Alyn Gorge caves

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Highlights

The caves of the Alyn Gorge provide excellent examples of both shallow and deep phreatic drainage systems which now lie within the vadose zone as a result of mine drainage.

Introduction

Ogof Hesp Alyn and Ogof Hen Fynhonau lie beneath the southern flank of the Alyn Gorge, upstream of Mold (Figure 6.2). These two caves represent components of the former underground feeders of the Alyn River, subsequently drained by mining activities. The Carboniferous Limestone rests uncomformably on Silurian mudstones and dips at about 15° east; the caves are formed in the Asbian Loggerheads Limestone. This is broken by two sets of faults; an east-west trending set are mostly mineralized, and a north-south trending set are generally barren but some have notably wide breccia zones. The caves are developed adjacent to the Alyn River where it flows through the Alyn Gorge on its route across the limestone outcrop.

The only published accounts of these caves and their hydrology are by Appleton (1974, 1984, 1989).

Description

The entrance of Ogof Hesp Alyn lies on the south bank of the Alyn Gorge. Over 2000 m of passages have been mapped in the cave, most of them along the phreatic trunk route which has a series of loops over a vertical range of 90 m (Figure 6.26). Most of the cave was beneath the water table, until it was drained in about 1901. Lead and zinc ores were mined from zones beneath the natural water table, and this required massive pumping until deep drainage adits were driven to drain the limestone almost to sea level. The new adits drained most of the cave by capturing the flow which it originally fed to risings at its northern end. The Hesp Alyn passages are a mixture of rounded phreatic boreholes, tall rifts on the main faults, and elliptical tubes on bedding planes. Slow phreatic flow has etched networks of fissures out of some fracture zones. Some of the downloops are partly choked with collapse debris and clastic sediment, or contain perched sumps, and small modern inlets have invaded some sections. The upstream end of the cave lies on a mineral vein breached by a short length of active streamway.

Ogof Hen Ffynhonau lies close to the west of Hesp Alyn, with its entrance in a mineralized fault adjacent to the main group of pre-mining springs in the Alyn Gorge. Over 800 m of passages have been mapped in the cave, and most are on bedding planes along the strike, with rifts where the main faults are crossed. They carry part of the River Alyn flow, and reach over half way to the sinkhole sources in the river bed (Figure 6.26). Large calcite decorations have been deposited in some of the passages, which were mostly above the water table prior to the mine drainage.

Interpretation

The two caves in the Alyn Gorge present a unique combination of two contrasting resurgence systems, one shallow and one deep, both now made accessible through artificial drainage of the phreas.

Ogof Hen Ffynhonau represents a relatively shallow drainage system which lay close to the local water table prior to mining; calcite dripstone accumulated in some dry parts. Sections of both phreatic and vadose passage typify the morphology of a cave close to the valley floor, which determined the levels of the local water table at the crests of its undulating profile. Much of the flow was derived locally, from sinks further south on the Alyn River, though some additional flow may perhaps have come from a deeper source. A natural rift choked with large rounded boulders lies 10

m above river level near the entrance and may represent a former resurgence.

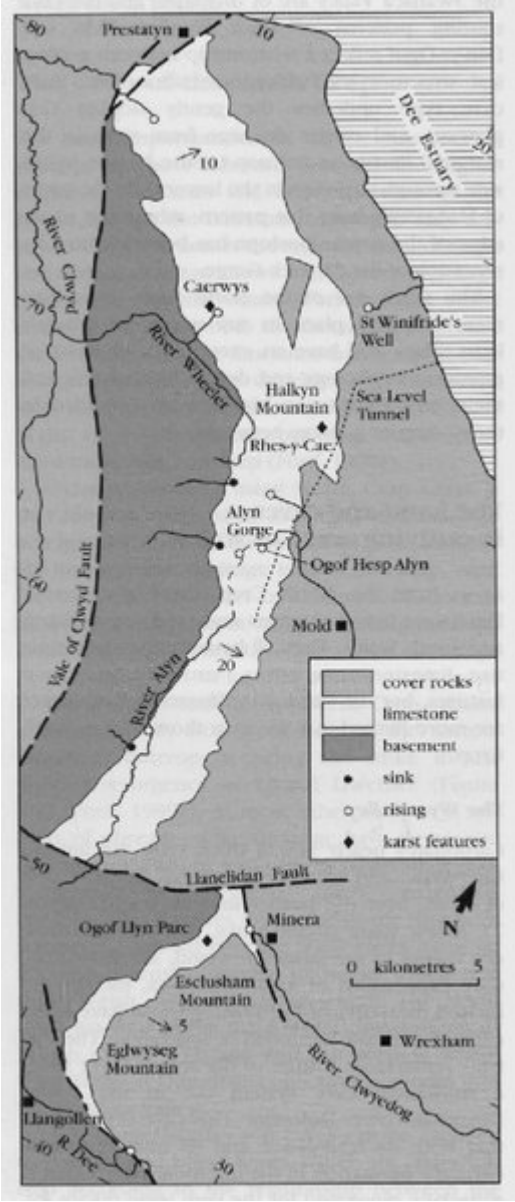
Ogof Hesp Alyn has a quite different morphology, reflecting its deeper phreatic origin away from the valley. Water flowing northwards, almost along the strike following the intersections of fractures and bedding planes. This orientation took the flow to increasing depths until vertical phreatic lifts developed on veins or cross-faults (Figure 6.27); these took the water to higher bedding planes before finally escaping through springs at river level. The conduit may have drained a large area of limestone to the south; there is a dearth of known sinks nearby. Short sections of vadose trench were cut through the crests of two loops close to the pre-mining water level, but the rest of the cave developed entirely under phreatic conditions. Its drainage by mining activities has been so recent that there has not been any significant vadose modification. The cave shows clearly the effect of geological structure on phreatic development, in particular the influence of major jointing, and also shows many phreatic solution features, notably solution pockets, phreatic tubes and large phreatic lifts. The linear arrangement of passages in the northern half of the system is partly due to a coincidence of strong north-south jointing with the northwards hydraulic gradient.

