Rogerley Quarry, County Durham

[NZ 019 375]–[NZ 022 373]

Introduction

The Rogerley Quarry GCR site lies 2 km west of Frosterley and close to the A689 between Stanhope and Wolsingham (Weardale). This disused quarry [NZ 019 375] provides an outstanding section of the clastic intervals associated with the development of the Great Limestone Cyclothem towards the southern margin of the Alston Block during early Namurian times (Pendleian, E_1). The site is also extremely valuable in understanding the complexities of fluvio-deltaic sedimentation during Pendleian times and it includes a spectacular profile through an ancient river channel, one of the finest of its kind in Britain. The account that follows is based largely on the definitive sedimentological work of Elliot (1973; 1974a,b; 1975; 1976b; 1986) and its re-evaluation by Hodge and Dunham (1991).

Description

The principal interest lies in the 20 m-thick clastic interval exposed between the top of the Great Limestone and the base of the Little Limestone (Figure 4.17). The sequence was described in detail by Elliot (1975, 1976b) who interpreted it as part of a delta lobe extending for 700 km^2 across the Alston Block (Figure 4.18) with a complex development history marked by phases of progradation, abandonment and post-abandonment.

Immediately overlying the Great Limestone, the progradational phase includes two thin (4.5 m) coarsening-upward sequences (interdistributary bay deposits) overlain by a thicker (10 m) fining-upward sequence (Figure 4.17)a deposited by a large meandering distributary channel. A prominent erosion surface at the base of the palaeochannel cuts down through the interdistributary bay deposits to within a metre of the top of the Great Limestone (Figure 4.17)a,b. The quarry face lies at right angles to the palaeochannel axis such that distinctive lateral changes within the channel fill may be viewed in profile along its length. The channel-fill includes at its base a conglomeratic lag deposit with mud-flakes scoured from the underlying beds, and is succeeded by trough cross-stratified, coarse sandstones (with a palaeoflow to the south or south-east) that grade upward into parallel-bedded sandstones. These are capped by a finer member of interbedded current ripple-Laminated sandstones and siltstones containing a few rootlets and the in-situ remains of *Stigmaria* root systems. Individual beds within the coarse member thicken towards the south-east and are separated by sigmoidal bedding planes with a depositional dip of approximately 5° in the same direction.

Considering their orientation with respect to the palaeoflow, Elliot (1976b) regarded these gently dipping planes as lateral accretion surfaces resulting from the sideways migration of point-bar deposits towards the channel axis.

Above this, a prominent coal seam extending across the top of both the channel and interdistributary bay deposits marks the end of the progradational phase and the onset of lobe abandonment (Figure 4.17)a. A similar but thinner 'abandonment' coal separates the two coarsening-upward sequences of the progradational phase. Higher in the succession are two further coarsening-upward units of the post-abandonment phase. The lower of these (3 m) includes mudstones, siltstones and sandstones with low-amplitude symmetrical ripples, flat laminations and current-ripple laminations overlain by a marine band containing brachiopods, crinoids, bryozoans and gastropods. A similar suite of lithologies occurs in the overlying unit (7 m) where, in the coarser lithofacies, trough cross-bedded sands with a palaeoflow to the north-east are succeeded by rootlet horizons and a marine band with pectenoid bivalves and crinoids (Figure 4.17)b.

Interpretation

Elliot (1975) suggested that the coarsening-upward profiles of the progradational phase were the product of levees, crevasse-splay lobes and minor sand spits that coalesced to form sand-sheets in an interdistributary bay area and part of a delta lobe that extended from Stanhope (2 km north-west of the quarry) to Stainmore (near Ravenstonedale) (Figure 4.18). As the delta prograded, a distributary channel became established across the delta top and cut an erosive path through the earlier-formed interdistributary bay deposits. Careful observation of the lateral accretion surfaces (epsilon cross-stratification) within the channel-fill sequence enabled Elliot (1976b) to determine the depth of the palaeochannel (7.5 m), its width (120 m), sediment discharge rates (100 m^3s^{-1}), meander belt width (1500 m) and meander wavelength (1370 m).

Isopach data for beds between the Great Limestone and Little Limestone provided by Hodge and Dunham (1991) indicate that this channel was the first of four branch channels issuing from a much larger distributary — the Allercleugh Channel' (comparable in size to the modern Mississippi) — which was the principal feeder channel to the Stanhope–Stainmore delta lobe, and which extended from Hexham in the Northumberland Basin, in a south-westerly direction, possibly as far as Baugh Fell on the Askrigg Block (Figure 4.18). Following channel development, marshes became established over the delta top forming coal as the delta lobe was abandoned. Subsequently a marine incursion introduced coastal-bay and barrier-island sediments over the top of the delta lobe as it subsided during the post-abandonment phase of development (Elliot, 1974a, 1975). While accepting much of the sedimentological detail in Elliot's (1975) work, the continuity and geographical limits of his delta lobes were questioned by Dunham (1990) and Hodge and Dunham (1991) because of conflicts with established correlations across the Alston Block.

