
Chapter 4 Southern Scotland and the Lake District

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Introduction

Old Red Sandstone rocks crop out in the Scottish Borders and eastern Dumfriesshire (Mykura, 1991; Trewin and Thirlwall, 2002). Situated south of the Southern Upland and Lammermuir faults, these isolated outcrops lie in the Southern Uplands Terrane ((Figure 4.1); Browne *et al.*, 2002). Together with small outcrops of conglomerates fringing the Vale of Eden, these strata provide important evidence for the interpretation of the Old Red Sandstone palaeogeography of Britain. The oldest strata, which are of Late Silurian to Early Devonian age, comprise predominantly fluvial conglomerates and sandstones assigned to the Reston Group. Volcanic rocks in the Reston Group include basaltic and andesitic lavas and tuffs of the Eyemouth Volcanic Formation between St Abbs Head and Eyemouth in Berwickshire (Greig, 1988; Stephenson, 1999) and the Cheviot Volcanic Formation in Roxburghshire (Browne *et al.*, 2002). It is likely, but unproven, that the strata of the Reston Group were deposited in basins separated from those of the Midland Valley of Scotland (Browne *et al.*, 2002). One of the most extensive of the conglomerates, the Great Conglomerate Formation of the Reston Group (Davies *et al.*, 1986), crops out in the Dunbar, Lauder and Haddington areas. It comprises boulder conglomerates with wacke sandstone clasts and interbedded thin sandstones. Although no diagnostic fossils have been recorded, the strata are considered to be of Early Devonian age on the basis of correlation with pre-volcanic sedimentary rocks at Bell Hill, St Abbs (Greig, 1988; cf. Rock and Rundle, 1986).

No rocks of Mid-Devonian age are known in the Southern Uplands Terrane. Following a period of uplift and denudation at the end of the Caledonian Orogeny, alluvial basins developed in the Scottish Borders during Late Devonian times. Their fill is largely assigned to the Stratheden Group (Paterson and Hall, 1986; Browne *et al.*, 2002). The Stratheden Group rests with angular unconformity on Old Red Sandstone of Silurian to Early Devonian age or on Early Palaeozoic turbidites of the Southern Uplands. The unconformity at Jedburgh (the Jedburgh Unconformity; (Figure 4.2)) is a Regionally Important Geological and Geomorphological Site (RIGS).

The largest of the Late Devonian basins is the Scottish Border Basin (Leeder, 1973, 1974, 1976), which extends from Berwickshire south-westwards to Jedburgh and from there as a narrow, discontinuous belt to Kirkbean on the Solway coast. In the Eyemouth and Jedburgh districts, the Stratheden Group comprises a clastic red-bed succession of mainly fluvial pebbly sandstones, siltstones and some conglomerates. The group's thickest development (up to 200 m) is in the Langholm, Jedburgh and Cheviot districts. The conglomerates were mainly sourced from the Galloway highlands (Leeder, 1973, 1976). The sandstones provided a good source of local building material and many of the Borders abbeys and houses of the Tweeddale district are constructed of them (MacGregor and Eckford, 1946).

Nodules and beds of dolomite and chert are common in the Upper Old Red Sandstone and are particularly well-developed in Liddesdale (see Palmers Hill Rail Cutting GCR site report, this chapter). They are interpreted as calcretes and silcretes, indicative of contemporaneous pedogenesis. The calcrete-bearing strata are referred to the Kinnesswood Formation of the basal Carboniferous Inverclyde Group, as at Pease Bay (see Siccar Point to Hawk's Heugh GCR site report, Chapter 3) and at Milton Ness near Arbroath in the Midland Valley (see GCR site report, Chapter 3). Up to 30 m of these distinctive strata are present at Kirkbean, in Annandale and Liddesdale and at Bummouth and Cockburnspath (Smith, 1967, 1968; Leeder, 1973, 1974; Paterson *et al.*, 1976; Browne *et al.*, 2002). At Kirkbean, and in Annandale and Liddesdale, the Kinnesswood Formation is overlain by weathered vesicular olivine basalt lavas of the Birrenswark Volcanic Formation (Stephenson *et al.*, 2003). In Berwickshire, it passes up conformably into the Ballagan Formation (Cementstone Group of Smith, 1967, 1968).

