
Penyghent Gill

[SD 857 734]

Highlights

The Penyghent Gill valley contains the finest illustration of cavern unroofing and collapse in Britain. The collapsed cave system shows clear relationships to both the geological structure and the valley rejuvenation.

Introduction

Penyghent Gill is a major tributary to the River Skirfare, which flows down Littondale to Wharfedale. The lower section of the gill valley is deeply entrenched in response to glacial overdeepening of Littondale. The Giant's Grave cave system lies at the head of the gill, just above a major knickpoint. This cave system contains over 700 m of passages, all at shallow depths beneath the valley floor. At its lower end there is an extensive area of collapse where the structure of the subsided limestone blocks is clearly recognizable on the surface. Although the site is a spectacular example of cave formation, collapse and unroofing, all in response to rejuvenation, it is poorly documented. The caves are briefly described by Long (1974) and Brook *et al.* (1988):

Description

Streams draining from the Blishmire peat bogs sink into caves formed within the Girvanella Nodular Band of the Hawes Limestone. The Giant's Grave caves have nearly 700 m of passages, broken by unroofed sections where the stream flows in daylight. The Main Cave carries the stream along a single bedding plane in a passage mostly about 1 m high and 2–12 m wide, with braided channels looping round bedrock columns (Figure 2.40). The stream emerges to daylight where the bedding plane is exposed at the head of the incised section of Penyghent Gill. It cascades into an area of collapse and feeds multiple routes either into the Lower Cave or into the surface course. The Lower Cave resurges lower down the gill, where its gradient increases and the valley sides steepen.

The almost horizontal limestone at Giant's Grave has two major bedding planes, about 2 m apart, on each of which there are small areas of well dissected limestone pavement (Figure 2.40). The Main Cave and the lower pavement are formed on the lower bedding plane. The zone of collapse is about 50 m across, and involves the beds immediately beneath both bedding planes. The limestone has been undercut by the Main Cave and its downstream, unroofed extension, and also by flow along a third, lower bedding plane which now floors the collapse zone between the Main and Lower Caves. A mass of jumbled tilted blocks constitute the collapse zone (Figure 2.41); minor bedding planes have been etched into the walls of the detached blocks, whose original relationships to each other can still be recognized.

At Giant's Grave the surface drainage has been captured underground and then re-exposed. Many other tributary streams to Penyghent Gill also exhibit underground capture, cave formation and cliff undercutting in response to valley rejuvenation. Lockey Gill has been diverted underground, but this is through a narrow fissure cave which is stable and very far from a state of collapse.

Interpretation

The main development of the Giant's Grave cave system followed the rejuvenation of Penyghent Gill, as a consequence of the glacial deepening of Littondale, which constitutes the local base level. The formation of the wide, braided cave passages has been aided by the presence of the conspicuous bedding plane, and the lack of deeper cave drainage is partially due to the lack of vertically extensive joints in the less disturbed limestone far from the Craven Faults; single joints rarely extend through more than one bed of limestone (Waltham, 1974b). Following the rejuvenation of Penyghent Gill, numerous tributary streams sank into joint fissures in response to the increased hydraulic gradients, but they then

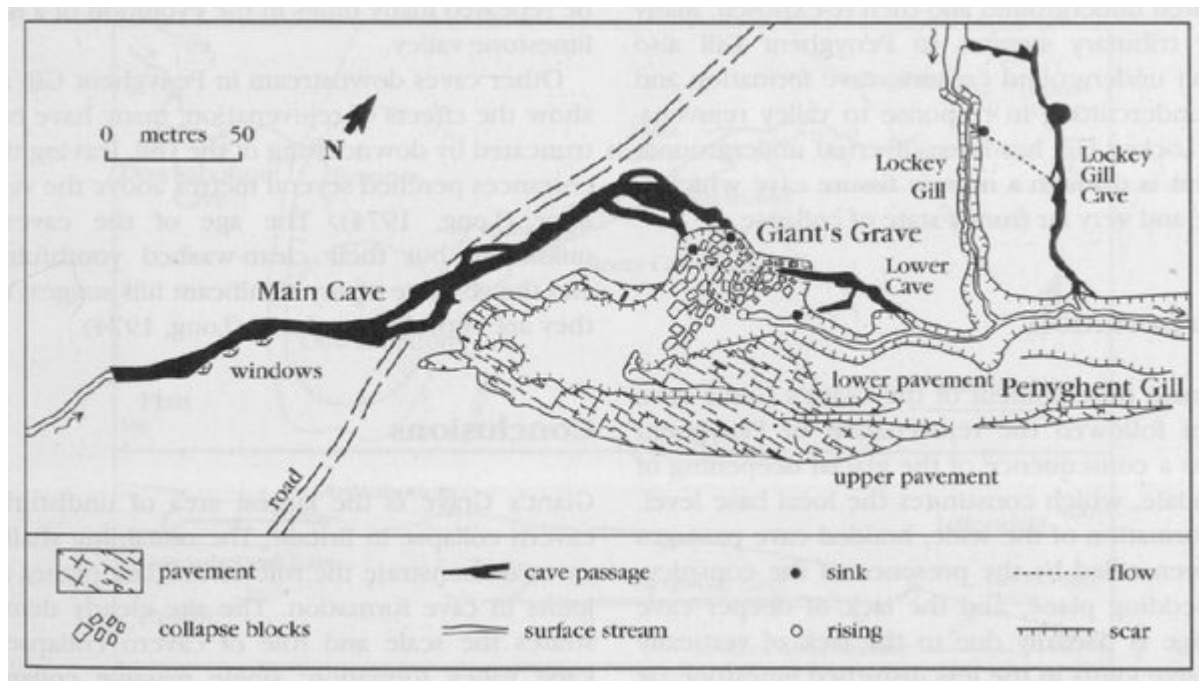
followed shallow, nearly horizontal courses perched on the bedding planes. As the limestone above the shallow caves is further thinned by surface lowering, the wide roof spans progressively collapse, creating the masses of subsided blocks, of which Giant's Grave is the best example. This process clearly contributes to the karstic development and entrenchment of the valley, and the process may be repeated many times in the evolution of a deep limestone valley.

Other caves downstream in Penyghent Gill also show the effects of rejuvenation; many have been truncated by downcutting of the Gill, leaving their entrances perched several metres above the valley floor (Long, 1974). The age of the caves is unknown, but their clean-washed youthfulness and the absence of any significant fills suggest that they are entirely postglacial (Long, 1974).

Conclusions

Giant's Grave is the largest area of undisturbed cavern collapse in Britain. The remaining shallow caves demonstrate the role of bedding planes and joints in cave formation. The site clearly demonstrates the scale and role of cavern collapse in karst valley formation; single massive collapses instantly creating valleys or gorges are not involved. The very small scale of the Giant's Grave collapse stands in marked contrast to the larger karst valleys of Cheddar Gorge, Trow Gill and the Winnats Pass; these sites are not collapsed caverns, but cave collapse has played a role in their progressive excavation.

References



(Figure 2.40) Geomorphological map of the collapse area and associated caves at Giant's Grave at the head of Penyghent Gill.



(Figure 2.41) The foundered blocks of limestone in the collapse area at Giant's Grave, Penyghent Gill. (Photo: A.C. Waltham.)