



3D architecture of a hyper-extended rift basin (Central-North Porcupine Basin, Offshore Ireland)

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The Porcupine Basin is located in the western Irish offshore. Its characteristic V-shaped oceanic propagator presents evidences of extreme crustal thinning. In this study we investigate the main crustal structures and sedimentary architecture of the Porcupine Basin based on well, seismic, gravity and magnetic data. Several W-E sections have been interpreted in the central part of the basin, perpendicular to the main rifting axis. Large-scale basin structures and lithospheric architecture of the Porcupine Basin have been calibrated with gravity and magnetic inversion.

Positive gravimetric anomalies identified above the central part of the basin are the consequence of shallow high density bodies. These are explained by the presence of low-crustal exhumed rocks and mantle rocks uplifted at shallower depth during Late Jurassic-Early Cretaceous rifting. Seismic interpretation allowed identifying the main structural conjugate domains of a passive margin: (a) stretching domains with steep normal faults within the brittle upper crust, (b) necking domains, coinciding where the crust starts to thin considerably and the accommodation space increases, and (c) a central hyper-extended domain, dominated by tilted lower-crust blocks bounded by low angle faults, where syntectonic sequences overlie exhumed crustal rocks, indicating that the crust had to be substantially thinned in the brittle regime when this sequence was deposited. These newly-created faulted blocks of lower crust induce a very high stretching factor (>10) in the central part of the basin. Mantle is likely to have been exhumed south of our study area, where presence of oceanic crust has been suggested.

We consider the development of the crustal and distal domains in sequence resulting in forming diachronous syn-rift sedimentary sequences that are younging toward distal margin domains. Two units are identified for the Late Jurassic syn-rift sediments: Unit 1 and Unit 2. Older Unit 1 is interpreted to be present over the stretching and necking domains and absent in the central area. However, younger Unit 2 is thought to be deposited after lower crust exhumation, therefore it is widespread over the whole basin and present in its central part. Globally, Late Jurassic syn-rift units are thinner and younger towards the north of the Porcupine Basin where the extension is reduced and younger.

According to previous studies, our results confirm that the amount of crustal extension increases from north to south along the rifting axis, the continental crust becoming progressively more extended and the basin becoming wider towards the south.