The Triassic red beds of the Cheshire Basin

Introduction

The Cheshire Basin is represented by a large area of outcrop (Figure 3.31)a of continental deposits, where up to 3000 m of sediment accumulated during the Triassic Period (Evans *et al.,* 1993; Plant *et al.,* 1999). In the northern part of the basin, the sequences terminate with Mercia Mudstone Group units of Mid Triassic age, whereas, farther south, higher beds are preserved and the successions continue through the Late Triassic Epoch, and include red mudstones of the classic 'Keuper Marl', overlain by the Blue Anchor Formation, which is succeeded by the Penarth Group. The Cheshire Basin was fault-controlled, subsiding against the Wem–Red Rock fault system (Figure 3.31)b to the SSE. Individual units are thicker in the north, but the succession there has been truncated by erosion of the higher beds.

The stratigraphical succession in most of the Cheshire Basin has already been encountered in the Cumbria–East Irish Sea Basin area (see above; (Figure 3.19)). The transitional Permo-Triassic Kinnerton Sandstone Member of the Wirral and the Manchester Marl Formation of the north-east Cheshire Basin are absent farther south. The Chester Pebble Beds Formation is, however, widespread, as is the overlying Wilmslow Sandstone Formation. In the west of the Cheshire Basin, there is a passage from the Wilmslow Sandstone Formation into the locally developed Bulkeley Hill Sandstone Formation. The highest unit in the Sherwood Sandstone Group in the Cheshire Basin is the Helsby Sandstone Formation, which has been divided into members (Thompson, 1970b; Warrington and Thompson, 1971; Warrington *et al.,* 1980).

Borehole data and seismic surveys have indicated that a major unconformity, probably equivalent to the Europe-wide Hardegsen Unconformity, occurs within the Helsby Sandstone Formation (Evans *et al.,* 1993). This unconformity lies above the Bulkeley Hill Sandstone Formation, which has only local distribution (Figure 3.31)b, and below the Helsby Sandstone Formation. Tectonic activity on the major fault system may have declined at this time, and the overall rate of accumulation of sediment diminished, with sedimentation styles switching from dominantly arenaceous to a mix of argillaceous and evaporitic units.

The lowest unit of the Mercia Mudstone Group is the Tarporley Siltstone Formation, formerly called the 'Waterstones', which overlies the Helsby Sandstone Formation. Then follows a succession of mudstones, with major halite units interbedded, the Northwich Halite Formation, up to 290 m thick, and the Wilkesley Halite Formation, up to 405 m thick (Wilson, 1990, 1993). Warrington *et al.* (1980) did not name the Mercia Mudstone Group mudstones in the Cheshire Basin, but Wilson (1993) has since termed the mudstone between the Tarporley Siltstone and Northwich Halite formations, the 'Bain Mudstone Formation', and that between the two named halite formations the 'Byley' and the 'Wych' mudstone formations. The Wilkesley Halite Formation is succeeded by the Brooks Mill Mudstone Formation (see (Figure 3.19)).

Biostratigraphical control of the Triassic succession in the Cheshire Basin is patchy. The position of the Permian-Triassic boundary is poorly constrained; it lies above the Manchester Marl Formation that has yielded Permian fossils (Pattison *et al.,* 1973; Warrington *et al.,* 1980, p. 31), and below the Helsby Sandstone Formation, which has yielded Anisian (Mid Triassic) miospores (Warrington, 1967, 1970a,b; Warrington *et al.,* 1999). The intervening Chester Pebble Beds, Wilmslow Sandstone, and Bulkeley Hill Sandstone formations do not contain fossils, but the Chester Pebble Beds are conventionally regarded as Triassic in age. The reptile *Rhynchosaurus* from the Helsby Sandstone and Tarporley Siltstone formations of Grinshill, north Shropshire, is also Mid Triassic, probably Anisian, in age, by comparison with independently dated reptile faunas from the Midlands (Warrington *et al.,* 1980, p. 33; Benton *et al.,* 1994). Isolated palynological samples from the Mercia Mudstone Group have allowed some dating, and suggest that the Northwich Halite Formation is late Anisian in age, the Wilkesley Halite Formation, perhaps Carnian (Warrington *et al.,* 1980, p. 34).

