Llethrid valley

[SS 53 90]

Highlights

The Llethrid valley system is a fine example of a complete dry valley system extending across the limestone outcrop, between a stream sink and a resurgence, each close to the limestone boundaries. Two caves include parts of the flood route of the underground drainage, and another has yielded an important Pleistocene fauna.

Introduction

The Llethrid valley is cut through the complete sequence of the Carboniferous limestones where the outcrop lies across the core of the Gower Peninsula (Figure 6.1). From the sink which swallows the water draining off the Namurian and Upper Limestone Shales, the valley is dry for 1500 m southwards to the resurgence, where older, impure limestones reach the surface. The underground route of the base flow is inaccessible, but Llethrid Swallet and Tooth Cave have passages which act as a flood overflow route.

The evolution of the valley system has been discussed by Groom (1971; and in Atkinson and Smart, 1977), though there is controversy over the local effects and extent of the Devensian glaciation (Bowen and Henry, 1984; Bowen *et al.,* 1989, Campbell and Bowen, 1989). The karst landforms of the Gower are summarized in Ede and Bull (1989), the caves are documented in Price (1984), Stratford (1995) and Oldham (1982), and the karst hydrology is considered in Ede (1973). Cathole is the most important of the inland caves in the Gower with respect to its Pleistocene fossils and Bronze Age human remains (Campbell, 1977; Campbell and Bowen, 1989).

Description

The valley drains against the northerly dip of the Carboniferous limestones, which is mostly at about 20° except where it steepens near Llethrid Swallet. A thin band of Oystermouth Beds, the local equivalent of the Upper Limestone Shales, separates the limestone from the Namurian shales which form the headwater catchment on Pengwern Common. Over 400 m of massive, pure limestones are exposed down the valley (Figure 6.23), before the less permeable Penmaen Burrows Limestone is reached; these are dolomitic and shale-rich, and continue south of the resurgence to a faulted contact with Devonian sandstones.

Upstream of Llethrid Bridge, a permanent stream flows on the shales. Where it passes onto the highest limestones, the water flows underground via a number of choked sinks. Downstream, the valley is dry and meanders south, as a trench cut 30 m into the limestone plateau. Its sides are steep, with crags and lengths of bare cliffs, and several dry tributary valleys drain into the main valley. Most of the dry valley has a broad grassy floor; this is widest at the Green Cwm where the main valley confluence is cut in the weaker Penmaen Burrows Limestone. A relict stream channel is present only along a short section just above the confluence.

The main sink, only active at high stage, is the entrance to Llethrid Swallet; this has over 300 m of small stream passage, which forms a flood route almost inactive at low stage, with a large sloping chamber heavily modified by bedding collapse above it (Figure 6.23). In the left bank, shortly below the sink, Tooth Cave has 300 m of low muddy passage leading into another section of the flood route about a kilometre long; this is normally dry down to an almost permanent sump, through which the downstream end is rarely accessible, and the whole passage fills in flood. Cathole has a wide entrance in a cliff 17 m above the valley floor; it is a cave remnant with two dry chambers, in which sediments have yielded a cold Devensian fauna and Creswellian artefacts (Campbell, 1977; Campbell and Bowen, 1989).

The Parkmill, or Wellhead, resurgence lies in the eastern side of the valley, at an elevation of about 15 m, nearly 30 m below the sink; it is impenetrable and now lies under a pool impounded to facilitate pumped abstraction. Llethrid Swallet

provides about 20% of the water at the resurgence, with a flow-through time of 20 hours; the rest comes from percolation input and other smaller sinks. On the opposite side of the valley, Kitchen Well is a smaller spring, fed entirely by percolation water. It has a mean calcium hardness of 197 ppm in winter, and 206 ppm in summer; both these values are higher than those for the Parkmill resurgence, which is fed partly by swallet water and is frequently diluted by flood flows with low solute loads (Ede, 1973). Below the resurgences, the stream flows on the surface over the impure limestones to reach the sea at Oxwich Bay.

