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# Ogof Draenen

[SO 23 12]–[SO 25 09]–[SO 26 11]

This is a proposed GCR site, of which only Siambre Ddu is currently a designated SSSI

## Highlights

Ogof Draenen is a major cave system developed in Carboniferous Limestone almost entirely beneath its own allogenic catchment on the overlying Coal Measures. Large passages record an unusually clear example of flow diversion related to differential rates of incision in two adjacent valleys. Abandoned phreatic conduits contain the finest examples in Britain of solutional wall notches associated with sediment deposition or ponding. The adjacent cave of Siambre Ddu is Britain's finest example of a chamber which is an element of interstratal karst, formed by solution directly beneath a cover of Millstone Grit.

## Introduction

Ogof Draenen is developed beneath the escarpment and moorland extending south-east of the Clydach Gorge (Fig 6.1). The outcrop of the limestone is confined to a narrow sinuous strip along the steep, north-facing scarp face of the escarpment and an elongate window in the Afon Lwyd valley south of Blaenavon. Most of the cave lies beneath the outcrop of the cover rocks; less than 10 m of Namurian Basal Grit is overlain by thin shales and sandstones, also of the Namurian, and a much greater thickness of Westphalian Coal Measures. The cave passages of Draenen are developed at numerous levels throughout almost the entire thickness of the Abercriban Oolite Group. These Lower Dinantian limestones are 50 m thick on Gilwern Hill, but thin to 30 m on the Blorenge, due to progressive eastward overstep of the unconformable Basal Grit cover. Other than the massive, bioclastic Gilwern Oolite at the top of the sequence, much of the carbonate is extensively dolomitized and some is thinly bedded. The dip is 4° south-west, and the dominant joint set is NNW–SSE, nearly parallel to several small faults.

There are no major sinks feeding the cave, but many of the streams draining across the escarpment have at least part of their flow captured as they cross the limestone outcrop. The largest risings proven to take flows from Ogof Draenen are at Snatchwood and Pontnewynydd, both 7 km south of Blaenavon down the Lwyd Valley and just north of the Trevithin Fault. Some cave water drains to small risings in both Cwm Llanwenarth and Cwm Dyar.

Ogof Draenen was discovered late in 1994, and the only published descriptions are those by the explorers (Bolt *et al.*, 1994, 1995) and one brief discussion of the geomorphology (Simms *et al.*, 1996). The hydrology is discussed by Gascoine (1994), and Siambre Ddu is briefly referred to in Stratford (1995), Thomas (1974) and Gascoine (1982).

## Description

The entrance to Ogof Draenen is a small phreatic tube developed high in the Gilwern Oolite and truncated by the hillside above Cwm Llanwenarth. It is the only access to more than 48 km of mapped cave passages (Fig 6.18). The entrance series descends to Tea Junction, where it meets the long passages aligned almost on the strike on the western side of the system. To the south, Beyond a Choke is a major active streamway; the large phreatic passage is increasingly entrenched to the south, with a narrow, locally joint-guided, vadose canyon more than 30 m deep beneath an almost horizontal phreatic tube. Towards its southern end the phreatic tube descends to stream level in a series of loops. Strewn with boulders in the northern section, it has a fine sediment floor and deep pools towards the south. North of Tea Junction, Gilwern Passage is a major abandoned conduit with several tributary passages from complex areas of rifts and collapse; its underfit stream now drains to a rising in Cwm Dyar. The Gilwern Passage series contains some fine speleothems, including calcite rafts; thick sediment sequences contain false floors, clastics with epsilon cross-bedding, numerous coal clasts, and well preserved current ripples which indicate northward flow.

A complex series of mainly abandoned passages lies east of Beyond a Choke (Figure 6.18). Upstream Passage contains thick deposits of laminated sands and clays similar to those in Main Passage of Agen Allwedd; they drain south, but the current bedding indicates flow to the north, and the sediment fill may be from temporary glacial inputs at passage breaches, which were remote from the sinks at the head of the stream caves. A minor inlet extends north to give access to more than 2 km of abandoned high-level passages in Waterfall Series. South of the entrance series, Lamb and Fox Chamber is a large collapse feature extending into the upper part of the Abercriban Oolite; its walls are undercut by an exceptionally wide solutional notch, and have sands and gravels preserved on remnant ledges. Two vadose canyon passages drain towards the south; the eastern passage has a small phreatic tube in its roof and extends to a further junction. The Canyon is a large paragenetic canyon passage with a vadose trench incised beneath. Megadrive is a major abandoned phreatic conduit with a meandering vadose trench incised several metres into its floor; it contains extensive sediment banks, has very fine solutional notches along its walls (Figure 6.19) and extends to a large choked chamber close behind the scarp face.

