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Porth yr Ogof, Breconshire

By
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With a report on the geomorphology of the cave by M. D. Newson, B.Sc.

Parish; Ystradfellte
Maps: 1 in. Sheet 141
6 in. SN 91SW

Main Entrance—SN 928124
Altitude—approx. 775ft. (236m.)
Length—2,220 metres
1.38 miles

CONTENTS

INTRODUCTION

Porth yr Ogof is situated in the Brecon Beacons National Park amidst the fine scenery of the Upper Vale of Neath. The cave lies on the Afon Mellte (River Mellte) about a kilometre south of the village of Ystradfellte (fig. 37) and is best approached by striking northwards from the Head of the Valleys road (A 465) at Hirwaun or Glynneath. From near Ystradfellte Youth Hostel a narrow road winds down to the valley bottom where there is a newly constructed car park. From here footpaths lead to the Main Entrance and to the Resurgence.

Although not a show cave, Porth yr Ogof is visited by a large number of tourists each year. Indeed only one other cave in Wales—the commercialized Dan yr Ogof in the Swansea Valley—attracts more visitors. The Entrance Chamber and the dry 'Right Hand Series' are quite often explored by adventurous members of the public and the cave is also very popular with both novice and experienced cavers. It still offers scope for original exploration to the cave diver.

NAMES OF THE CAVE

The word *porth* in Welsh (Latin *porta*) means something grander than a door and *Porth yr Ogof* is best translated as 'Gateway to the Cave.' Lhuyd (1698) referred to *Porth Gogo* and this is near enough to show that the present name for the cave was used by tourists in the Seventeenth Century. Other names mentioned by early travellers are *Porth Mawr* (Great Gateway) and *Cwm Porth Cavern*, but these have long fallen into disuse.

The only other name in current use is *White Horse Cave*, which originates from the distinctive figure formed by a band of white calcite, 50m. inside the Main Entrance. More imaginative minds have likened the figure to the skeleton of a child and it is for this reason that the lake in front of it has been called *Llyn y Baban* (Lake of the Baby).* Today, however, the lake is more often known as the White Horse Pool.

HISTORY OF EXPLORATION

Early Visitors

Porth yr Ogof has one of the most impressive entrances of any cave in Britain and as it is also situated in an area of outstanding natural beauty it is not at all surprising to find that many notable 18th and 19th century English travellers included it in their itineraries. A few of them ventured inside the cave and their explorations were the first to be recorded. However it is certain that the locals must have made similar expeditions many centuries previously. Had the cave not been so prone to flooding it might have made an ideal home for early man.

The late F. J. North made an extensive search of the literature relating to early visitors to the cave and the results are included in his delightful book *The River Scenery at the Head of the Vale of Neath*. The first reference to Porth yr Ogof seems to have been made by the

*Hall (1861) adds that "the guides have a legend of a child murdered and some miraculous restoration of a drowning infant from this black abyss to deepen the thrilling interest of the place."

naturalist and antiquary Edward Lhuyd in a letter to John Ray dated 1698. Notable visitors in the early part of the 19th century were the Reverend Richard Warner of Bath, the Reverend John Evans, Benjamin H. Malkin, Thomas Roscoe and others. Their writings vary in accuracy but all make interesting reading. Warner (1800) walked up the Mellte Valley from the Hepste and on arriving at Entrance I wrote that he:—

> 'perceived the River Felddta, like the classical Alpheus, rolling its stream through a vast subterranean cavern, which it had entered about a quarter of a mile above. Had the water been low, we might have pursued its gloomy course through the windings of this natural excavation, for nearly one hundred yards, to an aperture on the left hand, where it quits its secret bed, and again emerges into day; but the floods preventing us, we continued our walk to the valley, in which it first shrinks from the light and hides its head in the rock. This is a scene more solemn than any we had hitherto contemplated; a profound and gloomy glen, formed by the rocky banks, approaching each other so closely, as only to allow a narrow intermediate hollow, through which the River Felddta forces a troubled passage.'

John Evans too, was clearly a classical scholar (or a plagiarist) for writing a few years later he described the river at Porth yr Ogof thus:—

> 'Here, like the classical Alpheus, it takes a subterranean course, bids a temporary adieu to daylight and leaves the beholder in silent admiration. How far it thus secretly flows you are prevented from ascertaining. The guide informs you that he has penetrated more than half a mile, but found the various windings so numerous, that he judged it prudent to return, lest he should share the fate of a man, who was lost for the space of three days.'

Lack of space precludes further quotation from these early writers and the interested reader is referred to the bibliography for additional references.

Just as the size of Porth yr Ogof was sometimes exaggerated in early writings it was also inaccurately portrayed by several 19th Century artists. Shaw (1967) has listed the pre-1900 non-photographic illustrations of the cave and examples are reproduced in North's book. Roscoe (1836) includes an etching by E. Watson, of the Main Entrance which looks extremely impressive but bears little relation to the cave as we know it today. Strangely both this etching and a series of water colours by T. Hornor (1816) show the river flowing out of the Main Entrance.

Full Exploration

Members of the Cardiff Naturalists' Society visited Porth yr Ogof quite frequently in the late 19th century and early part of this century.

The Society's *transactions* include several references to the cave which are listed in the bibliography. It was not until September, 1936, that the cave was really fully explored, by a party of Mendip cavers mainly from the Wessex Cave Club. By using a 17ft canoe they were able to negotiate the deep section of the underground river downstream of the White Horse and to explore several short side passages off it. Probably their most important discovery, however, was the Cafel Hywel (Hywel's Grotto) in the Right Hand Series. They made the first survey of the cave, which was published in the pre-war journal *Caves and Caving* (Braithwaite, 1938). E. E. Roberts of the Yorkshire Ramblers' Club explored the cave a week after the Mendip party and he revisited it in May 1937 with Gerard Platten (Roberts, 1938).

In the 1950's Porth yr Ogof was one of several caves in South Wales to have its bacteriological and botanical flora studied (Williams and Benson-Evans, 1958).

Recent Discoveries

For 25 years after Braithwaite's visit very little new was found in the cave. Over the last three years fresh discoveries have been made by the Cave Diving Group, in an attempt to extend the system upstream from Entrance C towards the swallet.

