

SEISMIC DATA PROCESSING REPORT

for

Origin Energy

Survey:	2005 Shearwater 2D Survey & Reprocessing
Location:	T/18P, Bass Strait, Offshore Northern Tasmania
Date:	July 2007

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1 Introduction

The Shearwater 2D Seismic Survey was recorded by P.G.S. using the M/V Orient Explorer towing 4 X 4350 m streamers with 100 m separation and a single gun array. The 2D data were acquired concurrently with the Shearwater 3D Seismic Survey during November and December 2005. A total of 202.50 km of sail line kilometres was acquired, comprised of 15 lines. The survey is located in Tasmanian permit: T/18P in the Bass Basin, offshore from the north coast of Tasmania.

In addition to the newly acquired data, a total of 1366 kilometres of pre-stack reprocessing were incorporated into the survey. Data for the pre-stack reprocessing field data arrived in staggered shipments as it had to be procured from several data repositories. Some pre-stack data could not be sourced and these lines were deleted from the processing list.

Testing for the Shearwater Survey was comprehensive with attention paid to multiple and noise removal, amplitude preservation, and phase-matching of the differing data vintages. All testing results were presented in Power-point format and delivered with SEG Y files where required. All velocity QC files were copied to DVD media and sent to Origin's office in Brisbane where a MGIVA velocity QC system had been installed by Fugro Seismic Imaging..

Cable 2 data was used for velocity generation and analysis for each of the 2005 2D acquisition lines. The remaining cables were NMO corrected using the picks from the cable 2 inline.

Once production processing commenced the focus was on accurate velocity estimation. Three passes of analyses were performed and the picks checked by Origin Energy.

All processing was undertaken at Fugro Seismic Imaging's office in Perth, Western Australia.

1.1 Personnel

Fugro Seismic Imaging Pty Ltd

Simon Stewart	Marine 2D Manager
John van Kampen	Senior Geophysicist
C.K. Ong	Senior Geophysicist

Origin Energy

Randall Taylor	Chief Geophysicist
Mike Lonergan	Staff Geophysicist
Darren Rutley	Staff Geophysicist

1.2 Location Map (Shearwater 2D & 3D)

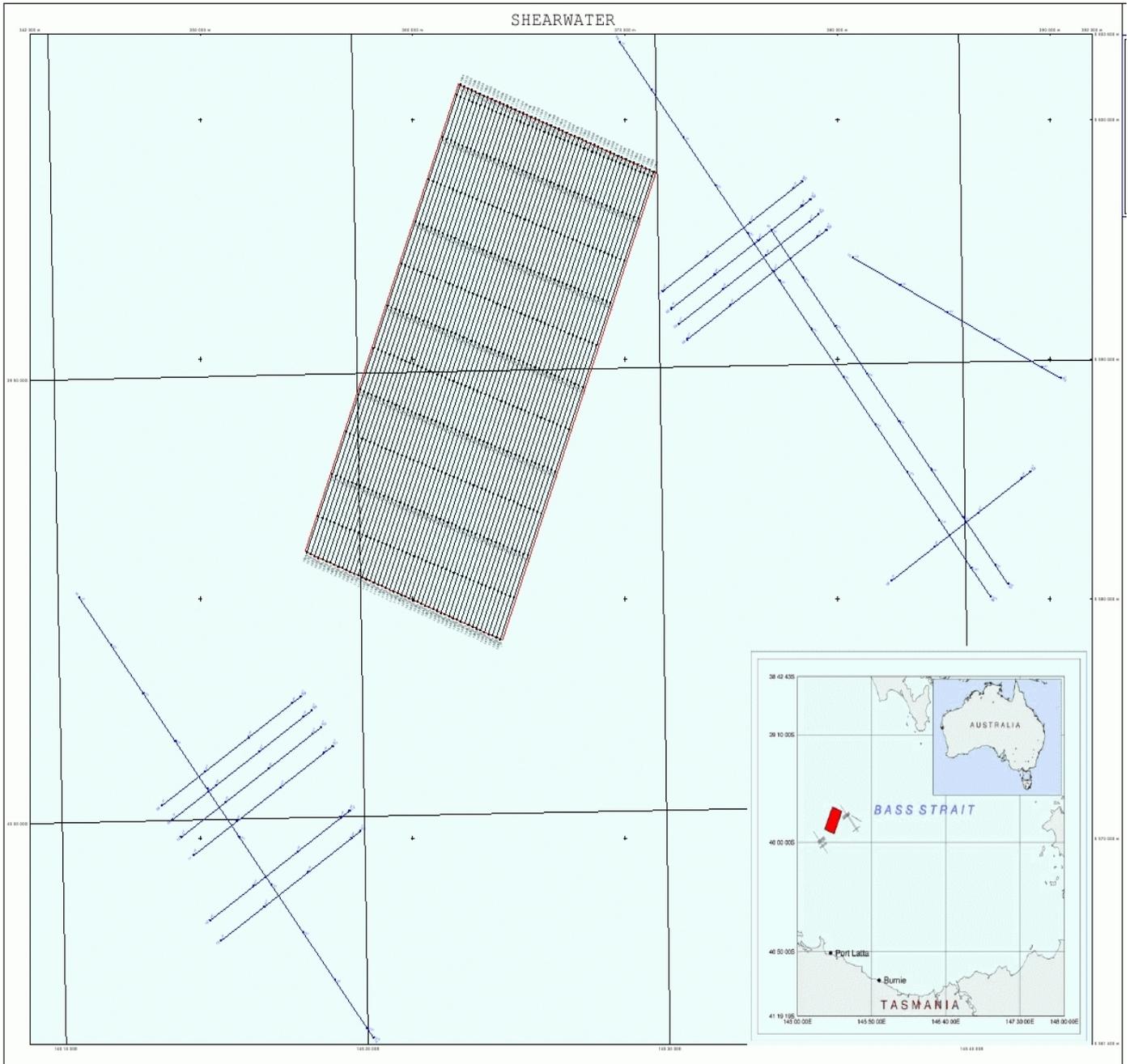


Figure 1: Shearwater 2D and 3D line location map.

1.3 Location Map (T/18P 2006 Reprocessing)

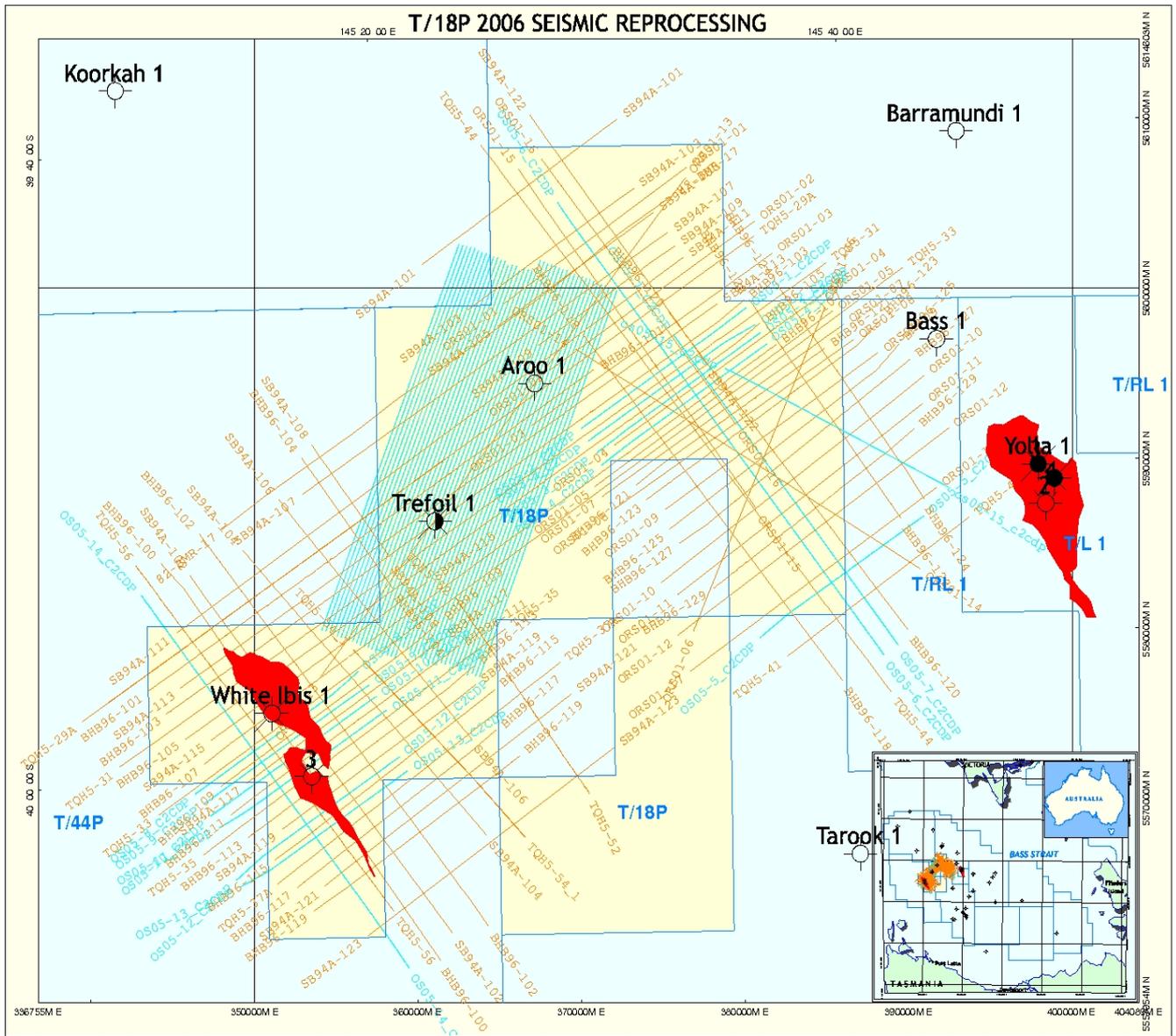


Figure 2: Shearwater 2D/3D & Reprocessing Line Location Map

1.4 Tape Listing (Shearwater 2D Survey)

Line information has only been listed for the 2D component of the 2005 Shearwater Survey. For information regarding the 3D lines please refer to the separate Seismic Data Reprocessing Report for the 3D Shearwater Survey.

Tape No.	Line/Seq.No.	Seq	FFID	FSP	FGSP	LFID	LSP	LGSP
39732	OS2D2007P1001	1	1	840	840	951	9	13
39733	OS2D2015P1002	2	100	100	100	652	631	627
39871	OS2D3014P1067	67	2011	1020	1020	2085	946	946
39872	OS2D3014P1067	67	2086	945	945	2998	33	33
39873	OS2D3014P1067	67	2999	32	32	3018	13	13
39874	OS2D3010P1068	68	6000	420	420	529	9	13
39875	OS2D3013P1069	69	100	100	100	531	511	507
39876	OS2D3009P1070	70	100	420	420	530	9	13
39877	OS2D3011P1071	71	100	100	100	531	511	507
39898	OS2D2006P1083	83	100	101	101	1012	1000	1000
39899	OS2D2006P1083	83	1013	1001	1001	1373	1351	1347
39900	OS2D2005P1084	84	100	100	100	532	511	507
39901	OS2D3012P1085	85	101	100	100	532	511	507
39902	OS2D2003P1086	86	100	100	100	531	511	507
39903	OS2D2001P1087	87	100	420	420	230	300	300
39904	OS2D2001P1087	87	232	298	298	530	9	13
39905	OS2D2004P1088	88	100	100	100	356	346	346
39906	OS2D2004P1088	88	358	348	348	531	511	507
39907	OS2D2002P1089	89	100	420	420	531	9	13
39908	OS2D3008P1090	90	100	420	420	531	9	13

1.5 Line Listing (Shearwater 2D Survey)

<i>LINE NAME</i>	<i>First SP</i>	<i>Last SP</i>	<i>Length (Km)</i>
OS2D2001S2c1	420	13	10.200
OS2D2001S2c2	420	13	10.200
OS2D2001S2c3	420	13	10.200
OS2D2001S2c4	420	13	10.200
OS2D2002S2c1	420	13	10.200
OS2D2002S2c2	420	13	10.200
OS2D2002S2c3	420	13	10.200
OS2D2002S2c4	420	13	10.200
OS2D2003S2c1	100	507	10.200
OS2D2003S2c2	100	507	10.200
OS2D2003S2c3	100	507	10.200
OS2D2003S2c4	100	507	10.200
OS2D2004S2c1	100	507	10.200
OS2D2004S2c2	100	507	10.200
OS2D2004S2c3	100	507	10.200
OS2D2004S2c4	100	507	10.200
OS2D2005S2c1	100	507	10.200
OS2D2005S2c2	100	507	10.200
OS2D2005S2c3	100	507	10.200
OS2D2005S2c4	100	507	10.200
OS2D2006S2c1	102	1347	31.150
OS2D2006S2c2	102	1347	31.150
OS2D2006S2c3	102	1347	31.150
OS2D2006S2c4	102	1347	31.150
OS2D2007S2c1	840	13	20.700
OS2D2007S2c2	840	13	20.700
OS2D2007S2c3	840	13	20.700
OS2D2007S2c4	840	13	20.700
OS2D2015S2c1	100	627	13.200
OS2D2015S2c2	100	627	13.200
OS2D2015S2c3	100	627	13.200
OS2D2015S2c4	100	627	13.200
OS2D3008S2c1	420	13	10.200

