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1988 FORSYTH SEISMIC SURVEY

BONAPARTE BASIN

OP 186, NORTHERN TERRITORY

CONTENTS

MAPS AND FIGURES

ABSTRACT

Scope

Total line length	: 188 kilometres			
Prospects	: Milligan's Lagoon	South Pincombe	Bundaberg Lead	Weaber Re-shoot
Lines (17)	: BNT88-500, 501,502	BNT88-503,504, 506,508,510, 512	BNT88-505, 514,516, 518	84-15RE, 87-409RE 87-412RE, 87-414RE

Contractors

Recording	:	Geosystems Pty. Ltd.
Line Clearing	:	Kentworth Pty. Ltd.
Uphole Drilling	:	Daly Drilling Company, Bennett's Drilling Services
Field Supervision	:	SAAGEX Pty. Ltd. (T. Grocke)
Data Processing	:	Horizon Seismic Australia Pty. Ltd.

Recording Parameters

500 channel sign-bit recording, group interval 12 metres, 84 fold, Vibroseis "Varisweep" 10-72 Hz, 6 x 6 second sweeps, source interval 36 metres.

Statics

Type	:	Multiple upholes
Holes surveyed	:	82
Hole depths	:	15-82 metres

Permitting

Pastoral Holdings	:	Spirit Hill, Legune
Traditional Owners	:	Aboriginal Sacred Sites Authority, Darwin; Maralam Aboriginal Community

Environment

Terrain	:	Black soil savannah, lightly timbered plains, occasional rock outcrops, mud flats, tidal inlets.
Main Concerns	:	Avoid grass fires from vehicle exhausts. Avoid creating windrows across plains, cutting down trees, blocking water flow in creeks. Reduce line of sight by weaving line.

Results

Data quality poor to fair.
Small structure exists at South Pincombe.
No four-way dip closure at Milligan's Lagoon.
No substantial dip reversal on Bundaberg lines.

INTRODUCTION

The Forsyth Seismic Survey in OP 186 in the north-west of the Northern Territory was carried out in the latter part of 1988.

The objectives of the survey were further definition of prospects at Milligan's Lagoon and Pincombe, and regional data acquisition in the north-east of the Block.

The prime contractor was Geosystems Pty. Ltd. whose report on field operations forms Part B of this report.

Data processing was carried out by Horizon Seismic Australia Pty. Ltd.

DATA PROCESSING

The seismic data processing contract was awarded to Horizon Seismic Australia Pty. Ltd. in Perth, WA, on the bases of price and previous experience with sign-bit data.

Extensive testing of the complete processing sequence was undertaken to optimise parameters. The final sequence and parameters are summarised below:

1. Conversion from GEOCOR IV format to in-house format.
2. Resample 2 ms to 4 ms.
3. Apply statics to floating datum.
4. Common depth point sort 500 trace shots to 84 fold CDPs.
5. Band-limited deconvolution (10-72 Hz).
   8 ms predictive gap, 160 ms operator, 2% white noise.
6. NMO corrections derived from CVS analysis every 1 km.
7. Inner trace mute.
8. Trace scaling, 200 ms window, 10% window overlap.
9. Surface consistent residual statics.
10. CDP consistent residual statics (trim statics).
11. Static corrections, floating datum to MSL.
12. 2:1 receiver array simulation (trace sum).
13. Deconvolution, 8 ms predictive gap, 120 ms operator, 1% white noise.
14. Time variant filter.
15. Scaling, 500 ms windows.
16. Tau-P coherency enhancement.

Detailed area-by-area processing reports follow.

