Hambleton Quarry, North Yorkshire

[SE 058 533]

Introduction

The Hambleton Quarry GCR site is a disused quarry [SE 058 533] which lies adjacent to the Embsay and Bolton Abbey Steam Railway, 300 m west of Bolton Abbey Station and 6 km east of Skipton. The section includes arguably the finest section of the Asbian Draughton Limestone (= Pendleside Limestone Formation of Riley, 1990a) and Draughton Shales in the Craven Basin (Figure 6.2); here displayed in a spectacular series of minor fold structures (Figure 6.23) on the south-eastern flank of the Skipton Anticline (Figure 6.1). Exposures of the slightly older Skibeden Shales with Limestones (= topmost part of the Worston Shale Group of Riley, 1990a) also occur at the site. The succession incorporates a variety of relatively deep-water sedimentary features including turbidites and storm deposits which bear testament to a period of crustal instability towards the end of Dinantian times. It also includes a varied suite of largely derived macrofossils and microfossils.

Details of the stratigraphy and macrofossil distributions were first published by Hudson and Mitchell (1937). Later work focused attention on the distribution of two microfossil groups, namely conodonts (Metcalfe, 1976, 1981) and foraminifera (Fewtrell and Smith, 1978), and on sedimentological aspects (Barraclough, 1983). Because of structural complexities on the northern side of the quarry, the description below considers only those outcrops seen on the south side of the quarry where the stratigraphy is more easily recognized.

Description

The Skibeden Shales with Limestones outcrop in a series of discontinuous exposures towards the eastern end of the quarry. A fault separates these outcrops from those of the Draughton Limestone and Draughton Shales seen to the west. The Skibeden Shales with Limestones comprises a sequence (< 10 m) of thick dolomitic mudstones with subordinate silty limestones, the latter containing occasional chlorite 'patches' but few obvious macrofossils (Hudson and Mitchell, 1937).

By contrast, the Draughton Limestone (*c.* 25 m) is a well-bedded turbiditic and conglomeratic limestone unit with minor shale interbeds (Ramsbottom, 1974; Fewtrell and Smith, 1978). Its lower part (*c.* 13 m), referred to by Hudson and Mitchell (1937) as the 'Lower Draughton Limestone' (Figure 6.24) or 'Breccia Beds', is dominated by thickly bedded limestones and contains a derived coral–brachiopod fauna. Taxa recorded from this interval by Hudson and Mitchell (1937) include *Siphonodendron* cf. *martini, Palaeosmilia murchisoni, Rylstonia, Sutherlandia* '*Emmonsia*' *parasitica, Krotovia spinulosa* and *K. aculeata.* The succession includes two distinctive limestone breccia beds containing angular to subrounded clasts of bioclastic limestone up to 30 cm in size (but generally smaller) set in a partially dolomitized limestone matrix (Hudson and Mitchell, 1937). The more prominent of these units (*c.* 2 m thick) at the top of the Lower Draughton Limestone is widely recognized throughout the Craven District as a useful lithostratigraphical marker bed (Figure 6.24). This bed was formally referred to as 'Tiddeman's Breccia' by Hudson and Mitchell (1937) in honour of R.H. Tiddeman who first recorded it and in recognition of his pioneering work in the area (see Tiddeman, 1889, 1891). The higher part of the unit (*c.* 12 m), referred to as the 'Upper Draughton Limestone' (Figure 6.24) or 'Emmonsia Beds' by Hudson and Mitchell (1937), consists of darker, thinner-bedded bioclastic and lithoclastic limestone with minor developments of shale and a 'Zaphrentid phase' fauna.

Above this, the Draughton Shales (*c.* 18 m) comprise a sequence of dark shales with occasional thin limestone interbeds and phosphate nodules. A thin flaggy sandstone capped by approximately 5 m of sandy shale occurs at the base of the unit. Although identifiable macrofossils are rare in these beds, locally they are known to contain bryozoans, goniatites, brachiopods and crinoids (Hudson and Mitchell, 1937).

Despite the dearth of identifiable shelly macrofossils, rich microfaunas are recorded from both the Draughton Limestone and the Draughton Shales at Hambleton by Fewtrell and Smith (1978) and Metcalfe (1981). Rare dendroid graptolites (*Dictyononema kittyae* and *Pseudodictyonema*)from either the 'Skibeden Shales' or the Draughton Limestone also occur at the site (Chapman *et al.,* 1993).