LINE NAME	First SP	Last SP	Length (Km)
OS2D3008S2c2	420	13	10.200
OS2D3008S2c3	420	13	10.200
OS2D3008S2c4	420	13	10.200
OS2D3009S2c1	420	13	10.200
OS2D3009S2c2	420	13	10.200
OS2D3009S2c3	420	13	10.200
OS2D3009S2c4	420	13	10.200
OS2D3010S2c1	420	13	10.200
OS2D3010S2c2	420	13	10.200
OS2D3010S2c3	420	13	10.200
OS2D3010S2c4	420	13	10.200
OS2D3011S2c1	100	507	10.200
OS2D3011S2c2	100	507	10.200
OS2D3011S2c3	100	507	10.200
OS2D3011S2c4	100	507	10.200
OS2D3012S2c1	100	507	10.200
OS2D3012S2c2	100	507	10.200
OS2D3012S2c3	100	507	10.200
OS2D3012S2c4	100	507	10.200
OS2D3013S2c1	100	507	10.200
OS2D3013S2c2	100	507	10.200
OS2D3013S2c3	100	507	10.200
OS2D3013S2c4	100	507	10.200
OS2D3014S2c1	1020	13	25.200
OS2D3014S2c2	1020	13	25.200
OS2D3014S2c3	1020	13	25.200
OS2D3014S2c4	1020	13	25.200
Total Length:			809.800 km

1.6 Line Listing (Reprocessing)

<i>LINE NAME</i>	<i>First SP</i>	<i>Last SP</i>	<i>Length (Km)</i>
82-BMR-17	1	460	15.318
BHB96-100	1001	2187	27.135
BHB96-101	1001	2370	31.318
BHB96-102	2105	917	27.181
BHB96-103	2713	917	41.079
BHB96-104	1250	917	7.635
BHB96-105	2710	917	41.011
BHB96-107	1000	2792	40.988
BHB96-109	1558	917	14.676
BHB96-111	1001	1666	15.225
BHB96-113	1586	917	15.316
BHB96-115	1004	1654	14.882
BHB96-117	1503	917	13.419
BHB96-118	1171	2219	23.980
BHB96-119	1001	1598	13.670
BHB96-120	1875	917	21.923
BHB96-121	1001	1534	12.207
BHB96-122	1001	1610	13.945
BHB96-123	1616	917	16.002
BHB96-124	1523	917	13.876
BHB96-125	1615	917	15.979
BHB96-127	1001	1698	15.956
BHB96-129	1510	917	13.579
ORS01-01	1802	1190	11.494
ORS01-02	1450	2144	13.031
ORS01-03	1260	2091	15.600
ORS01-04	2014	1300	13.406
ORS01-05	1150	1984	15.656
ORS01-06A	1000	1984	18.469
ORS01-07	1150	1985	15.675
ORS01-08	1160	1986	15.506
ORS01-09	1801	1070	13.725
ORS01-10	1828	870	17.981

LINE NAME	First SP	Last SP	Length (Km)
ORS01-11	1748	870	16.481
ORS01-12	1540	2518	18.356
ORS01-13_A	2707	869	34.481
ORS01-14	2548	1350	22.481
ORS01-15A	1000	2198	22.481
ORS01-16	1801	870	17.475
ORS01-17	1460	2331	16.350
SB94A-101	270	798	13.225
SB94A-102	111	1110	25.000
SB94A-103	640	200	11.025
SB94A-104	1010	170	21.025
SB94A-105	310	717	10.200
SB94A-106	111	790	17.000
SB94A-107	111	1138	25.700
SB94A-108	300	31	6.750
SB94A-109	670	320	8.775
SB94A-111	1494	31	36.600
SB94A-113	111	1647	38.425
SB94A-115	111	700	14.750
SB94A-117	557	31	13.175
SB94A-119	554	31	13.100
SB94A-121	111	805	17.375
SB94A-122	320	988	16.725
SB94A-123	720	31	17.250
TQH5-29A	1	1610	48.300
TQH5-31	240	1930	50.730
TQH5-33	600	2400	54.030
TQH5-35	1060	1760	21.030
TQH5-37A	930	1593	19.920
TQH5-41	1000	1400	12.030
TQH5-44	1500	2800	39.030
TQH5-52	400	810	12.330
TQH5-54-1	1	450	13.500
TQH5-56	1650	2447	23.940
Total Length:			1365.89

2 Acquisition Parameters

2.1 2005 Shearwater 2D Survey

DESCRIPTION	DETAILS
<i>Data recorded by:</i>	P.G.S.
<i>Date recorded:</i>	November/December 2005
<i>Vessel:</i>	Orient Explorer
General:	
<i>Field CMP Interval</i>	6.25 m
<i>Nominal Fold</i>	87
<i>Recording Format:</i>	SEG-D 8036
Seismic source:	
<i>Type</i>	Bolt 1500LL / 600B Airguns
<i>Volume</i>	2500 cu.in.
<i>Pressure:</i>	1800 psi
<i>Depth:</i>	6 m
<i>Shot interval 2D:</i>	25 m
<i>Shot interval 3D:</i>	37.5 m flip-flop
Recording system:	
<i>Type:</i>	Syntrak / gAS
<i>Record length:</i>	5120 ms
<i>Sample interval:</i>	2 ms
<i>Number of Channels:</i>	348
<i>Near Channel:</i>	1
<i>Recording Delay:</i>	120 ms
<i>Low Cut Filter:</i>	3Hz @ 12 dB/octave
<i>High Cut Filter:</i>	206Hz @ 276 dB/octave
<i>Gain Setting</i>	12 dB
Receivers:	
<i>Streamer Type :</i>	Syntron / Teledyne LDA
<i>Streamer depth:</i>	8 m
<i>Number of Streamers/Groups:</i>	4 x 348
<i>Group interval:</i>	12.5 m
<i>Nominal near group offsets:</i>	
<i>Cable1/Cable2/Cable3/Cable4</i>	199m/122m/99m/158m

2.2 2001 Shelduck 2D Survey

DESCRIPTION	DETAILS
<i>Data recorded by:</i>	Fugro Geoteam
<i>Date recorded:</i>	June 2001
<i>Vessel:</i>	Geo Arctic
General:	
<i>Field CMP Interval</i>	6.25 m
<i>Nominal Fold</i>	122
<i>Recording Format:</i>	Demultiplexed, SEG-D (3590 media)
Seismic source:	
<i>Type</i>	Airgun Array
<i>Volume</i>	2660 cu.in.
<i>Pressure:</i>	2000 psi
<i>Nominal Depth:</i>	5 m
<i>Shot interval:</i>	18.75 m
Recording system:	
<i>Type:</i>	I/O MSX
<i>Record length:</i>	5120 ms
<i>Sample interval:</i>	2 ms
<i>Number of Channels:</i>	366
<i>Near Channel:</i>	1
<i>Recording Delay:</i>	0 ms
<i>Low Cut Filter:</i>	4 Hz @ 12 dB/octave
<i>High Cut Filter:</i>	206Hz @ 264 dB/octave
<i>Polarity:</i>	First break is negative
Receivers:	
<i>Centre near group to centre far group:</i>	4587.5 m
<i>Nominal Streamer depth:</i>	7.5 m
<i>Number of groups:</i>	368
<i>Group interval:</i>	12.5 m
<i>Centre source to centre near group:</i>	148 m
<i>Number of Streamers:</i>	1

2.3 1996 Hummock 2D Survey

DESCRIPTION	DETAILS
<i>Data recorded by:</i>	P.G.S. Exploration
<i>Date recorded:</i>	January 1996
<i>Vessel:</i>	Odin Explorer
General:	
<i>Field CMP Interval</i>	7.62 m
<i>Nominal Fold</i>	84
<i>Recording Format:</i>	SEG-D (8015)
Seismic source:	
<i>Type</i>	Airgun Array
<i>Volume</i>	1330 cu.in.
<i>Pressure:</i>	2000 psi
<i>Depth:</i>	6 m
<i>Shot interval:</i>	22.86 m
<i>Gun Delay</i>	0 ms
Recording system:	
<i>Type:</i>	?
<i>Record length:</i>	6144 ms
<i>Sample interval:</i>	2 ms
<i>Number of Channels:</i>	252
<i>Near Channel:</i>	252
<i>Recording Delay:</i>	81 ms
<i>Low Cut Filter:</i>	3 Hz @ 6 dB/octave
<i>High Cut Filter:</i>	218 Hz @ 484 dB/octave
<i>Polarity:</i>	First break is negative
Receivers:	
<i>Centre near group to centre far group:</i>	3932.74 m
<i>Streamer depth:</i>	6.5 m
<i>Number of groups:</i>	252
<i>Group interval:</i>	15.24 m
<i>Centre source to centre near group:</i>	107.50 m
<i>Number of Streamers:</i>	1

2.4 1994 Rocky Cape Survey

DESCRIPTION	DETAILS
<i>Data recorded by:</i>	Western Geophysical
<i>Date recorded:</i>	1994
<i>Vessel:</i>	Western Atlas
General:	
<i>Field CMP Interval</i>	12.5 m
<i>Nominal Fold</i>	120
<i>Recording Format:</i>	SEG-D (8048)
Seismic source:	
<i>Type</i>	Airgun Array
<i>Volume</i>	3305 cu.in.
<i>Pressure:</i>	1850 psi
<i>Depth:</i>	6.0 m
<i>Shot interval:</i>	25 m
<i>Gun Delay</i>	0 ms
Recording system:	
<i>Type:</i>	WG-24
<i>Record length:</i>	6144 ms
<i>Sample interval:</i>	2 ms
<i>Number of Channels:</i>	240
<i>Near Channel:</i>	1
<i>Low Cut Filter:</i>	6 Hz @ 18 dB/octave
<i>High Cut Filter:</i>	196 Hz @ 214 dB/octave
<i>Polarity:</i>	First break is negative
Receivers:	
<i>Centre near group to centre far group:</i>	2987.5 m
<i>Streamer depth:</i>	10 m
<i>Number of groups:</i>	240
<i>Group interval:</i>	12.5 m
<i>Centre source to centre near group:</i>	131 m
<i>Number of Streamers:</i>	1

2.5 1985-B Amoco 2D Survey

DESCRIPTION	DETAILS
<i>Data recorded by:</i>	G.S.I.
<i>Date recorded:</i>	October 1985
<i>Vessel:</i>	Eugene McDermott II
General:	
<i>Field CMP Interval</i>	15 m
<i>Nominal Fold</i>	60
<i>Recording Format:</i>	Demultiplexed, SEG-D
Seismic source:	
<i>Type</i>	Airgun Array
<i>Volume</i>	4075 cu.in.
<i>Pressure:</i>	1800 psi
<i>Depth:</i>	10 m
<i>Shot interval:</i>	30 m
<i>Gun Delay</i>	51.2 ms
Recording system:	
<i>Type:</i>	TSR 001
<i>Record length:</i>	6000 ms
<i>Sample interval:</i>	2 ms
<i>Number of Channels:</i>	240
<i>Near Channel:</i>	240
<i>Recording Delay:</i>	0 ms
<i>Low Cut Filter:</i>	8 Hz @ 18 dB/octave
<i>High Cut Filter:</i>	128 Hz @ 72 dB/octave
<i>Polarity:</i>	First break is negative
Receivers:	
<i>Centre near group to centre far group:</i>	3585 m
<i>Average Streamer depth:</i>	13 m
<i>Number of groups:</i>	240
<i>Group interval:</i>	15 m
<i>Centre source to centre near group:</i>	396 m
<i>Number of Streamers:</i>	1

2.6 1982 B.M.R. 2D Survey

DESCRIPTION	DETAILS
<i>Data recorded by:</i>	G.S.I.
<i>Date recorded:</i>	1982
<i>Vessel:</i>	?
General:	
<i>Field CMP Interval</i>	16.66 m?
<i>Nominal Fold</i>	48
<i>Recording Format:</i>	SEG-D
Seismic source:	
<i>Type</i>	Airgun Array
<i>Volume</i>	? cu.in.
<i>Pressure:</i>	? psi
<i>Depth:</i>	6 m?
<i>Shot interval:</i>	33.33 m?
<i>Gun Delay</i>	51.2 ms
Recording system:	
<i>Type:</i>	DFS V
<i>Record length:</i>	6144 ms
<i>Sample interval:</i>	2 ms
<i>Number of Channels:</i>	96
<i>Near Channel:</i>	96
<i>Low Cut Filter:</i>	? Hz @ ? dB/octave
<i>High Cut Filter:</i>	? Hz @ ? dB/octave
<i>Polarity:</i>	First break is negative
Receivers:	
<i>Centre near group to centre far group:</i>	3166.35 m
<i>Streamer depth:</i>	10 m?
<i>Number of groups:</i>	96
<i>Group interval:</i>	33.33 m?
<i>Centre source to centre near group:</i>	365 m
<i>Number of Streamers:</i>	1

Note: No observer's Reports or Acquisition information were available for this vintage.

3 Parameter Testing

The processing flow for the 2D data was based on test results from the 3D survey. These results were applied to a selected line, OS2D-2005 (Cable 3), to confirm their validity for the 2D data.

The processing stream for the new acquisition data then became the basis for each of the reprocessing vintages. Again, a line was chosen for each vintage and parameters adjusted for the differing acquisition parameters.

