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Structural styles and shortening estimates for the inverted external British Variscides to determine maximum thrust displacements.

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The Bristol Channel contains major Variscan thrusts juxtaposing distinct tectonostratigraphic terranes: the Upper Carboniferous Rhenohercynian, Culm (south) and Sub-Variscan Foredeep, Coalfield (north). There is agreement the contrasts across the Channel are not restricted to this, since underlying marine Devonian differs from continental ORS and Lower Carboniferous radiolarian-chert differs from the Main Limestone. The famous basins were mapped intricately over 100+ years by the UK geological survey and by academics across Europe, and questions about their juxtaposition date back to 1895 in the Quarterly Journal of the Geological Society, London.

Our aim, is to use structural styles and shortening to determine an upper limit for displacements upon the major thrusts. We investigate the magnitudes of shortening from south to north through the Culm and north Devon basins, and from west to east across SW Dyfed, central South Wales, Bristol, Mendips, Oxfordshire, and Kent, using an immense legacy of sections drawn by various authors, including the recent basin dynamics group of Wales.

Estimates corrected for Mesozoic negative inversion show 45% shortening due to accommodation-chevron and box folding in the Culm, 40% due to folds, back-thrusts, and fore-thrusts in the north Devon basin, 30% beneath northern parts of the Channel, and 33% along the strike of the foredeep from Wales to Kent. There is also great contrast in deformation style, between the Culm continuous-folds and the foredeep with reactivated faults, rounded folds, and thrusts, related to preferential slip along seams within central parts of the Middle Coal Measures.

Shortening can be 70%, close to underthrusts in the southern Culm; adjacent to regional thrusts along the north Devon coast; and, proximal to disturbances within the foredeep. This intensity of composite deformation would not be out of place close to tectonic-scale thrusts, between these terranes. Additionally, thrusts of this scale are detectable on regional seismic profiles and were the topics of recent studies. Structural inspection reveals significant 1km-scale displacements along NW-SE strike-slip faults common to both terranes and upon WSW-ENE oblique-ramp thrusts local

to the Vale of Glamorgan and Severn estuary. WNW-ESE frontal ramps with ~10km-scale displacements are considered candidate ‘stems’ to tectonic-scale thrusts and are found in Gower, Devon, and inner Channel.

Further investigations could elaborate the style of transmission of major thrust displacement from beneath the hinterland into the foredeep, whether by reactivation, decapitation, translation, and rotation of structural fabrics. There are complications of Mesozoic negative and Cenozoic positive inversions to consider in section restoration and adjustments are required to reveal how large displacements were dissipated exactly.

Reservations are that shortenings in hanging-walls can be poor indicators of displacement magnitude upon individual thrusts within sequences. Nevertheless, we conclude there is nothing contrary to the occurrence of a 100km-scale displacement, especially if accounting the tectonic-scale dimension and 300-500km geographic separations of modern terranes analogous to facies equivalent to the Culm and foredeep.