Dan-yr-Ogof

[SN 838 160]

Highlights

Dan-yr-Ogof is an outstanding example of a cave system with contrasting geological controls on its configuration; it has fault-guided inlet passages draining to a trunk route which is predominantly bedding-controlled close to the axis of a minor syncline. The cave contains classic examples of phreatic and vadose passage morphology, some of which are now superbly decorated with calcite speleothems.

Introduction

The Dan-yr-Ogof cave system includes the truncated fragment known as Tunnel Cave and is located on the western side of the Tawe, or Swansea, Valley, north-east of Ystradgynlais (Figure 6.1). Parts of both Dan-yr-Ogof and Tunnel Cave are operated as show caves, the latter under the name of Cathedral Cave; above the two entrances, Ogof yr Esgyrn is a cave fragment which has yielded many Bronze Age and later artefacts (Mason, 1968). The caves are developed almost entirely in the Carboniferous Dowlais Limestone, of Holkerian age, which locally reaches a thickness of about 100 m; some passages extend into the Asbian limestone above. Old Red Sandstone crops out to the north, and part of the cave lies beneath the cap of Namurian Basal Grit which overlies the limestone to the south. The gentle southerly dip of the Palaeozoic succession is interrupted by the Cribarth Disturbance (Owen, 1954; Lowe, 1989b), a belt of tight folds and faulting. Immediately north of this, the cave lies within a shallow, asymmetric syncline in the limestone (Figure 6.3). Several minor faults extend north or NNE from the Cribarth Disturbance, parallel to the major joint set, and a minor joint set is orientated WNW–ESE.

Allogenic water reaches the caves mainly from the Old Red Sandstone slopes to the north, though it appears that much of the flow which formerly entered the system has been captured by the River Haffes to the north. Percolation water from the limestone outcrop contributes significantly to the underground flow, and there are numerous dolines and small stream sinks on the hillsides above the cave.

The Dan-yr-Ogof cave system has been described by Coase and Judson (1977) and Coase (1967, 1975, 1989), and the hydrology is reviewed by Gascoine (1989). Short descriptions of the cave passages are given by Stratford (1995), though there are significant more recent discoveries (Kealy, 1992; Murlis, 1992).

Description

Dan-yr-Ogof contains more than 16 km of cave passages (Figure 6.4). The south-eastern arm of the system, largely known as Dan-yr-Ogof 1 and part of Dan-yr-Ogof 2 (DY01 and DYO2), is the trunk route of the cave, with passages at several levels draining to the north-east. The linear passages of Dan-yr-Ogof 3 (DYO3) form the western arm of the system and are inlet passages draining south, largely along a series of north-south faults.

The downstream end of DYO1 has an artificial tunnel into the show cave just above the resurgence. This intercepts a long high-level passage, which connects with the lower, active passage at various points. The main river cascades through a series of lakes, ponded by sediment banks and rock bars within the old, horizontal, phreatic tubes. Downstream it flows through the sumps of the Battle of Britain Series (Murlis, 1992); upstream it emerges from more totally flooded passages, and is only seen again in the Syphon Series of DYO1, in the magnificent phreatic borehole of Bakerloo Straight in DYO2, and in the complex series of partly flooded phreatic tubes of Mazeways. Above the lower, active level, there is an extensive, and complex, series of meandering high-level passages, locally well decorated with calcite speleothems and containing thick, clastic, sediment sequences. The show cave high level has undercut vadose passages with remnants of a phreatic tube preserved in the roof (Figure 6.5). Further west, this level is dominated by old phreatic passages, modified considerably by vadose entrenchment. Extensive collapse and choking with sediment have broken these passages into a series of isolated fragments; the chokes have been bypassed via much smaller high-level phreatic passages — including the series of small rifts which provide the route into DYO2.

