Bradwell Dale

[SK 171 792]–[SK 174 808]

Highlights

Bradwell Dale and its upstream continuation, Stanlow Dale, lie along the margin of the karst, south-east of Castleton. They are the product of gorge incision caused by reef knolls interrupting the uniclinal shift of a valley excavated along a shale–limestone interface. Within Britain, this type of gorge is unique to the Peak District karst, where these two dales exhibit the clearest morphology of the type.

Introduction

Bradwell Dale and Stanlow Dale (Figure 4.9) form part of a dry valley network which drains north along the east dipping margin of the limestone plateau, immediately south of Bradwell. The valley is incised into the Lower Carboniferous limestones of the Eyam Group, which consist of both bedded, back-reef, lagoonal carbonates and also mounded reef knoll limestones. The gorge is important in demonstrating the role of the reefs in obstructing the downdip uniclinal shift of the valley to the east, instead forcing the valley to incise vertically, creating the gorge seen today. Modern drainage is now underground, so that the gorges, which were developed under periglacial conditions in the Pleistocene, are now dry.

The geomorphic evolution of Bradwell Dale and its associated caves were comprehensively described by Ford *et al.* (1975). These and several other anomalous gorges in the Peak District were further assessed by Ford and Burek (1976) who outlined the role of the reef knolls in the gorge formation, and by Ford *et al.* (1977a) as part of an overview of the karst geomorphology of the Bradwell area. The chronology of Bagshaw cavern, and its implications for Bradwell Dale, was outlined by Ford *et al. (1983).*

Description

The gorges and dry valleys are cut into the Carboniferous limestone, which dips east at 5–10°. The limestone then disappears under the Edale shales a few hundred metres to the east, where a broad strike valley draining to the north has developed along the limestone-shale boundary. The main Bradwell and Stanlow gorges are developed slightly updip along a prominent line of knoll reefs (Figure 4.9). They are incised up to a depth of 40 m into massive limestones, forming steep cliffs and craggy outcrops. The gorges extend some 2 km from Nether Water Farm in the south, north along strike to Bradwell village. Tributary to these are the dry valleys of Hartle Dale and Intake Dale which drain east down the limestone dipslope, meeting the gorge at Hazlebadge Farm. All the valleys are now dry, as modern drainage is underground. Several stream sinks are present along the shale boundary and these feed to a major resurgence in Bradwell village. The largest cave system associated with the gorge is Bagshaw Cavern (Figure 4.9); there are also other small sinks and cave fragments within the gorge and its tributaries, including fissures which have yielded Pleistocene mammal remains (Ford *et al.,* 1977a).

Interpretation

Ford and his co-workers (1975, 1976) described the role of the knoll reefs in the formation of Bradwell Dale, Stanlow Dale and the various other deeply entrenched valleys, or anomalous gorges, in the Peak District karst. They recognized that Bradwell Dale evolved along the shale/limestone boundary, and gradually shifted uniclinally eastwards and downdip as the shale margin was eroded back. Eventually, the original river draining the base of the dip slope was trapped by a series of reef knolls and prevented from migrating any further east; from then on, vertical incision predominated. The gorges of Bradwell Dale and Stanlow Dale were thus incised immediately updip of the main reefs. The shale cover continued to be stripped back, forming the broad shallow strike valley to the east of the gorge along the shale–limestone contact.

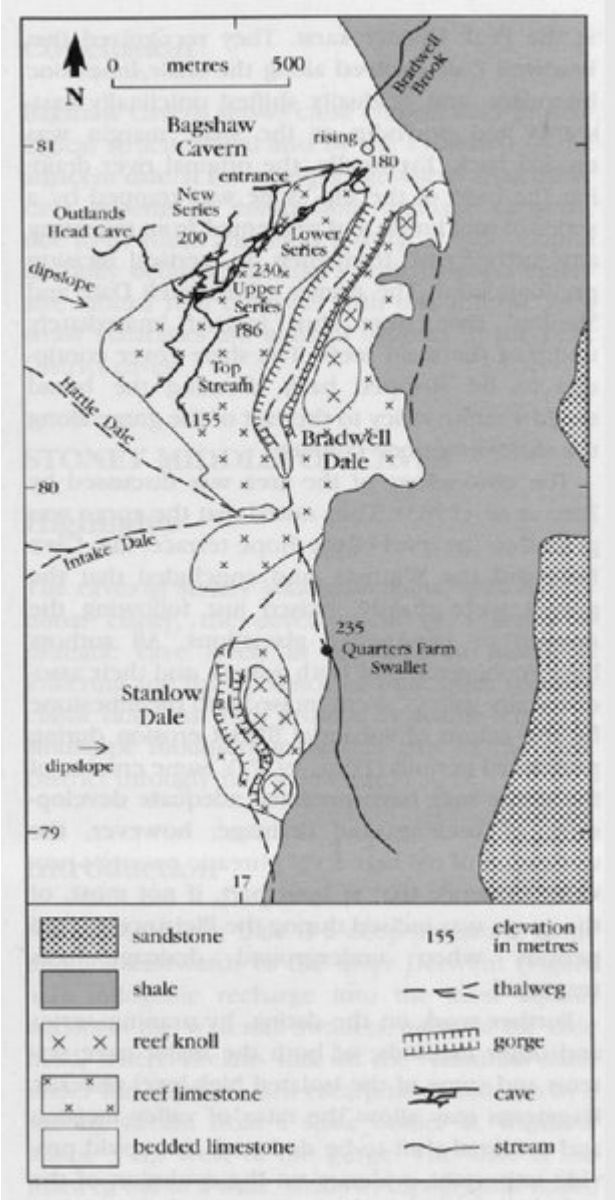
The chronology of the area was discussed by Ford *et al.* (1983). They noted that the gorge was graded to the level of the Hope terrace, like Cave Dale and the Winnats, and concluded that the gorges were mainly incised just following the Anglian or pre-Anglian glaciations. All authors have recognized that both gorges, and their associated dry valleys, were incised into the limestone by the action of subaerial fluvial erosion during periglacial periods (Ford, 1977a). Some erosion of the gorge may have predated adequate development of underground drainage; however, the truncation of old high-level phreatic passages provides evidence that at least part, if not most, of the gorge was incised during the Pleistocene cold periods when underground drainage was restricted.

Further work on the dating, by uranium-series and other methods, of both the major cave systems and some of the isolated high-level phreatic fragments may allow the rates of valley incision and uniclinal shift to be deduced; this could provide important evidence on the evolution of the area.

Conclusions

The site encloses part of a fine karst valley system with two gorge sections, which are the clearest examples in the Peak District where incision is due to the prevention of a valley migrating uniclinally downdip by reef knolls in the liinestone sequence. British examples of this phenomenon are found only in the Peak District. The tributary valleys are also good examples of dry karstic valleys in their own right, abandoned by the modern drainage which is underground.

References



(Figure 4.9) Geological map of Bradwell Dale and Stanlow Dale. Bagshaw Cavern is shown in outline, and lies mainly in the bedded limestones beneath the reef knolls (from survey by Eyam Exploration Group).