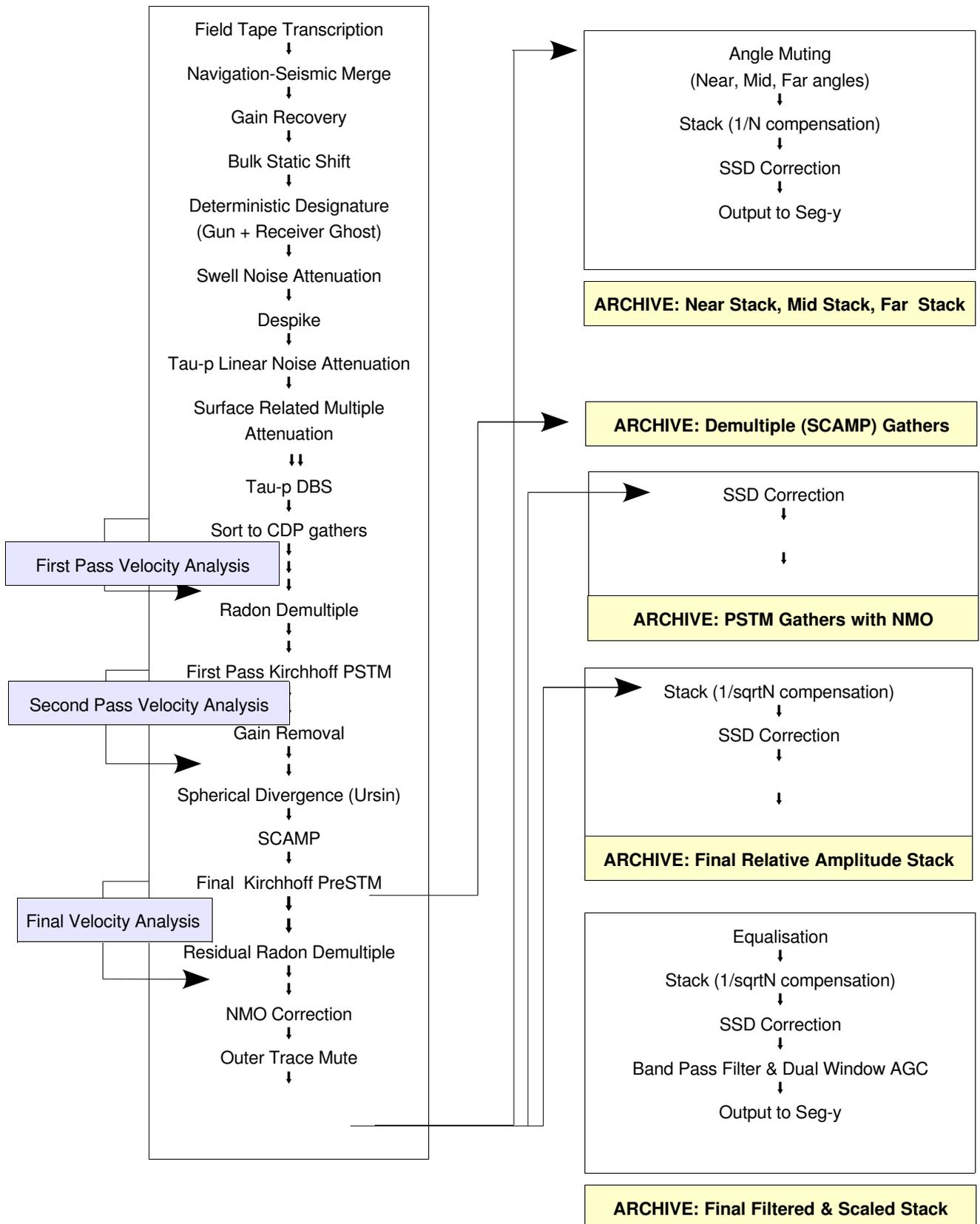
All tests were output into power-point format and sent to Origin by email.

The following table summarises tests performed.

Description	Format
Gain Recovery	Shot
Deterministic Designature	Shot
DespikeSwell Noise Attenuation	Shot
Swell Noise Attenuation	Shot/Gather/Stack
Tau-p Linear Noise Removal 1	Shot/Gather/Stack
SRME	Shot/Gather/Stack
Tau-p Deconvolution	Shot/Gather/Stack
Adjacent Trace Sum	Shot/Stack
Radon Demultiple	Gather/ Stack
Surface Consistent Amplitude Scaling	Gather/ Stack
Kirchhoff Pre-stack migration	Gather/ Stack
Residual Radon Demultiple	Gather/ Stack
Mutes	Gather/ Stack
Final RMS Velocities	Stack
Relative Amplitude	Stack
Angle Migrated Stacks - Near	Stack
- Mid	Stack
- Far	Stack
AVO Attributes - Intercept	Stack
- Gradient	Stack
- Delta Rp	Stack

4 Processing Sequence Diagram

Processing stream shown is for the Shearwater 2D data. Reprocessed lines followed this sequence as closely as possible.



5 Processing Description

5.1 Transcription

The supplied field tapes were copied directly to disk, without transcription from SEG-D format. The practice of preserving a pristine field tape image ensures that the field tapes need only be read once in a processing project. The field tape images are later converted to Fugro Seismic Imaging internal format - trace sequential with samples in 32 bit IEEE floating point.

5.2 Navigation-Seismic Merge

The seismic trace headers were updated with easting and northing values from the supplied navigation files. The Geodetic Datum as surveyed was GDA94.

Navigation Parameters	
Spheroid:	International (6378137.0, 298.257)
Projection type:	002 UTM South
Projection Zone:	55S
Longitude of CM:	147 0 0.000E

5.3 Gain Recovery

A gain function was applied to the data to compensate for amplitude decay. The function applied used t^2 compensation for spherical divergence losses, (t is two way travel time (twt) in ms).

5.4 Bulk Static Shift

A -120 ms static shift was applied to the Shearwater 2D Survey lines to compensate for the recording system delay.

Recording System Delay	
Vintage	Static Applied
<i>ORS01</i>	None Applied
<i>BHB96</i>	-81 ms
<i>SB94A</i>	None Applied
<i>TQH5</i>	-52 ms
<i>82BMR</i>	-52 ms

5.5 Low Cut Filter

A minimum phase low-cut filter (3 Hz at 6 dB/Octave) was applied to the shot records.

Reprocessing Vintages:

No minimum-phase low-cut filter was applied to any of the reprocessing vintages.

5.6 Swell Noise Attenuation

Swell noise attenuation is achieved by shaping the amplitude spectra of selected "swell noise affected" traces.

Analysis and attenuation are performed in the FX domain, processing one source position at a time. For analysis, the amplitude spectra are normalised, considering only the higher frequency range which is less influenced by swell noise. After normalisation the swell noise traces are recognised by their relatively high amplitude, low frequency component. The shallow portion of each shot record is muted before analysis, removing the high amplitude shallow reflections and direct arrivals.

The user nominates a frequency range for analysis, and for spectral scaling. Typically this frequency range is from 0 to 30 Hz. Scalars are calculated to shape the spectra of individual swell noise affected traces to the mean of the non swell noise affected traces. The scalars are fully applied from 0 to one half the defined frequency range, after which the scalars are tapered to zero application at the maximum defined frequency. No modification is made to other traces.

The mechanism of swell noise recognition is not influenced by change in source energy, or by systematic variation in trace amplitude levels. Shots not affected by swell noise will not present any traces for swell noise attenuation.

The swell noise attenuation is monitored by recording the number of channels flagged as being affected by swell noise.

5.7 Random Spike Attenuation

Despike was applied to remove any anomalous high energy amplitudes which could be the source of noise in the pre-stack migration. Amplitudes were measured in a matrix of 45 time windows of 100 ms length. The matrix was composed of seven consecutive time windows across 11 adjacent traces in a shot gather. The amplitude of the centre window is compared to the rest of the matrix and the centre window is defined as containing a spike if the peak to median ratio is greater than 15, or if the centre window median value exhibits more than 8.0 units of standard deviation from the average median. Spike affected windows are scaled to the mean of the matrix.

5.8 Instrument Dephase and Source Designature

A filter was designed to convert the supplied far field signature to its zero phase equivalent. The effect of applying this filter to the data is to remove the phase effects of the recording instruments, and to collapse the effective source signature. (See Section 8, for the modeled source far field signature and full system response with source and receiver ghost listing).

Reprocessing Vintages:

ORS01: Applied

BHB96: Applied

SB94A: Source Signature unavailable.

TQH5: Source Signature unavailable.

82-BMR: Source Signature unavailable

5.9 Tau-P Linear Noise Removal

Shot records were NMO corrected with 1st pass velocities and then interpolated from 348 traces to 695 traces. After F-X interpolation, NMO was removed and the data transformed into the Tau-P domain using the linear transform. Strong linear noise trains with large dip can be differentiated from primary energy in the linear tau-p space, and these events are attenuated by a scaling pattern - tapering from the primary to noise areas of the transform. The transform was performed with p limits of -2000 ms and 4000 ms, with increments of 8 ms (reference offset of 4520m).

Reprocessing Vintages:

No F-X interpolation was applied to the reprocessed data prior to transformation of the data into the tau-p domain.

5.10 SRME

SRME or **S**urface **R**elated **M**ultiple **E**limination uses the geometry of shot recording to estimate all possible multiples that can be generated by the surface. It was developed by the Delphi Consortium at TUDelft in the Netherlands. One order of surface related multiples is predicted using auto-convolutions of input data. The predicted multiple energy is then removed from the input gathers by a process of cascaded adaptive subtraction.

It was not necessary to interpolate new shots since the recorded shotpoint interval equalled the group interval. The recorded data is extrapolated to zero offset, before constructing the multiple estimate by a series of convolutions and summation.

A mute was applied to the input shot records prior to remove direct arrival energy. Before adaptive subtraction, the modelled multiples were NMO corrected and any energy above the first seafloor multiple removed by muting.

5.11 Tau-p Linear Transformation & Predictive Deconvolution

Shot records were again NMO corrected with 1st pass velocities and then interpolated from 348 traces to 695 traces. After F-X interpolation, NMO was removed and data transformed into the Tau-P domain using the same linear transform described in section 5.9..

The design window for the deconvolution consisted of a single 3500 m/sec window, 332 ms total operator length and a gap length of 32 ms. Application of the deconvolution was to the whole trace

length.

5.12 Receiver Array Simulation and Decimation

Before decimating the shot records from 12.5m to 25.0m group interval, an adjacent trace summation was performed with alignment along NMO curves. The first pass velocity functions were used for this process.

Adjacent Trace Sum Parameters	
Input traces:	348
Input trace interval:	12.5m
Output traces:	174
Output trace interval:	25 m

Trace Mix Details			
Time (ms)	Trace Mix	Time (ms)	Trace Mix
0	1 - 2 - 1	TMax	1 - 2 - 1

Reprocessing Vintages:

ORS01: Not Applied

BHB96: Not Applied

SB94A: Applied. 240 traces/shot decimated to 120. Output trace interval: 12.5 metres.

TQH5: Applied. 240 traces/shot decimated to 120. Output trace interval: 15 metres.

82-BMR: Not Applied

5.13 CDP Gather

The pre-processed shot records were sorted into common depth point gathers.

CDP Gather Parameters	
SP interval:	25 m
Group interval:	12.5 m
Number of channels:	174
CDP interval:	12.5 m
CDP fold:	87

Reprocessing Vintages:

CDP Gather Parameters - ORS01	
SP interval:	18.75 m
Group interval:	12.5 m
Number of channels:	366
CDP interval:	6.25 m
CDP fold:	122

CDP Gather Parameters - BHB96	
<i>SP interval:</i>	22.86 m
<i>Group interval:</i>	15.24 m
<i>Number of channels:</i>	252
<i>CDP interval:</i>	7.62 m
<i>CDP fold:</i>	84

CDP Gather Parameters - SB94A	
<i>SP interval:</i>	25 m
<i>Group interval:</i>	25 m
<i>Number of channels:</i>	120
<i>CDP interval:</i>	12.5 m
<i>CDP fold:</i>	60

CDP Gather Parameters - TQH5	
<i>SP interval:</i>	30 m
<i>Group interval:</i>	30 m
<i>Number of channels:</i>	120
<i>CDP interval:</i>	15 m
<i>CDP fold:</i>	60

CDP Gather Parameters - 82BMR	
<i>SP interval:</i>	30 m
<i>Group interval:</i>	30 m
<i>Number of channels:</i>	120
<i>CDP interval:</i>	16.66 m
<i>CDP fold:</i>	60

5.14 First Pass Velocity Analysis

First pass velocities (1km interval) were determined using the Fugro Seismic Imaging Pty. Ltd. "MGIVA" interactive velocity analysis program. Each velocity analysis comprised a semblance display, a CDP stacked panel repeated 17 times with a suite of velocity functions, and a central CDP gather. The suite of functions were generated using 0%, +/-2 %, +/-4%, +/-6%, +/-8 %, +/-10%, +/-12%, +/- 15%, and +18% increments from a central velocity function. The central function was a water depth based velocity representative for the grid area.

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

5.15 (High Resolution) Radon Multiple Attenuation

Attenuation of multiples was achieved by modelling and subtraction using a least squares, parabolic radon transform. Normal moveout corrections were performed using the first pass velocities, and the CDP gathers transformed into the parabolic Tau-P domain. The segment of the Tau-P domain corresponding to primary reflections is muted, leaving the multiple energy to be transformed back into the T-X domain and subtracted from the original CDP gather.

