Annexure A

EP 134 – Petro-Venture's Report on Processing Techniques Employed

REPORT ON PROCESSING TECHNIQUES EMPLOYED

TRI-STAR ENERGY COMPANY
2009 MINI-SOSIE DATA

FINKE AREA, PEDIRKA BASIN
NORTHERN TERRITORY
AUSTRALIA

June 2009

Introduction

New processing approaches have been undertaken to better evaluate coal potential in the Finke area, Pedirka Basin, Northern Territory of Australia. A series of 14 short Mini-Sosie seismic lines were acquired by Velseis Pty, Ltd. to the west of existing seismic and well information in an attempt to add critical additional information to a regional picture of coal measures encountered in wells such as the Mt. Hammersley, Dalmatia and Etingimbra. While coal measures are fairly deep in these wells, the coal measures rise to the WNW. The Mini-Sosie lines provide additional information in areas where the coal measures may exist at very shallow levels below the surface.

Since the coal seams are thin, on the order of 3 to 6 meters, obtaining maximum seismic resolution is very important. Initial processing results were a bit disappointing, showing maximum frequency content of less than 125 Hz. However, the new processing described in this report shows significant improvement with maximum frequencies greater than 250 Hz.

Seismic Acquisition Parameters

The general parameters used to acquire the 14 short lines of data are as follows:

- Sample interval: 1 ms
- Trace length: 1.000 sec.
- Source: 65 kg whacker/rammer
- Ram segment: 5 m
- Rams per segment: 300-600 (varied with surface conditions)
- Low cut filter: 40 Hz, 12 dB/oct
- High cut filter: 375 Hz, 72 dB/oct
- Geophone: 30 Hz
- Geophone array: 3 elements in line over 4 m, (2 m spacing)
- Shot spacing: 5 m (Except 10 m for lines 1 and 6)
- Receiver spacing: 5m (Except 10 m for lines 1 and 6)
- Number of channels: 120
- Nominal CDP fold: 60
- Nominal far offset: 297.5 m (Except 595 m for lines 1 and 6)
- Live array: split spread with full-fold roll-on/roll-off

  Note that a full-fold roll-on/roll-off was used, so the actual CDP fold and actual far offset were in places much higher than nominal (especially in the shorter lines in which the roll-on/roll-off makes up most of the line).

The seismic crew used a 65 kg Wacker Rammer as an energy source for the seismic acquisition. (See Figure 1 below.) Each S.P. consisted of 300-400 impacts from the energy source which were summed for each shotpoint.

Figure 1 – Wacker Energy Source

This energy source produced as much as 0.600-1.000 seconds of penetration in the area of interest.

High resolution recording was achieved using geophones with a natural frequency of 30 Hz. A typical response curve for a 30 Hz geophone is shown in Figure 2 below.