The Cave Diving Group first visited the cave in 1961 when members of the South Wales Section dived in Llyn y Baban. They failed to find any underwater resurgence (Davies, 1966). The exploration of the sumps upstream of Entrance C has been carried out intermittently since July 1967 by the Somerset Section of the Group (Kaye, 1968 and in press). The sump at Entrance C was the first line of attack but then in September 1967 the Cwmbran Caving Club opened up Entrance B (Jones *et al.*, 1967) to reveal another possible diving site. In March, 1968 after a long dry period this new sump (Sump 2) was transformed into a 3m. duck leading to an air bell and another sump. The latter was soon investigated by divers (Jones, 1968) and eventually in December 1968 an underwater through trip from Entrance C to Entrance B was completed (Sump 3). Entrance C remained the diving base for the main assault upstream, however, and two major advances were soon made. In April 1969 J. Cobbett penetrated the sump for an estimated 170m. and then on June 21st, J. Parker in a remarkable dive, extended this to 240m. before running out of line. He followed his success by linking the new underwater passage with the sump in Entrance A, a little higher up the valley and on July 9th, by using A as the new diving base was able to proceed for a further 15m. up the underground river to discover the Upper Cave (Davies, 1969).

The U.B.S.S. became interested in Porth yr Ogof partly through the activities of its diving members, partly because of its explorations in the nearby Little Neath River Cave (Norton *et al.*, 1967) but mainly because of the intrinsic beauty of the site. The cave has rightly been described as the finest small cave in the country. The lack of any complete, published survey of the cave prompted the authors to start a new one in August 1968 and this forms the basis of the present paper.

ENTRANCES TO THE CAVE

Porth yr Ogof has no fewer than 15 entrances. To facilitate description of the cave these have been lettered as follows:—

A—Top Entrance. This is situated on the east bank of the Mellte, about 1·5m. above the dry river bed at SN 92881253. It has been recorded previously by the Hereford Caving Club (Barnes, 1964).

B—Cwmbran Entrance. This is also on the east bank, low down at river level (SN 92851250).

C—Situated at the base of a large cliff at SN 92841245, this entrance affords a fine view of the underground Mellte. Some cavers know it as the Tradesman's Entrance but reference to Braithwaite's original survey shows that this name was really intended for Entrance I.

D_1 and D_2—are high up on the west bank of the river near the Main Entrance and lead into the Maze.

E—Main Entrance (SN 928124).

F, G and H—These are by the footpath a few metres south of the road. F has a small fence around it. All three entrances lead into the Right Hand Series.

I and J—The footpath passes between these two large collapse entrances about 150m. south of the road. The western one (I) gives a view of the underground Mellte whilst the stream from Sump 7 is seen at the bottom of the eastern one (J).

K and L are obscure holes near the resurgence.

M—is the obvious entrance on the rocky platform overlooking the resurgence.

N—The Resurgence (SN 92721221).

DESCRIPTION OF THE CAVE

The following account is complementary to the survey (Plate 21) and the bracketed figures refer to sections of the cave passage on the survey. The sumps are numbered according to the system used by the C.D.G. (Lloyd, 1969 and 1970). The relation of the cave to the surface is shown in plate 21, inset.

Main Entrance to the Resurgence

The Main Entrance is finely situated at the base of a 15m. cliff and at the head of a steep sided, rocky and wooded gorge (Plates 17A, 17B). It has a maximum width of 17·5m. and a height of 5m.—the largest entrance in Wales. The Entrance Chamber is of equally generous proportions (1) with a boulder strewn floor and it can be explored without a light. On the right hand wall a large passage leads off to the Right Hand Series whilst a few metres further along a climb of 1·5m. gives access to a small passage ending in the static Sump 6. This has been dived for 3·5m. and leads to another small passage which comes out above the main stream further down. On the left hand wall five passages lead off. The first soon becomes choked but the second which is larger leads to a low but very wide chamber with connections with the Upper Stream Passage. The other three passages also lead to this stream passage, the first two at floor level and the third, a roomy phreatic tube, at roof level.

50m. from the entrance and just before the start of the dark zone, progress is halted by a lake—the White Horse Pool. Those prepared to get their feet wet can climb around the left side of the pool to the White Horse, but this has little to commend itself, for the calcite vein loses its equine resemblance at close quarters. The River Mellte gushes into the pool from the Upper Stream Passage, just past the White Horse. From here on the river passage is most impressive with black vertical walls and deep water for 55m. (2). Eventually the water becomes shallower (Plate 20A) and a bedding plane opens up at roof level on the right (3) connecting with the Right Hand Series and marking the start of the Great Bedding Cave. A small tributary from Sump 10 enters on the left. The surface origin of this water is unknown but the sump itself has been explored by divers for 80m. without reaching the end. The approach passage to the sump is low and wet with a very small airspace. Going downstream the water gradually becomes shallower until after 30m. the passage forks. The left branch carries the stream to the Main Stream Passage whilst the right fork is a dry oxbow of the main stream. It is mostly crawling and leads into the White Horse Pool via a short duck.

Back in the main stream below the tributary, there is a sudden rise in the roof bed of 1m. and the vastness of the Great Bedding Cave is seen at its best. A tributary from the Right Hand Series enters and at this point the passage is over 35m. wide (4). The river is quite shallow here and a little further on there is a wide shingle beach on the left. A crawl over this past a tree trunk leads to a small tributary passage active in wet weather. This route also connects with a distributary of the main stream which flows under a low arch to Sump 7. Just after this branch leaves, the main stream becomes deeper again and the roof gets lower (5) before a second

rise in the roof bed. A wade through waist deep water then brings the explorer to Entrance I. A low bedding plane crawl leaves on the right and a little further downstream a large oxbow goes off rejoining the main route at the final lake. Meanwhile the river flows on past I in a lofty bedding cave and descends a series of short rapids. Entrances I and J have been formed by the collapse of the eastern side of this bedding cave. At Entrance J the distributary mentioned earlier is seen again and can be followed upstream to Sump 7 which is about 10·5m. long. The underwater route is obstructed by the branches of a tree, swept in by the floods. Downstream of J the distributary is separated from the main stream by a wide shingle bank (6) and does not rejoin it until the final lake. The main stream descends further small rapids to reach this lake. Daylight is now seen from the resurgence but can only be reached by those prepared to swim, for the water is over 5m. deep. The roof dips steeply over the first part of the lake so that airspace in dry weather is usually about 0.5m., but then it rises again and the river flows along a narrow canal (7) before leaving its underground course for good. (Plate 19A).