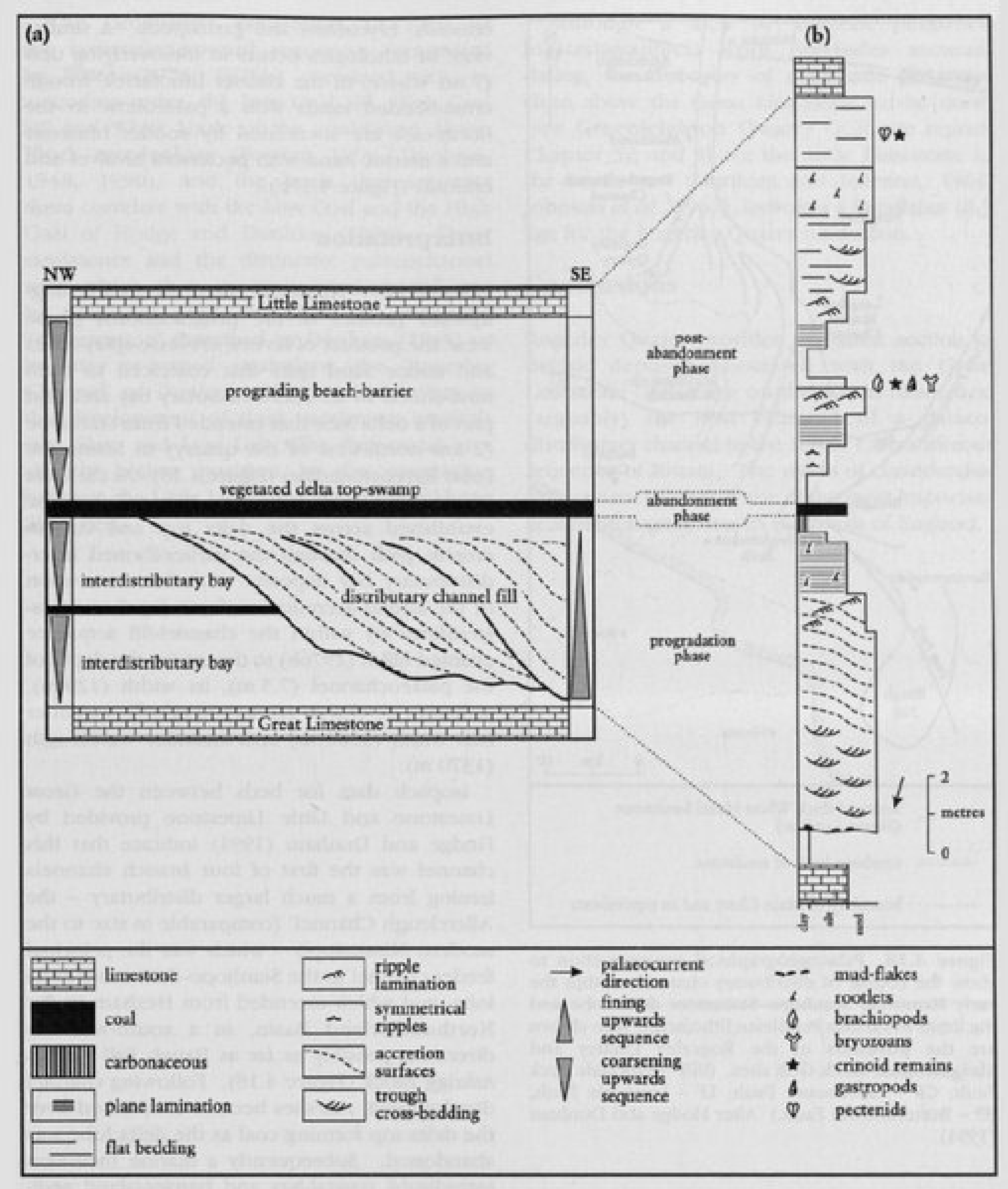
The prominent sandstones in each of the coarsening-upward sequences recognized by Elliot (1975, 1976b) correlate with, in ascending order, the Low Coal Sill, High Coal Sill and White Hazle of the established Alston Block terminology (Forster, 1809; Dunham, 1948, 1990), and the coals that separate them correlate with the Low Coal and the High Coal of Hodge and Dunham (1991). These sandstones and the distinctive palaeochannel with which they are associated should not be confused with those of the 'Rogerley Transgression' described by Dunham (1948) or its later re-named equivalent, the 'Rogerley Channel' of Dunham (1990), which relate to the development of thick sandstone intervals (the Slate and Low Grit sills) that occur at a slightly higher position in the succession between the Little Limestone and the Rookhope Shell Bed.

