
Breedon Cloud Quarry, Leicestershire

[SK 413 214]

Introduction

The Breedon Cloud Quarry GCR site is a working quarry (also referred to as 'Cloud Hill Quarry') [SK 413 214] located south of Breedon-on-the Hill in north-west Leicestershire. The site exposes several hundred metres of steeply dipping Lower Carboniferous limestones and dolostones. The early Chadian Milldale Limestones comprise a sequence dominated by bedded dolostones with some chert and dolomitic sandstones. The overlying late Holverian to Asbian Cloud Hill Dolostone, is made up of bedded dolostones and dolomitized mud-mounds. Most of the sequence was deposited in a nearshore shallow marine shelf setting on the Hathern Shelf, with evidence of storm events and shallowing-upwards. A regionally significant unconformity, the 'Main Breedon Discontinuity', separates the two formations. The importance of the site derives from the quality and thickness of outcrop and the exposure of conformable and unconformable contacts between the various formations and members represented; it is also the type locality for a number of locally significant lithostratigraphical units and for the stratigraphically useful brachiopod *Levitusia humerosa*. Key references to the strata exposed here include Fox-Strangways (1905, 1907), Parsons (1918a), Mitchell and Stubblefield (1941), Mortimer *et al.* (1970) and Monteleone (1973). Recently, Ambrose and Carney (1997) have compiled a detailed report on this site, and much of what follows here, including stratigraphical terminology, is based on their work.

Description

Approximately 300 m of Lower Carboniferous strata are exposed at this site. The beds mostly dip towards the west, the dip increasing from 40° to 50° on the west side of the quarry to 60° to 90° on the eastern side. The lowest exposed beds are assigned to the Milldale Limestones. This unit, more than 200 m thick in the quarry, comprises grey to buff, bedded, crystalline dolostones with undulating bedding surfaces, commonly with clay or shaly partings up to 10 cm thick. Chert nodules in parts of the sequence show evidence of in-situ brecciation. A limestone interval with a significant siliciclastic component (the Holly Bush Member) recognized towards the middle of this sequence at the southern end of the quarry is approximately 45 m thick. This contains beds of fine- to medium-grained dolomitic sandstone, sandy dolostone and beds with well-rounded pebbles up to 5 cm in diameter. The pebbly beds contain a variety of clast types, including some of volcanic origin which may be derived from the Charnian basement. An interval of non-dolomitic or only partly dolomitized grey, fine- to coarse-grained, bedded, skeletal, oolitic and peloidal grainstones lies above the Holly Bush Member. The uppermost part of the formation is entirely dolostone.

The fauna of the Milldale Limestones is quite diverse. Brachiopods, including *Levitusia humerosa* and chonetoids (see (Figure 7.36)), are the most common fossils, but crinoid debris, solitary and colonial corals, gastropods and the echinoid *Archaeocidaris* are also known. Mitchell and Stubblefield (1941) include a more complete listing; Monteleone (1973) also recorded bivalves, conodonts, fish remains, ostracodes and scolecodonts.

The top of the Milldale Limestones is truncated and eroded by the 'Main Breedon Discontinuity'. This is one of three sharp discontinuities recognized in the quarry (Ambrose and Carney, 1997) which dip westwards with the adjacent strata. The Lower Breedon Discontinuity occurs within the Milldale Limestones and the Upper Breedon Discontinuity occurs within the Cloud Hill Dolostone. The Main Breedon Discontinuity defines the base of the Cloud Hill Dolostone for which the quarry represents the type locality. In the northern part of the quarry the Cloud Wood Member (up to 36 m thick) is recognized within the lower part of the formation. The member comprises a lower mudstone-dominated unit, and an upper unit of bedded or massive crystalline dolostones, with evidence of syn-depositional slumping.

In most of the quarry the 125 m-thick Cloud Hill Dolostone is not subdivided into formally defined stratigraphical units, but distinctive 'bedded dolostone' and 'mud-mound' facies are recognized (Ambrose and Carney, 1997). The bedded dolostones are crystalline with undulatory bedding planes, many with mudstone or clay partings. Crinoid remains are abundant in some beds, and brachiopods and corals also occur. Evidence of small-scale cross- stratification is also

present; originally the bedded dolostones were probably skeletal grainstones. The mud-mound facies that makes-up the bulk of the formation is equivalent to Monteleone's (1973) Bioherm Member, and the upper four of five subdivisions recognized by Mitchell and Stubblefield (1941) above the level of the Main Breedon Discontinuity (see Ambrose and Carney, 1997, table 2). Buff to grey, massive, crystalline dolostones represent the dominant lithology. They are generally fossiliferous, containing a diverse brachiopod fauna, crinoids, corals, bivalves, gastropods, nautiloids and ammonoids, although most of the fossils have been destroyed by dolomitization (for a more complete faunal listing, see Mitchell and Stubblefield, 1941).

In the upper part of the face in the south-west corner of the quarry, bedded, nodular and crystalline dolostones of the Ticknall Limestone are exposed. The base of the formation is taken at the first palaeosol in a sequence of thinly bedded, fossiliferous dolostones.