The Hi-resolution radon option was invoked, where the resolution of the radon transform is improved by adding weighting terms to the least squares solution, thus minimising the residual error. To further reduce the potential for aliasing, the radon transform was performed on 174 fold gathers formed by F-X interpolation of new shots in the common offset domain. Following demultiple, the interpolated traces were dropped from the processing stream. A mild t-x mute was applied immediately before the radon transform to remove NMO stretch noise from the shallow zone of longer offsets.

Radon Transform Parameters	
Reference offset	4500 m
Frequency range	3-100 Hz
Minimum p	-1500 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+3000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	563

Multiple removal was achieved by subtracting the modelled multiples from the original (NMO corrected) gather. Application of demultiple in the shallow regions was controlled by tapering the amplitudes of the multiple model.

Reprocessing:

ORS01: F-x Interpolation to 366 traces.

Radon Transform Parameters - ORS01	
Reference offset	4711 m
Frequency range	4-125 Hz
Minimum p	-1500 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+3500 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	334

BHB96: F-x Interpolation to 252 traces.

Radon Transform Parameters - BHB96	
Reference offset	3933 m
Frequency range	4-125 Hz
Minimum p	-1500 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+3500 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	334

SB94A: F-x Interpolation to 120 traces.

Radon Transform Parameters - SB94A	
Reference offset	4500 m
Frequency range	3-100 Hz

Minimum p	-1500 (parabolic delta-t, at reference offset)
Maximum p	+3000 (parabolic delta-t, at reference offset)
No. of p traces	563

TQH5: F-x Interpolation to 120 traces.

Radon Transform Parameters - TQH5	
Reference offset	3981 m
Frequency range	4-125 Hz
Minimum p	-1500 (parabolic delta-t, at reference offset)
Maximum p	+3500 (parabolic delta-t, at reference offset)
No. of p traces	501

Radon Transform Parameters - 8 2BMR	
Reference offset	3500 m
Frequency range	3-100 Hz
Minimum p	-1500 (parabolic delta-t, at reference offset)
Maximum p	+3500 (parabolic delta-t, at reference offset)
No. of p traces	501

5.16 Remove Gain Recovery

The previously applied t^2 gain function (see Section 5.3) was backed off.

5.17 Spherical Divergence (Ursin)

With the previously applied t^2 gain function removed, an offset and velocity dependent spherical divergence approximation as described by Bjorn Ursin (GEOPHYSICS Vol.55 No.4, pp492-496 1990) was now implemented in its place.

$$\sqrt{\frac{T0 \times V^4}{V0^2} + (2 \times (\frac{V}{V0})^2 - 1) \times X^2 + \frac{X^4 \times (\frac{1}{V0^2} - \frac{1}{V^2})}{t0^2}}$$

Where T0 is the two way travel time, V is the RMS velocity at T0, and V0 is the velocity in the first layer. Although this method is applicable to uncorrected data as a moveout tracking divergence correction, for algorithmic ease it is applied to NMO corrected CDP gathers.

5.18 Surface Consistent Amplitude Recovery

The amplitude of any trace is affected by various factors, including the shot strength, response and coupling of the receivers, trace offsets and the geology. Surface Consistent Amplitude Recovery

(SCAMP) is designed to analyse amplitudes in a surface consistent manner. It estimates the amplitude variations due to various components and computes weighting levels for each component, using the Gauss-Seidel iterative method. The components selected to resolve extraneous amplitude variations were the shot strength, channel number (offset) and receiver response (virtual receiver location). The Gauss-Seidel iterations were performed on all lines simultaneously, providing a survey consistent solution. The inclusion of the offset component produces a solution which balances the mean amplitudes with offset. The scalars were modified by computing a running median, such that only local fluctuations in channel amplitude removed, and the smooth amplitude variation with offset preserved.

5.19 Pre-Stack Time Migration (Velocity Analysis)

Straight-Ray Kirchhoff Migration using smoothed 100% first pass velocities. The number of common offset planes used in the migration was 87 and the CMP interval was 12.5m. The half aperture distance was 7.5 kilometres and 50% antialias protection was used.

To migrate a single trace position the diffraction stack technique sums input data along diffraction curves centred at the output position. The maximum width of these diffraction curves governs the maximum number of traces which must be considered either side of a trace to be migrated. This number is referred to as the aperture or scan width.

For unstacked data, recorded at some common offset x , the diffraction curve is given by:

$$T_x = 0.5 \sqrt{T_0^2 + \left(\frac{2X + x}{V}\right)^2} + 0.5 \sqrt{T_0^2 + \left(\frac{2X - x}{V}\right)^2}$$

where X and V are defined above and x is the section offset.

5.20 Second Pass Velocity Analysis

Second pass velocities (0.5km interval) were determined using the Fugro Seismic Imaging Pty. Ltd. "MGIVA" interactive velocity analysis program. Each velocity analysis comprised a semblance display, a CDP stacked panel repeated 17 times with a suite of velocity functions, and a central CDP gather. The suite of functions were generated using 0%, +/-2 %, +/-4%, +/-6%, +/-8 %, +/-10%, +/-12%, +/-15%, and +18% increments from a central velocity function. The central function was the velocity derived from the first pass analysis.

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

Velocity accuracy was judged by the 'flatness' of primary events on the interactive gather.

5.21 Final Pre-Stack Time Migration

Straight-Ray Kirchhoff Prestack Time Migration using smoothed 100% second pass velocities. The number of common offset planes used in the migration was 87, and the CMP interval was 12.5 m. The aperture distance was 7.5 kilometres, and 50% antialias protection was used. The last 500 ms of data on the section was scaled down prior to migration.

5.22 Final Pass Velocity Analysis

The third pass velocity analysis was conducted on the final pre-stack migration data. In addition a residual radon demultiple was also applied to further remove remnant multiples from the gathers. Analysis was performed at 0.25 km intervals using the Fugro Seismic Imaging Pty. Ltd. "MGIVA" interactive velocity analysis program. Each velocity analysis comprised a semblance display, a CDP stacked panel repeated 17 times with a suite of velocity functions, and a central CDP gather. The suite of functions were generated using 0%, +/-2%, +/-4%, +/-6%, +/-8%, +/-10%, +/-12%, +/-15%, and +18% increments from a central velocity function. The central function was the velocity derived from the second pass analysis.

These final velocities were archived to CD-ROM media as ASCII text in Western Geophysical's 2D velocity format.

5.23 Radon Multiple Attenuation (Residual Demultiple)

The initial demultiple was performed in a lenient fashion because the preliminary velocity field did not permit fine discrimination between primary and multiple energy. Most seafloor multiple energy was removed, but some interbed multiples and seafloor multiples with residual moveout were remnant in the final migrated gathers. Attenuation of these remnant multiples was achieved by modelling and subtraction using a least squares, parabolic Radon transform.

Normal moveout corrections were performed using the final velocities, and the CDP gathers transformed into the parabolic Tau-P domain. The segment of the Tau-P domain corresponding to primary reflections is muted, leaving the multiple energy to be transformed back into the T-X domain and subtracted from the original CDP gather.

The Hi-resolution radon option was invoked, where the resolution of the radon transform is improved by adding weighting terms to the least squares solution, minimising the residual error. A mild t-x mute was applied immediately before the radon transform to remove NMO stretch noise from the shallow zone of longer offsets.

<i>Radon Transform Parameters</i>	
<i>Reference offset</i>	4458 m
<i>Frequency range</i>	3-100 Hz
<i>Minimum p</i>	-500 (<i>parabolic delta-t, at reference offset</i>)

Maximum p	+3000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	701

Multiple removal was achieved by subtracting the modelled multiples from the original (NMO corrected) gather. Application of demultiple in the shallow regions was controlled by tapering the amplitudes of the multiple model.

Reprocessing:

Radon Transform Parameters - ORS01	
Reference offset	4698 m
Frequency range	3-100 Hz
Minimum p	-500 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+3000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	701

Radon Transform Parameters - BHB96	
Reference offset	4698 m
Frequency range	3-100 Hz
Minimum p	-500 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+3000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	701

Radon Transform Parameters - SB94A	
Reference offset	4458 m
Frequency range	3-100 Hz
Minimum p	-500 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+3000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	701

Radon Transform Parameters -TQ H5	
Reference offset	3966 m
Frequency range	3-80 Hz
Minimum p	-4000 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+4000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	801

Radon Transform Parameters - 82-BMR	
Reference offset	3484m
Frequency range	3-80 Hz
Minimum p	-4000 (<i>parabolic delta-t, at reference offset</i>)
Maximum p	+4000 (<i>parabolic delta-t, at reference offset</i>)
No. of p traces	801

5.24 NMO Correction

Dix fourth order NMO corrections were applied using the final picked 0.25 kilometre PSTM velocity functions.

|

5.25 Outer Trace Mute

This process was applied to the relative amplitude and filtered/scaled stacks only

A post NMO outer trace mute was applied to remove any coherent noise on the outer traces and to reduce contamination from the effect of NMO stretch on the far offsets.

Outer Mute Parameters		
Seafloor twt	Offset (m)	Application times (ms)
100 ms	130	0
	210	0
	810	500
	4720	3000

Reprocessing:

Outer Mute Parameters - ORS01		
Seafloor twt	Offset (m)	Application times (ms)
100 ms	180	0
	210	0
	810	500
	4720	3000

Outer Mute Parameters - BHB96		
Seafloor twt	Offset (m)	Application times (ms)
100 ms	130	0
	210	0
	810	500
	4720	3000

Outer Mute Parameters - SB94A		
Seafloor twt	Offset (m)	Application times (ms)
0 ms	100	0
	250	120
	4600	3000

Outer Mute Parameters - TQH5		
Seafloor twt	Offset (m)	Application times (ms)

Outer Mute Parameters - TQH5		
<i>0 ms</i>	100	0
	250	120
	4600	3000

Outer Mute Parameters - 82BMR		
Seafloor twt	Offset (m)	Application times (ms)
<i>0 ms</i>	130	0
	210	0
	810	500
	4410	2800

5.26 Angle Mute Stacks

This process was applied to the near, mid and far angle stacks only

Angle stacks, stacks generated after restricting input to a portion of the gather corresponding to a particular range of incident angles, were produced for lithology and fluid predictions. The angle of incidence calculations were performed using Walden's method, and considered a smoothed version of the the third pass velocities.

Angle Stack Parameters	
Near Stack	0 - 15 degrees
Mid Stack	15 - 30 degrees
Far Stack	30 - 45 degrees

5.27 AVO Attributes

AVO analysis is applied using the Shuey Approximation. A velocity function is used to calculate the angle of incidence at each layer boundary and then interpolated to produce the angle of incidence at each time sample and offset. A robust linear regression is used to calculate the intercept and gradient of the amplitudes at each time sample (Walden, 1991).

Intercept is the zero offset reflection coefficient and gradient is essentially the change in amplitude with offset at any particular time sample within a CDP gather.

The AVO processing sequence was identical to the regular processing up to, and including, pre-stack time migration. The subsequent processing was as follows:

- Application of 4th Order NMO correction
- (Mild) Outer-trace mute
- Gun and Cable Static Corrections
- AVO analysis – 3 attributes produced:
- (1) Intercept Stack; (2) Gradient Stack; (3) Delta Rp Stack

5.28 Common Depth Point Stack

The traces within each common depth point gather were summed. The method of fold compensation was varied with the intended use of the resulting stack. The near, mid, and far angle stacks employed $1/(N)$ stack fold compensation. (where N represents the number of traces contributing to the stack, calculated at each sample). The final structural stack used $1/\sqrt{N}$ stack fold compensation.

5.29 Statics

A static compensation for gun and cable depths was applied. The static value applied was calculated using average gun and cable depths supplied in the observers reports, converted to a time shift using a water velocity of 1500 m/s..

<i>Shot/Receiver Depth Statics</i>	
<i>Vintage</i>	<i>Static Applied</i>
<i>OS2D</i>	+9 ms
<i>ORS01</i>	+8 ms
<i>BHB96</i>	+8 ms
<i>SB94A</i>	+10 ms
<i>TQH5</i>	+15 ms
<i>82BMR</i>	+14 ms

5.30 F-X Deconvolution

F-X Deconvolution is a process designed to effectively attenuate random noise by prediction of the non-random signal content in a seismic trace. Each input trace is transformed into the frequency domain. Groups of traces are used to design filters to predict the Fourier components of adjacent traces. For each frequency in the range specified by the user, (See table below), a complex Wiener filter of 5 traces is generated. This filter is used to predict the amplitude and phase at the next trace. This is done twice in a forward and reverse direction. The output sample for this frequency is the average of the forward and reverse predictions. In this manner, predicted traces are reconstructed in the frequency domain and then transformed back into the time domain. The output derived from the "FXDCN" process may be regarded as true-amplitude.