Interpretation

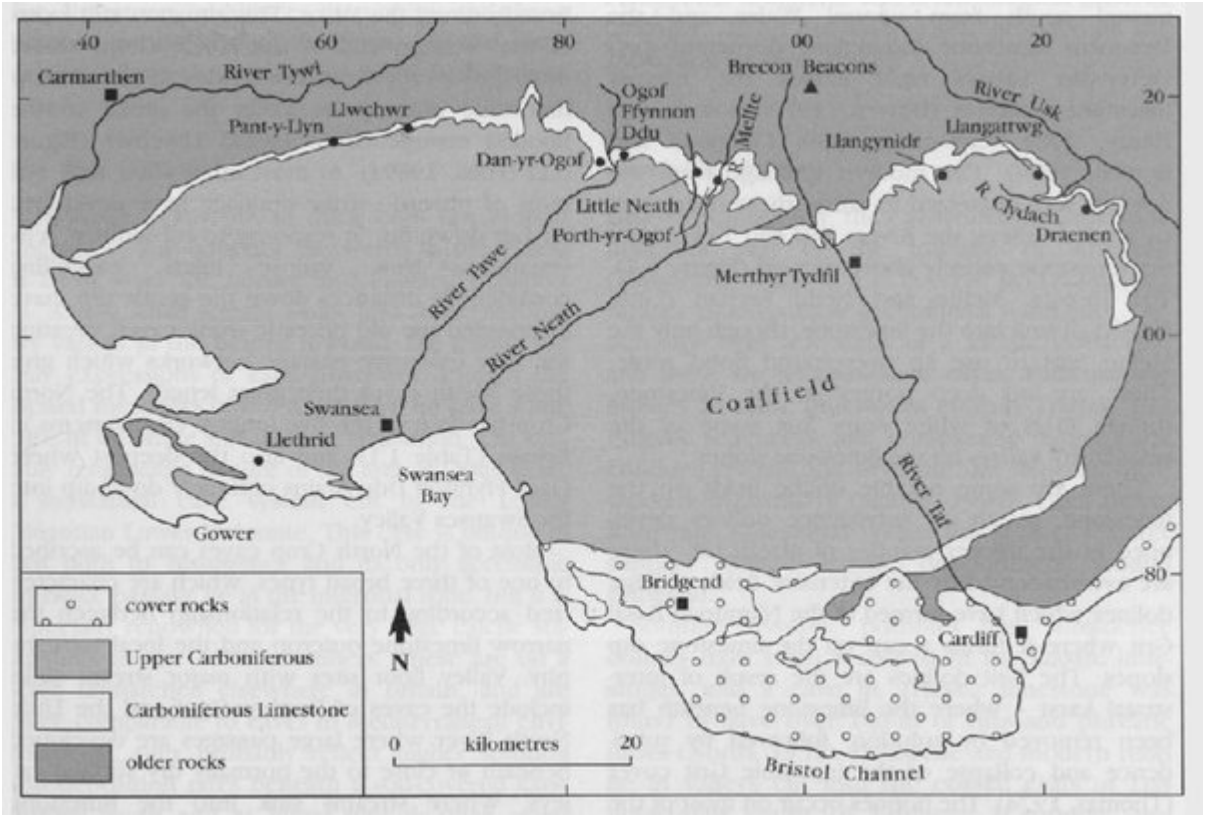
The Llethrid valley is incised into the 60 m coastal platform surface of Gower, which was probably developed in the early Pleistocene (Ede and Bull, 1989). Valley entrenchment was therefore later than this, and underground drainage was initiated to form phreatic caves, as the limestone plateau was exposed. The main chamber in Llethrid Swallet may be a remnant from this early phase. The dry valley system was almost certainly incised during periglacial periods when the underlying cave systems were choked with till or ice, allowing surface flow. Groom (1971) suggested that the main dry valleys on the Gower were incised during the penultimate interglacial, although this is unlikely unless underground drainage had not become fully integrated by this time. The northern part of the valley was probably glaciated during the Devensian (Bowen *et al.,* 1986), and meltwater from this and earlier glaciations almost certainly flowed down the valley. The meandering nature of the valley indicates its fluvial origin, while extensive infill by solifluction during periglacial episodes accounts for the smooth valley profile.

The known caves all lie in the younger part of the limestone sequence, where groundwater flow appears to have been captured on some particularly favourable cave-inception horizons (Lowe, 1989b). Beyond the explored limits of the caves, the flow route descends through the stratigraphic sequence, but rises to the surface above the dolomitic Penmaen Burrows Limestone. All the accessible passages in Llethrid Swallet and Tooth Cave pre-date the modern phase of cave formation and are only active under flood conditions. The modern drainage route is immature and unable to cope with flood discharges; it may be developing in smaller cave passages within the stratigraphically lower limestones. Dating of stalagmites in the Llethrid Valley caves has the potential to provide estimates for the timing of valley incision, which would define a minimum age for the formation of the 60 m planation surface.

