Entrance cutting at Bath University, Avon

[ST 767 645]

R.G. Cooper

Introduction

Bath University of Technology is sited on Bathampton Hill to the east of Bath at 204 m OD. It has two main roadway entrances, one 400 m down the hill on North Road, and the other on the top of the hill where North Road meets The Avenue. The first of these runs through a cutting in limestones of the Great Oolite Series (Lower Jurassic) (Figure 6.6). In the cutting, the rockface on the western and north-western side of the road shows very clear examples of dip-and-fault structure (Figure 6.7) and (Figure 6.8).

The City of Bath is situated in one of the most intense zones of landslipping in Great Britain. This is largely due to the presence of Lower Jurassic limestones overlying incompetent Lias Clays, in an area where the River Avon and its tributaries are deeply incised in steep-sided valleys (Kellaway and Taylor, 1968; Chandler *et al.,* 1976). The largest-scale movements took place during Pleistocene times. The Great Oolite is cambered on the western, northern and eastern slopes with downslope dips of up to 37° (Hawkins and Kellaway, 1971). Gulls that result from this cambering have been described by Hawkins (1977).

Description

Until 1967 the only outcrop at the site was an old quarry. The roadway to the university was then cut through the Great Oolite, revealing that the strata are in a disturbed state (Hawkins, 1977). The basal 2 m seen in the northern part of the quarry section are generally medium to thickly bedded oobiosparites (the terminology used to describe limestones in this section is taken from the classificatory/descriptive system of Folk (1959)). Above this is another massive bed 1.9 m thick, which, especially near the road cutting, has weathered to show thickly bedded strata of oobiosparite grading upwards into oosparite. A poorly seen 0.1–0.2 m-thick band of marl in the northern cambered and collapsed section of the quarry is more clearly seen on the left of the cut entrance. In the old quarry section, this marl has frequently penetrated up into the disturbed, thinly bedded 1 m-thick overlying pelmicrite bed. Above this is a 0.4 m-thick bed of oomicrite which has a thin band of pelmicrite, and contains rounded gravel-sized clasts of micrite. In the quarry section, this intensively bored, more resistant band acts as a type of roof bed: gulls in the lower strata, often infilled with calcreted limestone fragments, frequently do not penetrate upwards through it. It is overlain by 1.25 m of cross-bedded biosparrudites, with the foresets dipping westwards. These cross-bedded rocks are overlain by a 0.35 m bed of biomicrudite, which, in the left-hand side of the cutting, is capped by 0.7 m of oosparite (Hawkins, 1977).

The structural disturbance of the beds, as revealed in the road cutting, is of considerable interest. It has not yet been possible to explain satisfactorily all of the structures, or to determine accurately the geological succession further than that given in the paragraph above. The gulls, up to 0.4 m wide on the left-hand side of the cutting 15 m from the entrance, are good examples of the way that tension applied to massive beds causes a complete fracture to open; yet in the 2 m thinly bedded upper horizon, bed-by-bed slip means that the tensional strain is taken up by many small movements and no fracture penetrates through to the surface (cf. Hawkins and Privett, 1979). The fact that these cavities exist, yet are not visible at the surface, is obviously of importance in the construction of buildings on the plateau surface (Hawkins, 1977).

Entering the cutting, one of the first things noticed is the almost horizontal bedding to the left, yet the beds on the right have a northerly dip of 26°. This face has not been sampled in detail (Hawkins, 1977). It exposes an oosparite bed, over 1 m thick with a highly bored and oyster-covered surface. This distinct bed, when followed laterally is displaced in several places at the position of old gulls, now largely infilled with travertine. Ascending the incline, the sub-horizontal beds on the left-hand side suddenly begin to dip northwards, and by the bridge they have a dip of 30°. Between the sub-horizontal and inclined beds is a 0.3–0.5 m zone of disturbance, possibly representing a fault or gull breccia. Just east of the bridge, dip-and-fault structures can be seen displacing by 0.82 m and 1.7 m respectively, the 0.43 m bed of biosparrudite with irregular borings overlain by oosparite with fine, generally vertical, boring.

