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# Hale Moss caves

[SD 500 775]

## Highlights

The caves of Hale Moss are the best examples in Britain of network caves which may have formed in narrow zones marginal to former lakes and within the range of their water table fluctuations.

## Introduction

Network caves are a feature of the low limestone scars adjacent to the peat mosses in the lowland karst east of Morecambe Bay (Figure 3.1). The mosses occupy broad depressions in the limestone which may have originated as poljes enlarged by base level solution. They were modified by Pleistocene ice transgressions, and now have outwash fills (Oldfield, 1960) and sub-aerial drainage outlets across the limestone. Along the western margin of Hale Moss, bluffs of Dinantian limestone form the high ground adjacent to the peat bog; this is massively bedded but well jointed, and dips at up to 6°. There are ten short cave systems in the limestone; all are almost horizontal and lie within a narrow altitude range of 23–27 m.

The caves and karst of the area have been discussed by Ashmead (1969, 1974a) and Gale (1981a, b), and the caves are described by Brook *et al.* (1994).

## Description

The main passage style in the known caves at Hale Moss is a joint controlled maze in the limestone adjacent to the margin of the peat moss (Figure 3.7). A few larger trunk passages extend further into the limestone bluffs, and some sections have developed as low, wide bedding plane passages. Most of the cave passages are less than 1 m high, and those formed on the joints are generally less than 1 m wide. Because of their small size and consequent inaccessibility, many of the joint networks have not been entered, and the trunk passages occupy an unduly large proportion of the mapped caves.

The ten known caves at Hale Moss have a total of over 1 km of passages, but this can represent only a fraction of the inaccessible, choked, unknown or undersized fissure networks in this zone of the karst. Hale Moss Cave is typical, with over 200 m of joint maze, joint guided trunk route and bedding passages, all on the same level in the dipping limestone (Figure 3.7). Hazel Grove Cave is a longer system of passages of similar style, and is formed on two levels, 2 m apart (Ashmead, 1969). All the other caves are shorter, and many are just fragments exposed by degradation of higher benches in the limestone.

## Interpretation

The caves of Hale Moss include excellent phreatic maze caves of the type normally developed by slowly moving water (Palmer, 1975). They are true three-dimensional mazes in that their rift openings have developed by solution of multiple intersecting joint systems and also of the bedding planes. Their macro-appearance as two dimensional mazes is only due to the solution being confined to narrow zones of altitude by external hydrological factors. Most of the cave passages lie at an altitude of 25–27 m, just below a poorly defined limestone bench; some passages in Hazel Grove Cave lie at a separate level about 2 m lower, which is very close to the top surface of the sediment fill within the Moss (Ashmead, 1974a).

There is debate over the environment of development of these cave systems. Ashmead (1969, 1974a) interpreted the Hale Moss caves as having developed close to the top of the phreatic zone by very slowly circulating water around the

margins of the lake which formerly occupied Hale Moss. This accounts for the horizontal development of each cave, where preferential flow within the shallow phreatic network led to the development of the more linear trunk passages. Gale (1981a) considered the phreatic network caves to represent mere fragments of typical karst drainage systems formed by water flowing under hydrostatic pressure. Wall scallops are evidence of flowing water, small phreatic avens indicate higher contemporary water tables, and the horizontal development of the caves is related to flow along the strike.

