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OCT structure, COB location and magmatic type of the S Angolan & SE Brazilian margins from integrated quantitative analysis of deep seismic reflection and gravity anomaly data

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Integrated quantitative analysis using deep seismic reflection data and gravity inversion have been applied to the S Angolan and SE Brazilian margins to determine OCT structure, COB location and magmatic type. Knowledge of these margin parameters are of critical importance for understanding rifted continental margin formation processes and in evaluating petroleum systems in deep-water frontier oil and gas exploration. The OCT structure, COB location and magmatic type of the S Angolan and SE Brazilian rifted continental margins are much debated; exhumed and serpentinised mantle have been reported at these margins.

Gravity anomaly inversion, incorporating a lithosphere thermal gravity anomaly correction, has been used to determine Moho depth, crustal basement thickness and continental lithosphere thinning. Residual Depth Anomaly (RDA) analysis has been used to investigate OCT bathymetric anomalies with respect to expected oceanic bathymetries and subsidence analysis has been used to determine the distribution of continental lithosphere thinning. These techniques have been validated for profiles Lusigal 12 and ISE-01 on the Iberian margin. In addition a joint inversion technique using deep seismic reflection and gravity anomaly data has been applied to the ION-GXT BS1-575 SE Brazil and ION-GXT CS1-2400 S Angola deep seismic reflection lines. The joint inversion method solves for coincident seismic and gravity Moho in the time domain and calculates the lateral variations in crustal basement densities and velocities along the seismic profiles.

Gravity inversion, RDA and subsidence analysis along the ION-GXT BS1-575 profile, which crosses the Sao Paulo Plateau and Florianopolis Ridge of the SE Brazilian margin, predict the COB to be located SE of the Florianopolis Ridge. Integrated quantitative analysis shows no evidence for exhumed mantle on this margin profile. The joint inversion technique predicts oceanic crustal thicknesses of between 7 and 8 km thickness with normal oceanic basement seismic velocities and densities. Beneath the Sao Paulo Plateau and Florianopolis Ridge, joint inversion predicts crustal basement thicknesses between 10–15km with high values of basement density and seismic velocities under the Sao Paulo Plateau which are interpreted as indicating a significant magmatic component within the crustal basement. The Sao Paulo Plateau and Florianopolis Ridge are separated by a thin region of crustal basement beneath the salt interpreted as a regional transtensional structure. Sediment corrected RDAs and gravity derived "synthetic" RDAs are of a similar magnitude on oceanic crust, implying negligible mantle dynamic topography.

Gravity inversion, RDA and subsidence analysis along the S Angolan ION-GXT CS1-2400 profile suggests that exhumed mantle, corresponding to a magma poor margin, is absent..The thickness of earliest oceanic crust, derived from gravity and deep seismic reflection data, is approximately 7km consistent with the global average oceanic crustal thicknesses. The joint inversion predicts a small difference between oceanic and continental crustal basement density and seismic velocity, with the change in basement density and velocity corresponding to the COB independently determined from RDA and subsidence analysis. The difference between the sediment corrected RDA and that predicted from gravity inversion crustal thickness variation implies that this margin is experiencing approximately 500m of anomalous uplift attributed to mantle dynamic uplift.