Ffairfâch Railway Cutting and Afon Cennen

[SN 6307 2142]–[SN 6220 2003]

Introduction

The railway cutting just south of the village of Ffairfâch and the outcrops in railway cuttings and in the banks of the Afon Cennen to the south are the standard sections respectively for the Ffairfâch Group and Llandeilo Flags, as defined by Williams (1953); together they afford the most complete section through the upper Abereiddian and Llandeilian in the Llandeilo district. The section is the best succession within the type Llandeilo area, and although exposures are more numerous in nearby Dynevor Park (see site report), faulting and folding there make the succession more difficult to determine.

The geology of the area around Llandeilo was first described by Murchison (1835, 1839), who named the calcareous flags exposed there the 'fourth formation of the Silurian System' and considered the grits (i.e. the Ffairfâch Group) stratigraphically underlying the flags as representing an 'attenuated remnant of the Caradoc Sandstones'. Dc la Beche (1846) and Aveline (1857) revised Murchison's interpretations and these were then incorporated by Murchison (1867) into the basis of the succession as it is understood today.

Strahan *et al.* (1907) gave a full description of the area for the Geological Survey, and this formed the basis for Williams' (1953) work, in which he offered a detailed lithological and biostratigraphical subdivision of his newly introduced 'Ffairfâch Group' and the Llandeilo Flags. He also described the stratigraphically important trinucleid trilobites and brachiopods (Williams, 1948, 1949). From its position between the lower Llanvirn shales beneath and Llandeilo Flags above, Williams suggested that the Ffairfâch Group was a facies of the *murchisoni* Zone, and this interpretation has generally been followed. On the basis of conodonts, however, Bergström *et al.* (1987) proposed that the upper part of the Ffairfâch Group correlated with part of the *teretiusculus* Zone, implying that only the lower part belonged to the *murchisoni* Zone.

More recent work has also focused on facies, faunas and palaeocommunities in the Ffairfâch Group (Williams *et al.,* 1981) and in the type Llandeilo (Wilcox and Lockley, 1981). The brachiopod faunas were revised by Lockley and Williams (1981) and the ostracods were described by Jones (1986–1987).

Discussions on the status of the Llandeilo Series have necessarily involved this section (e.g. Williams *et al.,* 1972; Ross *et al.,* 1982; Whittington *et al.,* 1984; Fortey *et al.,* 1991, 1995; Bassett and Owens, 1996). Even if the Llandeilo is relegated to the status of a stage, as proposed by Fortey *et al.* (1995) and followed in this account, it is the present site that will act as its standard.

Description

The main part of this section comprises exposures, railway cuttings and small quarries over a distance of 1.4 km upstream along the Cennen Valley SSW from the level crossing at Ffairfâch (Figure 8.15). To the north of the level crossing there are small exposures of shales of the *artus* Zone, for example on the east bank of the Cennen [SN 6307 2142] and [SN 6309 2132], where soft, black shales dip steeply (70–73°) to the south and have yielded graptolites, including *Didymograptus artus* Elles and Wood, and the trilobites *Protolloydolithus ramsayi* (Hicks). These shales pass upwards into grey, ashy shale with irregular bioturbated beds that, immediately below the base of the Ffairfâch Grit at the level crossing [SN 6287 2122], yield the heterorthid brachiopod *Tissintia prototypa* (Williams). The type section of the Ffairfâch Group extends for 110 m south-west of the railway, in cuttings and an adjacent overgrown quarry between [SN 6287 2122] and [SN 6280 2112]. Williams (1953) recognized five units within the Ffairfâch Group, and these were given formational status by Lockley and Williams (1981) and described in detail by Williams *et al.* (1981) as follows.

1. The lowest, the Ffairfâch Grit, up to 26 m thick, consists of massively bedded, clean-washed arkosic grits, with individual beds on average about 1 m in thickness; thin shales occur in the upper part. *Tissintia prototypa* has been

found in the upper part of the Ffairfâch Grit, and a few other brachiopods and other fossils from one of the shale bands.

