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# Ludford Lane and Ludford Corner

[SO 5124 7413]–[SO 5120 7410]

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## Introduction

This classic locality was traditionally regarded as the reference section for the Silurian–Devonian boundary in Britain. Currently it is one of several key sites that define the Ludlow Series (see Holland *et al.*, 1963) and Downton Group in their type area of the Ludlow Anticline and Downton Syncline. The site contains internationally important faunas and floras.

The outcrop occurs for more than 100 m along 'Whitcliffe Road ('Ludford Lane') and continues to the junction with the A49 Leominster road ('Ludford Corner'), just south of Ludford Bridge at Ludlow, Shropshire (Figure 5.6), (Figure 5.15). Its geology and palaeontology have been extensively documented for more than 150 years in books and papers (e.g. Murchison, 1839; Harley, 1861; Elles and Slater, 1906; White, 1950; Holland *et al.*, 1963; Allen, 1974; Antia, 1979, 1980; Bassett *et al.*, 1982; White and Lawson, 1989; see especially Miller, 1995 and references therein) and field guides (Lawson, 1977b, locality 13; Siveter *et al.*, 1989, locality 3.2; Jenkinson, 1991, locality 13). The historical background of the study of the site and its pivotal role in the complex development of the concept and age determination of the Downton Group are detailed especially in White (1950) and Bassett *et al.* (1982).

Both the Ludford Lane and Ludford Corner exposures show the uppermost parts of Upper Whitcliffe Formation of the Ludlow Series overlain by the lowermost part of the Downton Castle Sandstone Formation of the Pídolí Series (Figure 6.3), (Figure 6.4), (Figure 6.5). In the work to provide an internationally agreed chronostratigraphy for the Silurian, and following the notions of White (1950) and Holland *et al.* (1963) regarding the base of the Downtonian sequence of rocks, this site was promoted as a possible basal boundary stratotype for the fourth and youngest series (to be termed the Downton) of the Silurian (Bassett *et al.*, 1982). In the event, a stratotype candidate from the Czech Republic was preferred, hence the name Pídolí Series. The Ludford Lane and Ludford Corner site displays a body stratotype for the Upper Whitcliffe Formation, the type sections for the Ludlow Bone Bed and Platyschisma Shale members of the Downton Castle Sandstone Formation and a reference section for the Sandstone Member of the Downton Castle Sandstone Formation (Bassett *et al.*, 1982; Lawson and White, 1989; White and Lawson, 1989).

## Description

The Ludlow Bone Bed Member, discovered in 1835 by Dr J. Lloyd and the Reverend T.T. Lewis (Murchison 1839, p. 197), occupies a distinct cleft along the section in Ludford Lane and at Ludford Corner. It consists of some 0.2 m of lenticular and ripple-laminated siltstones containing several thin layers of discontinuous vertebrate-rich sands, the basal one of which is *the* Ludlow Bone Bed *sensu stricto* (Figure 6.3), (Figure 6.5). The bone comprises mostly fish remains, such as acanthodian scales and agnathan denticies (e.g. Agassiz, 1939; Harley, 1861; White, 1950; Turner, 1973; see also Dineley and Metcalf, 1999). Murchison (1839, p. 198) noted that... so brilliantly black are many of the organic [fish] fragments, that when discovered, this bed conveyed the impression that it inclosed [*sic*] a triturated heap of black beetles cemented in a rusty ferruginous paste'.

The succeeding Platyschisma Shale Member (up to 2 m thick) comprises parallel- and cross-laminated and unlaminated mudstones and shales with subordinate siltstones. The overlying Sandstone Member, consisting mostly of sandstones and siltstones alternating with thin mudstones, is best seen high in the outcrop along the A49 at Ludford Corner (Figure 6.4) and is also present at the top of the section in Ludford Lane itself.

The olive calcareous siltstones of the Upper Whitcliffe Formation (>0.5 m seen) have a fully marine fauna that includes articulate and inarticulate brachiopods, bivalves, bryozoans and also the ostracod *Calcaribeyrichia torosa*. Some of these

