Clints Quarry, North Yorkshire

[SD 967 575]

Introduction

The Clints Quarry GCR site is a disused quarry located close to the Grassington-Skipton railway line a kilometre south of Rylstone [SD 967 575]. This site offers a stratigraphically important and fossiliferous Holkerian–Brigantian section that extends from the top of the Worston Shales (= the Hodder Mudstone Formation of Riley, 1990a; and see (Figure 6.2)) to a prominent limestone conglomerate, variously assigned to the Pendleside Limestone Formation by Arthurton *et al.* (1988) and to the Lower Bowland Shales by Riley (1990a). This conglomerate was formed by erosion at the northern margin of the Craven Basin during a significant period of late Asbian–early Brigantian earth movements. Important site descriptions are provided by Wilmore (1910) and Booker and Hudson (1926).

Description

Clints Quarry, also known as Itylstone Railway Quarry' (Wilmore, 1910; Hudson and Mitchell, 1937) and 'Clint Rock Quarry' (Arthurton *et al.,* 1988), lies on south-eastern limb of the NE–SW-trending Eshton–Hetton Anticline, approximately 1 km south of the Winterburn Fault (an easterly trending splinter of the South Craven Fault System to the west; see (Figure 6.1)). The succession dips gently to the south-east (Figure 6.22).

At its base, the Worston Shales comprise approximately 4 m of calcareous mudstone with thin argillaceous limestone interbeds. These beds, containing *Pustula* cf. *pyxidiformis* (Arthurton *et al.,* 1988) and *Merocanites* (Rose *et al.,* 1973), were referred to as part of the 'upper mudstone-rich subdivision' of the Worston Shales by Arthurton *et al.* (1988), and as part of the Rylstone Limestones by Booker and Hudson (1926). A sharp but planar unconformity surface separates this unit from the overlying beds which Arthurton *et al.* (1988) regarded as part of the Pendleside Limestone Formation (= Skelterton Limestone of Booker and Hudson, 1926) and which Riley (1990a) considered as part of the Lower Bowland Shales (see Aitkenhead *et al.,* 1992). Missing from the succession at this unconformity is the Hodderense Limestone Formation and, if Riley is correct, the Pendleside Limestone Formation (Riley, 1990a).

Above the Worston Shales an 8.4 m succession, ascribed to the Pendleside Limestone Formation by Arthurton *et al.* (1988) and to the Lower Bowland Shales by Riley (1990a) crops out, which can be subdivided into two unequal parts. The lower part (= the 'well bedded limestone subdivision' of Arthurton *et al.* (1988) and the 'Zaphrentid Bed' of Booker and Hudson, 1926) comprises well-bedded grey crinoidal packstones (*c.* 3 m) with possible chlorite mottlings near the base and limestone lithoclasts at its top. A rich fauna dominated by zaphrentid corals and brachiopods is reported from these beds including *Amplexizaphrentis enniskilleni,* cf. *Fasciculophyllum densum, F.* cf. *junctoseptatum, Rotiphyllum rushianum, Zaphrentites parallela, Rylstonia benecompacta, R.* cf. *dentata, Dictyoclostus multispiniferus, Krotovia spinulosa,* and 'an indeterminate goniatite' (Arthurton *et al.,* 1988). The higher part (= the 'limestone conglomerate subdivision' of Arthurton *et al.* (1988) and the 'Lithostrotion arachnoideum Beds' of Booker and Hudson, 1926) is a massive (3.4 m) conglomerate (= 'Tiddeman's Breccia' — see Hudson and Mitchell, 1937; and Arthurton *et al.,* 1988) with granule- to pebble-sized limestone lithoclasts up to 15 cm in diameter set in a bioclastic limestone matrix (Figure 6.22). Lithoclasts in the conglomerate are subrounded to subangular (Arthurton *et al.,* 1988) and include pebbles of the Hodderense Limestone Formation (Riley, 1990a). Arthurton *et al.* (1988) recorded a mixed coral–brachiopod assemblage of Holkerian or Asbian age from this unit including *Axophyllum vaughani, Siphonodendron martini, S. sociale, Avonia youngiana* and *Plicatifera plicatilis.* Above this, the succession is represented by well-bedded to lenticular packstones (*c.* 2 m) containing a coral–brachiopod assemblage of early Brigantian age including *Diphyphyllum furcatum, D. lateseptatum* and *Striatifera striata* (Arthurton *et al.,* 1988), *Sutherlandia 'Emmonsia' parasitica* and *Michelinia tenuisepta* (Booker and Hudson, 1926) but which also includes the late Asbian (P_{1a}) goniatite index *Goniatites crenistria* (Rose *et al.,* 1973).

