
Bickerton Hill, Cheshire

[SJ 508 547]

Introduction

The escarpment between Tower Wood and Droppingstone Well reveals natural exposures in the Wilmslow, Bulkeley Hill, and Helsby sandstone formations of the Sherwood Sandstone Group. The sediments are mainly fine-grained, red sandstones, interpreted as sandy braided river deposits, but conglomerate beds of the Delamere Pebbly Sandstone Member (Helsby Sandstone Formation) are prominent in the upper parts of the section and record the transition to more proximal, braided river deposition. This is an important site for the study of Triassic palaeoenvironments, and for illustrating several stratigraphical units in the Cheshire Basin.

This site has been described by Hull (1869), Poole and Whiteman (1966), and Thompson (1970a,b).

Description

Bickerton Hill lies towards the southern end of the central Cheshire Ridge that stretches from Beeston Castle in the north, through the Peckforton Hills, to Larkton Hill in the south. The area is an old copper mining district, and it has long been a classic spot for geologists (Figure 3.34).

The Triassic stratigraphy of this area shows some variation from that of the Wirral and other parts of the Cheshire Basin (Figure 3.19). The tripartite division of the Helsby Sandstone Formation is not recognized in this area, with only the Delamere Pebbly Sandstone Member being present. A distinctive unit, the Bulkeley Hill Sandstone Formation, is present between the Wilmslow Sandstone and the Helsby Sandstone formations. The area is bounded to the east by a major NE–SW fault, the Bickerton–Bulkeley Fault, with a downthrow of at least 360 m to the east (Figure 3.35). This fault explains the major change in topography from the high Cheshire Ridge in the west to the low-lying Cheshire plain. Throughout the sandstones are granulation seams and fracture systems with orientations (strike 360°, dip 66° west; strike 300°, dip 70° east), which are conjugate with the main fault system.

The outcrop of the Wilmslow, Bulkeley Hill, and Helsby sandstone formations around Bickerton (Figure 3.35)a relates in part to topography and to additional faults. The area between Droppingstone Farm and Raw Head has magnificent exposures of the Wilmslow Sandstone Formation, which comprises a thick sequence of red and variegated, very fine-, fine-, and medium-grained sandstones. The main sedimentary structures are small-scale (0.1 to 0.3 m) cross-bedding and sets of horizontal or low-angle planar stratification. Many of these units demonstrate a pseudo-pin-striped appearance. Measurements of cross-bedding azimuths indicate sediment transport consistently towards the north-west and NNW.

The overlying Bulkeley Hill Sandstone Formation comprises fluvial and aeolian sandstones, and is capped by the conglomerates and sandstones of the Delamere Pebbly Sandstone Member of the, Helsby Sandstone Formation. Southwards and westwards, the Bulkeley Hill Sandstone Formation is progressively cut out below the Helsby Sandstone Formation, which comes to rest directly upon the Wilmslow Sandstone Formation. The Delamere Pebbly Sandstone Member consists of red, secondarily buff or white, lenticular planar- or trough-cross-bedded, mostly coarse, ill-sorted, pebbly sandstone, rich in mud clasts.

The main mineralization at Bickerton occurs in a fault-bounded zone that can be traced for a distance of 800 m along the Bickerton–Bulkeley Fault (Figure 3.35)b. The mineralization was described by Naylor *et al.* (1989b). The 0.5-m-wide ore zone is parallel to the fault, and resulted from mineralizing fluids in the sandstones becoming trapped against the impermeable Tarporley Siltstone Formation to the east. There is little evidence of the mineralization now, although some of the more porous sandstones have abundant barite cements and some of the exposures of the Delamere Pebbly Sandstone Member have barite rosettes up to a few centimetres in diameter. Ore minerals identified from Bickerton

include bravoite, bornite, ten-nantite, chalcopyrite, covellite, and a range of Ni-Co-Fe sulpharsenides.

Interpretation

The depositional environment of the Wilmslow Sandstone Formation is interpreted as a sandy braided fluvial system. The plane and pseudo-pin-striped sandstones may represent low-amplitude sand waves or macroforms reflecting the relatively low-energy (aggradational) nature of the depositional system.