Interpretation

The Skibeden Shales with Limestones were included as part of the Worston Shale Formation by Fewtrell and Smith (1980) — a formation generally regarded as the lateral facies and time equivalent (in part) of Riley's (1990a) newly defined Hodder Mudstone Formation and Worston Shale Group (see (Figure 6.2)). Similarly, the Draughton Limestone is now generally equated with the Pendleside Limestone Formation (Ramsbottom, 1974; Arthurton *et al.*, 1988; Riley, 1990a). Following the work of previous authors (Hudson and Mitchell, 1937; Ramsbottom, 1974; George *et al.,* 1976; Fewtrell and Smith, 1980), the Draughton Shales are considered as a separate unit below the Lower Bowland Shales and, in this account, they are grouped with the Draughton Limestone as part of the Pendleside Limestone Formation (see (Figure 6.2)). Metcalfe (1981), however, regarded them as part of the Lower Bowland Shales.

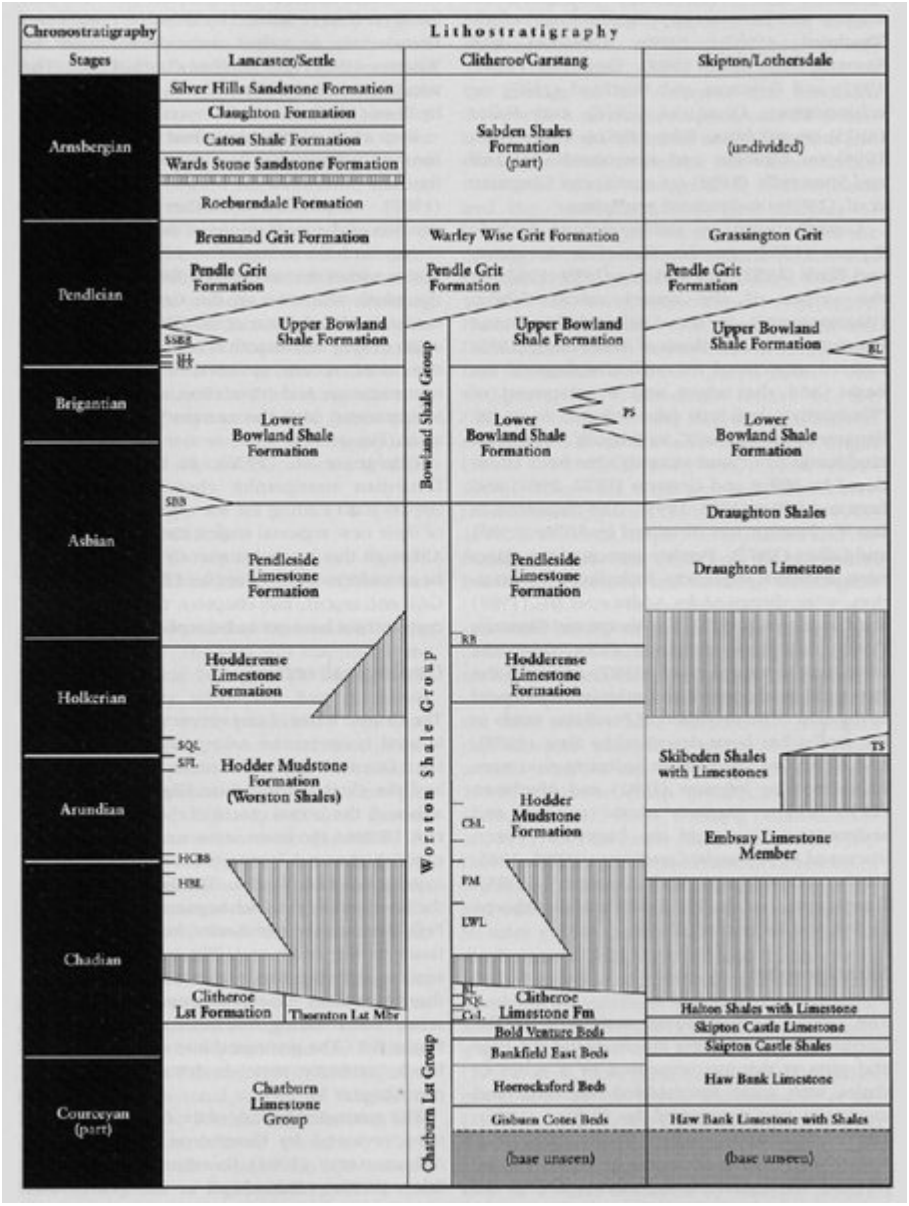
Despite the presence of derived faunal elements in the Draughton Limestone, the Hambleton succession is considered to be of D_1 (Asbian) age (Hudson and Mitchell, 1937; George *et al.,* 1976). This view was later confirmed by the discovery of suspected upper Viséan foraminifera (Fewtrell and Smith, 1978) and Asbian conodonts (Metcalfe, 1981). The base of the *Gnathodus bilineatus* conodont zone (Metcalfe, 1981) lies in the Draughton Limestone at the top of Tiddeman's Breccia (I. Metcalfe, pers. comm., 1978) (see (Figure 6.24)).

