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# Howey Brook

[SO 087 591]–[SO 095 589]

## Introduction

Exposures in Howey Brook provide sections through the lower part of the *Didymograptus murchisoni* Zone of the Builth—Llandrindod inlier, which includes the type locality for *Didymograptus murchisoni* itself. The brook affords a sequence of shales and flags, with contemporaneous igneous rocks that represent the attenuated northern part of the outcrop of the Builth Volcanic Formation; it provides a good example of the succession that occurs in this part of the inlier, as follows:

Builth Volcanic Formation (with Llandrindod Tuff at base, overlain by reworked tuffs)

Camnant Mudstones Formation

Both the shales and some horizons within the tuffs are richly fossiliferous; they include the type localities for several trilobite, brachiopod and graptolite species.

Historically this site is of interest since it was described in detail by Murchison (1839, p. 325), who logged and illustrated the sequence exposed in a ravine (the 'Cwm-re') through which a large tributary of the Howey flows; he referred to it as the 'chief feeder' (later, following Elles (1940), referred to as the 'main feeder'). Murchison described an alternating sequence of flags, shales and ashes and inferred that the volcanics were erupted in a submarine environment. He noted the presence of both trilobites and graptolites, the latter in his bed 'f', where there were abortive workings for coal (the adit may be the 'cave' indicated on the 1:25 000 topographical map). It is probable, by inference from Murchison (1839, pp. 326, 694), that this is the horizon with the calcareous concretion that contains the type specimens of *Didymograptus murchisoni* (Beck), the type species of *Didymograptus*. These specimens were re-described and refigured by Elles and Wood (1901), Strachan and Khashoggi (1984) and Jenkins (1987), and Lapworth (1879b, p. 197) used this name when he established the *murchisoni* graptolite zone, albeit in a wider sense than that employed today.

Elles (1940, pp. 395, 401) gave the only detailed description of the section since that of Murchison and presented a sketch-map of the 'main feeder' and adjacent part of Howey Brook. Jones and Pugh (1949, p. 85) used this section, among others, to infer sequences of events from which they derived their picture of Ordovician palaeogeography in the Builth district (see Newmead site report). The area of Howey Brook appears on the 1:25 000 British Geological Survey map of the Builth—Llandrindod inlier (Earp, 1977); much of this map was based on the mapping of Jones and Pugh, who offered a modification to the interpretation given by Elles. Part of Earp's map, including this site, has subsequently been revised by Davies *et al.* (1997), and their version is followed here. The sections in the upper part of Howey Brook and the 'main feeder' have yielded trilobites (described by Elles (1940) and Hughes (1969, 1971, 1979)), graptolites (Jenkins, 1987) and brachiopods (Lockley and Williams, 1981; Williams *et al.*, 1981).

## Description

The upper reaches of Howey Brook cross the southern limb of the Gilwern Anticline, in the core of which the Camnant Mudstones crop out (Figure 8.26). Although most of the outcrop is drift-covered, resistant tuffs of the overlying Llandrindod Tuff, the lowest member of the Builth Volcanic Formation, form scarps running NNE from the brook [SO 089 592] on the south-east limb of the anticline and along Carregwiber Bank on the north-west limb. Black, richly fossiliferous silty shales of the upper part of the Camnant Mudstones lying in Elles' (1940) '*Didymograptus speciosus* and *Cryptolithus gibbosus* Subzone' (now considered to be at the base of the *murchisoni* Zone — see Davies *et al.* (1997, p. 11)) are exposed on the south bank of the brook [SO 089 592]. They dip south-east under the tuffs at about 55° in the 'cliff section', famous for its abundant trinucleids (*Bettonolithus chamberlaini* (Elles) (type locality) and *Trinucleus abruptus* Hughes) and other trilobites (*Ogyginus corndensis* (Murchison) and *Flexicalymene aurora* Hughes) (see Elles (1940) and

Hughes (1969, 1971, 1979)). Graptolites include pendent *Didymograptus* and *Glossograptus hincksii fimbriatus* (Hopkinson), and brachiopods are represented by *Tissintia prototypa* (Williams) and lingulates.

