

Subsidence and Uplift in the Carboniferous Basins of Northern England: Interplay Between Asthenospheric Processes and Crustal Architecture at the Variscan Margin of Laurussia

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The Carboniferous basins of northern England have been intensively studied in recent years. They were initiated by lithospheric extension of the Laurussia margin bordering the Rheohercynian Ocean. In Dinantian time, several elongate asymmetric half-graben developed, partly controlled by preexisting crustal structures of Neo- proterozoic to early Palaeozoic age. Asthenospheric melting produced extensive basaltic magmatism, emplaced along major crustal lineaments. Intra-basinal highs were underpinned by buoyant granite-intruded basement blocks. Strong footwall-uplift on rift flanks resulted in localised erosional unconformities not present in the basins.

Silesian strata postdate lithospheric extension, forming during a long period of thermal relaxation. The basin axis runs north-south, oblique to the Dinantian depocentres. In Namurian time, detritus from the reactivated Caledonian mountains in Norway and Scotland was fed to major southward-prograding fluviodeltaic systems developed in eustatically-controlled lowstand and highstand system tracts. These were constrained by highs in the south (London-Brabant Massif) and east (Nocton High), underpinned by crustal domains which remained buoyant until late Namurian time. Westphalian strata transgressed onto these residual highs. By this time the landscape had evolved into a plain close to sealevel, covered by rivers, lakes and swamps, episodically invaded by marine incursions. In late Westphalian time, the region began to suffer compressional deformation in the farfield of the Variscan orogenic system. Inversion was most intense along reactivated basement lineaments and in a peripheral bulge to north of the developing orogenic foreland basin. These newly uplifted regions superceded the northern provenance in latest Westphalian time and fed sediment to a new basin template. In latest Carboniferous to early Permian time, extensive plume-related post-orogenic magmatism led to crustal uplift and erosion, setting the scene for Permo-Triassic basin development.