COMBABULA PROCESSING/REPROCESSING PROJECT
ATP606P, SURAT BASIN, QUEENSLAND

SEISMIC DATA PROCESSING REPORT

For

ORIGIN ENERGY RESOURCES LTD

339 Coronation Drive
Milton, QLD 4069

By

KENMORE GEOPHYSICAL

19 Sophia Street
Kenmore
BRISBANE Q.4069

26 February 2005

1. Introduction

1.1 Survey Location

The data to be processed/reprocessed were from various vintages of data in permit ATP606P in the Surat Basin.

1.2 Survey Size

The data comprised 12 seismic lines totalling approx. 203 km.

1.3 Acquisition

The lines were acquired by Geosource (1981,1982, 1983) and Terrex (2004).

1.4 Processing Contractor

The data were processed by Kenmore Geophysical, Brisbane over the period February 2004 to November 2004.

1.5 Key Personnel

Contractor Personnel:

Nigel Fisher

Origin Energy Personnel

Randall Taylor
Greg Pass
Sam Taubert

2. Acquisition

(i) Gesource 1981 & 1982

INSTRUMENTS:

Type:	
Record Length:	4 seconds
Sample Rate:	2 msec
Tape Format:	SEGB
Recording Filter:	Out – 125 Hz

SOURCE:

Energy Source:	Vibroseis
Type:	3 x Vibes, 12 m pad to pad
Sweep Length:	8 seconds
Sweep Details:	8 sweeps per VP
Sweep Frequencies:	12 – 100 Hz
Source Location:	Centred on stations
Source Interval:	33 m

RECEIVERS:

Type:	Geospace 20D 14 Hz					
No. of Channels:	96					
Array:	12 phones over 33 m.					
Array location:	Centred on stations					
Group Interval:	33 m					
Spread Diagram:	Chan	1	48	SP	49	96
	Offset	1683	132		132	1683

(ii) Gesource 1983

INSTRUMENTS:

Type:	
Record Length:	3 seconds
Sample Rate:	4 msec
Tape Format:	SEGB
Recording Filter:	Out – 125 Hz

SOURCE:

Energy Source:	Vibroseis
Type:	3 x Vibes, 17.5 m pad to pad
Sweep Length:	10 seconds
Sweep Details:	8 sweeps per VP
Sweep Frequencies:	15 – 90 Hz
Source Location:	Centred on stations
Source Interval:	35 m

RECEIVERS:

Type:	Geospace 20D 14 Hz					
No. of Channels:	96					
Array:	12 phones over 35 m.					
Array location:	Centred on stations					
Group Interval:	35 m					
Spread Diagram:	Chan	1	48	SP	49	96
	Offset	1785	140		140	1785

(iii) Terrex 2004

INSTRUMENTS:

Type:	
Record Length:	3 seconds
Sample Rate:	1 msec
Tape Format:	SEGD 3490
Recording Filter:	3 – 246 Hz

SOURCE:

Energy Source:	Vibroseis
Type:	2 x Vibes, 12.5 m pad to pad
Sweep Length:	3 & 6 seconds
Sweep Details:	
Sweep Frequencies:	12 – 125 HZ
Source Location:	Centred between stations
Source Interval:	12.5 m

RECEIVERS:

Type:	Oyo 10 Hz					
No. of Channels:	200					
Array:	12 phones over 12.5 m.					
Array location:	Centred on stations					
Group Interval:	12.5 m					
Spread Diagram:	Chan	1	100	SP	101	200
	Offset	1243.75	6.25		6.25	1243.75

3. Processing Summary

REFORMAT
|
TRACE EDITING
|
SPHERICAL DIVERGENCE CORRECTION
|
CONVERSION TO MINIMUM PHASE
|
SURFACE-CONSISTENT SPIKING DECONVOLUTION
|
SPECTRAL WHITENING
||
REFRACTION STATIC CORRECTION TO FLOATING DATUM
|
COMMON MID-POINT GATHER TO CROOKED LINE
|
VELOCITY ANALYSIS
|
SURFACE-CONSISTENT RESIDUAL STATICS
|
VELOCITY ANALYSIS
|
SURFACE-CONSISTENT RESIDUAL STATICS|
|
NON SURFACE-CONSISTENT RESIDUAL STATICS
|
DMO
|
VELOCITY ANALYSIS
|
OUTER TRACE MUTING
|
AUTOMATIC GAIN CONTROL
|
STACK
|
SPECTRAL WHITENING
|
F-X DECONVOLUTION
|
MIGRATION
|
BANDPASS FILTER
|
AUTOMATIC GAIN CONTROL