The Camnant Mudstone Formation is overlain by the Buihth Volcanic Formation, and its lowest member, the Llandrindod Tuff, crops out between the 'cliff section' and the confluence of the 'main feeder' and the Howey Brook (Figure 8.26); it comprises a basal pyroclastic breccia grading upwards into lapilli tuff. This is overlain unconformably by the middle (unnamed) member of the Buihth Volcanic Formation, a sequence dominated by reworked tuffs (volcaniclastic sandstones) that are exposed in the banks and in the vicinity of the 'main feeder' over the next 300 m. A shale band at [SO 0909 5920] yields *D. munchisoni* and lingulate brachiopods; at the top of a small hill just north of the brook [SO 0925 5915], fine sandy ashes, considered to belong to the Cwm-amliw Tuff by Earp (1977), have afforded a diverse brachiopod fauna in association with abundant bryozoans and subsidiary numbers of trilobites, molluscs, graptolites and other fossils (Lockley and Williams, 1981; Williams *et al.*, 1981). This is the type locality for the brachiopods *Christiania elusa* Lockley and Williams and *Macrocoelia llanilloensis elongata* Lockley and Williams; the latter and *Dalmanella parva* Williams are numerically the most abundant, with *Hesperorthis dynevorensis* Williams and *Glyptorthis cf. viriosa* Williams also common.

The remainder of the section in the 'main feeder' also exposes the reworked tuffs of the Buihth Volcanic Formation. It is part of this that was illustrated by Murchison (1839, p. 325), and a map of the whole section was given by Elles (1940, p. 402). Tuffs, flags and shales crop out, dipping downstream at between 30° and 35°; the more resistant tuff and ash bands give rise to the series of waterfalls in the ravine section. Many of the shaly and flaggy horizons are fossiliferous; at [SN 9013 5913] they have yielded *Diplograptus priscus* Elles and Wood, and below the main waterfall [SO 0917 5906] *Amplexograptus confertus* (Lapworth), pendent *Didymograptus* and dalmanellid brachiopods (C.J. Jenkins, unpublished). It is within this stretch that the type locality of *D. munchisoni* presumably lies. Upstream, at the head of the gorge section [SO 0935 5898], the stream passes down into the upper part of the Camnant Mudstones Formation, here largely drift-covered.

