Burton Point, The Wirral, Cheshire

[SJ 303 735]

Potential GCR site

Introduction

The cliffs at Burton Point provide a section through the contact between the Kinnerton Sandstone Formation and the overlying Chester Pebble Beds Formation. The former comprises cross-bedded, medium- to coarse-grained sandstone and thinly bedded siltstones, interpreted as deposited both in ephemeral channels and by aeolian processes. The overlying Chester Pebble Beds Formation comprises pebbly sandstones, arranged in fining-upwards sequences, deposited in a series of sandy, braided, river channels. The site provides the best exposure of the Permo-Triassic Kinnerton Sandstone Formation, and its contact with the Chester Pebble Beds Formation.

The geology of the Triassic rocks of the Wirral area has been documented by Hull (1869, pp. 39–40), Morton (1891), Wedd *et al.* (1923), Rice (1939a,b), Thompson (1970b, 1985), Somerville *et al.* (1986), Macchi and Meadows (1987), and Jackson and Mulholland (1993).

Description

Burton Point is located on the western side of the Wirral Peninsula, close to the town of Neston, near the head of the Dee Estuary. The sediments are exposed in a series of low cliffs that border salt marshes.

The Kinnerton Sandstone Formation, formerly the 'Lower Mottled Sandstone', is a thick sequence (150–300 m) of sandstones that has not been subdivided (Warrington *et al.,* 1980). On the Wirral Peninsula, this formation comprises slightly gritty and arenaceous sandstones. Pebbles are uncommon in the formation, although there are intraformational mudstone rip-up clast layers, for example near the top (Thompson, 1986; Macchi and Meadows, 1987).

The sandstones are arranged in a series of cross-bedded and planar-bedded units (Figure 3.23). Although the cross-bedding is generally small-scale, there is evidence for bar-scale bed-forms. One cross-bedded sandstone unit has been distorted by a slumping event, producing an excellent example of contorted bedding (Figure 3.24)a. The planar-bedded units are characterized by irregular surfaces, and grain size varies between laminae on a scale of millimetres or centimetres. Rarely, the sandstones occur as thin sheets that have a bi-modal grain■ size distribution. Small-scale bedforms are associated with this facies, including fining-upwards sequences and rippled surfaces (Macchi and Meadows, 1987).

The boundary between the Kinnerton Sandstone Formation and the overlying Chester Pebble Beds Formation is clearly marked by the appearance of pebbles in the sequence (Figure 3.24)b. Hull (1869, p. 39) described the contact, and how he measured some 130 m of pebble beds above the contact. The Chester Pebble Beds Formation is characterized by coarse-grained sediments in cross-bedded sets up to 2.5 m thick. Fining-upwards sequences are common, and many have coarse-grained pebble lags at the base, often resting on an erosion surface. The sandstones are generally coarse- and medium-grained, although there are some finer-grained beds. The finer-grained units are generally associated with small-scale cross-bedding. Coarse units contain abundant intraformational and extraformational pebbles, often arranged in large lenses. Most of the pebbles are vein quartz or fragments of volcanic rock; reworked intra-formational mudstones are present, but uncommon (Wedd *et al.,* 1923; Macchi and Meadows, 1987).

Interpretation

The sedimentary succession at Burton Point documents a change in terrestrial depositional conditions in an overall arid or semi-arid climatic regime. The Kinnerton Sandstone Formation shows several depositional styles. Planar

cross-stratified sediments, representing fluvial conditions, are frequently overlain by trough cross-bedding, features interpreted as produced by the falling stage of a flood. The planar-bedded sandstones and rare ripple clasts are not associated with channel structures, suggesting that these sediments were deposited by sheet floods (Figure 3.23). Together, the sheetflood sediments and cross-bedded channel sediments suggest that the Kinnerton Sandstone Formation was deposited in a series of ephemeral braided channels. The contorted bedding and slump structures indicate that the sediments accumulated close to the water table (Macchi and Meadows, 1987). It has been suggested that the cross-bedding might have an aeolian origin: the grains often have the well-rounded outline and frosted surfaces characteristic of aeolian deposition. There are also a number of thin bi-modally laminated sheet sandstones that have wavy lamination and adhesion structures characteristic of damp aeolian interdune deposits However, it is possible that many of the aeolian sediments were reworked by fluvial processes (Macchi and Meadows, 1987).

