Colour Heugh–Bowden Doors, Northumberland

[NU 066 337]–[NU 070 326]

Introduction

The crags of the Colour Heugh–Bowden Doors GCR site [NU 066 337]–[NU 070 326], 8 km north-east of Wooler, Northumberland, are among the most impressive and important outcrops of the Fell Sandstone Group in northern England. The group defines an important phase in the evolution of the Northumberland Trough, recording the mid-Viséan (Arundian–Holkerian) activity of a large braided river system which may have been comparable in extent to the braided stretches of the Brahmaputra River in Bangladesh (Monro, 1986; but see Turner *et al.,*1997). The outcrops at this site preserve excellent sedimentary structures, including unusual overturned cross-stratification and several small, steep-sided channels, and these have featured in several detailed analyses of Fell Sandstone Group sedimentology (e.g. Robson, 1956; Hodgson, 1978; Turner and Monro, 1987). The term 'Fell Sandstone' dates back to Miller (1887) and Fowler (1926), and the lithostratigraphical terminology established in the Northumberland area by these authors has changed little since. The deposit is an important aquifer and source of water for the Berwick-upon-Tweed district. It has also been considered as a potential reservoir for geothermal energy in the Tyneside area (Cradock-Hartopp and Holliday, 1984; Holliday, 1986).

Description

Petrographically, the Fell Sandstone Group consists of moderately to poorly sorted, medium- to coarse-grained, quartz arenites and subarkosic and lithic arenites with subangular to subrounded clasts and a few pebble layers (Monro, 1986). The following description is drawn largely from the work of Turner and Monro (1987). At Colour Heugh and Bowden Doors, several hundred metres of SW-facing crags up to 8 m high expose the upper parts of the Fell Sandstone Group succession, not far below the overlying Scremerston Coal Group (Turner and Monro, 1987; Turner and Heard, 1995). These strata form part of the faulted north-east limb of the Holburn Anticline. Turner and Monro (1987) recognized three facies, the lateral and vertical relationships between which are illustrated in (Figure 3.28)a. Facies 1, with exposed thicknesses of up to 0.5 m, comprises coarse reddish sandstone with large-scale, but generally poorly defined trough cross-stratification. There is also evidence of scour at the base of this facies. Facies 2 consists of poorly sorted, fine- to medium-grained sandstone. It is generally structureless, but contains undulatory lamination, isolated sets of cross-stratification, some channels and a few water-escape structures. This facies occurs in units of between 3.5 m and 3.75 m thickness. Facies 3 forms units up to 7 m thick, consisting of fine- to medium-grained sandstone with alternating trough and planar cross-stratification (including partially overturned cross-stratified units; see (Figure 3.28)c) and minor horizontal stratification. These may combine to produce complex patterns of internal structure. Cutting across facies 2 and 3 are nine sharply defined channels (eight at Bowden Doors, one at Colour Heugh).

These channels are small, steep-sided, between 1.7 m and 2.5 m deep, and filled with fine- to medium-grained structureless sandstone (Figure 3.28)b. At this site, the Fell Sandstone Group is unfossiliferous, although elsewhere, it is known to include wood fragments, bivalves and ostracodes (e.g. Turner *et al.,* 1997).

Interpretation

Although earlier workers considered the Fell Sandstone Group to be at least partly marine in origin (Robson, 1956; Smith, 1967; Hodgson and Scott, 1970) and to include some aeolian beach-dune deposits and littoral beach sands, more recent work has indicated that the Fell Sandstone Group was deposited by a low-sinuosity, perennial, braided river system that flowed westwards into a shallow sea in the Bewcastle area via braid delta complexes (Hodgson, 1978; Monro, 1986; Turner and Monro, 1987; Turner *et al.,* 1993). The areal extent of the river may, however, have been overestimated, as analysis of the Fell Sandstone Group on a regional scale highlights a number of facies changes that are difficult to explain as a simple consequence of increasing distance from source. These local variations in facies and

thickness have been attributed to tectonic control of sand-body development in transfer zones between tilted fault blocks (Turner *et al.,* 1997). Thus, the Fell Sandstone Group river system was probably made up of a number of active braidplains locally confined by intrabasinal syndepositional normal faults, and was not a single basin-wide river system (Turner *et al.,* 1993, 1997).