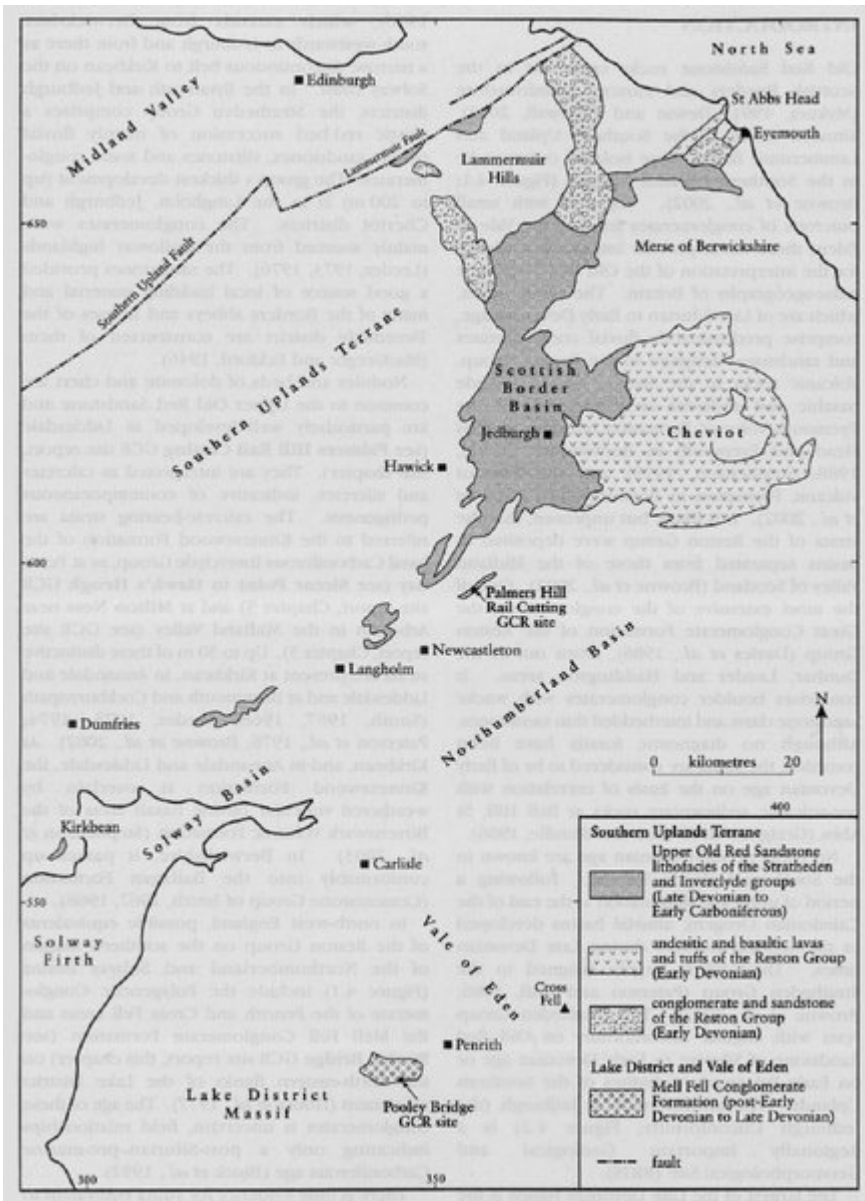
In north-west England, possible equivalents of the Reston Group on the southern margin of the Northumberland and Solway basins (Figure 4.1) include the Polygenetic Conglomerate of the Penrith and Cross Fell areas and the Mell Fell Conglomerate Formation (see Pooley Bridge GCR site report, this chapter) on the north-eastern flanks of the Lake District mountains (House *et al.*, 1977). The age of these conglomerates is uncertain, field relationships indicating only a

post-Silurian–pre-marine Carboniferous age (Bluck *et al.*, 1992).