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SEISMIC PROCESSING REPORT

KEY TO ABBREVIATIONS

1 LINE	2 CREW	3 PC	4 STATIONS	5 GI	6 FOLD	7 ACQ	8 SPROC	9 PRELIM	10 FINAL	11 FLMAPP	12 DIST	13 MIG
88-500	GSYS	HOR	770-200	12.0	125	120988	051088	161288	100389	260589	250889	

1. Year line programmed and unique line identification.
2. Acquisition contractor.
3. Processing contractor.
4. Station numbers at start and end of line.
5. Group interval in metres.
6. Multiplicity of subsurface coverage.
7. Date acquisition completed.
8. Date statics sent to processing contractor.
9. Date preliminary section received from contractor.
10. Date final section received.
11. Date final section approved for filming.
12. Date prints of section distributed to partners etc.
13. Was section migrated? Y = yes.

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SEISMIC PROCESSING REPORT

186- MILLIGAN'S LAGOON

LINE	CREW PC	STATIONS	GI	FOLD	ACQ.	SPROC	PRELIM	FINAL	FLMAPP	DIST	MIG
88-500	GSYS HOR	770-200	12.0	125	120988	051088	161288*	100389	260589	300889	Y
88-501	GSYS HOR	650-230	12.0	125	140988	051088	151288*	220289	260589	300889	Y
88-502	GSYS HOR	200-818	12.0	125	130988	051088	161288*	100389	260589	300889	Y
TOTAL KILOMETRES					19	19	19	19	19	19	

ACQUISITION PARAMETERS
INSTRUMENT - GEOCOR IV 1024 Channel Seismic Data Acquisition and Processing system. (Including R.T.C.) 500 channels recorded to 4 sec at 2ms sample rate.
SOURCE - Vibroseis, Litton LRS 311 Vibrator units on International Paystar 5050 6X6 trucks. Electronics Pelton model V Advance (VARISWEEP), 30% drive level.
Source array - 3 Vibs in line, 24m pad to pad, 6 metre move up, interval 36m.
Sweeps - 6 Linear upsweeps, 10-40Hz, 14-56Hz, 36-72Hz, 34-72Hz, 13-48Hz, 11-44Hz. 6 second sweeps.
RECEIVERS - L21A geophones, 6 per string, linear array 2m between phones, 12 metre group interval. Offsets 2994m - 0 -12m - 2994m.

PARAMETERS
Pre stack - Resample from 2ms to 4ms sample rate. Apply floating datum statics correction. CDP sort 500 channels shot domain to 84 fold cdp domain.
Deconvolution band limited (10-72Hz) 8ms gapped 160ms operator, design windows 30m 800-1000ms, 150m 450-1200ms, 1500m 2500-3500ms. Inner trace mute 0m 1000-4000ms, 30m 1200-4000ms, 336m 1600-4000ms, 480m 2100-4000ms, 864m 3600-4000ms. N.M.O. corrections based on C.V.S analysis every 1Km. Initial trace mute. Scaling 200ms windows 10% overlap. Surface consistent residual statics. CDP consistent residual statics. Correction floating datum to MSL.
Post stack. - Trace sum (2:1). Deconvolution 8ms predictive gap 120ms operator.
T.V filter 15/18-70/84 Hz 100% apply 600ms, 12/15-60/72 Hz 100% apply 1200ms
12/15-50/60 Hz 100% apply 1800ms 9/12-40/48 Hz 100% apply 2500ms
Trace scaling 500ms window. Post stack Tau 'P' filtering.

TESTING
Extensive pre-stack testing of line BNT88-503 from the N.T. Forsyth survey.
Tests run -: Prestack shot domain F.K. filtering. Deconvolution before stack trials various predictive gaps and operator lengths, designature and spiking deconvolution and band limited deconvolution. Prestack equalisation various fixed windows and AGC's. Muting test including inner trace muting.
Array simulation, two to one sum pre and post stack. Line 88-420 had the application of trim statics applied.
Post stack. Line 88-420 DAS trials various gaps, spectral balance. Coherency enhancement and Tau 'P' filtering with and without DAS. Lines 88-424 and 512 tested with F.D. migration using 100% smoothed stacking velocities.

STATICS
Uphole statics. - Field statics calculated by Geosystems in field based on upholes. Depth of weathering and velocities interpolated relative to datum.