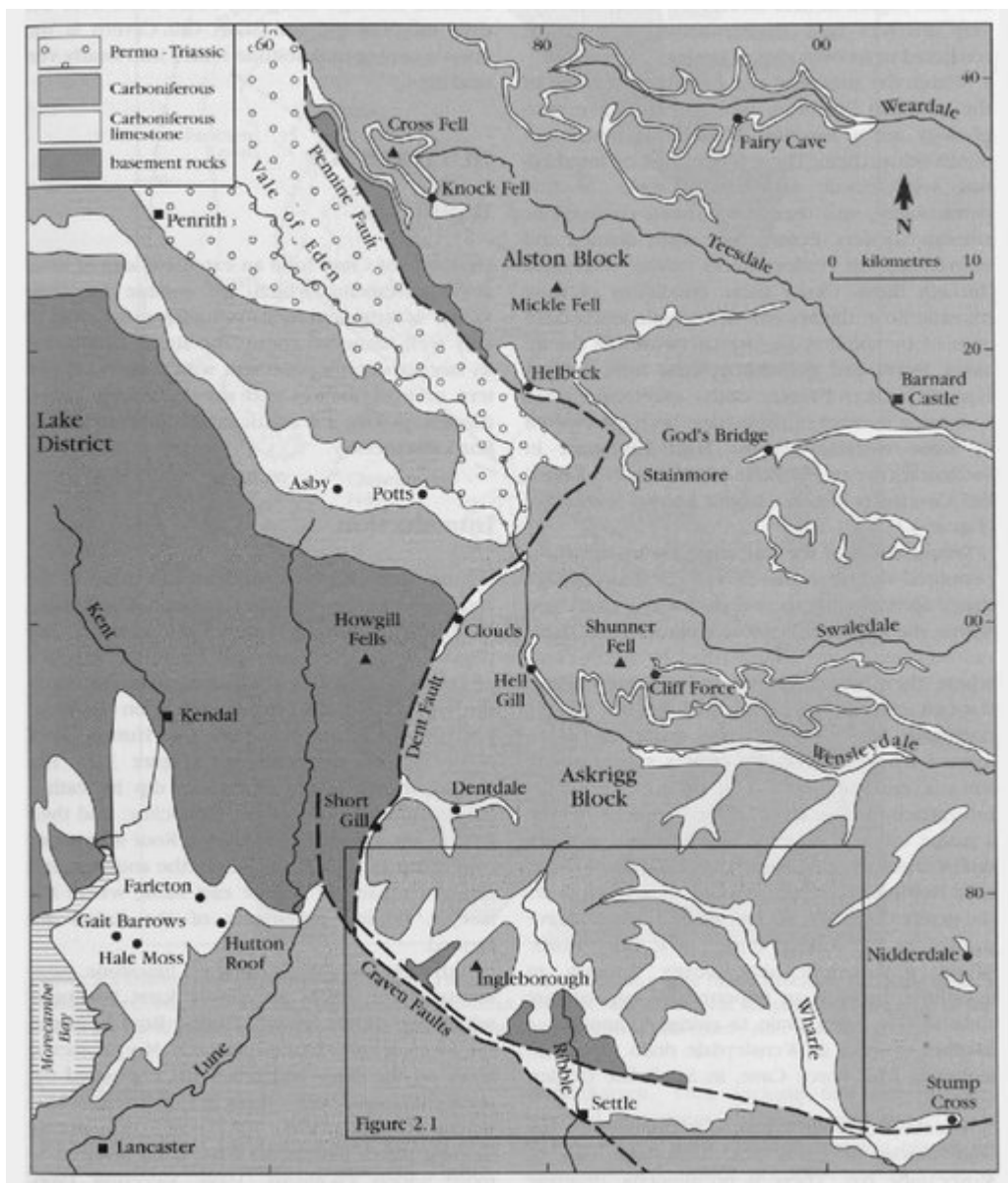
The two hypotheses only differ in emphasis. The maze caves may be the only true examples in Britain of cave development at the water table adjacent to a lake margin, with their altitudes correlating with former lake levels. The linear caves associated with them indicate higher flow regimes away from the lake margins, in a more normal environment of efficient karst drainage. Hale Moss Cave has both types of passage (Figure 3.7). The morphology of these caves stands comparison with other sites. Maze caves, foot caves and trunk routes are all developed at water table levels in most areas of tropical limestone, perhaps typified by the Mulu karst in Borneo (Waltham and Brook, 1980a, b), but this has no implications of a tropical palaeokarst at Hale Moss. Horizontal networks of blind passages, without associated trunk caves, are developed in steeply dipping Carboniferous limestone around the margins of the Killarney lakes in Ireland (Priesnitz, 1985).