Although a lack of modern published biostratigraphical work precludes accurate dating, the discovery of diagnostic goniatites close above the Great Limestone to the north (*see* Greenleighton Quarry GCR site report, Chapter 3), and above the Little Limestone to the north-west (Dunham and Johnson, 1962; Johnson *et al.,* 1962), indicates a Pendleian (E_l) age for the Rogerley Quarry succession.

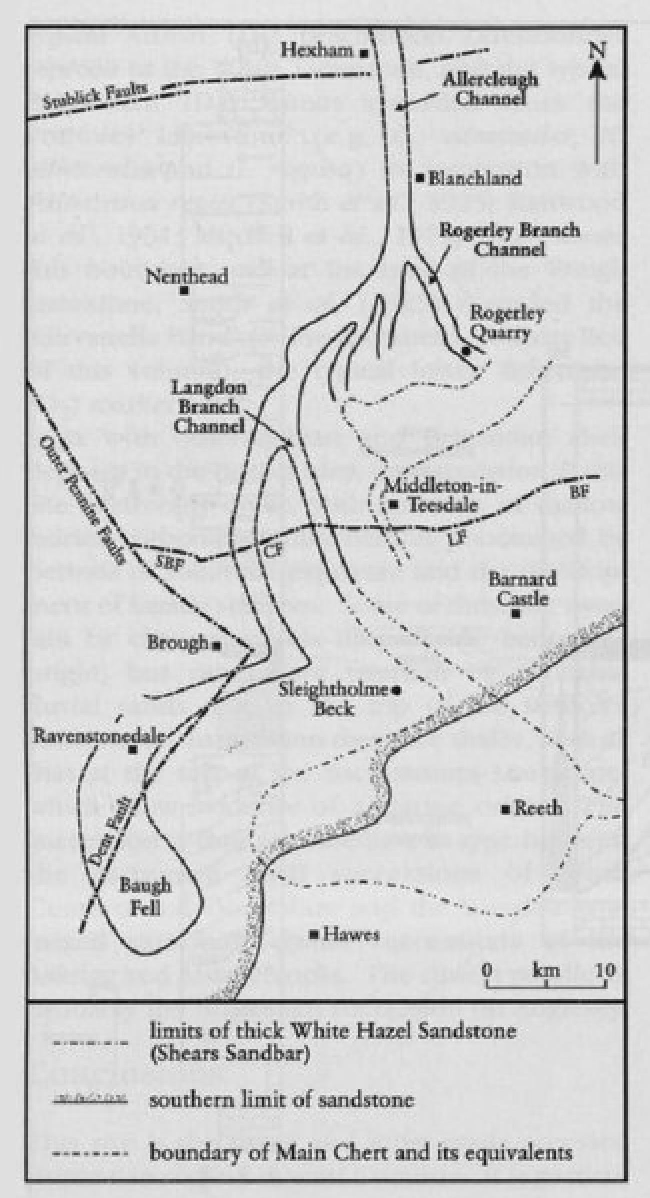
Conclusions

Rogerley Quarry provides the finest section of deltaic deposits associated with the Great Limestone Cyclothem on the Alston Block, and (arguably) the best example of a palaeodistributary channel in the Lower Carboniferous sequence of Britain. The site is of considerable educational value and one of the most important sedimentological sites in the north of England.

References



(Figure 4.17) (a) Interpretation of the palaeoenvironments represented within the Great Limestone Cyclothem (Pendleian) in the vicinity of Rogerley Quarry, and (b) simplified sedimentary log of the Rogerley Quarry succession. After Elliot (1975, 1976b).



(Figure 4.18) Palaeogeographical reconstruction to show the course of distributary channels within the early Namurian Stanhope–Stainmore delta lobe and the limits of various Pendleian lithofacies. Also shown are the positions of the Rogerley Quarry and Sleightholme Beck GCR sites. (SBF — Swindale Beck Fault; CF — Closehouse Fault; LF — Lunedale Fault; BF — Butterknowle Fault.) After Hodge and Dunham (1991).