
Minera caves

[SJ 25 50]–[SJ 25 51]

Highlights

The caves of Minera form the most extensive integrated cave system yet explored in North Wales, with a major trunk conduit draining from active and inactive tributaries to a series of progressively more recent, and lower, resurgence passages.

Introduction

The Minera cave systems lie beneath the northern slopes of Esclusham Mountain, west of Minera and south of the Clywedog Valley (Figure 6.2). Ogof Llyn Parc, Ogof Dydd Byraf and Ogof Llyn Du are fragments of an integrated karst drainage system; they are now separated only by short sections of passage choked with sediment (Figure 6.24). The Carboniferous Limestone dips at 5–15° just south of east, and is truncated to the north by the Llanellidan Fault which downthrows the overlying Cefn y Fedw Sandstone of the Millstone Grit. The limestone unconformably overlies cleaved Ordovician shales which crop out to the west. Cave development within the site extends down through the Brigantian and Asbian succession of the Cefn Mawr, Loggerheads and Leete Limestones.

Water draining from the moorland in the west collects into the Aber Sychnant. This flows north across thick till and through a short limestone gorge, before turning east to become the River Clywedog, where the remains of another limestone gorge survive in the floor of the older, abandoned Minera quarries. The main allogenic input to the caves is through sinks west of and along the Aber Sychnant where it crosses the limestone west of Ogof Llyn Parc. Other sinks lie further south, near the outcrop of the Cefn y Gist Vein.

The only published accounts of the explored caves within this system are those of Appleton (1986, 1987, 1989), with a brief account of the divers' extension to Ogof Llyn Du by Whybro (1987).

Description

Swallow holes along the course of the Aber Sychnant are immature fissures largely choked with limestone blocks, gravel and peat.

Ogof Llyn Parc is entered through mined shafts and levels on the Pool Park Vein. These intercept the main cave at a depth of 130 m, from where natural cave passages extend for over 4000 m, with a vertical range of 115 m (Figure 6.24). The main streamway emerges from the Quarry, a passage up to 12 m wide and 8 m high, modified by roof collapse of the thinly bedded Leete Limestone south of the Pool Park Vein. Downstream, the Miners' River Passage is a phreatic tube 3 m high and 7 m wide following the strike of the beds. It enlarges as it is joined by three other tributaries flowing downdip from the west. The Northwest Inlet flows for almost half of its length over a floor of Ordovician shales, and forms a 3 m cascade over a minor fault with a 3 m throw. Fault Inlet follows a poorly mineralized fault with the Ordovician shales exposed on its north side. The water now sinks into impenetrable bedding planes towards the lower end of the Miners' River Passage. Prior to draining when the miners cut adits below the natural resurgence, the main stream flowed along the Northeast Passage. Both this and a high-level passage along the strike further updip lead into the Master Passage, up to 6 m wide and 11 m high, developed along the north side of a small fault. This was the main trunk drain for the whole mountain, and a number of large, ancient, phreatic passages converge onto it. These abandoned passages contain abundant calcite speleothems and clastic sediments, some in sequences of stalagmite layers interbedded with clastics containing broken and detached speleothems. The lowest section of the Master Passage, on its easterly loop down the dip, contains thick clastic sediments exposed in a rejuvenated stream trench, before it turns north to a sand and gravel choke close to the Park Vein.

Three chambers, up to 70 m high and 20 m wide, are developed along the Park Vein, and are accessible via a separate 90 m deep mined shaft (Figure 6.24). The Great Cavern lies downstream of the sand choke at the end of Ogof Llyn Parc, and the downstream continuation is a phreatic tube 6 m in diameter choked with gravel in a downward loop (Figure 6.25).

The Master Passage of the Minera caves continues through Llyn Du Cavern (Figure 6.24). A large elliptical phreatic tube contains some flooded sections before turning north-east along the strike with a number of loops and tributaries; a large talus cone which contains sandstone blocks indicates a connection with the surface some 60 m above. The larger passage continues at a high level, to a choke close to Ogof Dydd Byraf, with a smaller inlet choked only a few metres from the northern cave system. A smaller phreatic tube lies directly beneath parts of the high level, and is linked to it by various younger vadose inlets. This then turns downdip into a phreatic loop which ends at a lift on the Ragman Vein; the whole loop, 26 m deep and 270 m long, is still flooded. Downstream from the Ragman Sump, a phreatic tube on the bedding descends from the crest of the loop, entrenched by a vadose canyon, with abundant stalactites and gour dams up to 1.5 m high. The old phreatic passage extends to the site of a former resurgence in the floor of the Clywedog valley. More recently, a lower route has taken the main drainage of the area to the Ffynnon Wen rising, prior to its capture by the miners' drainage adits. The Grand Turk Passage carried water against the dip, to the same old resurgence. It is a low phreatic tube on one bedding plane in the lower part of the Loggerheads Limestone, and the source of this water is unknown.