MIGRATION
All lines were F.D. migrated with 100% smoothed stacking velocities.

CURRENT STATUS (31/10/89)
Project completed.

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SEISMIC PROCESSING REPORT

186- PINCOMBE

LINE	CREW	PC	STATIONS	GI	FOLD	ACQ	SPROC	PRELIM	FINAL	FLMAPP	DIST	MIG
88-503	GSYS	HOR	200-860	12.0	84	060988	051088	060189*	310389	270789	250889	Y
88-504	GSYS	HOR	584-287	12.0	84	110988	051088	161288*	130389	260589	250889	Y
88-506	GSYS	HOR	224-1133	12.0	84	110988	051088	170189*	040489	260589	250889	
88-508	GSYS	HOR	200-701	12.0	84	090988	051088	151288*	020389	260589	250889	Y
88-510	GSYS	HOR	200-758	12.0	84	080988	051088	161288*	300389	260589	250889	Y
88-512	GSYS	HOR	734-200	12.0	84	070988	051088	161288*	130389	260589	250889	Y
TOTAL KILOMETRES						42	42	42	42	42	0	

ACQUISITION PARAMETERS

INSTRUMENT - GEOCOR IV 1024 Channel Seismic Data Acquisition and Processing system. (Including R.T.C.) 500 channels recorded to 4 sec at 2ms sample rate.
SOURCE - Vibroseis, Litton LRS 311 Vibrator units on International Paystar 5050 6X6 trucks. Electronics Pelton model V Advance (VARISWEEP), 30% drive level.
Source array - 3 Vibs in line, 24m pad to pad, 6 metre move up, interval 36m.
Sweeps - 6 Linear upsweeps, 10-40Hz, 14-56Hz, 36-72Hz, 34-72Hz, 13-48Hz, 11-44Hz. 6 second sweeps.
RECEIVERS - L21A geophones, 6 per string, linear array 2m between phones, 12 metre group interval. Offsets 2994m - 0 -12m - 2994m.

PARAMETERS

Pre stack - Resample from 2ms to 4ms sample rate. Apply floating datum statics correction. CDP sort 500 channels shot domain to 84 fold cdp domain.
Deconvolution band limited (10-72Hz) 8ms gapped 160ms operator, design windows 30m 800-1000ms, 150m 450-1200ms, 1500m 2500-3500ms. Inner trace mute 0m 1000-4000ms, 30m 1200-4000ms, 336m 1600-4000ms, 480m 2100-4000ms, 864m 3600-4000ms. N.M.O. corrections based on C.V.S analysis every 2Km. Initial trace mute. Scaling 200ms windows 10% overlap. Surface consistent residual statics. CDP consistent residual statics. Correction floating datum to MSL.
Post stack. - Trace sum (2:1). Deconvolution 8ms predictive gap 120ms operator.
T.V filter 15/18-70/84 Hz 100% apply 600ms, 12/15-60/72 Hz 100% apply 1200ms
12/15-50/60 Hz 100% apply 1800ms, 9/12-40/48 Hz 100% apply 2500ms
Trace scaling 500ms window. Post stack Tau 'P' filtering.

TESTING

Extensive pre-stack testing of line BNT88-503 from the N.T. Forsyth survey.
Tests run -: Prestack shot domain F.K. filtering. Deconvolution before stack trials various predictive gaps and operator lengths, designature and spiking deconvolution and band limited deconvolution. Prestack equalisation various fixed windows and AGC's. Muting test including inner trace muting.
Array simulation, two to one sum pre and post stack. Line 88-420 had the application of trim statics applied.
Post stack. Line 88-420 DAS trials various gaps, spectral balance. Coherency enhancement and Tau 'P' filtering with and without DAS. Lines 88-424 and 512 tested with F.D. migration using 100% smoothed stacking velocities.

STATICS

Uphole statics. - Field statics calculated by Geosystems in field based on upholes. Depth of weathering and velocities interpolated relative to datum.

MIGRATION

All lines except 88-506 were F.D. migrated with 100% smoothed stacking velocities.

