
Wookey Hole

[ST 532 480]

Highlights

Wookey Hole is a large resurgence cave developed in a unique geological situation, passing from the Carboniferous limestone into the cemented scree of limestone debris represented by the Triassic Dolomitic Conglomerate. The upstream reaches of the cave system display classic examples of deep phreatic circulation in a dipping aquifer, with successive passage levels developed in response to downward migration of the resurgence.

Introduction

The cave of Wookey Hole, located just north of the village of Wookey Hole, is operated in part as a show cave. It is a major resurgence lying on the southern margin of the Mendip limestone plateau (Figure 5.1) with a mean flow only exceeded by that of the Cheddar Rising. It is the outlet for allogenic water draining off the North Hill sandstone inlier into the swallet caves of Swildon's Hole and St Cuthbert's Swallet, as well as much of the remaining subterranean drainage derived from the southern flanks of North Hill and Pen Hill. The Ebbor Thrust extends north-west-southeast only a short distance south of the mouth of Wookey Hole and Ebbor Gorge, and has preserved a narrow slice of Upper Carboniferous sandstones and shales between two masses of limestone. West of the Ebbor Gorge this potential aquiclude extends to an altitude of up to 190 m but to the east, near Wookey Hole resurgence itself, it has been breached by a Triassic valley. The show cave is developed entirely within this ancient ravine which is filled up to 100 m of Dolomitic Conglomerate, a poorly sorted Triassic breccia of limestone fragments in a calcareous silt matrix. The upstream portion of the cave is developed largely in Carboniferous limestone which has a south-west dip of 10–15°. The Dolomitic Conglomerate is crudely bedded and is crossed by a number of fractures aligned north-west-south-east.

Wookey Hole has an extensive literature covering aspects of cave development (Drew 1975b; Ford 1965b, 1968; Donovan 1988) and hydrology (Atkinson 1978; Atkinson *et al.*, 1967). Macfadyen (1970), Gatacre *et al.* (1980) and Duff *et al.* (1985) provide general accounts, and Barrington and Stanton (1977) and Irwin and Jarratt (1992) describe the cave passages.

Description

The present Wookey Hole resurgence is located near the base of the Dolomitic Conglomerate at the head of a short gorge, created by headward retreat of the cliff face over the active and abandoned cave exits. The lower part of the streamway, as far as Wookey 12, is developed entirely in Dolomitic Conglomerate (Figure 5.15). Largely flooded passages, typically 5 m across, link low bedding chambers and tall, narrow rift chambers developed along vertical fractures. From the roofs of some of these outer chambers, old outlet passages extend to the surface. Between the resurgence and Wookey 4 the modern streamway is almost level, but beyond this it descends in a major loop, emerging from the Carboniferous limestone at Wookey 12.

The inner streamway continues in a series of deep phreatic loops linking chambers which have been formed by vadose incision and modification of the loop crests. A larger section of vadose passage up to 15 m high, 6 m wide and more than 120 m long is developed at Wookey 23. The furthest point yet reached in Sump 25 is a gravel constriction 60 m below water level. Above the streamway at Wookey 20 an inclined rift, with many speleothems, ascends over a distance of 600 m to enter a boulder collapse at the junction of the Carboniferous limestone with the Dolomitic Conglomerate, beyond which the passage divides. One branch continues to ascend through the Dolomitic Conglomerate while the other re-enters the limestone before ending in a choke. An abandoned phreatic lift forms a truncated passage linking Wookey 9 to the hillside (Figure 5.15).

Three small cave remnants survive in the Dolomitic Conglomerate on the east side of the ravine below Wookey Hole cave. Badger Hole is the largest of these, with a 13 m wide entrance and almost 60 m of excavated passages. Close by lies the Hyaena Den containing some 45 m of passages. Rhinoceros Hole is another small fragment of phreatic passage 13 m long. All of these sites contain rich mammalian faunas, including Devensian mammoth, reindeer and hyaena, and Ipswichian rhinoceros and hippopotamus, together with Middle and Upper Palaeolithic human artefacts. These indicate that sediment deposition commenced at least 100 000 years ago (Donovan, 1988; Tratman *et al.*, 1971; Tratman, 1975).

