

Development of extension over time during rifting of the Jeanne d'Arc Basin, offshore Newfoundland

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The Jeanne d'Arc Basin formed during multiple rift events and passive subsidence associated with the opening of the North Atlantic Ocean through the Mesozoic and Tertiary. It is frequently reported that crustal thinning in rift zones is greater than extension due to brittle faulting. Previously, there have been estimates of total extension from fault analysis along single transects across the basin or from change in crustal thickness. This study has established the timing, direction and quantity of extension for each rift phase using detailed fault analysis.

2D and 3D seismic data and well data were used to create time structure maps at the start of each rift phase. These maps were restored to their position before each rift phase using beta values derived from fault heave extension estimates as input into GeoArctic's proprietary PlateDEF software. The restored maps were compared with restorations produced using change in crustal thinning to measure beta. It was established that fault heave measurements from the 2D data underestimates extension by approximately 50% when compared with measurements from the 3D data. This observation was incorporated into the extension estimates.

Extension was most significant during the Late Triassic to Early Jurassic rift phase. The total amount of extension measured using fault heaves in this study corresponds closely with the total amount of extension measured using change in crustal thickness in the regional North Atlantic deformable plate model, for total extension with beta values generally around 2. This indicates that stretching is uniform with depth in this area. This detailed study can be used to refine the regional North Atlantic deformable plate model.

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