A massive choke immediately north-east of Gerrard Platten Hall lies directly below the Crater, a large collapse doline on the surface. The high level continues into the Grand Canyon, which has a classic keyhole shape, with a vadose trench 2 m wide and up to 7 m deep cut in the floor of a large meandering phreatic tube (Figure 6.5). Flabbergasm Chasm is a magnificent phreatic tube up to 3 m wide forming an abandoned loop north of the Grand Canyon roof tube. It is decorated with calcite straw stalactites up to 2.5 m long and gypsum oulopholite flowers, while crystal pools, mud-cracks and drip-pits adorn the floor. Further west the main passage widens to 8 m, but thick clastic sediments reduce its present height to 2 m, before Monk Hall, Cloud Chamber and Hangar Passage form a section clear for their full heights and richly decorated with straw stalactites and other calcite speleothems (Figure 6.6). This large old passage is partially blocked by collapse at several points, and eventually ends to the west at clay and boulder chokes. Phreatic tubes at a lower level (Figure 6.5) include Bakerloo Straight, and are largely abandoned as the main water flows through another, lower set of flooded conduits.

From Cloud Chamber, the ponded Green Canal passage links through to more, large, dry passage at the southern end of the fault-controlled, western limb of the cave system. To the south, sections of large passage are blocked by clay and boulder chokes, and a network of smaller phreatic tubes extends through a flooded section to Mazeways Two. Dali's Delight, close to the Abyss, has irregular scalloped pillars etched into the Honeycombed Sandstone, a distinctive band of basal Asbian arenaceous limestone 1 m thick. To the north, a narrow vadose canyon is a flood route from the north which passes beneath the Rottenstone Avens, and leads upstream to junctions where high-level rifts, decorated with helictites, pass over the sumped section at The Rising.

The Great North Road is the main passage in DYO3; it is a large vadose canyon modified greatly by collapse along a series of closely spaced, steeply dipping fault planes (Figure 6.5). At Pinnacle Chamber, the passage is 10 m wide and 20 m high, with the Pinnacle Series of high-level passages developed above. Further north, a superb section of undercut, meandering vadose passage swings round from the west below a phreatic tube, 6 m high and 15 m wide. The two unite briefly upstream in a classic keyhole-shaped passage, before the phreatic tube turns north again in The Mostest, beautifully decorated with coloured flowstone, gour pools and calcite crystals around a dried-out pool. Beyond a junction with an inlet from the north, the main passage contains numerous large boulders of grit and quartz conglomerate beneath the Gritstone Avens. Large sediment banks precede a massive terminal choke in The Far North, a passage 13 m high and wide and modified by block collapse (Figure 6.5), at the end of the explored cave.

Tunnel Cave contains more than 2100 m of passages (Figure 6.4). The northern inlets of the cave are descending series of narrow vadose rifts, locally with well developed roof tubes (Figure 6.5). These unite downdip, to the south, into a vadose canyon which leads into the large passage of Davy Price's Hall, extensively modified by collapse and containing thick banks of sand, silt and mud. This chamber is now open as a show cave, under the name of Cathedral Cave, with an artificial entrance close to its tiny active outlet.

Interpretation

Both the Great North Road and Tunnel Cave have developed due to drainage almost straight down the regional dip. The linear form of the Great North Road reflects its development on a series of north-south faults and associated fractures, while Tunnel Cave follows only joints which are less extensive. The gradient of DYO3 is less than the dip, so that it climbs stratigraphically on the fault planes — reflecting initial development under phreatic conditions. Both these inlets, and a third inlet from Sinc y Geidd (Figure 6.3), drain into the south-eastern arm of the cave, developed close to the trough of the asymmetrical syncline north of the Cribarth Disturbance.

The axis of the syncline is almost level, and the nearly horizontal phreatic passages have drained towards the aquifer outlet in the Tawe Valley. The cave is not in the trough of the main fold, whose surface expression is the tongue of Grit outcrop just to the south-east (Figure 6.3). However, dips recorded in the cave clearly show the presence of a shallow synclinal flexure, repeatedly displaced by small crossing faults, the axis of which is rigorously followed by the cave

(Coase and Judson, 1977). Joints have exerted a minor influence by creating a network of fissures which the main flow utilized; many passage segments are joint aligned, but the main cave nowhere strays far from the direct line to the valley resurgence. The confluence of the Great North Road faults with the syncline is the site of a sprawling complex of passages in Mazeways, which extends as development along the strike by water from Sinc y Geidd.