Entrances L and M are on the rocky platform overlooking the resurgence whilst K is an obscure hole nearby. L drops down into a rift which enters the final lake. M leads into quite a sizeable passage which can be followed south for 15m. where it is choked with mud and boulders or north for 34m., under K to a duck near the final lake.

The total length of the underground river from the Main Entrance to the Resurgence is 295m. and the drop about 6m. A profile of this route is shown on the survey.

Upper Stream Passage

This is best approached from Entrance C. From the left the underground River Mellte will be seen emerging from Sump 3 and it flows south from C along a fine section of stream passage (Plate 18). Low crawls on the right connect with the bedding chamber near the Main Entrance. 55m. from C most of the stream flows off to the left down a small passage to Sump 4 which is 1·3m. long. It rejoins the original passage immediately after this in a small chamber but then flows away again along another short oxbow, 25m. long. The main passage takes part of the stream and has connections on the right with the Entrance Chamber. After the second oxbow, the passage becomes lower and eventually the roof comes to within a few centimetres of the water in a duck 3m. long (Sump 5). It can be passed in dry weather but presents an awkward dive as there is deep water on the far side. The stream turns sharply to the N.W. immediately after Sump 5 and flows along an oval tunnel (8) for 28m. before cascading into the White Horse Pool.

Right Hand Series

Just inside the Main Entrance a large passage leads off to the Right Hand Series. Following the obvious main route round to the left it is possible to get to the Great Bedding Cave without any caving equipment other than a light. The explorer will pass under G and H and near to Entrance F, which is a steeply inclined passage that can be free-climbed. G and H however, require tackle and are really part of the same aven. G is the easier of the two to ladder, being broken by ledges at 4 and 8·5m. and 14m. of ladder (45ft.) is required plus an appropriate length of lifeline and a 3m. belay which can be attached to a boulder at the top.

An interesting variation of the route described above is to take the longer oxbow to the west. This is entered by turning right 20m. along the other passage beneath a pile of flood debris. After 25m. a large pool, 'the Creek', is reached and this is followed by a fine section of canyon passage (Plate 19B). A small stream from a nearby aven and from F flows in on the left and on the right there are a series of high level oxbows (9) one of which leads to Hywel's Grotto. The stream flows on to the Great Bedding Cave.

Hywel's Grotto is reached via a sandy crawl (10) which leads eventually to a pool about 5m. long. Partial immersion in this permits the explorer to enter a short but attractive section of passage (Plate 20B), ending in a small grotto. A wet bedding plane leads off from here but quickly becomes too low. Regrettably cavers have destroyed many of the formations in and around Hywel's Grotto.

The Maze

This is a very complex series of passages to the west of the Main Entrance. It can be entered at several points in the Right Hand Series, the most obvious of which is above the Creek. There are three distinct levels connected intermittently by small shafts, and two small streams, carrying percolation water, flow into the series.

It is possible to climb out to the surface at two places D_1 and D_2 and to see daylight at several others. D_1 is reached by crawling through a stagnant pool and climbing a tight rift on the far side. The route to D_2 is rather pleasanter and involves straddling up a rift at one end of a small chamber.

Upstream of Entrance C

The underwater passage from C to the airbell near B has been called Sump 3 by the C.D.G. and is 28m. long. Sump 2, which is only 3m. long, leads out from the airbell to Entrance B itself and in very dry weather it becomes a duck. Sump 1 is the upstream continuation from the airbell.

The underwater passage is high and wide with good visibility and its development has been strongly influenced by the NNW–SSE rifts, characteristic of the Upper Stream Passage. In the middle section of Sump 1, the river flows NNW for 40m. and at the southern end of this stretch there is another small airbell. 58m. further upstream the river is joined from the north by a flood tributary passage from Entrance A. From the small entrance chamber there is a duck into a smaller pool chamber, leading to an underwater squeeze and the sump passage. Upstream of the junction the river passage continues for a further 15m. to a chamber marking the start of the Upper Cave.

The Upper Cave is on two levels. A climb of 2.5m. from the water chamber leads to the first, where there are two static sumps (8 and 9). Between the two, the passage is low with a boulder run-in along the northern wall. Two avens, one near Sump 8 and the other just beyond Sump 9 lead to high level passages about 6m. above. These have only been sketched in on the survey to Grade 1. Several small passages to the west and south end in boulder chokes and it is likely that these connect with holes above the cliff on the east bank of the Mellte.

The river itself has been followed up from a 4m. pot in the lower level for a total of 75m. into a very complex area of stream passages (Grade 1 on survey). There is ample scope for further exploration upstream from here by divers but the gradient from the swallet (Church Sink) is very gentle and it may be that much of the route will be submerged with only occasional sections of open stream passage.

THE CAVE IN FLOOD

In Summer the bed of the River Mellte is usually dry between Church Sink at Ystradfellte and Porth yr Ogof. In wet weather, however, the sink soon fills up and the river flows on along the surface to the Main Entrance of the cave. Mellte means lightning and is an appropriate name, for after heavy rain the river can rise with alarming speed. This fact is not at all surprising for the catchment area covers over 35km^2 of the Central Fforrest Fawr Mountains, which reach a maximum altitude of 730m. (2,400 ft.)

The Main Entrance of Porth yr Ogof makes an impressive spectacle when the river is in spate (Plate 17B). Warner (1800) described it as a 'gaping fissure, arched and high, into which the River Felddta rushes with foaming impetuosity.' In high flood the approach ledges to the entrance become submerged and at the resurgence water gushes up under a considerable hydrostatic head. After exceptional floods water may even reach the roof of the Main Entrance and much of the cave becomes submerged. Under such conditions a large amount of debris is washed

into the cave and some impressive examples of this—in the form of the tree trunks—can be seen today in the Entrance Chamber, the Right Hand Series and just upstream of Entrance I.

