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# Cwm yr Abbey

[SN 5002 1988]–[SN 5013 1943]

## Introduction

The upper parts of the Carmarthen Formation (Cwmfrïd and Cwm yr Abbey members) and lowest part of the overlying Afon Ffynnant Formation are well-exposed in this stream section. It is the type section for the Cwm yr Abbey Member and contains the basal stratotypes for this member and for the Whitlandian Stage, the Afon Ffynnant Formation and the *Furcalithus radix* Zone.

Briefly mentioned by Strahan *et al.* (1909), this section was mapped in detail by Fortey and Owens (1978, fig. 5, p. 235), who demonstrated the presence here of the upper part of the Carmarthen Formation and its passage upwards into the Afon Ffynnant Formation (Fortey and Owens, 1987, p. 96). The good and mostly continuous exposure makes this an ideal section in which to demonstrate these relationships in an area where natural outcrops are few and generally small; it has afforded sufficient fossils (trilobites) to establish the biostratigraphical framework. The facies exposed here were used in the regional analysis of Arenig sedimentology by Traynor (1988).

## Description

Cwm yr Abbey, a deep, wooded dingle that flows northwards into the Tywi (Figure 8.7), has long exposures interspersed at intervals with short stretches of non-exposure. The strata generally dip north at about 60°, although there is a good deal of minor folding and faulting. The oldest strata, the upper part of the Cwmfrïd Member, crop out for about 100 m along the southernmost part of the dingle. As elsewhere, the Cwmfrïd Member here comprises alternating mudstones and turbidites, the latter ranging in thickness from a few centimetres to over one metre; commonly they show graded bedding that confirms the northward younging of the succession. Fossils are restricted to the mudstone bands and include the asaphid trilobite *Merlinia rhyakos* Fortey and Owens, for which this is the type locality; and the olenid trilobite *Bienvillia praecalva* Fortey and Owens. Near the top of the Cwmfrïd Member, a different olenid, *Porterfieldia punctata* Crosfield and Skeat (Figure 8.4)c, replaces *B. praecalva*.

The base of the Cwm yr Abbey Member (the uppermost unit of the Carmarthen Formation) is drawn formally at the top of the uppermost turbidite unit [SN 5010 1952]. Characterized by grey, irregularly fracturing mudstone, the Cwm yr Abbey Member represents the '*Peltura punctata* Beds' *sensu stricto* of older literature. The characteristic olenid trilobite *Porterfieldia punctata* is common throughout the member, accompanied by less frequent *Merlinia rhyakos*, orthoconic nautiloids and the dendroid graptolite *Callograptus cf. tenuis* Bulman. The uppermost beds of the Cwm yr Abbey Member are exposed for some 10 m downstream from the road bridge (B4300) and become progressively more shaly and conspicuously micaceous, passing upwards into the Afon Ffynnant Formation.

Lithologically the alternating shales and turbidites of the Afon Ffynnant Formation are indistinguishable from those of the Cwmfrïd Member, and *P. punctata* occurs in the lowest 10 m or so; but this fauna is then replaced by a different fauna comprising the asaphid *Ogyginus hybridus* (Salter) and the trinucleid *Furcalithus radix* Fortey and Owens. As in the Cwmfrïd Member, the trilobites occur in the mudstone intercalations.

The base of the Afon Ffynnant Formation ('Tetragraptus Beds' of older literature) is drawn at the base of the lowest turbidite unit at Cwm yr Abbey. The base of the *Furcalithus radix* Biozone and that of the Whitlandian Stage of the Arenig Series are drawn formally in this section at 40 m above the base of the Afon Ffynnant Formation [SN 5002 1985]. Shales and turbidites of the latter, forming a series of rapids, crop out for approximately a further 50 m in the stream of Cwm yr Abbey and in a tributary immediately to the west.