The series of passage levels, and the sediment and speleothem deposits which they contain, record a long and complex history which awaits an absolute chronology based on uranium-series dating of speleothems. Initially the cave system consisted of a series of small, fracture-controlled, phreatic rifts and tubes which drained downdip to the south, into the syncline of the Cribarth Disturbance. Slower flows to the north-east within the syncline trough enlarged the more complex network of fissures which were the ancestors of the many passages now forming DYO2 and DYO1. Remnant from this phase may be the small, high-level, phreatic tubes which survive as bypasses around the massive chokes in the southern part of the system. The large high-level trunk passages, mostly on DYO2, represent the main phase of cave development, since fragmented by collapse and ,sediment infill. The large size of the trunk passages probably indicates a much higher flow than that of the present active streamway.

Subsequent drawdown has resulted in extensive vadose modification of many of these old phreatic passages, notably on the shallow phreatic loops caused by the interplay of joint control and dip within the syncline. Downcutting of the Tawe Valley, and erosion through some of the phreatic loops within the cave, has favoured enlargement of new drainage routes at lower levels through the same fissure networks. This process has been repeated a number of times in different parts of the system, but the majority of the development has been phreatic in the synclinal trough; the active drainage route is still largely flooded. Vadose entrenchment of the phreatic tubes has been deepest close to the resurgence, in direct response to the surface lowering, and in the steeper passage gradient of Tunnel Cave.

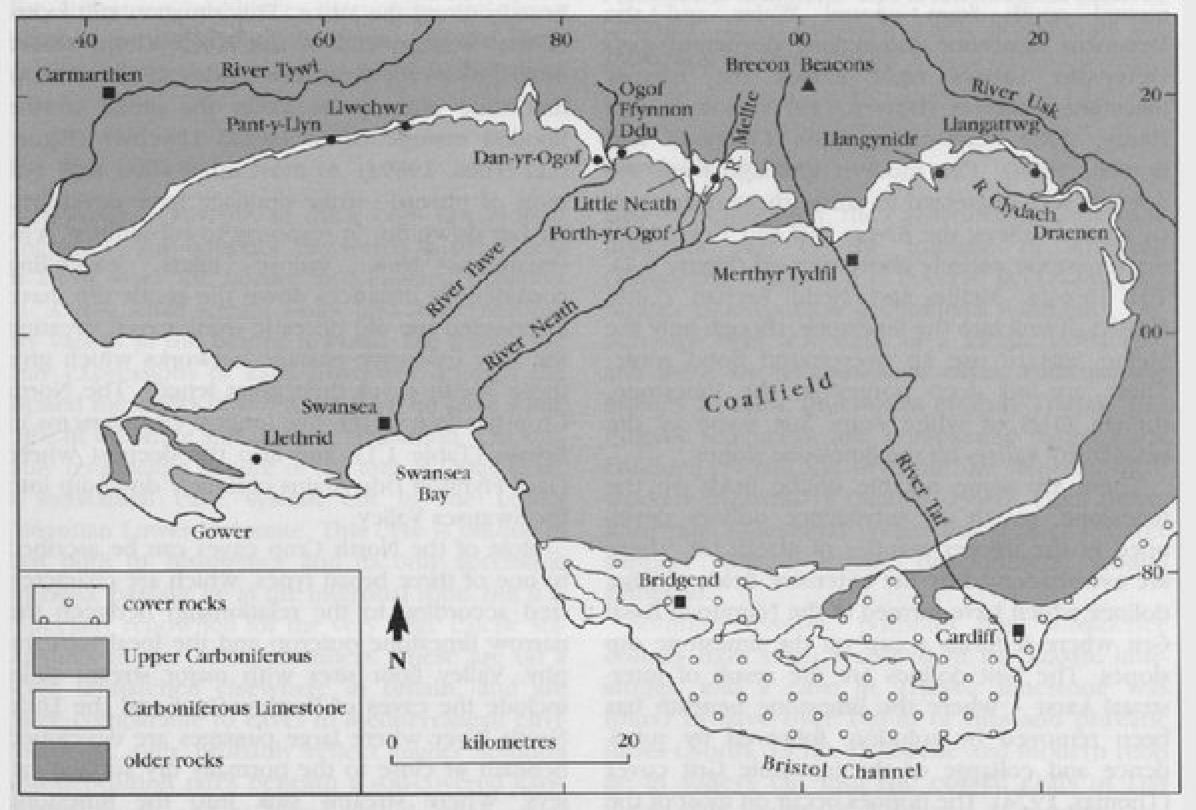
The abrasiveness of sand sediment washed into the cave may account for the largest section of passage being that closest to the former sinks feeding into the Far North. These large passages date probably from a period prior to the capture of much of the surface drainage by the River Haffes (Figure 6.3). The choke in Gerrard Platten Hall lies 40 m below a large collapse doline, and the feature represents an early stage of the dissection and eventual destruction of the cave. Tunnel Cave appears to have been an inlet to Dan-yr-Ogof before the side of the Tawe Valley retreated far enough to remove the junction; its truncation is another aspect of cave destruction.

