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303858

DATA PROCESSING REPORT

1989 JINKA &

1989 GEORGINA RIVER SEISMIC SURVEYS

JULY - AUGUST 1989

GEORGINA BASIN, EP10, EP13 N.T. &

ATP 380-P, QLD

AUSTRALIA

for

PACIFIC OIL AND GAS PTY LTD

826 WHITEHORSE ROAD

BOX HILL VIC 3128

by

ONSHORE

DIGITAL EXPLORATION LIMITED

(A DIGICON COMPANY)

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FEBRUARY 1990

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PR90/085C.

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INTRODUCTION

During July-August, 1989 Pacific Oil and Gas Pty Ltd carried out a seismic reflection survey in the Georgina Basin in the Northern Territory.

Approximately 126 kilometres of data were acquired in the Jinka Survey and 75 kilometres in the Georgina River Survey.

The data was acquired by Geosystems Pty Ltd party GSC #205 and processed by Digital Exploration Limited in their Brisbane centre.

Following is a list of the lines acquired by Geosystems and the acquisition parameters used.

	LINE	STATIONS	KMS
	89 - 204	100-1768	20.02
EP10	89 - 205	100-2932	33.98
	89 - 208	100-1768	20.02
	89 - 212	100-2768	32.02
	89 - 216	100-1768	20.02
EP13/ATP-380P	89 - 303	100-6352	75.02
			201.08

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ACQUISITION PARAMETERS

Recording

Recorded By:	Geosystems Pty. Ltd., Party GSC No. 205
Date:	July - August 1989
Instruments:	Geocor IV
Tape Format:	SEGY
Tape Density:	1600 BPI
Sample Rate:	2 msecs.
Record Length:	4 secs.

Source

Energy Source:	Vibroseis X 4
Sweep/VP:	8 Varisweeps
Sweep Length:	5982 msecs.
Sweep Frequency:	Varisweep bandwidth 10 - 76 Hz.
Sweep Type:	Linear
Source Array:	24 m. spacing, 6 m. moveup, array centred on peg
Source Interval:	48 m.

Spread

Number Of Groups:	550
Group Interval:	12 m.
Geophone Array:	6 phones over 12 m.
Spread Pattern:	3294 m. - 6 m. - 0 - 6 m. - 3294 m.
Coverage:	6800%

PRODUCTION PROCESSING SEQUENCE

1. Reformat
2. Resample
3. True Amplitude Recovery
4. Trace Editing
5. F-K Filter
6. Deconvolution
7. Common Depth Point Gather
8. Datum Static Computation and Application
9. Velocity Analysis
10. Automatic Residual Static Computation and Application
11. Velocity Analysis
12. Normal Moveout Correction
13. Pre-stack Muting
14. Time Variant Scaling
15. Automatic Residual Static Computation and Application
16. Common Depth Point Stack
17. Tau-P Filtering
18. Migration
19. Digital Bandpass Filtering
20. Time Variant Scaling
21. Datum Correction

PROCESSING

1. REFORMAT

The data from the field tapes were decoded and converted to Digicon's internal 9 track, trace sequential format for subsequent processing.

2. RESAMPLE

The data were resampled from 2 msec. to 4 msec. A 90 Hz. high cut anti-alias filter of the Butterworth type was applied prior to resampling.

3. TRUE AMPLITUDE RECOVERY

True amplitude recovery phase of seismic data processing consists of the following steps:-

a. Removal of binary gain (non-linear) which is applied to the data during recording.

b. Correction for the absorption of energy due to inelastic attenuation of the earth which is experimentally shown to be linear and frequency dependent, i.e. increasingly greater losses of higher frequencies with record time.

To correct for these effects each trace is multiplied by a gain function (normally expressed in decibels per second) which usually remains constant for the prospect and brings the records to a readable level. An exponential gain function of 0db at 500 ms. to 12db at 2500 ms. was found to be adequate for the entire survey. For line 89-303 a function of 0dB at 500 msec to 10dB at 1500 msec was used.