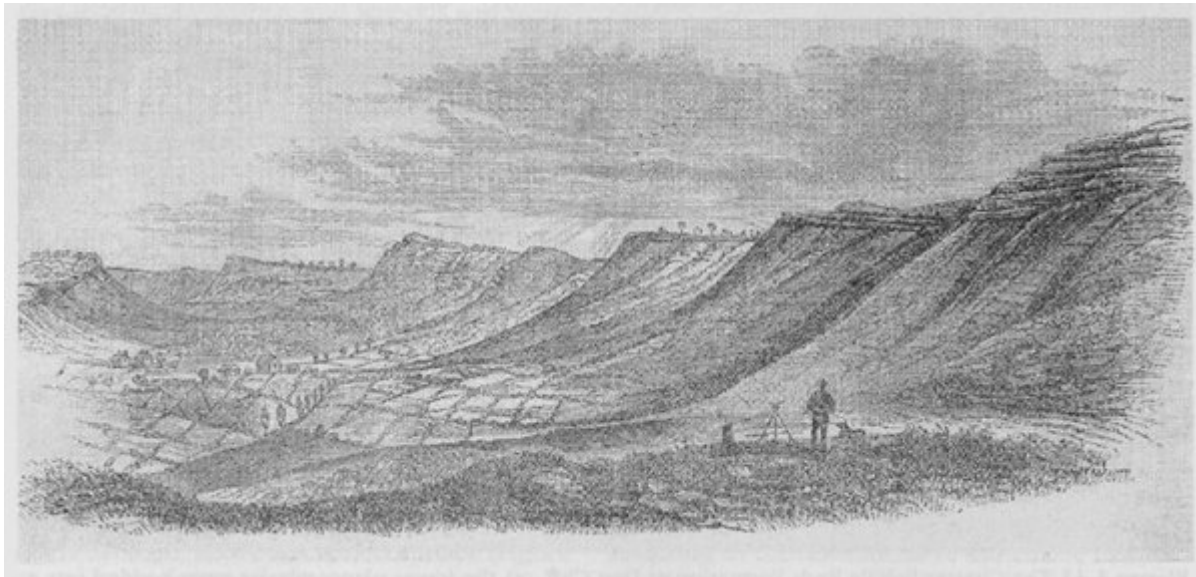
The Bulkeley Hill Sandstone Formation contains evidence for a mixed fluvial and aeolian regime.

The Delamere Pebbly Sandstone Member is the product of high-energy fluvial deposition. The change from the Bulkeley Hill Sandstone Formation to the Helsby Sandstone Formation is the manifestation of a regional angular unconformity (Evans *et al.*, 1993), which may reflect rejuvenation and uplift of source areas to the south and west, and may be equivalent to the Hardeggen unconformity seen in the North Sea basins and in continental Europe.