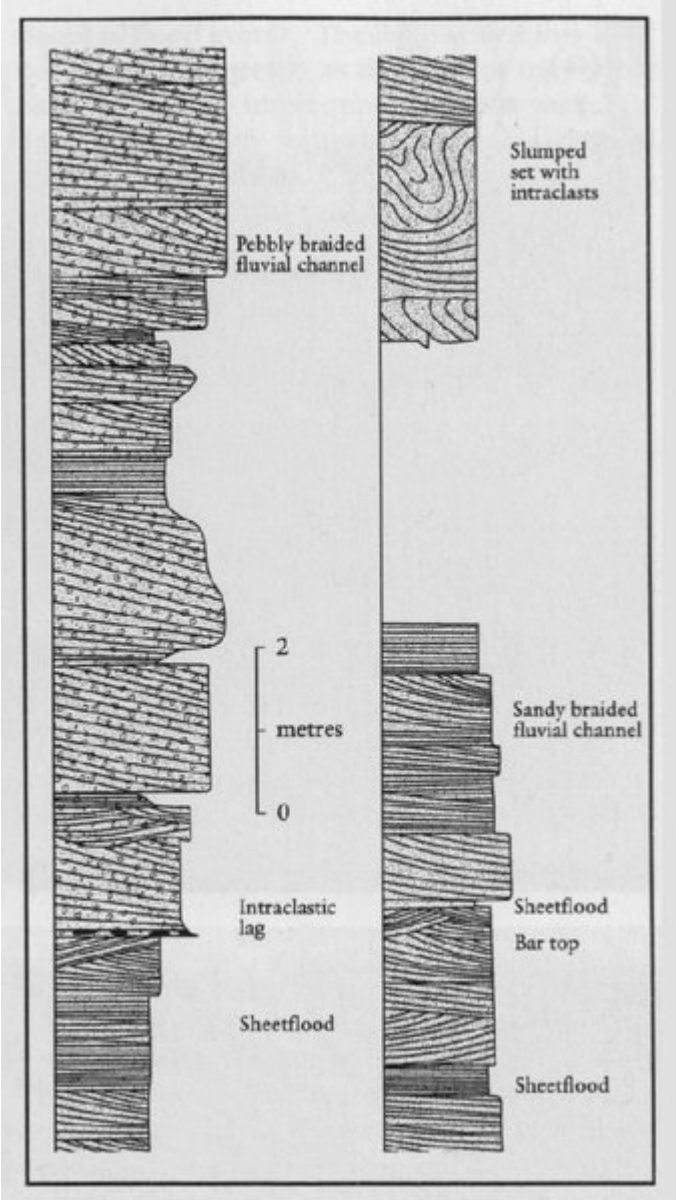
The Chester Pebble Beds Formation was deposited in higher-energy conditions. The fining-upwards sequences represent the falling stages of flood events. The large-scale cross-bedded units, interpreted as deposits of transverse bars, frequently interconnect, which makes it difficult to identify individual channels. Small-scale cross-bedding represents bedforms emplaced on the top of bars and in interbar areas. Together, these features indicate a complex pattern of braided channels (Macchi and Meadows, 1987).

The age of the Kinnerton Sandstone Formation is not clearly defined (Thompson, 1986), having been placed in the Permian by Smith *et al.* (1974) and spanning the Permian-Triassic boundary by Warrington *et al.* (1980). It probably interfingers laterally with the Manchester Marl Formation, which has yielded late Permian fossils. The overlying Chester Pebble Beds Formation lacks fossils, but is overlain successively, in the Cheshire Basin, by the Wilmslow Sandstone Formation, and the Helsby Sandstone Formation; the latter contains miospores indicative of a Mid Triassic, Anisian, age (Warrington *et al.,* 1999).

