Aptian Salt Palaeo-Bathymetry and Subsidence on the Northern Angolan Rifted Margin

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ABSTRACT

The bathymetric datum with respect to global sea level for Aptian salt deposition in the South Atlantic is hotly debated. Reverse post-breakup subsidence modelling has been used to determine the palaeo-bathymetry of base Aptian salt deposition on the Angolan rifted continental margin. This technique consists of the sequential flexural isostatic backstripping of the post-breakup sedimentary sequences, decompaction and reverse modelling of post-breakup lithosphere thermal subsidence constrained by lithosphere β factors from gravity inversion. Reverse post-breakup subsidence modelling restores the proximal autochthonous base salt to between 0.2 and 0.6 km below global sea level at the time of breakup. In contrast, the predicted water-loaded bathymetries of the more distal base salt at breakup time are greater between 2 and 3 km. Gravity inversion to give crustal thickness, RDA and subsidence analysis show that the distal Aptian salt is underlain by hyper-extended continental crust rather than exhumed mantle or oceanic crust. Our preferred interpretation is that Aptian salt was deposited between approximately 0.2km and 0.6km below global sea level, and that the inner proximal salt subsided by post-rift (post-tectonic) thermal subsidence alone, while the outer distal salt formed during syn-tectonic crustal thinning, prior to breakup, resulting in additional tectonic subsidence. Our analysis argues against Aptian salt deposition on the Angolan margin in a 2-3km deep isolated ocean basin, and supports salt deposition on hyper-extended continental crust formed by diachronous rifting which migrated distally, culminating in late Aptian breakup. We use a kinematic forward structural and stratigraphic model of continental lithosphere stretching and thinning leading to continental breakup and rifted margin formation to test the above interpretation. The model is used to predict subsidence and palaeobathymetry history and incorporates the flexural isostatic response to extensional faulting, crustal thinning, lithosphere thermal loads, sedimentation and erosion. The kinematic forward model is constrained by crustal thickness and Moho depth observations determined from gravity inversion.