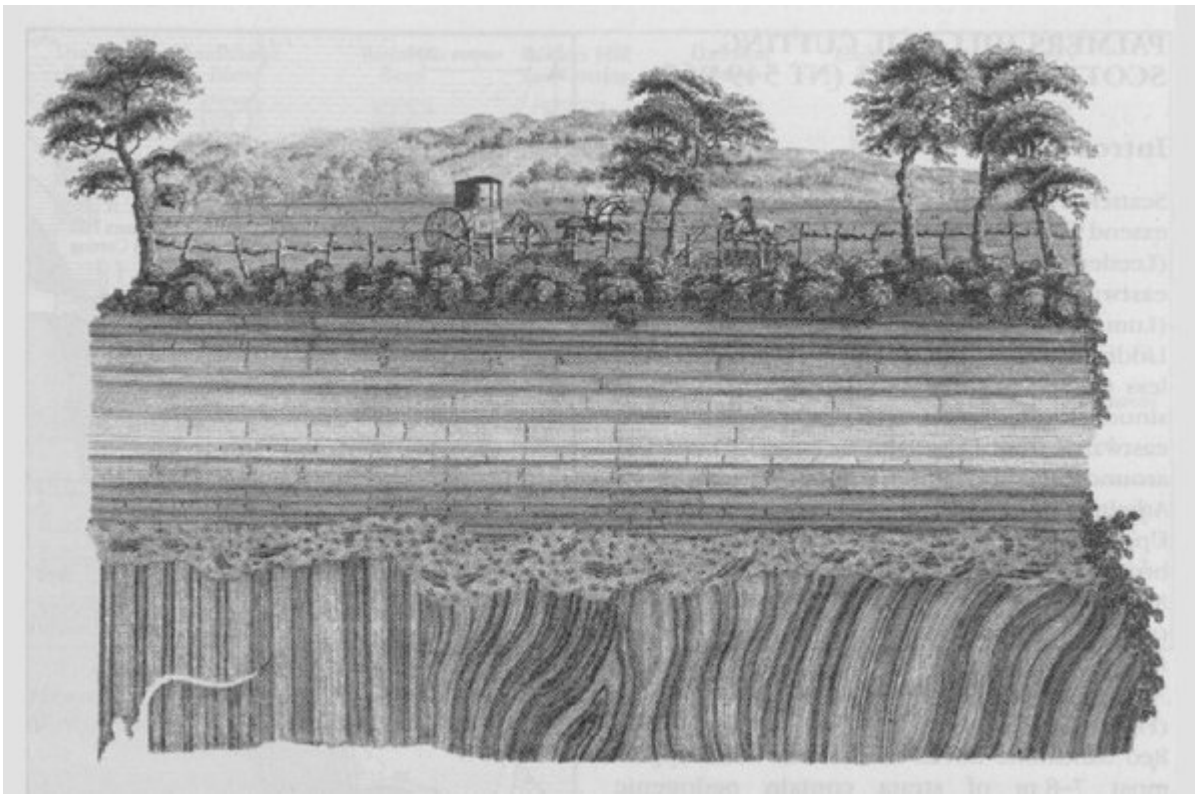
There is little evidence for strata equivalent to either the Stratheden Group or the overlying Kinnesswood Formation on the margins of the Lake District Massif. Interestingly, however, Capewell (1955), in his regional study of pre-marine Carboniferous 'Basement Series' sedimentary rocks on the east side of the English Lake District, refers to characteristics in the alluvial 'Red Sandstones' of the Birk Beck valley that may be similar to those of the Ballagan Formation 'cementstone' facies of the Midland Valley of Scotland. The Birk Beck valley succession comprises Lower Conglomerates (possible correlatives of the Pinksey Gill Beds of Tournaisian age (Weston, 1977), Red Sandstone and Upper Conglomerates, conformably overlain by Lower Carboniferous marine strata. Thus, there is local evidence in the Lake District for the development of Old Red Sandstone lithofacies of Late Devonian to Early Carboniferous age.

The transition from continental Old Red Sandstone to marine deposition may have taken place at slightly different times in the Early Carboniferous in the basins of Southern Scotland. The debate over the age of the Old Red Sandstone was fuelled by the discovery in the 19th century of fossil fishes (Jameson, 1805; Milne, 1843; Nicol, 1847; Powrie, 1870). The discovery of *Holoptychius noblissimus* Agassiz at Wauchope Burn, SSW of Jedburgh (Milne, 1843) and fish fragments believed to have come from Tudhope Quarry, Jedburgh (Nicol, 1847) resulted in the beds being assigned to the 'old red sandstone'. Powrie (1870) assigned strata with similar fish fragments at Denholm Hill, Hawick to a 'Passage Group' between the Upper Old Red Sandstone and the Carboniferous strata. Strata bearing *Holoptychius noblissimus* Agassiz at Dinley Burn, Langholm were referred to the Upper Old Red Sandstone by Peach and Horne (1903). Lumsden *et al.* (1967) noted that neither the presence of cornstone (calcrete) or *Holoptychius* was diagnostic of precise age, and that the strata now assigned to the Kinnesswood Formation could be Late Devonian or Early Carboniferous in age.

[References](#)



(Figure 4.1) Distribution of Old Red Sandstone strata of the Southern Uplands and the Lake District.



(Figure 4.2) Engraving after a drawing of the unconformity at Jedburgh [NT 652 198] by John Clerk of Eldin (1787), used for Plate III of the *Theory of the Earth*, Volume 1, by James Hutton (1795). Vertical Silurian greywackes and shales are unconformably overlain by Upper Old Red Sandstone basal breccia and overlying sandstones. From Craig et al. (1978), reproduced by permission of Sir R.M. Clerk Bt.