
Sawdde Gorge

[SN 715 260]–[SN 728 245]

Introduction

This internationally known locality displays all four Series of the Silurian. It consists of a major section along the narrow gorge of the Afon Sawdde, together with nearby trackside exposures and quarries, between 2.2 and 4.3 km SSE of Llangadog, on the southern side of the Tywi Valley, southern Wales (Figure 4.45). The almost continuous series of exposures, between Bont Fawr in the north-west and Pont-ar-Ilechau to the south-east, show late Telychian Llandovery Series to P█ídolí rocks (Figure 5.66). Pont-ar-Ilechau — the 'Bridge on the tiles' — presumably refers to the 'tilestones' lithology of former usage relating to the Old Red Sandstone. The Ludlow and P█ídolí part of the Sawdde Gorge sequence is described here; the Llandovery and Wenlock strata are detailed in the report of a Wenlock site of the same name in this volume.

The locality occurs on the south-east flank of the NE–SW trending Towy Lineament, an anticline within the so-called Welsh Borderland Fault System of the Welsh Basin. This fold was active and had a significant control on regional patterns of sedimentation during the Ordovician and Silurian (Woodcock and Gibbons 1988). The geology of the Sawdde area was mentioned by Phillips (1848) and the Sawdde sequence was known to Murchison, who included it in *The Silurian System* (1839) and the various editions of *Siluria* (e.g. 1854). Other workers presented alternative versions of the local stratigraphy, especially regarding the delimitation of Silurian and Devonian strata (e.g. De la Beche, 1846; Symonds, 1872; Stamp, 1923; Straw, 1930).

In modern times the sedimentology, stratigraphy and palaeontology of the pre-Ludlow part of the sequence has been investigated by Williams (1953), Bassett (1974a), Calef and Hancock (1974) and Hurst *et al.* (1978). The Ludlow of Sawdde Gorge was described in detail by Potter and Price (1965) in their paper on the 'Ludlovian and Downtonian' in the Llandovery–Llandeilo region of southern Wales. As a key section in the Welsh Basin, Sawdde Gorge has also been referred to in several other stratigraphical and broad-scale facies analyses across the Silurian of the region (e.g. Holland and Lawson, 1963; Squirrell and White, 1978; Bassett *et al.*, 1982; Cherns, 1988). Richardson and Lister (1969) and Burgess and Richardson (1995) have reported about the microflora of the Sawdde Gorge. Summaries of the entire Silurian sequence at Sawdde Gorge, together with detailed itineraries, appear in the field guides of Bassett (1982b) and Siveter *et al.* (1989).

Description

The Ludlow is currently divided into six lithostratigraphical units and the overlying P█ídolí is represented by two units (Potter and Price, 1965; Bassett, 1982b). All of the beds young to the SSE, with high dips of up to 70°. Macro-faunas are shelly and diverse (Figure 5.66) but in many cases are difficult to correlate precisely with the stratigraphical divisions of the type Ludlow sequence. The age determinations for the Ludlow units at Sawdde Gorge, as discussed below, follow Potter and Price (1965); however, it should be noted that, based on the nearby Cennen Valley and adjacent sections, Squirrell and White (1978) offer slightly revised correlations for these units. The Gorstian to early Ludfordian part of the Sawdde Gorge sequence yields high diversity cryptospore and miospore assemblages (Burgess and Richardson, 1995).

The basal Ludlow Tresglen Formation (90+ m) can be examined in exposures occurring just before and at the bottom of the slope approximately [SN 7217 2472] in the forestry track that leads from Coed Shon farm, southwards towards Pen-Arthur plantation, 250 m west of the Sawdde Gorge. This unit consists of grey to green, laminated, micaceous siltstones, shales and mudstones. It has yielded a *Dicoelosia* community (Calef and Hancock, 1974), which was interpreted to represent a more offshore, deeper water assemblage (transgression) than the *Salopina*–bivalve community of the underlying late Wenlock Ffynnant Sandstone Formation.

Continuing south for a short distance, beyond the lowest point in the track, the trackside exposures chart an increase in shaly beds and sandstone units and the disappearance of an assemblage dominated by *Dicoelosia biloba*, thereby marking a gradual transition into the overlying 294 m thick Black Cock Formation. The base of the latter is defined at about 70 m upstream [SN 7239 2490] from the small former footbridge, about 100 m south of Ffynnant Farm, over the Sawdde Gorge. The lower part of the unit consists of grey to black calcareous shales and siltstones with medium-bedded sandstones; these lithologies are well displayed in the lower half of the quarry [SN 7225 2469] on the west side of the track to Pen Arthur and also around the bluff at southern entrance to that quarry. Bioturbation is common in these beds in the quarry, as are rottenstone bands with a diverse brachiopod (e.g. *Atrypa reticularis* and *Leptostrophia filosa*) and bivalve (e.g. *Grammysia*) fauna.