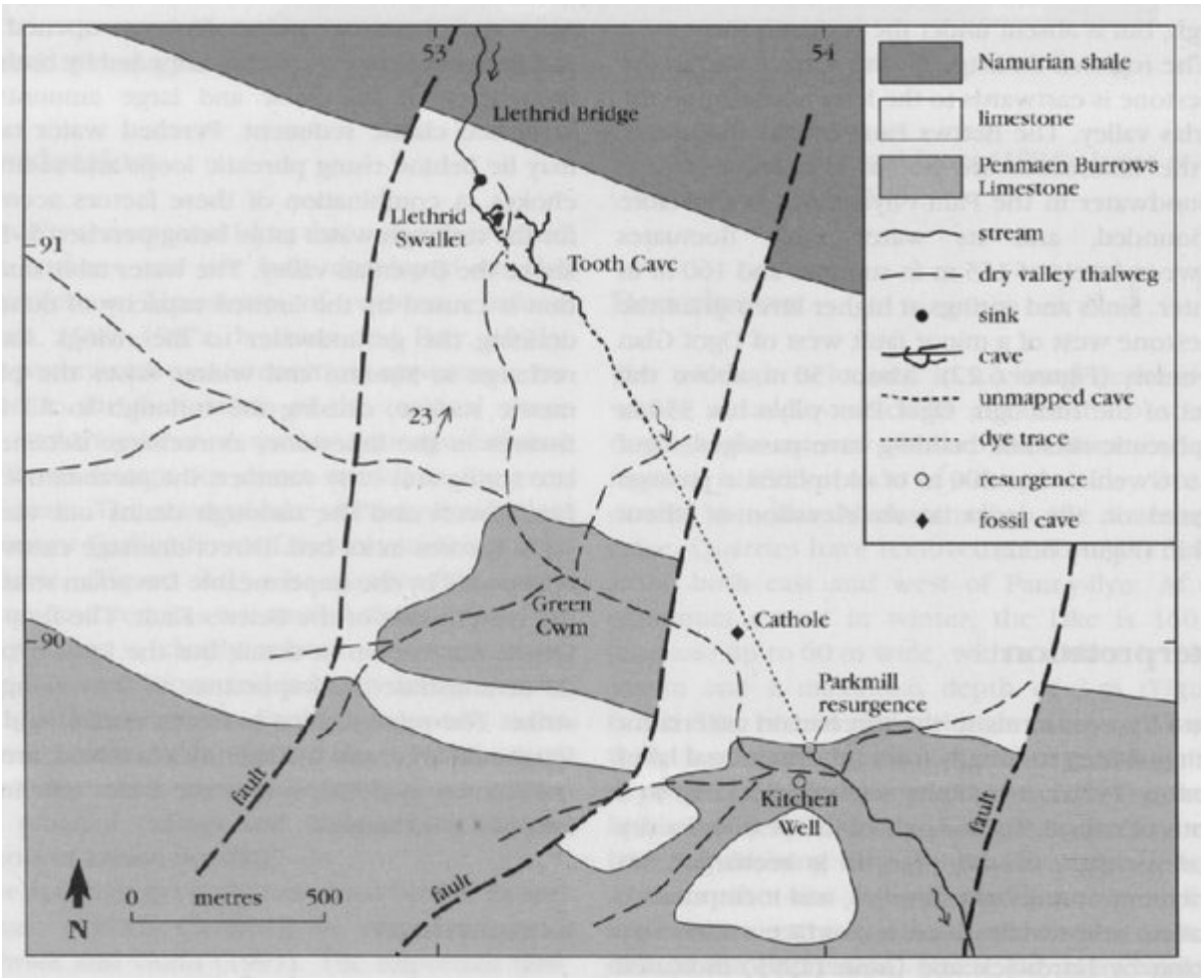
Conclusions

Llethrid Valley contains some of the best karst features on the Gower. It is an excellent example of a karst dry valley with a complete spectrum of allogenic and autogenic underground drainage, and active and abandoned caves.

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 6.23) Geological map of the dry valleys and caves of Llethrid. The position of the downstream section in Tooth Cave is only approximate, as it is normally flooded and has not been mapped in detail.