Kinematic evolution model of intraplate rift margins: Dampier Sub-Basin

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Plate reconstructions have relied upon magnetic data for the precise reconstruction of continents. From the Early Cretaceous onwards, magnetic seafloor isochrons are generally used and for the Paleozoic until the Late Jurassic paleomagnetic data is used. However, the method of reconstructing the earliest continental deformation prior to active rifting lack the same precision in positioning and large uncertainties exist in respect of the timing of the stages of deformation. This work aims at reconstructing the Intraplate rift margins of Dampier sub-basin in the Northern Carnarvon Basin, Western Australia. We employed a backstripping technique on 64 boreholes to produce sediment thickness maps of the sub-basin since 195 Ma. Thirteen isopach maps were created at different timesteps, showcasing the cumulative variation of sediment thicknesses over time. One of the results was the clear development of a central rift basin at each timestep. From this rift basin, we built a kinematic model of the evolution of rifting. The results indicate that initiation of rifting correlates with the Late Triassic Northeastern Gondwana Rifting, with the southern part of the rift opening faster than the northeastern region. Further rifting coincides with the 155 Ma Argo Ridge and the 136 Ma India-Ant-Arctica Seafloor spreading events. Rifting ceased in the Lower Cretaceous. Overall the rifting was dominated by lateral motion of both margins with the eastern margin majorly propagating at higher velocities than the western margin. This kinematic evolution impacts on the evolution of petroleum systems within the region by controlling maturation, migration, and trapping of hydrocarbons. This work presents a method that may be applied in other rifted regions to understand the evolution of rift basins for exploration purposes.

Keywords: Intraplate reconstructions, Rifting, Dampier, Backstripping, Isopach maps

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