COMMENTS

Line 88-503 the velocities were revised at final stack near the intersection with 88-506. No major improvement was achieved however.

CURRENT STATUS (31/10/89)

Project completed.

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SEISMIC PROCESSING REPORT

186- BUNDABURG REGIONAL

LINE	CREW	PC	STATIONS	GI	FOLD	ACQ	SPROC	PRELIM	FINAL	FLMAPP	DIST	MIG
88-505	GSYS	HOR	200-3917	12.0	125	021188	091188	170189*	300389	260589	300889	
88-514	GSYS	HOR	1910-200	12.0	125	201088	301088	060189*	220389	260589	300889	
88-516	GSYS	HOR	2066-266	12.0	125	311088	091188	161288*	100389	260589	300889	
88-518	GSYS	HOR	296-1577	12.0	125	281088	091188	161288*	220289	260589	300889	
TOTAL KILOMETRES						102	102	102	102	102	102	

ACQUISITION PARAMETERS

INSTRUMENT - GEOCOR IV 1024 Channel Seismic Data Acquisition and Processing system. (Including R.T.C.) 500 channels recorded to 4 sec at 2ms sample rate.
SOURCE - Vibroseis, Litton LRS 311 Vibrator units on International Paystar 5050 6X6 trucks. Electronics Pelton model V Advance (VARISWEEP), 30% drive level.
Source array - 3 Vibs in line, 24m pad to pad, 6 metre move up, interval 36m.
Sweeps - 6 Linear upsweeps, 10-40Hz, 14-56Hz, 36-72Hz, 34-72Hz, 13-48Hz, 11-44Hz. 6 second sweeps.
RECEIVERS - L21A geophones, 6 per string, linear array 2m between phones, 12 metre group interval. Offsets 2994m - 0 -12m - 2994m.

PARAMETERS

Pre stack - Resample from 2ms to 4ms sample rate. Apply floating datum statics correction. CDP sort 500 channels shot domain to 84 fold cdp domain.
Deconvolution band limited (10-72Hz) 8ms gapped 160ms operator, design windows 30m 800-1000ms, 150m 450-1200ms, 1500m 2500-3500ms. Inner trace mute 0m 1000-4000ms, 30m 1200-4000ms, 336m 1600-4000ms, 480m 2100-4000ms, 864m 3600-4000ms. N.M.O. corrections based on C.V.S analysis every 2Km. Initial trace mute. Scaling 200ms windows 10% overlap. Surface consistent residual statics. CDP consistent residual statics. Correction floating datum to MSL.
Post stack. - Trace sum (2:1). Deconvolution 8ms predictive gap 120ms operator.
T.V filter 15/18-70/84 Hz 100% apply 600ms, 12/15-60/72 Hz 100% apply 1200ms
12/15-50/60 Hz 100% apply 1800ms, 9/12-40/48 Hz 100% apply 2500ms
Trace scaling 500ms window. Post stack Tau 'P' filtering.

TESTING

Extensive pre-stack testing of line BNT88-503 from the N.T. Forsyth survey.
Tests run -: Prestack shot domain F.K. filtering. Deconvolution before stack trials various predictive gaps and operator lengths, designature and spiking deconvolution and band limited deconvolution. Prestack equalisation various fixed windows and AGC's. Muting test including inner trace muting.
Array simulation, two to one sum pre and post stack. Line 88-420 had the application of trim statics applied.
Post stack. Line 88-420 DAS trials various gaps, spectral balance. Coherency enhancement and Tau 'P' filtering with and without DAS. Lines 88-424 and 512 tested with F.D. migration using 100% smoothed stacking velocities.

STATICS

Uphole statics. - Field statics calculated by Geosystems in field based on upholes. Depth of weathering and velocities interpolated relative to datum.

MIGRATION

Not performed.

CURRENT STATUS (31/10/89)

Project completed.

