WA Branch

Interpretation Of High Resolution Gravity And Magnetic Surveys For Oil And Gas Exploration

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Gravity and magnetics have undergone a renaissance over the last few years in their use for oil exploration. This has principally occurred through acquisition of data at much closer spacings than before. Higher density of data provides increased resolution of gravity and magnetic fields and enables new processing techniques to be applied, just as in the switch from "2D" to "3D" mode in seismic. The result is a spectacular improvement in spatial resolution and sensitivity to low amplitude field variations. Basement and volcanic related anomalies that have been the traditional objects of investigation by gravity and magnetic methods are now far better imaged. The novel resolution of field variations, arising form subtle physical property contrasts within the sedimentary section itself, is also significant. Images of gravity and magnetic field variations and their transforms (including 'pseudo-depth slices') are not an end in themselves but are a starting point for interpretation. Interpretation including modelling is the only means to reliably extract geological information and test structural hypotheses using gravity and magnetic field measurements. Interpretation of subtle variations arising from within the sedimentary section are particularly challenging. These require full integration with seismic controls, attention to detail in suppressing any artefacts in the data, and quantitative modelling to investigate the implied physical property contrasts of conceptual models. Close integration with seismic also ensures that such studies focus on uncertainties and ambiguities left unresolved by the seismic.

An example of a high resolution gravity study will be presented from the North Sea. This study shows what can be achieved from measurement of gravity on a marine 3D seismic survey. The tectonics of the study area are very similar to those that can be found across much of the North-west Shelf - suggesting that similar studies could be applied with advantages in this area. A second example will be shown of a high resolution aeromagnetic survey flown in South-east Asia to complement a seismic study for fault mapping at a prospect scale. The results of high resolution aeromagnetic surveys are difficult to predict, but again there are similarities between this case study and the aeromagnetic expression of faults cutting the sedimentary section in several offshore Australian basins, including those on the North-west Shelf.

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