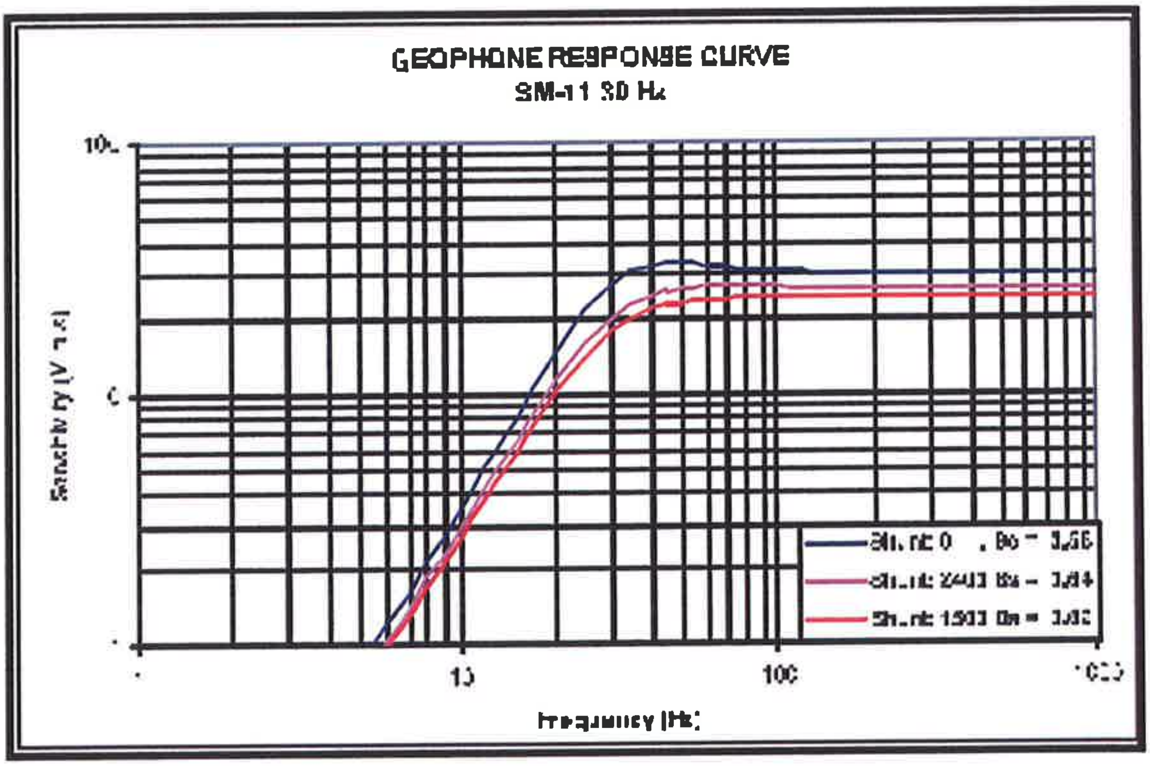

Figure 2 – Typical response curves for a typical 30 Hz geophone.

Initial Processing Parameters - Preliminary Processing Results

Initially, a standard processing approach, as shown below, was tried. Listed below are the processing parameters initially tried in processing a few of the 14 lines:

- Trace edit
- Spherical divergence correction (1/(t*v^2) spreading formula, and -9dB/s exponential correction)
- Refraction statics (300 m final datum elevation, 3000 m/s replacement velocity)
- Surface consistent spiking deconvolution, 80 ms operator, 0.01% white noise)
- Spectral whitening, 200 ms operator, 8 freq panels, 10-20-220-240 Hz corner freqs
- 1st pass velocity picking at 125 m intervals
- 1st pass residual statics calc and apply
- 2nd pass velocity picking at 62.5 m intervals
- 2nd pass residual statics calc and apply
- NMO, 30% stretch mute
- AGC, 200 ms operator
- CDP trim statics calc and apply, 8 ms max shift
- CDP stack
- For migration output: Steep dip explicit FD time migration, 90% velocity scale, 70 degree max dip
- For final output: 3 point trace mix
- Bandpass filter, 30-40-110-130 Hz corner freqs

Unfortunately, it soon became apparent from the initial results on this line as well as others that the field data were very noisy and required a more intensive effort to yield maximum information.

Figure 3 below shows an example of the initial results for line TR-06.