2. The succeeding Pebbly Sands (35 m thick) crop out in the back wall of the quarry; the transition is seen in the northern face of the quarry, where the grits are replaced by a succession of bioturbated flaggy sandstone beds overlain by pebbly grits.
3. The overlying Flags and Grits (46 m thick) exposed in the south of the quarry and along the adjacent cutting comprise seven mainly intergrading lithological units, including fine calcareous siltstones, flaggy calcareous siltstones, sandstones and conglomeratic grits; the uppermost 15 m of the unit consists of calcareous sediments with shelly, crystalline limestones and siltstones, rubbly calcareous shales, impure limestones and a number of thin bentonites.
4. The Ashes and Lavas are poorly exposed here; they are about 15 in thick, consisting of crystal tuffs with arenaceous and pyroclastic horizons.
5. The ashy facies is succeeded abruptly by Rhyolitic Conglomerate — about 8 m of variable conglomeratic sandstones forming the topmost component of the Ffairfâch Group; it includes fine argillaceous partings and shaly calcareous horizons.

Apart from the lower part of the Ffairfâch Grit, the Ffairfâch Group is fossiliferous throughout (Figure 8.16), with the brachiopods *Dalmanella parva* Williams, *Salopia turgida* (M'Coy), *Sowerbyella antiqua* Jones, *Macrocoelia Ilandeiloensis* (Davidson) and *Glyptorthis viriosa tumida* Lockley and Williams, the trilobites *Basilicus* cf. *tyrannus* (Murchison), *Flexicalymene cambrensis* (Salter) and *Marrolithus* sp., and bryozoans. Anchorage spines of the sponge *Hyalostelia fasciculus* (M'Coy) are common throughout much of the succession (Williams *et al.,* 1981, table 2). Species of the brachiopod *Tissintia* occur in succession: *T. prototypa* at the top of the Ffairfâch Grit, *T. immatura* (*Williams*) at the top of the Pebbly Sands and in the Flags and Grits, and *T. plana* (Williams) at the top of the latter and in the Rhyolitic Conglomerate. Of other brachiopods, *Hesperorthis dynevorensis Williams is* restricted to the upper part of the Pebbly Sands and *Horderleyella convexa Williams to* the upper part of the Flags and Grits and higher horizons. The calcareous bands in the Flags and Grits have yielded ostracods such as *Tallinnella? tomacina* Jones and *Brephocharieis complicata* (Salter) and conodonts (*Baltoniodus prevariabilis* (Fahraeus) and *Eoplacognathus lindstroemi* (Hamar)), whilst a calcareous horizon within the Rhyolitic Conglomerate has yielded the con-odont *Ammphognathus inaequalis* Rhodes.

The junction between the top of the Ffairfâch Group and the basal Llandeilo Flags is not exposed, and although a non-sequence has been suspected (e.g. Bergström *et al.,* 1987) there is reason to believe that, if present, it is of no great magnitude (see Bassett and Owens, 1996). The Lower Llandeilo Flags is exposed in a small quarry south-west of the railway [SN 6275 2104] that has yielded trilobites (*Basilicus tyrannus, Ogygiocarella debuchii* (Brongniart) and *Marrolithus inflatus* Williams), brachiopods (*Dalmanella parva* Williams and *Schizocrania salopiensis* Williams) and the crinoid *locrinus cf. pauli* Donovan and Gale (Donovan, 1986–1995).

The most complete exposures of the Llandeilo Flags lie southwards along the Cennen Valley, which Williams (1953, p. 188) regarded as the type section. Wilcox and Lockley (1981) estimated a total thickness of 716 m of sediments, with 63% of the succession exposed. Williams (1953) recognized a local succession comprising 13 units characterized by distinctive fossil assemblages and often also distinctive lithologies; he grouped these into three major divisions, which he termed 'Lower Llandeilo' (199 m thick), 'Middle Llandeilo' (278 m) and 'Upper Llandeilo' (239 m), equating to zones based on trinucleid trilobite species.

The Lower Llandeilo Flags comprises eight lithological units, of which parts of three are exposed in this section: the *Lloydolithus lloydii* Flags at ([SN 6275 2104], see above), a limestone and shale member in a quarry [SN 6273 2102] and *Marrolithus inflatus maturus* Beds in the river bank [SN 6275 2903]. In general, the Lower Llandeilo is seen better in Dynevor Park (see site report).