The stages in the development of the caves, with their consecutive sequences of passages and repeated rejuvenations, must relate to the series of ice advances and the glacial and fluvial valley deepening during the Pleistocene. Much of the original allogenic drainage has been lost to the River Haffes, in an unusual example of underground drainage being captured by a surface stream. The resurgence is now perched above the valley floor, as the water emerges from a truncated phreatic tube very close to the base of the cavernous limestone. A preliminary interpretation of events ascribes different drainage routes and cave passages to the interglacial stages of the Pleistocene (Coase, 1989), but it remains conjectural without absolute dates from the cave sediments. Environmental and chronological data have yet to be elucidated from the thick clastic and speleothem sequences in the various cave levels, to obtain a clearer picture of the evolution of both the cave system and its surrounding landscape.

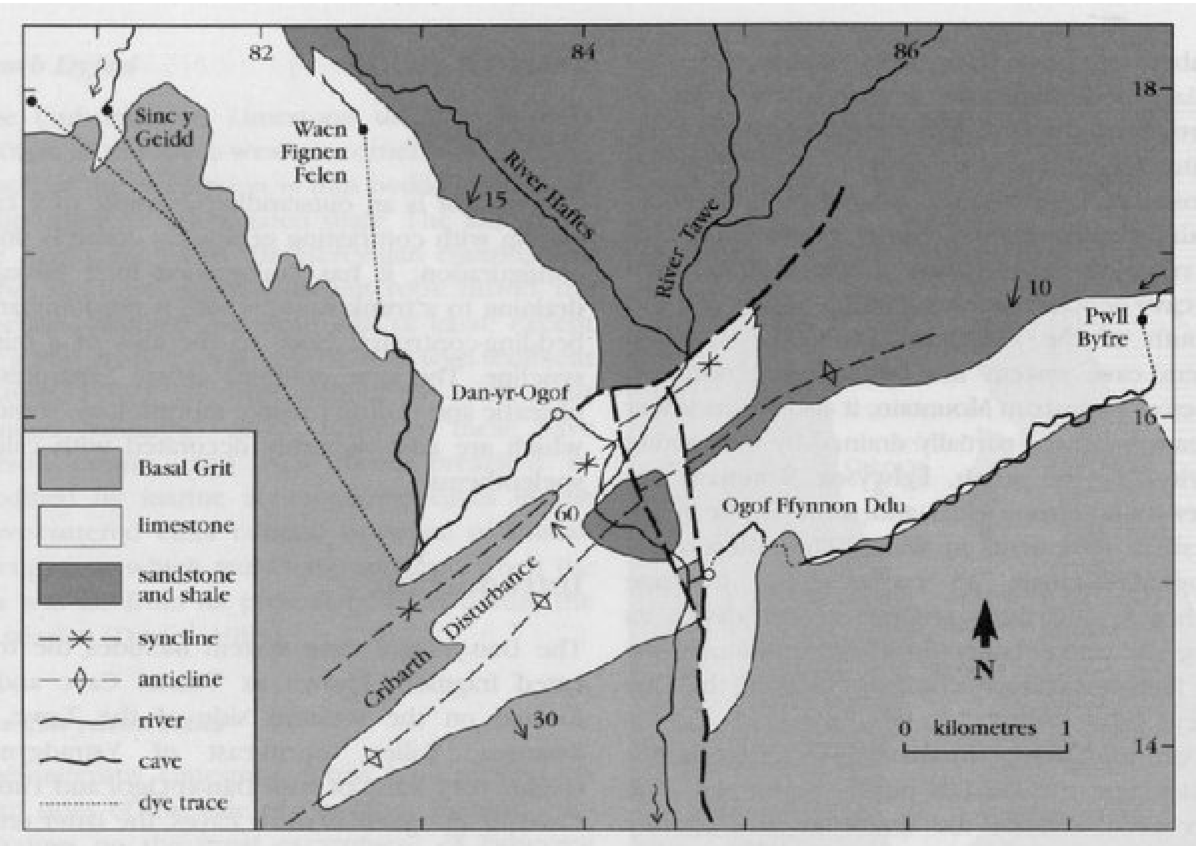
Conclusion

Dan-yr-Ogof is a major cave system with large, fault-guided passages uniting in a drained phreatic trunk route along the axis of a syncline. It shows very clearly the effect of various geological controls on cave development, and it contrasts with the adjacent Ogof Ffynnon Ddu, a cave system with a conspicuously different morphology in the same limestone in a different structural situation on the other side of the Cribarth Disturbance (Figure 6.3). Rejuvenation in response to valley incision has left an extensive series of partly abandoned, high-level passages, many of which are classic examples of their type, superbly decorated with calcite speleothems.