faunal elements also occur in the overlying Ludlow Bone Bed Member but in general the Downton Castle Sandstone Formation is characterized by a reduced diversity assemblage of different aspect (Figure 6.5). At the base of the Downton Castle Sandstone Formation several brachiopods disappear and *Modiolopsis* bivalves, the inarticulate brachiopod *Lingula minima* and the biostratigraphically important ostracods *Frostiella groenvalliana*, *Londinia arisaigensis* and *Nodibeyrichia verrucosa* enter the sequence (Figure 6.5), (Figure 6.6), (Figure 6.7). Associates in that formation include remains of a diverse fish fauna of about 14 species (mostly from the lower two members), gastropods such as *Turbocheilus helicitis* and *Loxonema* sp., many eurypterid species (e.g. *Hughmilleria acuminata*; see Kjellesvig-Waering, 1961, Manning, 1993), arthropleurid arthropod remains (Shear and Selden, 1995) and fragments of early land plants such as *Cooksonia* (e.g. see Lang, 1937; Bassett *et al.*, 1982, p. 14; Jeram *et al.*, 1990; Edwards *et al.*, 1996). The Ludlow Bone Member at Ludford Corner has yielded trigonotarbid arachnid and centipede cuticles (Figure 6.8), the earliest direct evidence globally of terrestrial animals (Jeram *et al.*, 1990; Dunlop, 1996, 1999).

Conodonts are rare, but include *Ozarkodina* cf. *crispa* from just below the top of the Whitcliffe Formation and *Ozarkodina confluens*, *Ozarkodina excavata*, *Coryssognathus dubuis* and *Ozarkodina remscheidensis eosteinhornensis* in the Ludlow Bone Bed Member (Aldridge and Smith, 1985; Miller and Aldridge, 1993, 1997; Miller, 1995). In the basal few metres of the Downton Castle Sandstone Formation land-derived spores substantially increase in numbers and marine phytoplankton, principally acritarchs, show a corresponding decrease (Richardson and Lister, 1969; Richardson and Rasul, 1990).

Based on a complex web of correlation, mainly involving microfossils such as conodonts and especially ostracods, the base of the Downton Castle Sandstone can be correlated across to North America and, via fully marine Baltic sequences, to the base of the type Plidoli Series in the Czech Republic (Martinsson 1963, 1967; Shaw, 1969; Siveter, 1978, 1989; Bassett *et al.*, 1982, 1989; Hansch *et al.*, 1991; Hansch and Siveter, 1994; Miller, 1995; see (Figure 6.7)). No measurable amount of time is missing within the basal part of the Downton Group in its main outcrop in the Welsh Basin. However, some microfossil evidence suggests that the top of the Ludlow Series may not be represented in the shelf area in the Welsh Borderland (Miller *et al.*, 1997; Viira and Aldridge, 1998).

## Interpretation

This overall regressive sequence formed on the Midland Platform of the remnant Welsh Basin (Siveter *et al.*, 1989, fig. 11; Bassett *et al.*, 1992, figs S5b, S8b). The sediments indicate a fairly quick but fluctuating change from a relatively shallow, mainly clear but sometimes turbid proximal shelf environment (conquinoid siltstones of the Whitcliffe Group) to near-shore, perhaps coastal plain conditions (Sandstone Member, Downton Castle Sandstone Formation) (see Watkins, 1979; Allen and Tarlo, 1963; Allen, 1974, 1985; Bassett *et al.*, 1982; Miller, 1995).

The notable faunal and sedimentological change at the base of the Ludlow Bone Bed Member is ascribed by most authors to a sudden regression and transgression (see Miller, 1995) and the sediments themselves may reflect shallow subtidal to low intertidal conditions, recurrent storm reworking and the accumulation of vertebrate-rich lags (Smith and Ainsworth, 1989). Certainly the presence of land animals and plants indicate proximity to shore.

The Platyschisma Shale Member probably represents intertidal environments. The occurrence of complete hummocky cross-stratification sequences in the Sandstone Member at Ludford Corner (Figure 6.4) indicates shallow marine, subtidal to intertidal, storm generated conditions (Siveter *et al.*, 1989; Smith and Ainsworth, 1989). Overall, the sedimentary and restricted faunal characteristics of the Sandstone Member suggest the formation of sand bodies in a marine-influenced environment close to land.

Ludlow–Pīdolí boundary sequences are also present, in facies similar to that at Ludford Lane and Ludford Corner, at GCR sites in the English West Midlands (Brewin's Canal and Turner's Hill), the southern Welsh Borderland (Linton Quarry, Gorsley Inlier; Wood Green and Longhope Hill, May Hill Inlier; Woodbury Quarry, Abberley Hills; Perton Road and Quarry, Woolhope Inlier; Tites Point, near Tortworth) and South Wales (Brook House, Usk Inlier). The equivalent sequence at GCR site Lower Wallop Quarry in the Long Mountain area, west Shropshire, reflects a more basin margin setting. The Sawdde Gorge and Capel Horeb sites in southern Wales also have Ludlow–Pīdolí sequences but in both cases the Pīdolí lies unconformably on late Ludlow strata. The GCR sites at The Helm, Hill's Quarry and Benson Knott