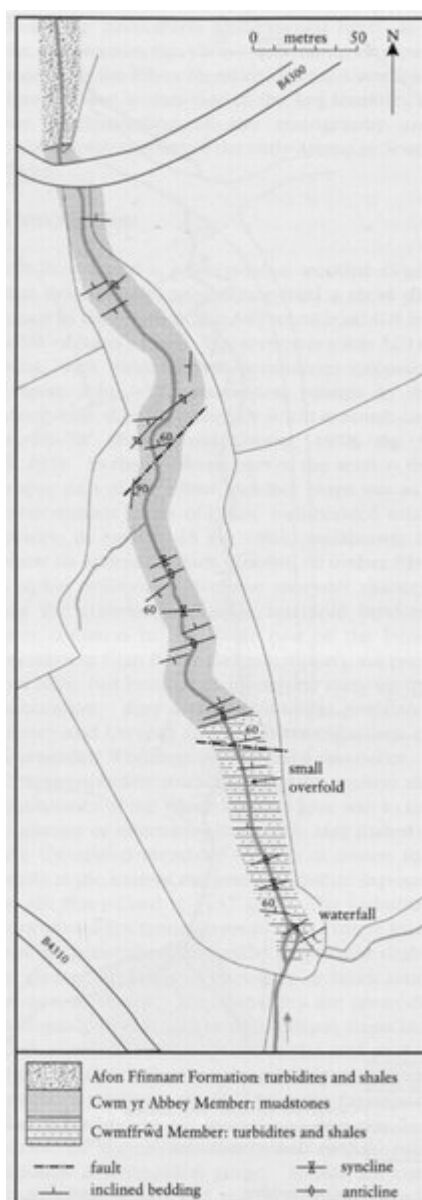
## Interpretation

The Cwmffrwd and Cwm yr Abbey members of the Carmarthen Formation represent a typical olenid biofacies, the only example of this in the Arenig (and in the Ordovician) of the Welsh Basin. The environment has been interpreted as oxygen-impoverished, conditions for which olenid trilobites were specially adapted (Fortey, 1975). In the Carmarthen area Fortey and Owens (1978, p. 238) presented evidence to suggest that it was developed in relatively deep water, perhaps corresponding to the oxygen-minimum layer in present oceans. Hemipelagic mudstone deposition (Traynor, 1988, p. 279) was interrupted in the earlier part of the sequence (Cwmffrwd Member) by repeated influxes of turbidites (Fortey and Owens, 1978) which Traynor (1988) interpreted as having been derived from high concentration turbidity currents and sandy debris flows in a sub-storm wave-base setting. More open-sea conditions prevailed during the deposition of the Afon Ffynnant Formation, with the disappearance of the specialized olenids and in the incoming of a new trinucleid-asaphid fauna that, higher in the succession (e.g. at nearby Cwm Ffynnant), contains the graptolites *Azygograptus hicksii* (Hopkinson). *O. hybridus* is a trilobite characteristic of the early Whitlandian across southwest Wales, affording correlation with sections in the Whitland district to the west. The olenid biofacies is restricted to the Carmarthen district, rendering correlation outside that area rather imprecise.

