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## Cave Dale

[SK 150 825]

### Highlights

The deep karst valley of Cave Dale is significant in that it is a deep limestone gorge immediately underlain by a major cave system with which it has no evident genetic link. It was carved by fluvial erosion under periglacial conditions, and its lower end narrows into a rocky gorge. Another, totally separate, gorge has been formed by cavern collapse at the outlet of the underlying cave passage. The juxtaposition of these two gorges, unconnected and of contrasting origins, is unmatched elsewhere in Britain's karst.

### Introduction

Cave Dale is a fine example of a dry karst valley, narrowing to a rocky gorge in its lower reaches (Figure 4.8). Immediately adjacent to the valley and underlying it is Peak Cavern, at the resurgence entrance of which is the Peak Cavern gorge. Both gorges are incised into the northern flank of the limestone plateau immediately south of Castleton and provide sections through the Lower Carboniferous reef belt.

The entrance gorge and cave system of Peak Cavern have been described in numerous publications (reviewed by Nash, 1991), but only Ford (1986a, b) has fully described the genesis of the gorge. The formation of Cave Dale has received scant attention, but its origins were debated in a wider argument over the formation of dry valleys in Derbyshire by a number of authors (Warwick, 1964; Knighton, 1975; Ford, 1986a, 1987). Dating of the underlying Peak Cavern was undertaken as part of a larger study of the Castleton caves (Ford *et al.*, 1983).

### Description

The Cave Dale valley begins on the limestone plateau near Rowter Farm at an elevation of 440 m and feeds down the steep outer slope of the exhumed limestone reef front before debouching into the Hope Valley at Castleton, 240 m lower (Figure 4.7). In its upper reaches it is a shallow, wide, open grassy valley with one small tributary, incised about 10 m into the plateau. Its floor and sides are pitted with old mining depressions and dolines. Lower down the gradient steepens (Figure 4.8), eventually forming a fine karstic gorge at the foot with cliffs over 30 m high. Resistant bands of limestone form scars along other lengths of the valley sides.

The lower reaches of the dale are graded to the Hope Valley floor which is the level of the Hope Terrace (Waters and Johnson, 1958). An outcrop of basaltic lava (the Cave Dale Lava) occurs in the middle section, creating a positive irregularity in the long profile. A spring occurs where the lava outcrops, as downward drainage through the limestone is impeded. The resulting stream flows a short distance down the valley before sinking into the limestone below the lava flow, to reappear in Peak Cavern almost directly below. Apart from this, the valley is totally dry. Some of the cliffs at the downstream end have been modified by small-scale quarrying.

Underlying much of Cave Dale are the main streamway and tributary passages of Peak Cavern. This has the largest cave entrance in Britain, sited at the head of a short narrow gorge with cliffs over 50 m high. This is also cut into the side of the limestone hill, and its floor is breached by the various resurgences which carry most of the water sinking on the plateau above. The cross-section, long profile and overall dimensions of the Peak Cavern gorge are all in marked contrast to those of Cave Dale.

### Interpretation

The origins of Cave Dale were discussed by Warwick (1953, 1964) who suggested that, in common with the other dry valleys in the area, it developed through superimposition of a complex drainage network initiated on a Namurian shale cover. Rejuvenation led to the desiccation of the tributary valleys, after the formation of knick-points in their floors. Knighton (1975) put forward an alternative interpretation for these knick-points, advocating that the steepening of the thalwegs was a response to maintain flow continuity where geology imposed constraints on the adjustability of width. Ford (1986a) noted that the step in the Cave Dale profile was probably a structural feature caused by the outcrop of the basalt lavas rather than a true knickpoint. In a series of publications dealing with the limestone geomorphology of the Castleton area, Ford (1977b, 1986a, b, 1987) identified the role of periglacial meltwaters in the formation of the Cave Dale. He suggested an Ipswichian age for the main period of incision based on dating evidence from the underlying Peak Cavern (Ford *et al.*, 1983).

