
Baileycroft Quarry, Derbyshire

[SK 286 542]

Introduction

The Baileycroft Quarry GCR site [SK 2865 5420] is a disused quarry either side of the B5036 a few hundred metres north of Wirksworth town centre. The main part of the quarry is behind a petrol station to the west of the road; part of the quarry is on the opposite side of the road and is now used as a salt stockpile [SK 2875 5415]. These exposures provide a dramatic demonstration of the stratigraphical relationships between the Bee Low Limestones–Monsal Dale Limestones (Asbian–Brigantian) deposited on a shallow-water carbonate shelf, and the unconformably overlying slope and re-sedimented beds of the Eyam Limestones (Brigantian). The unconformity developed on the Bee Low (Hoptonwood) Limestones and Monsal Dale (Matlock) Limestones was first identified by Shirley (1959) who considered it to be a product of an erosional episode prior to the deposition of the Eyam (Cawdor) Limestones; an episode which, by implication, was responsible for the removal of the entire Monsal Dale (Matlock) Limestones from the south-east end of the quarry. This view was supported by the stratigraphical and sedimentological investigations of Smith *et al.* (1967), Walkden (1970) and Frost and Smart (1979).

Description

At this site, approximately 11 m of Bee Low Limestones are exposed, comprising thickly bedded grainstones and packstones with a few discontinuous layers and lenses of disarticulated brachiopods. A typical Asbian fauna is present, including *Axophyllum* '*Carcinophyllum*' *vaughani*, *Dibunophyllum bourtonense*, *Palaeosimilia purchisoni* and *Davidsonina septosa* (Frost and Smart, 1979). The prominent bedding planes are overlain by clay wayboards and represent palaeokarstic surfaces. The top of the Asbian Stage is marked by an irregular karstic surface with a prominent shale. Overlying this are a few metres of the Brigantian succession (Monsal Dale Limestones) comprising dark wackestone passing upwards into massive, well-sorted, crinoidal packstone–grainstone. Above this is an unconformity that progressively cuts down through the Monsal Dale Limestones into the Bee Low Limestones as the unconformity surface is traced from the top of the quarry face at its northern end to the base of the face at its southern end (Figure 7.20). This unconformity is irregular and, in the main part of the quarry to the west of the road, it is overlain by dark, thinly bedded limestones with argillaceous partings; the bedding in these limestones is highly irregular with abrupt thickness changes. These beds have been dated palaeontologically as P₂ (Smith *et al.*, 1967) and are thus of late Brigantian (Eyam Limestones) age.

Some 10 m of section is exposed in the salt stockpile area, and at the south end of this face a prominent, highly undulatory discontinuity is present, overlain by thinly bedded dark limestones that drape the discontinuity surface (Figure 7.21). Shirley (1959), Walkden (1970) and Frost and Smart (1979) suggested that this is a continuation of the unconformity seen in the main part of Baileycroft Quarry, although the possibility that this surface represents a slumped contact within the Brigantian succession cannot be completely dismissed. This discontinuity is developed on pale, thickly bedded limestones in which macrofossils, including reworked solitary corals and gigantoproductid brachiopods, are common. These pale limestones comprise thickly bedded, graded, bioclastic grainstones with highly scoured undulatory bases. Some beds contain highly abraded solitary corals, gigantoproductid brachiopods and rounded granule- to cobble-sized intraclasts. The bedding in this unit is chaotic; some beds in the central part of the face have been rotated up to 45° to the horizontal (Figure 7.21). Thinly bedded dark argillaceous limestones form the top of the section. These show highly contorted beds that drape the discontinuity at the southern end of the exposure.

Interpretation

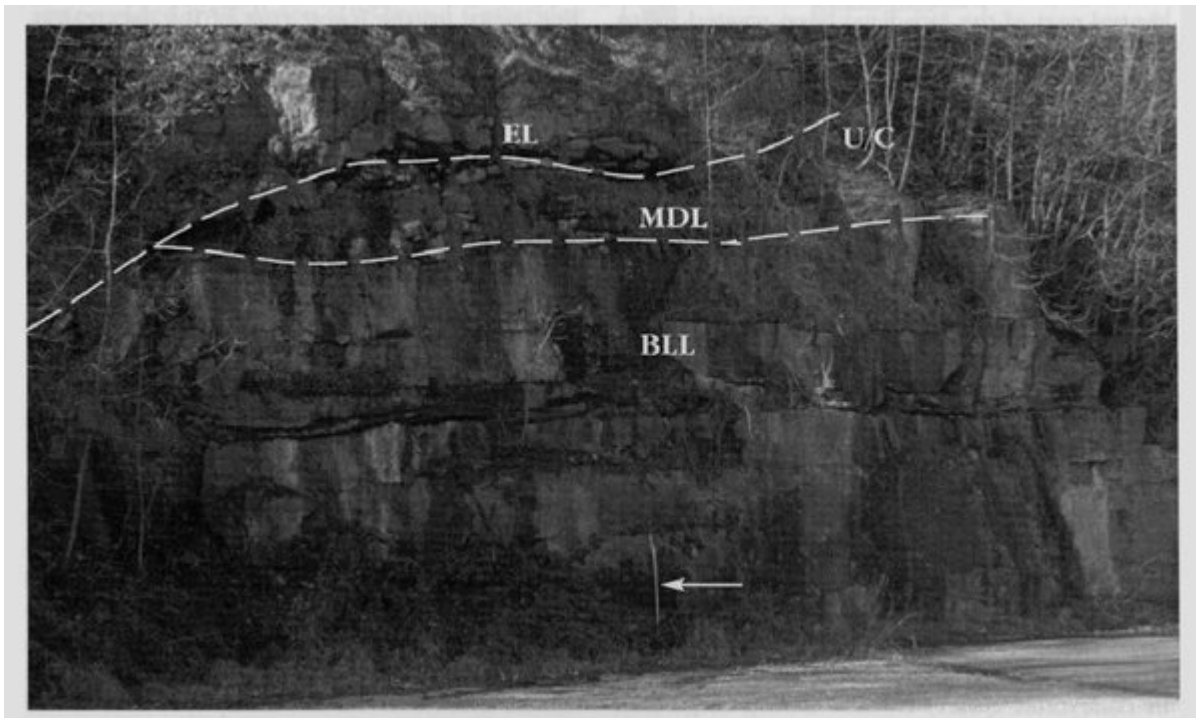
The Bee Low Limestones were deposited on a flat-topped carbonate shelf in a few tens of metres water depth. Occasional sea-level low-stands resulted in the accumulation of volcanic-derived soils on palaeokarstic surfaces over the