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SEISMIC PROCESSING REPORT

186- WEABER

LINE	CREW	PC	STATIONS	GI	FOLD	ACQ	SPROC	PRELIM	FINAL	FLMAPP	DIST	MIG
84R-15	GSYS	HOR	566-200	12.0	125	051188	091188	170189*	020389	070789*	250889	
87R-409	GSYS	HOR	761-200	12.0	125	041188	091188	161288*	090389	070789*	250889	
87R-412	GSYS	HOR	200-824	12.0	125	051188	091188	151288*	090389	070789*	250889	
87R-414	GSYS	HOR	761-200	12.0	125	031188	091188	151288*	090389	070789*	250889	
TOTAL KILOMETRES						25	25	25	25	25	0	

ACQUISITION PARAMETERS
INSTRUMENT - GEOCOR IV 1024 Channel Seismic Data Acquisition and Processing system. (Including R.T.C.) 500 channels recorded to 4 sec at 2ms sample rate.
SOURCE - Vibroseis, Litton LRS 311 Vibrator units on International Paystar 5050 6X6 trucks. Electronics Pelton model V Advance (VARISWEEP), 30% drive level.
Source array - 3 Vibs in line, 24m pad to pad, 6 metre move up, interval 36m.
Sweeps - 6 Linear upsweeps, 10-40Hz, 14-56Hz, 36-72Hz, 34-72Hz, 13-48Hz, 11-44Hz. 6 second sweeps.
RECEIVERS - L21A geophones, 6 per string, linear array 2m between phones, 12 metre group interval. Offsets 2994m - 0 -12m - 2994m.

PARAMETERS
Pre stack - Resample from 2ms to 4ms sample rate. Apply floating datum statics correction. CDP sort 500 channels shot domain to 84 fold cdp domain.
Deconvolution band limited (10-72Hz) 8ms gapped 160ms operator, design windows 30m 800-1000ms, 150m 450-1200ms, 1500m 2500-3500ms. Inner trace mute 0m 1000-4000ms, 30m 1200-4000ms, 336m 1600-4000ms, 480m 2100-4000ms, 864m 3600-4000ms. N.M.O. corrections based on C.V.S analysis every 2Km. Initial trace mute. Scaling 200ms windows 10% overlap. Surface consistent residual statics. CDP consistent residual statics. Correction floating datum to MSL.
Post stack. - Trace sum (2:1). Zero phase deconvolution.
T.V. filter 15/18-70/84 Hz 100% apply 600ms, 12/15-60/72 Hz 100% apply 1200ms, 12/15-50/60 Hz 100% apply 1800ms, 9/12-40/48 Hz 100% apply 2500ms,

Extensive pre-stack testing of line BNT88-503 from the N.T. Forsyth survey. Tests run -: Prestack shot domain F.K. filtering. Deconvolution before stack trials various predictive gaps and operator lengths, designature and spiking deconvolution and band limited deconvolution. Prestack equalisation various fixed windows and AGC's. Muting test including inner trace muting.
Array simulation, two to one sum pre and post stack. Line 88-420 had the application of trim statics applied.
Post stack. Line 88-420 DAS trials various gaps, spectral balance. Coherency enhancement and Tau 'P' filtering with and without DAS. Lines 88-424 and 512 tested with F.D. migration using 100% smoothed stacking velocities.

STATICS
Uphole statics. - Field statics calculated by Geosystems in field based on upholes. Depth of weathering and velocities interpolated relative to datum.

MIGRATION
No migration was performed.

COMMENTS
These lines area reshoots, with the sign bit recording system, of older lines originally recorded with more conventional systems. The sign bit reshoots do not show any major improvements over the original work.

CURRENT STATUS (31/10/89)
Project completed.

