Dove Dale

[SK 13 58]–[SK 14 51]

Highlights

Dove Dale is perhaps the finest example in Britain of an allogenic river cutting through a limestone massif. It forms an extensive and spectacular gorge with many notable karst features, and admirably demonstrates the nature of fluvial erosion within a limestone terrain.

Introduction

The River Dove crosses the Carboniferous limestone outcrop in a deeply entrenched gorge. It maintains its flow over the entire limestone outcrop, a distance of 10 km, and provides a clear example of river superimposition onto a limestone outcrop. The river, fed by a large shale catchment, is too large to sink underground, and erosion has continued until the present. The gorge morphology shows excellent adjustment to the different lithologies and structures within the limestone, and the walls contain various karst features, including Dove Holes and Reynard's Cave.

Warwick (1953, 1964) first studied the geomorphology of the Dove and Manifold valleys. Ford and Burek (1976) discussed the importance of the geological structure and the position of reef-knolls in determining the river course. An overview is documented in Ford (1977a). Rowe *et al.* (1988b) and Atkinson and Rowe (1992) discussed the geomorphic evolution of the area and commented on the age of the relief using uranium-series dating of caves in the neighbouring Manifold valley. The caves in the valley sides are described in Gill and Beck (1991), and the area is described in a field guide by Ford and Gunn (1992).

Description

The River Dove maintains its course across the south-eastern corner of the limestone outcrop (Figure 4.1), cutting a meandering valley north to south up to 150 m below the limestone plateau level. The headwaters of the river lie on the Millstone Grit, and it flows onto the limestone at the head of Wolfscote Dale. For the next 10 km the river is deeply entrenched into the undulating limestone plateau, descending some 70 m to emerge from the mouth of Dove Dale (Figure 4.18). A series of tributary valleys, notably Biggin Dale and Hall Dale, feed from the limestone plateau into the main valley; all are now dry, and many hang above the main valley floor. The valley rim is characterized by sharp breaks of slope at levels around 300 m. The lower section of the valley sides are thickly wooded, but are broken by lines of cliffs, some forming impressive vertical crags. Ilam Rock is an isolated limestone pillar breached by a cave which contains extensive tufa.

Several caves open into the valley sides, but most are small fissures penetrable for only a few metres; all show phreatic features. Dove Holes have two large unconnected cave entrances on the east bank, but only extend back a few metres. This site and several of the smaller caves have yielded Devensian and Holocene mammal remains as well as human artefacts (Spencer and Melville, 1974). A number of small risings lie along the banks of the Dove, most emerging just above river level on the east bank; these feed percolation water from the adjacent limestone plateau. The modern underground drainage appears to be immature and poorly integrated.

Interpretation

The gorge section of Dove Dale owes its origins to the superimposition of the River Dove onto the limestone outcrop by progressive erosion of the Namurian shale cover, largely during the Pleistocene. Discharge of the river is sufficient to prevent it all sinking underground, and it maintains surface flow across the entire limestone outcrop; this is now aided by artificial ponding to improve the fishing in its downstream reaches. Knickpoints in the dry tributary valleys indicate multiple

rejuvenations, caused by erosion and base-level lowering in the valleys to the south on Triassic mudstone (Burek, 1977). The dry valleys were incised during periglacial periods, when underground drainage was prevented, only to be abandoned during each warm phase. Continued incision in the main valley, due to maintenance of the Dove flow, has left the tributary valleys hanging.

The sinuous form of Dove Dale is not a pattern of meanders inherited from when the drainage course superimposed onto the limestone; it was determined by the outcrops of the reef knolls within the limestone (Ford and Burek, 1976). As it cut into the carbonates, the river was forced to take the lowest available course between the biohermal masses of strong reef limestone. The river course tends to wind in between the reef knolls, and is deflected around several of them (Figure 4.18). The river has trimmed the edge of some reef masses, rather than cut through them. Where the river cuts between adjacent reef knolls, it forms steeper sides in its gorge, notably where it passes between Bunster Hill and Thorpe Cloud at the lower end of the Dale. East of Thorpe Cloud, an abandoned meander is perched 60 m above river level.