Access to Ogof Dydd Byraf is gained via mined passages which have intercepted a natural rift. Most of the cave is a relict phreatic system on two main levels. A lower main passage, developed in the middle of the massive Loggerheads Limestone, extends north through a series of decorated chambers, where elliptical tubes 4 m wide have been modified by roof collapse. High solution cavities lie on cross-joints, and one section opens into a three-dimensional network of passages developed on three bedding planes linked by steep joint fissures. These passages contain some very fine calcite deposits, with gours, crystal pools, cave pearls, curtains and white and green stalactites; there are also many mud formations and sequences of fine silts and muds deposited in slowly moving water. The upper level of passages are developed at the base of the more thinly bedded Cefn Mawr Limestone and have suffered more extensive collapse. They lie about 35 m above the present floor of the Clywedog Gorge. Some of the caves are choked with clastic sediment, and some contain a profusion of deep-red stalactites, stalagmites and helictites, with stalagmite crusts formed on mud flakes.

Many fragments of cave passage were intersected by the faces of the disused Minera Quarry. They represent remnants of old inlets to the Minera caves, and most have been choked with calcite and clastic sediments; stalagmites from one cave have been dated to about 56 ka.

Interpretation

The Minera caves developed in several phases as water tables dropped in direct response to the lowering of the resurgence outlets. These new resurgences were formed as a consequence of surface lowering through the Pleistocene, and more specifically through excavation of the Clywedog valley through Minera, which progressively exposed the top of the limestone at lower altitudes downdip to the east. Vadose drainage has always been essentially eastwards, downdip as far as the water table. Below this level, the phreatic drainage was northwards, roughly along the strike, to the contemporary outlet, at or near the lowest limestone outcrop. Successive routes were displaced downdip to the south-east, with greater lowering and displacement closer to the shifting resurgences at the downstream end of the system. Consequently, the old phreatic trunk routes diverge from a common source in the Miners' River Passage in Ogof Llyn Parc. Inlet passages have stayed in the same positions while their upper ends have been progressively removed by scarp retreat in their direction.

The shifting patterns of karst drainage can therefore be reconstructed and correlated with the geomorphological history of the area. The high-level passages in Llyn Parc, Llyn Du and Dydd Byraf are remnants of the same trunk route which was one of the earliest established through the limestone. Other fragments of ancient high-level routes, now almost entirely choked with sediment, were cut by the working faces of the Minera quarries. Later downdip captures include the Northeast Passage in Llyn Parc and the lower tube and Ragman Passage in Llyn Du. Youngest of all are the still immature and not yet accessible modern drainage routes into the low-level mine adits. The extensive sediment and

speleothem deposits within the various parts of the system may enable a detailed chronology of the Pleistocene history of the area to be reconstructed.

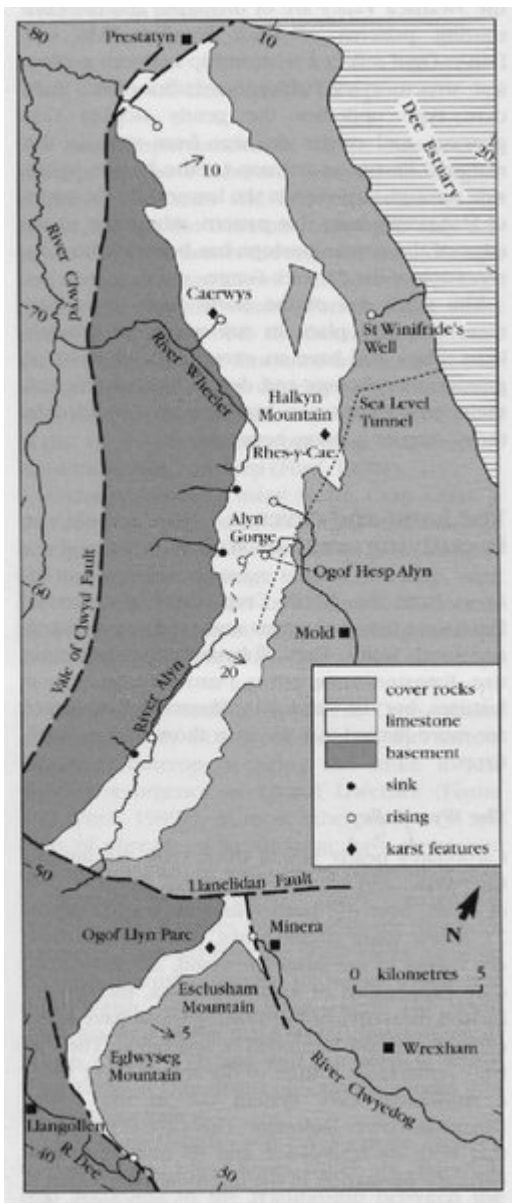
Within the broad pattern of strike drainage, the morphology of the cave passages demonstrates strong control by geological features. Thick shale beds, palaeokarst horizons, the basal clastic sequence of the limestone, and the contact with the Ordovician shales are all well exposed underground, and clearly influence the passage positions and morphology. Major phreatic passages are developed on bedding planes along the strike, while at least two of the vadose inlets flow for part of their length downdip along the underlying Ordovician shales. In Ogof Llyn Du, vadose incision has occurred in the drained phreatic tube, downdip on the bedding, immediately east of the Ragman Vein; this was the downstream limb of the phreatic uploop with the lift on the vein.