4. Testing

The principle testing related to deconvolution and the use/non-use of spectral whitening. Surface-consistent and single trace deconvolutions were tested with and without spectral whitening. The choice was an unsurprising surface-consistent spike decon. with following spectral whitening.
It was intended to use DMO wherever helpful. In practice it was used on all data but the low-fold 1981 and 1982 data due partly to the low fold but especially due to the shooting geometry.

5. Production Processing

1. Transcription

The data were read from SEGY transcription of the original field data on Exabyte 8mm tapes and converted to Promax internal format.

2. Trace editing

All records were examined for bad traces, in particular for reversed or bad receiver locations.

3. Amplitude Recovery

A spherical divergence correction (VTT) was applied using a smoothed version of the stacking velocity function, end time being 2000 msec.

4. Dephase

The data were converted from zero to minimum phase prior to deconvolution.

5. Surface-consistent Spike Deconvolution.

Design Gates:	X (Offset)	6.5	1240	1850
	Time	90 - 2600	670 – 2700	950 - 2800

Operator Lengths: 120 msec
White Noise: 0.1 %

6. Spectral Whitening.

Using 8 frequency panels, bandwidth 5-10-85-95 Hz.

7. Refraction statics

A two-layer model was employed . A replacement velocity of 2500 m/sec was used for the static calculation. The weathering velocity was taken as 1000 m/sec. The final datum was 244m. The statics were applied to floating datum in the first instance.

8. CMP gather

Common midpoint gathering to the natural bin sizes was performed for the reprocessing. For the new data, the bin size was taken as 12.5 m, twice the natural value. The data were processed crooked-line in all cases.

9. Velocity analysis

First-pass velocity analyses were run using whole-line constant velocity stacks, thereafter at approx. 0.5 km intervals, these velocities being smoothed prior to the first run of residual statics.

10. Surface-Consistent Residual Statics

The maximum allowable static was 20 msec in magnitude. Promax's Maxpower routine was employed for this process.

11. Velocity analysis

Second-pass velocity analyses were run at approx. 0.5 km intervals using suitable semblance, gather and mini-stack displays.

12. Surface-Consistent Residual Statics

The maximum allowable static for the second run of surface-consistent residuals was 10 msec in magnitude. Promax's Maxpower routine was employed for this process once again.

13. Non Surface-Consistent Residual Statics

The maximum allowable static for this was 6 msec in magnitude.

14. DMO

Kirchhoff DMO was performed in the common-offset domain for the 1983 and 2004 data only.

15. Velocity analysis

Final velocity analyses were run at approx. 0.5 km intervals using suitable semblance, gather and mini-stack displays.

16. Normal Move-out

This was applied using the final velocities.

17. Outer Trace muting

This was applied using a varying mute function picked from common-offset gathers. Below is a representative mute:

X(Offset, m) =	100	560	1300	1800
T(Time, msec)=	20	500	1250	1600

18. Trace Scaling

Using an AGC of 500 msec gate length.

19. CMP Stack

Stack having appropriate nominal fold.

20. Static correction.

From floating datum to datum of 244 m.

21. Spectral Whitening.

Using 8 frequency panels, bandwidth 5-10-85-95 Hz.

22. F-X Deconvolution

23. Migration

The Kirchhoff method (dips up to 90 degrees accommodated) was used with 95% of the smoothed final stacking velocity field.

24. Bandpass filter

The final filter was as follows:

T(Time, secs)	0.5	1.0	1.6	2.5
Filter(Hz, dB per octave)	20/24 – 110/80	15/18 – 70/72	10/18 – 60/50	8/12 – 40/36

25. Trace scaling

Using an AGC of 800 msec gate length.

26. Display

Display was from –100 msec to 2900/3900 msec using scales of 1 : 12 500 and 10 cm per second. Field polarity was maintained throughout processing.
Broadly speaking, a negative value on tape (trough display) should represent an increase in acoustic impedance.