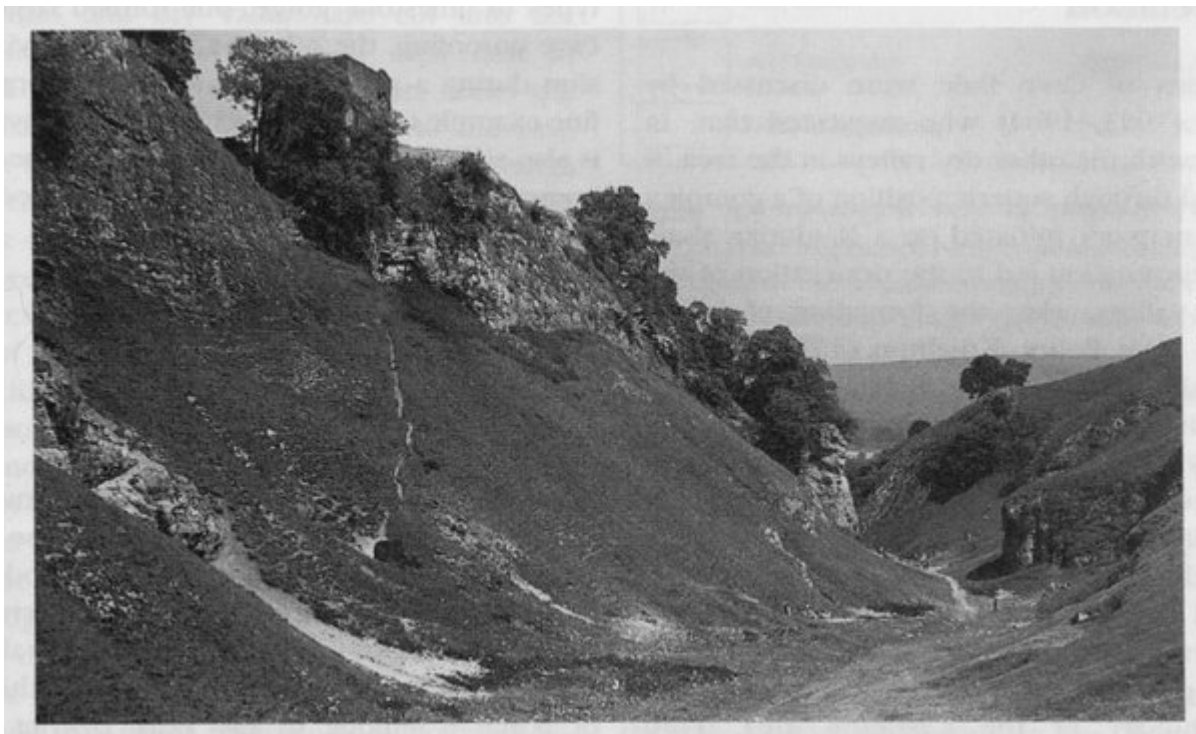
The origins of the Peak Cavern gorge are also discussed by Ford (1977a) and Ford *et al.* (1983), who noted that the gorge showed evidence of having been a vauclosian spring, which was initiated during the phreatic development of Peak Cavern during the Hoxnian interglacial. Downcutting through the lip of the vauclosian spring coupled with roof collapse has created the spectacular gorge seen today. Its roofed-over continuation can be seen in the entrance chamber of Peak Cavern.

The lower part of Cave Dale overlies one of the largest chambers in Peak Cavern. The only connection between the dale and the cave is through a very narrow fissure (now blocked); this is not an old sink, but is a phreatic rift in the cave roof which has been intersected by the valley. This lack of relationship between Cave Dale and Peak Cavern supports the view that Cave Dale is a young valley, excavated when the ground was frozen and the cave below was temporarily inactive (Ford, 1986a).