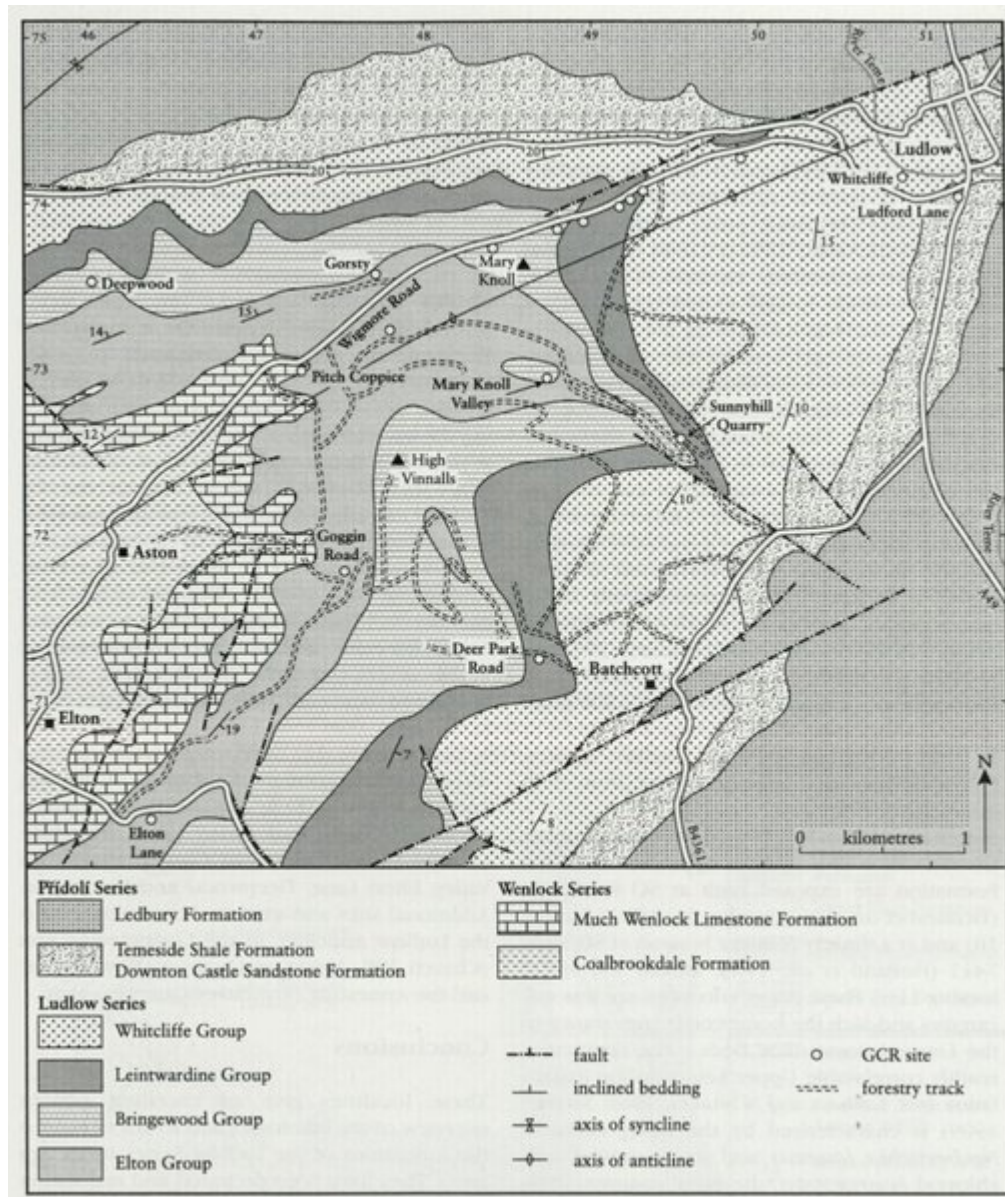
collectively embrace the Ludlow–Pridoli transition in the Lake District.