The Middle Llandeilo Flags crops out on the river banks and in railway cuttings at five places, where there are exposures of three of Williams' four lithological units. The limestones with *Marrolithus anomalis* and the overlying *M. simplex elevata* flags crop out in the Cennen in a section 160 m long centred on [SN 6275 2078] and slightly higher beds of the latter in a railway cutting [SN 6270 2072]. The flags and limestones of the highest unit of the Middle Llandeilo are exposed in the railway cutting [SN 6253 2050], and in the Cennen [SN 6270 2054] and [SN 6230 2037], where they pass up into the

Upper Llandeilo Flags, which crops out extensively in the river adjacent to Talhardd. Wilcox and Lockley (1981, p. 287) noted that a distinctive black shale with *Marrolithus* that crops out around [SN 6222 2004] is part of the overlying *Dicranograptus* (or Mydrim) Shales, which intervene between the Upper Llandeilo and the overlapping Wenlock beds.

Many of the Llandeilo units are abundantly fossiliferous, with rich trilobite—brachiopod faunas. Of the former, *Basilicus tyrannus* and *Ogygiocarella debuchii* range throughout much of the succession, with climaxes at particular horizons (Wilcox and Lockley, 1981, fig. 6), whilst *Flexicalymene cambrensis* extends to the base of the Upper Llandeilo. A succession of trinucleids (*Lloydolithus lloydii* and species of *Marrolithoides* and *Marrolithus*) are the basis of the zonal scheme erected by Williams (1948), with small refinements by Wilcox and Lockley (1981). Articulate brachiopods (e.g. *Sowerbeyella antiqua* Jones, *Dalmanella parva* Williams and *Horderleyella* sp.) are dominant in the Lower and parts of the Middle Llandeilo, whilst lingulates, craniates and *Tissintia immatura* predominate in the Middle and Upper Llandeilo (Wilcox and Lockley, 1981, fig. 6). Graptolites are a rarity, but Bassett and Owens (1996) noted *Hustedograptus cf. teretiusculus* (Hisinger) from the Lower Llandeilo of the old quarry [SN 6275 2104] south of Ffairfâch cutting.

Interpretation

As the historical type section for the Llandeilo Series, this site is of international importance, and retains regional and national significance if the recommendation by Fortey *et al.* (1991, 1995) to unite the Llanvirn and Llandeilo series is adopted. The cutting at Ffairfâch is the type locality for the eponymous group or formation and is the type locality for the brachiopods *Gelidorthis cennenensis* Lockley and Williams and *Triplesia edgelliana* (Davidson).

Detailed work on the palaeoecology and faunal changes for both the Ffairfâch Group (Williams *et al.,* 1981; Lockley, 1983) and the Llandeilo Flags (Wilcox and Lockley, 1981; Lockley, 1983) has followed from the detailed biostratigraphy described by Williams (1953). In the Ffairfâch Group three successive regressive cycles in sublittoral to intertidal environments were recognized, and in the Llandeilo Flags a sequence of environments ranging from intertidal to open-shelf, each identified by predominant facies and faunas. Taken together, the Ffairfâch Group-Llandeilo Flags succession represents an upwardly deepening sequence.

