Stoney Middleton caves

[SK 21 75]

Highlights

The caves of Stoney Middleton show, with exceptional clarity, the development of a series of phreatic cave levels in response to base-level lowering and the presence of aquicludes and bioclastic horizons. They provide a valuable record of landscape modification in this area of the Peak District through the Pleistocene.

Introduction

Stoney Middleton Dale is a deep limestone gorge draining eastwards to the River Derwent (Figure 4.1). Allogenic recharge into the karst aquifer occurs at the Waterfall Swallets, north of the Dale head, where streams sink off the Namurian shale under the Millstone Grit escarpment, and also by a sinking stream from a shale outlier at Wardlow Mires, 3 km west of the gorge. The Dale is the thalweg out of a wide, shallow, topographic basin, which reflects the structure of the Wardlow syncline with the shale outlier at its centre. The catchment is bounded to the west of the basin by the outcrop of the Litton Tuff, which act as an aquiclude, maintaining a large groundwater reservoir within the basin. Several large phreatic cavities, possibly of considerable age (Beck, 1977), lie beneath the southern and eastern flanks of the basin. The catchment area for the risings at Stoney Middleton covers 17 km2, with 60% on limestone. The discharge is now entirely by mined drainage soughs, except in flood conditions, when the estavelles at Wardlow Mires and Carlswark Cavern discharge large streams.

The geological setting, evolution and hydrology of the caves of this site have been discussed by Beck (1975, 1977), Christopher and Beck (1977) and Ford and Gunn (1992). The caves are described by Gill and Beck (1991), with an account of Streaks Pot and Merlin Mine in Beck (1990).

Description

Waterfall Swallet is the largest of the sinks on Eyam Edge. It lies in a large doline which fills in flood and overflows into the adjacent cave system of Waterfall Hole. This cave reaches 43 m deep in a series of rift caverns, extensively modified by collapse, which enlarge beneath the wayboard at the base of the Eyam Limestone. Little Waterfall Swallet lies on the same fracture system a short distance to the north-east. Sinkholes at Eyam are largely hidden by the culverts which carry the Jumber and Hollow Brooks through the village, but one has been followed to a depth of 100 m in vein cavities. These brooks continue southwards via the Dell and Eyam Dale respectively, seeping into their valley floors in dry weather, or joining the Dale Brook in wet conditions.

Stoney Middleton Dale exposes an almost con tinuous section, 3 km long, through the Brigantian Monsal Dale limestones of the Carboniferous. Within this sequence several important speleogenic horizons have been recognized (Beck, 1975). A number of caves are developed, mainly along the strike on these horizons (Figure 4.10); they form a series of levels which reflect external erosional events.

The highest and oldest part of the cave system is the First Remnant Complex, represented by a series of tubes at levels of 210–216 m (Figure 4.11). Vadose feeders to the system are represented by Cucklet Church Cave and The Saltpan with their isolated fragments of passage in crags west of the Delf. The Second Remnant Complex is seen only as a large phreatic tube in the Dynamite Series of Carlswark Cavern; it lies directly beneath the First Remnant tube, which it clearly postdates.

The Carlswark Complex is the most extensive level of the system, with the majority of Carlswark Cavern, Streaks Pot and Yoga Cave developed at a level of about 180 m. Carlswark Cavern has two main relict phreatic tubes. Eyam Passage lies to the south and Streaks Pot represents its truncated continuation west of the Delf. Stalactite Passage is the northern

tube downstream of the joint-controlled phreatic rifts of the Dynamite Series. The entire Carlswark Complex is developed at the base of a limestone bed crowded with silicified *Gigantoproductus,* where a thin clay bed has arrested vertical percolation and initiated development of the network of tubes. Eyam Passage has a spectacular roof formed in the Lower Shell Bed, and also reveals excellent examples of bedding plane anastamoses. The Lower Complex is little known since it lies mostly below the thalweg and is largely flooded.

