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## River Irfon

[SO 033 515]–[SO 029 505]

### Introduction

This section on the River Irfon is contained within its lowest reaches, where it joins the River Wye at Builth Wells in central Wales. Initial comments on the geology of the Builth area were provided by Murchison (1839, 1854), and by De la Beche (1846) and Phillips (1848) in their work for the Geological Survey. Lapworth (1880a, b) also used the area in his investigations on the stratigraphical distribution of graptolites in the Lower Palaeozoic, the Wenlock rocks here being characterized by him into a lower *murchisoni* Zone and, for the most part, an upper *linnarssoni* Zone.

It was as a result of the studies of Elles (1900) and Wood (1900), however, on Silurian strata at Builth, that the area assumed great importance for the biostratigraphy of Wenlock (in particular) and Ludlow strata. These authors established there a sequence of graptolite zones that were then adopted as a standard for use elsewhere in the UK and also areas abroad. Some of these zones, in terms of nomenclature and extent, have been modified since, but in general they have held good. The most noteworthy amendment has been the subsequent inclusion of the *ludensis* Biozone (= *vulgaris* zone of Wood, and as used by Elles) in the Wenlock Series and not the Ludlow.

Straw (1937) next investigated Silurian rocks of the Builth area, producing a stratigraphical account and map of the Ludlow south of Builth Wells. Jones (1947) then described the Silurian geology north and west of the town, much of this work concerned with Wenlock rocks. More recently, a PhD thesis on the geology, biostratigraphy and graptolite fauna of the Builth Wenlock has been written by Harris (1987), and also the Geological Survey have been working there. These two studies, when published, may affect details of the interpretation and significance put forward in the present review of the Irfon site, and also those of the other four Builth Wenlock sites.

Additional comment on the research given in outline above, which has further relevance to the Irfon section, can be found in the introduction to the Trecoed–Castle Crab site. Since Elles' (1900) work Builth has been considered the type area for the Wenlock graptolite sequence.

Wenlock rocks of the *ellesae* Biozone (= *rigidus* Zone of Elles) to *ludensis* Biozone are exposed in the Irfon site, though the site boundary continues, importantly, to include a Wenlock–Ludlow boundary section and also succeeding Ludlow strata.

### Description

In the Builth Region the River Irfon flows from WSW to ENE and skirts the north-western fringe of Builth Wells, at which point it enters the River Wye. The site boundary includes both banks of the Irfon for about 1.25 km upstream from the suspension bridge situated near its confluence with the Wye. Most of the section is in Wenlock age rocks. Ludlow strata occur in the upper part of the section, on the eastern and southern parts of the meander loop approaching Caer-beris. Some horizons are available only in the river bed at times of very low water.

The Wenlock strata in the Irfon section, as in the Builth area as a whole, belong to the 'Wenlock Shales'. This lithostratigraphical unit approximates to the Coalbrookdale Formation of the type Wenlock area, but in the Builth district it is in need of a new formational name. The general dip of the beds in the section is to the south-east, but there is (J. Davies pers. comm.) a small, open anticline, plunging eastwards between the suspension bridge and the outfall of the Afon Chwefru. During a dry summer, Elles (1900) recorded *ellesae* Biozone rocks on the left bank from between the suspension bridge and Park Farm (now the Golf Club House). She listed six graptolites from this locality: *Cyrtograptus ellesae* (= *Cyrtograptus rigidus* Tullberg of Elles), *Pristiograptus dubius*, two varieties of *Monograptus flemingii*, *Monoclimacis vomerina vomerina* and *M. vomerina basilica*. Rickards (1976), more recently, gave only the first three of these species as being present in the *ellesae* Biozone. Slightly farther upstream and on the right bank, from opposite the

Afon Chwefru which enters the Irfon at Park Bridge, Elles described *lundgreni* Biozone calcareous 'flags' and shales, the more calcareous horizons containing concretions up to a metre in diameter. The graptolites she recorded from here include *Cyrtograptus lundgreni*, *P. dubius*, and *M. flemingii* var. g; she also listed a *Cardiola* species, a phacopid trilobite and an orthocone. From a little farther upstream until the road bridge, on the left bank, strata of the *lundgreni* Biozone containing graptolites are discontinuously exposed.