Limestones of the Great Oolite Series are seen in the old quarry at the lower end of the cutting. In the cutting section deposits of chert and flint gravel with loamy clay fill solution cavities in the limestone. Locally, one band of limestone has been dissolved out and the space infilled with gravel overlain by bedded loam. Both the limestone and the cave filling had subsequently been strongly tilted and faulted as a result of cambering and the formation of dip-and-fault structures. It therefore follows that at the time when caves were formed and the overlying drift deposits were washed into the horizontal solution cavities, the camber slope on the west side of Bathampton Down did not exist. At that time, even after the deposition of the re-sorted high-level drift deposits, this section of the Great Oolite Limestone of Bathampton Down was virtually undisturbed (Hawkins and Kellaway, 1971).

During the construction of reservoirs on the top of Bathampton Hill in 1955, some large gulls were seen, in which masses of stiff plastic clay with pebbles of patinated flint, chert and limestone, and roughly bedded loamy gravel, were enclosed in limestone fissures. In 1969 a second set of reservoirs was built on the flat plateau top. These showed large caverns, pipes and swallow holes, some having been developed by the differential solution of individual limestone bands. In these excavations the Great Oolite limestones were not cambered, the bedding of the rocks being horizontal (Hawkins and Kellaway, 1971).

Interpretation

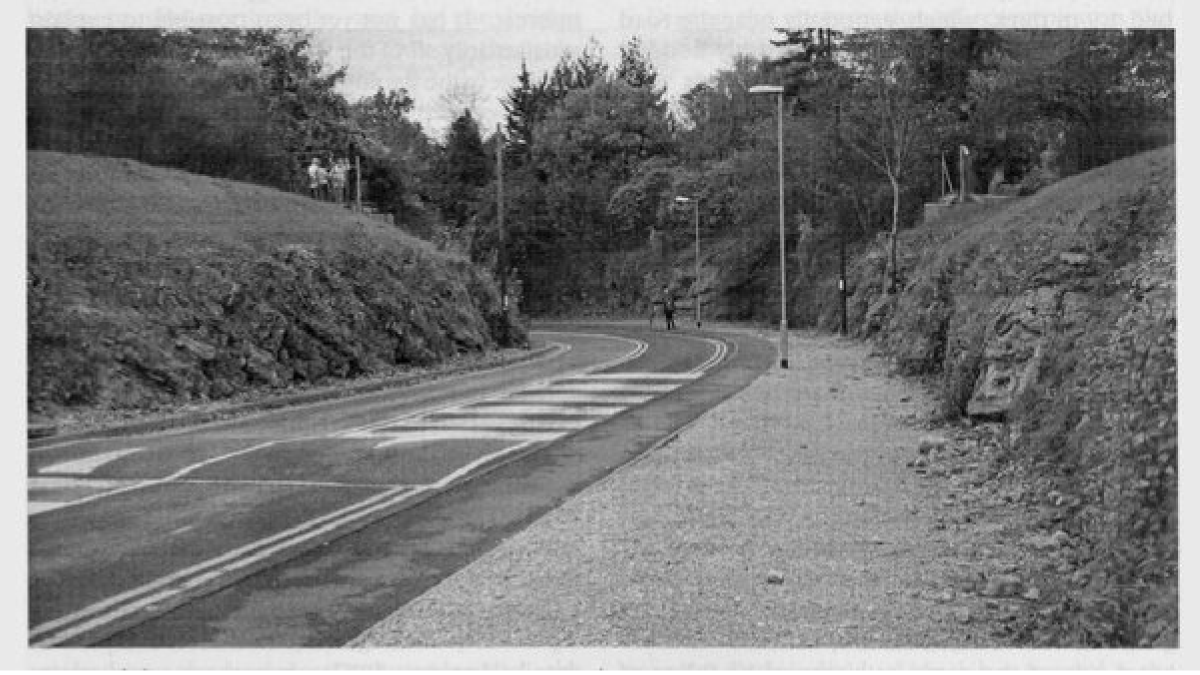
It is clear that the gull-bounded blocks of Great Oolite have settled on the underlying Lias Clay in such a way that their downslope dips are greater than would have been expected as a result of differential lowering by the cambering process. Each individual block has rotated in the downslope direction, as well as being lowered. Each may also have settled into the underlying clay by different amounts.

