
Birks Fell caves

[SD 93 76]

Highlights

Two remarkably linear, active, cave systems lie parallel to each other under the edge of Birks Fell, and are almost parallel to the adjacent, steep side of Wharfedale. They demonstrate the overriding influence of a dominant joint set, causing underground drainage to flow for a considerable distance against the dip of the limestone and parallel to the valley side.

Introduction

The caves are located under the eastern slopes of Birks Fell, overlooking Wharfedale south-west of Buckden (Figure 2.1). Both caves are developed in the Great Scar Limestone, with their sink entrances just below the mixed shale and limestone sequences of the Yoredale facies. The limestone dips very gently to the north and is broken by a fault and a major joint set, both trending north-west-south-east. Birks Fell Cave was described initially by Coe (1968), and the passages in all the caves are described by Brook *et al.* (1988).

Description

Birks Fell Cave is the eastern system, containing more than 3600 m of passages extending to a depth of 142 m (Figure 2.46). The entrance lies where a stream sinks through the Girvanella Nodular Band, the distinctive horizon of nodular algal limestone within the Hardraw Limestone, marking the top of the Great Scar facies. Narrow, joint-controlled rifts alternate with low, bedding-controlled sections in the entrance series. Beyond two inlets draining from the west, the main passage heads south-east as a large rift developed along a fault. Beyond two avens, also with inlets draining from the west, the passage becomes larger and contains extensive collapse within its tall rifts; parts are well decorated with secondary calcite. Grand Gallery is a rift passage 20 m high leading to a series of high-level oxbow passages, decorated with stalactites and gour pools. The main streamway continues to Elbow Bend where the dry passage to the south-east ends in a choked rift 20 m from the end of Hermit's Cave (Figure 2.46). The active stream passage turns to the NNW, and a low passage draining downdip along a thick shale bed lies between two sections of rift passage. The final narrow rift ends at a sump only 120 m from the resurgence.

Parallel to Birks Fell Cave, and a short distance west into the hillside, a cave system with 1600 m of passage, developed over a depth of 117 m, links a sink at Redmire Pot to a resurgence at Birks Wood Cave (Figure 2.46). From the sink, a narrow rift streamway leads down several cascades and through some flooded sections, before joining the larger Main Streamway, where the water enters from Smegmire Pot. A large, vadose, rift continues past inlets from the west, to a short section decorated with remarkable helictites up to 300 mm long. Further rift passages, sequences of cascades, chambers modified by collapse, and more sections well decorated with helictites continue to a series of low bedding-plane passages with several flooded sections, which emerge at the resurgence exit of Birks Wood Cave.

Interpretation

The structural geology of the limestone has clearly influenced the development of both caves. The exceptionally linear form and the tall rift passages of Birks Fell Cave reflect the development along a fault for most of its length. The parallel Redmire/Birks Wood cave system, as well as Smegmire Pot and the two main inlets of Birks Fell Cave, have developed along the joints, and probably some minor faults, of a set parallel to the main fault. Both the Birks Fell caves have developed obliquely down their limestone fractures, with remarkably gentle gradients and only small shafts along their courses. This is in marked contrast to most of the fault or joint guided potholes in the Yorkshire Dales karst, which drop rapidly down vertical shafts to base level. The influence of a second joint set, trending NNW–SSE, can be seen in both

caves, notably in the passage downstream of Elbow Bend in Birks Fell Cave (Figure 2.46).

Dominance of the fractures in guiding the initial drainage through the limestone is reflected in the fact that, over most of their length, the caves drain obliquely against the dip. The passages in Birks Wood Cave are developed largely along bed-ding/joint intersections; shallow phreatic loops are developed by ponding where the cave drains updip, and are interspersed with cascades where the streamway breaks through to lower stratigraphical levels. This contrasts with the type of phreatic loop prevalent in the Mendip caves at both Cheddar and Wookey, where the water flows downdip before ascending to stratigraphically higher levels up phreatic lifts developed along joints.

