# PROCESSING REPORT

## FOR PANCONTINENTAL PETROLEUM PTY. LTD.

LOCATION: AMADEUS BASIN

AREAS: MEREENIE
WATERHOUSE
OORAMINA
PALM VALLEY



COMPILED BY:-

HOSKING GEOPHYSICAL CORPORATION (AUSTRALIA)

# INDEX

## INTRODUCTION

The field survey was undertaken in 1973 by Petty-Ray Geophysical (Aust.) Crew 6317. The original processing was conducted by Petty Ray Geophysical. Reprocessing was performed by Hosking Geophysical Corporation (Aust.) at their Perth processing office from March to August 1983.

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# FIELD SURVEY INFORMATION

## (A) ACQUISITION PARAMETERS -

| | Field Acquisition Parameters |
|---|---|
| Fold | 1200% |
| Spread configuration | 24 trace; offsets: 1890-350-X-350-1890 |
| Group interval | 140 m |
| S.P. interval | 140 m |
| Source | Thumper |
| Source array | 16 drops per 175m |
| Geophone type | EV2A-14 |
| Geophone configuration | 4 groups of 12 |
| Recording instrument | SDA-1 |
| Record length | 4 sec |
| Sample rate | 2 msec |
| Recording filter | 12 - 62.5 Hz |
| Gain | IFP |
| Tape format | 1600 B.P.I. SEGA |

## (B) FIELD DATA SUPPORT MATERIAL -

Observer and surveying reports along with field tapes were received from Magellan Petroleum Pty. Ltd.

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## PROCESSING PARAMETER EXPERIMENTATION

Testing procedures were performed on each area separately. The lines chosen were 73-1-6.5, 73-3-PV4, 73-3-AEX, and 73-4-1.1.

The testing for processing parameters was conducted as follows:

1) True amplitude Recovery:-

   Spherical divergence correction was achieved by the application of gain using the following formula -

   $$\text{Gain} = K\,t^{n}\,e^{at}$$

   where "t" = time, "K" and "n" were set to 1.0, and "a" was varied.

   "a" values from 0.2 through to 1.0 in increments of 0.2 were tested by way of display of shot records.

2) Pre-Dcon Band-Pass Filter:-

   Filter panels of shot records were displayed to determine this filter. A wide band filter at the field filter values was employed to ensure that as little noise as possible went into the deconvolution operator design.

3) Deconvolution:-

   Stack panels were created for different minimum phase deconvolution types; predictive with gaps of 16, 24, 32, 40, and 48 msec, and spiking with 5% white noise. Operator length of 124 msec and design window of 400 - 1600 msec for near offset, and 1200 - 2400 msec for far offset remained constant throughout.

4) Muting:-

   Initial and surgical muting were tested. Tests took the form of variable offset stacks.

   Initial muting proved to be critical and parameter changes were required frequently through the prospect. As a result initial mute tests were run at least once (and often several times depending on the length and character of the line) on every line.

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5) Post Stack Band Pass Filtering:-

Band pass stack panels were produced to determine the band pass filter.

## WEATHERING STATICS

Weathering statics were derived from the production weight drop refraction breaks.

Refraction breaks were picked by hand from the production records (every shot) and statics derived using the Gardner/Layat method. Breaks were picked in both the forward and reverse directions and intercept times converted to one way statics. (See Appendix C).

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# PROCESSING SEQUENCE

1) Demultiplex -

Conversion of field data to PHOENIX I format. Data resample from 2 msec to 4 msec.

2) Line Geometry Creation

3) True Amplitude Recovery -

Using the formula -

$K t^{n} e^{at}$ where "t" = time, "K" and "n" were set to 1.0 and "a" = 0.2.

4) Trace Equalization -

800 msec AGC scaling.

5) Band-Pass Filtering -

12 - 65 Hz filter applied prior to deconvolution to remove noise.

6) Deconvolution -

Predictive deconvolution with a 124 msec operator length, 32 msec gap, 1% white noise, and a design window of 400 to 1600 msec for the near offset, 1200 to 2400 msec for the far offset.

7) Datum Statics (1) -

Application of the floating datum correction as calculated from the average elevation corrections within each CDP.

8) Weathering Statics -

Application of weathering corrections derived from first breaks.

9) Normal Moveout Corrections -

Locations for constant velocity stack velocity analyses were determined from the brute stack.

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10) Initial Muting -

Parameters vary line to line.

11) Datum Statics (2) -

Datum level for the Waterhouse and Ooramina areas was 550 m while datum for Mereenie and Palm Valley areas was 800 m.

Correction velocity for all lines was 3800 m/sec.

12) Auto-Statics -

Surface consistent statics were obtained using a design gate of approximately 300 - 1500 msec and a max allowable static of 20 msec.

The residual statics trim was calculated on a 7 trace pilot (sometimes changed slightly depending on data), with a design window of approximately 100 - 2000 msec. The maximum allowable variance in the acceptance of traces for the pilot was +/- 10 msec. The maximum allowable shift on traces within the CDP gather was set at +/- 20 msec. Traces whose calculated residual static correction was picked to be larger than this value were reduced in amplitude to 30% of their overall gain.

13) Stack -

12 fold

14) Post-Stack Band-Pass Filter -

The filters applied to the data were as follows:

| | | |
|---|---|---|
| Mereenie: | 10/14 - 40/45 Hz | |
| Palm Valley: | 10/12 - 43/48 Hz | 0 - 2200 msec |
| | 10/12 - 38/43 Hz | 2200 - 4000 msec |
| Waterhouse: | 10/14 - 40/45 Hz | |
| Doramina: | 10/12 - 38/42 Hz | |

15) Scaling - 500 msec gate constant windows were used.