Interpretation

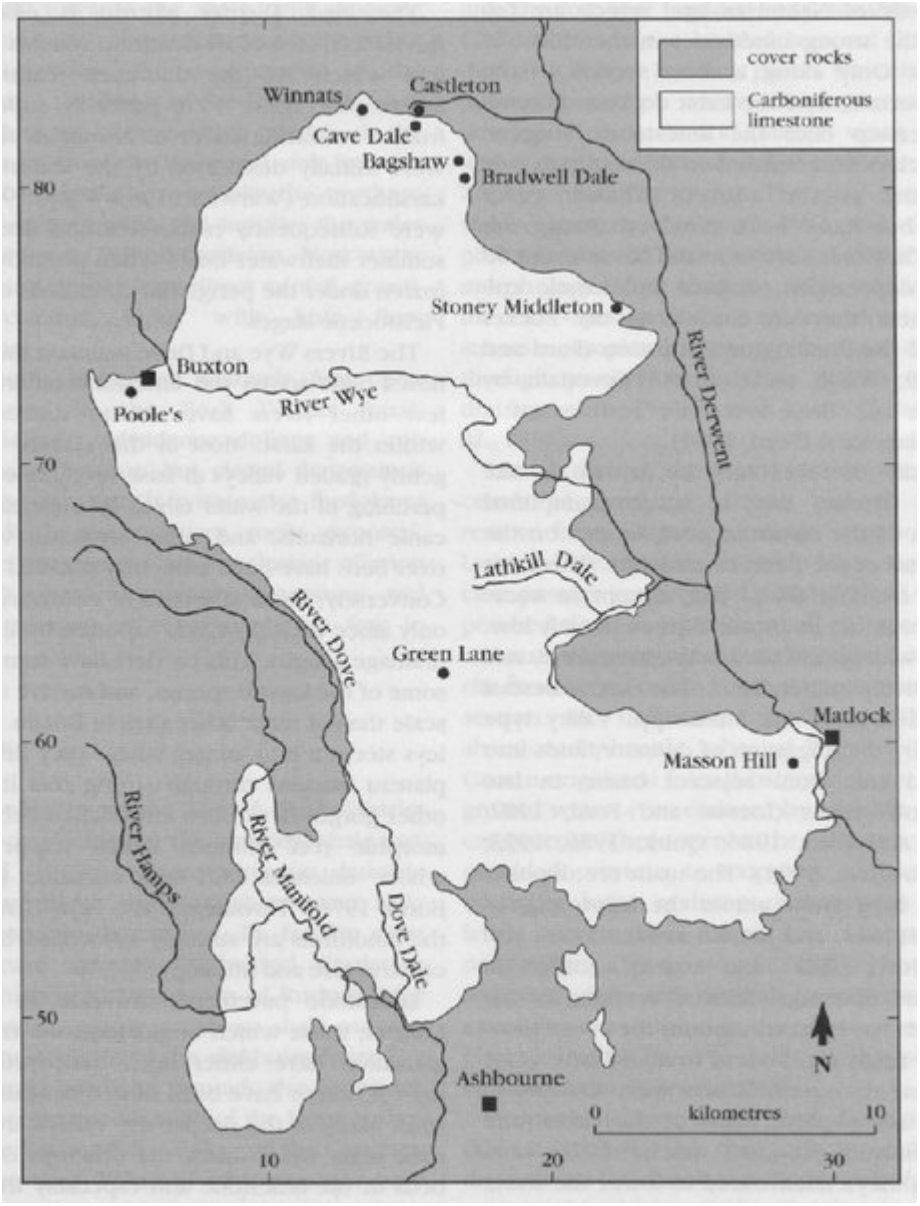
Cave development in the Stoney Middleton area has been influenced to an unusual degree by a combination of stratigraphic and surface topographic controls. The Lower Shell Bed is a bioclastic horizon, directly underlain by a clay wayboard aquiclude, which acted as an important inception horizon for the phreatic caves. Joint control is also conspicuous within the caves, both at the speleogenic horizons and as rifts linking them vertically.