Hermit's Cave represents a former outlet for Birks Fell Cave, now lying 35 m above the valley floor. A later phase of Birks Fell Cave evolved with the lower passage draining north, downdip but still along major joints to the modern resurgence in the valley floor; this was probably a consequence of a glacial deepening of Wharfedale, wholly or partly in the Devensian. Secondary calcite deposits in the lower caves are not yet dated, but could provide a time-scale for the excavation of Wharfedale.

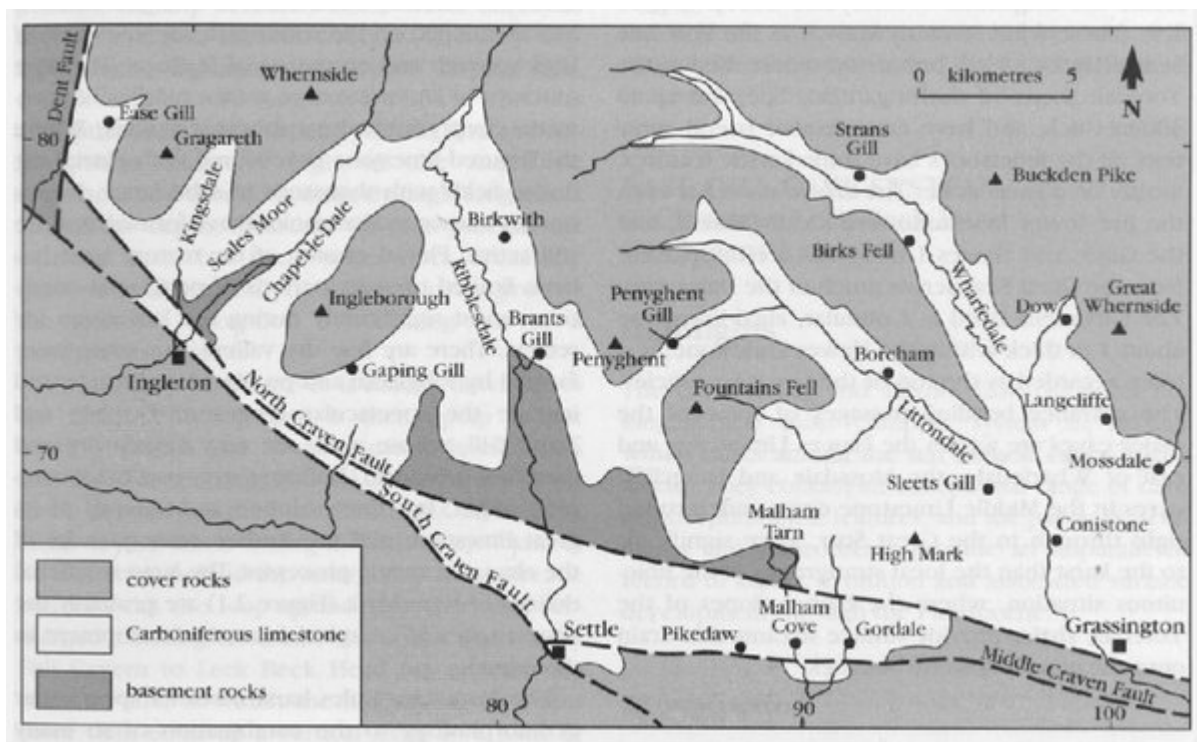
Though both caves are structurally guided in plan, their gently graded profiles ignore the potential influences of fractures and bedding, except on short sections of bedding cave. The uniformly graded profiles appear to have developed in a single phase along a hydraulically favourable, straight line path from the sinks to the contemporary resurgences in the slope north of Firth Gill. These paths would have been features of the steep water table in a youthful karst, and the conduits have retained their drainage roles, even though their upper parts are now effectively perched in the mature karst where the stable water table is close to the level of the nearby resurgences in the dale floor.

The development of two adjacent, independent, parallel, linear caves along the hillside that they drain has had a distinctive and unusual influence on their hydrology. Much of the allogenic drainage from the shale cover is captured by the Birks Wood Cave, and the only inlets to enter Birks Fell Cave drain from sinks which lie beyond the northern limit of Redmire Pot. None enters the lower part of Birks Fell Cave.