16) Migration -

Finite difference wave equation migration.

## FINAL DISPLAY

The final display on film was made with a bias of 0% and with normal polarity ( a negative value on tape is displayed as a trough ).

The display scale for the final and migrated stacks was 3.98 tr/cm (1:27860) and 10 cm/sec.

A line graph plot of the one way static at each location was displayed above the section. This is the combined elevation and weathering static for each surface location.

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# CONCLUSION

Marked improvement in data quality was achieved over previous processing results. Factors leading to this improvement in order of importance were:-

1) Weathering Statics

In the original 1973 processing, static corrections were based on elevations only, whereas in reprocessing the data, picking first breaks enabled full weathering and elevation corrections to be applied. Weathering thickness was found to vary considerably throughout the prospect area and on most lines stacking response was improved greatly with the application of correct statics.

2) Mutes

Mute tests were run on all lines. Optimal muting was an important factor in data quality.

3) Velocities

Velocity analyses were run close together resulting in strong velocity control.

# APPENDIX A

## PURCHASE TAPES

Composited tapes of all raw stacks (post auto-statics) were made for client purchase in SEGY format, 1600 B.P.I.

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

CPT No. 156 contains raw stacks for lines - 73-1-E, GA1, GA2/GA2X, GE, M1, JC, 7.5, F, 4.5, 4.5X, 4.7, 6.5.

CPT No. 184 contains raw stacks for lines - 73-3-1.5, 1.6, 1.7, 2.2, 2.3, 3.2, 3.3S, 3.3N, 3.4, 3.6, AEX.

CPT No. 183 contains raw stacks for lines - 73-1-GA3, GA3X, GA4 73-3-PV1, PV2, PV3, PV4.

CPT No. 185 contains raw stacks for lines - 73-4-1.1, 1.5, 1.6, 1.7, 1.8, 1.9, 1.9X, 2.1, 2.2, 2.3, 2.3X, 2.4.

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# APPENDIX B

## LINE INFORMATION

| LINE | S.P. RANGE |
|---|---|
| **MEREENIE** | |
| 73-1-E | 100 - 161 |
| 73-1-GA1 | 100 - 367 |
| 73-1-GA2/GA2 EXT | 67 - 206 |
| 73-1-GE | 100 - 313 |
| 73-1-M1 | 100 - 341 |
| 73-1-JC | 101 - 261 |
| 73-1-7.5 | 100 - 200 |
| 73-1-F | 100 - 401 |
| 73-1-4.5 | 100 - 325 |
| 73-1-4.5 EXT | 100 - 140 |
| 73-1-4.7 | 100 - 194 |
| 73-1-6.5 | 100 - 444 |
| 73-1-GA3 | 100 - 202 |
| 73-1-GA3 EXT | 100 - 211 |
| 73-1-GA4 | 100 - 142 |
| **PALM VALLEY** | |
| 73-3-PV1 | 100 - 176 |
| 73-3-PV2 | 100 - 195 |
| 73-3-PV3 | 100 - 254 |
| 73-3-PV4 | 100 - 240 |
| **WATERHOUSE** | |
| 73-3-1.5 | 100 - 195 |
| 73-3-1.6 | 100 - 162 |
| 73-3-1.7 | 140 - 200 |
| 73-3-2.2 | 93 - 221 |
| 73-3-2.3 | 105 - 265 |
| 73-3-3.2 | 100 - 185 |
| 73-3-3.3S | 90 - 249 |
| 73-3-3.3N | 250 - 342 |
| 73-3-3.4 | 100 - 208 |
| 73-3-3.6 | 100 - 240 |
| 73-3-AEX (E) | 100 - 347 |
| 73-3-AEX (W) | 354 - 500 |

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| LINE | S.P. RANGE |
|---|---|
| OORAMINA | |
| 73-4-1.1 | 100 - 399 |
| 73-4-1.5 | 100 - 268 |
| 73-4.1.6 | 100 - 257 |
| 73-4-1.7 | 100 - 283 |
| 73-4-1.8 | 100 - 216 |
| 73-4-1.9 | 100 - 175 |
| 73-4-1.9 EXT | 100 - 208 |
| 73-4-2.1 | 100 - 235 |
| 73-4-2.2 | 100 - 149 |
| 73-4-2.3 | 100 - 171 |
| 73-4-2.3 EXT | 100 - 133 |
| 73-4-2.4 | 100 - 145 |

# APPENDIX C

The weathering statics method used by Hosking Geophysical has its development in the procedures established by Gardner and Layat. Trace by trace shot and receiver corrections are derived by establishing a continuous intercept curve from refraction breaks picked from the acquired data.

Intercept time is essentially the difference between the actual travel time of the refracted wave and the time if the wave had travelled a straight line between shot and receiver at the sub-weathering velocity, or

$$I = T - X/V_m.$$

With the redundancy in multi-fold coverage, intercept curves are developed which are the accumulated differences of the variations in time between traces encountering the velocity marker at the base of the weathering and the constant value of the trace interval divided by the marker velocity, as described in the above equation. These curves are derived for both the forward and reverse profiles and averaged to eliminate possible errors in the estimation of the marker velocity.

Intercept times are reduced to one way statics by the equation

$$S = KI, \text{ where } K = 1/2 \cos \theta \; (V_w/V_c - 1),$$

resulting in a profile which gives a static at every surface position.

Details on the theoretical background for the method may be found in the paper "Modified Gardner Delay Time and Constant Distance Correlation Interpretation" by C. Layat, printed in the S.E.G. publication "Seismic Refraction Prospecting".