The Hambleton succession is interpreted as a relatively deep-water sequence deposited on a southward-dipping carbonate slope during a period of tectonic instability that persisted from Asbian to early Brigantian times. Although the Skibeden Shales with Limestones are thought to represent storm deposits (Barraclough, 1983) that formed immediately prior to this period of instability, the Draughton Limestone most probably developed as a series of turbidite and debris-flow deposits as a direct response to it, these having been triggered by earth movements to the north that simultaneously caused the break up of the Asbian reef limestone complex along the northern margin of the basin (Gawthorpe, 1986, 1987a). The presence of fossils derived from the Cracoe Reef-Belt indicates a northerly derivation for this unit (Ramsbottom, 1974). The Draughton Shales were most probably deposited as hemipelagic sediments following this period of tectonic disturbance.

Conclusions

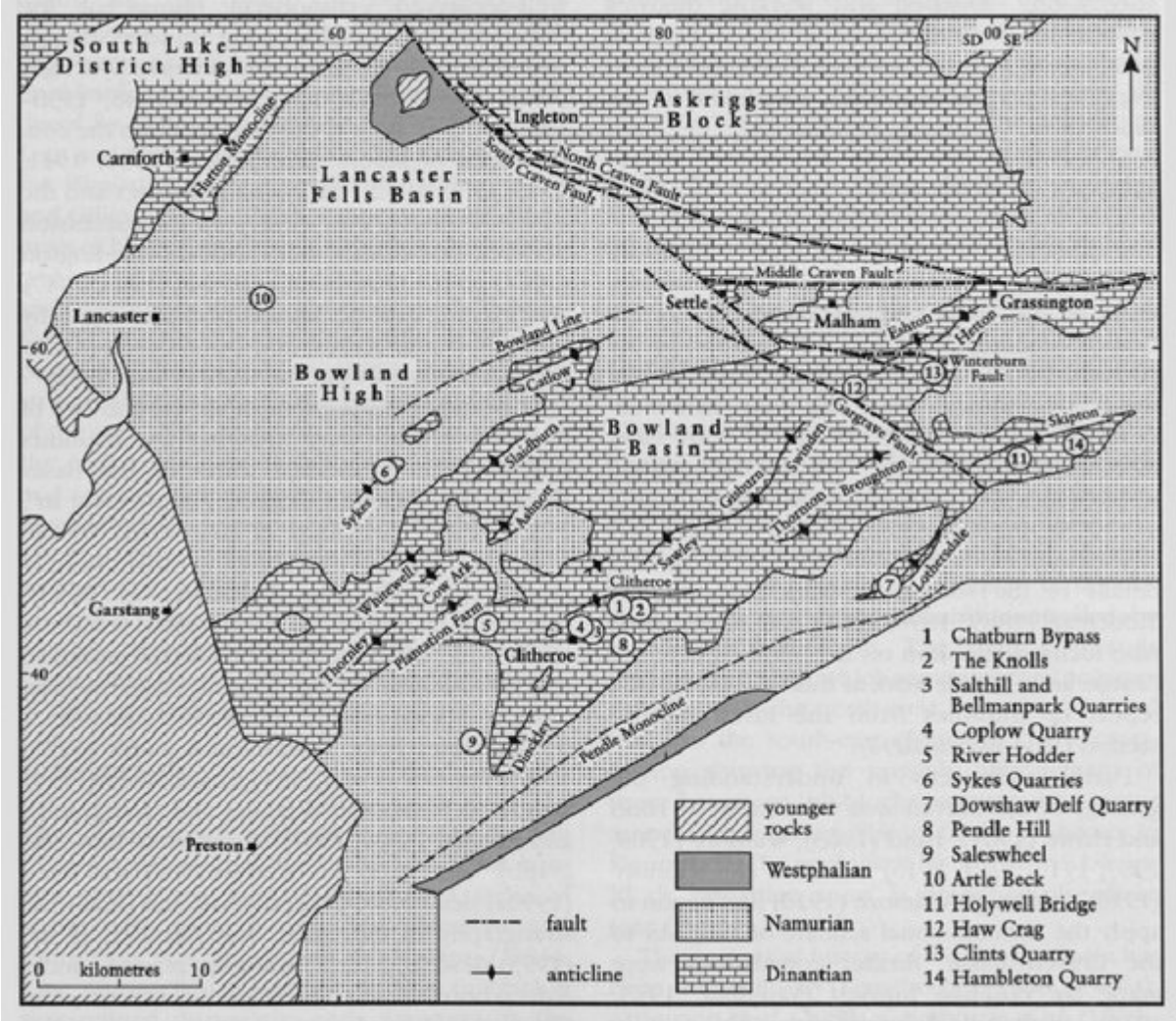
The Hambleton Quarry GCR site provides an outstanding section of the Draughton Limestone and Draughton Shales, and is one of the most important developments of Asbian strata in the Skipton Anticline. The site is of particular value In understanding the structural and sedimentary evolution of the northern part of the Craven Basin at a critical phase in its history, as early Carboniferous basin-margin fault systems were rejuvenated during Asbian times. The succession was most probably deposited in a relatively deep-water marine environment and was derived, at least in part, from sediment gravity flows triggered by faulting in the Craven Fault Zone.