A complex series of abandoned passages south of Megadrive includes St David's Hall, the largest collapsed chamber yet found in Ogor Draenen, and connect to the active streamway of Agent Bloreng. This descends steeply via a series of cascades into a trench incised more than 30 m beneath the original phreatic tube; it joins the lower part of the Beyond a Choke trunk streamway. Abandoned phreatic conduits in the Elliptic Passage Series extend east of Megadrive; these connect with passages extending beneath Bloreng to the Big Country, where tributaries unite in a passage which is up to 10 m high and 20 m wide and drains to the south.

Calcite speleothem development is very limited through most of the cave, due to the lack of percolation water beneath the impermeable cover rocks. Gypsum crystals are locally abundant on walls, fallen blocks and sediments in some abandoned passages. Helictites and anthodites are spectacularly abundant in some of the abandoned passages. Accumulations of bat guano are significant in some passages near the scarp face where old entrances are now blocked. Bradyodont fish teeth and fin spines are commonly etched in relief on passage walls in the richly bioclastic Craig-y-Caer Coral Bed at the base of the Gilwern Oolite.

Siambre Ddu lies in the scarp face east of the Draenen entrance (Figure 6.18), with a short entrance passage leading to a single chamber 25 m in diameter and 10 m high. The roof is an almost flat bedding plane in the strong sandstone of the Basal Grit, though early stages of collapse of individual beds has started to modify this into an arched profile. A thick shale is exposed in the walls beneath the Grit, and the underlying limestone is obscured by the collapse debris which litters the floor. This includes fragments of a fossil tree trunk of *Lepidodendron*, whose cast, 6 m long, survives in the roof. The chamber roof and walls, and many fallen blocks, are coated with a soft black deposit, which is high in manganese (Gascoine, 1982) and is probably a mixture of oxides and humates. Siambre Ddu lies directly above some dripping avens, floored with Grit boulders, in a side passage off Megadrive in Ogor Draenen.

## Interpretation

The main passages of Ogor Draenen are largely aligned close to the strike in a thin unit of gently dipping limestone. Successive conduits have developed due to progressive downdip shift of the drainage in response to the availability of lower resurgence sites in new outcrops of the limestone exposed by surface lowering. The uniform alignment of the Gilwern and Beyond a Choke Passages also reflects the orientation of the dominant joint set parallel to a strike-slip fault. Most of the passages are developed along joints adjacent to the fault, suggesting that the latter is relatively impermeable. A minor fault is crossed in one chamber which is modified by collapse, but the lack of collapse throughout such a great length of passage adjacent to a fault is remarkable. Lithological factors have influenced the cave passage shapes. Passages in the Gilwern Oolite and other massive units have largely retained their original solutional profile, while those in more thinly bedded carbonates lower in the succession have been greatly modified by collapse.

Passages in Ogor Draenen are developed at multiple levels within the limestone, and show a complex pattern of flow. Passages in the lower part of the Abercriban Oolite were formed by flow either to north or south, or in some cases to both. In the Gilwern Oolite almost all passages, including Megadrive, which is the highest and oldest trunk conduit in the system, have scallops indicating flow to the south. The fossil passages in Waterfall Series appear to represent an

upstream extension of Megadrive, but the intervening section has been removed by retreat of the escarpment face. An abundance of coarse, angular sediment derived from the Millstone Grit suggests that the main sinks lay only a short distance to the north, but have since been destroyed by scarp retreat. Deposition of this sediment at the vadose-phreatic interface was responsible for promoting lateral dissolution and creating the spectacular wall notches in this part of the cave. If Megadrive continued along the same trend as the other main drains in the system, then the original high-level resurgence may have been located in Cwn y Nant, a re-entrant in the scarp south-east of Blaenavon. Indiana Highway, with its headward extension in Waterfall Series, and the Canyon represent downdip captures of the Megadrive flow, which was probably in response to a westward shift of the resurgence, either due to scarp retreat or to lower site in the Afon Lwyd valley.

Subsequently, White Arch Passage developed as a separate drain, lower in the limestone, extending north into Gilwern Passage, where scallops and sediment bedforms indicate consistent flow to the north. It was also fed by inlets draining north along the Score, perhaps derived from sinks on Bloreng. The underfit stream in Gilwern Passage now drains to a resurgence in Cwn Dyar.