4. TRACE EDIT

This option is used on some records to zero noisy or wild traces which would not make a useful contribution to the stack. Information from the displayed reformatted field records, field monitor records and observers logs is combined to determine the editing table.

5. F-K FILTER

This process applies to shot data, a zero phase F-K filter in the X-T domain using straight forward design principles. Reflections are separated from interfering noise on the basis of differences in apparent horizontal velocity. Events which are slower than the specified cut velocity are rejected. Amplitude and phase of the signal in the accept zone are preserved. The velocity cut used was +/- 4124 m/sec.

6. DECONVOLUTION

Deconvolution is the process of designing and applying an inverse filter to remove the effects on the recorded data of the earth's filtering and distortion of the source wavelet characteristics. The deconvolution is accomplished by the application of one or more whitening filters designed from the auto-correlation of the data trace of the input records.

The filter is designed to whiten or broaden the frequency spectrum within a band pass having an allowable signal-to-noise ratio. By whitening the pass-band, the time transient is collapsed into a shorter interval thus providing finer delineation of the reflecting horizons.

On the subject data a gapped deconvolution filter of 20 msec. with an operator of 161 milliseconds was designed on data within the window defined by the following offset-time pairs:

6 m. - 200 msec, 3294 m. - 1100 msecs
6 m. - 3000 msec, 3294 m. - 3000 msecs

7. COMMON DEPTH POINT GATHER

The seismic traces along a line are gathered into data sets on the basis of common reflection point. The offsets, surface and sub-surface co-ordinates and shot sequence numbers are annotated in the trace headers for use in the subsequent processing.

8. DATUM STATICS COMPUTATION - REFRACTION STATICS METHOD

The input is digitised first breaks from the production records. Geometry information is drawn from the database and used with the input elevation listings to fully define the profile. Details of shot and receiver offsets, instrument delay correction, weathering velocity (Vo), and selected datum elevation are also provided.

The routine is iterative, and progressively adjusted first break times are submitted for updating of sub-weathering velocities (Vr) and delay times (Td) at each group location. Both of these are constrained by suitable smoothing filters to inhibit erratic variation.

After the final iteration, usually 5, the geophone static (Tg) is computed as an elevation correction plus a weathering correction as follows:-

$$Tg = -\left[\frac{E}{Vr} + KTd\right]$$

where $$K = \sqrt{\frac{Vr - Vo}{Vr + Vo}}$$

and E = elevation above datum

The shot correction (Ts) is obtained from:-

$$Ts = Tg + Tuh$$

The weathering thickness (Wx) is computed as:-

$$Wx = \frac{Td \times Vo}{\text{Cos}\left(\text{arc Sin}\,\frac{Vo}{Vr}\right)}$$

After calculation, the shot and receiver statics are averaged to produce a mean static and a residual shot and receiver static, which is usually quite small. Subsequent processing is performed on data with only the residual components applied. Effectively the data is referenced to surface.

The mean static is applied to the data after the final filtering process to correct the data to the selected seismic datum of 400 metres.

9. VELOCITY ANALYIS (SVELFAN)

SVELFAN Velocity Analysis is an automatic production orientated technique designed to obtain RMS velocity information from seismic data in CDP gather form.

Based on pre-determined knowledge of the stacking velocities which might be expected in an area, a set of velocity ranges versus two-way reflection time is input to the program together with a number of consecutive CDP gathers, for each location where a velocity study is required. Also input is a number, N, (usually 9 - 11), of velocity functions to be applied to the gathers.

The program takes the maximum and minimum functions as specified by the ranges and times above and evenly intersperses N-2 other functions between them. It then applies these functions, stacks and filters the data.

The SVELFAN display consists of six parts:

a. The uncorrected central gather of the input group.
b. The central gather NMO corrected by the central velocity function.
c. The stacks formed by NMO correcting, stacking and filtering the set of CDP gathers using the N functions.
d. A display of velocity versus reflection time showing the N functions and points of high coherence at preselected intervals, e.g. 50 milliseconds.
e. A plot of relative coherence amplitude versus time.
f. A listing of velocities versus time of up to three velocities at any time level, based on coherence measurements.