One other form of flooding must be mentioned. During cold winters when there is snow on the southern slopes of the Fforest Fawr Mountains or when the River Mellte is frozen, meltwater can cause a mild flood in the cave. An example of this phenomenon was witnessed by members of the Cwmbran Caving Club on a sunny but very cold day in February 1968. Davies (1968) described the event as follows:—

> '. . . At about 12 noon we noticed that the ice was suddenly beginning to break up in places. Closer examination revealed that this was because floating ice was being forced upwards by a rise in the water level. Within minutes running water could be seen coming round the bend 300 yards upstream, forming little waterfalls where none had existed before. Very rapidly the water level rose by 1½ ft., filling rock basins and pebbly hollows to the full width of the river bed.'

Although a flood of this size causes no real danger in the Main Cave it can rapidly submerge Entrance B.

SAFETY IN THE CAVE

It is a sad and regrettable fact that two cavers have been drowned in Porth yr Ogof. The incidents occurred in June 1957 and August 1968 (*Western Mail* reports 24.6.57 and 8.8.68).

In dry weather the trip along the underground river to the resurgence is an easy and enjoyable undertaking for the wet-suited caver but it should always be treated with respect. It involves a good deal of wading and some swimming in deep water and because the temperature of the water is seldom above 10°C. even in summer, the risk of exposure should be remembered.

In flood conditions the underground river is dangerous. The passage immediately upstream of the resurgence becomes sumped and the force of the water downstream of the White Horse makes a through trip to Entrance I inadvisable. Recently it has become fashionable to include the Upper Stream Passage in the through trip, by free-diving Sumps 4 and 5. This should only be attempted at low water conditions and by cavers who have previous experience of free-diving.

GENERAL GEOLOGY AND DRAINAGE OF THE VALLEY

The headwaters of the Mellte, the Afon Llia and the Afon Dringarth drain off the Old Red Sandstone of the Fforest Fawr Mountains. Not long after their confluence the River Mellte meets the Carboniferous

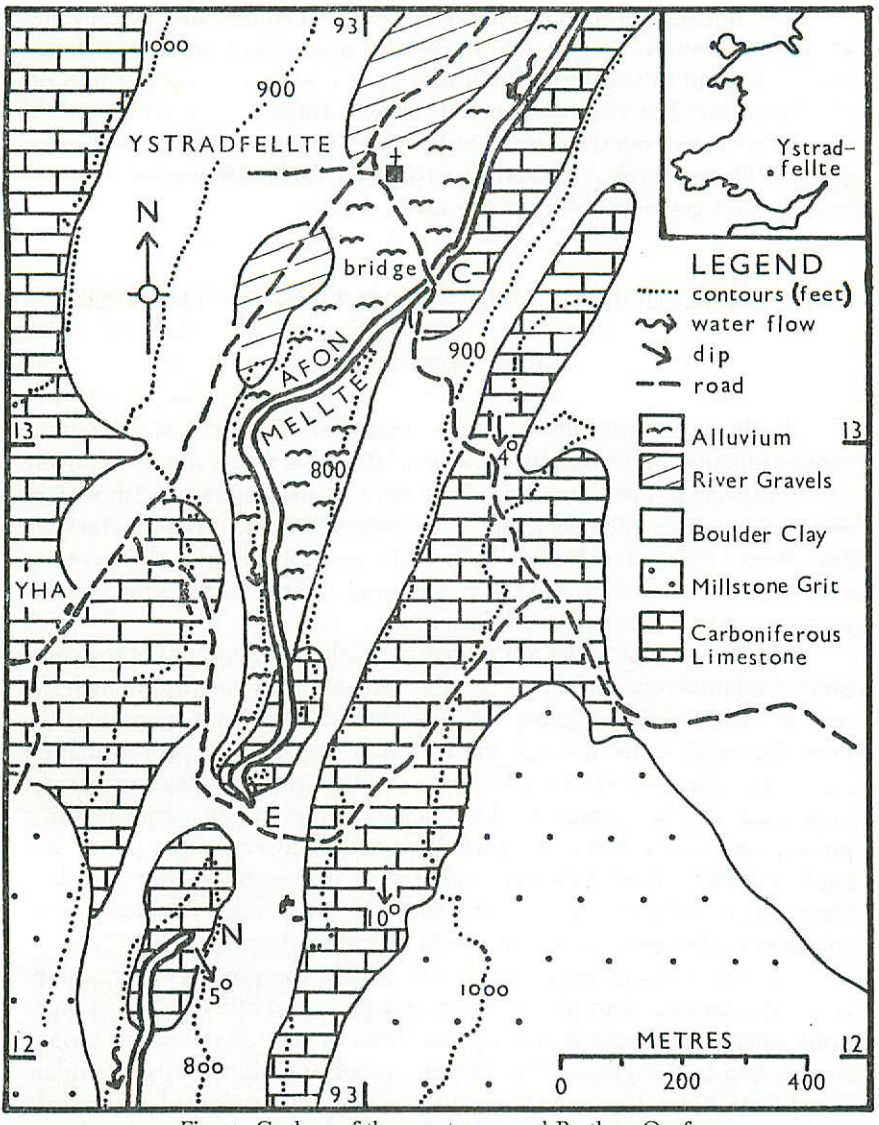

Fig. 37. Geology of the country around Porth yr Ogof.
Main entrance (E). Resurgence (N). The Swallet [Church Sink] (C).
Based on Ordnance Survey and Geological Survey, Crown copyright reserved.

Limestone (fig. 37) and in dry weather the whole of the river sinks underground on its east bank at SN 932133 near Ystradfellte Church (Church Sink). Repeated flooding has frustrated the efforts of several parties that have attempted to dig out the swallet.

The underground course of the river from Church Sink to Entrance C, where it is next seen is about 900m. in a straight line. Homes tested the connection in 1964 and found that 1½ ozs. of fluorescein put into the sink reappeared at C in 2¼ hours (Hartwell, 1965).

