Geophysical Research Abstracts
Vol. 20, EGU2018-17621, 2018
EGU General Assembly 2018

Dynamics of continental break-up in oblique setting: insights from 3D numerical modelling

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Using modern, state-of-the-art, high performance computing tools to simulate 3D lithospheric scale oblique rifting permits to produce a level of complexity (asymmetry, poly-phasing of deformation) which was only previously only obtained with more complex model configurations or boundary conditions in 2D.

Our models show that obliquity causes oceanic rift propagation to stall, resulting in an apparent polyphased tectonic evolution. Break-up of extremely oblique segments can be delayed 10 to 25 Myr after the break-up of the divergent segments. During this period, stalling normal rift propagation leads to the formation of deep anoxic basins, micro continental ribbons which form pattern similar to observed northern Atlantic profiles and Angola-like hyper-extended margin.

Natural fracture zones and transform margins are not defined by line segments, but rather a 100 km diffuse zones of deformation where significant asymmetry can be accommodated by exhumation of lower crustal material or/and asymmetry of spreading depending on the nature of the lower crust. They record the integration over time of several stages of deformation that lead to oblique break-up. Trying to reconstruct plate motion with rigid plate transform margins model is impossible. New generation 3D dynamic models can help predicting where and when significant amounts of stretching and wrenching are expected to occur.