The upper part of the main (unnamed) member of the Black Cock Formation comprises more massive arenaceous shales and mudstones, with siltstones and sandstones, and is thought to be of mid- to late Gorstian age. At Cwar GU's, about 300 m north of Pont-ar-Ilechau, the steeply dipping beds in the northernmost [SN 7263 2480] of the two large roadside quarries and the north-west face of the adjoining southern quarry are entirely in this upper part of the formation (Figure 5.67). These strata show a splendid array of ripple-mark structures and contain calcareous rottenstones and shelly coquinas dominated by bivalves (e.g. *Modiolopsis*, *Grammysia*) and gastropods (e.g. *Loxococoncha*), with brachiopod (e.g. *Isorthis*, *Microsphaeridiorhynchus*, *Howellella*) and trilobite (e.g. *Harpidella*, *Acaste*, *Trimerus*) associates.

The succeeding Carn Powell Member (c. 40 m total thickness) can best be examined in the east side of the southern quarry at Cwar Gas (Figure 5.67), where the base of the member is defined. *Grammysia*-rich beds, which are seemingly faulted into the high part of the southern corner of the trackside quarry, west of the Sawdde Gorge, at [SN 7225 2469], are also assigned to the Cam Powell Member. Characteristically, this member consists of flaggy-bedded purple and grey sandstones with subordinate thin beds of calcareous lenses, rottenstones and conglomerates.

The Trichrûg Formation (185 m) was assigned by some early workers to the Old Red Sandstone. Comprising red sandstones, pebbly sandstones, conglomerates and siltstones, its base is defined high in the south-east corner of the southern quarry at Cwar Glas, where it overlies the Cam Powell Member. Immediately south-east of Cwar Glas the formation forms a hummocky ridge in the hillside. The Trichrûg Formation can also be examined in the bed and banks of the Sawdde about 30–40 m downstream from its confluence with Afon Meilwch, at Pont-ar-Ilechau. It is also intermittently exposed for about 400 m along the track from immediately south of the quarry at [SN 7225 2469], west of the Sawdde Gorge; for example, at the crown [SN 7262 2445] of the westerly bend in the track, coarse pebbly sandstones of the top part of the unit are displayed. Inarticulate brachiopods such as *Orbiculoidea* and *Lingula*, together with gastropods such as *Loxonema* and *Bucanopsis* are elements of the sparse, low diversity fauna of the Trichrûg Formation, which is thought to be the same age (late Gorstian) as the upper part of the Upper Bringewood Formation of the central Welsh Borderland (Potter and Price, 1965).

The Upper Cwm Clyd Formation (33 m) consists of green and grey flaggy laminated siltstones and mudstones with shell lenticles and subordinate sandstone and conglomeratic sandstone units. The overlying Lower Roman Camp Formation comprises about 54 m of grey to green-grey indurated mudstones with siltstone interbeds. Both formations are exposed along the westerly swinging track 200 m west of Pont-ar-Ilechau [SN 7260 2445] and, along strike, just north-west of Pont-ar-Ilechau in the banks and bed of the Sawdde Gorge itself. At the latter locality the base of the Upper Cwm Clyd Formation is clearly demarcated where greenish, flaggy to tabular bedded sandstones and siltstones, containing (near the base) subordinate coarse conglomeratic sandstones, succeed coarse red sandstones of the Trichrûg Formation. The upper part of the Upper Cwm Clyd Formation contains shelly lenticles with a restricted marine fauna of gastropods (*Loxococoncha*) and brachiopods such as *Isorthis*, *Microsphaeridiorhynchus*, *Sphaerirhynchia* and *Protochonetes*.

The base of the Lower Roman Camp Formation may be examined in the north bank of the Afon Meilwch, directly below the small bridge over its confluence with the Afon Sawdde [SN 7278 2452]. There, the gradual incoming of somewhat darker grey and slightly thicker bedded units containing the biostratigraphically important (Upper Leintwardine) *Neobeyrichia lauensis* and other ostracods signifies the change from the underlying Upper Cwm Clyd Formation. The brachiopod *Salopina lunata* also enters the sequence in the Lower Roman Camp Formation but, in general, the shelly faunas of these two formations are similar. Potter and Price (1965) consider the Upper Cwm Clyd and Lower Roman

Camp formations to be correlatives of the Lower and Upper Leintwardine formations (early Ludfordian) respectively of the central Welsh Borderland.