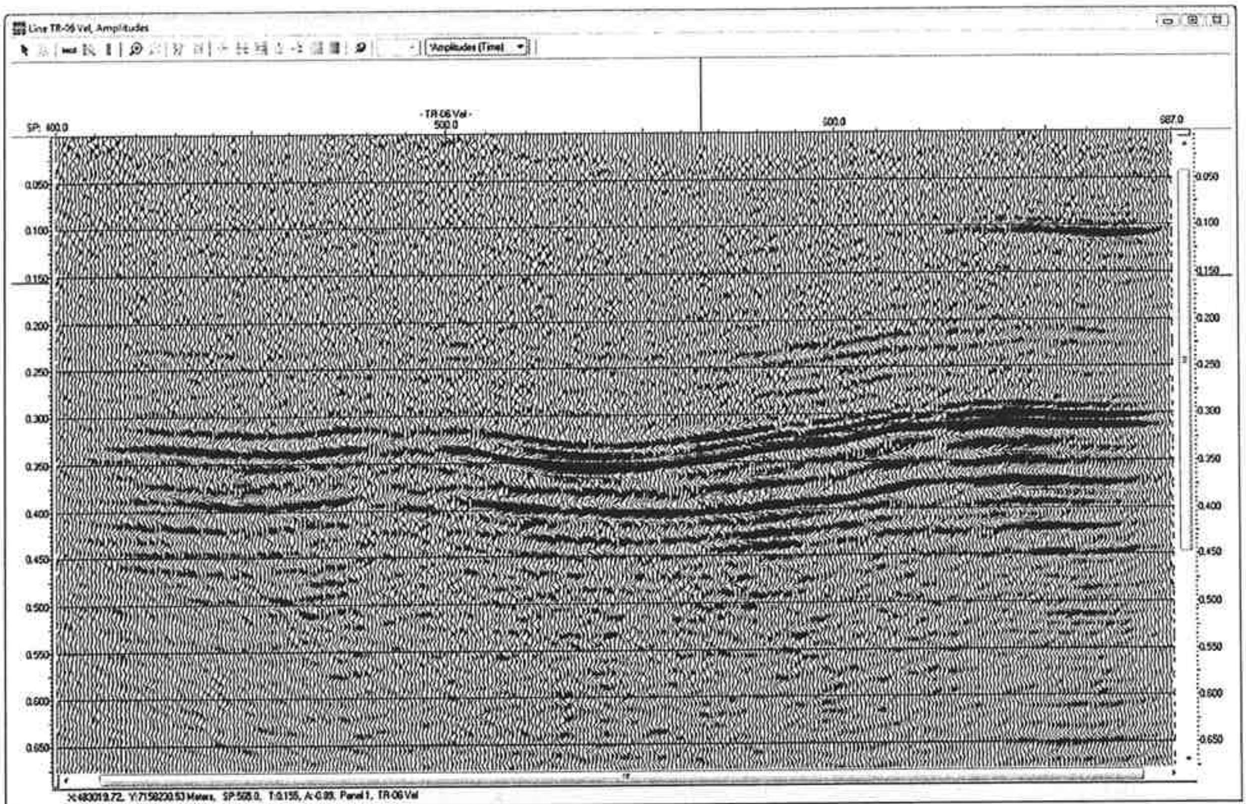

Figure 3 – Line TR-06 Original processing sequence. Very poor quality data above 0.300 seconds and below 0.450 seconds.

New Processing Approach

As one can easily see from Figure 3, there is not much chance of gaining high resolution information from this level of data quality. So, a new approach was taken using a proprietary denoising approach by GeoEnergy, Inc. as well as very careful attention to solving both statics and velocities. The processing sequence for producing a post stack migration is listed below.

- Geometry application
- Gain application
- Refraction statics calculation and application
- Surface consistent spiking deconvolution
- Initial velocity analysis (400 meters apart)
- Apply normal moveout
- Surface consistent residual statics (first pass)
- Velocity analysis (200 meters apart)
- Surface consistent residual statics (second pass)
- Velocity analysis (200 meters apart)
- Final normal moveout and mute applied
- Trim statics
- Denoise application
- Stack

- Migration
- Moved to flat datum of +300 meters
- Output to SEGY formatted file

It should be noted that trace mixing was not part of the Geoenergy processing sequence while the original processing attempts used a 3-trace mix for noise reduction. The result from this new approach is shown in Figure 4 below.