## Conclusions

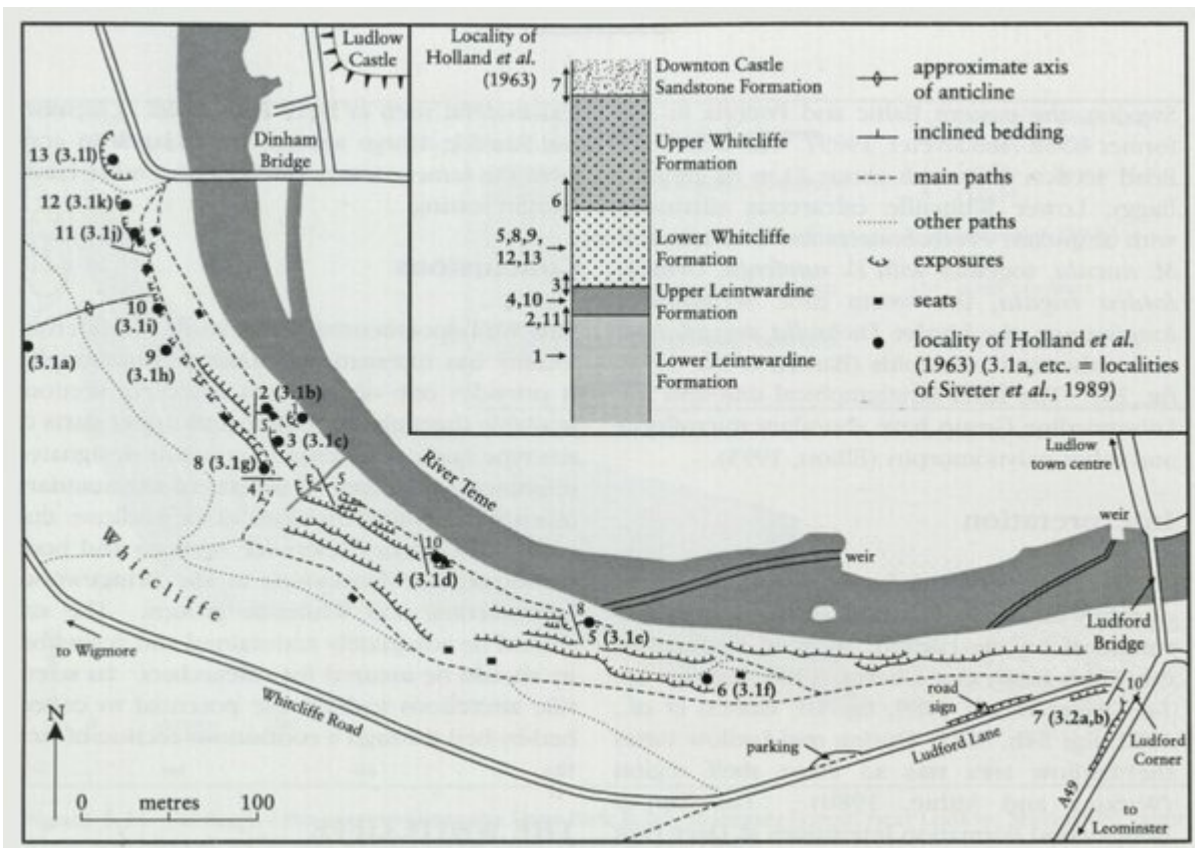
This is a world famous locality of primary importance to the history and definition of Silurian stratigraphy, the evolution of the biosphere and the history of the Lower Palaeozoic Welsh Basin. It displays the basal boundary stratotype for the Downton Group (Pridoli Series) resting on a body stratotype for the Upper Whitcliffe Formation (Ludlow Series). The Downton Group here contains the earliest known land animals in the world, early land plants, unusual arthropods and the famous Ludlow Bone Bed containing fish remains. It is the type locality for many taxa.

The site is studied by researchers and secondary and tertiary level educational parties and should be rigorously protected and maintained. Hammering is normally strictly forbidden, though limited collections for research purposes can be obtained from the Ludford Lane section after obtaining the appropriate permission.