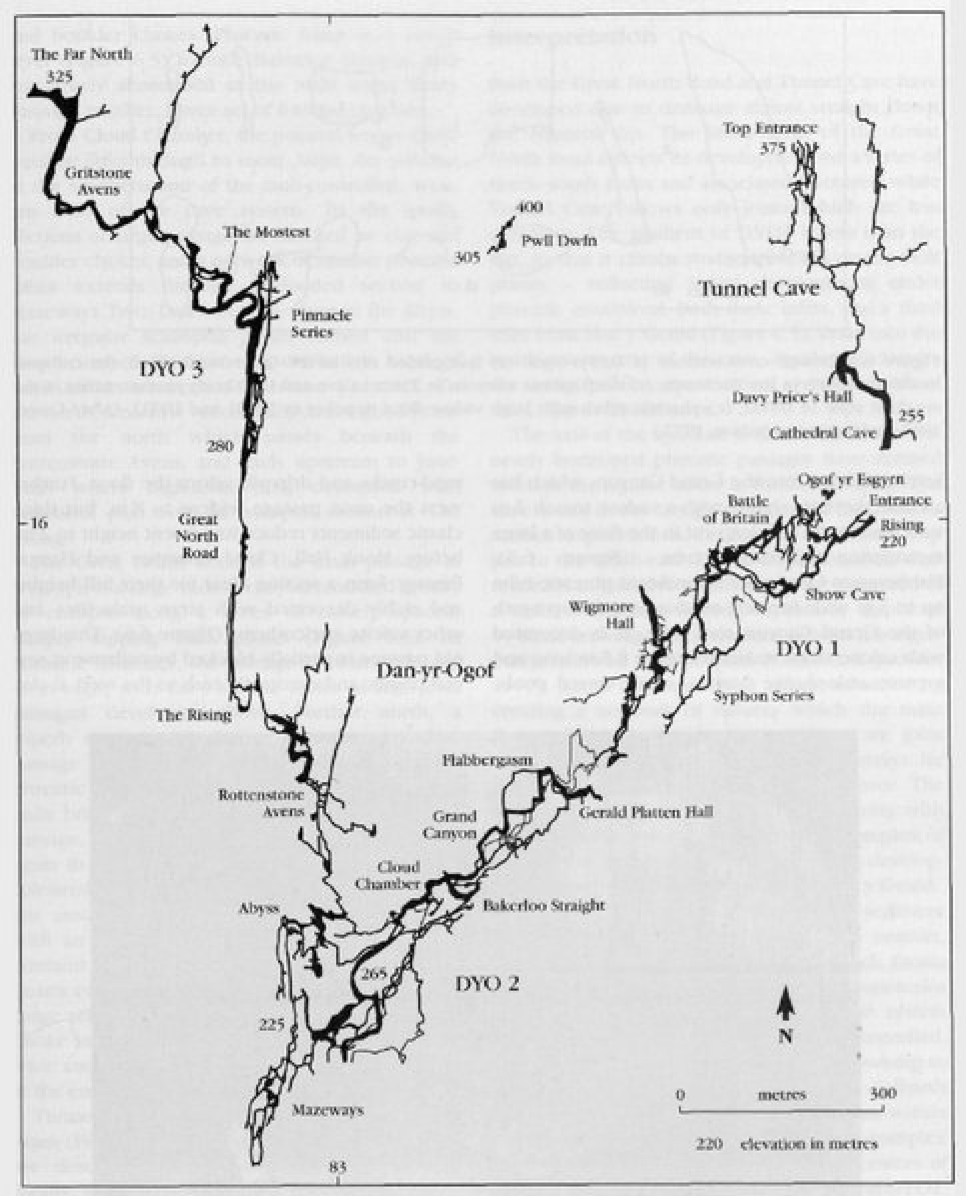
References



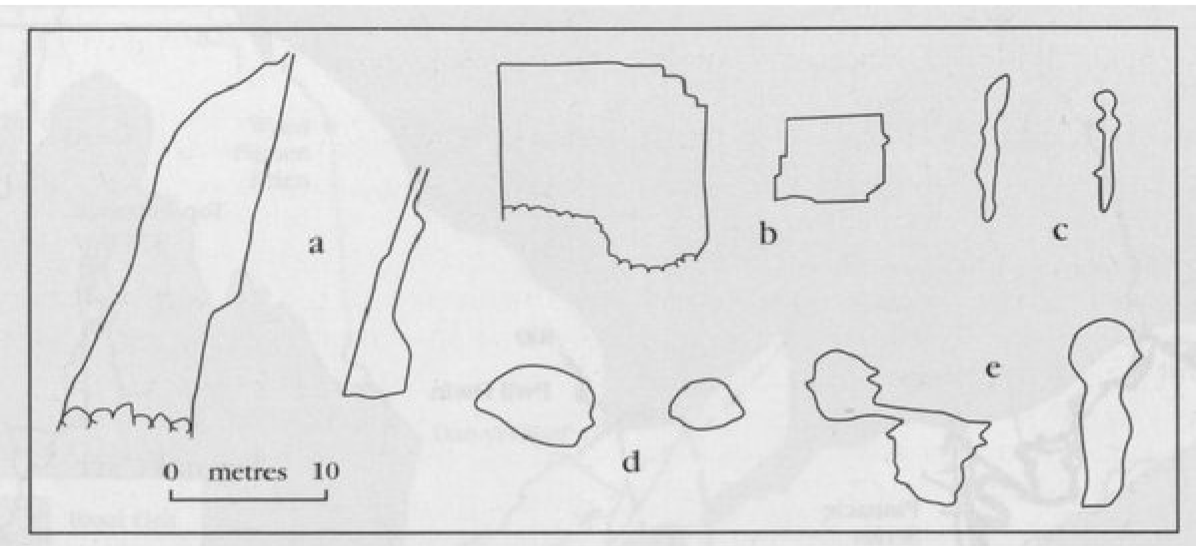
(Figure 6.1) Outline map of the karst areas around the perimeter of the South Wales coalfield, with locations referred to in the text. The cover rocks in the south are Triassic and Jurassic mudstones and thin limestones.



