Caldon Low Quarry, Staffordshire

[SK 077 491]

Introduction

The Caldon Low Quarry GCR site is a working quarry [SK 0770 4915] close to Waterhouses. It offers a particularly important section of the Caldon Low Conglomerate, locally the basal member of the Hopedale Limestones (Chisholm *et al.,* 1988). Although the precise age and origin of this deposit remains uncertain, its development above an unconformity separating the Hopedale Limestones from the underlying Mil'dale Limestones (early Chadian) is critical in understanding the palaeogeographical evolution of the North Staffordshire Basin and Staffordshire Shelf during Early Carboniferous times. Early descriptions of the deposit are by Jackson and Alkins (1919), Barke *et al.* (1920) (who regarded it as post-Carboniferous in age), Jackson and Charlesworth (1920) and Ludford (1951). However, the account presented here is based on the more recent work of Chisholm *et al.* (1988).

Although parts of the section originally described by Jackson and Atkins (1919), including the lowest beds of the Caldon Low Conglomerate and the basal unconformity, are now buried by infill, an informative and at least partly comparable section showing features of relevance to the Caldon Low Quarry GCR site occurs at neighbouring Cauldon Quarry 0.4 km to the east. A description of these features is included in the site report below for cross-reference.

Description

A strike section of well-bedded and pale-coloured calcarenite (*c.* 6 m thick) close to the base of the Hopedale Limestones is exposed in a small south-facing cliff, close to the currently disused railway line at the northern end of the quarry (Figure 7.30). The lower part of this succession (the Caldon Low Conglomerate) comprises 3 m of conglomeratic limestone with scattered pebbles of quartz, quartzite, altered green lava and limestone set in a carbonate matrix containing a significant amount of coarse quartz sand. A coral–brachiopod fauna from this locality, including *Siphonodendron martini, Acanthoplecta mesoloba, Avonia youngiana, Linoprotonia* cf. *hemisphaerica* and *Megachonetes* cf. *papilionaceus,* is thought not to be age diagnostic, but is, perhaps, more typical of the Asbian Stage than earlier stage intervals (Chisholm *et al.,* 1988), although it may include some reworked elements.

To the east, in Cauldon Quarry, an erosion surface and angular unconformity separates the Hopedale Limestones from the underlying Milldale Limestones (Figure 7.31). Here, the lower beds of the Hopedale Limestones comprise a varied lithofacies mix of limestone breccia (= the Caldon Low Conglomerate), dark, thin-bedded limestone and pale-coloured, well-bedded or massive calcarenite. The sequence is punctuated by a number of irregular erosion surfaces. Associated undulations in the bedding are generally concordant with the irregular profiles of the erosion surfaces that lie beneath them. At this site (Cauldon Quarry), the Caldon Low Conglomerate contains a large (18 m) detached block of 'reef' limestone (see Parkinson and Ludford, 1964) and a Courceyan–Arundian faunal assemblage (*Zaphrentites delanouei, Cyathaxonia rushiana, Caninia cornucopiae, Koninckophyllum* cf. *praecursor, Linoprotonia* cf. *hemisphaerica,* and both tournayellid and endothyrid foraminifera), which is thought to be derived (Chisholm *et al.,* 1988). A significant amount of carbonate mud is present in the matrix of the conglomerate. Beds above the Caldon Low Conglomerate containing scattered quartz grains and pebbles also contain derived faunal elements including Chadian–Holkerian conodonts and foraminifera. The presence of *Lithostrotion araneum,* archaediscid foraminifera (at the *angulatus* stage) and *Gigasbia gigas* at different stratigraphical levels indicates a possible age range for these beds stretching from the Holkerian to the Asbian (Chisholm *et al.,* 1988); however, a more recent assessment by N. Riley (pers. comm., 2002) suggests that these beds are, most probably, of Asbian age.