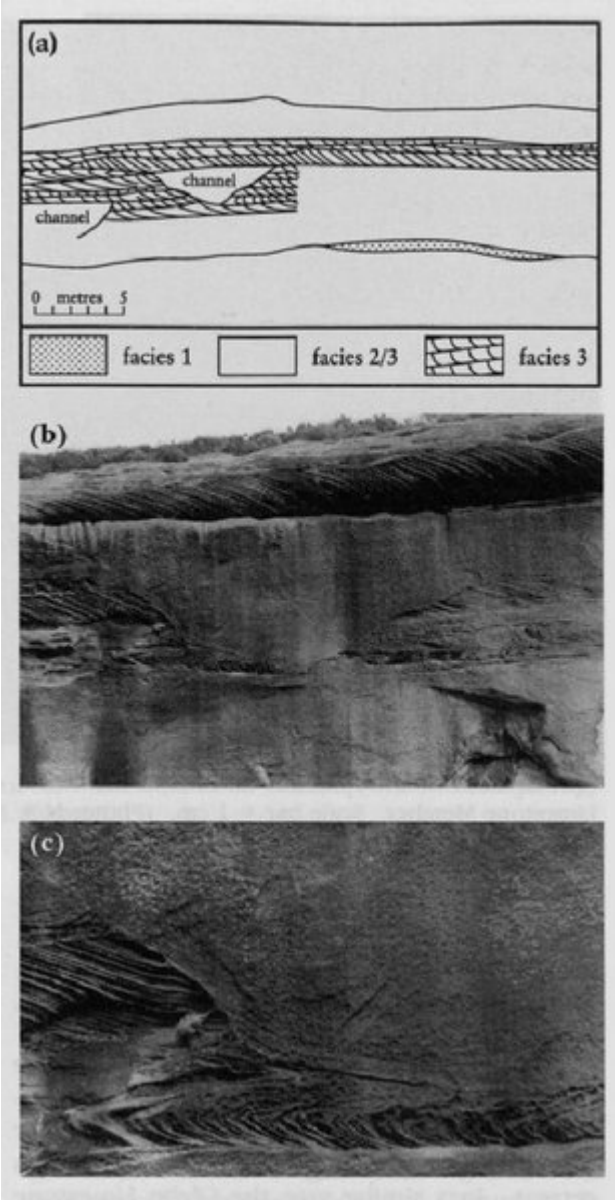
At Bowden Doors and Colour Heugh, facies 1 was deposited in the lower parts of laterally extensive, shallow channels; facies 2 was deposited in channels adjacent to linguoid or transverse bars in which facies 3 was deposited (Turner and Monro, 1987). The channels were formed by sediment-laden mass flows initiated by collapse of the river bank. These flows moved across rather than down the main depositional channel, along scoured, pre-channelized pathways in front of large sandy bedforms. The steep channel banks would have collapsed if unsupported, indicating very rapid cutting and filling of the channel.

The deformation of the cross-stratification at this locality has been attributed to shear resulting from sediment-laden water acting on the top of the original sandy bedform (Turner and Monro, 1987).

Conclusions

The Fell Sandstone Group preserves a sedimentary succession of considerable importance in understanding the Northumberland Trough's depositional systems, palaeogeography and evolution during mid-Viséan times. The Colour Heugh–Bowden Doors GCR site is of considerable regional importance as one of the best inland exposures of the Fell Sandstone Group in Northumberland, and is renowned throughout the north of England for the spectacular preservation of its sedimentary structures.

References



(Figure 3.28) (a) Part of the outcrop face at Bowden Doors illustrating the facies distribution within the Fell Sandstone Group and the position of mass-emplaced channel margins. (b) Cross-section of a prominent channel which cuts down 2.5 m through the underlying facies. (c) The channel fill is mostly structureless, but faint diffuse marginal laminations are evident on the left side of the channel. The lower part of the channel intersects with a zone of overturned cross-stratification. After Turner and Monro (1987). (Photos: B. Turner.)