
Dowshaw Delf Quarry, North Yorkshire

[SD 934 448]

Potential GCR site

Introduction

The Dowshaw Delf Quarry site is a disused quarry [SD 934 448] which lies in the west part of the Lothersdale Anticline (Figure 6.1). It exposes a 30 m section of Embsay Limestone Member (Arundian) unconformably overlain by the Twiston Sandstone Member (Holkerian) (Figure 6.15). Both these members lie within the middle part of the Hodder Mudstone Formation; the Embsay Limestone Member being the lowest exposed member of this formation in the Lothersdale area. Without the benefit of micropalaeontological evidence, the Embsay Limestone Member was erroneously mapped as part of the Chatburn Limestone Group (Tournaisian) by Earp *et al.* (1961). However, later work by Fewtrell and Smith (1978) revealed the presence of middle Viséan foraminiferal assemblages in this unit. Riley (1990a) demonstrated the significance of the unconformity in its regional context. The locality is significant in that it demonstrates the effect of syn-depositional tectonics at the base of the Holkerian Stage and shows the effect of these tectonics and associated sea-level change on sediment supply. It is also an excellent section for the examination of detrital deep-water carbonates derived from shallow-water regions marginal to the Craven Basin, but which are elsewhere concealed under younger rocks.

Description

The section is about 30 m thick, and exposes the upper part of the Embsay Limestone Member. It contains hardly any interbedded mudstones. Most limestone beds are of metre-scale thickness, with sedimentary bed contacts not necessarily coinciding with bedding planes (amalgamated beds). Basal bed contacts are erosive and show sole structures. Graded bedding is also common. Most beds comprise fine- to medium-grained grainstone with ooids, peloids, foraminiferal tests and calcareous algae. Macrofossils, apart from crinoid ossicles, are rare. Fewtrell and Smith (1978) demonstrated that the abundant foraminiferal assemblages were of Viséan age. They contain abundant primitive Cf4d Subzone archaediscid foraminifera (now referable to *Glomodiscus*, *Kasachstanodiscus*, and *Uralodiscus*). Shaly intervals comprise calcisiltites with chondritiform and helminthoid burrows. At the top of the south face of the quarry, a 60 cm-thick development of fine-grained, internally structureless sandstone (the Twiston Sandstone Member) rests with sharp (and angular) unconformity on the Embsay Limestone Member (Figure 6.15). In the Skipton Anticline, to the north, this sandstone rests conformably on shales 175 m above the level of the Embsay Limestone Member, suggesting that significant sediment was removed, or not deposited, at Dowshaw Delf Quarry during the hiatus.