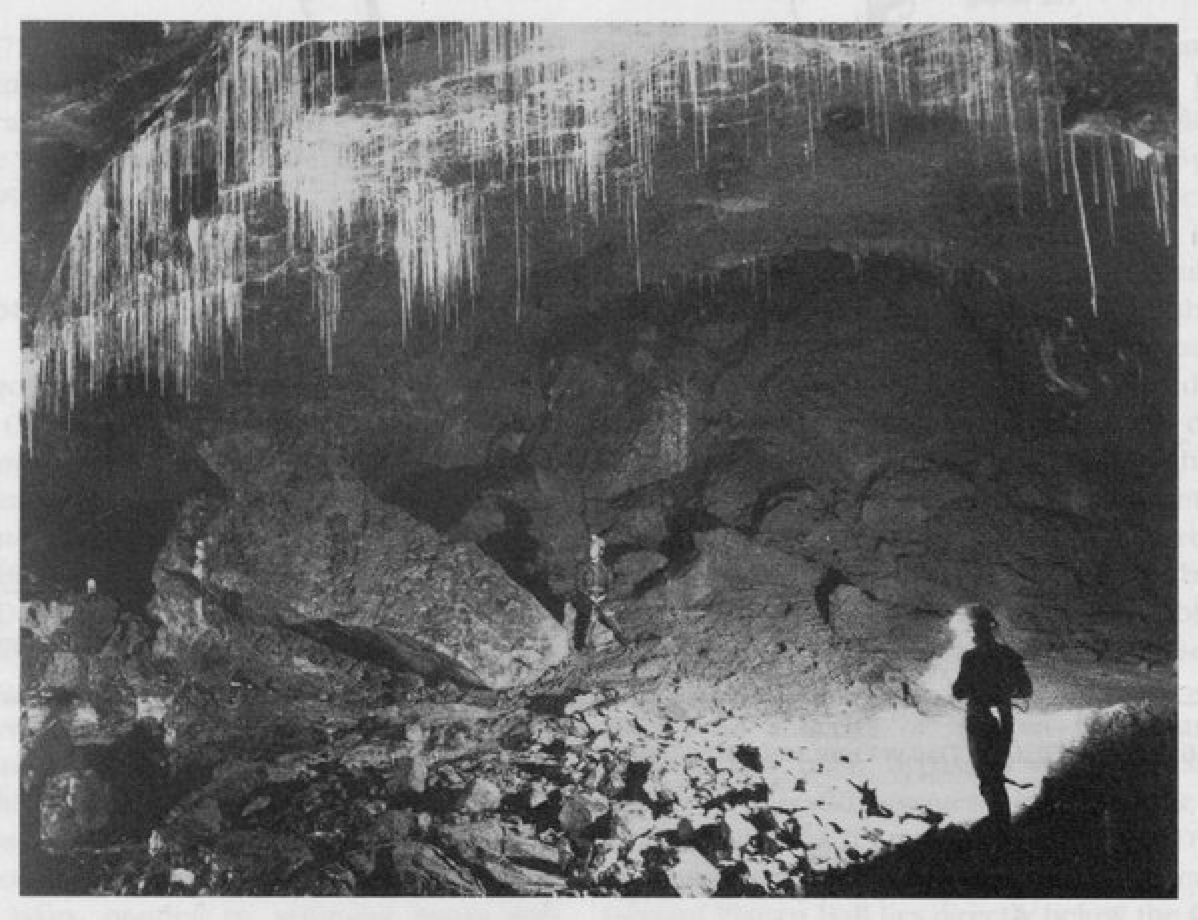
(Figure 6.3) Geological map of the North Crop of the Carboniferous Limestone where it is crossed by the River Tawe in the Swansea Valley. Many small faults are omitted to improve clarity. The sandstones and shales below the limestone are mainly Devonian but include the Lower Limestone Shale from the Carboniferous. The only caves marked are the main stream passages in Dan-yr-Ogof and Ogof Ffynnon Ddu.



(Figure 6.4) Outline map of Dan-yr-Ogof and Cathedral Cave (from survey by South Wales Caving Club).



(Figure 6.5) Passage cross-sections in Dan-yr-Ogof: (a) fault-guided rifts in the Great North Road; (b) collapse-modified tunnels in the Far North; (c) deep vadose canyons in Tunnel Cave and DYO2; (d) phreatic tubes in the synclinal zone of DYO2; (e) phreatic tubes with large vadose floor trenches in DYO1 and DYO2. (After Coase, 1967, and Coase and Judson, 1977.)



(Figure 6.6) Calcite straw stalactites hang from the arched phreatic roof of Cloud Camber in Dan-yr-Ogof. (Photo: J.R. Wooldridge.)