Readers are referred to works by Jones (1939), Pringle and George (1948), Thomas (1959) and North (1962) for further information on the geology and geomorphology of the area.

GEOMORPHOLOGY AND FORMATION OF THE CAVE

By

M. D. Newson B.Sc.

Porth yr Ogof shows some excellent features of limestone geomorphology, both underground and at the surface. All are relatively easily inspected. The area around the cave is well endowed with surface depressions, often of spectacular dimensions, Thomas (1959), Hartwell and Jones (1964), and Burke (1967). The gorge leading to the cave entrance is an example of cavern collapse and the cave itself shows classic phreatic and vadose solutional features.

North (1962) provides a brief outline of the development of the cave. Since Carboniferous Limestone is a non-porous rock structural weaknesses such as bedding planes, joints and faults are all important in guiding the flow of ground water through the rock and hence guide cave formation also. The wide, low entrance to Porth yr Ogof gives the key to the most important cave pre-cursors in the system—a series of four major bedding planes, just under a metre apart. The beds between these planes are capable of supporting extremely wide roof spans (as in the Great Bedding Cave). This being the case, other structural guides must be cited for the collapses in the upstream gorge and at Entrances I and J.

The upstream gorge appears to be still in the process of formation. It is a spectacular example of cavern collapse, most other gorges in limestone (such as at Cheddar) having now been attributed to normal surface river action in the Pleistocene. The enormous and almost cubic boulders around the Main Entrance to Porth yr Ogof have collapsed along joint planes and the present-day cliff above the entrance would seem to be a joint plane itself. Entrance C is the result of the main gorge and the Upper Stream Passage intersecting.

The Entrance Chamber and Great Bedding Cave are wide and low with relatively smooth roofs and with cobbles of limestone and sandstone forming the floor, thus obscuring the true cross-section. The smooth curve of the roof is interrupted in two ways. In long profile there are two points

(see survey) at which the collapse of one of the major beds of limestone produces a step-like change to a roof in the next bed above.

Also in the roof in these sections are solutionally excavated joints, appearing like canoe-shaped pockets. These are remnants from a phreatic phase (using the term phreatic to mean conditions of complete flooding during the very early stages of cave formation) and show that joints too are important in the formation of Porth yr Ogof.

That fuller excavation of joints—up to passage dimensions—has occurred can be seen from the survey. Mostly in the Upper Cave, the effects of NNW/SSE and NNE/SSW joints can be seen to guide the main directional trends of the cave. The Upper Stream Passage is clearly parallel to the NNW/SSE structural trend shown by two parts of Sump 1 and around Sump 9. These limbs are joined by NNE/SSW passages. The joint control in the main part of the cave seems to be less strong. However sharp changes of direction at the White Horse and a more gentle curve in the reverse direction near Sump 7 are joint controlled. The passages containing Sumps 5 and 10 are strongly orientated NNW/SSE; here the hydrological control exercised by jointing appears to be stronger than that by dip (*i.e.* bedding planes) since the water flow is to the northwest while dip is 5° to the south-southeast. This may be a developmental phase and when further karstification has occurred the bedding planes may become dominant and both sumps and streams drain away south-eastwards.

Entrances I and J are formed by a collapse of the dry valley floor into the cave proper. From inside the cave the reason is obvious—a major fault and zone of disturbance trending north-west/south-east. The separation of the stream into two channels just before these entrances appears to be unconnected with collapse, the intervening rock being solid and *in situ*. The stream distribution is thus a case of underground braiding.

Of the side passages in the cave the Right Hand Series are considered to be the oldest part; they only carry Mellte water during exceptional floods. Another reason for suggesting their early age is that vertical solutional connections with the surface (e.g. entrances F, G and H) were presumably the way in which water first abandoned the surface valley and initiated cave formation. The main route, marked by entrances F, G and H, of the Right Hand Series utilizes all the major bedding planes, rising to the upper level soon after the entrance and falling again near the junction with the Great Bedding Cave. The longer route (9) is developed in the same beds as the Main Entrance. The Maze shows three main levels, an upper phreatic series and a lower mainly vadose series (formed by a cave stream which did not wholly fill the passage). The intervening bed of limestone is permeated by avens which link the two series.

Hywels Grotto is possibly the oldest series in the known cave—containing many of the speleothem formations associated with abandoned passages (though it can still flood). However, the upper series of the Maze is equally old. An absolute date for the cave awaits more precise work on local glacial history but a stalagmited fill in an oxbow off the Great Bedding Cave suggests that the Right Hand Series may have existed through at least one cold phase of reduced water circulation. The fill is currently being excavated by flood waters.

Around the resurgence the fluted limestone bears testimony to the turbulent flow of water at this point—especially in floods when it 'boils up' here. An inspection of the entrance shows scallops—smaller turbulence forms which are very well developed in the main part of the cave. The difference in height between the cliffs above the Main Entrance and resurgence reveals that the present stream has a shallower gradient underground than its forerunner on the surface.

The Upper Stream Passage carries water under all conditions and can be considered the modern and future axis of the system. It would seem that the trend is for drainage to be migrating southwards and eastwards with the regional dip of the limestone. The Upper Cave's passages show that this migration is going on higher up the Mellte too but that conditions there are still largely phreatic and joint-controlled.

Other speleogenetic features worthy of mention are the large calcite vein in the passage linking Sump 5 with the White Horse Pool and the classic enlargement of a bedding plane, which can be crawled through, between the Upper Stream Passage and the Entrance Chamber (the southerly of three possible routes westwards, just south of Sump 4.)