Formations of the Sherwood Sandstone Group are exposed at so many localities in the Cheshire Basin that it was hard to make a selection for the GCR. The Mercia Mudstone Group is much less well exposed. Five proposed GCR sites were chosen with the intention of documenting the lower parts of the Triassic succession, and of showing the key

sedimentological and palaeontological evidence for palaeoenvironments. The five sites are, in approximate stratigraphical order, in the northern and central Cheshire Basin: Dee Cliffs (Chester Pebble Beds Formation); Bickerton Hill (Wilmslow, Bulkeley Hill, and Helsby sandstone formations); Frodsham (Frodsham Member of the Helsby Sandstone Formation); Red Brow Cutting (Tarporley Siltstone Formation); and in the southern Cheshire Basin: Grinshill (Helsby Sandstone and Tarporley Siltstone formations).

Dee Cliffs section, Cheshire

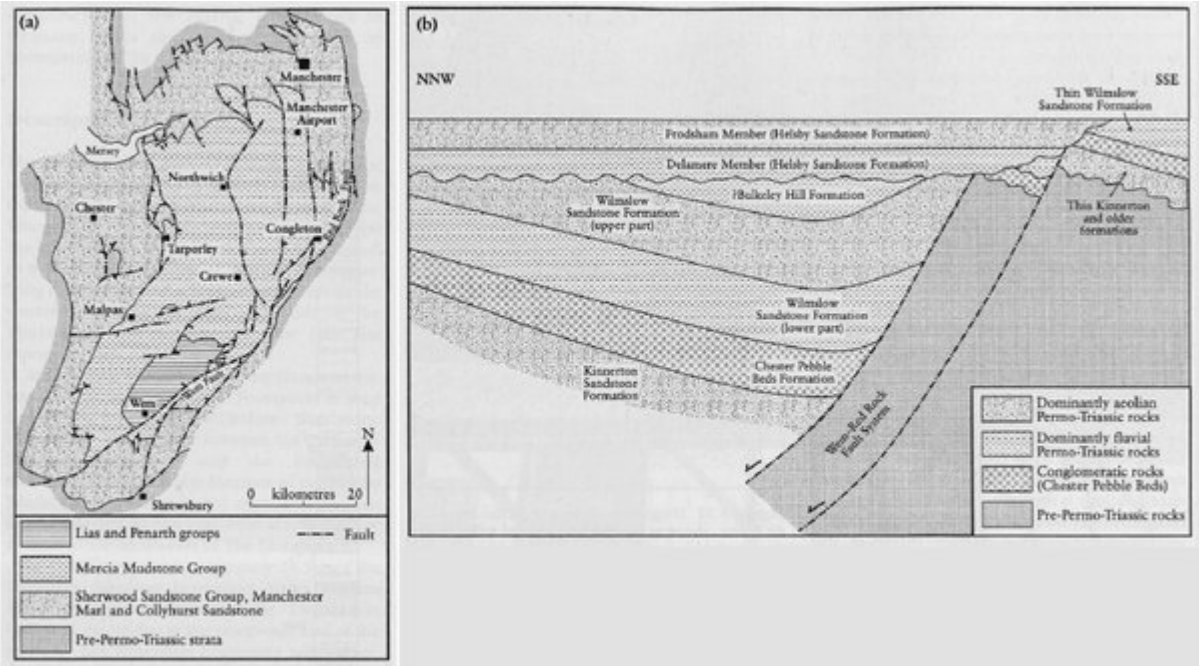
Bickerton Hill, Cheshire

Frodsham, Cheshire

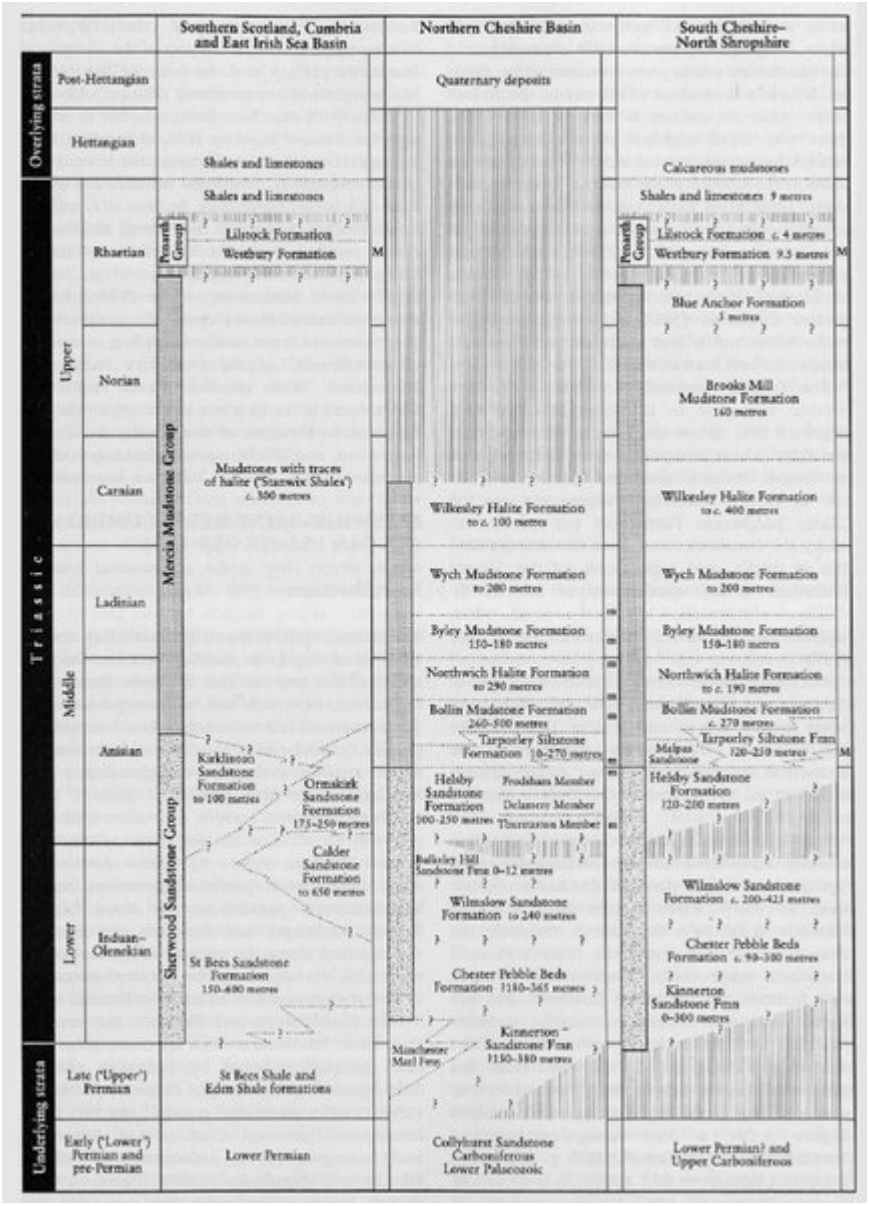
Red Brow Cutting, Cheshire

Grinshill Quarries, Shropshire

References



(Figure 3.31) a The geology of the Cheshire Basin, shown as a simplified geological map. See also Figure 3.31b. The key feature is the Wem-Red Rock fault system to the east, and major subsidence against that system during deposition of the Triassic successions. This explains why the sequences are thicker in the east and south-east than in the hinge zone to the north-west. Based on Wilson (1993), Evans et al. (1993), and Plant et al. (1999). b The geology of the Cheshire Basin, shown as a schematic cross-section. Based on Wilson (1993), Evans et al. (1993), and Plant et al. (1999).



(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).