The modern main streamway of Beyond a Choke is the lowest passage in the cave and drains south from Tea Junction down a very gentle gradient. A Choke marks the capture point where the earlier northward flow was re-routed towards the south. During the initial stages of this capture, water may have continued to flow north along Gilwern Passage as well as south along the precursor of Beyond a Choke. The preservation of current ripples which are unmodified or draped by mud suggests that the final abandonment of Gilwern Passage was comparatively sudden. Water continued to drain north along the Score after the capture, and supplied small capture passages westwards towards Beyond a Choke. The main capture was relatively recent, but sufficient time has elapsed for the remaining misfit streams in the Gilwern Passage series to entrench to the level of the main trunk passage. The deep and narrow vadose canyon in Beyond a Choke, and the comparable entrenchment in Agent Bloreng, suggests rapid incision since the abandonment of the northward flow route. Much of the Beyond a Choke streamway appears to be graded to current base level; it has a very low gradient with stretches of sediment floor and local ponding, but incision continues in the steeper, boulder-strewn descent of its upper reaches.

The flow re-routing from south to north then south again allows a sequence of scarp retreat and valley incision to be constructed for the cave catchment, though no dates for the cave sediments are yet available. In the earliest stage of cave development, water sinking along the eastern outcrop of the limestone, at altitudes of more than 380 m, drained southwards almost along the strike, until it could drain down the dip to limestone outcrops at altitudes around 310 m, exposed by differential scarp retreat. This stage predated the incision of both the Afons Lwyd and Clydach.

The second stage of development was associated with more rapid scarp retreat to the north, in the region of the present Clydach Gorge. The unroofing of the limestone at an altitude of about 250 m caused a reversal of the hydraulic gradient towards a new resurgence in the proto-Clydach valley. The new cave drainage to the north, via Gilwern Passage, was offset to the west of its southbound predecessor, as it shifted both downdip and into lower parts of the Abercriban Oolite. This stage of development in Ogof Draenen may be correlated tentatively with the development of Ogof Craig a Fflynnon, which still drains to a resurgence at a similar altitude on the opposite side of the Clydach Valley. The abundance of coal debris in the Gilwern Passage sediment suggests rapid stripping of overlying Coal Measures, perhaps associated with a poorly vegetated, periglacial environment. Remnants of cross-bedded sands in Upstream Passage are also the produce of a cold environment.

In the final stage of cave development, the main flow was captured southwards along Beyond a Choke, in response to incision of the Afon Lwyd towards the 120 m level of the present main risings; these were far below rising sites in the Clydach Gorge.

The present resurgence of drainage from the Llangattwg caves may lie at Pwll y Cwm only due to the breaching of a deep phreatic conduit by the incision of the Afon Clydach (Smart and Gardner, 1989). Prior to this breach, water may have continued southwards to an unidentified lower than any passages yet discovered in Ogof Draenen. The consistent northward flow in Gilwern Passage indicates that Ogof Draenen was not formed by water draining from a former eastward extension of the Llangattwg caves prior to incision of the Clydach Valley. The resurgences from Gilwern

Passage and from Ogor Craig a Ffynnon lie at close to the same altitude, and may indicate comparable ages for the two caves. The older, high-level passages in Ogor Daren Cilau and Agen Allwedd may also have drained towards this resurgence unless they developed in response to the incision of the Agon Lwyd, providing a low-level outlet more than 10 km to the south. The Megadrive trunk conduit predates the main Llangattwg caves, but the second and third phases of development on Ogor Draenen may have been contemporary with the evolution of the Llangattwg drainage system, when the Afon Clydach became a major control on the regional cave development.

Dating of the caves is not yet possible. Early Pleistocene origins are indicated by the altitude of the large fossil phreatic conduits high above the modern base level and their truncation by the modern hillside. Deep vadose entrenchment of the Beyond a Choke main streamway and its Agent Bloreng tributary suggests that the presently active passages are also of considerable age. Dating of the cave sediments will establish a chronology for the flow diversions already recognized within Ogor Draenen; this will provide evidence for the relative ages of the Clydach Gorge and the Afon Lwyd valley, and also relative rates of scarp retreat in this region of South Wales.