For this survey the analyses were run over 19 depth points with 11 velocity functions forming the fan, and were run at approximately 2 km. intervals before automatic residual statics and 1 km. intervals after automatic residual statics.

10. RESIDUAL STATICS

The routine assumes that the static variation from trace to trace is caused by velocity and thickness variations in the low-velocity weathering layer. It further assumes that refined static corrections, based on statics computed from the reflection data itself, are desirable.

The automated statics analysis routine is conducted on NMO corrected gather records by utilizing all possible cross correlations between traces within and from adjacent depth points.

A dip model, representing the observed structure on one or more events within a specified gate or gates, is input to the program to facilitate dip correction within the set of CDP gathers being operated on. The model is interpreted from the previous stacked section in the processing sequence.

The process iterates automatically and makes separate estimations of residual normal moveout and dip, then computes a set of surface consistent residual statics for all shot and receiver locations. The appropriate residuals may be output on tape for application at a later stage, or stored in the data-base.

The following correlation processing controls are generally followed while estimating residual statics and have some data dependence:

a. Static limits (+/- 20 msec. for these data).
b. Damping factor to prevent matrix instability.
c. Number of iterations (3 for these data).
d. The number of depth-points in the cross correlations. This was constant at 11, 9 and 7 through iterations 1, 2 and 3.

Residual geophone statics are applied in accordance with receiver surface location and residual shot statics with record or shot input sequence. Both are recorded in the appropriate trace headers.

For the 2nd pass automatic residual statics calculation a non surface consistent solution was determined. The following correlation processing controls were used:

a. Static limits (+/- 4 msec.)
b. Number of iterations (1 for these data)
c. Number of depth-points used in the cross correlations (5 for these data)

11. NORMAL MOVEOUT (NMO) CORRECTION

This operation is performed assuming that the energy travels in a straight ray path and utilizes the following equation:

$$T^2 \text{ (recorded)} = T^2 \text{ (corrected)} + \left[\frac{X \times 1000}{VRMS}\right]^2$$

A space varying velocity function is utilized and the program computes a new space-varying function for each trace, by making floating point cubic interpolations between input control points, to produce a high fidelity NMO output.

12. PRESTACK MUTING

The function of this process is to mute the very shallow long offset traces where the signal to noise ratio is extremely poor.

In particular, the disproportionate stretching of traces with decreasing velocity and increasing offset, by NMO correction, contributes significantly to the poor S/N ratio.

Final mute values are noted in Appendix 1.

13. PRE-STACK SCALING

At this final stage of preparation of the trace it is assumed that each has been statics and NMO corrected to a simulated zero offset condition, on the datum plane, for the particular CDP. So that each may contribute equally over its full length, to the summed trace, a short gate (500 milliseconds) Automatic Gain Control was applied, before stacking, to ensure that all were at optimum level.

14. COMMON DEPTH POINT STACK

After the completion of prestack muting and balancing the CDP data sets, which are corrected for the final velocity and residual statics, are summed algebraically. The resultant amplitude is divided by the number of live samples contributing to the summation to produce the final unfiltered stacked sample.

15. TAU-P FILTER

The stacked data is input to the program which is a 2-D time space dip filter that has two non-linear signal estimation options available, coherence masking and dip balancing. The dip pass region given was ±3.0 msec per trace and the unfiltered addback was 40%.

16. FILTERING

Zero-phase digital filters were used in the filtering of stacked data. For intermediate processing, a time constant band-pass filter having a low-cut of 10Hz. and a high-cut of 76Hz. was used.

Final time variant filters applied to lines are noted in Appendix 1.

17. POST STACK SCALING

A multi-gated balance was applied to the data after final filtering to bring the data to the desired amplitude level. The average absolute value (AABS) of the gate is computed and a scalar is applied to the centre point of the gate. This is repeated for each gate with the scalar interpolated between the gate centres.

