PSDM and Gravity / Gravity Gradiometry Integration: An integrated approach

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This paper demonstrates an integrated geophysical approach to imaging salt structures onshore and offshore Brazil and Gabon. Density and susceptibly information from gravity, Gravity Gradient Imaging (GGI) and Magnetic Gradiometry acquired over salt structures are integrated within a Seismic Velocity Modelling workflow. Combining a joint inversion modelling approach in this manner allows us to resolve the top and more importantly the base salt surfaces to a high degree of confidence. The paper will focus explicitly on the benefits that a Full Tensor Gravity system can give to a regional and a more detailed prospect level imaging project.

Gravity Gradiometry imaging (GGI) is a powerful geophysical technique that provides a superior measurement of the earth's gravitational field compared to that obtained with conventional gravity surveys. While a conventional gravity survey records a single component of the three-component gravitational force, usually in the vertical plane, Full Tensor GGI measures the derivative of all three components in all three directions. Being a differential measurement, Full Tensor GGI is inherently more sensitive to the distance of a mass anomaly, which has in the past led workers incorrectly to believe that it is only of use when resolving shallow structures. Indeed, GGI has been used successfully to resolve targets at depths in excess of 7km.

Integrated interpretation of seismic and potential field data takes place in three stages; (1) The preliminary interpretation of time domain data is required prior to starting a depth migration campaign, (2) the depth- velocity-density model development for depth migration follows before (3) the detailed interpretation of the target under inspection is generated.

In the initial phase of interpretation the major focus is on discretising the velocity field into units significant to the imaging effort. We take the opportunity to interpret with potential field information integrated, using a simple depth conversion to transform the time domain model into the depth domain. The outcome of this phase of work is a depth-rock property model incorporating velocity, density and where appropriate magnetic susceptibility. ***Implausible relationships between rock properties indicate a flaw in the model; we present a set of possibilities including mis-picks and the diagnostic incompatibilities that serve to identify them.***

Earth model development continues with the refinement of the velocity field and the rock property relationships to exploit the resolution of the gradiometry observations. The application of new technology to potential field measurement yields models which are sensitive to change at a scale useful to velocity model development for depth migration.