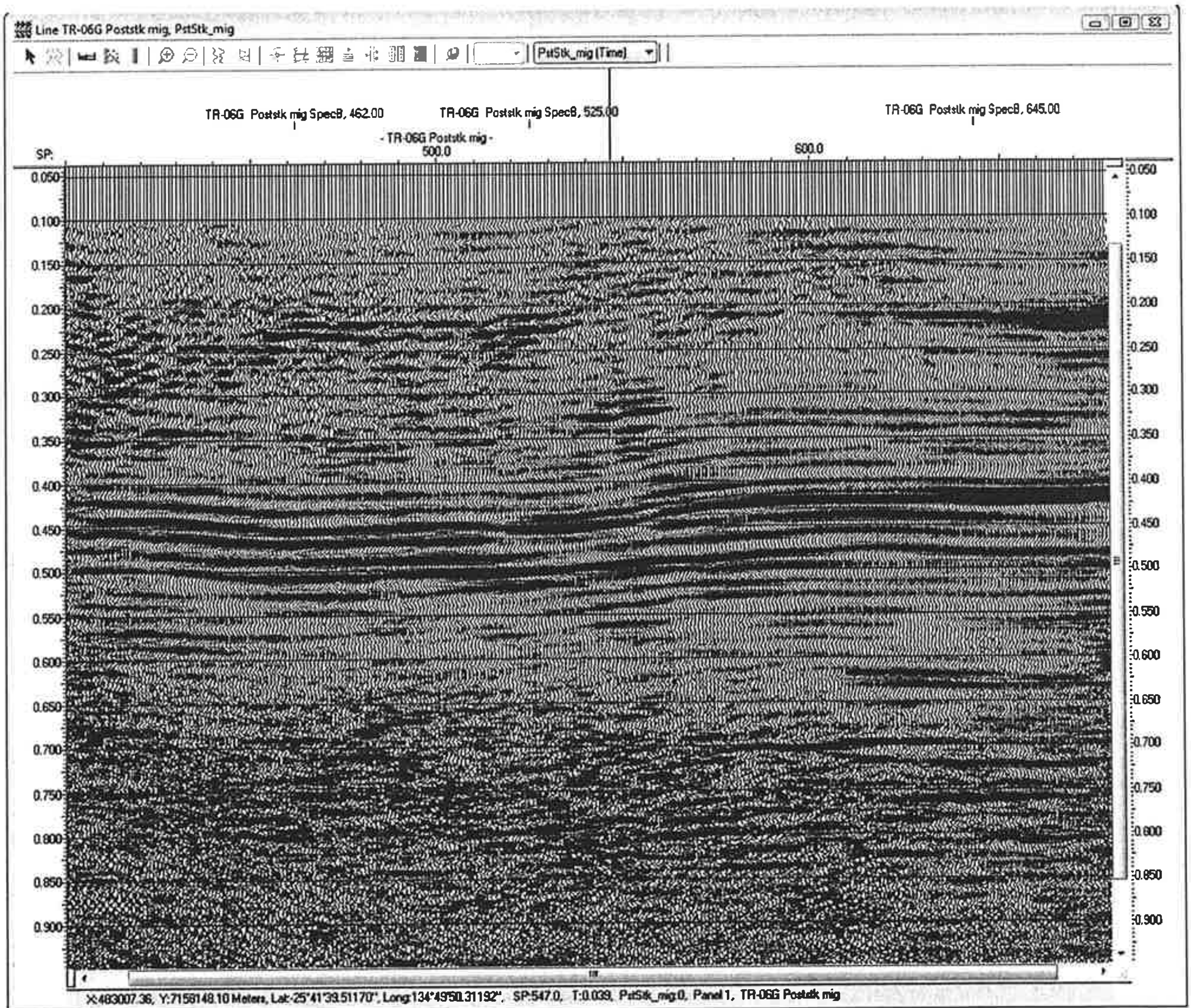

Figure 4 – TR-06 post stack migration using denoising processing and careful statics and velocity determinations.