18. MIGRATION (FINITE DIFFERENCE METHOD)

The lines were migrated using the finite difference method with a layer thickness of 40 ms from 0.0 secs. to 4.0 secs. and migration velocity of 90% of the smoothed stacking velocities.

19. DISPLAY

The final stack display films were at a horizontal scale of 50.8 traces per inch with the trace interval representing 6 metres on the ground. The vertical scale was 10.0 cm per second.

The migration stack displays were at a horizontal scale of 50.8 traces per inch and a vertical scale of 5.0 inches per second.

The films were fitted with a side panel on the right hand side with a comprehensive tabulation of line, field and processing information. Along the top of the films data relating to actual location along the line is displayed. This includes datum statics and residual statics, replacement velocity, line intersection details, well locations, surface elevation and R.M.S. velocity tables with their points of application. All films were in the wiggle trace-variable area mode, with timing lines every 100 milliseconds.

Reduced scale plot films of all migrated stacks were produced with a horizontal scale of 1:50,000 and vertical scale of 5.0 meters per second.

THE DATA PROCESSING SYSTEM

Digicon's installation in Brisbane is based on one Digital Equipment Corporation VAX 11/780 computer and one VAX 8650 computer, coupled with Digicon's Disco Seismic Data Processing System.

The hardware configuration is extremely flexible, with the Brisbane installation being one of many possible alternatives. Included in this establishment are twenty-five tri-density tape drives, disk storage of 6 gigabytes, five FPS array processors, two Numerix Vector processors, three Benson and one Versatic Electrostatic Plotters and twenty-six remote input/output terminals allowing multi-user, multi-functional interactive capability.

The 32-bit central processing unit and a 16 mega-byte main memory capacity enhances the scientific application of the VAX computers.

Plotting in a variety of modes is available through the on-line Benson plotters and a Geospace film plotter. Off-line a Regma A170 Ammonia paper printer enables high quality reproductions of paper and filmed sections.

The Disco System (Digicon's Interactive Seismic Computer) is an extension of the Digicon Modular Seismic Data Processing System developed over many years. Being modular, the system is completely flexible allowing complete user control of the number and sequence of operations performed in any job. The Disco Seismic monitor assembles the selected modules in the specified order and controls the processing run.

Respectfully submitted,

Michael C. Noble
LAND PROCESSING MANAGER

Bimal Banerjee
GENERAL MANAGER

Allen S. Gell
SENIOR GEOPHYSICIST

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APPENDIX 1

PROCESSING PARAMETER TESTS

A. PRE-STACK TESTING:

Pre-stack tests were performed on the shot record at VP1400, Line 89-212 and a stack panel between VP's 1300-1500 for the JINKA Survey. For the Georgina River Survey a shot record at VP 3452 and stack panel between VPs 3400-3500 were used.

(1) GAIN

The three shot records were measured for db level over 100 msec. time gates from time 0.10 sec. to 4.00 sec. From the resultant displays an exponential gain function was chosen and applied to the data. The db level was again measured and displayed after the application of the gain function.

(2) FILTER

Octave width bandpass filters were tested from 0-7.5 Hz to 90-180 Hz.

(3) F-K

The shot records were tested using velocity cuts of 3000 m/s and 4125 m/s after the application of the exponential gain function. The 4125 m/s velocity cut was chosen as this effectively removed the majority of reverberated refractions from the data without interfering with the reflection signal.

(4) DECONVOLUTION BEFORE STACK

The following combination of parameters were tested.

(a) Spike; 0.1% white noise, two gates:
near trace: 200 msec - 3000 msec
far trace: 1100 msec - 3000 msec
operator length: 121 msec

(b) Spike; 0.1% white noise, operator length 161 msec.

(c) Spike; 0.1% white noise, operator length 201 msec.

(d) Spike; 0.5% white noise, operator length 161 msec.

(e) Spike; 2.0% white noise, operator length 161 msec.

(f) Gap; 0.5% white noise, operator length 161 msec, gap 12 msec.

(g) Gap; 0.5% white noise, operator length 161 msec, gap 20 msec.

