13GA–EG1 Eucla-Gawler Seismic Survey – Acquisition and Processing

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The 834 km Eucla-Gawler 2D land vibroseis reflection seismic survey was acquired from Haig WA, November 2013, and continued east along a track parallel to the Trans Australian Railway ending at Tarcoola, SA, February 2014.

The deep crustal seismic survey was proposed to image the crustal architecture underlying the Eucla Basin and its relationship to the Gawler Craton to the east. The data may also indicate large structural zones that may have provided fluid pathways for mineralisation.

The seismic data were collected using 3 or 4 vibroseis 30 tonne trucks, shaking for 12 seconds 3 times for each vibe point, i.e. 4 trucks x 3 sweeps x 30 tonnes = 360 tonnes vibrating on the surface, to generate enough energy to image crustal structures down to the Moho through a 12 km spread of geophones.

The seismic reflection processing was complicated and continually tested and adjusted due to constant variations in the geology along the line. Variations in surface elevation, weathering layer depth and weathering layer velocity can degrade the final seismic image and these effects were removed using near surface refractor models, which also show the basin and weathering layers depth to bedrock and velocity variation along the seismic line.

For the western part of the seismic line, the average refractor velocity for the base of the Eucla Basin is 5870 m/s, typical of basement. Near the WA and SA border the bedrock refractor layer drops deeper and another basin layer begins with an average refactor velocity of 4700 m/s, indicating a very fast sedimentary sequence beneath the Eucla Basin. In the Gawler section of the seismic line, the base of the surface weathering layer has an average refractor velocity of 5800 m/s, similar to the west.

Normal moveout (NMO) correction was applied with stacking velocities which best image the reflections. The stacking velocities clearly show the extent and variation in velocity and depth of the near surface weathering and variations in the bedrock velocities down to about 20 km depth.

Dip moveout (DMO) correction has the effect of correcting the NMO to account for different dips occurring along the line, enhancing dipping structures. Many dipping structures and faults are imaged throughout the whole line, at all depths up to the base of weathering. Migration was applied to move the dipping structures to their correct location on the final images. Faults can be easily identified on the pre-migration stacks as large diffractions.

In some regions, the data appeared to have low amplitude and incoherent reflectivity and this has some correlation with thick weathering or sedimentary layering at the surface. In other areas multiples of reflections were seen due to energy reverberating between the hard limestone in the near surface and the hard basement.

This seismic data provides new insights into unknown geology in this area. Weathering, basins, crustal architecture and the Moho are imaged.