



A wide-angle experiment in the Porcupine Basin: Evidence for mantle exhumation and serpentinisation

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New wide-angle seismic data were gathered along a 230 km long profile that runs east-west at 51.8° N latitude across a deep structural feature within the Porcupine Basin, offshore Ireland. The experiment was designed to investigate the nature and origin of the Porcupine Arch and the underlying crust and upper mantle. Sixty-five Ocean Bottom Seismometers were deployed at 2 to 3 km intervals and airgun sources were fired at 100 to 150 metre intervals along it. The results of forward modelling of prominent primary and secondary reflected arrivals indicate that the continental crust is extremely thin (locally less than 2 km) across the basin centre, and in places may be absent. The sedimentary succession is up to 12 m thick and comprises three distinctive seismic layers. The two uppermost layers are interpreted as mostly a post-rift succession of Cretaceous and Cenozoic strata, deposited following a major phase of Jurassic lithospheric extension. The lowest layer thins rapidly towards the basin centre sympathetically with the pattern of crustal thinning. This is interpreted as a succession of predominantly Jurassic syn-rift sediments, whose large-scale geometry reflects the response to the focussing of extensional strain, produced by a simple shear mode of differential lithospheric extension. A strong asymmetry in both the geometry of the crustal and the sedimentary layers is probably related to this mode of extension and the pattern of basement subsidence that it produced. The degree of crustal thinning is far greater than that observed in the adjacent Rockall Basin, suggesting that local exhumation of continental mantle lithosphere may have occurred in parts of the Porcupine Basin. Very low Pn velocities in the subcrustal mantle beneath the Porcupine Arch are compatible with larger amounts of mantle serpentinisation than interpreted from similar seismic evidence in the Rockall Basin.