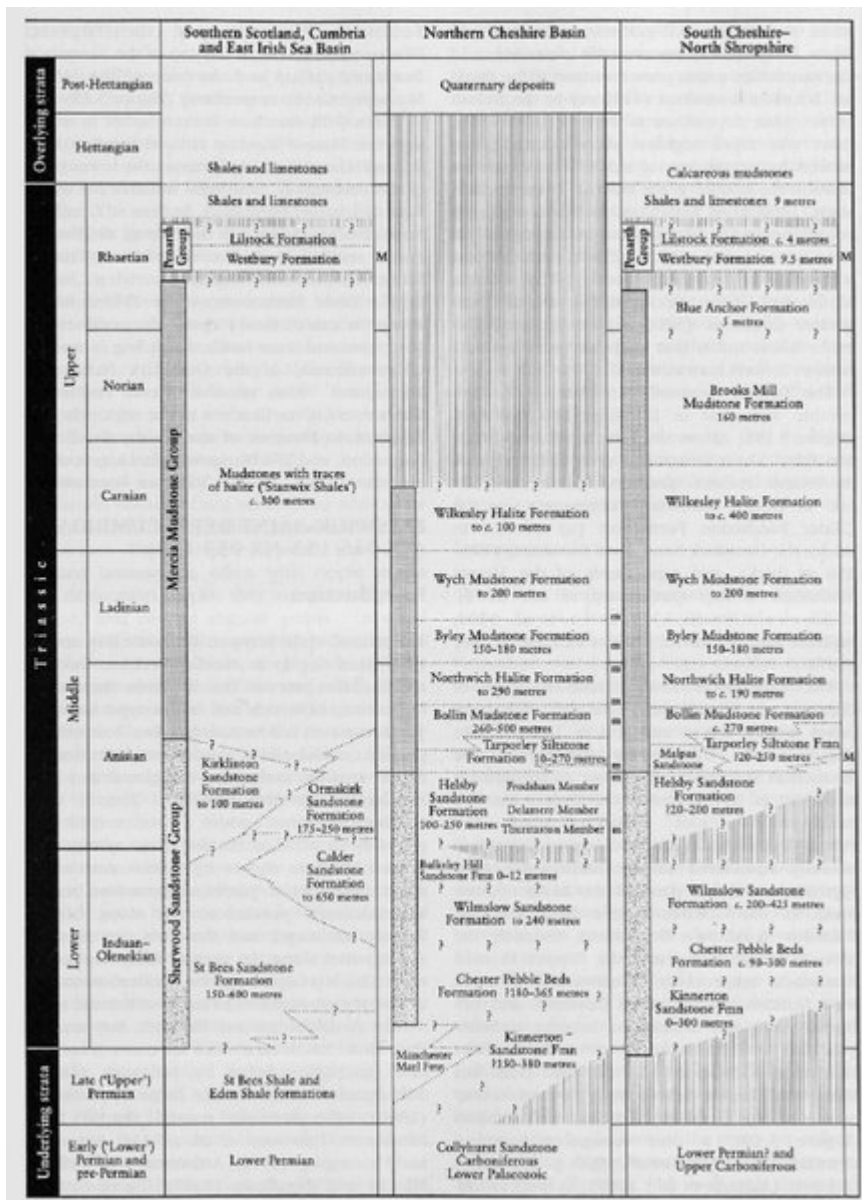
Conclusions

The Wilmslow, Bulkeley Hill, and Helsby sandstone formations at Bickerton Hill show an excellent succession through fluvial, mixed aeolian and fluvial, and high-energy fluvial depositional systems respectively. The change from relatively slow, low-energy deposition systems to the high-energy one of the Helsby Sandstone Formation occurs at a boundary that is interrupted as an unconformity that reflects a phase of uplift and enhanced erosion and may be the local expression of the Europe-wide Hardeggen Unconformity. In addition, complex mineralization occurs in sandstones adjacent to the faults. This is an important site for understanding regional-scale basin and international-scale palaeogeographical evolution during the Early to Mid Triassic epochs.

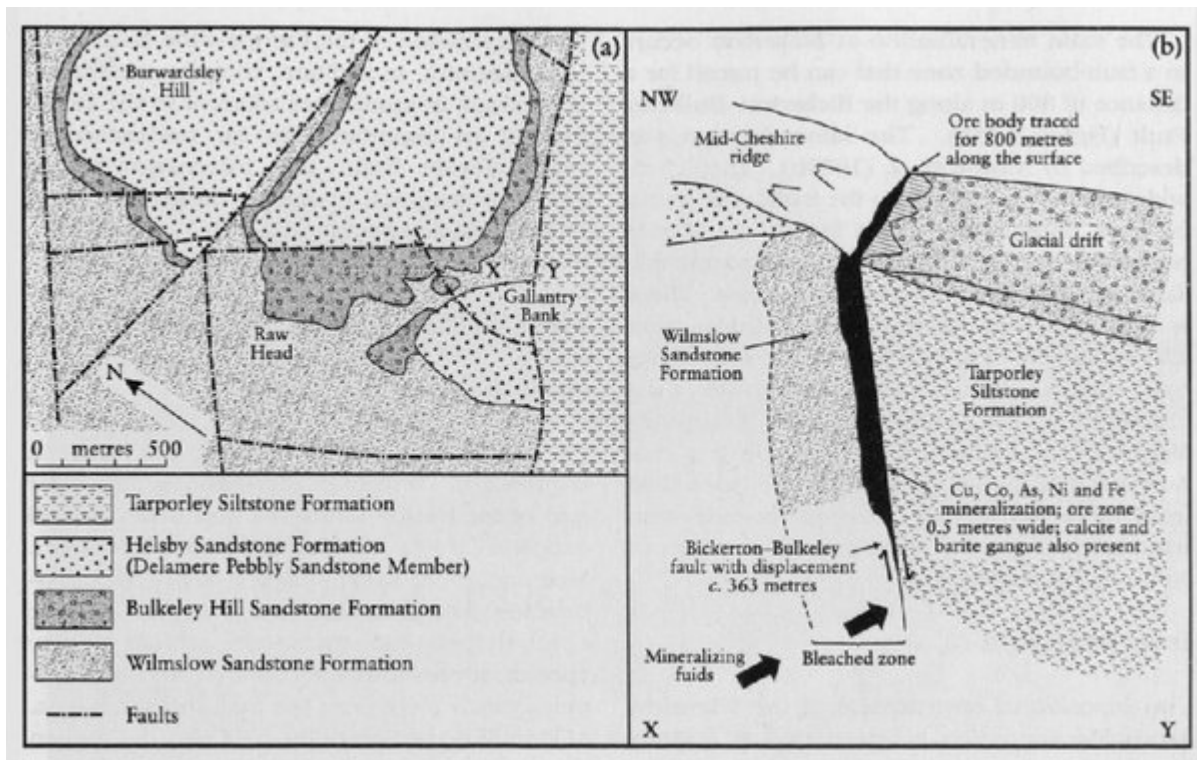
References



(Figure 3.34) West side of the Peckforton Hills, looking north, as shown in a classic view by Hull (1869).



(Figure 3.19) Stratigraphical columns for the Triassic successions of southern Scotland and Cumbria, and the East Irish Sea and Cheshire Basin areas. M, macrofossils; m, microfossils. Based on Warrington et al. (1980), Jackson et al. (1987), Wilson (1993) and Ivimey-Cook et al. (1995), Jackson and Johnson (1996), Akhurst et al. (1997) and Warrington (199713).



(Figure 3.35) The geology of Bickerton Hill; (a) a map of the outcrop of the main divisions of the Triassic System; (b) cross-section (X–Y), showing the faulted contact of the Wilmslow Sandstone Formation and the Tarporley Siltstone Formation, with associated mineralization. (From Naylor et al., 1989b.)