Though the historical development of the system remains largely a matter for informed conjecture the present erosion processes in Porth yr Ogof can be assessed by hydrological and chemical methods. Williams' (1963) thesis contains the results of many analyses of water in the area for its hardness. Because discharge conditions of the Mellte are so variable —(it may be said to have a 'flashy' regime)—a major point of the study was to assess the comparative limestone solution rates in flood and drought. In drought much of the system is not reached by stream water but percolation water contributes to the flow at the resurgence and (relatively) high hardness result. In flood there is dilution by surface water but much more of the system is reached and the net erosion is therefore greater. Williams shows that over the local limestone outcrop in 38 days per annum of flood some 285,000 kilogrammes of limestone are removed in solution, compared to 1,675 kgs. in 152 days of dry conditions ('ground water' conditions). In terms of dissolved limestone

concentrations the resurging water at the end of the system contains around 35 milligrams per litre in flood and 100 mg./l in ground water conditions. A good example of a ground water spring can be seen not far upstream of the main entrance on the right bank of the Mellte—this contains up to 150 mg./l of limestone, presumably the result of soil water, rich in acids travelling through small channels and giving a suitable kinetic situation for solution.

Under flood conditions it is also likely that abrasion of the vadose cave passages occurs as the Old Red Sandstone debris will move with some force over the limestone floors and walls.

NOTES ON THE SURVEY

INSTRUMENTS. The major part of the survey was carried out with an R.A.F. hand bearing compass read to the nearest degree, and a metallized linen tape read to the nearest inch. Clinometric and vertical measurements were recorded when necessary. For the profile of the Main Passage, a Suunto clinometer, read to $\frac{1}{2}°$ was added to instruments listed above.

The underwater survey from Entrance C to B and A and to the Upper Cave required different and inevitably less accurate instrumentation (Lloyd, 1970). A diver's Suunto wrist compass read to the nearest 10° and a courlene line marked at 10ft. intervals were used.

ACCURACY. A large number of closed traverses, both underground and on the surface, are included in the survey, and chiselled fixed survey points were made at all entrances and passage intersections. Closing errors were generally under 1% and an error over 2% was taken as an indication for resurvey. Closing errors were distributed along all the legs of the traverse according to their length. In the underwater survey the closing errors were around 10% and here the error was only distributed along the underwater legs of the traverse and not along the surface legs.

Small passages were surveyed by selecting survey stations on alternate walls whilst in the larger passages extra survey legs were included to fix the exact position of the walls. Grade 4C accuracy is claimed for the main survey.

FORMULATION OF DATA. All the survey data was computed into eastings and northings and plotted at a scale of 1 in 500. The original survey which has been reduced photographically for publication, is available in the Society's library.

PASSAGE LENGTHS. The surveyed passage lengths are as follows:—

	Metres	*Feet*
Main Entrance to Resurgence (E to N)	296	972
Minor branches of the Main Stream Passage ..	488	1602
Upper Stream Passage and branches	339	1112
Right Hand Series	288	946
The Maze	253	831
Upstream of Entrance	556	1826
Total ..	2220	7289

ACKNOWLEDGMENTS

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The landlord of the New Inn, Ystradfellte always made us welcome despite our dripping wet suits and, at times, unkempt appearance.

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PLATE 17A

The Main Entrance in Summer. The state of active collapse upstream from the cave can be gauged from the huge blocks of limestone and unstable tree growth.

(*Photograph: A. J. Morrison*)

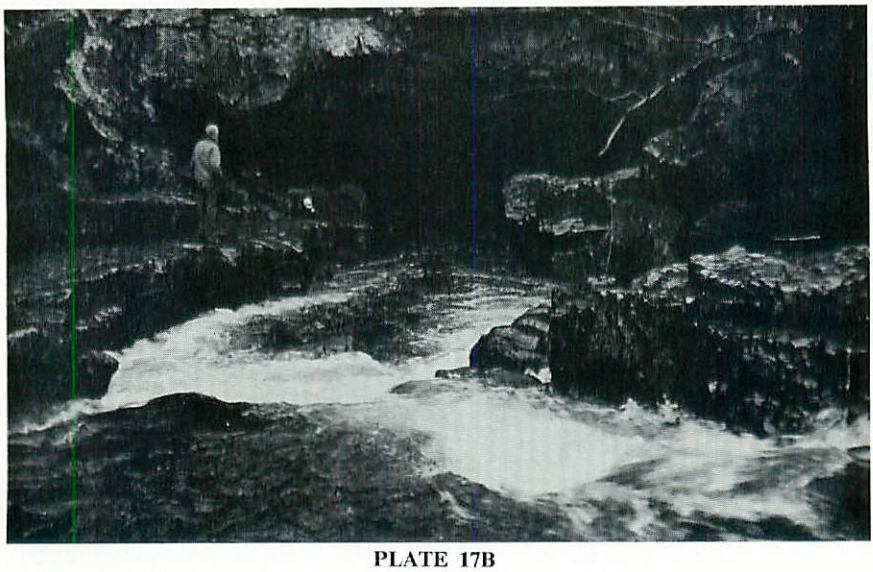

PLATE 17B

The Main Entrance in Winter—the River Mellte is in flood. Under heavy flood conditions the approach ledges by the figure are submerged.

(*Photograph: P. A. Standing*)

