IOR EXPLORATION
Seismic Data Processing Report
1999 WALKER SEISMIC SURVEY

Robertson

SEISMIC DATA PROCESSING

REPORT FOR

IOR EXPLORATION PTY LTD

1999 WALKER SEISMIC SURVEY

LOCATION	:	NORTHERN TERRITORY
PERMIT	:	AMADEUS BASIN EP 69
COMPILED BY	:	ROBERTSON RESEARCH AUSTRALIA PTY. LTD.

JUNE 1999

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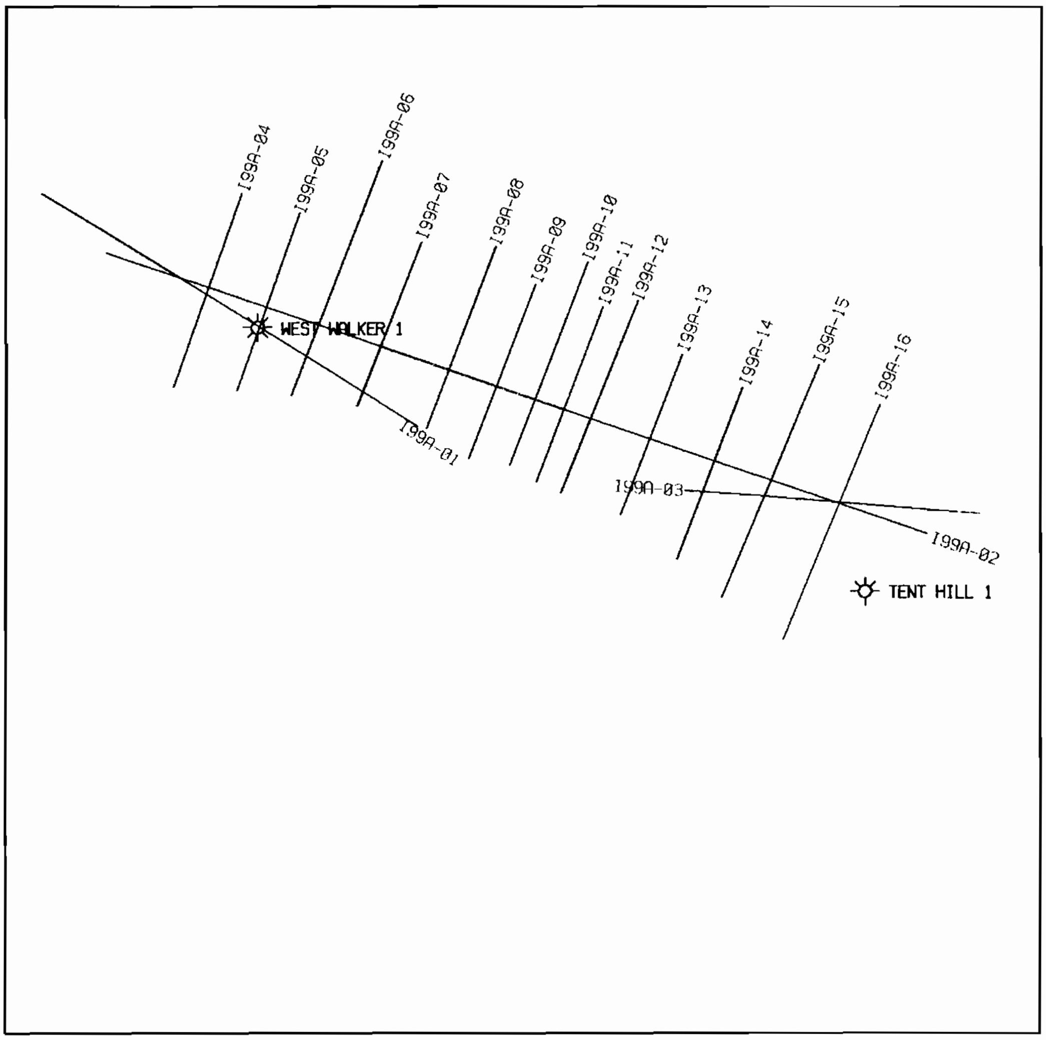
1. INTRODUCTION

The 1999 Walker Seismic Survey was acquired by Terracorp Pty Ltd in March 1999 and consisted of 16 lines. The data processed came to approximately 100 kilometres.