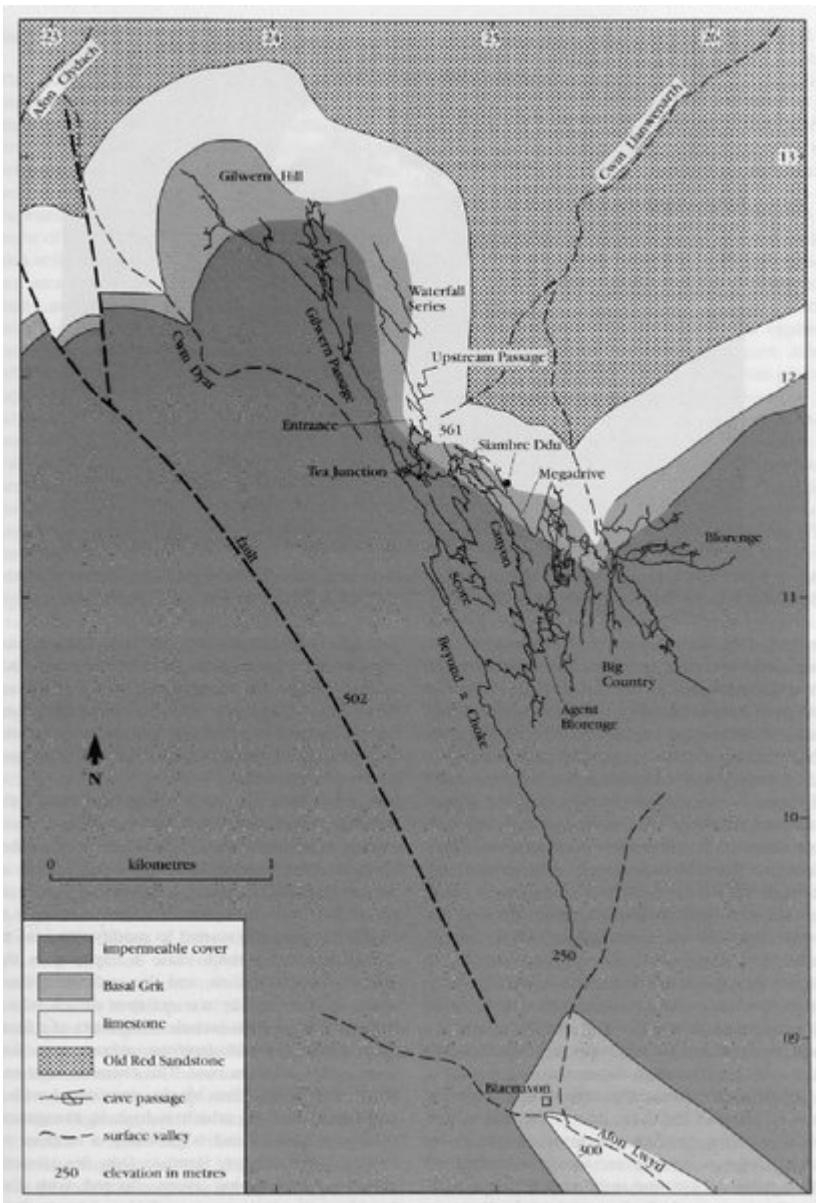
The abundance of coal clasts in sediments throughout Ogor Draenen suggests that allogenic recharge to the narrow limestone outcrop has been from the west, draining directly from the Coal Measures which overlie much of the cave; there is no positive evidence for input from a former Old Red Sandstone catchment to the east, comparable to that on Llangattwg. Downdip drainage into the limestone beneath the Namurian clastics has produced the interstratal karst of which Ogor Draenen is a component.

Siambre Ddu is also a feature of the interstratal karst, where a cave chamber is undergoing progressive collapse and upward stoping. It lies only 15 m below the modern surface, and will ultimately form a collapse doline in the overlying Millstone Grit. Collapse of the cap rock into the solutional chamber in the limestone has blocked and obscured the shafts into the underlying cave passage, but comparison may be made with the shafts of the Mellte Valley formed by dripwater immediately beneath the Grit (Burke and Bird, 1966; Burke, 1967). Continuing stages in the evolution of Siambre Ddu may be compared to the massive Grit chokes in Craig a Ffynnon, under Llangattwg, and the doline fields of Llangynidr. Iron and manganese deposits are well developed in the Siambre Ddu chamber, and may be comparable with the complex iron minerals formed by oxidation of pyrite and deposited with peat in shafts in the Mellte Valley (Burke, 1970).