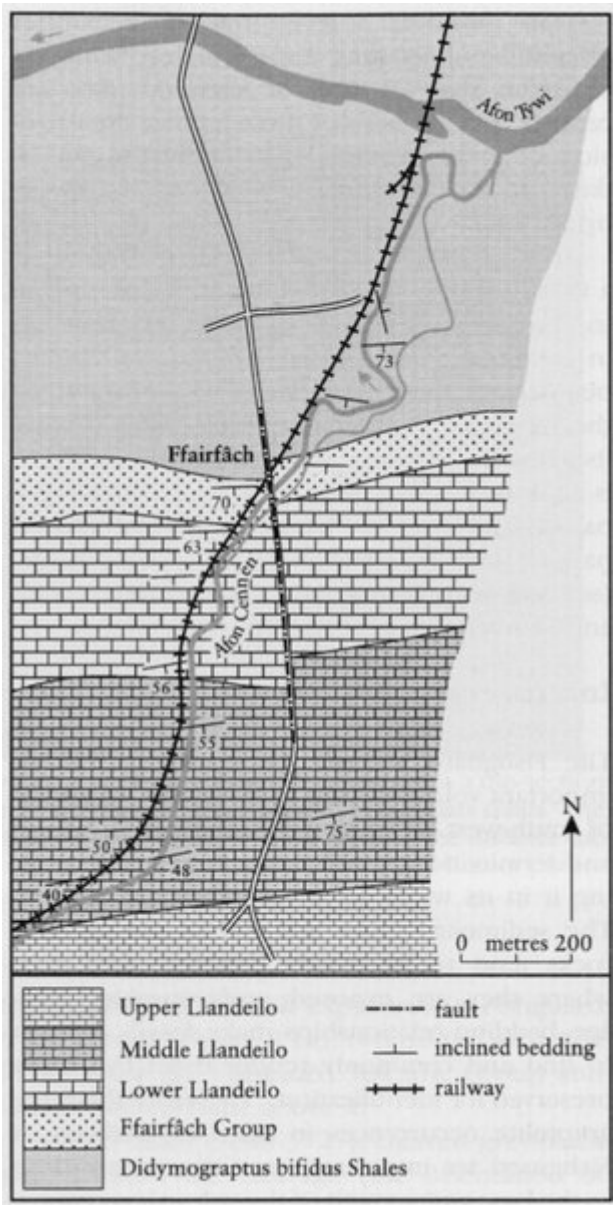
Much discussion has centred on the stratigraphical position of the Ffairfâch Group, which, following Williams (1953), has been taken as a facies of the *murchisoni* Zone, with the base of the Llandeilo Series coincident with the base of the Lower Landeilo Flags. Because of the virtual absence of graptolites, it has been difficult to relate this sequence in detail to contemporary ones elsewhere, e.g. at Builth and Shelve. Evidence from the conodonts from calcareous horizons at the top of the Ffairfâch Group (Bergström *et al.,* 1987) suggests that the base of the *teretiusculus* Zone is well below the base of the Llandeilo Flags: *Baltoniodus prevariabilis* and *Eoplacognathus lindstroemi* from the Flags and Grits are indicative of a level in the *Amorphognathus kielcensis* Subzone of the *Pygodus anserinus* conodont zone that correlates with a level high in the *teretiusculus* Zone (Bergström *et al.,* 1987, p. 298), whilst the presence of *Amorphognathus inaequalis* in the Rhyolitic Conglomerates indicates the *inaequalis* Subzone, the upper subzone of the *P. anserinus* conodont zone. Of the other fauna, many of the brachiopods (e.g. *Sowerbyella antiqua, Macrocoelia llandeiloensis, Dalmanella parva*) range upwards into the Llandeilo Flags, as do the trilobites *Basilicus tyrannus* and *Flexicalymene cambrensis,* and the ostracods *Tallinnella? tomacina* Jones and *Laterophores elevatus* Jones (for the latter of which this is the type locality). Some brachiopods are of more restricted range: *Tissintia prototypa* occurs only at the top of the Ffairfâch Grit and at the base of the Pebbly Sands, and *Hesperothis dynevorensis* only in the Pebbly Sands. *Tissintia immatura* appears to replace *T. prototypa* within the Pebbly Sands and ranges upwards to the top of the Llandeilo Flags.

Ranges of some of these taxa elsewhere may contribute towards establishing the position of the base of the *teretiusculus* Zone within the Ffairfâch Group. *Tissintia prototypa* does not occur above the top of the *murchisoni* Zone and ranges down into the *artus* Zone. *Hesperothis dynevorensis* occurs in the *murchisoni* Zone in the Builth–Llandrindod Inlier, and *Basilicus tyrannus* and *Flexicalymene cambrensis* appear in the *Asaphus* Ash in the Narberth-Lampeter Velfrey district immediately above beds with *Didymograptus murchisoni.* On the basis of these occurrences, there is a reasonable case for believing that the base of the *teretiusculus* Zone lies within the Pebbly Sands; there is no taxon in the succeeding part of the Ffairfâch Group that is indicative of a *murchisoni* Zone age.