Interpretation

The Worston Shales (Hodder Mudstone Formation) deposits at this site represent hemipelagic muds (Riley, 1990a) and thin storm-generated limestone interbeds which formed on the upper part of a carbonate slope (Gawthorpe, 1986, 1987a) towards the northern margin of the Craven Basin during Holkerian times ((Figure 6.4)b).

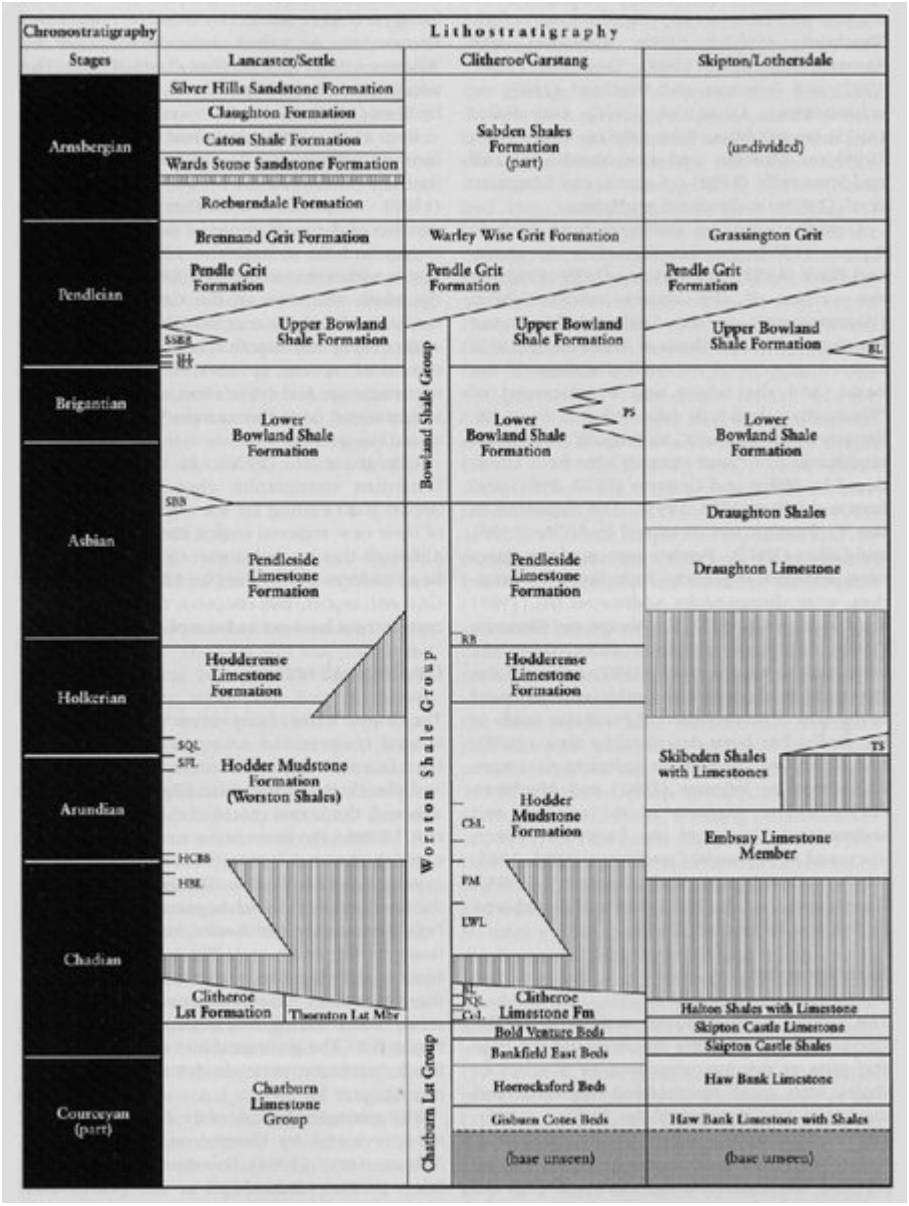
By contrast, the massive limestone conglomerate, with its mixed and partially derived Holkerian–Asbian faunas near the base of the overlying unit (Lower Bowland Shales), most probably formed as a debris-flow deposit during a period of late Asbian-early Brigantian crustal instability; this causing uplift and widespread erosion of the basin margin and triggering gravity flows down the basin flanks. The unconformity below the conglomerate also developed at this time. Erosion on this unconformity surface evidently removed the Hodderense Limestone Formation (and, possibly, the Pendleside Limestone Formation — if deposited), from the Lower Carboniferous successions of the Eshton-Hetton area, its erosional remnants appearing as pebbles in the overlying limestone debris bed (Riley, 1990a). The associated packstones both above and below the conglomerate (but still within the Lower Bowland Shale sequence) most probably represent either similar but smaller-scale debris deposits or storm-generated beds.