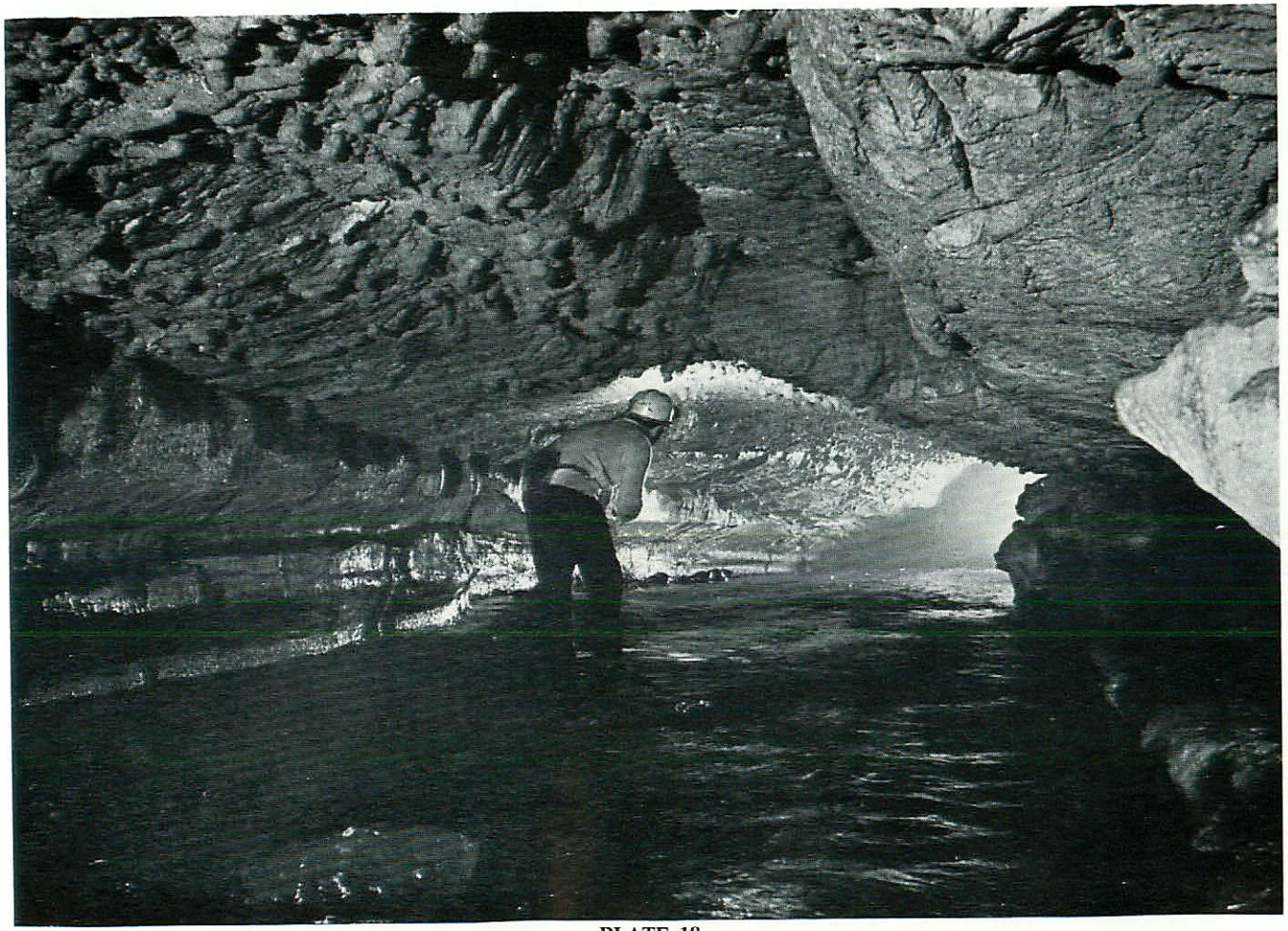

PLATE 18

The Upper Stream Passage showing typical vadose cave development along bedding planes but with an arched roof indicating jointing.

(Photograph: D. M. M. Thomson)

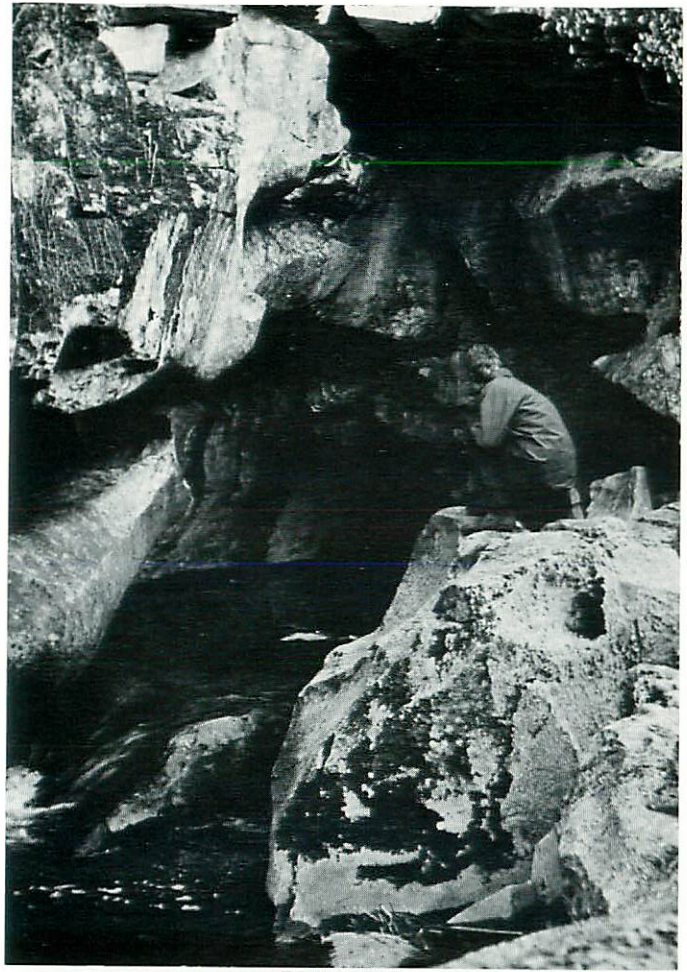

PLATE 19A

The Resurgence (Entrance N). Thorough erosion is shown at a variety of levels (bedding planes) each demonstrating signs of very turbulent flow.

(*Photograph: P. A. Standing*)