Interpretation

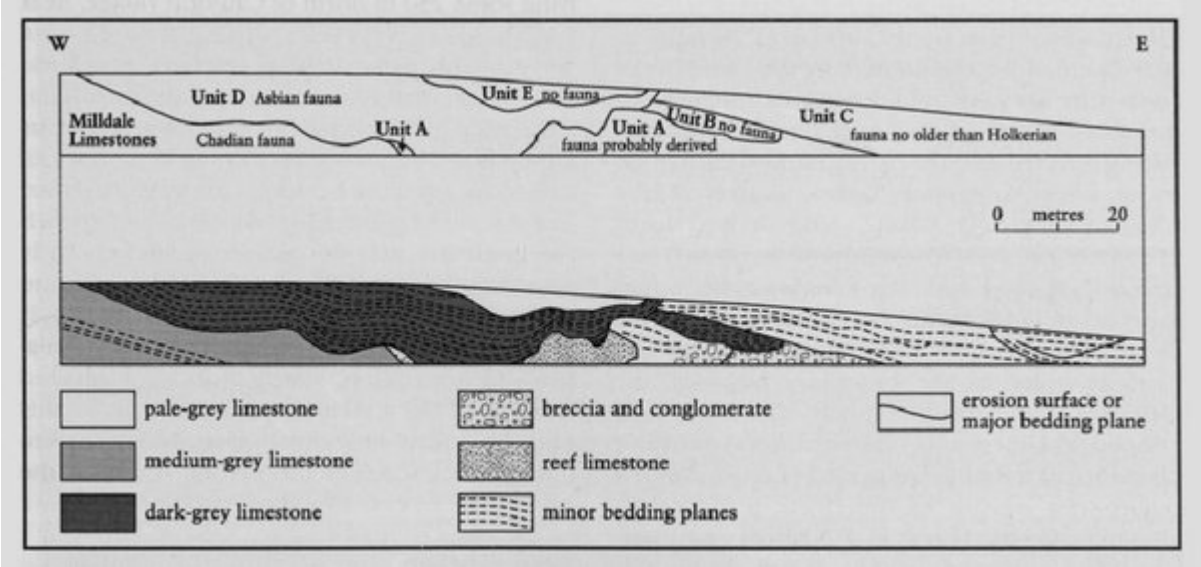
The Caldon Low Conglomerate is thought to have formed, at least in part, by the slumping of carbonate and siliceous lithoclasts into unconsolidated sediment, this re-sedimented material being directed into the North Staffordshire Basin from steep submarine slopes located nearby (Chisholm *et al.,* 1988). The derived fossil assemblages and discontinuity (erosion) surfaces associated with the conglomerate would appear to support this view. Furthermore, the association of this conglomerate with a major unconformity at the boundary between the Milldale Limestones (locally Chadian) and Hopedale Limestones (mainly Asbian) provides evidence of a significant period of erosion at the south-west margin of the North Staffordshire Basin during the Arundian–Holkerian time interval (Chisholm *et al.,* 1988). It was during this period that the Staffordshire Shelf became established to the south of the area; an area that extended south towards the northern shore of the Wales–Brabant Massif. These events are most probably the result of contemporary fault movements at the margin of a 'tilt-block' in the underlying basement; events which resulted in the clear differentiation of the Staffordshire Shelf from the North Staffordshire Basin during late Dinantian times.

Conclusions

The Caldon Low Conglomerate provides important evidence of the palaeogeographical changes taking place at the south-west margin of the North Staffordshire Basin during Dinantian times. Although the age of this deposit remains uncertain, it probably formed during late Holkerian or Asbian times as a result of uplift and the erosion of sediment from the developing edge of the Staffordshire Shelf margin. Uncertainties regarding the provenance of this sedimentary material make this an important site for sedimentological research in the future.

References

(Figure 7.30) General view of the Caldon Low Conglomerate (lower half of cliff face) in the Hopedale Limestones at Caldon Low Quarry. The height of the cliff is approximately 6 m. (Photo: P.J. Cossey.)



(Figure 7.31) Section of strata at Cauldon Quarry, illustrating the distribution of lithofacies (units A–E) at the base of the Hopedale Limestones. Note the development of a prominent conglomeratic unit (unit A), the presumed equivalent of the Caldon Low Conglomerate seen at the Caldon Low Quarry GCR site to the west, overlying a prominent erosion surface (unconformity) cut into the underlying Milldale Limestones. After Chisholm et al. (1988).