The FXDCN was applied in a time variant manner as the targeted noise was more apparent in the deeper section. The parameters were as follows:

F-X Deconvolution Random Noise Attenuation Parameters	
No of Traces for design of filter	50 traces
Length of Operator	5 traces
Frequency Range	
Lower cut-off (Hz)	3 Hz
Lower unity response (Hz)	0 Hz
Higher cut-off (Hz)	125 Hz
Higher unity response (Hz)	100 Hz

5.31 Inverse Q-filtering

Two fundamental properties associated with wave propagation through subsurface materials are: energy dissipation of plane waves with high frequency, and velocity dispersion by which plane waves of high frequency travel faster than ones with low frequency. These effects may be represented mathematically as the earth Q-filter, defined in terms of a specified earth Q model.

In seismic data processing where the earth Q model is often assumed to be frequency independent, inverse Q-filtering attempts to compensate recorded seismic signals for these wave propagation effects. A stabilization scheme (only on amplitude) was used.

5.32 Band Pass Filter

This process was applied to the filtered/scaled stacks only

Unwanted noise that lay outside the frequency range of the desired reflection data was attenuated by the application of a series of zero phase time variant filters. These filters employed cosine squared tapers between the limiting frequency pairs.

Bandpass Filter Parameters		
Seafloor twt	Time(ms)	Frequency trapezoid (Hz)
<i>0 ms</i>	100	5/10 – 80\100
	1000	4/8 – 70\85
	2000	4/8 – 55\65
	3000	4/8 – 50\60
	4000	3/5 – 40\50
	5000	3/5 – 30\40

5.33 Scaling

This process was applied to the filtered/scaled stacks only

A dual window, time variant AGC method was used for post-stack scaling. The negative effects normally associated with AGC are avoided by employing two different length windows to determine the amplitude model (using the minimum of the two mean amplitudes determined at each sample), then conditioning the model by a weighted mix with the scalar derived from a single window per trace. The initial scalar comparisons were made in 1000 and 400 millisecond windows, then the result combined with 40% of the scalar resulting from a single window. The short window stopped at 4000 ms..

5.34 Phase-Matching

The reprocessing data sets were matched to the 2005 Shearwater survey.

Tabled below are the static and phase values applied to each of the vintages to match the new acquisition data:

<i>Phase-Matching to Shearwater 2D & 3D</i>		
<i>Vintage</i>	<i>Phase Shift</i>	<i>Static Shift</i>
ORS01	180 degrees	-6 ms
BHB96	0 degrees	0 ms
SB94A	125 degrees	-7 ms
TQH5	-80 degrees	-12 ms
82-BMR	-90 degrees	17 ms

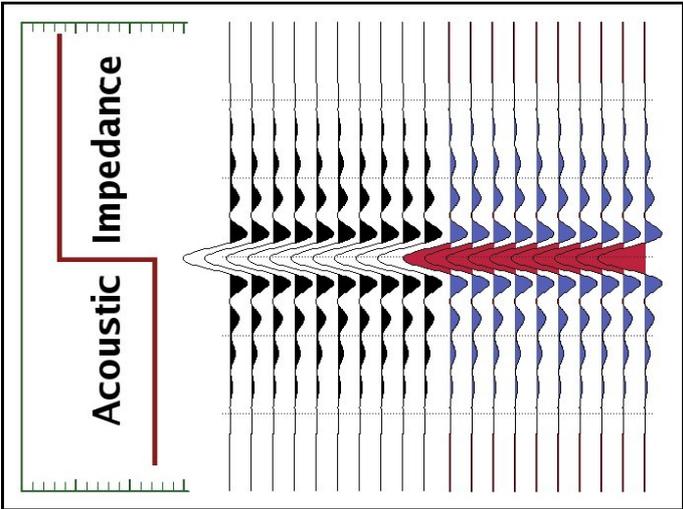
5.35 SEG Y Archive

Segy archives were produced for both gather and stack data sets. See 10.1 Data Disposition for a detailed list.

6 Polarity Statement

The final desired polarity was SEG reverse (or SEG negative), where an increase in acoustic impedance is represented by a negative number on tape, and white trough on display.

Figure 6.1 Desired polarity diagram. An acoustic impedance increase is represented by a trough.



7 Archive Listing

Tape Number 470AV072DVD (Preliminary)	Media	Lines	Description
470FM009DVD (Superceded by 470FM041DVD)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Filtered and Scaled Final Migrations
470FM010DVD (Superceded by 470FM040DVD)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Relative Amplitude Final Migrations
470FV011DVD (Superceded by 470FM038DVD)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Final Stacking Velocities
470NG012DVD-470NG030DVD	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	NMO Corrected PSTM Gathers
470AS031DVD (Superceded by 470AS037DVD)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Angle Stacks (Near 0-15, Mid 15-30, Far 30-45 and Full 0-45 Degrees)
470AS037DVD (Replacement of 470AS031DVD)	DVD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014	Angle Stacks (Near 0-15, Mid 15-30, Far 30-45 and Full 0-45 Degrees)
470MV038DVD	DVD	BHB96-124, ORS01-07 to ORS01-11	Final Stacking Velocities
470FV038DVD (Replacement of 470FM011DVD)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Final Stacking Velocities
470NG039DVD	DVD	OS2D-2015	NMO Corrected PSTM Gathers
470FM040DVD (Replacement of 470FM010DVD)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Relative Amplitude Final Migrations
470FM041DVD (Replacement of 470FM009DVD)	DVD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014	Filtered and Scaled Final Migrations
470MV046CD	CD		AVO Attributes
470MV050CD (Preliminary)	CD	82BMR, TQH5	Final Migrations
470FP054DVD (Superceded by 470FS062DVD)	DVD	SB94A Vintage	Final PSTM & Angle Stacks
470FP055DVD	DVD	BHB96 Vintage	Final PSTM & Angle Stacks
470FP056DVD	DVD	ORS01 Vintage	Final PSTM & Angle Stacks
470AA057DVD	DVD	BHB96, ORS01, OS2D & SB94A Vintages (Doesn't Include OS2D-2015)	AVO Attributes
470AA058CD (Preliminary)	CD	TQH5 Vintage & BMR-017	AVO Attributes
470FM059CD (Replaced by 470FM060CD)	CD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	Final Filtered Migrations
470FM060CD (Replacement of 470FM059CD)	CD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014	Final Filtered Migrations
470FS061DVD (Preliminary)	DVD	BHB96 Vintage	Final Filtered and Scaled Stacks
470AS062DVD (Replaced)	DVD	BHB96 Vintage	Angle Stacks
470AS063DVD (Preliminary)	DVD	BHB96 Vintage	Angle Stacks
470AA064DVD (Preliminary)	DVD	BHB96 Vintage	Angle Stacks
470AS064DVD (Preliminary)	DVD		
470AS065DVD (Preliminary)	DVD	SB94A – 17 Lines	Final PSTM/Angle Stacks

Tape Number 470AV072DVD (Preliminary)	Media	Lines	Description
(Replacement of 470FP054DVD)			
470AS066DVD (Preliminary)	DVD	TQH5	Final PSTM/Angle Stacks
470NA067CD (Final)	CD	2005 OS2D- Survey Lines & Reprocessing Vintages	Navigation Data
470AS068DVD (Preliminary)	DVD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014 + TQH	Angle Stacks (0-15°)
470AS068DVD (Replaced by 470FM081DVD)	DVD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014 + TQH5	Angle Stacks (0-15°, 15-30° & 30-45°)
470AS069DVD (Preliminary)	DVD	82-BMR, BHB96 & ORS01 Vintages	Angle Stacks (15-30°)
470AS069DVD (Final)	DVD	82-BMR, BHB96 & ORS01 Vintages	Angle Stacks (0-15°, 15-30° & 30-45°)
470AS070DVD (Preliminary)	DVD	SB94A & TQH5 Vintages	Angle Stacks (30-45°)
470AS070DVD (Final) (TQH5 Replaced by 470FS083DVD)	DVD	SB94A & TQH5 Vintages	Angle Stacks (0-15°, 15-30° & 30-45°)
470AA071DVD(Preliminary)	DVD	OS2D-2001 to OS2D-2007 OS2D-3008 to OS2D-3014	AVO Attributes (Delta Rp, Intercept & Gradient Stacks)
470AV071DVD (Preliminary) (Replaced by 470FS083DVD)	DVD	2005 OS2D- Survey Lines & Reprocessing Vintages	AVO Attributes (Delta Rp, Intercept & Gradient Stacks)
470AA072DVD (Preliminary)	DVD	2005 OS2D- Survey Lines & Reprocessing Vintages	AVO Attributes (Delta Rp, Intercept & Gradient Stacks)
470AV072DVD (Final)	DVD	82-BMR, BHB96 & ORS01 Vintages	AVO Attributes (Delta Rp, Intercept & Gradient Stacks)
470RA073DVD (Preliminary)	DVD	SB94A Vintage	Relative Amplitude Stacks
470AV073DVD (Replaced by 470FP079CD)	DVD	SB94A & TQH5 Vintages	AVO Attributes (Delta Rp, Intercept & Gradient Stacks)
470FS074DVD	DVD	2005 OS2D- Survey Lines & Reprocessing Vintages	Filtered and Scaled Stacks
470RA074DVD (Replaced by 470FM081DVD)	DVD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014	Relative Amplitude Stacks
470FV075CD (Preliminary) (Replaced by 470FP091CD)	CD	2005 OS2D- Survey Lines & Reprocessing Vintages	Final Stacking Velocities (Western Format)
470RA076DVD (Replaced by 470FS083DVD)	DVD	Reprocessing Vintages	Relative Amplitude Stacks
470FS077DVD (Replaced by 470FS081DVD)	DVD	OS2D-2001 to OS2D-2007, 2015 OS2D-3008 to OS2D-3014	Filtered and Scaled Stacks
470FS078DVD (Replaced by 470FS083DVD)	DVD	Reprocessing Vintages	Filtered and Scaled Stacks
470FP079CD (Replacement of 470AV073DVD)	CD	SB94A-107, OS2D-3014	Final PSTM & AVO Attributes
470FM080CD	CD	OS2D-3014	Final Stack Products (Filtered Stacks, Amplitude Stacks, Angle Stacks, AVO Attributes)
470FM081DVD	DVD	OS2D-3014 + SB94A-107	Final Stack Products (Filtered Stacks, Amplitude Stacks, Angle Stacks, AVO Attributes)

Tape Number 470AV072DVD (Preliminary)	Media	Lines	Description
470PSTMG001DLT to 470PSTMG005DLT	DLT	OS2D, 82-BMR, BHB96, ORS01, SB94A & TQH5 Vintages	Pre-PSTM Gathers
470NMOG001DLT to 470NMOG005DLT	DLT	OS2D, 82-BMR, BHB96, ORS01, SB94A & TQH5 Vintages	Final NMO Gathers
470FS082DVD (Labelled on DVD as 470CG089DVD)	DVD	2005 OS2D- Survey Lines	Final Displays in CGM+ Format
470CG082DVD	DVD	TQH5 Vintages	Final Stack Products (Filtered Stacks, Amplitude Stacks, Angle Stacks, AVO Attributes)
470CG083DVD(Labelled on DVD as 470CG090DVD)	DVD	Reprocessing Vintages	Final Displays in CGM+ Format
470FS083DVD	DVD	Copy 2, TQH5 Vintages	Final Stack Products (Filtered Stacks, Amplitude Stacks, Angle Stacks, AVO Attributes)
470PR084CD (Replaced by 470PR085CD)	CD	2005 OS2D- Survey & Reprocessing	Final Processing Report (PDF Format)
470CG089DVD (Listed as 470CG082DVD)	DVD	2005 OS2D- Survey Lines	Final Displays in CGM+ Format
470CG090DVD (Listed as 470CG083DVD)	DVD	Reprocessing Vintages	Final Displays in CGM+ Format
470FS091CD (Replaced by 470FS097CD)	CD	2005 OS2D- Survey Lines & Reprocessing Vintages	Final Stacking Velocities in "Western" ASCII Format
470FS097CD (Replacement of 470FP091CD)	CD	2005 OS2D- Survey Lines & Reprocessing Vintages	Final Stacking Velocities in "Western" ASCII Format
470PR084CD (Replacement of 470PR084CD)		2005 OS2D- Survey & Reprocessing	Final Processing Report (PDF Format)

8 Far-Field Signature Listing

Full system response with source and receiver ghost for 2005 Shearwater 2D Survey:

Array name : 2500LB_60_1800_100
Total volume : 2500 cu.in.
Source depth : 6.00 m
Streamer depth : 8.00 m
Group length : 0.00 m
Average pressure : 1800 psi
Ghost strength : -1.00
Seawater temperature : 20.00 C
Seawater velocity : 1521.6 m/s
Filter :
Low-cut frequency : 8.80 Hz
Low-cut slope : 18.00 dB/oct
High-cut frequency : 206.00 Hz
High-cut slope : 276.00 dB/oct
Instrument : S24 g-6.25
Time of 1st sample: -56.00 msec i.e. index of time zero = 29.0
Sample interval : 2.00 msec resampled from 0.5 ms.
Far-field position :
Distance : 9000.00 m
Azimuth : 0.00 deg
Angle of vertical : 0.00 deg