Both vadose and phreatic passages show a close control by faults and major joints. Enhanced solution along mineralized faults has led to the development of large chambers, notably the series of caverns along Park Vein, though smaller examples are widespread through the system. The dip-orientated faults and veins divert the strike-orientated flow into deep phreatic loops out to the east; the most conspicuous is the loop down the Master Passage in Llyn Parc and back up through the Great Cavern on the Park Vein. Phreatic lifts also occur where the bedding planes feed drainage to the mineral veins; the 26 m deep Ragman Sump in Ogof Llyn Du is the deepest accessible lift, while the downstream end of Ogof Llyn Parc is another, now largely choked with sediment in its second downloop. The Llyn Parc lift is now active only when a sufficient hydrostatic head has been raised on the upstream side to breach the sediment plug by lifting sediment the full height of the lift. Fluidization of the sand under these flood conditions has polished the limestone walls over the lift crest.

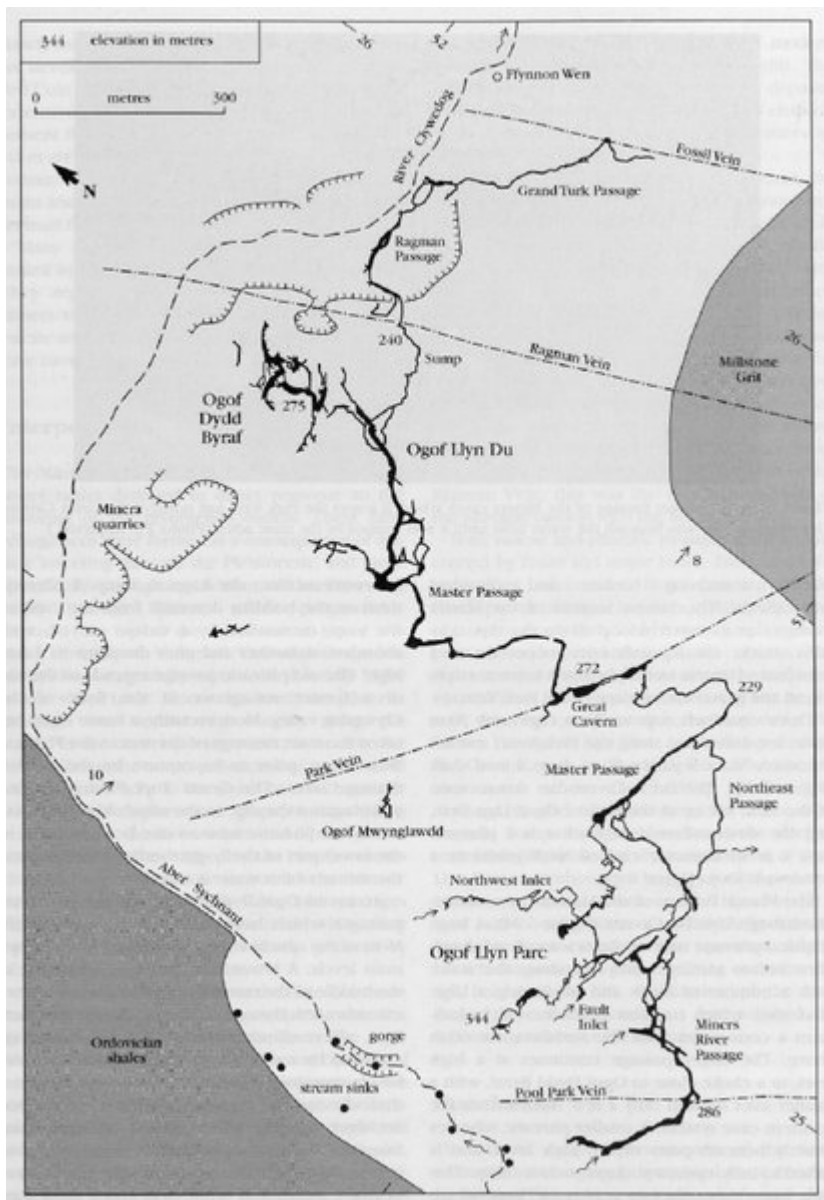
Conclusion