## Interpretation

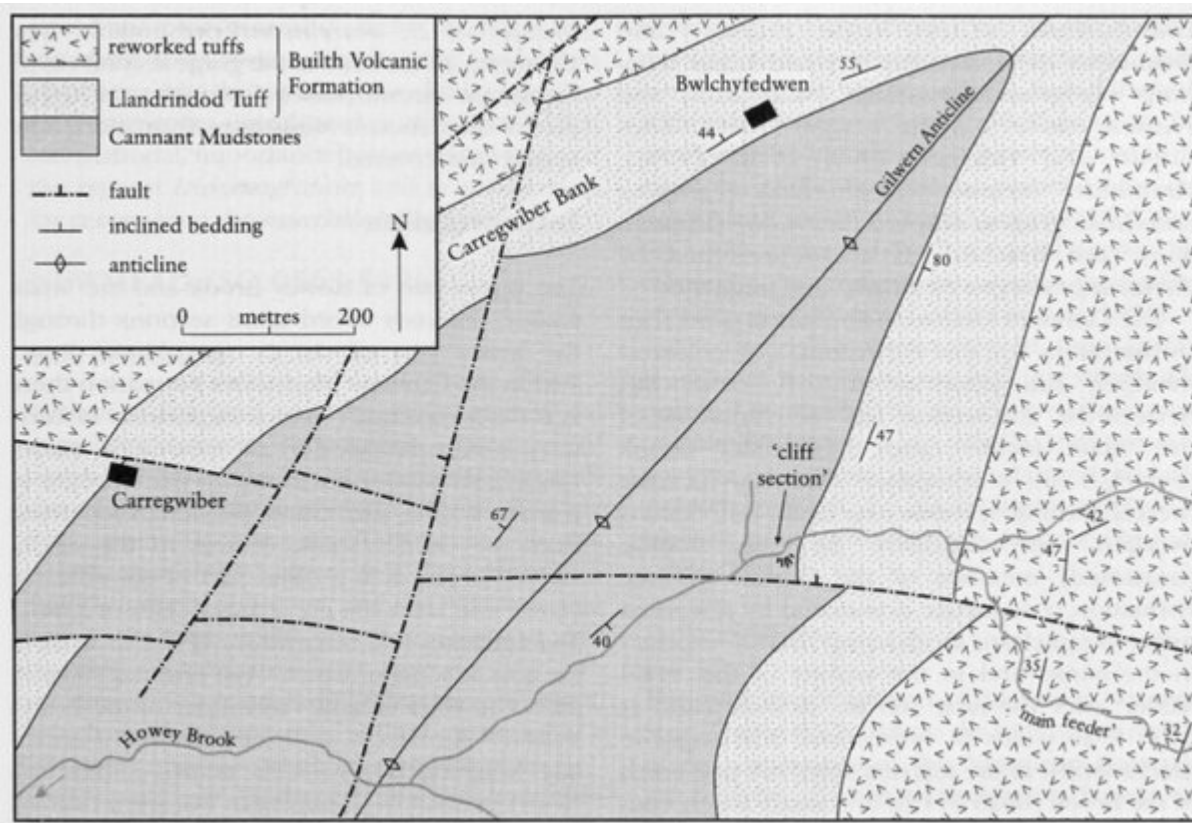
The upper part of Howey Brook and the 'main feeder' tributary afford good sections through the lower part of the *D. munchisoni* Zone. Within the Camnant Mudstones Formation there is evidence for quiet marine deposition in fairly deep waters, followed by an episode of volcanism in a submarine environment that brought in pulses of tuffs and ashes, presumably derived from the main volcanic centres to the south. Howey Brook is in a distal part of the volcanic centre and lacks the great thicknesses of basalts and andesites that occur towards Buihth Wells in the south, some of which were erupted subaerially. The volcaniclastic sandstones of the Buihth Volcanic Formation, with their abundant articulate brachiopods (Williams *et al.*, 1981), are clearly of shallow-water origin but were derived into a deeper-water setting by gravity flow (Davies *et al.*, 1997, p. 15).

Besides providing palaeogeographical and stratigraphical evidence for this part of the Buihth sequence, Howey Brook is the type locality for several species, most notably the zonal graptolite *Didymograptus munchisoni*. Redescription of the type material has not stilled controversy over the interpretation of this species (Strachan and Khashoggi, 1984; Jenkins, 1987; Strachan, 1996), and it may require new material from the type locality to resolve certain problems. A solution is desirable because *D. munchisoni* is used to effect correlation with sections in North and South Wales, in the Shelve area and many other places as far afield as continental Europe, North and South America, and China, whilst the zonal name is recognized globally. Among the trilobites, *Bettonolithus chamberlaini* is known in the Camnant Mudstones elsewhere in the Buihth Inlier and also occurs in the contemporaneous Betton and Weston Beds at Shelve.

## Conclusions

The Howey Brook site is valuable for displaying the biostratigraphical succession of the lower part of the *munchisoni* Zone in a fairly uniform mixed trilobitic–graptolitic facies, enabling dating of the local rock succession and correlation elsewhere; but the type locality of the graptolite *Didymograptus munchisoni* is of national, even international, importance because that species is the type of *Didymograptus* and is widely used for recognizing the *munchisoni* Zone.

## References



(Figure 8.26) Geological map of the Gilwern Anticline and Howey Brook including the 'main feeder' tributary, after Davies et al. (1997, fig. 5).