Exposure is lacking for about 180 m upstream from the A483 road bridge. Approaching the large bend in the river *lundgreni* Biozone rocks, hard calcareous shales with concretions, and associated graptolites, occur again (Figure 4.43), as well as orthocones and a cardiolid bivalve. *P. dubius*, *M. flemingii*, *Monoclimacis flumendosae* and *Pristiograptus pseudodubius* are recorded from here (Bassett, 1993). Stratigraphically immediately above this latter exposure are hard, calcareous flaggy siltstones and limestones which form a prominent band of strata striking roughly NE–SW across the river (Figure 4.44). These beds were originally included by Elles (1900) and Wood (1900) within the Ludlow Series. Elles (1900) recorded only *P. dubius* and a phacopid from this more carbonate rich, pot-holed band, and did not assign the band to any graptolite horizon, though Wood (1900) said that *Monograptus ludensis* (= *Monograptus vulgaris*) probably occurs in it, and recently (Siveter *et al.*, 1989) a *ludensis* Biozone graptolite fauna has been recorded from it together with the dalmanitacean trilobite *Delops*. Additionally, about two metres of *nassa* Biozone strata have now been indicated as present in the Irfon section, between *lundgreni* and *ludensis* biozone rocks (Harris, 1987; Corfield *et al.*, 1992).

The resistant, uppermost Wenlock *ludensis* Biozone beds are succeeded, at approximately the point where the road veers away from the river, by dark, laminated shales with a basal Ludlow *nilssoni* Biozone fauna. Graptolites from these shales include *Cucellograptus progenitor*, *Colonograptus colonus*, *Colonograptus compactus* and *P. dubius*, with *Saetograptus varians* and *Saetograptus leintwardinensis incipiens* entering in slightly younger beds (Bassett, 1993).

## Interpretation

The River Irfon section figured prominently in the accounts of Elles (1900) and Wood (1900), and Jones (1947) devoted a separate section of his paper to it. The *ludensis* Biozone was originally defined by Wood (1900) at Builth together with the Long Mountain (Rickards, 1976).

The prominent, calcareous band of *ludensis* Biozone age forms part of the youngest of the three slump sheets identified in the upper Wenlock of the Builth region by Jones (1947). The same band is also the lateral equivalent on the palaeoslope, where the Builth area was positioned throughout the Wenlock (Bassett, 1974a; Hurst *et al.*, 1978; Holland, 1992), of the Much Wenlock Limestone Formation of the shelf area. The dominant faunal elements of the Irfon section are graptolites, but the occurrence also of shelly fossils gives a mixed aspect to the fauna, a characteristic shown by the Builth region during the Wenlock and one which reflects its intermediate palaeogeographical position. The trilobite *Delops* is also known from similar calcareous beds at the same stratigraphical level in north Wales, Powys (the Long Mountain), Cumbria, Scania, Gotland and the Prague Basin (Siveter *et al.*, 1989).