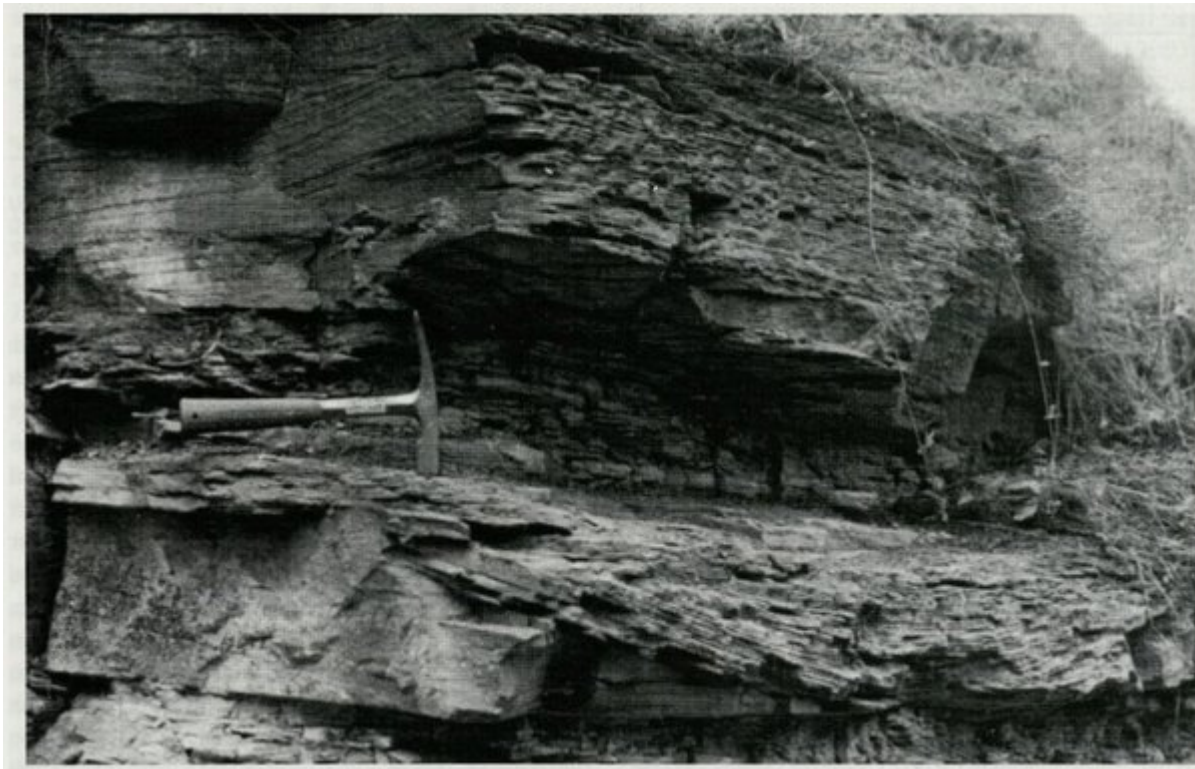
## References



(Figure 5.6) Map of the geology south-west of Ludlow, showing GCR sites along the Wigmore Road and elsewhere in the eastern part of the Ludlow Anticline (after Holland et al., 1963; Lawson, 1977; Lawson and White, 1989).



(Figure 5.15) Location and general stratigraphical position of localities at GCR sites The Whitcliffe and Ludford Lane and Corner, Ludlow, Shropshire (after Holland *et al.*, 1963; modified from Siveter *et al.*, 1989).

