Geophysically constrained microplate fragmentation model and microplate-controlled evolution of Mesozoic basins – rifted North Atlantic borderlands, offshore Newfoundland, Canada

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Borderlands of offshore Newfoundland comprise a deformed collage of fault bound crustal blocks, assembled during the formation of the Pangaean supercontinent and closure of the ancient oceans in the Mississippian. Reactivation of these inherited terranes and structural fabrics occurred as the North Atlantic Ocean opened. At least three rift phases increased basin accommodation and are recorded by tectonostratigraphic sequences within the offshore Mesozoic basins. An intact tectonostratigraphic rift package will display: (1) A basal rift onset unconformity (ROU) under syn-tectonic units that thicken into fault zones; (2) Post-extension thermal subsidence dominated by back-stepping units; and lastly (3) Waning post-rift basin deepening deposits often associated with capping carbonate marker units e.g., Petrel, Marker-A, Rankin, Iroquois. These rifting phases were driven by global plate motions which include: (1) Late Triassic to Early Jurassic divergent motion between Africa and North America; (2) Middle Jurassic divergent motion between Newfoundland and Iberia; (3) Late Jurassic to Early Cretaceous oblique rifting of Newfoundland away from Baltica (including Ireland); and (4) Early Cretaceous to Late Cretaceous extension associated with the opening of the Labrador Sea and Baffin Bay and the separation of Greenland from North America.

Recent articles on dynamic plate modelling have made use of the open source plate tectonic modeling environment GPlates and led to interest in development of an updated 4-D dynamic microplate model. This project intends to deliver a dynamic tectonic model able to simulate the crustal block kinematics, and deformation patterns along the continental borderlands of offshore Newfoundland. The completed model will be geophysically constrained while infinitely expandable, improving our visualizations of the distribution and control of crustal blocks on the evolution of sedimentary basins. The preliminary results show an increased understanding of crustal block fragmentation is important in understanding stress/strain partitioning, basin evolution, and tectonostratigraphy along deformable continental margins, including Newfoundland and its conjugates.

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