Formerly the Alyn River flowed northwards beyond Cilcain and through what is now the Wheeler Valley (Figure 6.2). At some point it was diverted across the limestone outcrop, thereby excavating the Alyn Gorge (Embleton, 1964), and it is clear that the caves must largely, if not entirely, postdate this event. The river is cutting down through glacial till along parts of its route through the gorge, suggesting that its diversion was pre-Devensian. Ogof Hen Ffynhonau appears initially to have resurged some 10 m above the present river level, suggesting that the caves too pre-date the last glaciation. The sediments and stalagmite sequences in Ogof Hen Ffynhonau are a consequence of these later events, but a chronology has not yet been established.

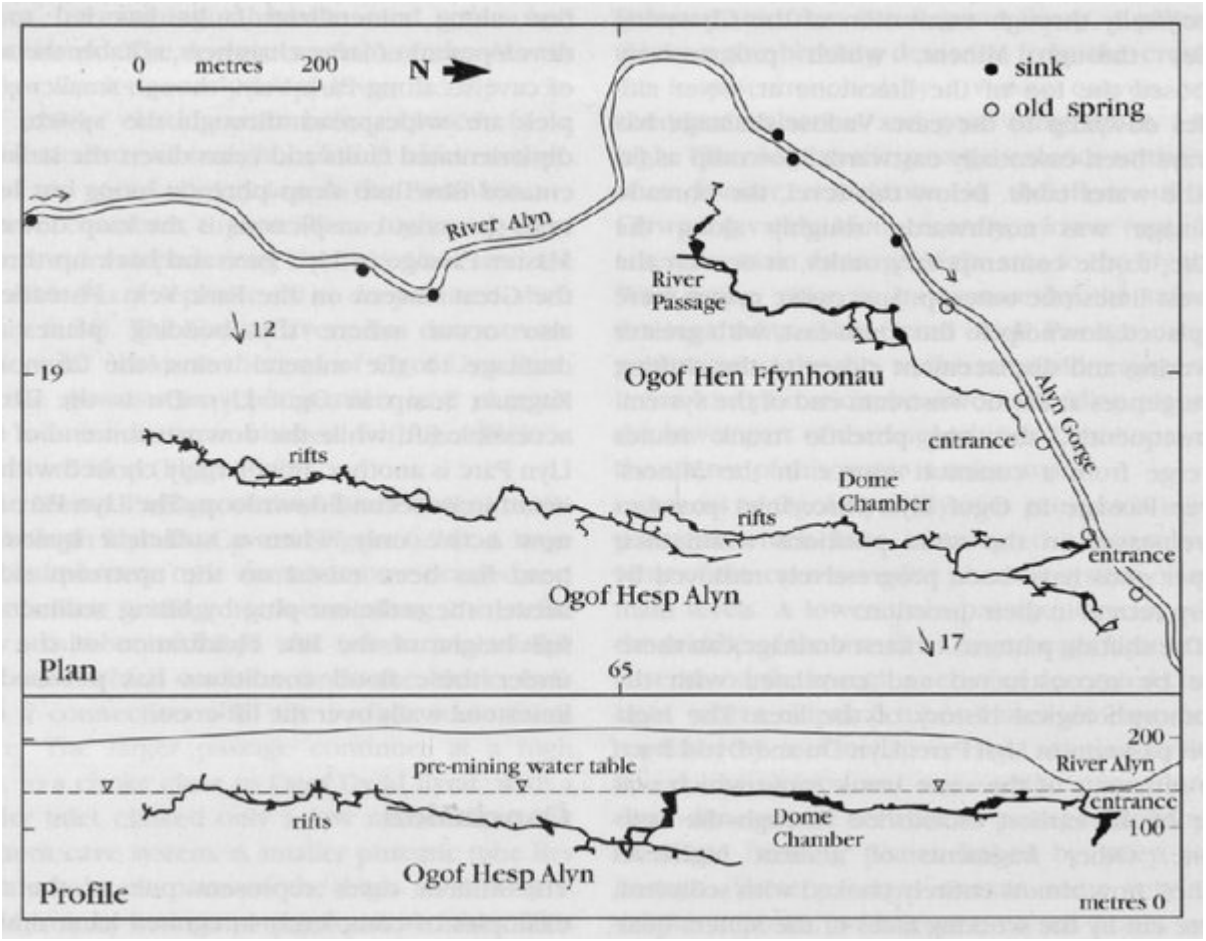
Conclusion

The Alyn Gorge site provides a unique example of cave development in almost purely phreatic conditions from just above the water table to a depth of 80 m below resurgence level. Lowering of the water table by deep mine drainage has revealed some long phreatic caves, which have their morphology uniquely well preserved. There is almost no vadose modification or sediment infifling. The caves offer a unique insight to the anatomy of a flooded karst aquifer.