References

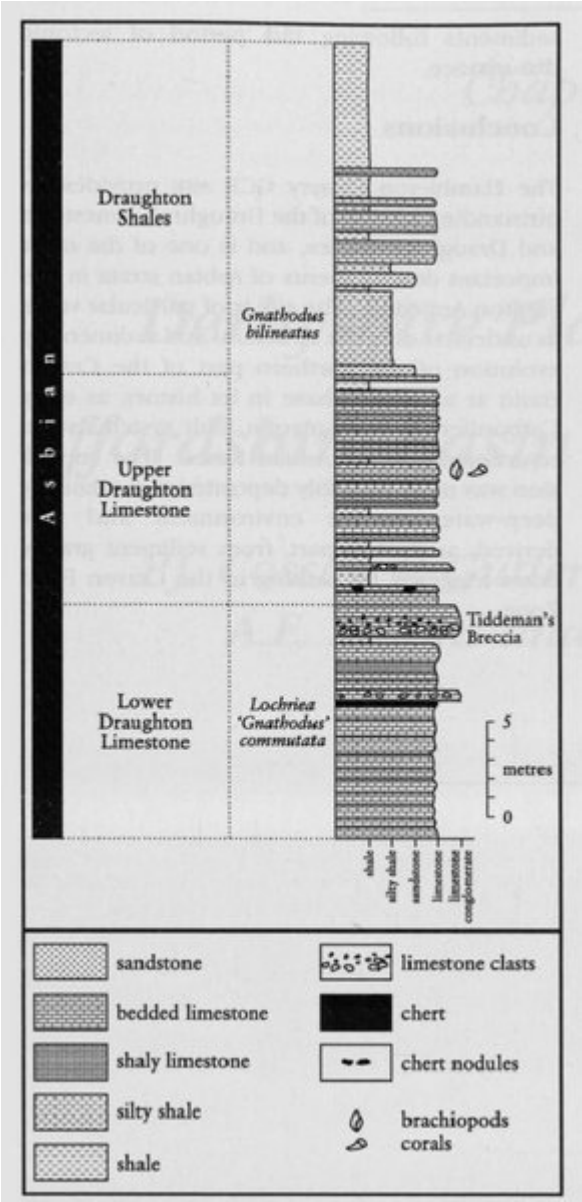


(Figure 6.2) Simplified stratigraphical chart for the Lower Carboniferous succession of the Craven Basin. (HBL — Hetton Beck Limestone Member; HCBB Haw Crag Boulder Bed; SFL — Scaleber Force Limestone Member; SQL — Scaleber Quarry Limestone Member; SBB — Scaleber Boulder Bed; SLS — Sugar Loaf Shales; SLL — Sugar Loaf Limestone; SSBB School Share Boulder Bed; CoL — Coplow Limestone Member; PQL — Peach Quarry Limestone Member; BL — Bellman Limestone Member; LWL — Limekiln Wood Limestone Member; PM — Phynis Mudstone Member; ChL — Chaigley Limestone Member; FIB — Rad Brook Mudstone Member; PS — Pendleside Sandstones Member; TS — Twiston Sandstone Member; BL — Berwick Limestone.) Areas of vertical ruling indicate non-sequences. Not to scale. Compilation based on Hudson and Mitchell (1937), Metcalfe (1981), Arthurton et al. (1988), British Geological Survey (1989), Riley (1990a, 1995), Aitkenhead et al. (1992), Brandon et al. (1995, 1998).

(Figure 6.23) Fold structures in the turbiditic Draughton Limestone (centre) at the Hambleton Quarry GCR site. The top of the Lower Draughton Limestone is located at the top of the thick (c. 2 m) limestone bed (Tiddeman's Breccia) at the base of the quarry face. Above, and to the right of the Draughton Limestone, are the darker beds of the Draughton Shales. (Photo: P.J. Cossey.)



(Figure 6.1) Geological map of the Craven Basin illustrating the distribution of Carboniferous outcrops and the locations of GCR sites described in the text. Note that in the Bowland Basin area, the hinge traces of major folds within the Ribblesdale Fold Belt are also shown. The Central Lancashire High lies to the south of the Pendle Monocline beneath the area obscured by the key. Based on Riley (1990a) and Brandon et al. (1998).



(Figure 6.24) Sedimentary log of the topmost beds of the Draughton Limestone and lower part of the Draughton Shales at the Hambleton Quarry GCR site near Skipton, Yorkshire. After Metcalfe (1981).