An unconformity (but with no angular discordance) at the top of the Lower Roman Camp Formation at Sawdde cuts out the Upper Roman Camp Formation (late Ludfordian), a unit which is present regionally to the north-east. The early Pŷdŷdolŷ Long Quarry Formation (20 m), the so-called 'Tilestones' of earlier literature, oversteps the Ludlow strata from north-east to south-west across the region. The latter formation consists of green-grey, mica-rich, flaggy bedded sandstones with a limited assemblage of brachiopods (e.g. *Lingula minima*, *Protochonetes ludloviensis*, *Microsphaeridiorhynchus nucula*), bivalves (e.g. *Modiolopsis complanata*), gastropods (e.g. *Turbocheilus helicitus*) and kloedinine beyrichiacean ostracods. The base of the Long Quarry Formation is seen in the river bed immediately north of the main bridge over the Sawdde at Pont-ar-Ilechau; exposures of the formation also occur in the small quarry behind the former Inn facing the main bridge [SN 7279 2446] and along the track approximately [SN 7232 2418] about 200 m south-east of Pen-Arthur-isaf, west of Sawdde Gorge.

The Lower Roman Camp Formation is succeeded regionally by conformable Pŷdŷdolŷ Raglan Marl Group red sandstones, siltstones and marls of Old Red Sandstone facies. The restricted fauna includes gastropod taxa (*Loxonema conicum*, *T. helicitus*), which are also found in older units, the brachiopods *Lingula cornea* and *L. minima* and leperditiid ostracods.

Interpretation

In general terms the various Silurian depositional facies at Sawdde Gorge mostly reflect nearshore shelf to shelf edge–basinal slope environments, positioned on the southern flank of the Towy Lineament and near the southern margin of the Welsh Basin (see Siveter *et al.*, 1989, figs 10, 11; Bassett *et al.*, 1992, figs S3b, S4a, S4b, S5a, S5b, S8). To the south of this relatively shallow marine shelf was the northern margins of the landmass of 'Pretannia' (Cope and Bassett, 1987), which undoubtedly sourced much of the Silurian sediments of the Llandovery–Sawdde–Llandeilo region of southern Wales.

Apart from a brief transgression in the earliest Ludlow, as indicated by the occurrence of the offshore *Dicoelosia* community (Tresglen Formation), the Llandovery to Pŷdŷdolŷ sequence at Sawdde demonstrates an overall shallowing upwards (Figure 5.66), transitional into non-marine environments in the Pŷdŷdolŷ. Post-earliest Gorstian there is a return to shallower, nearshore conditions in the Black Cock Formation, as indicated by the bivalve and gastropod assemblages near the top of the unit. The dominant patterns of sedimentation in the Trichrŷg Formation reflect the growth of a delta with associated estuarine and fluvial facies (Potter and Price, 1965), which advanced northwards from Pretannia; bands with marine fossils in the Trichrŷg Formation witness brief marine episodes. The shell-bearing Upper Cwm Clyd and Lower Roman Camp formations represent, overall, short-lived shallow marine re-incursions, which preceded the shallow to marginal marine and at times possibly lagoonal conditions signalled by the Pŷdŷdolŷ Long Quarry Formation. Above, the younger red beds are of fluvial aspect (see Bassett *et al.*, 1982 for a summary of the Pŷdŷdolŷ of the Welsh Basin).

