

Old Red Sandstone, Devonian, Northern England

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Introduction



'Polygenetic Conglomerate' seen in Limekiln Beck near Gamblesby [NY 6260 3980]. The subrounded clasts of Lower Palaeozoic volcanic and sedimentary rocks are contained in a coarse sandy matrix. (P006876).

Although a thick cover of Old Red Sandstone strata can be deduced from the metamorphic grade attained by the Lower Palaeozoic rocks of northern England, very little trace of it remains. The Early Devonian was a time of regional sinistral transtension and this seems the most likely mechanism to have driven the tectonic rifting and subsidence that would have been necessary if several kilometres

of mainly fluvial sediment were to accumulate. It is probable that much of the Lower Old Red Sandstone cover was then eroded and recycled southwards during subsequent, Acadian basin inversion. Local deposits of Upper Old Red Sandstone strata are post-Acadian, post-tectonic, and range in age from Late Devonian to Early Carboniferous. By the end of the depositional interlude, the region was largely a continental peneplain, and relict exposures of the end-Devonian land surface preserve soil profiles developed in an arid, tectonically quiescent environment.

Isle of Man

A likely remnant of the once-extensive Lower Old Red Sandstone fluvial deposits is the Peel Sandstone Formation, which has a small, faulted outcrop on the north-west coast of the Isle of Man. It comprises red, coarse-grained sandstone and conglomerate, deposited in braided river and alluvial plain environments by a river system flowing from the north-west; there are sporadic, interbedded calcrete (palaeosol) layers and a minor but significant aeolian component. Estimates of the sequence's thickness range from 500 m up to 2000 m. Slump folds and small-scale, synsedimentary thrust imbrication confirm a depositional palaeoslope inclined towards the south-east. The conglomerates contain a range of clast types and many of the clasts are relatively angular: quartz, quartzite, various volcanic and volcanoclastic lithologies (mostly felsic), sandstone, limestone and shale are well represented. Manx Group clasts are notably absent. The limestone clasts are of particular importance in that some contain Wenlock shelly fossils, whilst others have a possibly Ashgill fauna. The Wenlock fossils provide a maximum age for the Peel Sandstone Group, and from palaeomagnetic results it is regarded as most probably of Early Devonian age (about 400–410 Ma). Despite this likely pre-Acadian age, there is no indication that the Acadian cleavage in the adjacent Manx Group continues into the Peel Sandstones, nor is there any sign of significant tectonic deformation beyond the regional rotation to a dip of up to 50° north-west.

Northern England

In parts of north-west England, it has been customary to recognise a single unit of conglomeratic 'basement beds' separating Lower Palaeozoic strata from the Carboniferous limestone succession. However, in parts of Cumbria these 'basement beds' are better interpreted as two superimposed units: a lower, laterally discontinuous, red-bed succession, unconformably overlain by an upper unit of Carboniferous, mixed marine and terrigenous, clastic beds, locally including volcanic rocks. Only the rocks of the lower succession are now regarded as of Old Red Sandstone lithofacies and were laid down in a continental, pluvial-desert setting of high to moderate relief. Their deposition was controlled by rift systems whose orientation, sediment provenance and dispersal trends were very different from those associated with the ensuing Early Carboniferous rift regime. There is a complete absence of fossils, hence the age assignments can only be tentative.

Along the eastern flank of the Lake District massif, local conglomerate accumulations are apparently post-tectonic but, in the case of the Mell Fell Conglomerate Formation, are cut by Early Carboniferous dykes. The Mell Fell Conglomerate crops out from Great and Little Mell Fells and the northern end of Ullswater, northwards to the Carboniferous limestone escarpment west of Penrith; there is a small outlier in the Heltondale Beck by Askham village (NY 506 207). The polygenetic, red-bed conglomerate contains clasts derived mostly from the Borrowdale Volcanic Group and the Windermere Supergroup. Some clasts preserve a cleavage, confirming post-Acadian deposition, and so a Late Devonian (Upper Old Red Sandstone) depositional age seems likely. The depositional environment was one of coalesced alluvial fans and braided river channels in a pluvial, desert setting. The Mell Fell Conglomerate, at about 1500 m, is the thickest of the preserved conglomerate sequences and probably accumulated in a valley controlled by, or eroded along, the Causey Pike Fault.

This raises the possibility of post-Acadian movement on that important regional structure. In some parts of the Cross Fell inlier, the Lower Palaeozoic strata are unconformably overlain by up to about 35 m of coarse clastic rocks that have traditionally been associated as the 'Polygenetic Conglomerate' ([P006876](#)). Clasts are mainly of Lower Palaeozoic volcanic or sedimentary lithologies and a broad correlation with the Mell Fell Conglomerate has been generally assumed.

The Shap Wells Conglomerate Formation contains interbeds of mudstone and fluvial sandstone and is conformably overlain by the Blind Beck Sandstone Formation. The outcrop is small and restricted to the valley of the Birk Beck, a northern tributary of the River Lune. A broadly similar assemblage occurs farther south, where the Sedbergh Conglomerate Formation is exposed in its type area along the course of the River Rawthey, in disparate outcrops along the Pennine Fault Zone and in the valley of the River Lune, north of Kirkby Lonsdale; the overlying, 15 m thick Nor Gill Sandstone Formation is restricted to outcrops in a tributary of the River Rawthey. The conglomerates are coarse- to very coarse-grained, nonlocally sourced terrigenous deposits laid down in debris flows, coalescent alluvial fans and braided river systems. The Shap Wells conglomerate beds exposed along the Birk Beck interleave with varicoloured mudstone beds that were probably deposited in lakes; either localised, ephemeral and formed after flash floods, or semipermanent and in a playa-type setting. The red sandstone beds of the Blind Beck and Nor Gill formations are mainly lithic and poorly sorted river deposits, but include some beds of aeolian origin. In addition, the Nor Gill Sandstone Formation contains nodular and sheeted calcrete beds that originated as palaeosols.

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