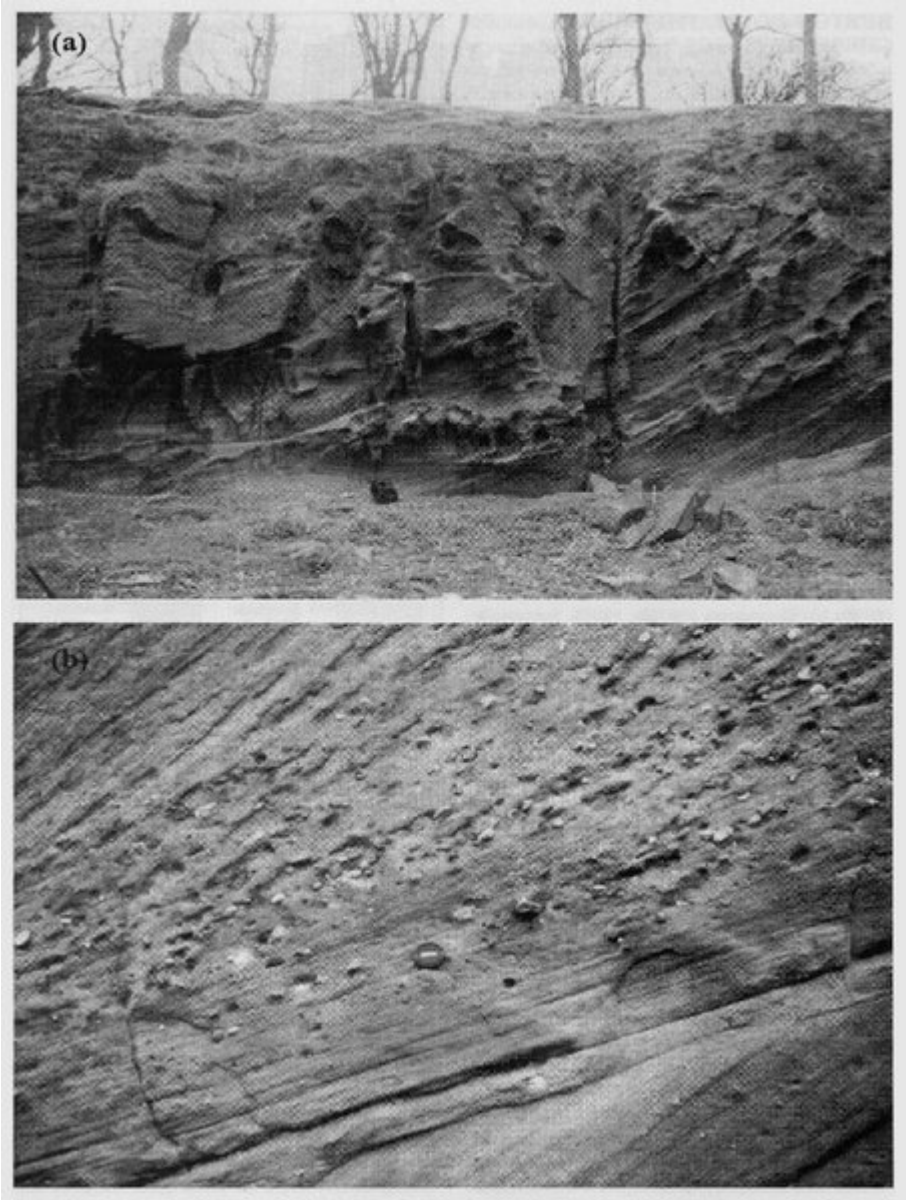
Conclusions

The succession exposed at Burton Point includes the Kinnerton Sandstone and the Chester Pebble Beds formations, and is considered to span the Permian-Triassic boundary. The Kinnerton Sandstone Formation is fine grained and shows cross-bedding and planar bedding; it is interpreted as the deposit of an ephemeral braided river system that transported largely reworked aeolian sand. The Chester Pebble Bed Formation sediments are coarse-grained, cross-bedded and arranged in fining-upwards sequences. These sediments were deposited in braided river channels. This is the best site for the study of the presumed Permian-Triassic transition and the Chester Pebble Beds Formation on the margins of the East Irish Sea Basin.

References



(Figure 3.23) Two sedimentary logs through the Kinnerton Sandstone Formation, recorded at two localities at Burton Point, showing a mix of fluvial styles. (After Macchi and Meadows, 1987.)



(Figure 3.24) (a) Cross-bedded units in the Kinnerton Sandstone Formation at Burton Point, with major syn-sedimentary slumping. (b) Pebbly sandstones with large-scale planar-tabular cross-bedding in the lower part of the Chester Pebble Beds Formation. (Photos: P Turner.)