The information from Geoenergy's website on nDenoise is as follows:

nDenoise™ - Intelligent Noise Attenuation

nDenoise™ preserves your data while adaptively removing noise, leaving the clear signal you need for interpretation and further processing.

Working from pre-stack, post-stack and even 4D data, nDenoise™ can effectively attenuate a wide variety of noises, including:

- Multiples
- Swell noise, ground roll, shot-generated noise
- Migration and other processing artifacts

Technology

nDenoise™ is based on an iterative Wavelet-Packet Best Basis coherent noise attenuation method. This unique patented GeoEnergy tool goes far beyond traditional or wavelet transform methods to provide the industry's best separation of noise and data.

Spectral Broadening

It is clear that there is far better reflection information shown in Figure 4 than in Figure 3. The resulting improvements in data quality allowed processing to be taken one step further with the application of spectral broadening. Figure 5 shows the result of the application of spectral broadening.

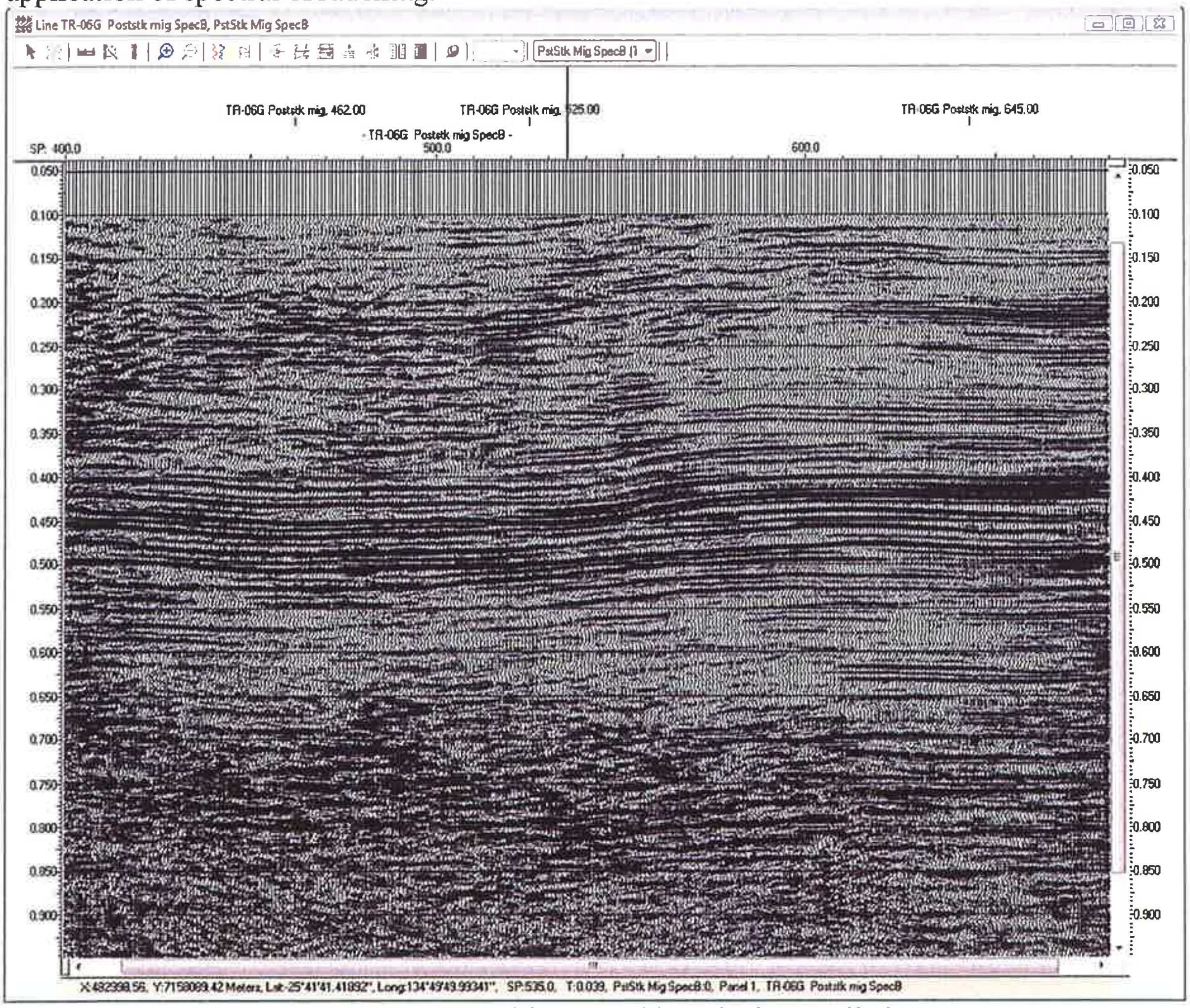

Figure 5 – TR-06 post stack migration with spectral broadening applied.

The information from Geoenergy's website on spectral broadening is as follows:

> **SpecB™ - Robust Frequency Enhancement**
>
> SpecB™ sophisticated algorithms broaden the spectrum of your seismic data while leaving amplitudes intact, giving you a clear advantage in interpretation.
>
> SpecB™ can:
>
> - Reveal small-scale faults
> - Provide high-resolution data consistent with well log synthetics
> - Improve resolution of acoustic impedance inversion
>
> **Technology**
>
> The spectrum broadening technology utilizes the information of the low to medium frequencies, and employs it to estimate the amplitude of the high frequencies. The method is effective up to the Nyquist frequency in 2D and 3D, and does not use well-log information. The SpecB™ technology does generate only geologically meaningful results tied to well synthetics.

It is obvious that there is far higher resolution available for coal seam discrimination shown in Figure 5. Overall, there was a very significant improvement in resolution as shown in the next two figures below. Figure 6 shows the power spectra of the data as processed using the initial standard sequence. Figure 7 shows the much improved frequency response achieved by the combination of denoising, careful static and velocity work followed by spectral broadening.