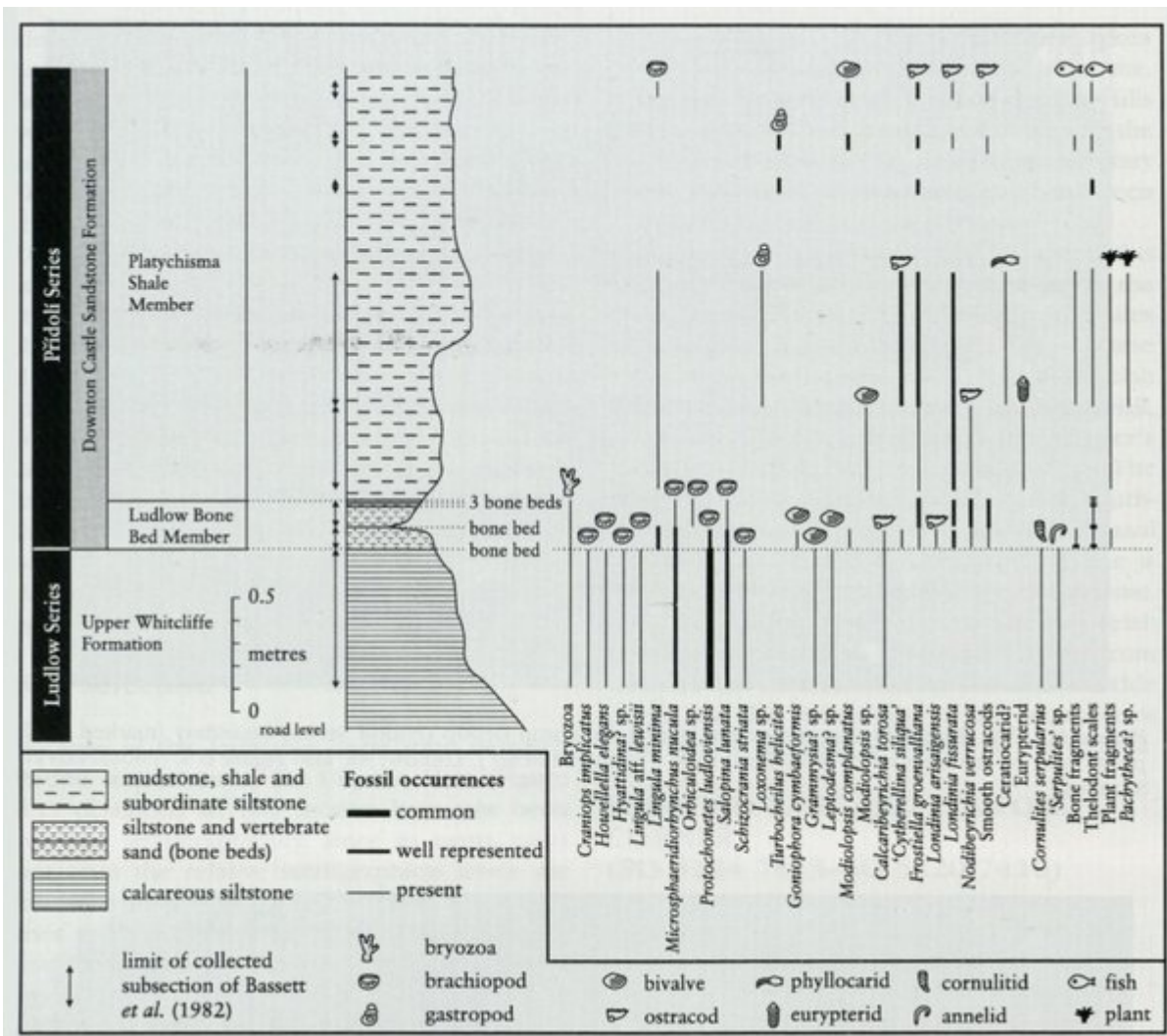


(Figure 6.3) The Whitcliffe Group (Ludlow Series)—Downton Group (Páidolí Series) boundary (marked by the position of the hammer head) at Ludford Lane (Whitcliffe Road'), Ludlow; see also Figure 6.5. (Photo: David J. Siveter.)