emergent carbonate platform during this period. The shelf carbonates were deposited within a few hundred metres of the Asbian shelf margin, located beneath Wirksworth at this time. This was followed by an episode of exposure and karstification at the Asbian–Brigantian boundary with carbonate sedimentation resuming in a shelf-top environment. The unconformity seen in Baileycroft Quarry formed during Brigantian times and locally removed all of the underlying Brigantian succession (Shirley, 1959; Walkden, 1970; Frost and Smart, 1979). This unconformity is thought to be below the level of the section exposed in the salt stockpile area. The pale limestones in this exposure are interpreted as bioclastic carbonates deposited by submarine debris flows and slumps derived from the Brigantian shelf. At least one major slumped unit is present in the pale bioclastic limestones that make up the lower part of the succession. The discontinuity seen at the south end of the salt stockpile is re-interpreted as a slump plane that emplaced thinly bedded argillaceous limestones on top of the thinly bedded, pale, coarsely bioclastic limestones. The contorted bedding was probably accentuated by compaction. The presence of gigantoproductids in the pale limestones at the base of the exposure suggests that they are of Brigantian age (Pattison, 1981).

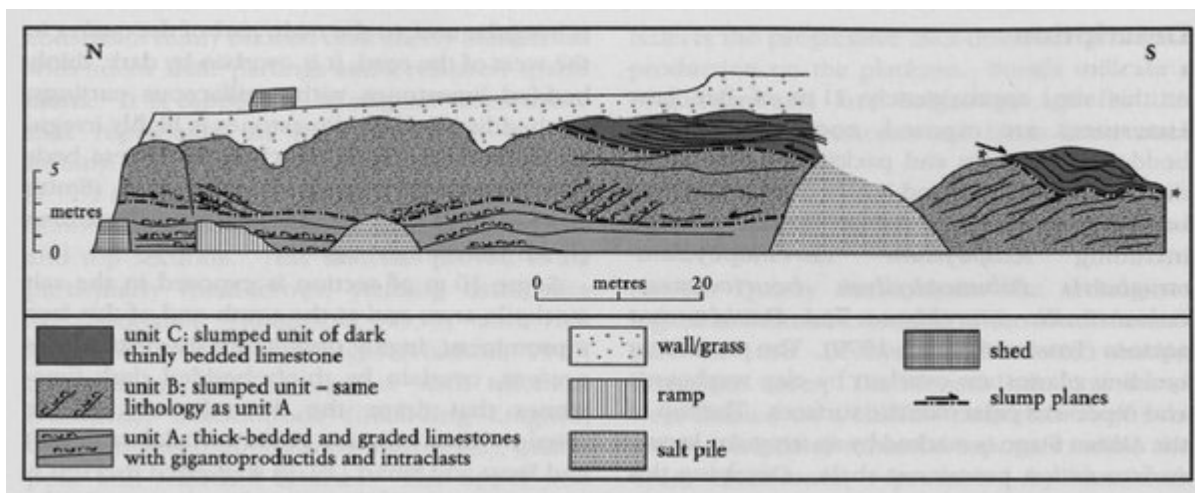
Conclusions

The unconformity seen at Baileycroft Quarry may represent part of a deep channel-like incision that formed perpendicular to the platform margin during Asbian times. This channel probably originated during a lowstand in Brigantian times when the shelf margin was deeply karsted removing much of the Brigantian shelf and slope deposits. This feature subsequently formed a submarine channel down which shelf-derived bioclastic sediment was transported by debris flows and slumps. Further work is needed to determine the date of the lower bioclastic interval at the salt stockpile and the age of the overlying dark thinly bedded limestones.

References



(Figure 7.20) The intra-Brigantian angular unconformity at Baileycroft Quarry showing irregular bedded Eyam Limestones (EL) above the unconformity surface (U/C) cutting down into the thinner, darker beds of the Monsal Dale Limestones (MDL) and the underlying thicker, paler beds of the Bee Low Limestones (BLL). The tape measure (see arrow, bottom centre) is 1.3 in long. (Photo: P Gutteridge.)



(Figure 7.21) Sketch section of the slumped and re-sedimented Brigantian beds in the salt stockpile area at Baileycroft Quarry. Half-arrows indicate slump planes (probable movement is into the plane of the section). The asterisked slump plane marks the contact previously interpreted as the sub-Brigantian (P_2-D_1) unconformity (see text for further details).