Interpretation

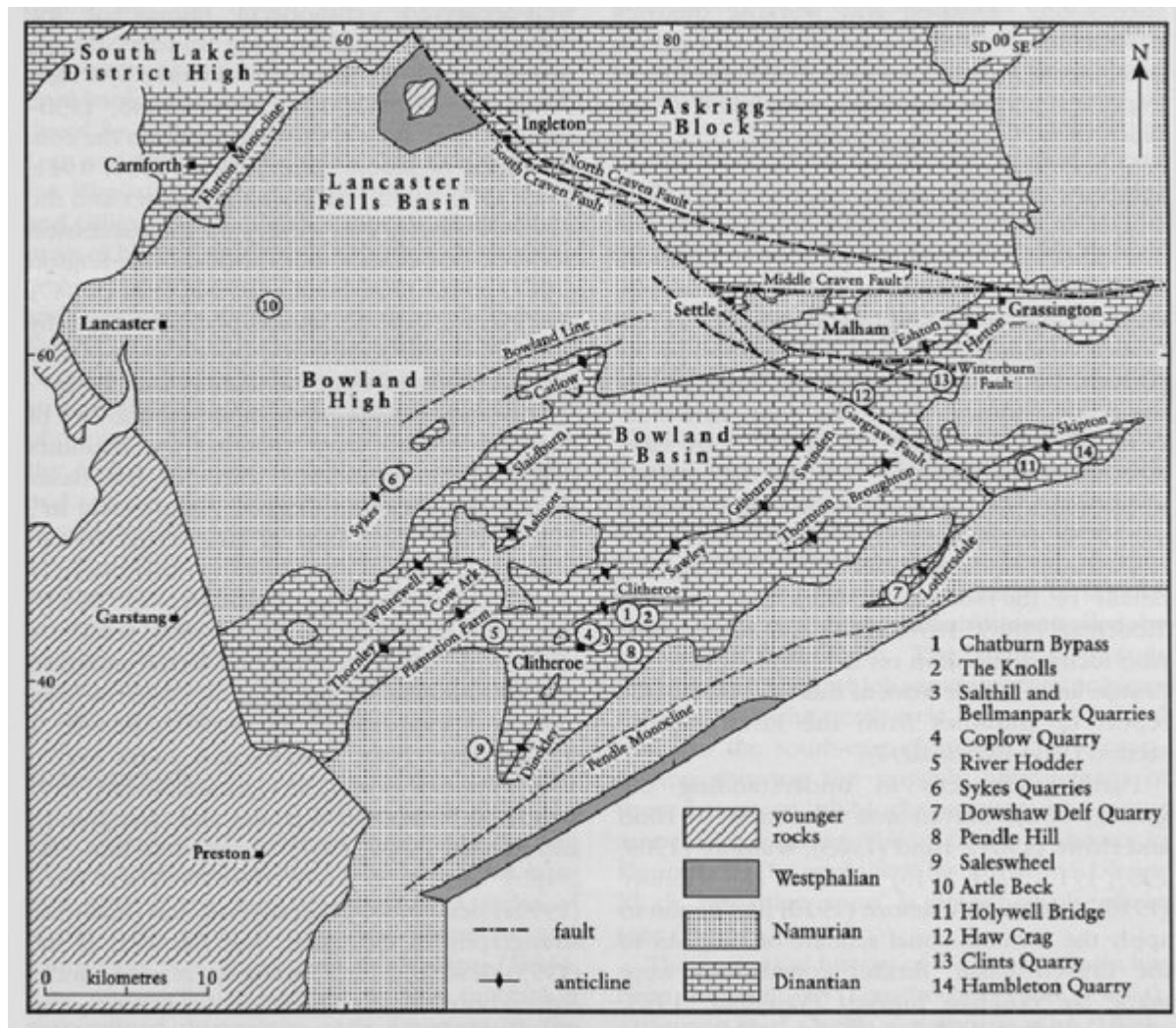
The presence of an unconformity or non-sequence is typical of Arundian–Holkerian contacts in Britain (Davies *et al.*, 1989; Riley, 1990a; Barclay *et al.*, 1994) and beyond (Riley *et al.*, 1995; Riley, 1999) in cratonic and peri-cratonic settings of Europe and the USA. Its development demonstrates the effects of a widespread tectonic event and sea-level fall towards the end of Arundian times, followed by an early Holkerian transgression. At Dowshaw Delf; the Embsay Limestone Member represents a carbonate turbidite system fed from carbonate ramps attached to the Askrigg Block and Central Lancashire High. Its thick, proximal character at Lothersdale may result from a more copious local supply from the Central Lancashire High via a transfer ramp within the Pendle Fault (now inverted to form the Pendle Monocline; the deflection of the monocline southwards by interpolation of the Lothersdale Anticline may be a result of a kink in the Pendle Fault where this transfer ramp once lay). Footwall uplift associated with closure of the transfer ramp by the Arundian–Holkerian tectonic event, not only shut off the carbonate supply from the ramp interior but also shed fine-grained clastics (probably by reworking of Devonian and/or Tournaisian clastics in the footwall, such as those penetrated in the Boulsworth Borehole south of Burnley on the Central Lancashire High), resulting in the deposition of the

Twiston Sandstone Member across the regraded and eroded top surface of the Embsay Limestone Member. Subsequent sea-level rise in Holkerian times drowned the Askrigg Block and Central Lancashire High deep enough to accommodate renewed ramp formation without significant export of carbonate into the Craven Basin where mudstones and eventually hemipelagic limestones (Hodderense Limestone Formation) occur, reflecting starvation of the sediment supply.

Conclusions

The association of tectonic activity and sea-level change across the entire Laurussian continent (from USA to the Former Soviet Union) suggests that eustasy and tectonics were related processes that produced the base Holkerian sequence boundary, unlike later in the Carboniferous Period when sea-level change associated with the waxing and waning of polar ice sheets was dominant.

References



(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 6.15) Unconformable contact between the Embsay Limestone Member (Arundian, thick-bedded; lower right) and the Twiston Sandstone Member (Holkerian, thin-bedded; top left) in the Hodder Mudstone Formation (Worston Shale Group) at Dowshaw Delf Quarry, Lothersdale, Lancashire. Note lens cap for scale, left of centre. (Photo: N.J. Riley.)