
The Triassic red beds of the western margin of the North Sea Basin

Introduction

The Triassic succession in the Southern North Sea Basin (SNSB), revealed by hydrocarbon exploration, has aided correlation between the British Triassic succession and the classic German Triassic sequence. The stratigraphy of the offshore sections, taken from many bore-holes and from seismic sections, has been summarized by many authors, including Kent (1967, 1975), Geiger and Hopping (1968), Balchin and Ridd (1970), Rhys (1974), Warrington (1974c), Warrington *et al.* (1980), Lott and Warrington (1988), Cameron *et al.* (1992), and Johnson *et al.* (1994). There is a close lithostratigraphical link between the offshore North Sea sections and parts of that seen onshore in eastern England. The Triassic succession in eastern England differs from that seen in the Cheshire Basin not least because the two areas were separated by the Pennine Chain.

Sequences are thicker in the north and east of the region, in Yorkshire and Lincolnshire, and thinner in Nottinghamshire, which was closer to the basin margin and to the upland sources of sediment. Some of the best exposures are in Nottinghamshire.

In central Nottinghamshire, and in parts of Leicestershire, there is a relatively complete Triassic sequence; an unconformity occurs between the Sherwood Sandstone and Mercia Mudstone groups, and a minor break in sedimentation may have occurred between the deposition of the Mercia Mudstone and Penarth groups (Figure 3.45). There is no objective palaeontological evidence for the location of the Permo-Triassic boundary, either in eastern England or in the SNSB

(Warrington *et al.*, 1980, p. 50). In the SNSB, the base of the Triassic System is arbitrarily located at the base of the Brockelschiefer, which overlies Permian deposits of the Zechstein succession (Rhys, 1974; Johnson *et al.*, 1994). To the west, the Brockelschiefer passes laterally into the Bunter Shale Formation (Figure 3.45) through the Saliferous Marls and the Permian Upper Marls, which are partly Permian and partly Triassic in age (Figure 3.46). The Sherwood Sandstone and Mercia Mudstone groups are broadly equivalent to the Bacton and Haisborough groups respectively of the offshore succession (Rhys, 1974).

In Nottinghamshire, Sherwood Sandstone Group deposition probably began in Late Permian times and terminated during the Early Triassic Epoch. The group comprises the Lenton Sandstone Formation, formerly the 'Lower Mottled Sandstones', and the Nottingham Castle Formation, formerly the 'Bunter Pebble Beds' (Figure 3.45). These units comprise some 100 m of sandstones and conglomerates deposited on the western edge of the SNSB; they thin westwards and thicken eastwards into the basin. The sediments were deposited in high-gradient, braided channel systems that flowed down major incised valleys into the area of deposition. Palaeocurrent directions indicate sediment transport from the Pennine upland to the southwest and west. The predominant depositional environment represented by the Sherwood Sandstone Group around Nottingham is alluvial fans. The sandstones show evidence of cyclicity, with cycles terminated by channel migration. Rarely, palaeosols, ventifact horizons, mudstones, and mud intraclasts are seen at the tops of cycles (Swinnerton, 1914; Taylor, 1968); these reflect low-energy overbank deposition and aeolian processes, but have been mostly removed by subsequent channel migration.

The Mercia Mudstone Group rests unconformably on the Sherwood Sandstone Group (Figure 3.45). The succession was divided by Elliott (1961) into nine formations, which were formalized by Warrington *et al.* (1980, pp. 51–2), and further modified by Charsley *et al.* (1990). The thin Retford Formation, formerly the 'Green Beds', passes southwards into the Sneinton Formation, formerly the 'Waterstones', both of them dominated by mudstones, and north and eastwards into largely undifferentiated Mercia Mudstone Group sediments (Smith and Warrington, 1971). The Sneinton Formation contains pseudomorphs after halite (Elliott, 1961), and has yielded the brachiopod *Lingula* and a fish fauna, signifying marine conditions at this level. The succeeding Radcliffe Formation contains dolomitic units that have been traced on borehole and seismic evidence across eastern England and to the southern North Sea, where they are evidently equivalent in part to the Dowsing Formation and the Muschelkalk equivalent (Figure 3.45); Rhys, 1974; Warrington *et al.*,

1980, p. 52; Johnson *et al.*, 1994). The remainder of the Mercia Mudstone Group succession comprises the Gunthorpe, Edwalton, Cropwell Bishop, and Blue Anchor formations, and is succeeded by the Penarth Group (Charsley *et al.*, 1990).

Dating of the Nottingham sequence has been attempted using macrofossils, such as the fish fauna from the Sneinton Formation, as well as trace fossils, and sporadic arthropods, but these offer only general information on age (Warrington *et al.*, 1980, pp. 52–3). More useful are palynomorphs (Smith and Warrington, 1971) recovered from several levels, and borehole geophysical logs and seismic surveys (Balchin and Ridd, 1970) in which regional markers have been identified.