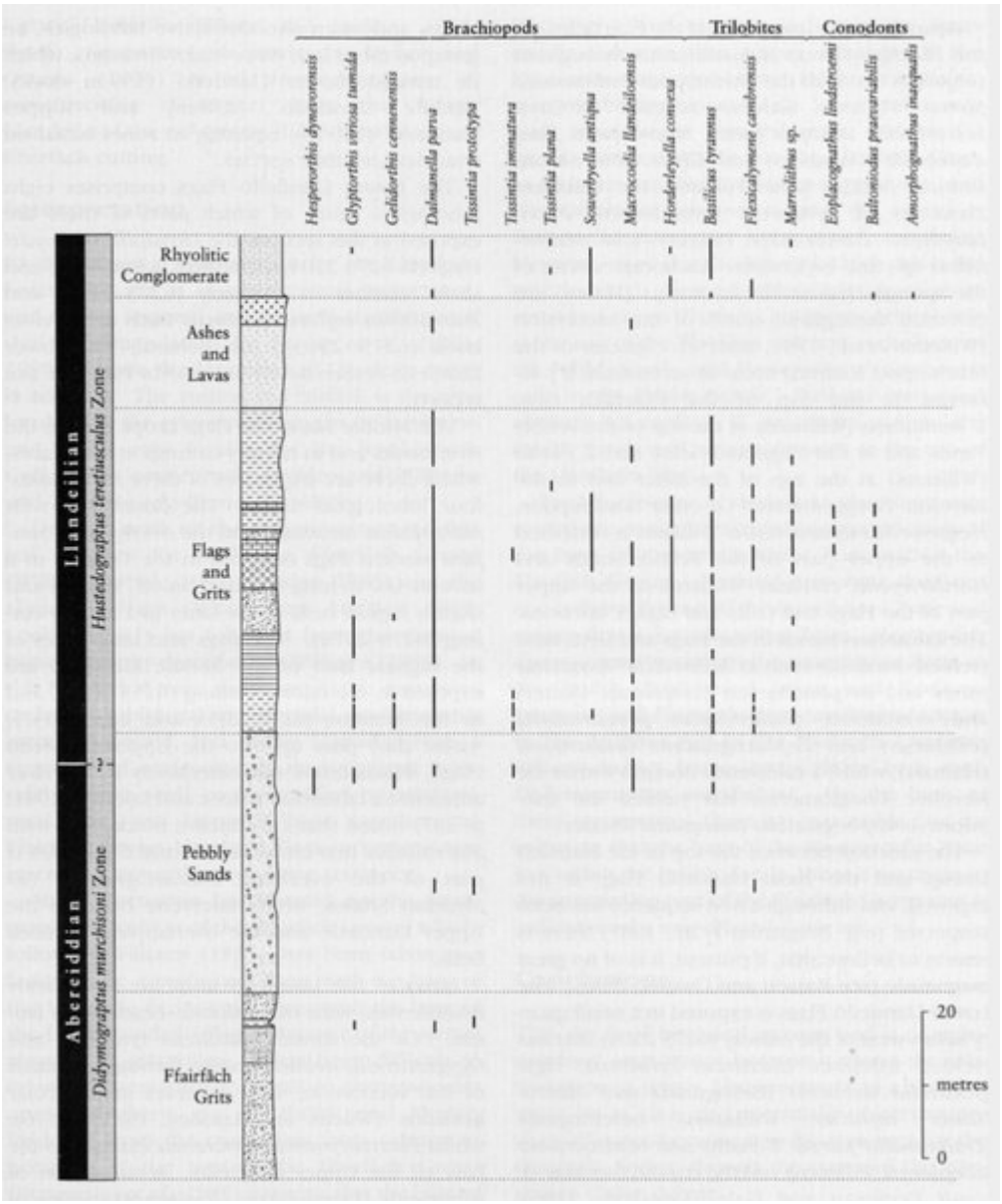
Conclusions

This site is of historical interest and is of stratigraphical importance because it shows the relationships of upper Llanvirn strata in a shallow-water facies. It is also potentially of international significance because it is the type area for the Llandeilo Series, though the status of this division is under debate.

References



(Figure 8.15) The geology around Ffairfâch and Afon Cennen, after Williams (1953) and Wilcox and Lockley (1981). The Cennen section is historically the type section for the Llandeilo Series (now Llandeilian Stage).



(Figure 8.16) Lithological and faunal succession in the type section for the Ffairfâch Group, after Williams et al. (1981).