The sequence of four cave levels represents a succession of shallow phreatic networks developed in response to intermittent rejuvenation and incision of the River Derwent upstream of the Matlock knickpoint (Beck, 1977). Each cave level was formed where favourable inception horizons lay just below the contemporary water table which was gently graded towards base level at the river. The minimal vadose trenching within the phreatic tubes suggests that each new level captured the entire drainage and fossilized the upper levels very rapidly (Ford *et al.,* 1983). The higher-level passages tend to be larger than those lower down, perhaps reflecting the formerly greater extent of the shale cover, and hence larger catchment area of allogenic water, at the time that they were active. Similarly, the position and vadose character of Cucklet Church Cave also suggest a more extensive shale cover at the time of initiation. Sedimentary fills in the abandoned levels demonstrate several stages of infilling and re-excavation; correlations with terrace levels suggest that the old highest level in the caves was active in pre-Anglian times, but stalagmite dating has not yet provided a chronological framework for all the levels (Ford *et al.,* 1983).

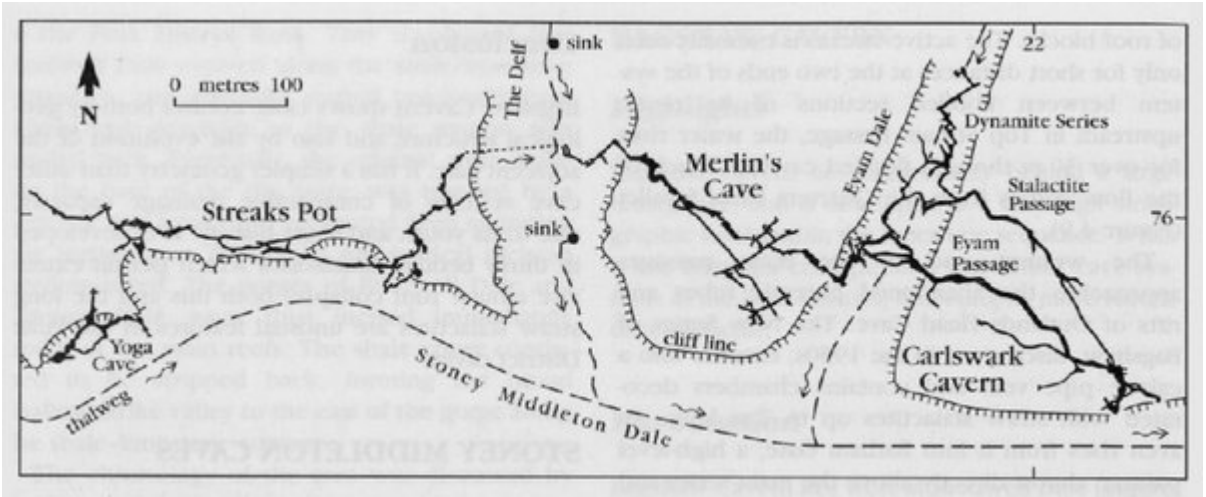
Conclusion

The Stoney Middleton caves provide excellent examples of the influence of aquicludes on the level of passage development. The successive levels of passage development also record, with exceptional clarity, the effect of lowering of surface drainage on underground drainage levels.

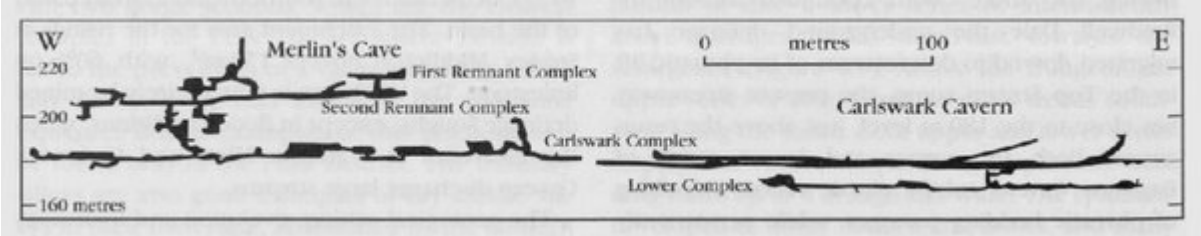
References



(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 4.10) Outline map of the cave systems under the northern flank of Stoney Middleton Dale (from survey by Technical Speleological Group).



(Figure 4.11) Long profile through Merlin's Cave and Carlswark Cavern showing the development on four levels (after Christopher and Beck, 1977).