Interpretation

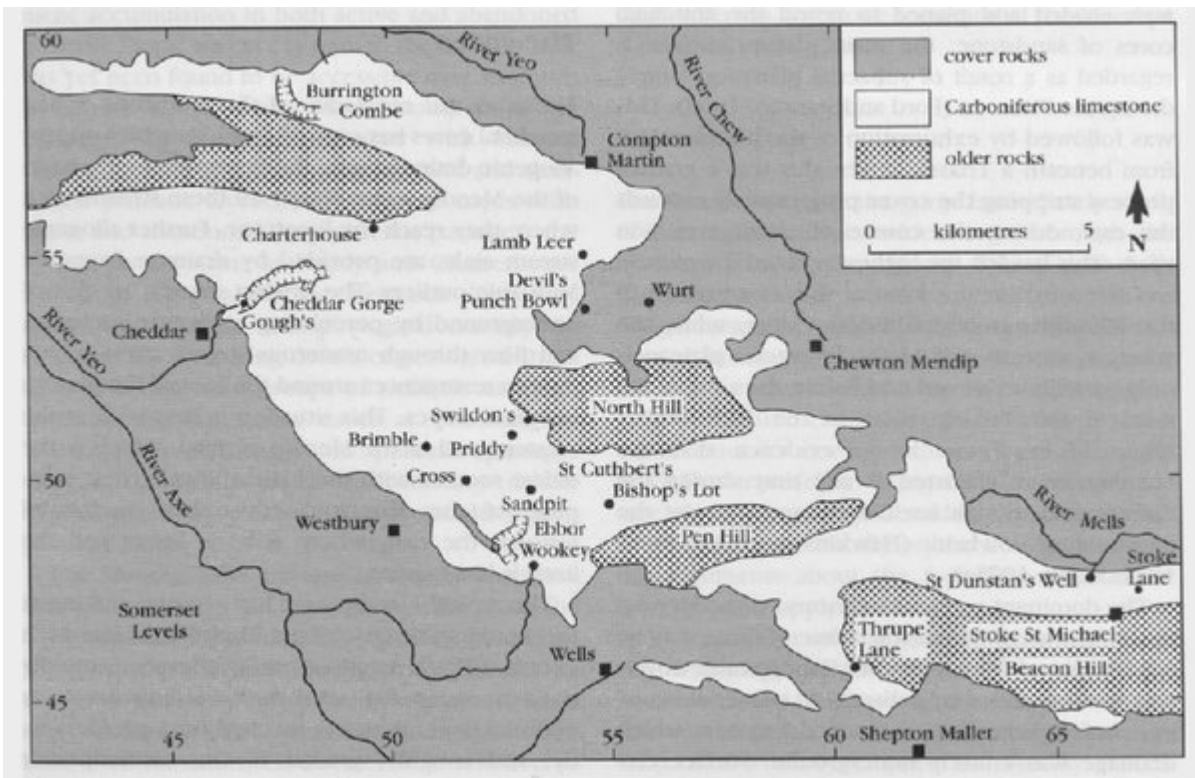
Wookey Hole is the only large cave in Britain developed in both steeply dipping Carboniferous limestone and Triassic Dolomitic Conglomerate, a well-cemented fossil scree. The different influences which these two rock types have exerted on cave development is clearly seen in the contrasting passage morphologies between the outer part of the system, developed in Dolomitic Conglomerate, and the inner part developed in Carboniferous limestone. In the Dolomitic Conglomerate, the streamway flows through a series of shallow loops linking low, bedding plane chambers, or through tall, narrow rifts developed by solutional enlargement of vertical fractures under phreatic conditions. In the Carboniferous limestone, the cave forms phreatic loops over 60 m deep, with the stream flowing downdip along bedding planes, before rising through rifts on the joints. The cave represents the finest example in Britain of deep phreatic development in steeply dipping limestones, and also shows excellent examples of vadose incision through the loop crests.