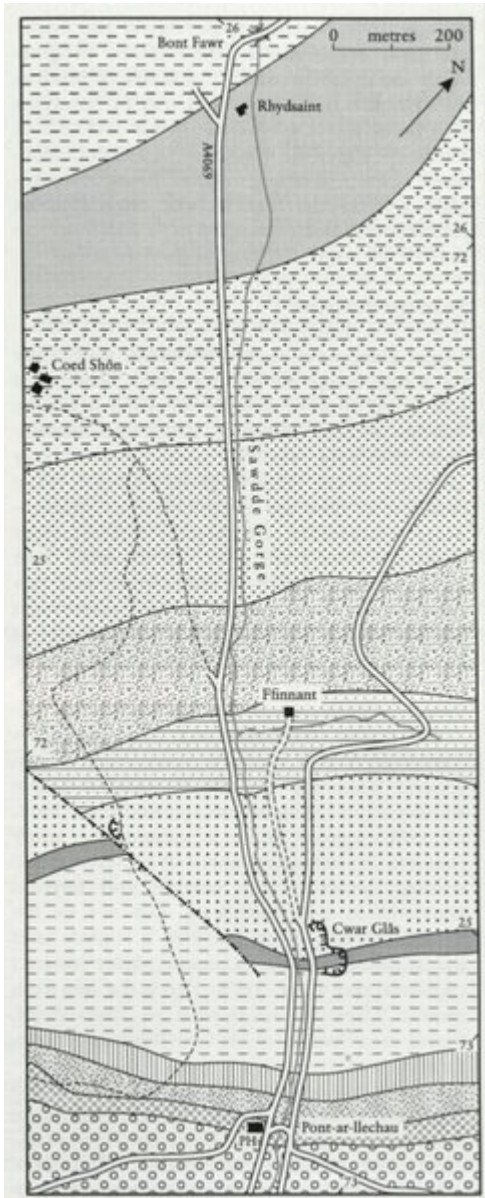
Like this Sawdde Gorge site, Capel Horeb Quarry, 15 km north-east along strike, also has Ludlow unconformably overlain by Pŷdŷdolŷ strata. The GCR site at Wernbongham, along strike to the south-east, displays Wenlock overstepped by (disputed) Pŷdŷdolŷ rocks. These sites network with the lower Silurian Sawdde Gorge site and the other, Llandovery and Wenlock sites in the Llandeilo to Llandovery area to provide a picture of the position and evolution of the shelf–shelf slope of the southern margin of the Welsh Basin during the Silurian.

Conclusions

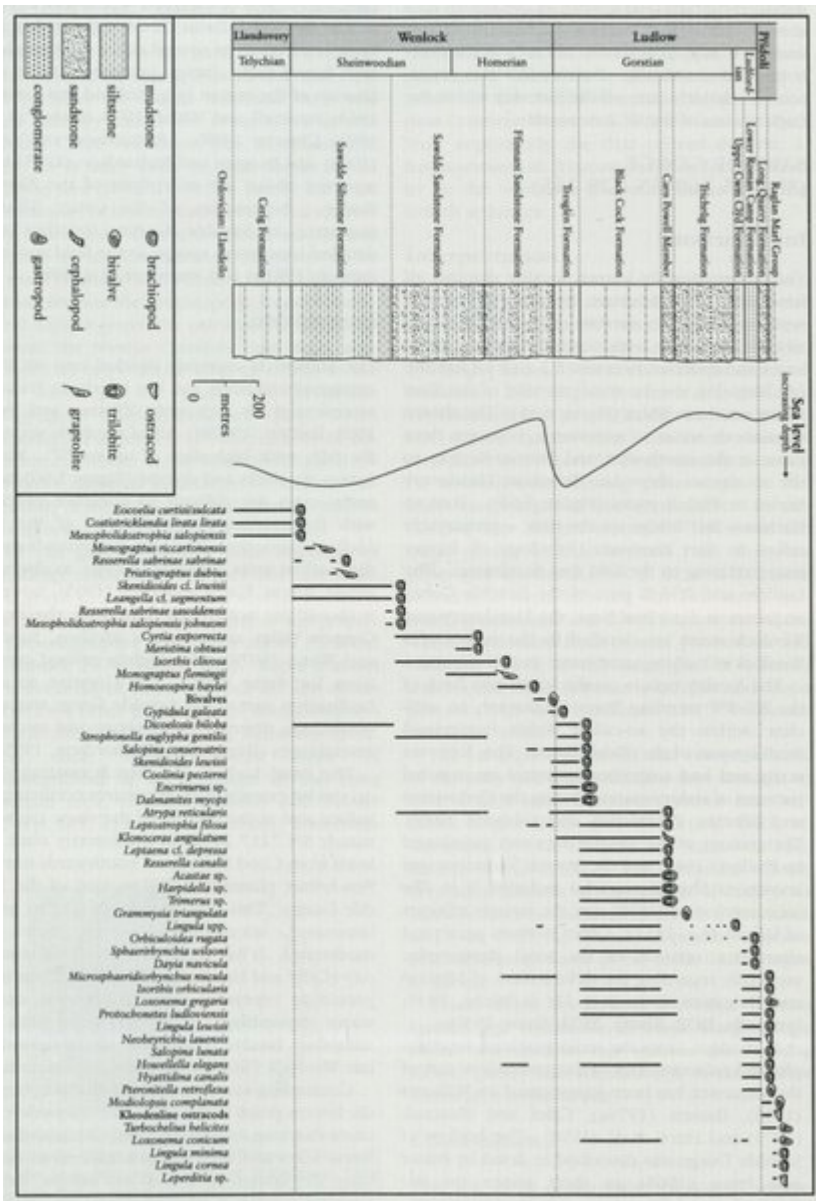
Together with its sister site covering the lower Silurian of the Sawdde Gorge area this site presents one of the most complete successions through the Silurian of the Welsh Basin. It also exposes the standard reference section of many regionally important lithostratigraphical divisions. Furthermore, the facies here have significance for palaeogeographical and palaeoenvironmental interpretation. Its sediments and/or faunal assemblages can be used to demonstrate the existence of a regionally prominent deltaic system and associated southerly landmass and, hence, the position of the

southern margin of the Welsh Basin. Its facies can also be used to chart the change from marine to fluvial conditions as the Welsh Basin silted-up and shallowed during Ludlow into Pliocene times.