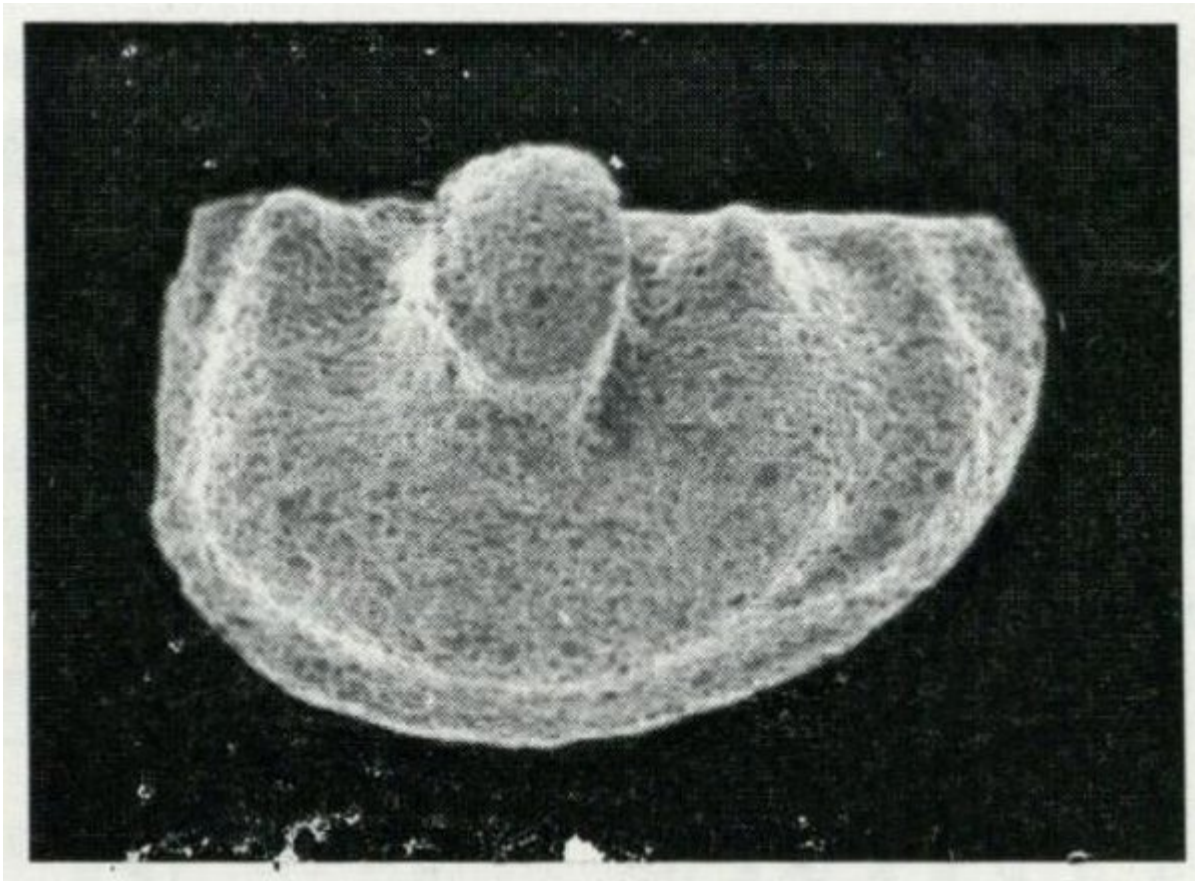


(Figure 6.4) Hummocky cross-stratification sequences in the Sandstone Member, Downton Castle Sandstone Formation, along the A49 road at Ludford Corner, Ludlow, Shropshire. (Photo: David J. Siveter.)

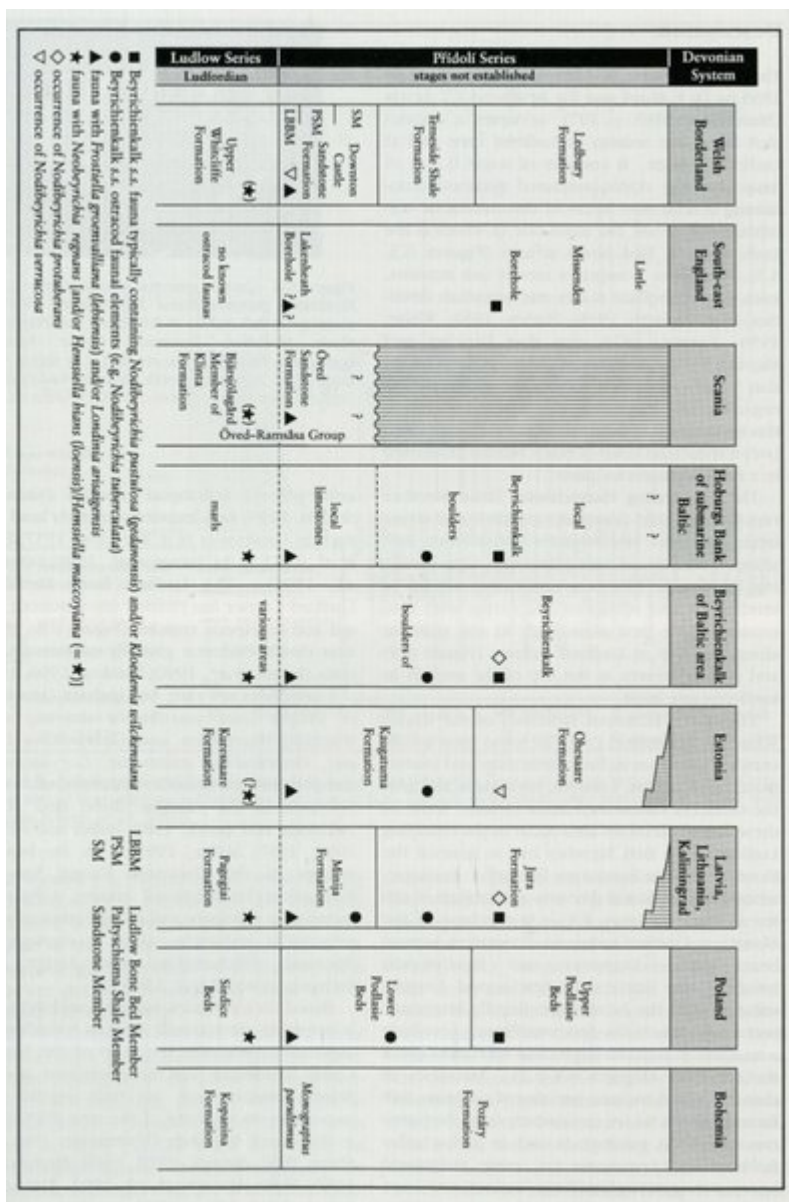


(Figure 6.5) Lithological and faunal succession across the Whitcliffe Group (Ludlow Series)/Downton Group (Pridoli Series) boundary at Ludford Lane (see Figure 6.3), Ludlow, Shropshire (after Bassett et al., 1982; modified from Siveter)

et al., 1989).