6. Quality Control

Various procedures were undertaken to ensure adequate quality control. These were:

- Inspection (on-screen) of all field records in shot and receiver gather mode to detect bad shots/receivers and reverse polarity receiver locations.
- Application of linear move-out during first-break picking for static computation allows for geometry checking, typically for mis-positioning of shots. All shots were examined this way as all shots were used in the refraction computation.
- Examination of residual statics profiles at each stage of the process.
- Examination of stack sections at each stage to ensure that overall improvement is being achieved at each significant stage.
- Generation of common-offset stack displays to QC the velocity functions being used – also to enable a space-variant mute to be chosen.

7. Processing Discussion

While the overall quality of the data, especially the new data, is good, many problems were encountered in relation to the old data. All of these were entirely due to navigation errors. Eventually good navigation data was obtained (or partly deduced from control points and by examining line and elevation ties). Actual errors encountered were the complete mispositioning of a line but more often evidence of stretch-and-squeeze effects due to inaccurate control points prior to interpolation of the remaining co-ordinates.

Appendix – List of Lines

Line	SP Range		CDP Range		Length
OW04-01	100	1700	1	1586	20.0125
OW04-02	44	1478	1	1368	17.9375
OW04-03	92	1108	1	1010	12.7125
COE81-42	128	1380	1	2491	41.349
COE82-40	108	596	1	971	16.137
COE82-42	100	620	1	1035	17.193
COE82-44	124	712	1	1170	19.437
COE82-46	100	712	1	1220	20.229
COE83-01	73	649	150	1295	20.195
COE83-02	99	304	202	603	7.21
COE83-04	98	305	201	606	7.28
COE83-06	99	201	202	477	3.605
Total					203.2975 km

Appendix – SEGY Label – stack data

Line	SP Range		CDP Range		Dataset
OW04-01	100	1700	1	1586	ow04-01_{dataset}
OW04-02	44	1478	1	1368	ow04-02_{dataset}
OW04-03	92	1108	1	1010	ow04-03_{dataset}
COE81-42	128	1380	1	2491	81-42_{dataset}
COE82-40	108	596	1	971	82-40_{dataset}
COE82-42	100	620	1	1035	82-42_{dataset}
COE82-44	124	712	1	1170	82-44_{dataset}
COE82-46	100	712	1	1220	82-46_{dataset}
COE83-01	73	649	150	1295	83-01_{dataset}
COE83-02	99	304	202	603	83-02_{dataset}
COE83-04	98	305	201	606	83-04_{dataset}
COE83-06	99	201	202	477	83-06_{dataset}

Client: Origin Energy Resources Limited
Area: ATP606P, Surat basin, Queensland
Data Details: 3/4 seconds length, 2/4 msec sample
Format: SEGY
Dataset Names: mig: filtered migration
stk: filtered stack
oomig: raw migration
oostk: raw stack
Date Created: 26th February 2005
Processed by: Kenmore Geophysical

Appendix – CGM+ Files

Line	SP Range		CDP Range		CGM+ Files
OW04-01	100	1700	1	1586	ow04-01_(stk/mig)
OW04-02	44	1478	1	1368	ow04-02_(stk/mig)
OW04-03	92	1108	1	1010	ow04-03_(stk/mig)
COE81-42	128	1380	1	2491	81-42_(stk/mig)
COE82-40	108	596	1	971	82-40_(stk/mig)
COE82-42	100	620	1	1035	82-42_(stk/mig)
COE82-44	124	712	1	1170	82-44_(stk/mig)
COE82-46	100	712	1	1220	82-46_(stk/mig)
COE83-01	73	649	150	1295	83-01_(stk/mig)
COE83-02	99	304	202	603	83-02_(stk/mig)
COE83-04	98	305	201	606	83-04_(stk/mig)
COE83-06	99	201	202	477	83-06_(stk/mig)

Client: Origin Energy Resources Limited
Area: ATP606P, Surat basin, Queensland
Data Details: 3/4 seconds length, 2/4 msec sample
Data: CGM+ files of f1nal stack and migrated final stack
Date Created: 26th February 2005
Processed by: Kenmore Geophysical