DATA PROCESSING REPORT

PANGAEA RESOURCES PTY. LTD.

2015 AVAGO 2D SEISMIC SURVEY NORTHERN TERRITORY, AUSTRALIA

Date Processed: *August 2015 – October 2015*
Date Compiled: *23 October, 2015*
Report Number: *VP15-801*
Compiled By: *Mario Vecchi*

Velseis Processing Pty Ltd
ABN 30 058 427 204

Velseis

Integrated Seismic Technologies

Disclaimer

This report has been prepared in good faith and with all due care and diligence. It is based on the seismic and other geophysical data presented and referred to, in combination with the author's experience with the seismic technique, and as tempered by the geological and stratigraphic evidence presented in various forms and through discussions with client representatives.

As such, the report represents a collation of opinions, conclusions and recommendations, the majority of which remain untested at the time of preparation. In the light of these facts it must be clearly understood that Velseis Processing Pty. Ltd., its proprietors and employees cannot take responsibility for any consequences arising from this report.

TABLE OF CONTENTS

INTRODUCTION

Velseis Processing processed 386.11km of seismic data for Pangaea Resources Pty. Ltd. from their Avago 2D Seismic Survey in the Northern Territory, Australia between August and October 2015. The data were processed through a standard Pre-stack Time Migration processing sequence.

Line Summary

Line	First Receiver	Last Receiver	GI (m)	Line length (km)
PB15-01	1000	3650	10	26.500
PB15-02	1000	6853	10	58.53
PB15-03	1000	4481	10	34.810
PB15-04	1000	6065	10	50.650
PB15-05	1000	2466	10	14.660
PB15-06	1000	2552	10	15.520
PB15-07	1000	2423	10	14.230
PB15-08	993	8738	10	77.450
PB15-09	1000	5747	10	47.470
PB15-10	1000	5629	10	46.290

Acquisition Parameters

Sample Rate	2ms
Record Length	4000ms
No. of Channels	500
Source Array	Vibroseis, 4-90Hz 8s sweep
Spread	5495m-5m-x-5m-5495m
Group Spacing	10m
V.P. Spacing	10m

TESTING

True Amplitude Recovery

Time raised to power correction, spherical divergence and dB/sec corrections were tested. A time-power correction of 2 was chosen.

Deconvolution

Differing deconvolution gaps and operators were tested, as were various design window options. Using an operator length of 160ms trace by trace spiking deconvolution was compared to a surface consistent spiking deconvolution. On the basis of these tests, a 2 window surface consistent spiking deconvolution using 160ms operator lengths was determined to give a better result than others tested.

Coherent Noise Rejection

After testing it was decided not to apply a velocity filter in the FX domain, after surface consistent deconvolution as was done in the 2013 processing.

PROCESSING PARAMETERS

Reformat

Input is reformatted to ProMAX internal data format.

Trace Edit

Remove bad or noisy traces from shot records interactively.

Geometry

Assign geometry information to trace headers. Information assigned to each trace includes source, receiver and CDP locations along with offsets, elevations, and CDP fold.

Gain

A time/power constant of 2.0 was applied to the data.

Static Computation

Statics calculated with a single layer refraction method.

For this refraction method, first breaks were picked on a refractor corresponding to the base of weathering.

Replacement Velocity	Final Datum
5000 m/s	300 m

Phase Conversion

The data were converted from zero to minimum phase.

Deconvolution

Whitening of the spectrum to enhance signal resolution was achieved using a 2 window Surface Consistent Spiking Deconvolution with 160ms operators which was picked from test stacks.

Velocity Analysis (1st Pass)

Velocities were picked using the ProMAX interactive velocity picking package (IVA). IVA uses velocity spectra, moved out gathers and stacked panels to assist in a careful interpretation of stacking velocities. As the velocity function is altered, revised gathers and stacks are produced until optimised stacking velocities are achieved.

Velocities were picked at locations 1000m apart. The regional velocity was used as the guide function and 11 velocity panels covering 85% to 115% of the guide velocities for every location. Each panel consisted of 11 trace CDP stacked sections using the 11 differing velocities.