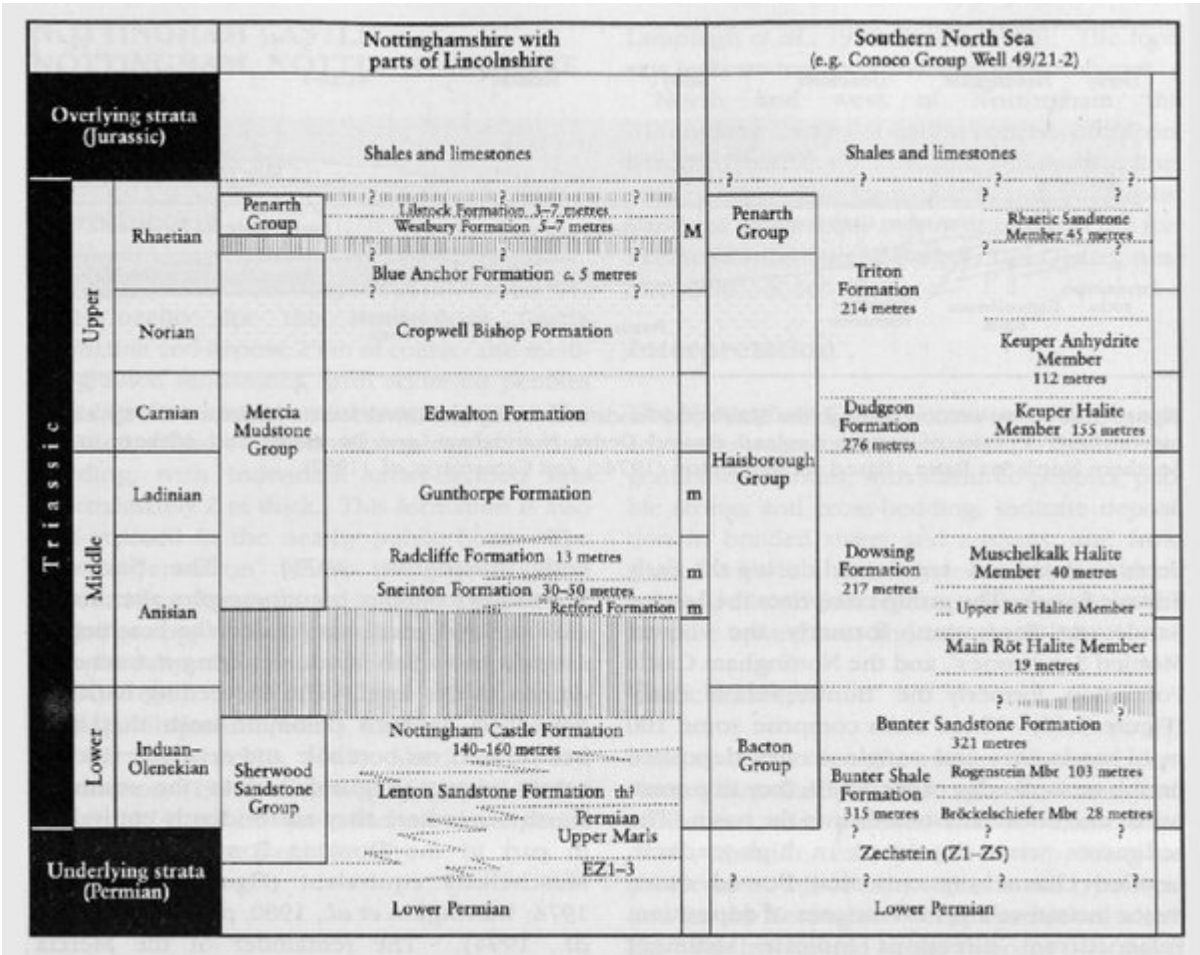
Among the exposures of the SNSB Triassic succession in eastern England considered for selection for the GCR, four locations near Nottingham were chosen, Nottingham Castle, Styrrup Quarry, and Scrooby Top Quarry for their superb exposures of the Nottingham Castle Formation, and Colwick railway section for the Sneinton Formation at the base of the Mercia Mudstone Group.

[Nottingham Castle, Nottingham, Nottinghamshire](#)

[Styrrup Quarry, Nottinghamshire](#)

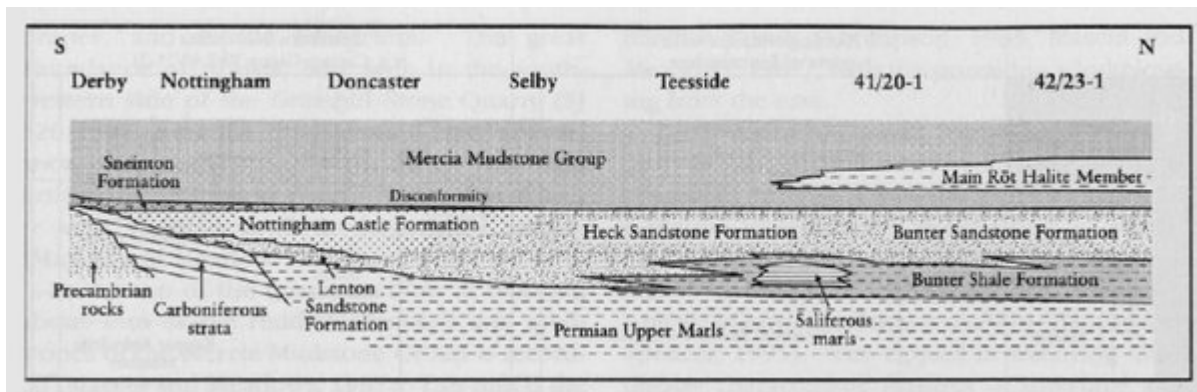
[Scrooby Top Quarry, Nottinghamshire](#)

[Colwick railway section, Nottinghamshire](#)



References

(Figure 3.45) Stratigraphical columns for the Triassic of central Nottinghamshire and for the southern North Sea. Based on Warrington *et al.* (1980), Cameron *et al.* (1992), and Johnson *et al.* (1994).



(Figure 3.46) Cross-section through the Sherwood Sandstone Group and lower Mercia Mudstone Group, showing onshore deposits of eastern England around Derby, Nottingham, and Doncaster, and offshore in the Southern North Sea Basin. Based on Warrington (1974c) and Cameron et al. (1992).