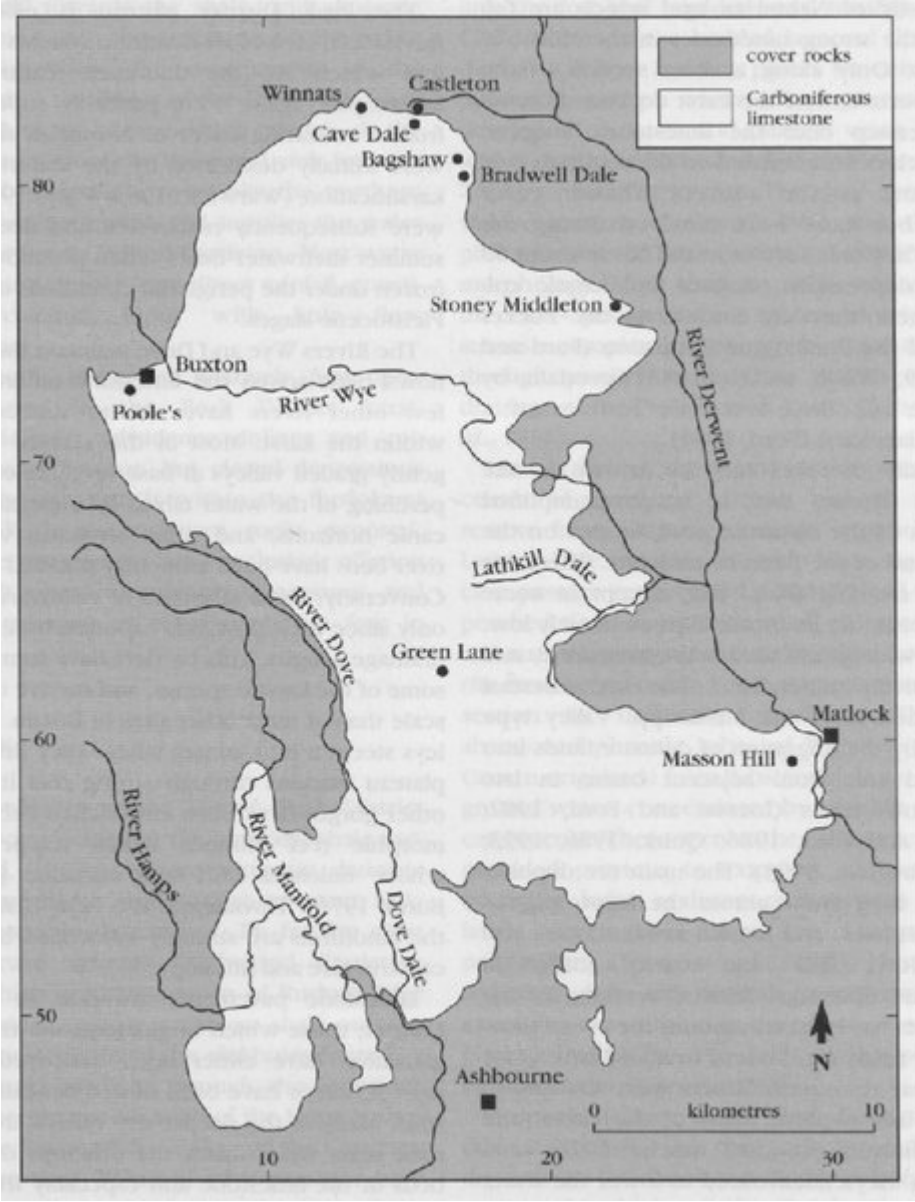
None of the caves in the valley sides is of any significant length; most are small old phreatic systems within the reef knolls. Dove Holes have large entrances where the river cliff has breached phreatic rifts. Reynard's Cave is another old phreatic tunnel, truncated in front of a joint-guided breach to leave a rock arch (Figure 4.19). Cave intersection and collapse has contributed little to the formation of the gorge. Nearly all the high cliffs, towers and crags are controlled by the limestone lithology; only their preservation is a function of karstic processes.