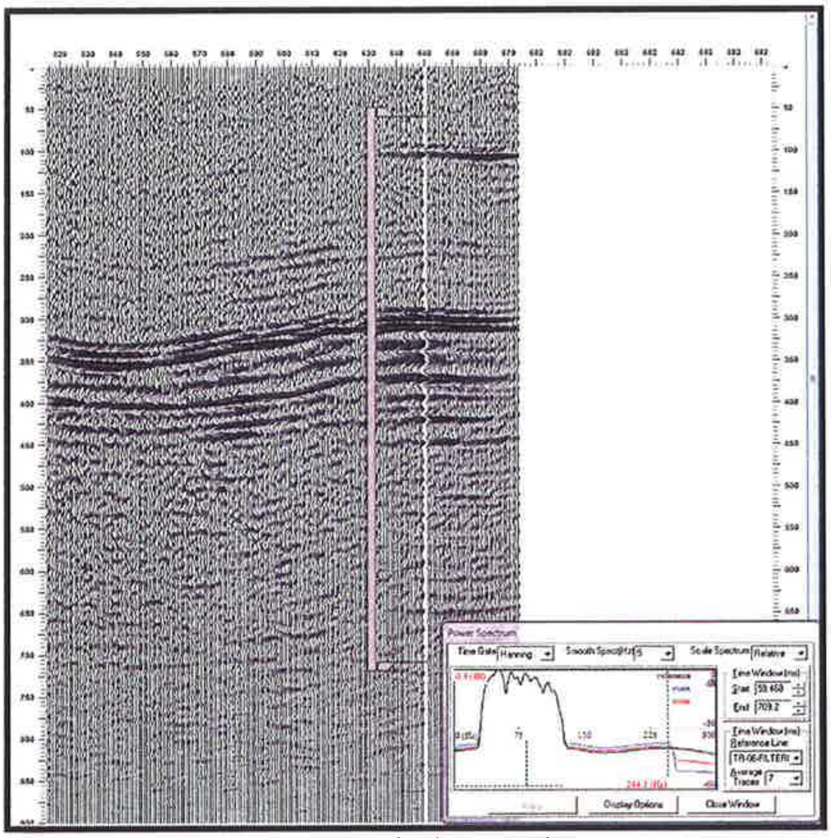

Figure 6 – Power spectra: Original processing

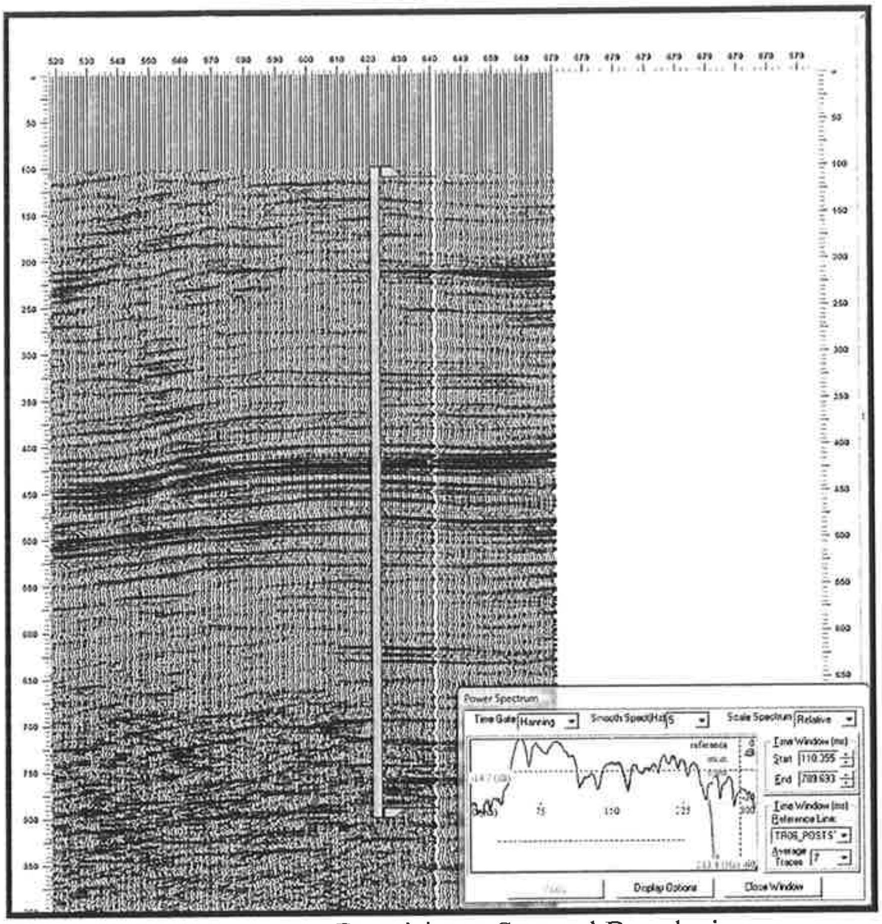

Figure 7 – Power spectra: Denoising + Spectral Broadening

Conclusions

It is clear from the information presented here that much better seismic information has been obtained using the combination of careful processing (careful static and velocity determinations), application of Geoenergy's denoising algorithm and the application of spectral broadening. Not only are there more coherent and continuous reflections, but there is also better resolution in the form of higher frequency data, particularly in the zone of interest – the coal intervals.

Final products from the current processing include the following:

- Post stack migration
- Post stack migration with spectral broadening (SpectB) applied
- Prestack time migration – PSTM
- Stack
- Corrected gathers