Landscape evolution, Northern England

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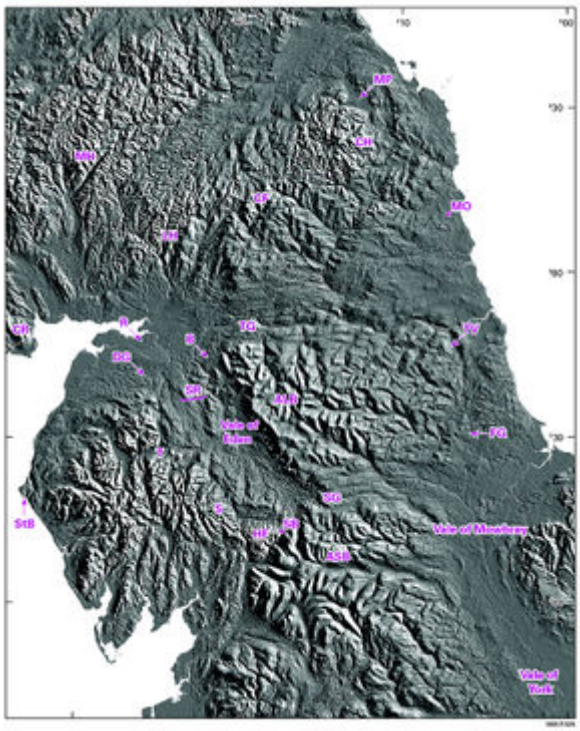
Introduction

Hadrian’s Wall and the Great Whin Dolerite Sill at Housesteads Crags west of Hexham, Northumberland. (P222329).



NEXTMap Digital Surface Model (1.2 m vertical resolution) (NEXTMap Britain elevation data from Intermap Technologies). ALB Alston Block; ASB Askrigg Block; B Brampton Kame Belt; CF Carter Fell; CH Cheviot Hills; CR Criffel; DG Dalston Gap; FG Ferryhill Gap; HF Howgill Fells; LH Langholm Hills; MH Moffat Hills; MO Maidens Hall opencast site; MP Millfield Plain; R Rogen moraine; S Shap Fell; SG Stainmoor Gap; SR Scottish Readvance limit at Carlisle; SB Scandal Beck interstadial site; StB St Bees Moraine; T Troutbeck interglacial sites; TG Tyne Gap; TV Team Valley. (P916120).

Durham Cathedral and Castle occupy a precipitous promontory within an incised meander of the River Wear. Photograph courtesy of D Robinson. (P916121).

The long-term evolution of the landscape of northern England prior to the last glaciation is not well known. Elaborate hypotheses involving several phases of marine erosion and subaerial peneplanation during the Palaeogene and Neogene have been proposed to explain apparent concordant summit levels and topographic benches, but they have not been substantiated and are at variance with the offshore record. Some elements of the landscape are inherited from surfaces that are very old indeed, for example, the sub-Devonian unconformity on the Lower Palaeozoic strata of the Lake District and Howgill Fells, and the sub-Permian surface on the Carboniferous strata of the Alston Block and outer Lake District. The dominant control on topography, however, is bedrock lithology. For example, the Whin Sill, a particularly hard and resistant rock, has created many dramatic features such as the escarpment followed by the Roman Wall (P222329), the cliffs of High Cup Nick on the north Pennine escarpment and High Force in Teesdale. The Fell Sandstone (Border Group) forms several notable escarpments in Northumberland. In contrast, depressions between the escarpments have resulted from the preferential erosion of mudstone and saprolite formed by chemical weathering in the humid tropical climate of the Palaeogene.

The present pattern of drainage (P916120) originated in the early Palaeogene during the creation of fault-bounded basins and massifs peripheral to the opening North Atlantic Ocean. Long-term isostatic uplift associated with granitic plutons positioned beneath the Lake District, Alston Block, Cheviots and the Isle of Man consequently influenced the developing pattern of drainage. The Lake District is a fine example of radial superimposed drainage that was initiated on a domed Chalk surface in the Palaeogene, but then accentuated by glacial erosion beneath ice caps centred over the area during several glaciations. The Howgill Fells exhibit deeply dissected, dendritic drainage incised into Silurian mudstones, and the famous ‘hair-pin gorge’ at Durham is a fine example of an entrenched meander (P916121) that is probably no older than late glacial. A similar age is likely for many examples of river capture, such as that affecting the headwaters of the River North Tyne in Northumberland.

There is little doubt that the glacial and periglacial episodes of the Pleistocene have left the dominant imprint on the landscape. Ice sheets stripped most unconsolidated deposits from the Pennine uplands, leaving large areas of smoothed and polished rock. Considerable glacial erosion occurred locally to form the cirques, arêtes, lake-filled glacial troughs and glacial breaches of the central Lake District. Erosion by meltwater created innumerable clefts and winding, steep-sided glacial drainage channels. These features commonly dissect interfluves and traverse obliquely across hillsides. In Northumberland, the sandstone cuestas have been accentuated where ice flowed parallel to the strike, as in the vicinity of the Roman Wall, but partially obscured where flow was transverse to the strike. Soft mudstones have been preferentially eroded to form strings of poorly drained, peat-filled basins.

Modification of lowland areas occurred mainly through glacigenic deposition, which formed widespread, gently undulating, poorly drained, relatively featureless plains of till interspersed with mounds, ridges and terraces of outwash sand and gravel. Locally, subglacial processes produced swathes of the ice-moulded, drumlin topography that is so characteristic of many Pennine dales and the Vale of Eden. The present drainage system was initiated during deglaciation, with many rivers following routes originally carved out by glacial meltwater. Some rivers were deflected from their preglacial courses, which are now concealed valleys filled with glacigenic material. Subglacial deposition of till has generally smoothed the topography relative to the underlying rockhead surface and without it some coastal areas would be submerged.

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