Residual Statics Calculation and Application

Surface consistent residual statics were calculated and applied using Maximum Power Autostatics.

Pilot or reference traces were formed for a 1500ms time gate following structure by flattening all traces along the autostatics horizon over 11 CDP's.

These traces are summed to form a single pilot trace. Each trace from the active CDP is time shifted relative to the pilot trace and summed with it. The power of the stack is measured for each time shift. This shift-power trace is then summed with other traces having the same shot and receiver in their respective domains.

After the shift spectra has been calculated for the entire line and summed in the Receiver/Shot domains, time shifts are picked at the maximum of the power shift spectra and stored as Static Values.

The pilot stack is updated and the process repeated for a number of iterations.

In this case, calculations were conducted for at least 8 iterations or until the RMS of the change in the computed statics was less than .05.

Velocity Analysis (2nd Pass)

Velocities were picked using the ProMAX interactive velocity picking package (IVA). IVA uses velocity spectra, moved out gathers and stacked panels to assist in a careful interpretation of stacking velocities. As the velocity function is altered, revised gathers and stacks are produced until optimised stacking velocities are achieved.

Velocities were picked at locations 500m apart. The first pass velocity was used as the guide function and 11 velocity panels covering 90% to 110% of the guide velocities for every location. Each panel consisted of 11 trace CDP stacked sections using the 11 differing velocities.

Residual Statics Calculation and Application

Surface consistent residual statics were calculated and applied using Maximum Power Autostatics.

Pilot or reference traces were formed for a 2000ms time gate following structure by flattening all traces along the autostatics horizon over 11 CDP's.

These traces are summed to form a single pilot trace. Each trace from the active CDP is time shifted relative to the pilot trace and summed with it. The power of the stack is measured for each time shift. This shift-power trace is then summed with other traces having the same shot and receiver in their respective domains.

After the shift spectra has been calculated for the entire line and summed in the Receiver/Shot domains, time shifts are picked at the maximum of the power shift spectra and stored as Static Values.

The pilot stack is updated and the process repeated for a number of iterations.

In this case, calculations were conducted for at least 8 iterations or until the RMS of the change in the computed statics was less than .05.

Surface Consistent Scaling

Traces were scaled in a surface consistent manner in order to maintain any amplitude responses within the data.

Trim Statics Calculation and Application

CDP consistent residual statics were calculated and applied.

Pilot or reference traces were formed for a 2000ms time gate following structure by flattening all traces along the autostatics horizon over 11 CDP's.

Kirchhoff Prestack 3D Time Migration

A Kirchhoff Prestack 3D Time Migration was used to move data to their correct subsurface locations. Stacking velocities were smoothed for PSTM.

Velocity Analysis (3rd Pass)

Velocities were picked using the ProMAX interactive velocity picking package (IVA). IVA uses velocity spectra, moved out gathers and stacked panels to assist in a careful interpretation of stacking velocities. As the velocity function is altered, revised gathers and stacks are produced until optimised stacking velocities are achieved.

Velocities were picked at locations 500m apart. The second pass velocity was used as the guide function and 11 velocity panels covering 90% to 110% of the guide velocities for every location. Each panel consisted of 11 trace CDP stacked sections using the 11 differing velocities.

Normal Moveout Correction

An NMO correction was applied to the data using the DMO velocity.
Dynamic corrections are applied to the data using the following formula.

$$TX^2 = T0^2 + X^2/V^2$$

TX = time at offset X
T0 = time at zero offset
X = offset of the trace
V = velocity at time T

Stack

Add traces within a common midpoint gather. The post stack trace was scaled by the square root of the sum of fold for each sample in the trace.

Static Shift

The data were shifted to final datum.

FX Deconvolution

The signal to noise ratio of the stacked sections was improved using FX Deconvolution filtering .

Bandpass Filter

A time-variant bandpass filter was applied to the data.

Scaling

A time-variant scaling was applied to the final data.