

Crust Evolution During South Atlantic Rifting - Insights from Conjugate Structural Restoration Models

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Strain evolution during rifting is constrained by properties inherent in the crust and lithospheric mantle. Rates of deformation, thermal gradients and the nature of rheological boundaries determine which mechanism predominates. The South Atlantic margin exhibits a complex poly-phase rift evolution which imparts a characteristic geometry to the distribution of stretched continental crust. Crustal deformation demonstrates an along-strike change from an asymmetric basin to a more symmetric basin. Prior to break-up the Santos Basin and its reconstructed conjugate are significantly wider than the Campos and Lower Congo Basins to the north. The plate margin appears to have experienced the same far-field extension, however the response and resultant degrees of brittle deformation has resulted in basins that are structurally distinct. The predominance of steep planar basement faults in the narrower northern basins is in marked contrast to the low angle nature of the extensional fault styles to the south. In trying to rationalize the apparent strain partitioning that has occurred we have modeled two conjugate regional cross sections which we have back-stripped and structurally restored to the onset of rift-related extension. The representative cross-sections traverse the conjugate basins and record the deformation experienced during rifting. The back-stripped sections reveal that the southern basins require to be modeled using a different set of parameters in order to satisfy syn-rift bathymetry and distribution of syn-rift facies. In order to maintain the paleo-bathymetry of the Sao Paulo Plateau we propose that the lower crust and or lithospheric mantle has undergone modification whilst being extended. To maintain its relative relief, magmatic thickening at the crust mantle boundary is proposed as a mechanism associated with an elevated thermal gradient. The deformation style is consistent with laterally distributed extension associated with a low strain rate and an elevated isotherm. This interpretation is consistent with the observation of the anomalous width of the Santos Basin and the unique distribution of shallow bathymetry associated with both late syn- rift and post-rift facies The Campos Basin and its conjugate are believed to have experienced brittle deformation of a relatively cooler crust with deformation localized.