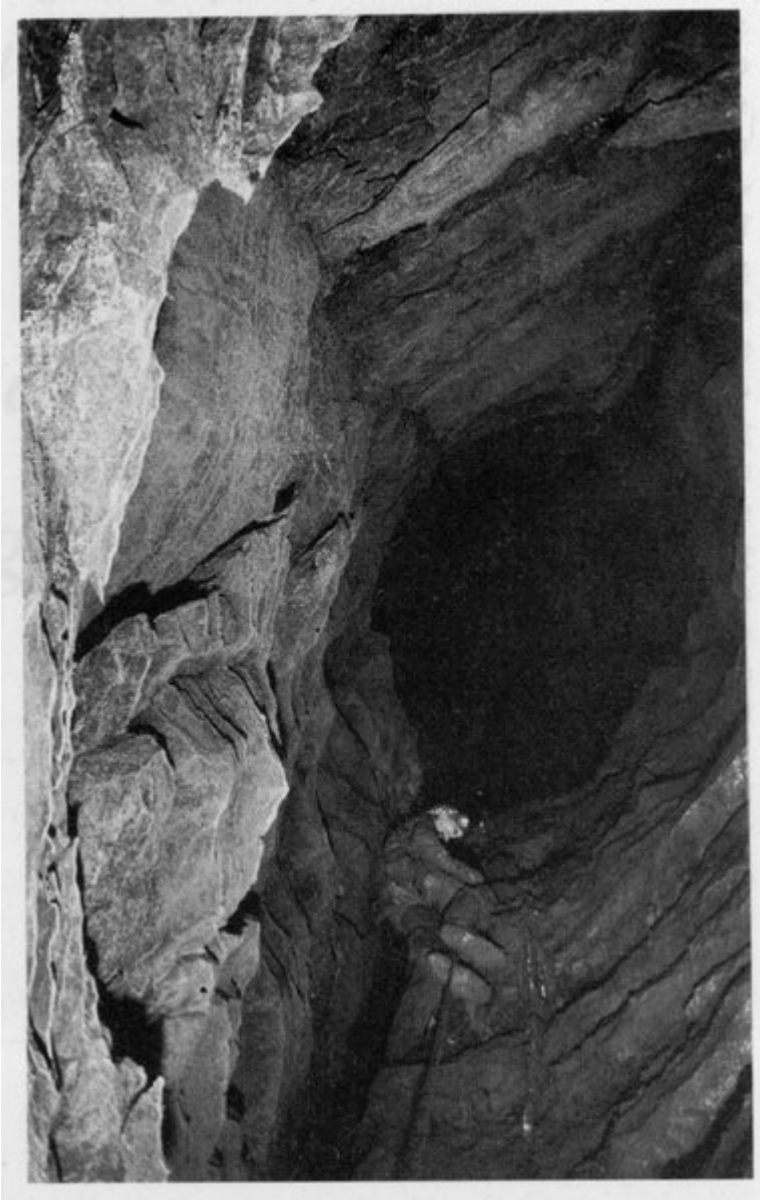
References



(Figure 6.2) Outline map of karst features in the Carboniferous Limestone of eastern Clwyd, North Wales, with locations referred to in the text. The main rivers and risings are shown as they were before disturbance by the mine drainage. The basement is Ordovician shale; the cover rocks are Upper Carboniferous and Triassic clastics. Many of the steps on the boundaries are due to minor faults.



(Figure 6.26) Plan and profile of the caves beneath the River Alyn (from surveys by North Wales Caving Club). The surface river loses water at the various sinkholes along its course on the limestone. Only Ogof Hesp Alyn is shown on the profile; it was almost completely flooded until deep mine adits captured its water.



(Figure 6.27) Looking up the 15 m shaft in Ogof Hesp Alyn. This phreatic lift on a major joint was active and completely submerged until mine drainage lowered the water table in 1901. (Photo: P.J.Appleton.)