(h) Gap; 0.5% white noise, operator length 161 msec, gap 32 msec.

Filtered and unfiltered displays with autocorrelation appended were produced.

B. STACK PANEL TESTS

Each test panel was full fold and each had a single velocity analysis performed using Digicon's VELFAN routine. Datum statics were applied to the stack panels.

The following mute function was determined and applied to each test panel following normal move out correction of the data.

OFFSET (m)	288	384	672	1056	1824	3288
TIME (msec)	0	200	325	475	600	838

A pre-stack 500 msec gated scaling function was applied to the data pre-stack followed by a 1000 msec gated function post stack. No frequency filtering was applied to the stacked data.

All panels had an exponential gain function of 12 db 500-2500 msec applied and were resampled to 4 msec after the application of an anti-alias filter.

The following tests were performed for each of the two locations.

(1) F-K +2.91 msec. per trace (vel 4124 m/s), spiking deconvolution, 0.5% white noise, operator length 161 msec. All traces displayed.

(2) as for (1) but displaying only every second trace.

(3) F-K +4.0 msec. per trace (vel 3000 m/s), spiking deconvolution, 0.5% white noise, operator length 161 msec. Display every second trace.

(4) F-K +\- 2.91 msec per trace (velocity 4124 msec), 2:1 sum, spiking deconvolution, 0.5% white noise, operator length 161 msec., display every trace (12m CDP interval).

(5) No F-K, spiking deconvolution, 0.5% white noise, operator length 161 msec., display every second trace.

(6) F-K +2.91 msec. per trace (vel 4124 m/s), gapped deconvolution, 0.5% white noise, operator length 161 msec., gap 20 msec. display every second trace.

(7) No F-K, 2:1 sum, no deconvolution, display every trace.

On the Jinka Survey tests were run using elevation statics but tests 1 and 2 were repeated using 2 layer refraction statics.
The Georgina River survey tests were on data using elevation statics only.

C. MUTE

Post stack mute tests were performed on two lines, 89-212 at VPs 1325-1375 and on line 89-303, VPs 3400-3450. The test consisted of 15 panels. Each panel represents the data stacked using increasing offsets to produce increasing fold stacks.

From the tests the following Post NMO correction mute function was selected for all lines within the Jinka Survey.

OFFSET (m)	295,	490,	780,	1360	2133	3300
TIME (msec)	0,	150,	300,	400,	525,	600

For line 89-303 the following mute was chosen.

OFFSET (m)	288	384	672	1056	1824	3294
TIME (msec)	0	200	325	475	600	838

D. FILTER

Post-stack filter tests were run on both line. From these tests the following filter function was determined and used for all lines in the survey.

FILTER: TYPE: BANDPASS
PHASE: ZERO

TIMES (msec)	LOW (HZ/DB per Octave)		HIGH
0	15/30	-	75/60
600	15/30	-	70/60
1500	12.5/30	-	65/60
2000	10/30	-	60/60
4000	10/30	-	60/60

For line 89-303 the following filter was chosen:

TIMES (msec)	LOW (HZ/DB per Octave)		HIGH
0	15/30	-	75/60
600	15/30	-	70/60
1500	12.5/30	-	65/60
2100	10/30	-	55/60
4000	10/30	-	55/60

H. MIGRATION

Migration tests were run on (Lines 89-208 VPs 830-1130 and line 89-204 VPs 1060-1360 and VPs 100-420) and comprised of the following panels:

(1) Finite difference method using 90% of the smoothed stacking velocities, and a migration layer thickness of 20 msec.

(2) Finite difference method using 90% of the smoothed stacking velocities, and a migration layer thickness of 40 msec.

(3) Finite difference method using 90% of the smoothed stacking velocities, and a migration layer thickness of 60 msec.

(4) F-K migration using 90% of the smoothed stacking velocities.

On the JINKA Survey line 89-204 additional post stack tests were run. These are described in Appendix 3.