The Minera caves represent one of the finest examples of completely integrated karst drainage in Britain. The system contains active and abandoned vadose inlets feeding to a sequence of phreatic strike passages which developed successively downdip in response to surface lowering and karstic rejuvenation. This pattern is repeated elsewhere in the dipping limestones of Britain; in their geometry, Yorkshire's Kingsdale and the Priddy caves drainage on Mendip differ only with respect to the magnitude of the local dips. All these cave systems have their oldest elements drained and abandoned, but only Minera has its recent phreatic passages accessible due to drainage by mined adits. Minera also has cave passages on mineral veins and along the base of the limestone, and the calcite speleothems in Ogof Dydd Byraf exhibit mineral colouring on a scale which is rare in Britain.

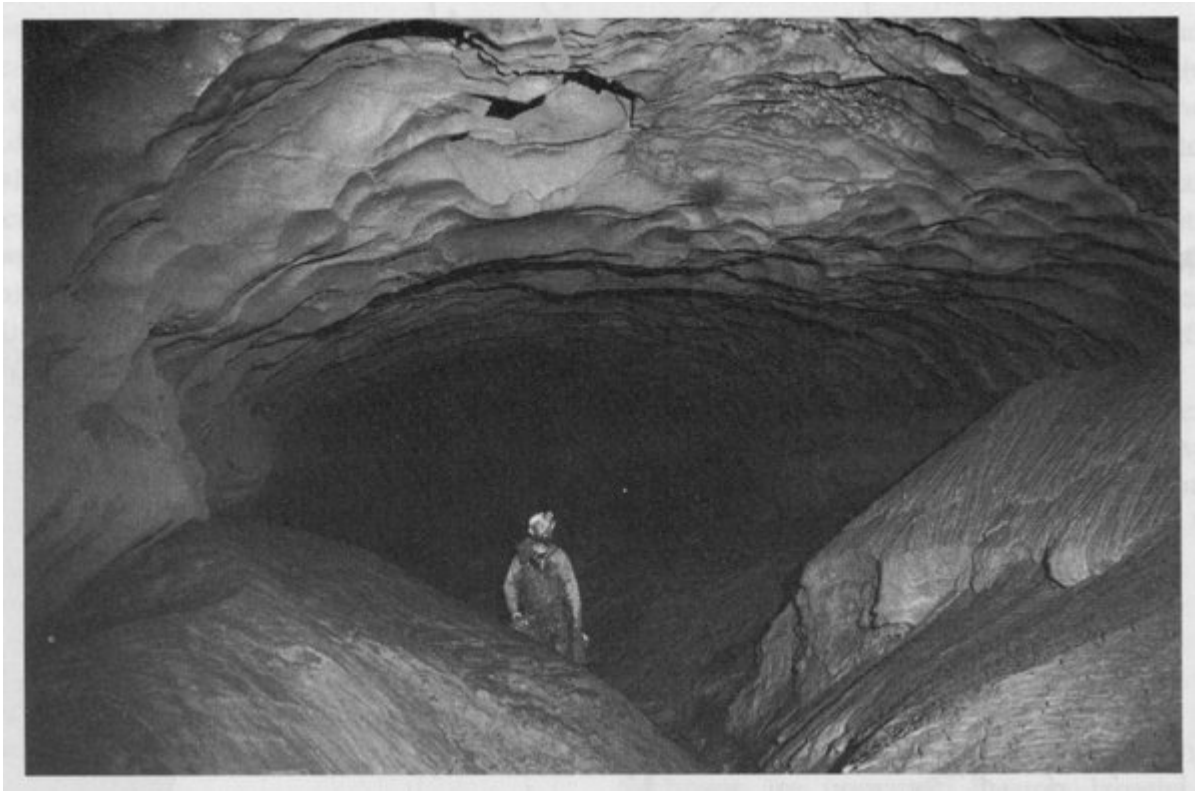
References



(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 6.24) Outline map of the caves of Minera (from surveys by North Wales Caving Club). The Ffynnon Wen resurgence is no longer active as its water has been captured by the deep mine adits.



(Figure 6.25) The Master Passage of the Minera caves where it leaves the Park Vein just north of the Great Cavern. This phreatic tube was beneath the water table until it was drained by the mine adits. (Photo: P.J. Appleton.)