Field data was received on magnetic tape and exabyte copies were made.

Processing was conducted by Robertson Research Australia at their Perth office. Final filming was completed in June 1999.

1.1 LINE LOCATION MAP



1.2 **PROCESSING SEQUENCE DIAGRAM**

TRANSCRIPTION (GEOCOR IV TO ROBERTSON FORMAT)

GREEN MOUNTAIN REFRACTION STATICS

AMPLITUDE RECOVERY

CDP SORT

DECONVOLUTION

VELOCITY ANALYSIS (APPROX. 2.0 KM INTERVALS)

SURFACE CONSISTENT RESIDUAL STATICS

VELOCITY ANALYSIS (APPROX. 1.0 KM INTERVALS)

DIP MOVE OUT

VELOCITY ANALYSIS (APPROX. 1.0 KM INTERVALS)

NORMAL MOVEOUT CORRECTION

OUTER TRACE MUTE

PRE-STACK EQUALISATION

FLOATING DATUM TO FINAL DATUM (500M A.S.L.)

COMMON DEPTH POINT STACK

|-->	F.D. MIGRATION
BAND PASS FILTER	BAND PASS FILTER
SCALING	SCALING
STACK DISPLAY	MIGRATION DISPLAY

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1.3 FINAL DISPLAYS

Final stacks and Migration stacks were filmed at normal polarity at the following scale.

25.4 tr/inch	10 cm/sec	scale 1 : 10000

Films consisted of 1 double clear, 1 sepia and 1 print

1.4 ARCHIVE DATA

The following data was archived in SEGY format.

A. Raw Stacks
B. Final Stacks
C. Raw Migrations
C. Final Migrations

There is a description block separating each data set which contains the line number and a description of the data which follows.

All tapes were produced in SEGY 5.0 gB format.
The time of first sample is -200 ms.

Also archived were the following
a) Velocity ASCII dump to floppy disk

1.5 DATA DISPOSITION

To Kuang Koo Sing in South Australia

All archive data, exabyte field tape copies, support data, velocities and films.

Original magnetic field tapes were sent to the department of mines in the Northern Territory.

1.6 LINE SUMMARY

Line	VPs	CDPs
I99A-01	100 - 600	1 - 1001
I99A-02	1095 - 102	1 - 1989
I99A-03	100 - 440	1 - 681
I99A-04	100 - 335	1 - 471
I99A-05	320 - 98	1 - 444
I99A-06	90 - 405	1 - 631
I99A-07	311 - 98	1 - 428
I99A-08	99 - 316	1 - 434
I99A-09	315 - 110	1 - 411
I99A-10	96 - 341	1 - 491
I99A-11	315 - 99	1 - 434
I99A-12	97 - 305	1 - 418
I99A-13	295 - 93	1 - 405
I99A-14	100 - 306	1 - 413
I99A-15	400 - 93	1 - 615
I99A-16	110 - 406	1 - 593

2. ACQUISITION PARAMETERS

Source	Vibroseis
Source Array	34 m (Pad to Pad 12 m)
Array Centre	Centred on stations
Number of Sweeps	2 sweeps per VP
Sweep Length	5 sec Varisweeps
Sweep Frequency	8-90 Hz
Cosine Taper	0.20 s
Source Interval	20 m
Fold	140 (nominal)
No. Data Channels	280
Spread Type	Split Spread
Offsets	2790 - 10 - VP - 10 - 2790 m
Group Interval	20 m
Geophone Array	6 over 20 m
Geophone Type	Sensor SM4 10 Hz
Recording Instrument	GEOCOR IV
Record Length	4 seconds (Correlated)
Correlation Type	Zero Phase
Sample Period	2 ms
Tape Format	Geocor IV 16 bit integer

3. FIELD DATA AND SUPPORT MATERIAL

The following support information was provided.

a) Observers' Reports
b) Floppy disks containing co-ordinate and elevation information
c) Uphole plots

4. PROCESSING TECHNIQUES AND PARAMETER VERIFICATION

Testing was carried out on line I99A-05.
An overall test sequence was established during the processing of this survey. A comprehensive suite of tests was conducted which included true amplitude recovery, deconvolution, mutes, post-stack filter, scaling, FX Decon, Tau-p filtering, spectral enhancement and migration.
The adjustment and fine tuning of the parameters to achieve the final processing sequences was discussed between Kuang Koo Sing on behalf of IOR Exploration and representatives of Robertson Research, namely Peter Scruton and Mick Curran.