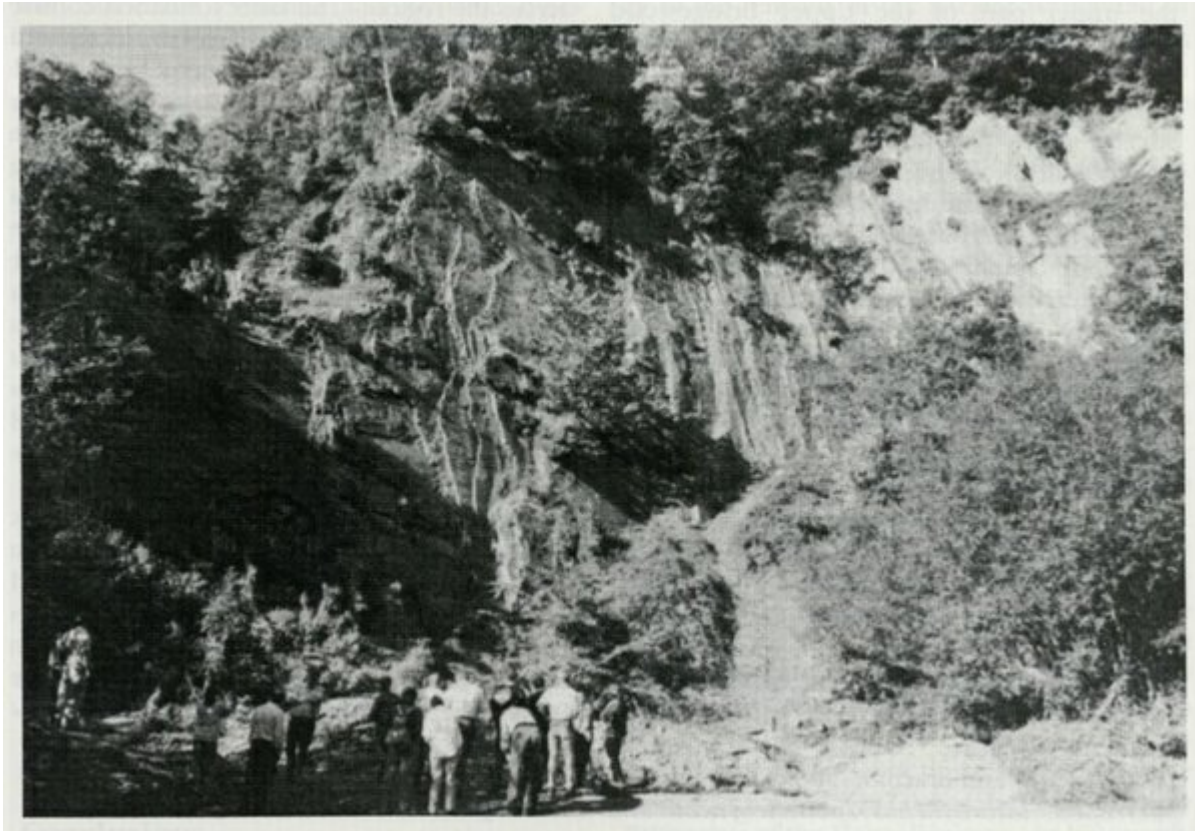
References



(Figure 4.45) Geology of the Sawdde Gorge, Llandeilo–Llandovery area (after Bassett, 1982b and Siveter et al., 1989).



(Figure 5.66) Silurian succession of the Sawdde Gorge, Carmarthenshire, showing lithologies, generalized sea-level curve and ranges of selected fossils (after Siveter et al., 1989).



(Figure 5.67) Steeply dipping, ripple-marked bedding planes of the highest beds of the Black Cock Formation (centre), overlain (upper right) by the Carn Powell Member, north side of the southern quarry at Cwar Gas, Sawdde Gorge, Carmarthenshire. (Photo: David J. Siveter.)