Breakup Processes in the South Atlantic: An Integrated Approach Based on Geological and Geophysical Interpretation and Tectonic Reconstructions

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The breakup and divergence of the Brazilian and West African continental plates is a direct consequence of opening the South Atlantic Ocean. Several models have been discussed recently for the development of the conjugate margins, including pure shear, simple shear and mantle exhumation mechanisms. Some of these models impact the tectonic and thermal evolution of the sedimentary basins as there are some suggestions of lithospheric stretching and continental rifting extending into the post-salt sequence.

This work integrates geological and geophysical evidence both in the Brazilian and West African continental margins and also analyzes deep seismic reflection profiles in the continent-ocean boundary in the deep water province, which are constrained by palinspastic reconstructions to define the breakup episode and inception of oceanic crust.

The breakup process was heralded by magmatism onshore and offshore. The peak of magmatic activity is associated with the Serra Geral - Etendeka volcanism pre-dating the syn-rift sedimentation. However, massive wedges of seaward-dipping reflectors are interpreted in the conjugate margins, not only in the Pelotas - Namibe basins, but also in the Santos-Campos- Espírito Santo province and in the African conjugate margin. These reflectors are interpreted to mark the continent-ocean transition towards an oceanic crust that was developed probably by Aptian times. Dating of the magnetic anomalies associated with these volcanic wedges provides important insights, suggesting that rifting started in the southernmost basins (Argentina) and advanced northwards by oceanic propagators.

Inferences of Albian rifting processes based on seismic interpretation of fault-controlled syn-rift troughs, isopach mapping of the Albian carbonate sequences, and interpretation of basement-involved salt tectonics during rifting are highly questionable as indicative of lithospheric rifting processes. The geometry of the carbonate platform depocenters are mainly controlled by salt tectonics, and abnormally reduced heat flow in some basins (such as Santos and Kwanza basins) might be explained by other mechanisms. The analysis of palinspastic reconstructions of the South Atlantic opening and breakup are also indicative of oceanic crust inception before the Albian in the southeastern Brazilian margin, but extensional reactivation episodes affecting Aptian and Albian sequences are locally observed in several segments of the conjugate margins.