Analysis of Deep Crustal Structures using Potential Field Data along Deep Seismic Sounding Lines

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Energy spectral analysis techniques have been applied to potential field data acquired over cratonic areas in the vicinity of the Olympic Dam Mine, Southern Australia. Two Deep Seismic Sounding lines had been acquired by the Australian Government over Olympic Dam and analysis of the potential field data at 4km intervals along the lines, was conducted. In addition, four profiles parallel to the Deep Seismic Sounding lines but offset by 8km, were also analysed to build a 3D model of the deep crust. There is a good correlation between horizons or interfaces found in this analysis and structures interpreted from the seismic data.

Interpretation of gravity data using energy spectral analysis along the Deep Seismic Sounding lines show a number of deep crustal structures are resolvable, including the Moho, while the analysis of the magnetic data allows the depth of the Curie isotherm to be inferred. In addition, many mid-crustal horizons and structures can be detected from the gravity and magnetic data suggesting that the horizons detected on the deep seismic sounding lines can be mapped at considerable distances from the Deep Seismic Sounding lines.

The results obtained from energy spectral analysis over these areas suggest that a much wider application of this approach could be highly valuable to investigate the deep structure under sedimentary basins, mineral provinces and to assist heat flow studies. This may be of considerable importance offshore where deep seismic sounding is expensive.