

CONTINENTAL BREAKUP, MAGMATISM AND SALT TECTONICS IN THE SOUTH ATLANTIC AND THE RED SEA

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ABSTRACT: The breakup and divergence of the South American – West African continental plates in the Mesozoic resulted in conjugate margins characterized by Neocomian to Barremian syn-rift deposits overlain by a thick sag basin and evaporites in the Aptian. Several tectonic models have been discussed recently for the development of the South Atlantic 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 from the rift to the drift stages as there are some suggestions of lithospheric stretching and continental rifting extending into the post-salt sequence, and the occurrence of serpentinized upper mantle underlying the salt diapir province near the continent-ocean boundary.

This work integrates geological and geophysical data in the South Atlantic and in the Red Sea – Gulf of Aden continental margins, which have been thoroughly investigated by research groups and petroleum companies. The Red Sea is interpreted as an incipient oceanic basin that is still in the embryonic stage of development, whereas the Gulf of Aden is slightly more evolved in the tectonic evolution. Recently acquired deep seismic reflection profiles extending towards the continent-ocean boundary in the deep water province of the Brazilian and West African conjugate margins suggest several similarities in Early Cretaceous magmatism and salt tectonics with equivalent analogs in the Red Sea.

A transect extending across the continental – oceanic crust boundary, constrained by palinspastic reconstructions, shows that salt tectonics in the Atlantic margins is highly variable and has advanced to a stage of forming allochthonous salt tongues that advanced towards the oceanic crust. In the Red Sea, the northern segment (near the Gulf of Suez) is still underlain by a rifted continental crust and the oceanic spreading ridge has not been formed yet. The Central Red Sea is characterized by active spreading ridges that form propagators which are presently rupturing the Late Miocene salt basin.

The tectono-sedimentary stages classically associated with divergent margins (the pre-rift, syn-rift, transitional and post-rift or drift phases) may be compared with the Red Sea – Gulf of Aden conjugate margins. Both regions are characterized by major episodes of magmatism in the pre-rift phase, and during the syn-rift phase, continental lacustrine to restricted marine sedimentation is observed. Salt tectonics is observed in the transitional phase, which is characterized by marine ingression overlying a sag basin that is locally marked by active extensional faults. Following the continental breakup, a marine carbonate to deep water sedimentary succession is characterized in the drift phase.

The Red Sea and Gulf of Aden are natural laboratories to study the early stages of divergent sedimentary basins, and particularly for the South Atlantic, they represent more adequate analogs than the Newfoundland-Iberian magma-poor margins. A model based on deep seismic profiles and gravity and magnetic interpretations suggest that the breakup of the continents and birth of oceanic basins are more commonly related to magmatic accretion rather than mantle exhumation.

PALAVRAS CHAVE: Continental breakup; magmatism; South Atlantic; Red Sea