Interpretation

Early attempts at correlation of the Breedon Cloud sequence hinged on comparisons with the outcrops to the north at Breedon-on-the-Hill: Fox-Strangways (1905, 1907) assigned these beds to the D Zone (Asbian to Brigantian) while Parsons (1918a) assigned them more specifically to the D₂ Subzone (Brigantian). With the exception of a mid-Tournaisian determination based on spores (Mortimer *et al.*, 1970), subsequent correlations of the lower part of the sequence were based on correlation of the beds containing *Levitusia humerosa* within the Milldale Limestones. These beds have been assigned a C2 (Alexander, 1934; Mitchell and Stubblefield, 1941) or C₂S₁ (Monteleone, 1973) age (i.e. Chadian to Arundian). More recently, they have been assigned an early Chadian age (Riley in Ambrose and Carney 1997).

The beds above the Main Breedon Discontinuity generally have been taken to be of Asbian age (Mitchell and Stubblefield, 1941; Monteleone, 1973). Palynological analysis indicates that the Cloud Wood Member was deposited some time during Holkerian–Asbian times (Turner, 1996) and the presence of the anurionoid *Goniatites* in the mud-mound facies higher in the formation indicates a late Asbian age for this unit (Ambrose and Carney, 1997; Ambrose and Filmer, 1999).

The Main Breedon Discontinuity was described as a fault by Parsons (1918a) and Monteleone (1973), but Mitchell and Stubblefield (1941) regarded it as an unconformity. Ambrose and Carney (1997) interpreted the feature as an angular unconformity representing an interval of erosion and/or non-deposition spanning the early Chadian to late Holkerian time interval. According to Ambrose and Carney (1997) this is an unconformity of regional significance, corresponding to an episode of non-deposition or erosion also seen in the Widmerpool Gulf and on the Staffordshire Shelf (see Caldon Low Quarry GCR site report, this chapter). Changes in dip adjacent to the unconformity in Breedon Cloud Quarry indicate tectonic disruption along the surface, and the slumping evident in the Cloud Wood Member may also be related to activity along this discontinuity (Ambrose and Carney, 1997). The other Breedon discontinuities are less significant. The Lower Breedon Discontinuity is interpreted as a slight angular unconformity (Ambrose and Carney 1997); the nature of the Upper Breedon Discontinuity is less clear, but it seems to be an unconformity associated with post-depositional steepening of bedding, possibly related to movement along the Main Breedon Discontinuity (Ambrose and Carney, 1997).

The locally high siliciclastic content of the rocks, the abundance of fragmentary skeletal remains, and evidence of grading and minor cyclicity indicate that the Milldale Limestones were deposited during storm events in a shallow proximal ramp setting (Ambrose and Carney, 1997). The strata of the Cloud Wood Member, exposed at the northern end of the quarry, reflect mud-dominated deposition in a quiet, relatively deep-water setting, with the interbedded carbonates interpreted as storm deposits (Ambrose and Carney, 1997). The internal structure and composition of the overlying mud-mound facies has been destroyed by dolomitization, but the thickness of the buildup indicates a water depth of at least 40 m. The undifferentiated dolostones of the Cloud Hill Dolostone at the southern end of the quarry are interpreted as storm-generated platform carbonate deposits similar to those of the underlying Milldale Limestones. They preserve evidence of gradual shallowing-up towards emergence and palaeosol development in the overlying Ticknall Limestone (Ambrose and Carney, 1997).

Of all the Lower Carboniferous Milers of the Hathern Shell; this site preserves the thickest sequence, spans the longest time interval and contains the most diverse suite of sedimentary rocks; in terms of stratigraphy, structure, palaeogeography and depositional environments it is among the most informative Dinantian section in the Midlands. The site is also significant as the type locality for the Cloud Wood Member, the Cloud Hill Dolostone, the Holly Bush Member of the Milldale Limestones, and for the diagnostic Chadian brachiopod *Levitusia humerosa* which is widely known across Europe and from the Russian Platform. The regional significance of the site notwithstanding, dating and correlation of much of the sequence is still rather poorly constrained. Detailed micropalaeontological analysis focusing on groups resistant to destruction by dolomitization (such as conodonts) may lead to a better understanding of the geological history of the strata exposed at the quarry and of the early Carboniferous geological history of the Midlands.

Conclusions

Breedon Cloud Quarry is significant as the site where several locally important lithostratigraphical units (e.g. Cloud Hill Dolostone, Cloud Wood Member, Holly Bush Member) are defined.

Furthermore, because of the rich diversity of its sedimentological, palaeogeographical, stratigraphical and structural features, this site has regional significance as one of the most geologically informative Lower Carboniferous sections in the English Midlands.

[References](#)



(Figure 7.36) Fallen dolostone block from the Milldale Limestones containing numerous internal molds of large brachiopods including *Levitusia humerosa*. The large *L. humerosa* in the foreground is 6 cm wide. (Photo: M.A. Purnell.)