



Controls of late Palaeozoic and Mesozoic extension in the British Isles: evidence from seismic reflection data in the Central North Sea

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In the area of the British Isles during the late Devonian and early Carboniferous, the oblique convergence of Laurentia and Gondwana imposed a torque on the adjoining terranes of Baltica and Avalonia. Their resulting clockwise rotation was accommodated by widely distributed N-S extension in the intervening zones previously formed by Caledonian and Acadian convergence. South of Laurentia and Baltica, late Palaeozoic extension was focused (1) at terrane margins, (2) in areas of limited Caledonian-Acadian plutonism, and (3) in places where the western (Iapetus) and eastern (Tornquist) convergence zones intersect at a high angle. One of these latter areas lies in Central England immediately north of the Midland Microcraton (part of Eastern Avalonia), where thermal subsidence associated with early Carboniferous extension gave rise to the late Carboniferous Pennine Basin. Interpretation of an extensive set of 3D and 2D long-offset seismic reflection data suggests that a similar area of enhanced extension at a fold belt intersection lies to north of the Mid North Sea High in the middle of the Central North Sea.

Variscan uplift and inversion of the late Palaeozoic basins began to predominate in mid-Carboniferous times as final amalgamation of all the different terranes to form Pangaea curtailed the initial episode of extension and thermal subsidence. This change in the tectonic regime was associated with the onset of tholeiitic volcanism within the convergence zones, and was followed by localised extension during the earliest Permian. Evidence obtained from seismic interpretation of the deep structure of the UK sector of the Central North Sea, suggests that late Carboniferous uplift and inversion along a northerly-trending axis analogous to the Pennine anticline controlled rift orientation during the episode of late Jurassic and early Cretaceous extension that formed the Central Graben. Other evidence indicates that subsequent local inversion of the Mesozoic basins in the same area can be spatially linked to the previous framework of late Devonian and early Carboniferous extension.

In Scotland, north of the Southern Uplands, the pattern of late Palaeozoic extension in the Midland Valley is similar to that in England and the Central North Sea. Minor differences can be attributed to the greater effect of Laurentian tectonics in Scotland, including the development of Lower Devonian basins and volcanic rocks, and the influence of strike-slip faults of the NNE-trending Great Glen set, which originated between Laurentia and Baltica, largely to the north of the terranes of southern, Gondwanan, affinity.

Published regional interpretations of variation in depth to the Moho in the UK can be used to examine the relative contribution of crustal stretching and magmatic underplating across the area.