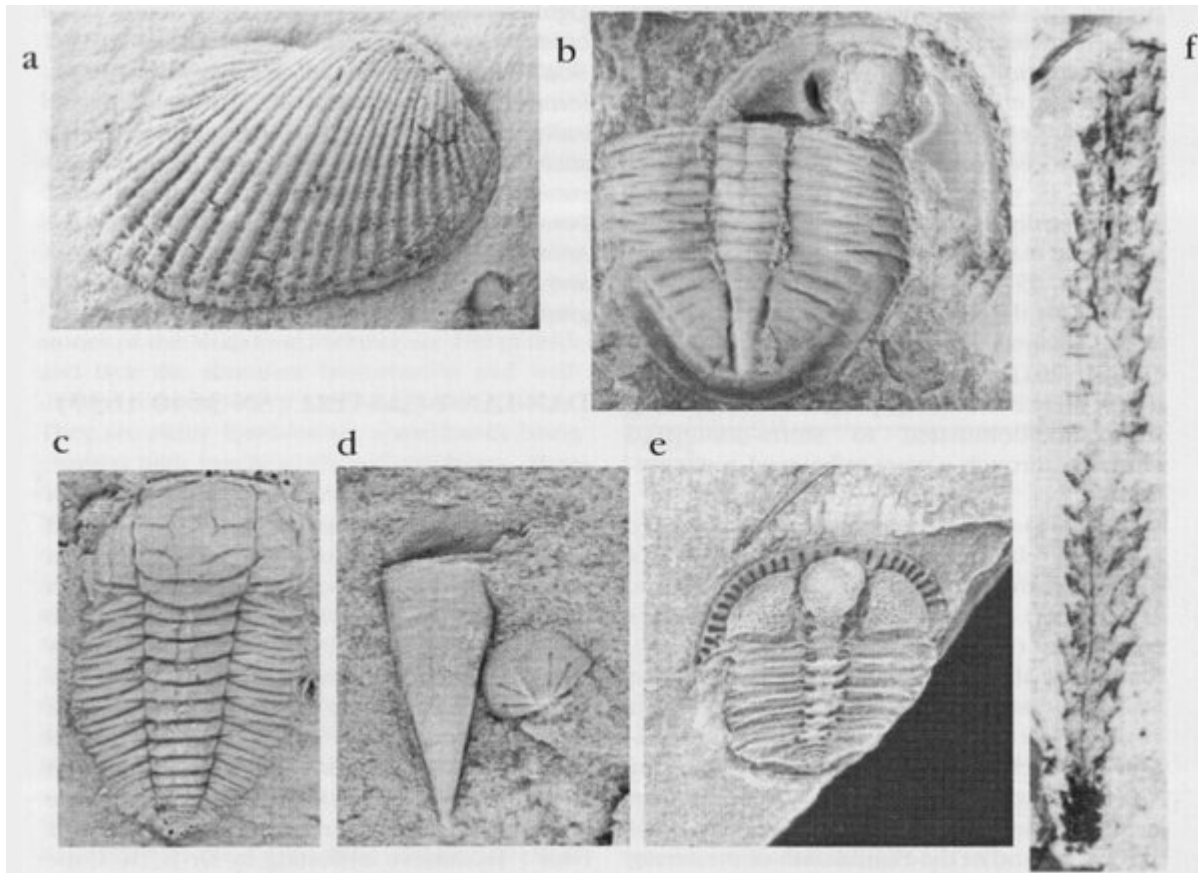
## Conclusions

The section at Cwm yr Abbey shows lithological and faunal changes that reflect an environmental shift from the poorly oxygenated conditions of the Olenid biofacies to better-oxygenated conditions characterized by trinucleid-asaphid faunas. The latter are typical of the Whitlandian Stage whose base is defined in this section.

## References



(Figure 8.7) Cwm yr Abbey stream section, exposing the type section of the Cwm yr Abbey Member of the Carmarthen Formation and the stratotype base of the Whitlandian Stage, after Fortey and Owens (1978, fig. 5).



(Figure 8.4) Fossils from Arenig and Llanvirn sites in South Wales. (a) *Falcatodonta costata* Cope, x4.5, from the Bolahaul Member (Moridunian) at Dan-lan-y-castell. (b) *Merlinia selwynii* (Salter), x2.5, Pibwr Member (Moridunian), Glan Pibwr. (c) *Portediellia punctata* (Crosfield and Skeat), x8, Cwm yr Abbey Member (Moridunian), Cwm yr Abbey. (d) Hyolithid conch and operculum, x 5, and (e) *Bergarnia rushtoni* Fortey and Owens, x 3.5, both from the Pontyfenni Formation (Fennian), Pontyfenni. (f) *Undulograptus austrodentatus* (Harris and Keble), x6, Llanfallteg Formation (basal Abereiddian), Llanfallteg.