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APPENDIX 2

SEGY FORMAT ARCHIVE TAPE LISTINGS

DATA SET: UNFILTERED FINAL STACK

TAPE NO.	LINE NO.	VP RANGE	INPUT CDP	LINETRC COUNTER
CPT-1279	89 - 204	100 - 1768	200 - 3575	1 - 3336
CPT-1279	89 - 208	100 - 1768	200 - 3535	3337 - 6672
CPT-1279	89 - 212	100 - 2768	200 - 5535	6673 - 12008
CPT-1279	89 - 216	1768 - 100	3523 - 201	12009 - 15331
CPT-1279	89 - 205	2932 - 100	5863 - 200	15332 - 20995
CPT-1187	89 - 303	100 - 6352	12770 - 201	1 - 12503

DATA SET: UNFILTERED MIGRATED STACK

TAPE NO.	LINE NO.	VP RANGE	INPUT CDP	LINETRIC COUNTER
CPT-1026	89 - 204	100 - 1768	200 - 3535	1 - 3336
CPT-1026	89 - 208	100 - 1768	200 - 3535	3337 - 6672
CPT-1026	89 - 212	100 - 2768	200 - 5535	6673 - 12008
CPT-1026	89 - 216	1768 - 100	3523 - 201	12009 - 15331
CPT-1026	89 - 205	2932 - 100	5862 - 200	15332 - 20994
CPT-1260	89 - 303	100 - 6352	1 - 6003 }	1 - 12503
			8004 - 14504 }	

APPENDIX 3

ADDITIONAL TESTING LINE 89-204

REPORT BY M. NOBLE

INTRODUCTION

A. Line 89-204 was one of five lines recorded as the 1989 Jinka seismic survey for Pacific Oil and Gas in EP10, N.T during July, 1989.

Subsequent processing of this survey was undertaken in Digital Exploration Ltd's Brisbane office. Experimental processing on line 89-212 established the pre-stack parameters to be used and processing proceeded on all lines with the agreed sequence.

A Preliminary Final stack section for line 89-204 was delivered to Pacific Oil and Gas on October 9 and it was noted at this time that reflection event continuity in the principal zone of interest (0.1 - 0.5 seconds two-way time) was fair to poor. As a result it was agreed that experimental processing should be undertaken in an effort to determine ways of further improving event continuity. A portion of line 89-204 from VP's 100 - 420 was selected for this processing which took place from October 10 - 15 and is summarised in this report.

EXPERIMENTAL PROCESSING

B. This processing occurred in two phases which took the form of a review of various parameters and processes pertinent to the problem. Phase I consisted of a review of 2nd pass velocity and residual statics interpretation and a test of the efficacy of post-stack Tau-P domain filtering. Phase II extended the data review to additional processing options and pre-stack muting parameters.

Phase I

The following preliminary final stacked outputs were produced at this stage of testing:

(a) no 2nd pass residual statics,

(b) no 2nd pass residual statics, revised input velocity field,

(c) no 2nd pass residual statics, post stack Tau-P domain filter,

(d) with 2nd pass residual statics, revised input window.

Stack (a) provided the benchmark for all subsequent testing.
Stack (b) was produced after a review of 2nd pass velocity analyses.

The revised velocity field was generally "faster" with changes in velocity up to 500 metres per second. The majority of changes, however, were in the vicinity of 100 - 200 metres per second which is less than 5% of the interpreted RMS velocity. For this reason very little difference was noted between stacks (a) and (b) but it was felt that stack (b) was marginally improved.

Stack (c) was generated in order to indicate how the data would respond to post-stack Tau-P domain filtering which had been used with success on surveys in an adjacent area. Results were encouraging with event continuity significantly improved without loss of temporal resolution.

Stack (d) involved a revision of the 2nd pass residual statics input window to 100 - 500 milliseconds. The original window of 100 - 1000 milliseconds, interpreted from the brute stack section, was found to be non-optimal when the original Preliminary Final stack was produced. (For ideal results in the future it is suggested that either a stack be produced routinely after 1st pass velocity and residual statics analysis or that 2nd pass residual statics parameters be tested on a suitable data panel before proceeding with the entire dataset). Stack (d) showed noticeable improvement over stack (a).