Amplitudes are in bar m

Time is increasing horizontally

0.000	0.000	0.000	0.002	0.004	-0.026	-0.006
0.019	-0.023	0.051	-0.014	-0.018	0.069	0.030
0.130	-0.039	0.119	-0.085	-0.218	0.135	0.644
0.624	-0.542	0.440	0.468	-1.104	2.469	-4.496
14.337	36.628	15.120	0.925	-20.905	-53.746	-57.064
-26.735	-3.662	17.700	46.480	31.486	9306	5.344
-1.223	2.344	1.810	-0.727	0.466	-0.825	0.266
-0.467	-0.818	-0.504	-0.822	-0.784	-0.575	-0.504
-0.342	-0.188	-0.175	-0.098	-0.098	-0.158	-0.095
-0.168	-0.317	-0.411	-0.687	-1.053	-1.471	-1.885
-1.856	-1.429	-0.833	-0.159	0.190	0.174	0.041
-0.146	-0.047	0.291	0.360	0.130	-0.415	-1.059
-1.214	-0.965	-0.475	0.138	0.370	0.275	0.103
-0.105	-0.016	0.366	0.807	1.297	1.534	1.405

1.086	0.469	-0.163	-0.517	-0.714	-0.528	-0.062
0.329	0.746	0.985	0.928	0.826	0.565	0.255
0.111	-0.054	-0.117	-0.060	-0.116	-0.119	-0.144
-0.246	-0.183	-0.152	-0.159	-0.021	-0.006	-0.043
-0.028	-0.183	-0.285	-0.324	-0.473	-0.476	-0.437
-0.437	-0.307	-0.208	-0.092	0.079	0.091	0.082
0.039	-0.139	-0.227	-0.319	-0.425	-0.329	-0.269
-0.224	-0.035	0.045	0.120	0.234	0.222	0.331
0.467	0.488	0.615	0.636	0.536	0.490	0.299
0.136	0.087	-0.067	-0.125	-0.129	-0.235	-0.238
-0.265	-0.346	-0.277	-0.262	-0.262	-0.161	-0.176
-0.173	-0.132	-0.184	-0.107	-0.015	0.009	0.141
0.177	0.122	0.121	0.025	-0.020	0.060	0.072
0.158	0.264	0.237	0.231	0.167	0.057	0.053
0.018	-0.010	0.030	0.000	-0.031		

9 SEG Y Header Information

9.1 SEG Y EBCDIC Line Header Information

Typical SEG Y EBCDIC line header (From Final Filtered Stack, Line: OS2D2001s2c3)

```
C01 COUNTRY          : ORIGIN ENERGY          SURVEY : SHEARWATER 2D
C02 COUNTRY          : AUSTRALIA                AREA  : BASS STRAIT
C03 PROCESSED BY    : FUGRO SEISMIC IMAGING     DATE  : OCTOBER 2006
C04 DATASET         : FILTERED & SCALED STACK  2D LINE : OS2D2001S2C3
C05 ACQ. YEAR       : 2005                      CABLE DEPTH : 8.0 m
C06 SHOT INTERVAL   : 25 m                      GROUP INTERVAL : 12.5 m
C07 SHOT DEPTH      : 6.0 m                      GROUPS PER CABLE : 252
C08 MIN OFFSET      : 99.0 m                     MAX OFFSET   : 4400 m
C09 GEODETIC DATUM  : GDA94                     PROJECTION   : 002 UTM SOUTH
C10 ZONE             : 55S                       SAMPLE RATE  : 2.0 ms
C11 CM              : 147 0 0.000E              MAX TIME    : 5120 ms
C12 PROCESSING SUMMARY
C13 TRANSCRIPTION          : SEG D format to internal format
C14 SPHERICAL DIVERGENCE   : T-SQUARED
C15 RECORDING FILTER DELAY : 120 MS
C16 NAVIGATION MERGE      : HEADERS UPDATED
C17 DETERMINISTIC DESIG.  : GUN + RECEIVER GHOST
C18 SIGNATURE DEPHASE     : OUTPUT TO ZERO-PHASE
C19 SWELL NOISE ATTENUATION
C20 TAU-P LINEAR NOISE ATTEN.: -2000-4000,751 P-TRACES
C21 SRME                  : MULTIPLE ATTENUATION
C22 TAU-P DECONVOLUTION   : 32MSEC GAP/300 MS OPERATOR LENGTH
C23 FIRST PASS VA        : 1.0 KM SPACING
C24 RADON DEMULTIPLE      : HIRES
C25 URSIN/SCAMP          : AMPLITUDE BALANCING
C26 SECOND PASS VA (PSTM) : 0.5 KM SPACING
C27 PSTM                  : KIRCHHOFF
C28 NMO (THIRD PASS VA)  : 4TH ORDER, 0.25 KM SPACING
C29 RESIDUAL DEMULTIPLE   : HIRES RADON TRANSFORM
C30 EQUALISATION
C31 OUTER TRACE MUTE      : 100M-0MS,250M-120MS,4600M-3000MS.
C32 STACK                 : 1/rootN
C33 GUN + CABLE STATIC    : +9.0 MS
C34 Q-COMPENSATION        : Q=180, GAIN LIMIT=12dB
C35 F-X DECONVOLUTION     : NOISE ATTENUATION
C36 BANDPASS FILTER & SCALE
C37 DATUM = GDA94, ZONE = 55S, CM = 147 0 0.000E
C38 SP RANGE:           400 TO 13
C39 CDP RANGE:           1 TO 988
C40 END OF EBCDIC HEADER
```

9.2 SEG Y Trace Header Definition

Location of strategic values in the SEG Y trace header.

DESCRIPTION	TYPE	BYTE
<i>Trace number within line.</i>	I32	1-4
<i>Trace number within reel.</i>	I32	5-8
<i>SEAFLOOR Two Way Time</i>	I32	9- 12
<i>Trace number.</i>	I32	13- 16
<i>Shot point number.</i>	I32	17- 20
<i>CDP number.</i>	I32	21- 24
<i>Trace offset (integer).</i>	I32	37- 40
<i>Scaler to be applied to coordinates</i>	I16	71- 72
<i>Coordinate units (m/arc)</i>	I16	89- 90
<i>No. of samples.</i>	I16	115-116
<i>amp interval in microseconds.</i>	I16	117-118
<i>Year of recording</i>	I16	157-158
<i>Julian day number (1-366)</i>	I16	159-160
<i>Hour of day (24 hour clock)</i>	I16	161-162
<i>Minute of hour</i>	I16	162-163
<i>Second of minute</i>	I16	165-166
<i>Easting of CDP.</i>	I32	193-196
<i>Northing of CDP.</i>	I32	197-200

10 Data Disposition

Data	Date sent	Destination
<p>Shearwater 2D and 3D Seismic Surveys Box 1: 30 x 3590 cartridges. Tape # 39732-39761 Box 2: 30 x 3590 cartridges. Tape # 39762-39791 Box 3: 30 x 3590 cartridges. Tape # 39792-39821 Box 4: 30 x 3590 cartridges. Tape # 39822-39851 Box 5: 30 x 3590 cartridges. Tape # 39852-39881 Box 6: 28 x 3590 cartridges. Tape # 39882-39909 Box 7: 8 x 3590 cartridges containing P190 & P294 Navigation. Tape # OS2DP011, OS05P011, OS05P021, OS05P031, OS2DR011, OS05R011, OS05R021, OS05R031 1 x 3590 cartridge. Tape # 39853. (This tape is a field tape copy of tape # 29841) 2 x 3590 cartridges containing Vessel Location Information. Tape # OS2DV011 & OS05V011 1 x 3590 cartridge containing Echo Sounder Positions. Tape # OS05E011 1 x 3590 cartridge containing P6/98 Binning Grid 1 x CD containing Coverage maps, contour maps, vessel position maps & P6/98. Tape # 7502761. 1 x CD containing Acquisition Report. Tape # 7502760 1 x CD containing data shipment information. Tape # OR112801041A 1 x DVD containing P190 Navigation. Tape # 028ND041DVD</p>	17-08-2006	Origin Energy South Tower, John Oxley Centre 339 Coronation Drive MILTON QLD 4064 Attn: Randall Taylor
<p>Rocky Cape Survey, Bass Basin 29 x 3590 cartridges. Tape # 4005015-4005043</p>	01-11-2006	Spectrum Data Suite 1, 14 Brodie Hall Drive BENTLEY WA 6102
<p>Shearwater 2D Reprocessing: Please find enclosed the following items: Box 1. 33 x 3590 cartridges containing field data. Tape # 7501521-7501528, 7501939-7501955, AU32231-001-AU32231-003, AU32231-006, GSA01648, 186FC035C, 186FC037C, 039733 2 x DLT tapes containing field data. Tape # SYD0056-001 & SYD056-002 Box 2. 15 x 3590 cartridges containing field data. Tape # 4006951-4006965 22 x exabytes containing field data. Tape # 6865-6867, 6869-6873, SO40-09A, SO40-17, AU33505-001 to 012 2 x exabytes containing navigation. Tape # 2393, 4033 1 x CD containing Observers logs for 1985B & Hummock Seismic Surveys 1 x CD containing Scanned Observation Logs. 1 x CD containing Navigation Data for Rocky Cape 1 x CD containing Transcription Report & Listings for AU33505-001 to 012 1 x CD containing Shelduck Obs Logs, Nav & Processing logs. Tape # 7500611 1 x CD containing Field data for vintages SB94A, TNK4 & TGH5 1 x CD containing support information. Tape # SYD0070</p>	19-04-2007	Origin Energy South Tower, John Oxley Centre 339 Coronation Drive MILTON QLD 4064 Attn: Tape Librarian

11 Appendix

11.1 SP-CDP Relationships – Shearwater 2D Survey

Shot point to CDP relationship, using the **source** position as reference.

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
OS2D2001S2c1	1	988	508	14.50
OS2D2001S2c2	1	988	508	14.50
OS2D2001S2c3	1	988	508	14.50
OS2D2001S2c4	1	988	508	14.50
OS2D2002S2c1	1	988	508	14.50
OS2D2002S2c2	1	988	508	14.50
OS2D2002S2c3	1	988	508	14.50
OS2D2002S2c4	1	988	508	14.50
OS2D2003S2c1	1	988	12	505.50
OS2D2003S2c2	1	988	12	505.50
OS2D2003S2c3	1	988	12	505.50
OS2D2003S2c4	1	988	12	505.50
OS2D2004S2c1	1	988	12	505.50
OS2D2004S2c2	1	988	12	505.50
OS2D2004S2c3	1	988	12	505.50
OS2D2004S2c4	1	988	12	505.50
OS2D2005S2c1	1	988	12	505.50
OS2D2005S2c2	1	988	12	505.50
OS2D2005S2c3	1	988	12	505.50
OS2D2005S2c4	1	988	12	505.50
OS2D2006S2c1	1	2664	14	1345.50
OS2D2006S2c2	1	2664	14	1345.50
OS2D2006S2c3	1	2664	14	1345.50
OS2D2006S2c4	1	2664	14	1345.50
OS2D2007S2c1	1	1828	928	14.50
OS2D2007S2c2	1	1828	928	14.50
OS2D2007S2c3	1	1828	928	14.50
OS2D2007S2c4	1	1828	928	14.50
OS2D2015S2c1	1	1228	12	625.50
OS2D2015S2c2	1	1228	12	625.50
OS2D2015S2c3	1	1228	12	625.50
OS2D2015S2c4	1	1228	12	625.50
OS2D3008S2c1	1	988	508	14.50

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
OS2D3008S2c2	1	988	508	14.50
OS2D3008S2c3	1	988	508	14.50
OS2D3008S2c4	1	988	508	14.50
OS2D3009S2c1	1	988	508	14.50
OS2D3009S2c2	1	988	508	14.50
OS2D3009S2c3	1	988	508	14.50
OS2D3009S2c4	1	988	508	14.50
OS2D3010S2c1	1	988	508	14.50
OS2D3010S2c2	1	988	508	14.50
OS2D3010S2c3	1	988	508	14.50
OS2D3010S2c4	1	988	508	14.50
OS2D3011S2c1	1	988	12	505.50
OS2D3011S2c2	1	988	12	505.50
OS2D3011S2c3	1	988	12	505.50
OS2D3011S2c4	1	988	12	505.50
OS2D3012S2c1	1	988	12	505.50
OS2D3012S2c2	1	988	12	505.50
OS2D3012S2c3	1	988	12	505.50
OS2D3012S2c4	1	988	12	505.50
OS2D3013S2c1	1	988	12	505.50
OS2D3013S2c2	1	988	12	505.50
OS2D3013S2c3	1	988	12	505.50
OS2D3013S2c4	1	988	12	505.50
OS2D3014S2c1	1	2188	1108	14.50
OS2D3014S2c2	1	2188	1108	14.50
OS2D3014S2c3	1	2188	1108	14.50
OS2D3014S2c4	1	2188	1108	14.50

11.2 SP-CDP Relationships – 82-BMR Reprocessing Vintage

Shot point to CDP relationship, using the source position as reference.

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
82-BMR-17	107	1014	1	454.50

11.3 SP-CDP Relationships – BHB96 Reprocessing Vintage

Shot point to CDP relationship, using the source position as reference.

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
BHB96-100	1	3809	915	2184.33
BHB96-101	1	4358	915	2367.33
BHB96-102	1	3815	2191	919.67
BHB96-103	1	5639	2799	919.67
BHB96-104	1	1250	1336	919.67
BHB96-105	1	5630	2796	919.67
BHB96-107	1	5627	914	2789.33
BHB96-109	1	2174	1644	919.67
BHB96-111	1	2246	915	1663.33
BHB96-113	1	2258	1672	919.67
BHB96-115	1	2201	918	1651.33
BHB96-117	1	2009	1589	919.67
BHB96-118	1	3395	1085	2216.33
BHB96-119	1	2042	915	1595.33
BHB96-120	1	3125	1961	919.67
BHB96-121	1	1850	915	1531.33
BHB96-122	1	2078	915	1607.33
BHB96-123	1	2348	1702	919.67
BHB96-124	1	2069	1609	919.67
BHB96-125	1	2345	1701	919.67
BHB96-127	1	2342	915	1695.33
BHB96-129	1	2030	1596	919.67

11.4 SP-CDP Relationships – ORS01 Reprocessing Vintage

Shot point to CDP relationship, using the source position as reference.

