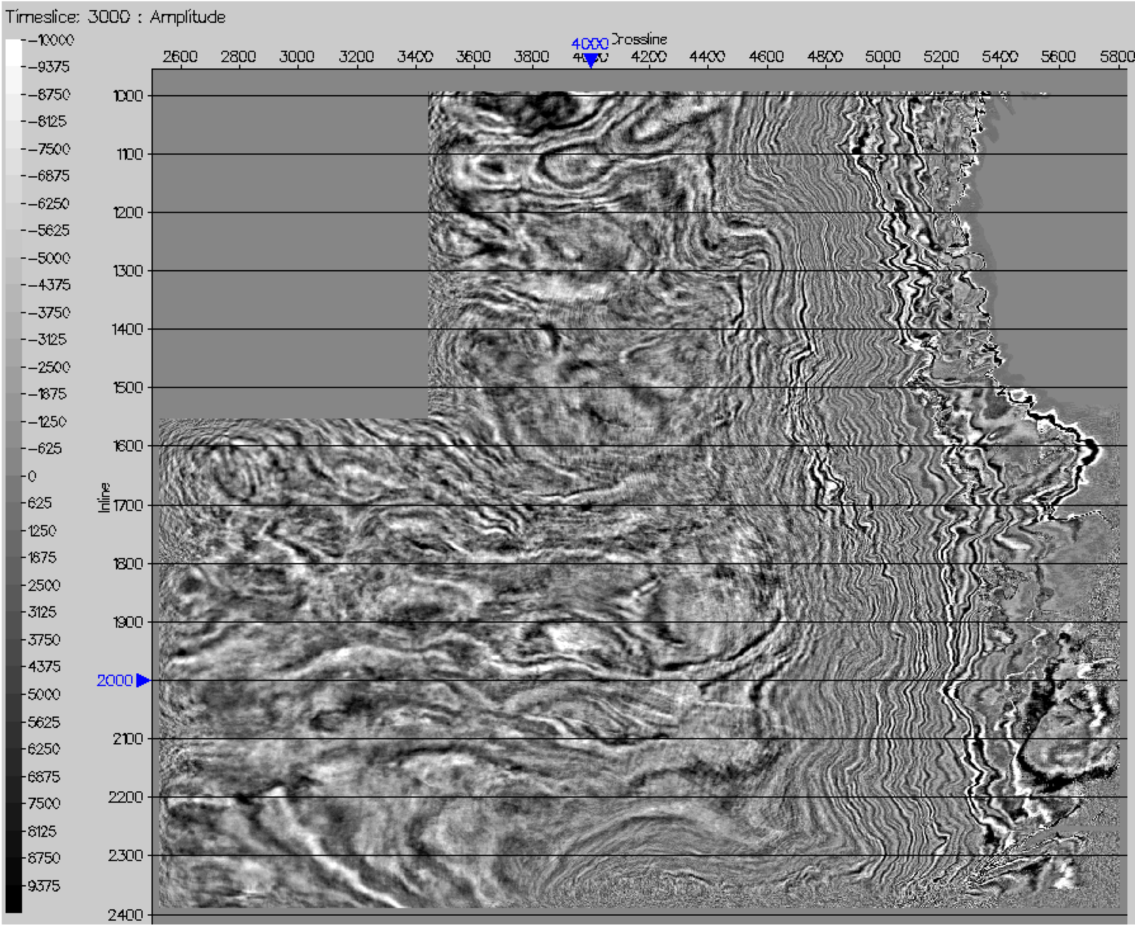

**Enclosure 56: Fast track kirchhoff post stack time migration – example crossline.**




**Enclosure 57: Hybrid KPSDM time scaled migration– example crossline.**




**Enclosure 58: Fast track kirchhoff post stack time migration – example time slice.**




**Enclosure 59: Hybrid KPSDM time scaled migration– example time slice.**