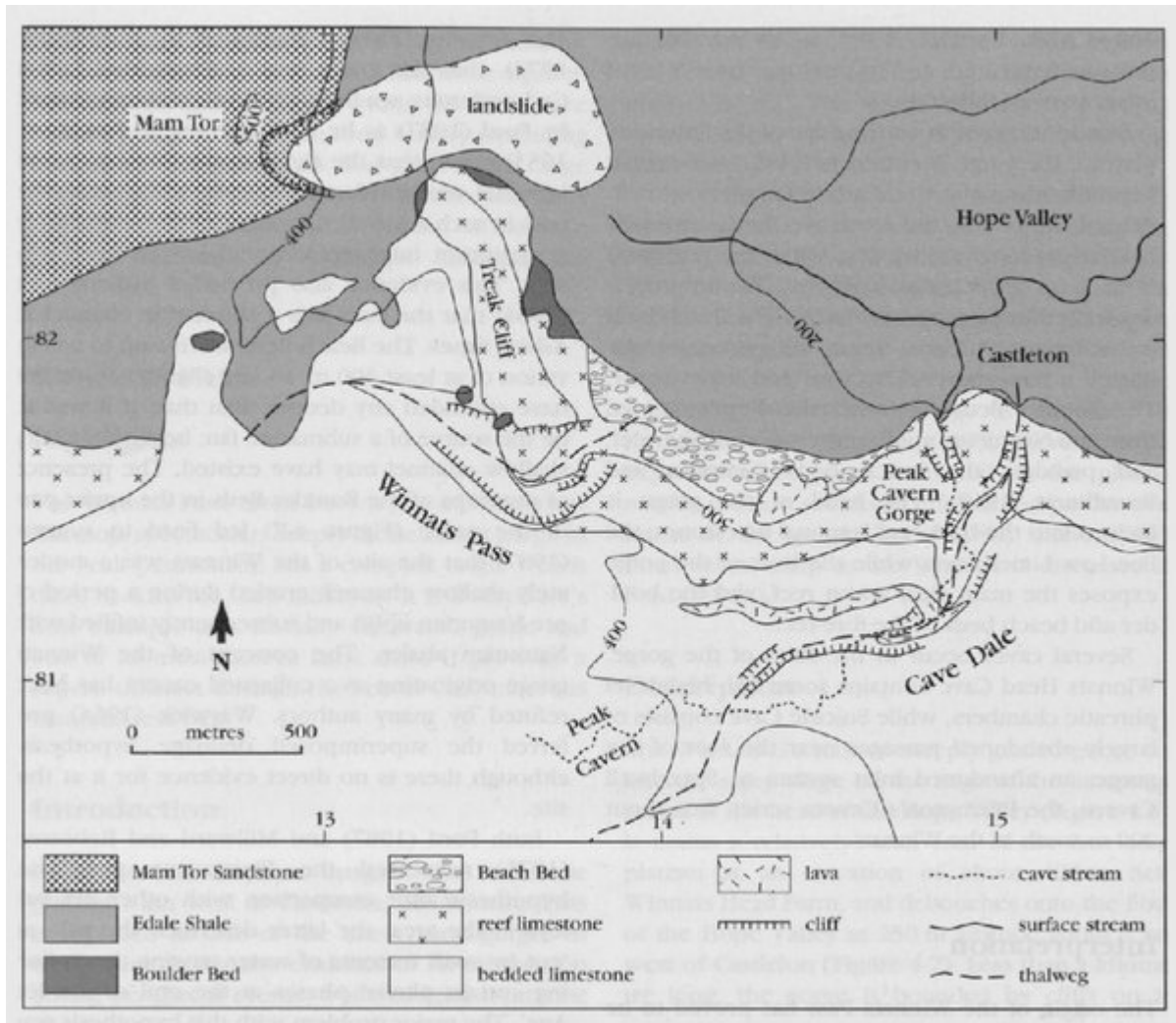
## Conclusions

Cave Dale and Peak Cavern provide a valuable and exemplary site with two genetically unrelated types of limestone gorge, one formed largely by cave unroofing, the other by subaerial fluvial erosion during a periglacial period. Each gorge is a fine example of its type in its own right. Cave Dale is also significant in being a deep limestone gorge immediately overlying a major uncollapsed cave system, to which it is genetically unrelated.

## [References](#)



(Figure 4.8) The lower part of Cave Dale looking downstream. Peveril Castle, on the left, overlooks the head of the adjacent Peak Cavern gorge. (Photo: A.C. Waltham.)



(Figure 4.7) Geological map of the Castleton reef belt containing Winnats Pass and Cave Dale.