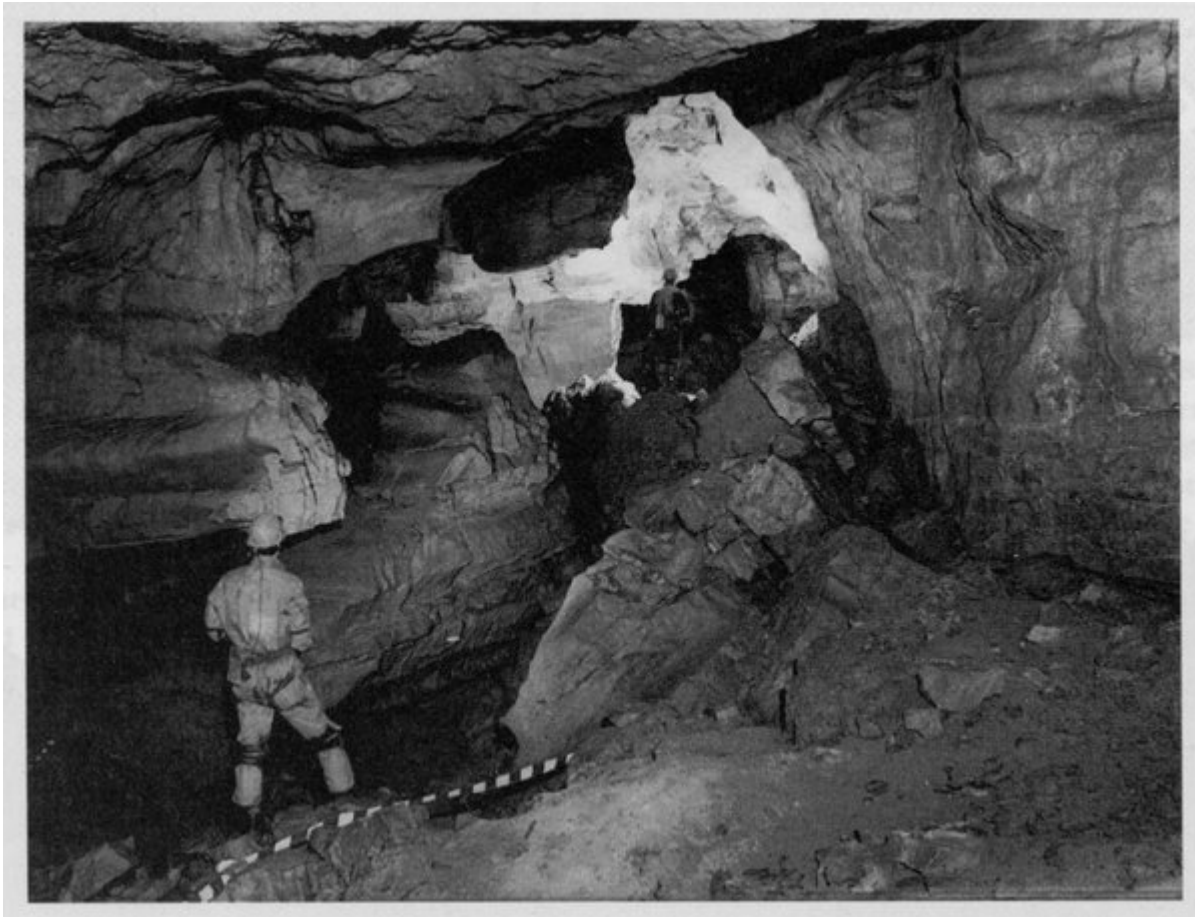
## **Conclusion**

Ogor Draenen is a major cave system with a downdip sequence of abandoned and active, strike-aligned conduits. These have evolved through an environment of changing hydrology where flow from the central part of the cave was first to the south, then to the north, and finally to the south again, in response to the early incision of the proto-Clydach and the later incision of the Afon Lwyd. The scale of the flow reversals is unmatched elsewhere in Britain, and their ease and rapidity were largely due to the very low gradients in major cave conduits which were developed almost along the strike. Both Ogor Draenen and Siambre Ddu are components of a system of interstratal karst, and the latter represents an early stage in the progressive development of a collapse doline in the overlying Basal Grit.

## **References**



(Figure 6.18) Outline map of Ogof Draenen; this is only a centreline plot of the cave, with no indication of passage widths (from survey by Chelsea Speleological Society).



*(Figure 6.19) The abandoned conduit of Megadrive in Ogof Draenen, with preserved solutional notches along the wall on the left. (Photo: C.D. Westlake.)*