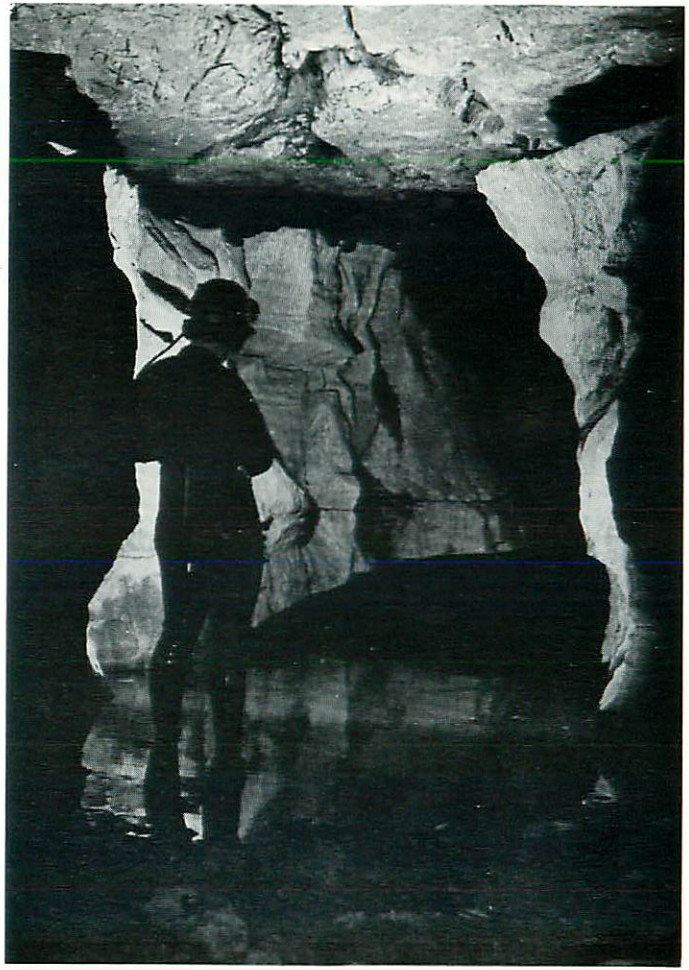

PLATE 19B

The Creek (Right Hand Series). The roof and floor follow bedding planes. The walls were formed by a period of vadose down-cutting from the upper to lower planes.

(*Photograph: P. A Standing*)

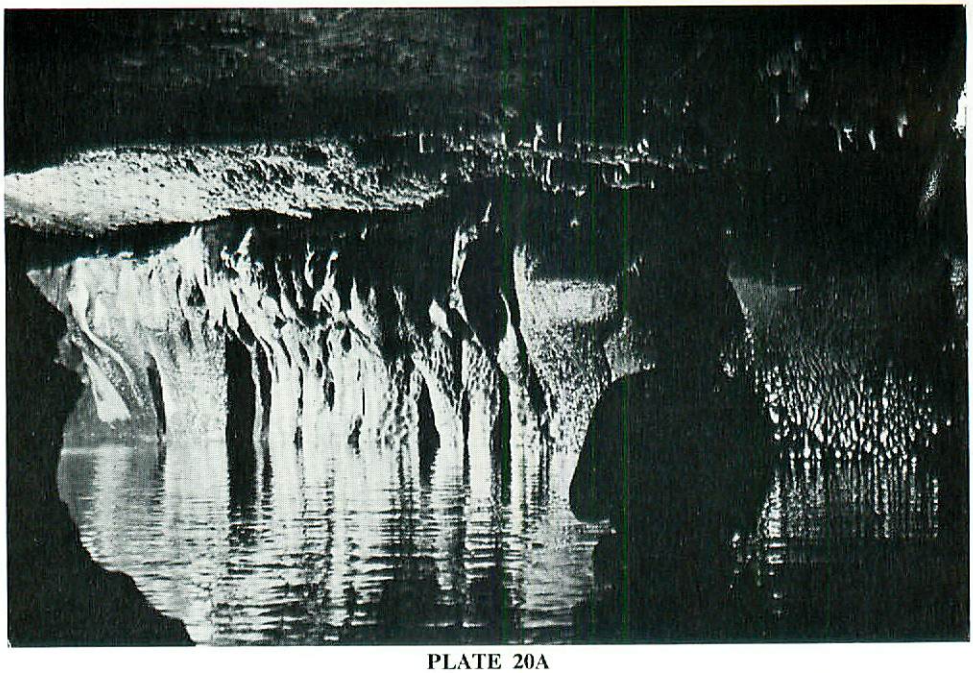

PLATE 20A

The underground river looking upstream near Section 3. The roof is formed along a bedding plane whilst the walls show scallop markings formed by erosion by turbulent water.

(Photograph: D. M. M. Thomson)

PLATE 20B

Speleothems in Hywel's Grotto.

(Photograph: D. M. M. Thomson)

PORTH YR OGOF

Survey 1968 - 1969

U.B.S.S. & C.D.G.

Metres 10 5 0 10 20 30 40 50 — Plan
20 0 20 40 60 80 100 160
Feet

N

LEGEND

Avens
Sumps
Pools
Changes in roof level
Rough outlines
Streams

N.G.R. SN. 928124

C.R.G. Grade 4C

RIVER MELLTE

Cwmbran Entrance B

Sump 2

Sump 3

Risings

shingle

Entrance C

Upper Stream Passage

Cliff

run in

D 1

The Maze

D 2

E

Main Entrance

Sump 4

The Creek

Right Hand Series

F

G

H

Hywel's Grotto

10

Sump 6

White Horse

2

8

9

3

Great Bedding Cave

Stream

Sump 5

1

Main shingle

4

Section I — J

Sump 10

5

Sump 7

I

J

shingle

6

fault

7

K

L

M

Resurgence N

Scales of Section I — J and of Profile
Horizontal : half . Vertical : twice the Plan

Profile of Streamway

Cliff

Main Entrance E

Eye of White Horse

Resurgence N

UPPER CAVE

run in

Sump 8

Sump 9

Top Entrance A

Aven

High Level Passages

Grade 1

Grade 1

12 ft. pot

Sump 1

SECTIONS

looking downstream. Scale x 2 of the Plan.

1
2
3
4
5
6
7
8
9
10

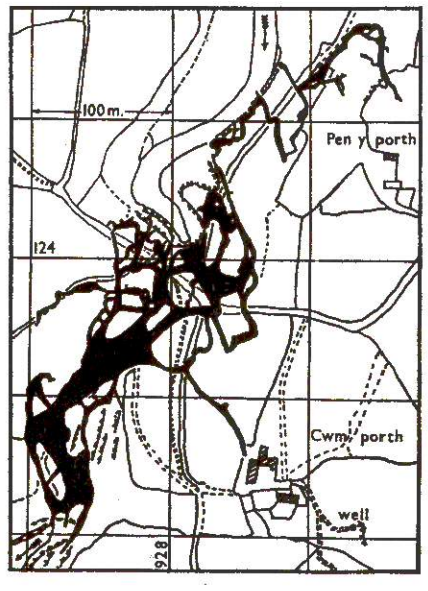

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PLATE 21