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
ORS01-01	1	2202	1927.67	1194
ORS01-02	1	2448	1324.33	2140
ORS01-03	1	2859	1134.33	2087
ORS01-04	1	2508	2139.67	1304
ORS01-05	1	2868	1024.33	1980
ORS01-06A	1	3318	874.33	1980
ORS01-07	1	2871	1024.33	1981
ORS01-08	1	2844	1034.33	1982
ORS01-09	1	2559	1926.67	1074
ORS01-10	1	3240	1953.67	874
ORS01-11	1	3000	1873.67	874
ORS01-12	1	3300	1414.33	2514
ORS01-13_A	1	5880	2832.67	873
ORS01-14	1	3960	2673.67	873
ORS01-15A	1	3960	874.33	2194
ORS01-16	1	3159	1926.67	874
ORS01-17	1	2979	1334.33	2327

11.5 SP-CDP Relationships – SB94A Reprocessing Vintage

Shot point to CDP relationship, using the source position as reference.

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
SB94A-101	125	1176	270	795.5
SB94A-102	125	2118	111	1107.5
SB94A-103	125	1000	640	202.5
SB94A-104	125	1800	1010	172.5
SB94A-105	125	934	310	714.5
SB94A-106	125	1478	111	787.5
SB94A-107	125	2174	111	1135.5
SB94A-108	125	658	300	33.5
SB94A-109	125	820	670	322.5
SB94A-111	125	3046	1494	33.5
SB94A-113	125	3192	111	1644.5
SB94A-115	125	1298	111	697.5

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
SB94A-117	125	1172	557	33.5
SB94A-119	125	1166	554	33.5
SB94A-121	125	1508	111	802.5
SB94A-122	125	1456	320	985.5
SB94A-123	125	1498	720	33.5

11.6 SP-CDP Relationships – TQH5 Reprocessing Vintage

Shot point to CDP relationship, using the **CDP** position as reference.

<i>Line</i>	<i>First CDP</i>	<i>Last CDP</i>	<i>First Shotpoint</i>	<i>Last Shotpoint</i>
TQH5-29A	120	3338	1	1610
TQH5-31	120	3500	240	1930
TQH5-33	120	3720	600	2400
TQH5-35	120	1520	1060	1760
TQH5-37A	120	1446	930	1593
TQH5-41	120	920	1000	1400
TQH5-44	120	2720	1500	2800
TQH5-52	120	940	400	810
TQH5-54-1	120	1018	1	450
TQH5-56	120	1714	1650	2447

11.7 Example Displays (Shearwater 2D Survey)

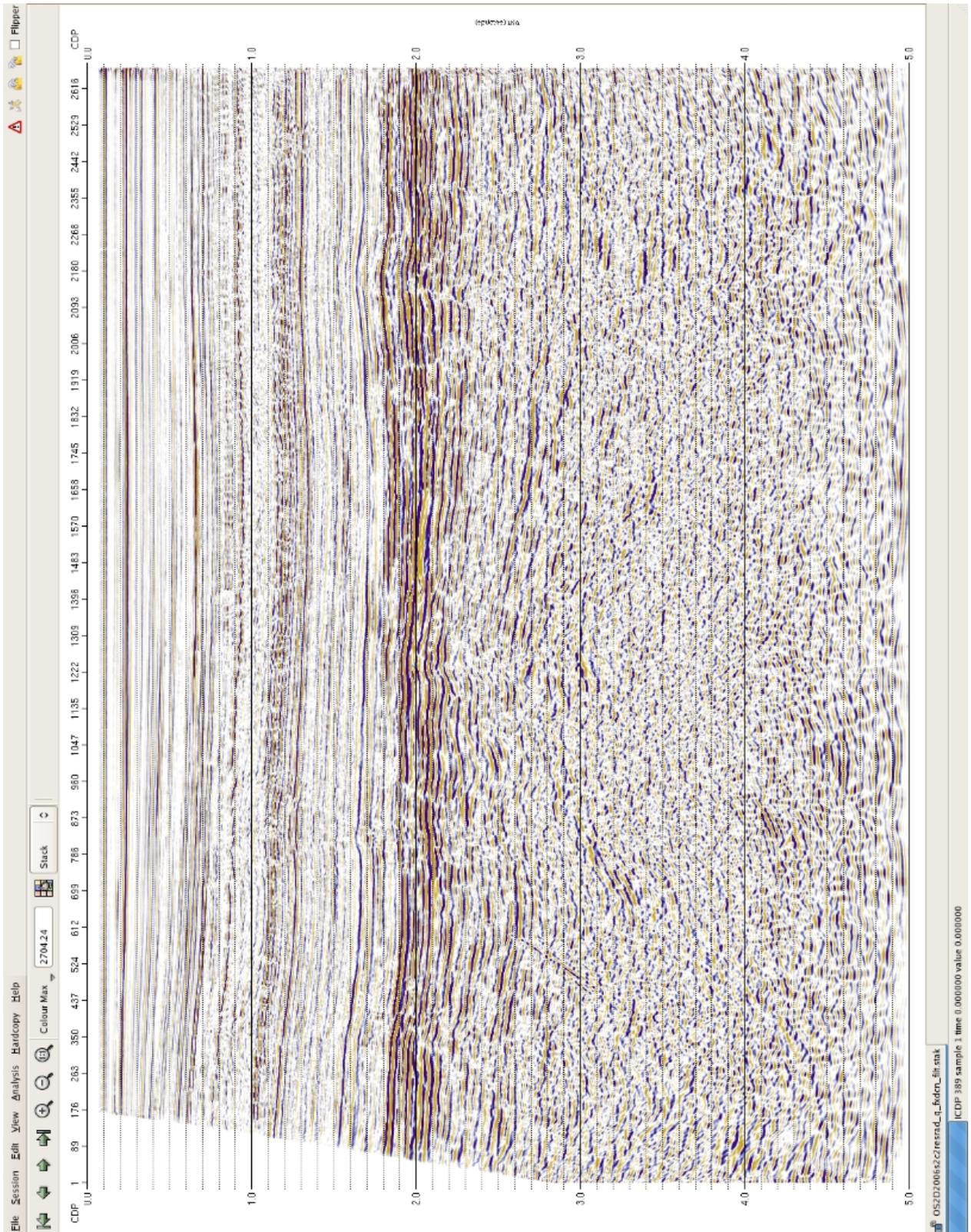


Figure 11.7.1 Line OS2D-2006S2C2 - Final Filtered Stack

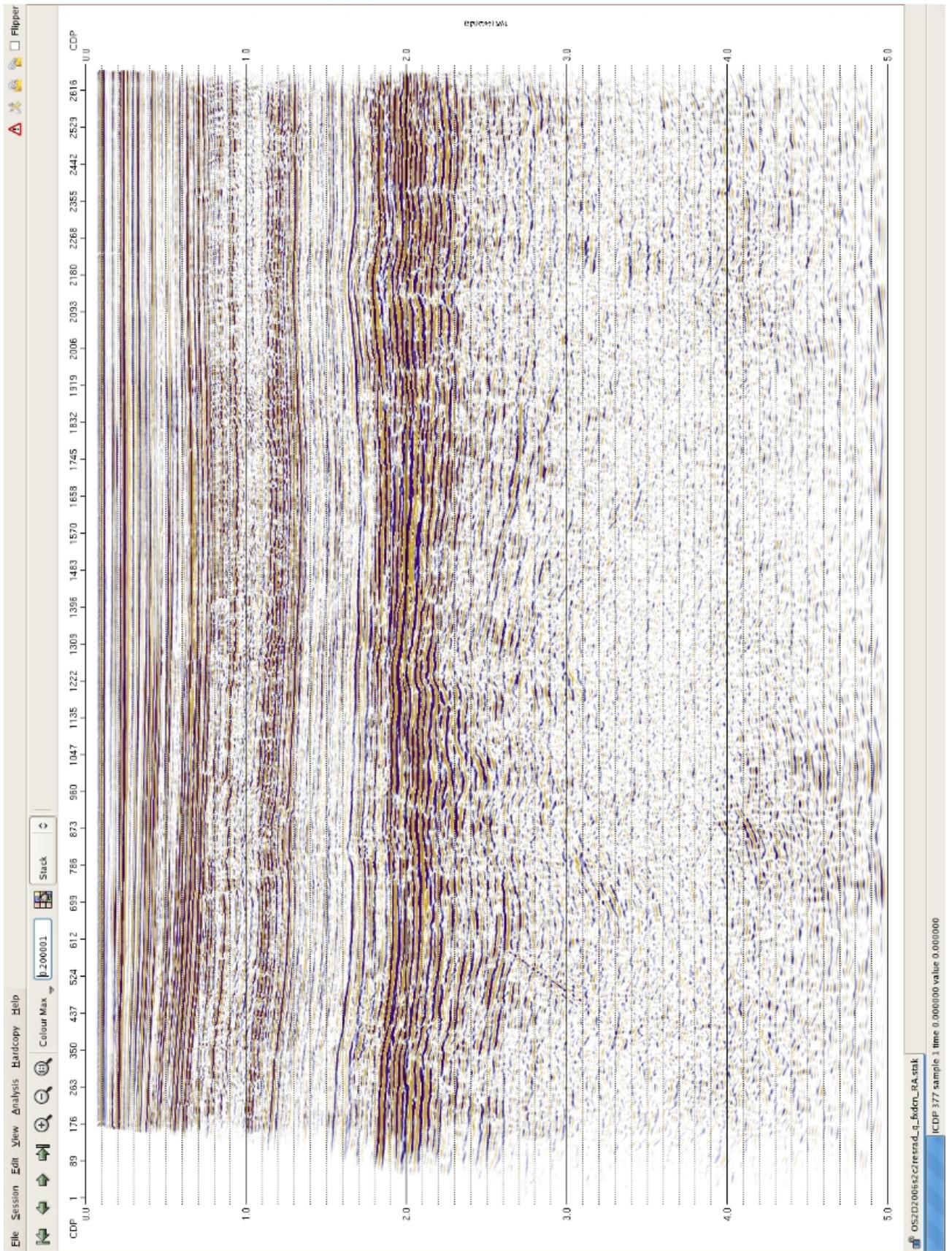


Figure 11.7.2 Line OS2D-2006S2C2 - Final Relative Amplitude Stack

11.8 Example Displays (2D Reprocessing)

BHB96 Reprocessing

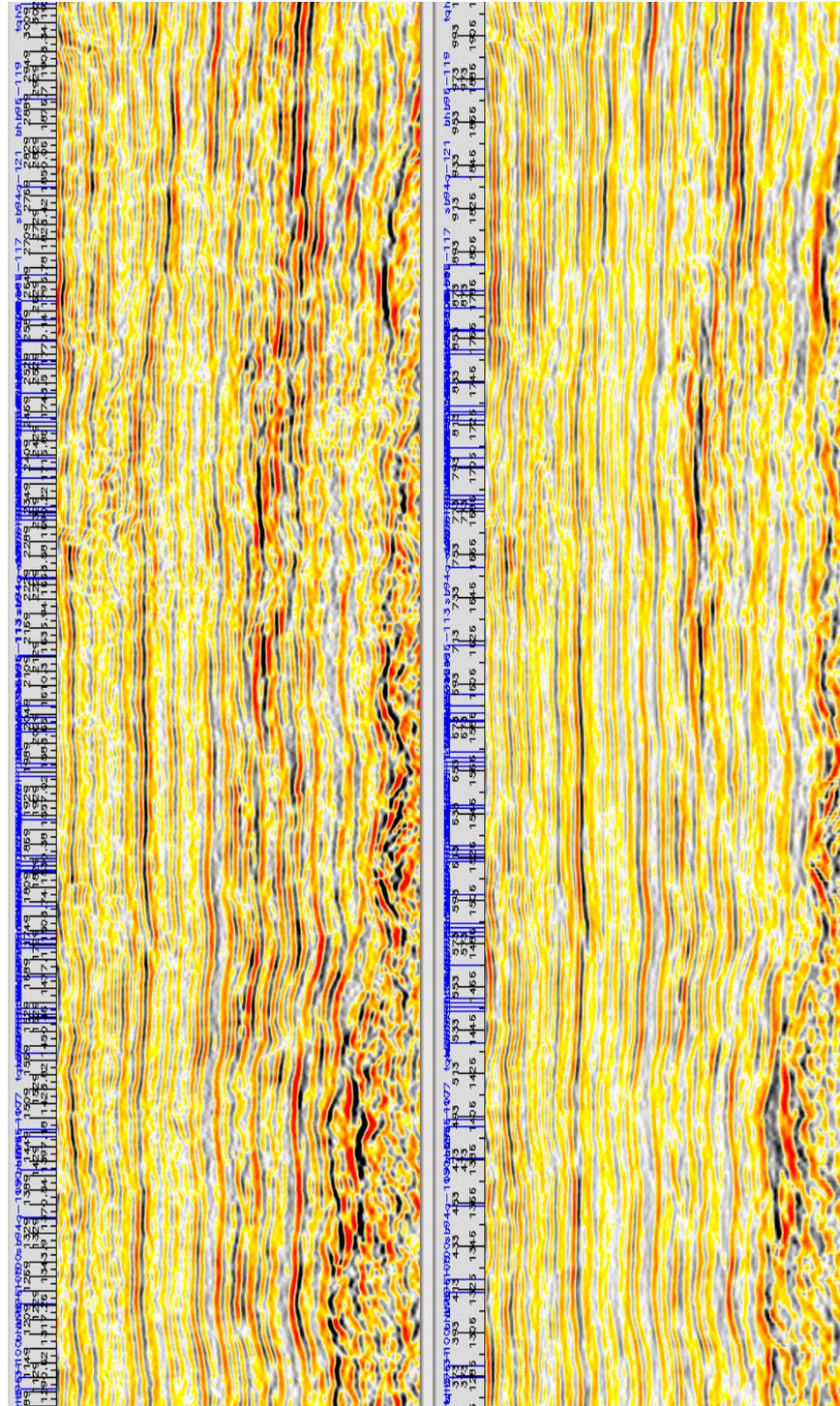


Figure 11.81. BHB96-100 – Stack Comparison - Previous processing (Bottom section) vs Reprocessing (Top section). Note: Image rotated -90 degrees.