No absolute chronology is yet available from cave sediment dating. By analogy with the Manifold Valley close to the west, it appears that Dove Dale began to incise into the plateau surface about 3.5 Ma ago (Rowe *et al.,* 1988b; Atkinson and Rowe, 1992). Breaks of slope at levels of 265–300 m mark the start of the latest phase of incision into an older landscape of low relief (the '1000-Foot surface' of Clayton, 1979).

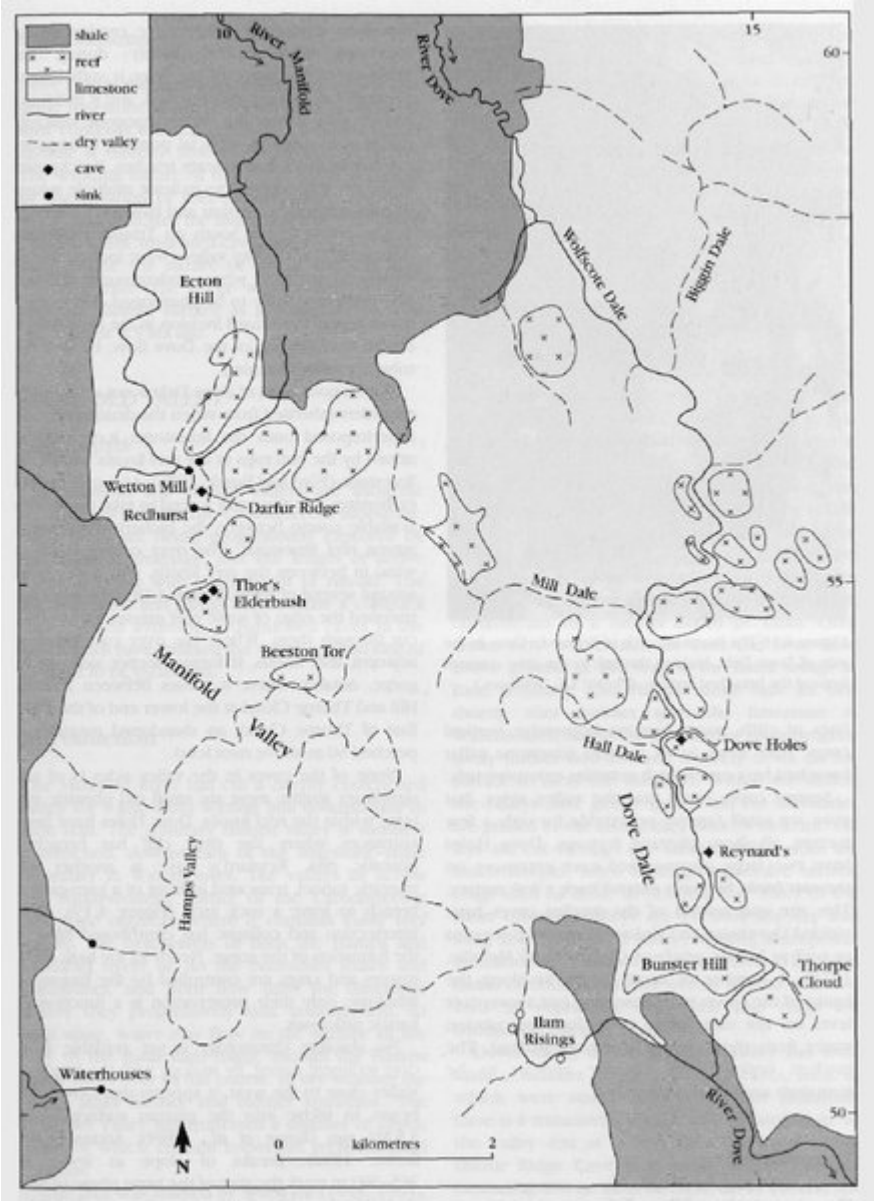
Conclusions

Dove Dale is the most spectacular and longest allogenic limestone gorge in Britain, and its allogenic flow contrasts with the dry tributary valleys where rainfall is directly absorbed into the limestone. The winding nature of the river course is guided by the position of reef masses within the limestone, and indicates the importance of lithological control. Cliffs, truncated caves and natural bridges demonstrate the nature of fluvial incision in a karstic terrain. The gorge was probably incised into the plateau surface as a result of renewed uplift about 3.5 Ma ago.

