Meta-analysis of the long-term stratigraphic evolution of rifted margin basins: the geodynamic context of the evaporites of the South Atlantic Ocean

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Résumé

Models of formation of rifted margins have significantly evolved over the last decades by identifying new styles of crustal thinning and magmatic production. However, the expression of these different processes in the depositional environments of the overlying basins remains to be determined. Using only published data, we integrated the sedimentary evolution of 21 basins of the Equatorial, Central and South segments of the South Atlantic that record various styles of crustal thinning and magmatic production. To compare these basins that underwent rifting at different times, we developed a new type of analysis allowing to evaluate statistically the (dis)similarities in depositional environment trends by normalizing them to the tectonic phases of the basin (syn-rift, transition and post-rift) rather than the stratigraphic or absolute ages: the GeoDyNamical Analysis.

We show that the timing of the long-term retrograding mega-sequence driven by lithosphere thinning depends on the deformation style and magma production. Along oblique margins of the Equatorial Segment, deepening initiated during syn-rift because their narrow crustal thinning style favors rapid tectonic subsidence surpassing sediment supply. Along wide margins of the Central Segment, deepening initiated later, at the end of the transition phase, because depth-dependent thinning favors slow tectonic subsidence and late break-up. Along magma-rich margins of the South Segment, deepening initiated during the transition phase, after volcanics stopped filling accommodation created by subsidence.

In the Central Segment, evaporites accumulated during the second half of the transition phase, when crustal thinning ceased in the proximal margin and migrated to its distal part. Immediately before and during evaporites accumulation, sediments recorded continental and coastal depositional environments resulting from the limited thermal subsidence in the proximal margin domain. Evaporite deposition lasted until the initiation of retrograding mega-sequence, at the onset of the post-rift phase and the end of crustal thinning in the distal margin.

Mots-Clés: South Atlantic Ocean, Rifted margin, Sedimentary basin, Stratigraphic architecture, Crustal necking

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