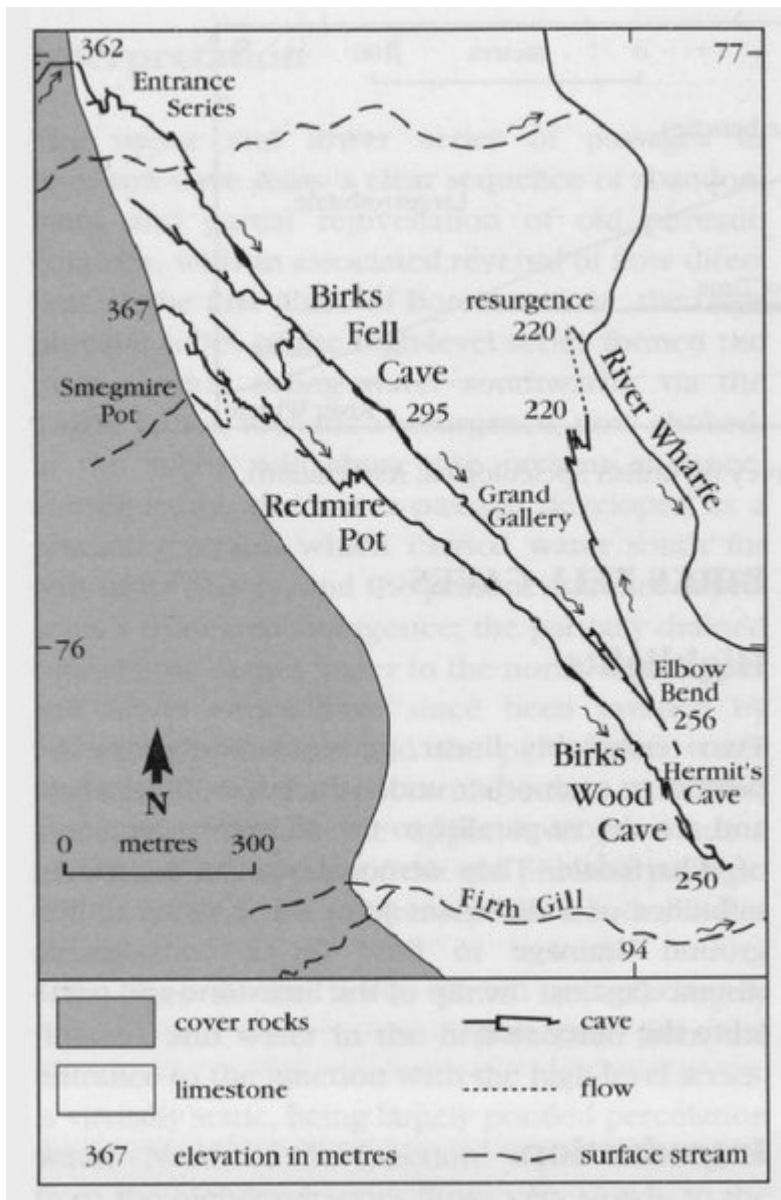
Conclusion

The two parallel and adjacent caves of Birks Fell provide a classic example of the manner in which geological controls on underground drainage and cave development can override the prevailing surface drainage patterns. Both caves are excellent examples of rift development along joints and faults, and Redmire Pot is also notable for some exceptionally large calcite helictites.

References



(Figure 2.1) Outline map of the Yorkshire Dales karst, with locations referred to in the text. The Carboniferous limestone shown includes all the Great Scar Limestone (Kilnsey, Cove and Gordale Formations) and also the lower Yoredale limestones (of the Wensleydale Group) where they are hydrologically linked to the Great Scar and are therefore part of the same karst unit. Higher limestones within the Yoredale Series are not marked. Basement rocks are Palaeozoic slates and greywackes. Cover rocks are the Yoredale facies of the middle and late Brigantian Wensleydale Formation and various Upper Carboniferous and Permian clastic formations.



(Figure 2.46) Outline map of the Birks Fell and Birks Wood Caves (from surveys by Craven Pothole Club and Cambridge University Caving Club).