Maximizing the Value of Deep Long-Offset Seismic Reflection Data

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Abstract

The composition and thickness of crustal basement are critical to frontier hydrocarbon exploration in deep-water rifted continental margin settings. We apply a set a quantitative geodynamic analysis techniques based on interpretations of ION BasinSPAN seismic reflection data to investigate the structure and tectonics of deep-water rifted margins. These quantitative analytical techniques consist of:

(i) Gravity inversion, incorporating a lithosphere thermal gravity anomaly correction, to give Moho depth, crustal basement thickness and continental lithosphere thinning.

(ii) RDA (residual depth anomaly) analysis to give departures from oceanic bathymetry.

(iii) Subsidence analysis using 3D flexural backstripping to give lithosphere thinning.

(iv) Joint inversion of deep seismic reflection and gravity data to give lateral variations in basement density and seismic velocity.

The combined interpretation of these independent quantitative measurements are used together to determine OCT structure, COB location and crustal type. Superposition of the 3D Moho surface determined from gravity inversion onto PSDM and PSTM seismic sections provides assistance to, and validation of, deep seismic reflection interpretation. Integrated quantitative analysis maximises the use of the ION deep seismic data. Examples of the application of the quantitative analysis of ION BasinSPAN deep long-offset seismic data are presented for the Black Sea Basin, NW shelf of Australia and offshore Uruguay and northern Argentina. We believe the integrated quantitative analysis of deep long-offset seismic data assists new ventures exploration strategy, helping to discriminate continental and oceanic areas together with crustal type, prior to any proprietary data acquisition. Grids of lithosphere beta factor, the residual radiogenic continental basement thickness and heat flow history produced by quantitative analysis also provide valuable input to petroleum system modeling.