4.1 TRANSCRIPTION

Field data recorded in Geocor IV 16 bit integer format were transcribed to Robertson internal format.

4.2 GREEN MOUNTAIN REFRACTION STATICS

Refraction statics are used to help reduce the structural biases introduced by weathering anomalies. Here refraction breaks were picked using the "Green Mountain" refraction statics package. The "Green Mountain" package then used the measured travel time from shot to receiver to extract information about the near surface layer. Over many shots and many receivers, it is determined whether the ray paths are direct arrivals or refracted along one of the layers modelled by the package. When we use the STV solution as we have here, a model is developed to estimate the velocities and the delay times for each refractor under each source and each station.

The Green Mountain STV solution is summarised by the following paragraph from the Green Mountain manual.

"STV is based on the Hollingshead technique of refraction statics. Extended delay time curves are calculated for each refractor for both the shots and receivers. In essence, the receiver delay time curve is a single source gather whose first arrivals are all from a single refractor. Correspondingly, the resultant shot delay curve is a single receiver gather whose first arrivals are from sources transmitting energy in that refractor. From these extended delay time curves the midpoint curve between the source and receiver delay time curves is extracted. The slope of the midpoint curve measures the relative velocity variations and sufficient fold for overlapping arrivals, STV produces excellent results."

The data is prepared for first break picking by outputting sufficient of the raw shot records (ie. to include all the first breaks) onto disk. A constant gain function is applied to all samples within a trace and a constantly updated quadratic moveout function is applied to each record to facilitated ease of picking. The raw data is then tied to the upholes.

4.3 AMPLITUDE COMPENSATION

A synthetic gain recovery curve was tested and selected for line I99A-05. The parameters selected were GAIN = 1.0 (t) + 20 log (t)

4.4 DECONVOLUTION

Extensive deconvolution testing was conducted on this dataset. This included predictive deconvolution and surface consistent deconvolution. These comparisons were made on a stack panel with residual statics applied. In the final analysis, band limited surface consistent deconvolution with a 2 sample gap yielded the best overall result, particularly in terms of resolution.

4.5 VELOCITY ANALYSIS

First pass velocity analysis was performed by using constant velocity stack panels of 21 traces over a velocity scan of 1500 to 5000 m/s at increments of 100 m/s at approximately 2.0 kilometre intervals.

Final velocity analysis was performed by "OMNIVEL" analyses, located at approximately 1.0 kilometre intervals. Each analysis comprised 21 CDPs stacked with 9 velocity functions with up to +/-4 percent variation on the central input function which is derived from the first pass velocity analysis. A contoured power display based on the power of stack of the inner 3 CDPs and a display of the central CDP gather both raw and with NMO corrections from each of the 9 velocity functions are used to interpret the optimum velocity function.

4.6 RESIDUAL STATICS

Robertson's NEBULA package was used to determine surface-consistent residual statics. A pilot trace is cross correlated with each data trace and the cross correlation functions are summed for each shot and station. The peak of each summed cross correlation is used to determine the static for each shot and receiver. The shifts from anomalous cross correlations are given a low weighting in the decomposition. The pilot trace is formed by summing adjacent traces; the number of traces summed, and the individual weights assigned to them is kept constant. Three iteration passes are used with statics generated in previous iterations being applied to the data for the current iteration. The pilot trace correlation is started from alternate ends of the line on successive iterations in order to ensure penetration of a reasonable pilot trace into poor signal-to-noise areas.