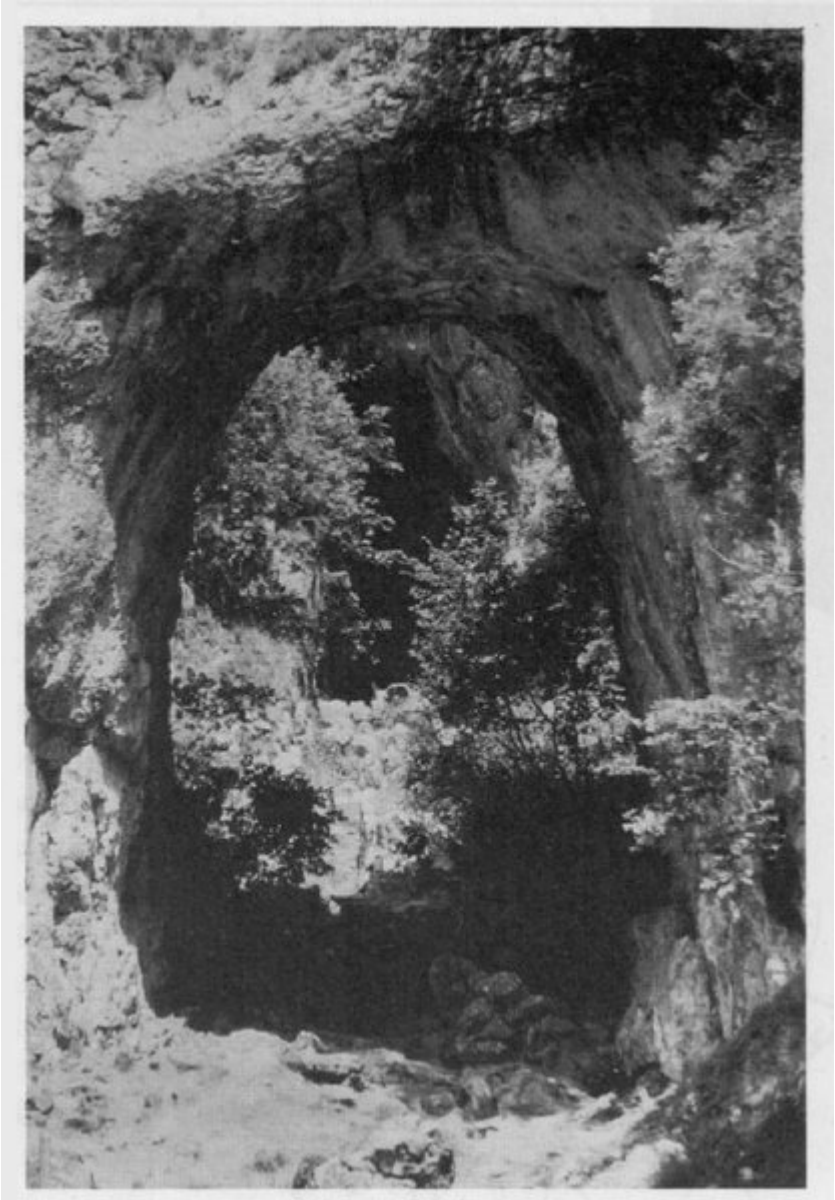
References



(Figure 4.1) Outline map of the Peak District karst, with locations referred to in the text. The cover rocks are Namurian shales and sandstones, and younger stratigraphic units.



(Figure 4.18) Geological map of the active and dry valley systems of Dove Dale and the Manifold River in relation to the reef knolls in the Carboniferous limestone (partly after Ford and Burek, 1976).



(Figure 4.19) The limestone arch of Reynard's Cave, in the side of Dove Dale, looking through to the cave remnant beyond the breached section. (Photo: A.C. Waltham.)