



Understanding the tectonic evolution of the West Orphan Basin, offshore Canada, and the conjugate Rockall Basin, offshore Ireland, using a seismic megatransect

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The Orphan Basin, offshore Newfoundland, Canada, is approximately conjugate to the rifted margin basins on the Irish Atlantic margin. At the onset of seafloor spreading leading to the opening of the modern North Atlantic Ocean, plate reconstructions, based solely on oceanic magnetic anomalies, show the Rockall Basin, west of Ireland, forming a continuous Mesozoic basin with the West Orphan Basin. Here, we seek to examine the nature of this potentially continuous basin through the development of a Newfoundland-Ireland conjugate margin basin model. The basin model was produced from a primary seismic megatransect constructed across the two margins, along with additional intersecting seismic lines chosen to extend the interpretation beyond the main line. The seismic reflection data were generously donated by TGS and by the Petroleum Affairs Division of the Department of Communications, Energy and Natural Resources, Government of Ireland.

All seismic reflection lines were consistently interpreted across both margins using Petrel software and restored to a pre-rift state through decompaction and thermal subsidence modelling using Move software. Fault restoration was also performed but was complicated by suboptimal seismic line orientations relative to the rifting directions.

Preliminary observations for the West Orphan Basin show a uniformly thick (~ 8 km) post-rift sedimentary sequence, overlying a thinner (~ 4-5 km) syn-rift sequence. In the Rockall Basin, a thinner post-rift sedimentary sequence is observed (~ 3-4 km), overlying a thicker syn-rift sequence towards the center of the basin (~ 6-7 km). Due to lack of deep well control, uncertainty remains about the extent and thickness of Jurassic sediments across the conjugate pair. Based on the character of the seismic data along the megatransect, Jurassic sediments appear spatially limited in the West Orphan Basin and effectively absent from the deep Rockall Basin. While still at a preliminary stage, the evolving conjugate basin model provides a tool for developing a more thorough understanding of the mechanisms involved in the rifting phases of the Newfoundland and Irish margins.