Where, as here, the downslope dip on cambered blocks exceeds the dip of the camber itself, irrespective of slope angle, the structure is termed 'dip-and-fault' (Hollingworth *et al.,* 1944). Contacts between adjacent blocks, displayed particularly well in the section at Bath, appear as normal faults heading upslope, with small downthrow on the upslope side.

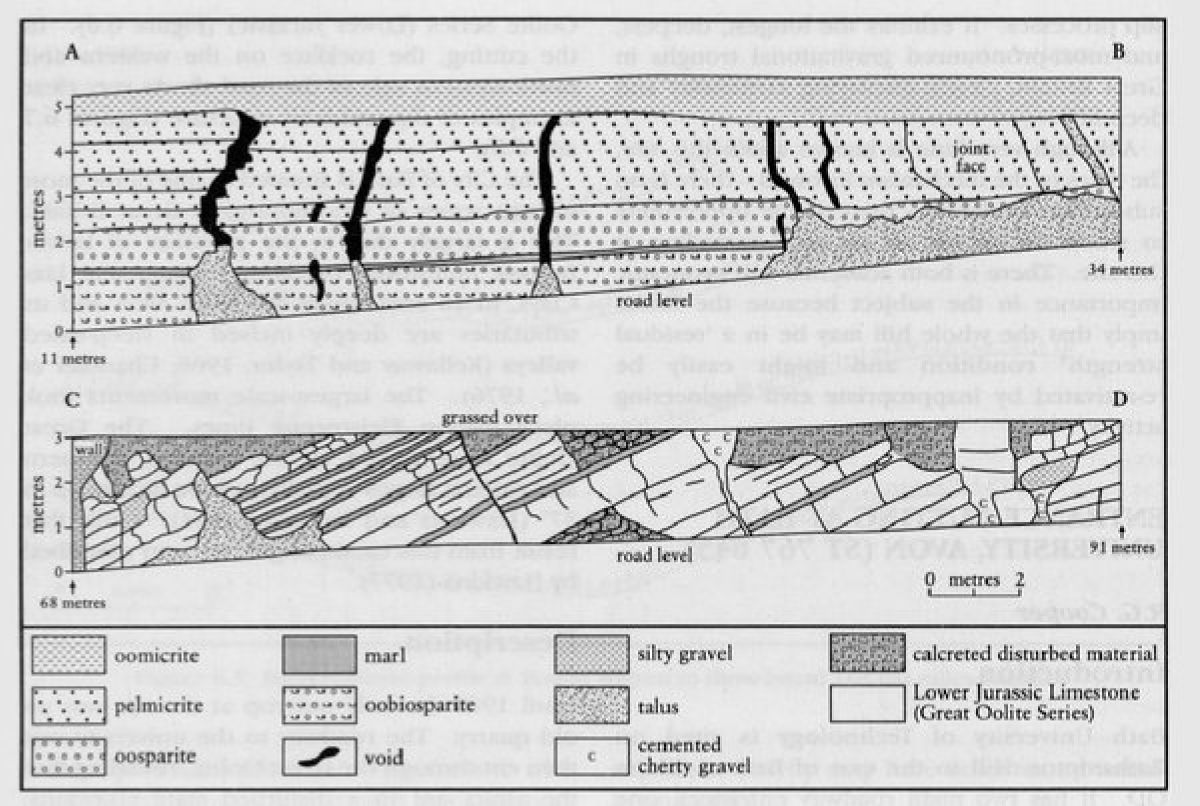
Conclusions

Dip-and-fault structures can be seen at many sites in Great Britain. They are, however, displayed with particular clarity at the Entrance Cutting at Bath University GCR site.

References



(Figure 6.6) Location of the Entrance Cutting at Bath University GCR site. (Photo: English Nature/Natural England.)



(Figure 6.7) Geological sections at the Entrance Cutting at Bath University GCR site. After Hawkins (1977).

(Figure 6.8) The section at the Entrance Cutting at Bath University GCR site showing the dip-and-fault structures. (Photo: R. Wright, English Nature/Natural England.)