SANTOS LTD.
SEISMIC PROCESSING REPORT

186- **WEABER REPRO**

LINE	CREW PC	STATIONS	GI	FOLD	ACQ	SPROC	PRELIM	FINAL	FLMAPP	DIST	MIG
87-412R	WEST HOR	100-350	30.0	60	250987	200189	100389*	020389	070789*	250889	
TOTAL KILOMETRES					8	8	8	8	8	0	

ACQUISITION PARAMETERS
INSTRUMENT - D.F.S. V/R.T.C. 120 channels, 4 second correlated records. 4ms sample rate.
SOURCE - Vibroseis. 3 vibrators, 15m pad to pad, 15m move ups.
2 X 6 second 8 - 80 Hz linear upsweeps, source interval 30m.
RECEIVERS - Geophones GSC 20D 10 Hz. 12 phones per group, 2.72m spacing.
Group interval 30m. Offsets 1845m - 75m - 75m - 1845m.

TESTING
Pre stack - Minimum phase conversion. Gain recovery 4T and 20log T to 3 seconds. Floating datum statics correction. F.K. filter (on 140.1 version only). CDP sort. Predictive deconvolution 8ms gap, 120ms operator. N.MO. corrections based on C.V.S. analysis every 1 Km. Initial trace mute. Scaling 200ms windows 10% window overlap. Surface consistent residual statics. CDP consistent residual statics. Correct floating datum to MSL.
Post stack - Zero phase deconvolution. Time variant filter
8/12-68/72 Hz 100% apply 1200ms
8/12-50/60 Hz 100% apply 2200ms
Trace scaling 500ms window. Post stack Tau 'P' filtering.

TESTING
Extensive pre-stack testing of line BNT88-503 from the N.T. Forsyth survey. Tests run -: Prestack shot domain F.K. filtering. Deconvolution before stack trials various predictive gaps and operator lengths, designature and spiking deconvolution and band limited deconvolution. Prestack equalisation various fixed windows and AGC's. Muting test including inner trace muting.
Array simulation, two to one sum pre and post stack. Line 88-420 had the application of trim statics applied.
Post stack. Line 88-420 DAS trials various gaps, spectral balance. Coherency enhancement and Tau 'P' filtering with and without DAS.
Additional testing on the 1987 reprocessing. F.K. filtering to match original Western processing. Pre and post stack deconvolution retested and alternate parameters applied.

STATICS
Uphole statics. - Field statics calculated by Geosystems in field based on upholes. Depth of weathering and velocities interpolated relative to datum.

MIGRATION
No migration was performed.

COMMENTS
This line was reprocessed to compare the Horizon processing sequence with the original processing and also to compare with the 1988 reshoot. The 1988 sign bit data did not show any major improvements over the 1987 reprocessed line. Two filmed versions of the line were produced, one with F.K. filtering (140.1) to enhance the deeper data and a second (140.2) with out F.K. for the shallow data.

CURRENT STATUS (31/10/89)
Project complete.

INTERPRETATION

The data recorded by the 1988 Forsyth Seismic Survey produced seismic sections of only poor to fair quality. It was possible to interpret and map only three of the four areas targetted by the survey. The results are as follows:

1. Pincombe

   Line BNT88-506 indicates no reversal of plunge on this lead.

2. South Pincombe

   The target horizon, top of the Ningbing Group, was mapped. A very small (non-economic) structure exists at South Pincombe. (Enclosure 1)

3. Milligan's Lagoon

   The target horizon, top of the Ningbing Group, was mapped. The 1988 data have shown that the previously mapped structure is more complexly faulted than originally indicated. It was revealed that there is no fourway dip closure, that any closure at all must be fault dependent, and that the fault dependent structure is very small (uneconomic). (Enclosure 2)

4. Bundaberg

   The regional data over the coincident gravity/magnetic anomaly has not revealed any structure with closure. The only hint of a rollover is on one line, BNT88-516. (Enclosure 3)

5. Weaber Reshoot

   It was anticipated that the use of sign-bit data acquisition would improve the data over Weaber Gas Field such that the reservoir sandstone within the Enga Sandstone could be seen in more detail and mapped with more confidence. Unfortunately the data did not meet expectations and achieving the goal was impossible. In fact, the 1988 data was not as good as the 1987 data so no interpretation was attempted.