The ages of the inland terraces and perched lake levels east of Morecambe Bay are not yet known, but the presence of glaciofluvial fills indicates the pre-Devensian origins of the rock basins. The caves must have a similar age, and the multiple levels at Hazel Grove suggest a sequence of stages in their development. Glacial modification of the surface topography may have been slight in this lowland karst (Gale, 1984), but it has created access to the caves, while rejuvenation has led to their abandonment and fossilization.

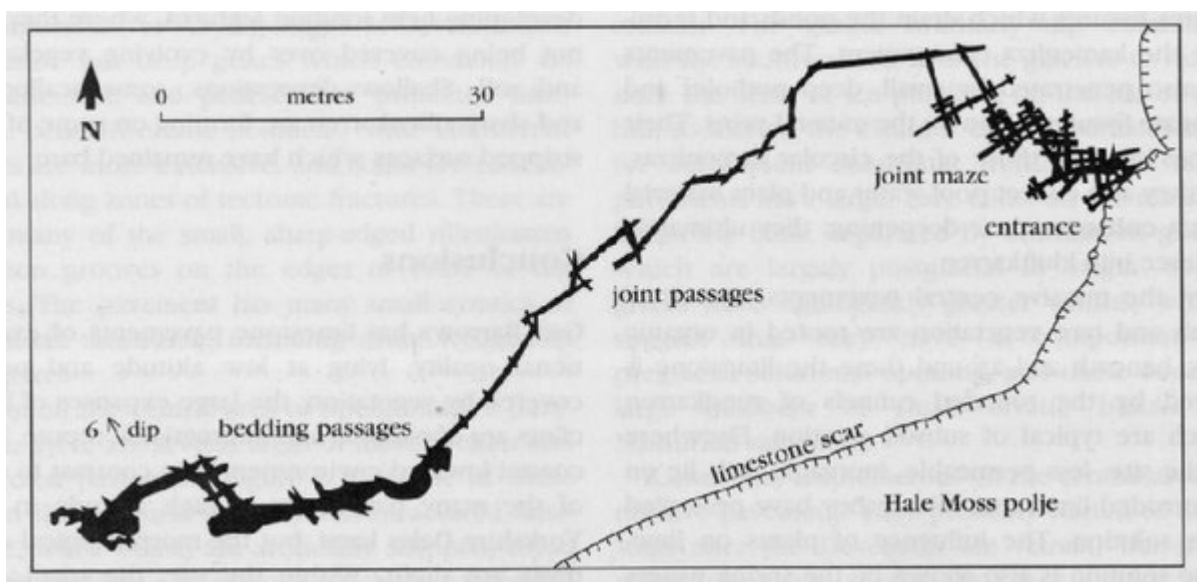
## **Conclusion**

The caves of Hale Moss contain mazes of phreatic passages which appear to be the result of solution by groundwater in the limestone margins of sub-aerial lakes, now filled with sediment and peat. They also have linear conduits which developed by faster karstic drainage away from the lakes. They are the finest of the many small caves in the Morecambe Bay karst, which are the only ones in Britain whose origins are directly related to past water levels in adjacent lakes.

## **References**



(Figure 3.1) Outline map of the karst regions in the northern Pennines, with locations referred to in the text. The other Carboniferous rocks are the non-carbonates of the Orton Group and Yoredale facies of the Dinantian, and the Namurian, but they include thin bands of limestone with lesser karst features not shown on this map. The Carboniferous limestone includes the Dinantian Great Scar Limestone, the Yoredale limestones with significant karst, and the Main or Great Limestone of Namurian age. The basement rocks are Lower Palaeozoic non-carbonates. Details and locations in the southern Dales are shown in (Figure 2.1).



*(Figure 3.7) Outline map of Hale Moss Cave (from survey by Red Rose Cave and Pothole Club).*