ORS01 Reprocessing

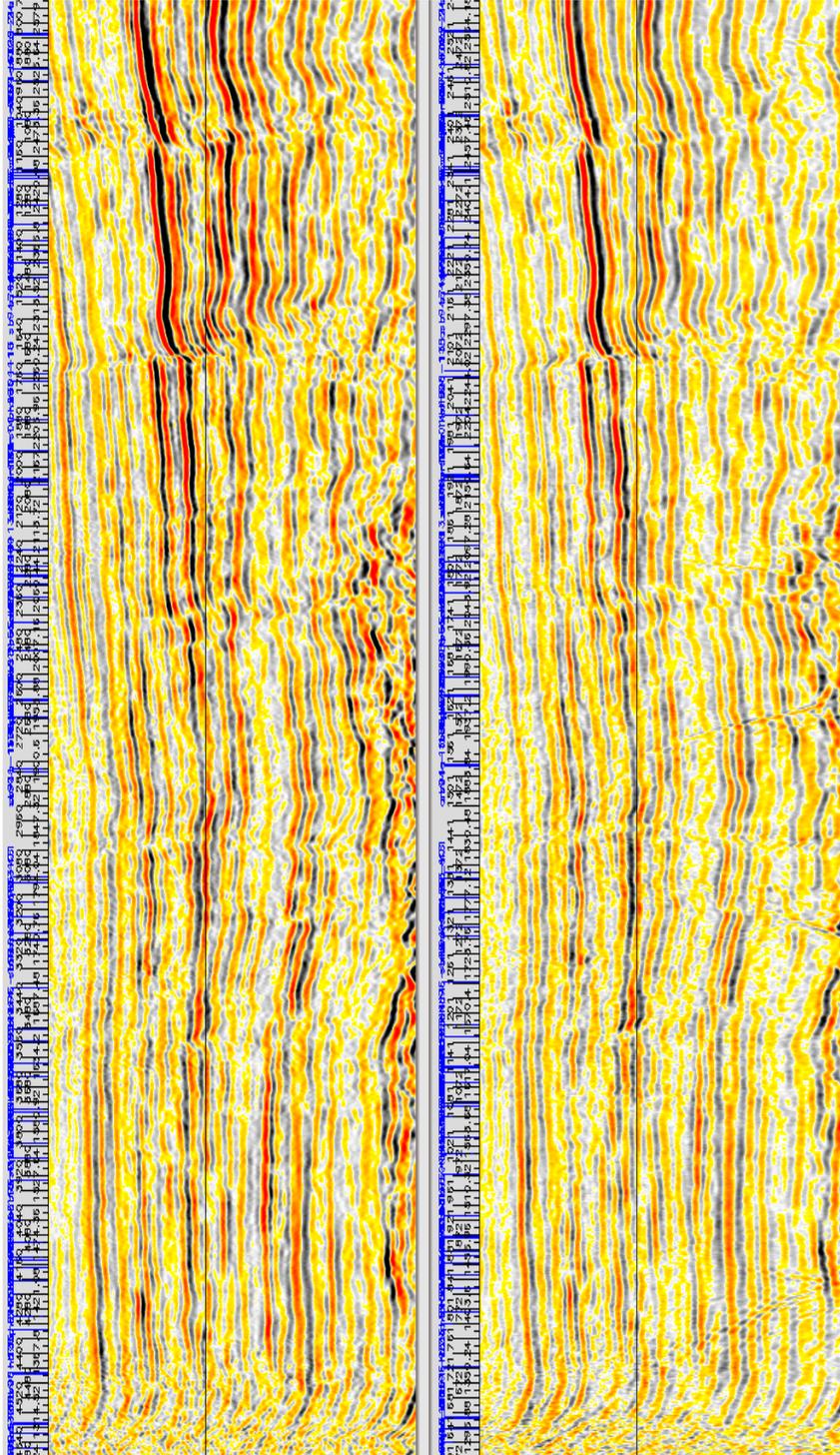


Figure 11.82. ORS01-13_A – Stack Comparison - Previous processing (Bottom section) vs Reprocessing (Top section). Note: Image rotated -90 degrees.

SB94A Reprocessing

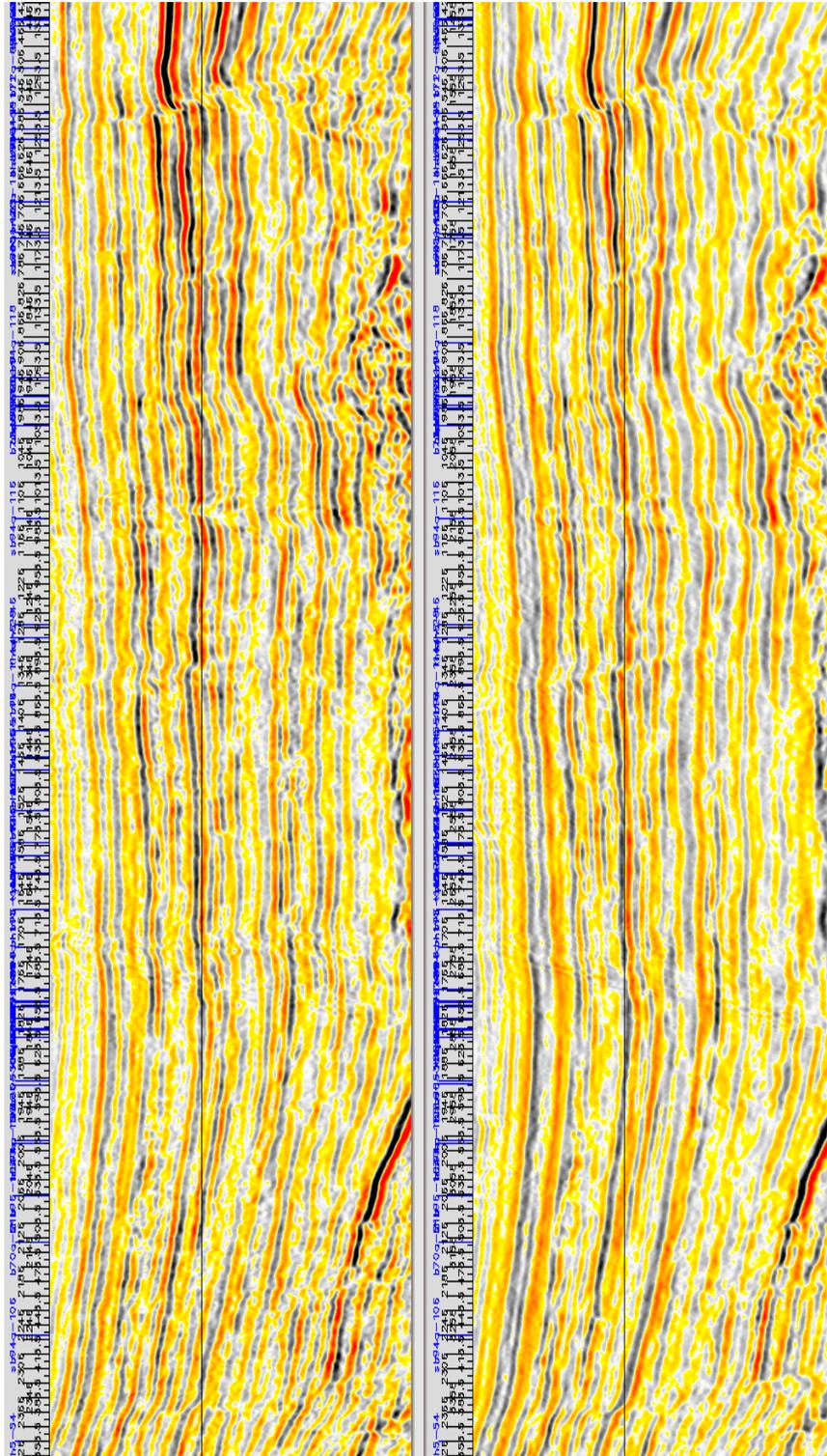


Figure 11.83. SB94A-111 – Stack Comparison - Previous processing (Bottom section) vs Reprocessing (Top section). Note: Image rotated -90 degrees.

TQH5 Reprocessing

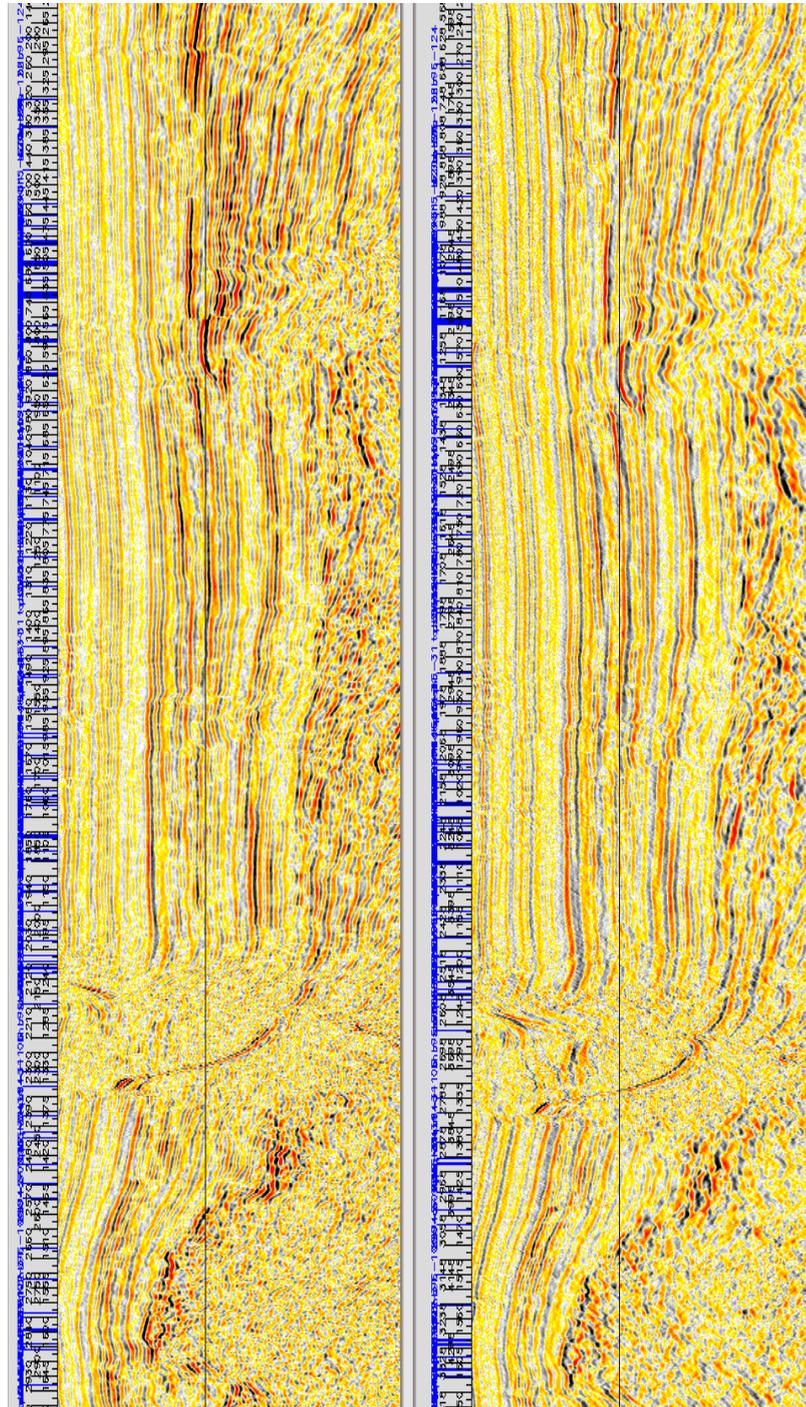


Figure 11.84. TQH5 – Stack Comparison - Previous processing (Bottom section) vs Reprocessing (Top section). Note: Image rotated -90 degrees.