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Magmatic Activity, Fracture Zones And Their Relationship To The Origin And Evolution Of The South Atlantic: Crustal Architecture And Tectonic Evolution Of Conjugate Sedimentary Basins From Gabon To Namibia

W.U. Mohriak[1], B.R. Rosendahl[2,]
[1]Petroleo Brasileiro S.A – E&P /CORP/EXP/TSP, Rio de Janeiro, Brazil;
[2]University of Miami, RSMAS, Florida, USA

Integration of seismic, potential field, and borehole data from the conjugate margins of West African and Brazil indicate that the rift architecture varied markedly along strike, and that volcanic episodes may substantially impact the tectonic evolution of the deep water provinces extending to oceanic crust. This work discusses various pairs of conjugate sedimentary basins, from Gabon -Rio Muni in the north "conjugated" with the Sergipe-Alagoas and Jacuípe basins, to the frontier regions south of the Walvis Ridge, including the Rio Grande Rise where volcanic features are worldwide paradigms for the interpretation of seaward-dipping wedges.

The main topics to be discussed include the geological and geophysical signatures of deep structures associated with the formation of tectonically induced accommodation space in the development of continental rifts and proto-oceanic volcanic wedges. Three main episodes of magmatic activity are observed in the South Atlantic. They begin with the Late Jurassic/Early Cretaceous event related to the Paraná - Etendeka flood basalts, and the volcanic rocks that occur in the offshore basins, followed by wedges of volcanic rocks interpreted as seaward-dipping reflectors, culminating in the Late Cretaceous - Early Tertiary event related to hotspot activity and leaky fracture zones. The following aspects are emphasized:

1. Rift depocenters are controlled by border faults sub-parallel to the margin and by transverse faults that may continue as transform fractures into the oceanic crust, such as the Ascension Fracture Zone.

2. In many basins along the southernmost segment of the South Atlantic, Early Cretaceous volcanics underlie continental lacustrine syn-rift sediments of Neocomian age, with marked geochemical similarities to onshore flood basalts.

3. Along some segments of the margin, the transition from outer rift blocks to oceanic crust is characterized by wedges of seaward-dipping reflectors possibly associated with the inital phases of oceanic crust emplacement.

4. Locally, the outermost rift blocks seem to be eroded by post-rift uplift caused by shearing or magmatic underplating.

5. The role of propagators as originally defined in the Red Sea – Afar region has been recently recognized in the South Atlantic as volcanic ridges formed before and after salt deposition, separating portions of the rift and salt basins before final breakup installed a divergent regime with pure oceanic crust.

6. The South Atlantic salt basins along both margins were controlled by tectonic and volcanic elements, and locally salt was deposited directly on the volcanic substratum.

7. Subsequent to the rift sequence, a quiescent period marked by a sag basin above a regional unconformity predates deposition of Aptian evaporites.

8. In the northern segment of the salt basin, pre-rift sediments with no volcanic material underlie syn-rift sediments.

9. Basement-involved extensional faults, volcanic activity, and enhanced continental margin uplift and denudation are indicative of reactivation of rift-phase faults well after salt depositon along some segments of the margin.

10. Tectono-magmatic episodes climaxed in the Later Cretaceous/Early Tertiary, forming large volcanic complexes along the conjugate margins.