Ford (1965b, 1968) considered that much of the phreatic character of the cave, and of the swallet caves at Priddy, developed through ponding behind a major aquiclude, perhaps of sandstone east of the Ebbor Thrust or of Triassic Mercia Mudstone, producing a considerable hydrostatic head. However, the Ebbor Thrust was already breached by Triassic times, while the resurgence stream would have rapidly incised into the soft Mercia Mudstone, preventing the development of a perched phreatic for any length of time. The ascending rifts above Wookey 20 and 9 may represent feeders to relict, vauculian risings in the flank of the Mendip Hills. The high-level passages from the outer chambers may represent a series of distributary passages which developed, at successively lower levels, of approximately 80, 72 and 65 m down to the present water table at 60 m. These levels can be correlated with a sequence of altitudes and episodes of vadose incision on the crests of the phreatic loops. The successive lowering of the phreatic overflow was controlled by the resurgence positions which developed in response to removal of the aquiclude confining the limestone to the south; ultimately this was a function of surface lowering of the plains to the south of the Mendip Hills during the Pleistocene (Macklin, 1985). The clastic and speleothem deposits within the cave offer the prospect of establishing an absolute chronology for this sequence of events, which can then be used in reconstructing the geomorphological evolution of the landscape in this area.

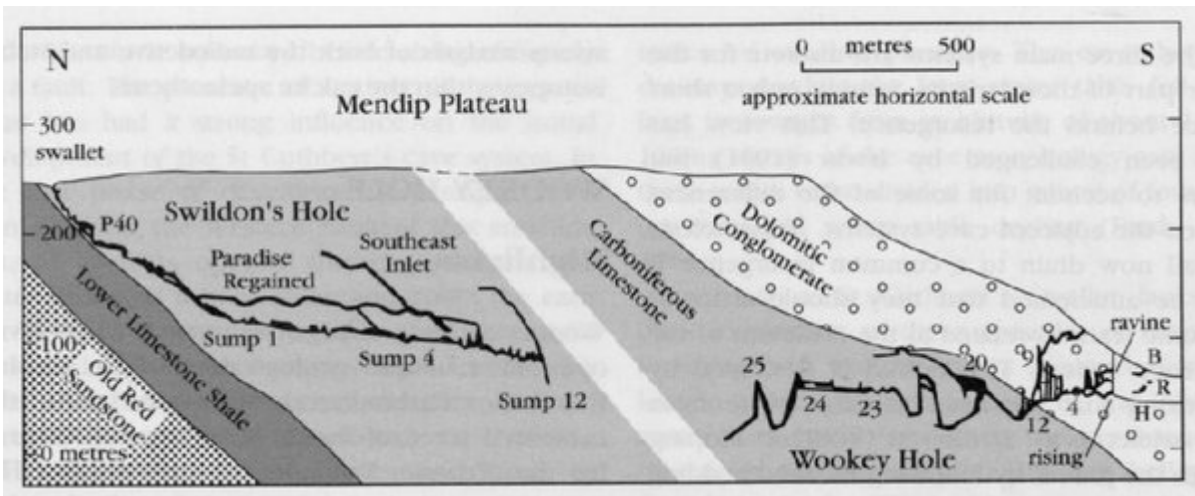
Conclusion

Wookey Hole is a major resurgence cave with the finest example of deep phreatic cave development in Britain. It is unique in being developed in both the Carboniferous Limestone and in the Triassic Dolomitic Conglomerate, and therefore demonstrates the different controls on karst drainage within these two important aquifers. The deep phreatic loops, controlled by the bedding and joints, include active and abandoned conduits in a configuration more complex than in the river cave at Cheddar.

[References](#)



(Figure 5.1) Outline map of the Mendip Hills karst, with locations referred to in the text. Cover rocks are mostly the Triassic and Jurassic mudstones and limestones; Upper Carboniferous rocks form the thrustured outlier on the east side of Ebbor Gorge. The Triassic Dolomitic Conglomerate is included with the Carboniferous limestone where it is composed of blocks of the limestone and is an integral part of the karst. Older rocks are the Devonian Old Red Sandstone and the Dinantian Lower Limestone Shale.



(Figure 5.15) Semi-extended profile through the cave system from Swildon's Hole to Wookey Hole. The gap in the middle has not yet been reached by underground explorations; the distance between the explored limits of the two caves is about 2.3 km, and the vertical scale is exaggerated by five. The small caves in the ravine are keyed as: B = Badger Hole; R = Rhinoceros Hole; H = Hyaena Den (after drawings by W.I. Stanton).