Lathkill Dale

[SK 15 66]–[SK 21 65]

Highlights

Lathkill Dale is a dendritic dry valley system deeply entrenched into a karst plateau; it is the best developed in the Peak District, and among the finest in Britain. The River Lathkill emerges from several springs at the lower end of the Dale, and has some of the most important examples of barrage and sheet tufas in Britain. The complex hydrology has been considerably affected by mine drainage.

Introduction

A dendritic network of shallow dry valleys incised into the limestone plateau drains eastwards from around the village of Monyash, and feeds into the head of Lathkill Dale (Figure 4.12). The upper part of the valley network is guided by the synclinal geological structure and is dry above Lathkill Head Cave, which is an active resurgence in wet weather. Below this cave, the surface stream is intermittent and seasonal until Pudding Springs are reached below the junction with Cales Dale, where the stream is permanent except in extreme drought. The surface flow is maintained in part due to toadstones (Carboniferous lavas) and less permeable limestones exposed in the valley floor.

The dry valley network was studied by Warwick (1953, 1964), while Ford and Beck (1977) expanded on his work, studying the chronological relationship of the downcutting of the dale to glaciation. In the lower part of the dale, thick deposits of tufa occur, some of which are still actively growing and form a series of barrages across the river (Towler, 1977; Aitkenhead *et al.,* 1985; Ford, 1989b; Pedley, 1993). These have enabled Pedley (1993) to deduce part of the Quaternary history of Lathkill Dale, but this is complicated by the considerable modifications imposed on the dale by past measures to affect mine drainage (Bamber, 1951; Robey, 1965). A comprehensive study of the dale's geomorphological history is awaited, though Ford *et al.* (1983) outlined a tentative chronology based on cave levels related to the Derwent terraces. The many caves in the dale are described by Gill and Beck (1991).

Description

The upper part of the Lathkill catchment consists of an elongate bowl centred on the village of Monyash, with a group of shallow dry valleys leading out to the east. These coalesce into a dry gorge with steep rocky sides incised up to 75 m below the level of the plateau surface. The gradient of the valley steepens markedly into the gorge section, and the steep rocky sides are fringed by coarse screes (Figure 4.13). At the lower end of this gorge, Lathkill Head Cave is the wet weather resurgence of the River Lathkill; in flood conditions this discharges a very large flow (Gill and Beck, 1991). Directly opposite is Critchlow cave which also discharges water in flood. Below this several more springs add to the stream, depending on the stage of flow, with water emerging from a spring at Holme Grove, from the Lower Cales Dale Cave, from Pudding Springs a kilometre downstream, and from Bubble Springs 3 km from Lathkill Head Cave. During severe drought, there may be no flow above Bubble Springs.

The general trend of Lathkill Dale is eastwards along the line of a gently plunging syncline. The dale exposes the Monsal Dale Limestones; these are mainly pure calcarenites with coral bands, but they include a lower facies of dark limestones which are rich in shale partings, thinly bedded and less permeable. Ford and Beck (1977) suggest that the dark limestones would have helped to maintain a surface flow along the dale, if the mine drainage had not artificially lowered the water table and captured much of the tributary input. At Bubble Springs, faults bring a bed of lava to the surface.

For much of its length below Pudding Springs, the floor of Lathkill Dale is covered partly by the remains of artificial dams, placed to improve the fishing, and partly by a large sheet of tufa. The tufa is most extensive at the lower end, and two tufa phytoherm barrages occur between Bubble Springs and Alport (Figure 4.12), with pool deposits in between (Pedley, 1993). The fossil tufa deposits further upstream are now being eroded by the stream or grassed over, and that at Pudding Springs has been modified by quarrying. An older, massive tufa sheet forms a cliff up to 8 m high and 150 m long immediately north-east of Alport (Figure 4.12).

Interpretation

Warwick (1964) described the Lathkill valley network in some detail and was convinced that the majority of the valley evolved from a complex drainage pattern initiated on overlying, impermeable shales, and that rejuvenation had led to progressive elimination of the tributary valleys. Ford and Beck (1977) suggested the main development of Lathkill Dale took place during the Pleistocene cold phases when periglacial conditions allowed surface flow of glacial meltwater and valley incision. They suggest that incision was initiated during the Last Interglacial, and followed the axis of the syncline; remnants of glacial till survive on the plateau. Initial incision was greatest at the downstream end and was via Greaves Hollow, which is now truncated and dry. Subsequently, the river was offset to the north (Figure 4.12), probably by some form of river capture (Ford and Beck, 1977), to follow the line of the mineral veins.

The role of rejuvenation appears to have been more limited in Lathkill Dale than it was in the Dovedale and Manifold valleys. None of the tributary valleys in the upper section hangs above the main valley floor (Warwick, 1964). Only lower down do some of the tributaries hang, and then they do so only by a few metres. One hanging tributary lies immediately south of Lathkill Head Cave (Warwick, 1964), but this may be a structural feature where contrasting limestone lithologies are juxtaposed across a mineralized fault (Ford and Beck, 1977). In other cases the tributary valleys may be partially infilled, thus apparently hanging above the main valley from where any infill has been removed.

The hydrology of Lathkill Dale is complex, has been much affected by mine drainage (Bamber, 1951; Ford and Beck, 1977), and is far from being fully understood. A natural phreatic cave system drains the upper part of the dale; Lathkill Head, Critchlow and the Lower Cales Dale caves represent the flood overflow or epiphreatic parts of the system. Below the Cales Dale junction, the Lathkill Dale and Mandale soughs were cut to drain the mines and have altered the flow regime, so that the main water now reappears at Bubble Springs.