The development of these features (debris bed and unconformity) together mark a significant late Asbian–early Brigantian phase in the evolution of the Craven Basin as early Carboniferous rifting gave way to thermally driven subsidence and regional basin sag (Gawthorpe, 1987a; Fraser and Gawthorpe, 1990).

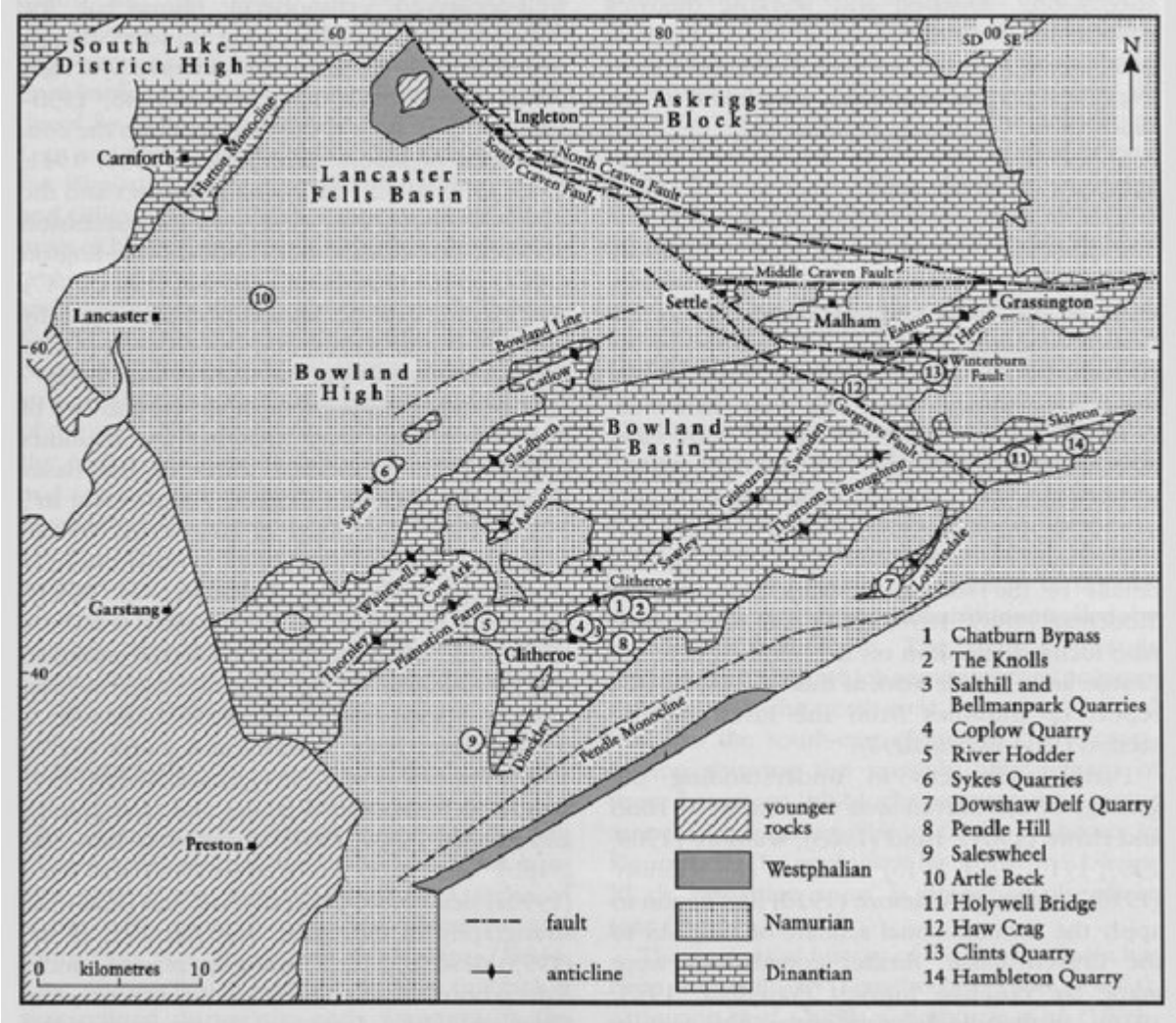
Conclusions

This site provides one of the finest sections across the Worston Shales–Bowland Shales boundary in the Craven District. The sedimentological and palaeontological characteristics of the sequence (reworked faunas, derived pebbles and sediment gravity flows) provide evidence for the existence of a significant unconformity at the base of the Lower Bowland Shales which developed during a late Asbian–early Brigantian period of tectonic instability that is widely recognized within the Craven Basin.

