EGU24-12991, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-12991
EGU General Assembly 2024

Tectonic structure and evolution of Brazilian Equatorial Margin

Julia Fonseca[1], César Ranero[2], Paola Vannucchi[3], David Iacopini[4], and Helenice Vital
[1]Università di Pisa , Dipartimento di Scienze della Terra , Pisa, Italy (julia.carvalho@phd.unipi.it)
[2]Consejo Superior de Investigaciones Científicas (CSIC), Instituto de Ciencias del Mar,Barcelona, Spain (cranero@cmima.csic.es)
[3]Università degli Studi di Firenze,Dipartimento di Scienze della Terra, Florence, Italy (paola.vannucchi@unifi.it)
[4]Università Degli Studi di Napoli Federico II, Dipartimento di Scienze Della Terra, Dell'Ambiente e Delle Risorse, Naples, Italy (david.iacopini@unina.it)

The Brazilian Equatorial Margin (BEM) is classically interpreted as a transform margin formed during the last phases of the Atlantic rifting of Gondwana. However, rift kinematics and subsequent continental break up has not been constrained.

We present a new model based on the interpretation of a 2D seismic grid acquired along the BEM. The datasets, provided by the Brazilian National Agency for Petroleum (ANP), expand for ~600 km of the margin and consist of approximately 10.000 km of crustal scale 2D seismic reflection profiles which have been calibrated with industry drillholes. The integration of crustal-scale tectonic structures and age and distribution of synrift sediment deposits allowed to determine the style and the timing of the different tectonic phases and to define the crustal thinning evolution of the entire rift system along the Potiguar and East Ceará Basins (NE Brazil).

Our findings indicate that: 1. rifting started ~140-136 My, 2. extension stopped earlier (late Aptian) in the shallow sector of the basin than in the deep-water (early Albian) domains. The shallow basin domains presents minor crustal thinning (~35 thick crust over ~100 km wide), whereas in the deep-water domains, about ~60 km wide, the crust is 4-8 km thick and it extended into the early Albian (116-110 My).

The distribution of deformation structures supports a model of rift evolution where: deformation is initially distributed while forming a shallow basin; it evolves by focusing the extension; finally, extension migrates toward the basin centre to form the deep-water domain. Constraints from seismic reflection data and drillholes help define an abrupt continent to ocean transition (COT), and breakup occurred during the early Albian. Basin sedimentation from its onset to the late Aptian is terrigenous, indicating an isolated environment disconnected from the Northern and Southern Atlantic oceans. Sedimentation changed during the late-most Aptian to the early Albian when marine facies deposited during a rapid ocean water infill of a previously endorheic basin.

The seismic images document that rifting across the margin is not dominated by transcurrent deformation, with strike-slip faulting limited to a relatively small sector, whereas most of the margin extended through normal faulting deformation during opening.

From the interpretation of the 2D seismic reflection grid it was possible to distinguish abrupt lateral changes in the architecture of the basement. These changes defined three distinct, first order segments along the margin named Southern, Central, and Northern segments. The different evolution of the three segments throughout the rifting process is defined by thickness map of the basement. The Northern segment is the only region that shows evidence of potential late synrift magmatism, likely formed during the COT emplacement, which defines second order segmentation. Our interpretation suggests a spatial correlation between first-order tectonic segmentation and second-order magmatic segmentation during the embryonic formation of the spreading center with the definition of fracture zone/transform faults. These findings suggest that most transform faults formed on the spreading centers may have originated from the pattern of continental segmentation during rifting.