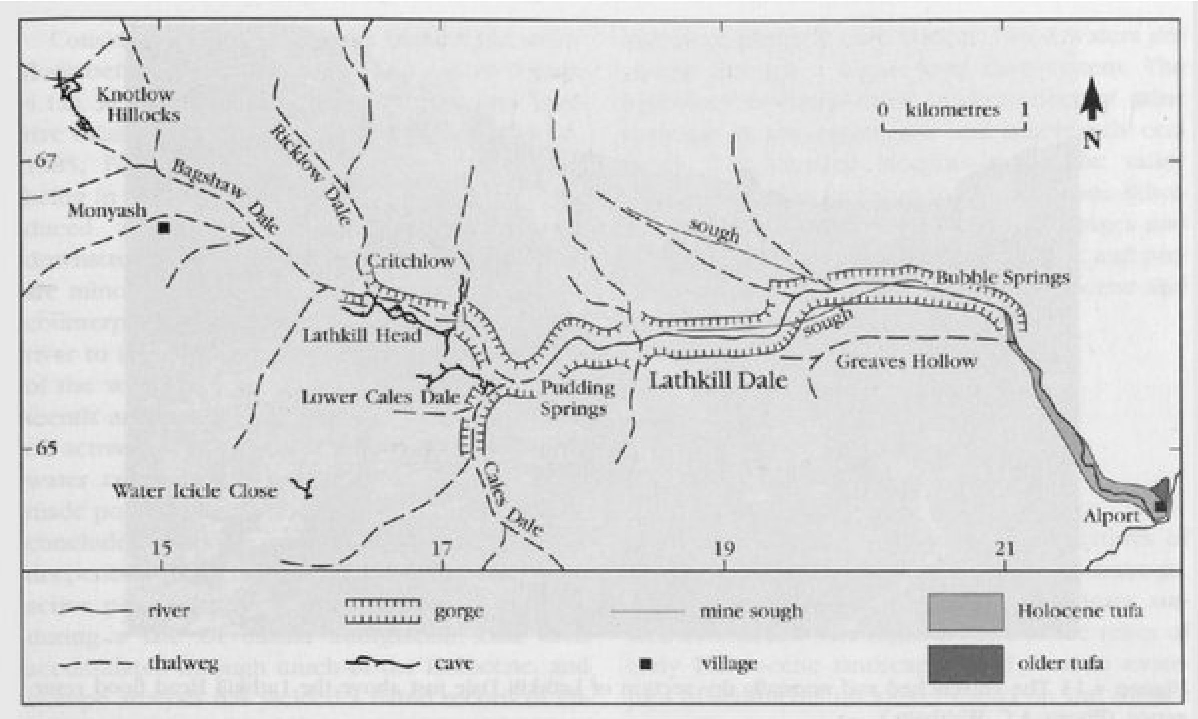
Considerable deposits of tufa blanket the valley floor between Bubble Springs and Alport (Figure 4.12). Reference has been made to the now inactive tufas above Bubble Springs (Aitkenhead *et al.,* 1985; Ford, 1989), the most detailed account being in Towler (1977), while Pedley (1993) produced a detailed study of the active tufas downstream of Conksbury. These modern tufas are minor in extent compared to their Holocene counterparts, due in part to the ponding of the river to improve fishing and the general lowering of the water table by mine drainage in the eighteenth and nineteenth centuries. The restriction on active tufa formation is due to both the falling water tables drying up the river and also manmade pollution inhibiting the algal growth. Pedley concluded that the pre-tufa Lathkill gorge was deepened during the earlier Devensian, with active phytoherm development causing ponding during a late Devensian interglacial. Tufa then accumulated through much of the Holocene, and isotope analysis has yielded a dated record of climatic and environmental changes from 10 000 to 4000 BP (Andrews *et al.,* 1994; Taylor *et al.,* 1994). Mean temperature reached a maximum around 8000 BP, and the forest cover was largely cleared in two stages by 5000 and 4000 BP. The tufa in the cliff above Alport was probably deposited during the Ipswichian interglacial.

Ford *et al.* (1983) suggest that the earliest phase of cave development was that associated with Water Icicle Close Mine, which has been dated in excess of 350 ka. The next phase was the development of Upper Cales Dale Cave, followed by renewed incision and the formation of Lathkill Head Cave. Limited incision of the dale occurred during the Devensian, followed by calcite deposition in the caves. Further dating of the speleothem sequences within the Lathkill caves is needed to confirm this chronology, and dating of the travertines could provide further data on Quaternary environments. Further dye tracing is required to resolve the complex hydrology of the karst.

Conclusions

Lathkill Dale is one of Britain's finest examples of a dendritic dry valley system. It was largely developed under periglacial conditions during Pleistocene cold phases. Surface flow occurs over differing lengths of the river bed depending on stage, with partial parallel drainage through an immature phreatic cave system. Flood waters discharge through a higher-level cave system. The hydrology is complicated by the effect of mine drainage in the eighteenth and nineteenth centuries. The detailed morphology of the valley shows a close relationship to the limestone lithol-ogy and structure. Several fine tufa barrages and sheets occur in the lower part of the dale and provide some evidence for the Late Pleistocene and Holocene development of the valley.

References



(Figure 4.12) Outline map of Lathkill Dale, its tributary dry valleys and its associated cave systems.

(Figure 4.13) The entrenched and normally dry section of Lathkill Dale just above the Lathkill Head flood resurgence. (Photo: A.C. Waltham.)