4.7 MUTING TRIALS

Mutes were selected by inspecting a series of stacked panels with increasing offsets included into each successive panel. An outer trace mute was applied to the data to remove any high amplitude noise at earlier times on the record and over-stretched moveout reflectors. The mute has a 60 ms taper.

4.8 SPECTRAL ENHANCEMENT

Pre-stack spectral whitening uses the SPECB module which allows equalisation of the amplitude spectrum of a trace with a given frequency range. The frequency range is divided into equal numbers of trapezoidal filters and each may overlap its neighbours. The trace is then filtered through each of these filters, AGCed and summed. This technique helps to suppress the low frequency range (ground roll) and enhances the higher frequency range as well. Tested but not used.

4.9 DMO

DMO was used primarily in correcting velocity distortion due to the dipping events in the area, but was also useful as a scattered noise reduction technique. Robertson's Hale DMO program applies 2-D convolution operators to map the data accurately from non-zero to zero offset.
The convolution is conveniently implemented by the summation method, applied to traces in common offset order. This procedure also achieves the desirable partial migration, whereby traces with common mid-points, but different source-receiver offsets, relate to the same subsurface locations after DMO for all dips.

4.10 FILTER TRIAL

A suite of filter sets was applied to a panel of stacked CDPs with only one set of filters on each panel. Filtering was performed in the frequency domain by applying a cosine-squared function. The cosine-squared cut-off filters are described by four frequencies F1, F2, F3 and F4.

4.11 FX DECON

This process is designed to effectively attenuate random noise by prediction of the non-random signal content in a seismic trace. It's use was to reduce the random noise prior to migration. Not selected for processing.

4.12 TAUP

A post stack Taup filter was tested. It was decided the Taup was a bit strong and was therefore not used.

4.13 FINITE DIFFERENCE (F.D.) MIGRATION

The migration method uses the technique of downward continuation in order to map reflectors to their true time position. Both first and second orders were tested and first order was used for processing. The depth step used was 8 ms. Trials with varying percentages of the stacking velocity were tested.

5. SUMMARY OF THE PROCESSING PARAMETERS

1. Transcribe Geocor IV data into Robertson internal format.

2 Floating datum computation using Green Mountain refraction statics.

3. Amplitude recovery Gain (dB) : 1.0t + 20.0 log(t)
(where t = time in seconds)

4. CDP Sort

5. Band limited surface consistent spiking deconvolution
Frequencies: : 15 - 80 Hz
Operator Length : 120 ms
White Noise : 0.5%
Design Windows : 200 - 1400 ms at near offset
1000 - 2200 ms at far offset

6. Velocity analysis using CVS panel
Frequency of analyses : 2.0 km intervals
Velocity range : 1500 to 4000 m/s
Number of CDP/analysis : 21

7. Surface consistent residual statics
Number of traces summed into pilot : 7
Maximum allowable static shift ± 15 ms

8. DIP Move Out
Kirchoff method usind 70 offset planes

9. Velocity analysis using 'OMNIVEL'
Frequency of analyses : 1.0 km intervals
Velocity range : 1300 to 4500 m/s
Number of CDP/analysis : 15
Number of 4% increment panels per analysis : 9

10. NMO correction using second pass velocity functions as annotated.

11. Outer trace mute

Offset (m)	:	510	610	1610	2010	2790 m
Time (ms)	:	0	200	600	700	1000 ms

12. Pre-stack scaling 500 ms AGC

13. Floating datum to datum correction. New time origin of -200 ms
Final datum : 500 m above mean sea level

14. Common depth point stack

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15.	F.D. Migration	Wave-equation method 100% smoothed stacking velocities 1st order solution
16.	Band Pass Filter	10 - 70 Hz at 1000 ms 10 - 60 Hz at 2000 ms 10 - 50 Hz at 2600 ms

17. Time variant scaling
Dual window AGC with lengths of 1000 and 400 ms
Equalisation applied 50%

7. CONCLUSIONS AND ACKNOWLEDGEMENTS

The processing of the survey was completed on schedule and without any problems. The data was of good quality and Robertson Research Australia would like to thank Kuang Koo Sing for his co-operation and immediate replies to queries.

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