Phase II

Although revised velocities, 2nd pass residual statics and implementation of a Tau-P filter had provided improvements, the underlying problem of a poor signal to noise ratio was still evident. In an attempt to improve the data further the following stack outputs were generated:

(a) with additional velocity analyses,
(b) with additional velocity analyses, and using a slower velocity trend,
(c) with revised pre-stack mute,
(d) with receiver domain FK filtering,
(e) with pre-stack Tau-P domain filtering,
(f) with revised velocities, pre-stack mute and 2nd pass residual statics and utilising post-stack Tau-P domain filtering.

Stack (a) was produced after generating and interpreting additional velocity analyses so as to provide a 0.5 km velocity analysis spacing. The additional functions did not show any significant lateral velocity variations and as might be expected the resulting stack was not noticeably different to the benchmark (stack (a) from Phase I).

Stack (b) was the result of reinterpreting the velocity analyses so as to follow a slower trend which had been noted during previous analysis. This approach was open to some doubt as the picked events were consistent with those expected from multiple reflections in the shallower layers and were of lower frequency content than events stacking at faster velocities. After review it was clear that event picks in the zone of interest could not be picked very differently and the slower trend could only be established on deeper events. The result showed few significant differences but was felt to be poorer than the benchmark.

Stack (c) was generated after revision of the pre-stack mute function as follows:

Original Mute		Revised Mute	
Offset (m)	Time (ms)	Offset (m)	Time (ms)
295	0	295	0
384	200	490	150
672	325	780	300
1039	500	1360	400
1843	600	2133	525
3300	850	3300	600

The original mute was established (along with other pre-stack parameters) by testing a panel of data on Line 89-212. Considering the event continuity problem it was felt that relaxing this mute, although allowing in more lower frequency "stretched" data, would perhaps allow more signal energy to stack up within the mute zone. This was indeed the case and noticeable continuity improvements were gained from this test.

Stack (d) involved an alternative approach to improving the signal to noise ratio namely FK filtering of data ordered into common receiver records. This approach can be effective when noise energy is coherent in the receiver domain, examples being back-scattered noise or surface-generated noises adjacent to particular receivers. At the least some benefit can be obtained simply from this second pass of filtering and its attenuation of random noise components. The result of application of this technique was a noticeably "cleaner" section but no significant improvement in event continuity was noted.

Stack (e) involved a further attempt to improve signal to noise ratio on a pre-stack basis by filtering data in the Tau-P domain. This procedure utilises a forward "slant-stack" to transform the data into a space determined by the parameters tau, which is the intercept time of the slant-stack, and P, the ray parameter, which is the slope of the slant-stack measured in units of inverse velocity or "slowness". Data can thus be separated according to their dip (or linear velocity) in the X-T domain and filtered by muting in the Tau-P domain before the reverse slant-stack is used to transform the data back to X-T space. Improvements in continuity were noted as a result of this process although some work remained to be done to properly scale the data amptitudes. It was not persevered with as the improvements shown were not felt to be sufficient to warrant the additional costs associated with this technique.

Stack (f) represented the culmination of the testing in that all the steps that had shown worthwhile improvement up to this stage were combined, i.e. revised velocities, pre-stack mute and 2nd pass residual statics and post-stack Tau-P domain filtering. This display showed considerable improvement over the benchmark and as a result this approach was adopted for processing all lines in the 1989 Jinka survey.

CONCLUSION

C. 1. Various parameters and processing techniques were tested and as a result the following were found to give best results:

(a) revision of pre-stack muting parameters,
(b) revision of 2nd pass residual static analysis window,
(c) utilisation of Tau-P filtering on a post-stack basis.

2. It is recommended that some time be spent optimising items 1.(a) and 1.(b) above on future surveys exhibiting similar problems whenever this time is available.

3. The use of Tau-P domain filtering on a pre-stack basis showed some promise on this dataset and it is recommended that its use be considered on future data wherever budgetary constraints allow.

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