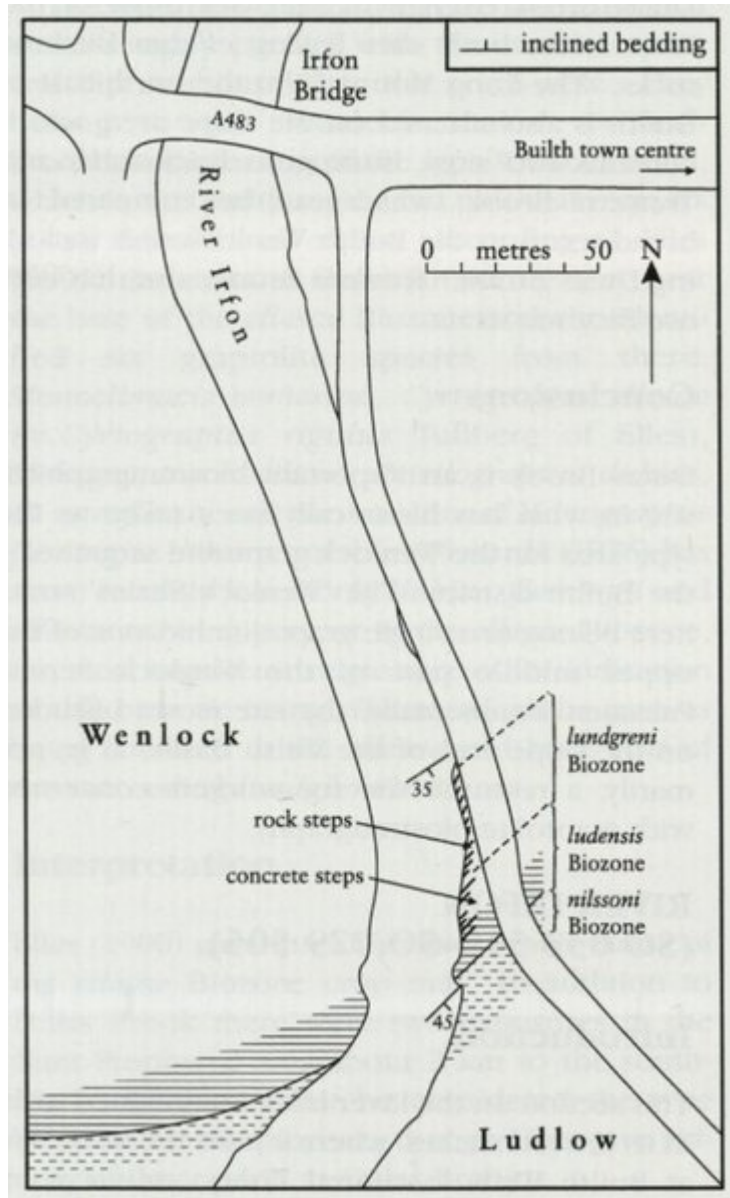
The River Irfon section has been used recently for isotopic analysis (Corfield *et al.*, 1992). Two  $\delta^{13}\text{C}$  depletions have been recognized here, a lower one at the level of the *nassa* Biozone and a slightly higher, more gradual one in the *ludensis* Biozone that continues across the Wenlock–Ludlow boundary. The lower depletion, at least, may be a reflection in the carbon isotope record of the widespread graptolite extinction event that occurred at the end of *lundgreni* Biozone times.

Trecoed–Castle Crab, Pen-cerig, Coed-mawr and Dulas Brook are other Wenlock sites at Builth; together with the Irfon section they form a close network of sites in the area for rocks of this age. Stratigraphically, the Irfon section overlaps slightly with Dulas Brook, both having *ellesae* Biozone rocks, but of the five Builth Wenlock sites only the Irfon section has high Wenlock (and succeeding Ludlow) strata. Elsewhere, the Trewern Brook site in the Long Mountain district compares closely, in terms of stratigraphy, fauna, lithofacies and palaeogeographical position, with the Irfon section.

## Conclusions

The River Irfon section is a very important site for biostratigraphy in the Builth district, the area where the succession of Wenlock graptolite zones was first demonstrated. It exposes 'Wenlock Shales' strata of middle to upper Wenlock age, which belong to four graptolite biozones, and their contact with overlying shales of the Ludlow Series. That part of the section with uppermost Wenlock to basal Ludlow strata and associated graptolite biozones is of particular importance. Shelly fossils also occur, the site demonstrating the rather mixed nature of the Wenlock age fauna at Builth, which was situated on the palaeoslope during this time. The section as a whole is used for research purposes; the Wenlock–Ludlow boundary part of it is visited by a much wider geological audience as it appears in field guides to the Welsh Basin. A high conservation value is attached to the site.

## References



(Figure 4.43) River Irfon, Builth Wells. Wenlock–Ludlow boundary section (after Siveter et al., 1989 and Bassett, 1993).



(Figure 4.44) River Irfon, Builth Wells. Right bank, looking south, about 180 m south of the bridge over the A483 road, showing *lundgreni* Biozone (foreground) and *ludensis* Biozone (river bluff, background) strata, Homerian stage, Wenlock Series. (Photo: Derek J. Siveter.)