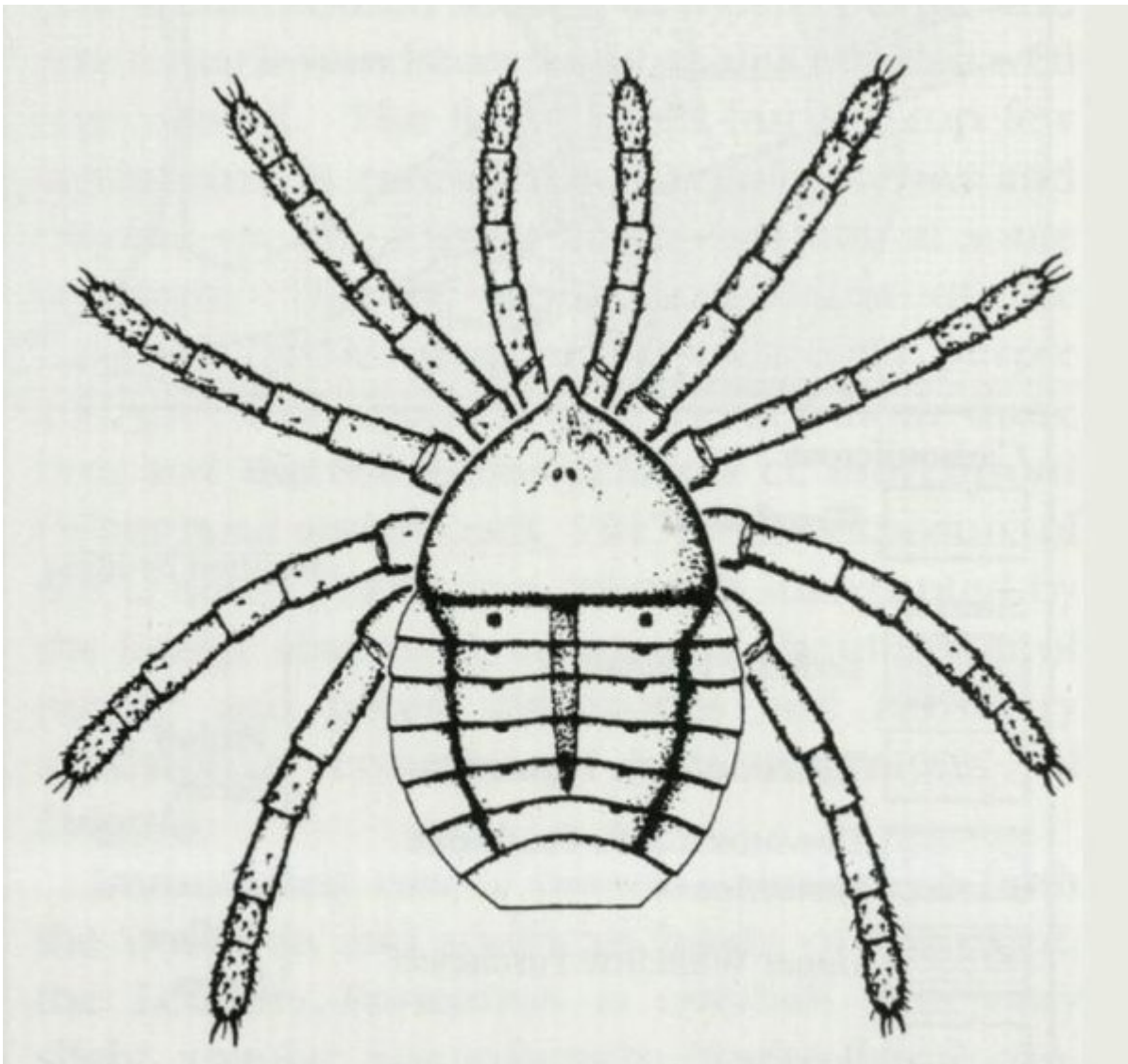


(Figure 6.6) Cast of external mould of the ostracod *Frostiella groenvalliana* Martinsson, 1963 (tectomorphic left valve, x 24) from the Platyschisma Shale Member, Downton Castle Sandstone Formation, Pídlí Series; about 1.5 m above Ludlow Bone Bed Member, north side of Ludford Lane, Ludlow, Shropshire. (Photo: David J. Siveter.)



(Figure 6.7) Correlation of latest Ludlow–Přídolí ostracod faunas of Britain, Baltoscandia and the Czech Republic (after Hansch and Siveter, 1994, fig. 1; see also Bassett et al., 1982, fig. 7; Siveter 1989, fig. 164, and Miller, 1995, fig. 14). Symbols denote the presence (mostly only the earliest occurrence) of a fauna within a stratigraphical unit, not their exact positions. Vertical columns not to scale.





(Figure 6.8) Reconstruction of *Palaeotarbus* Dunlop, 1999, a trigonotarbid arachnid, based partly on material from the Downton Castle Sandstone Formation, Ludford Corner, Ludlow, Shropshire. Carapace is c. 1 mm long (from Dunlop, 1996).