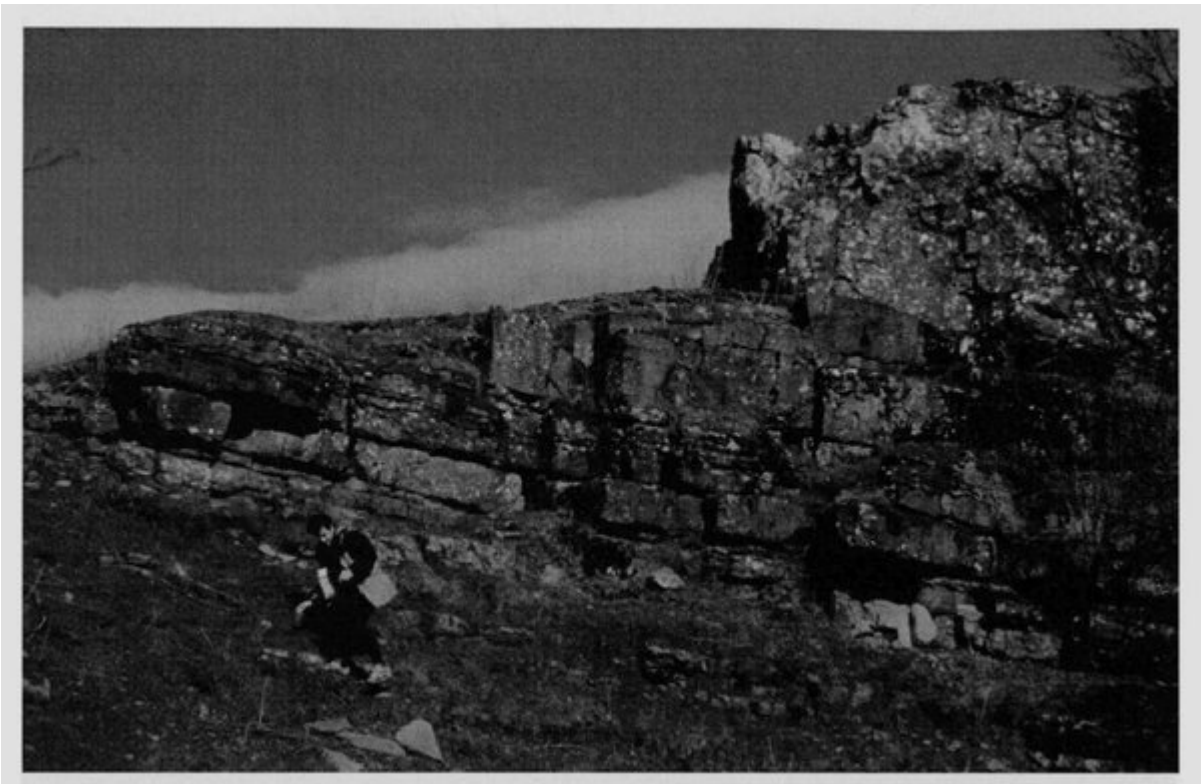
References



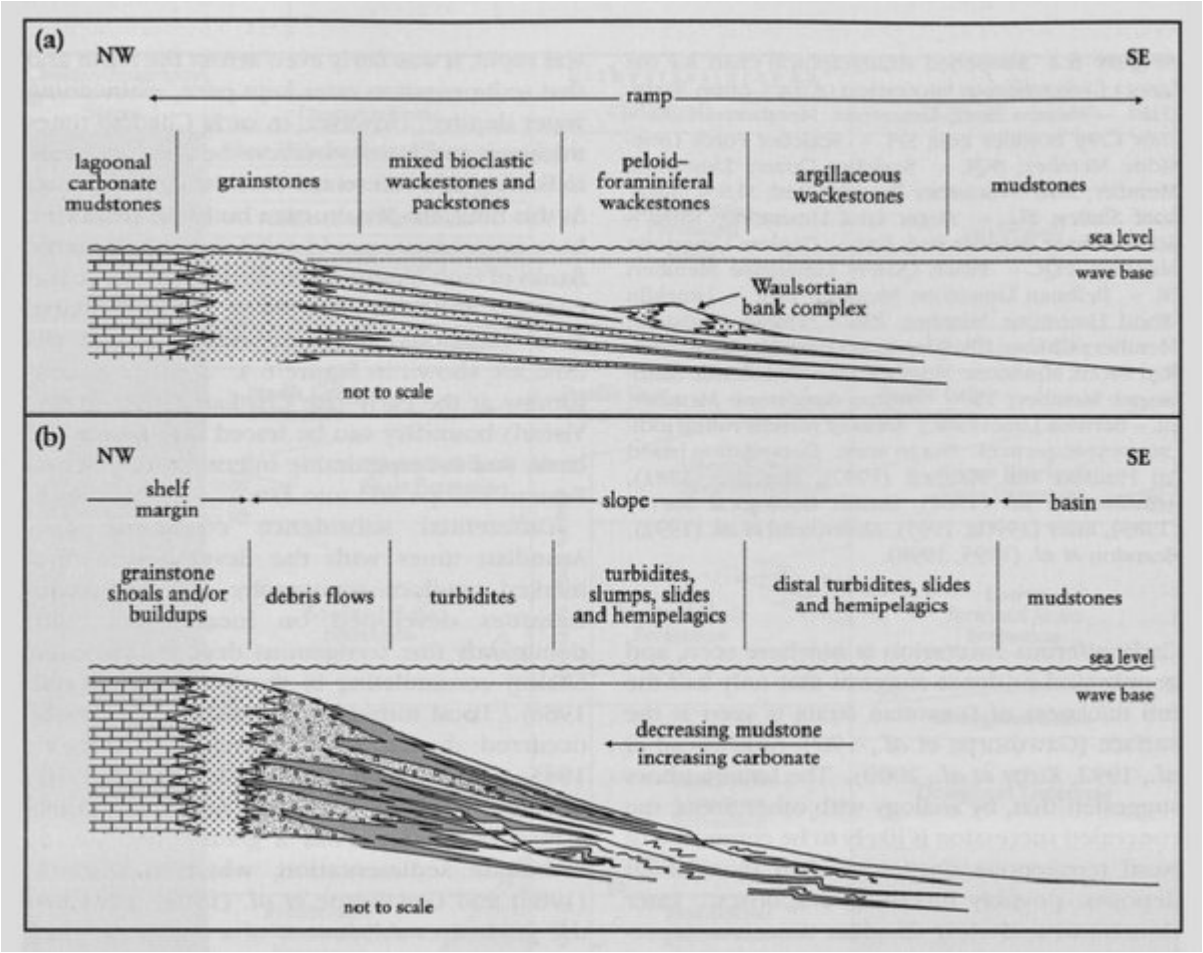
(Figure 6.2) Simplified stratigraphical chart for the Lower Carboniferous succession of the Craven Basin. (HBL — Hetton Beck Limestone Member; HCBB Haw Crag Boulder Bed; SFL — Scaleber Force Limestone Member; SQL — Scaleber Quarry Limestone Member; SBB — Scaleber Boulder Bed; SLS — Sugar Loaf Shales; 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 6.1) 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 6.22) Sequence of strata at the Clints Quarry GCR site, Rylstone, illustrating the Hodder Mudstone Formation (lower left) unconformably overlain by thickly bedded limestones (centre and right) at the local base of the Lower Bowland Shales (Riley, 1990a). Note that the thickly bedded limestones seen here were mapped as part of the Pendleside Limestone Formation by Arthurton et al. (1988). The most prominent limestone bed is the massive limestone conglomerate (debris bed) referred to in the text. (Photo: P.J. Cossey.)



(Figure 6.4) (a) Lateral facies variations along the carbonate ramp that characterized the Craven Basin during the Courceyan–Chadian interval. (b) Facies variations down the slope environments of the Craven Basin during the Arundian–Asbian interval. After Gawthorpe (1986).