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# Ludford Lane and Ludford Corner, Shropshire

[SO 5124 7414]–[SO 5120 7410]

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## Introduction

This site is located in Ludlow, Shropshire, on the nose of the ENE- to WSW-trending Ludlow Anticline. The rocks represented are those forming the highest part of the Ludlow Series and the most basal part of the Pridoli Series, some 418 million years old.

The general palaeontology, stratigraphy and sedimentology of the site have been extensively documented for more than 150 years in books and papers, for example those of 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) and Miller (1995, and references therein). The locality has also been included in field guides, both local and regional, such as those of Lawson (1977), Siveter *et al.* (1989) and Jenkinson (1991).

From a stratigraphical standpoint the site represents the reference section for the Siluro-Devonian boundary in Britain. This was prior to the base of the Devonian being defined in Czechoslovakia and also before the recognition and international adoption of the Pridoli Series as the fourth series of the Silurian System, the base of which is taken in the Anglo-Welsh area as approximating to the base of the Downton Group. The site remains however one of several key sites in this part of the Welsh Borderland that define the Ludlow Series, and the Downton Group (Pridoli Series) in their type areas.

Eurypterids from the site were first discussed in nineteenth century texts, for example those of Salter (in Sedgwick and M'Coy, 1855; Salter, 1859a) and Woodward (1872b), before being taxonomically revised by Kjellesvig-Waering (1958, 1961). They have been subsequently investigated by Manning (1993); assessed in terms of habitat by Plotnick (1999); and referred to by Tetlie (2006a). In relatively recent years acid digestion extraction techniques have yielded arachnid and myriapod fossils from here (Jeram *et al.*, 1990; Manning, 1993; Manning and Dunlop, 1995; Dunlop, 1996, 1999; Shear and Selden, 1995). A ceratiocarid crustacean has also been questionably recorded from the locality (Bassett *et al.*, 1982). Some of these more recently discovered arthropods are particularly significant in providing one of the stratigraphically earliest direct indications, in the form of body fossil as opposed to trace fossil evidence, of the presence of animals on land. The arthropods form a notable component of an internationally important fauna and flora from the locality.

The overall significance of the site is reflected in its additional inclusion in the GCR volumes on fossil plants (Cleal and Thomas, 1995), fossil fishes (Dineley and Metcalf, 1999), and Silurian stratigraphy (Aldridge *et al.*, 2000).

## Description

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 in Ludlow (see (Figure 2.39)). Both the Ludford Lane and Ludford Corner exposures show the uppermost parts of the Upper Whitcliffe Formation (Ludlow Series) overlain by the lowermost part of the Downton Castle Sandstone Formation (Pridoli Series) (Figure 2.42). The 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 succeeding Sandstone Member of this formation (Bassett *et al.*, 1982; Lawson and White, 1989; White and Lawson, 1989).

The Ludlow Bone Bed Member, discovered in 1835 by Dr J. Lloyd and the Reverend T.T. Lewis, is marked at Ludford Lane and Ludford Corner by a distinct recess in the section. It comprises 0.2 m of lenticular and ripple-laminated

siltstones containing several thin layers of discontinuous vertebrate-rich sands. The bone comprises mostly fish remains, such as acanthodian scales and agnathan denticles (e.g. Agassiz, 1839; Harley, 1861; White, 1250; Turner, 1973; Dineley, 1999b). The succeeding Platyschisma Shale Member is up to 2 m thick and consists of parallel and cross-laminated and unlaminated mudstones and shales, with some siltstones. The overlying Sandstone Member, comprising mostly sandstones and siltstones alternating with thin mudstones, is present in Ludford Lane, but is seen best by the A49 road at Ludford Corner.

The olive calcareous siltstones of the Upper Whitcliffe Formation, of which about 0.5 m or more can be seen at the site, have a fully marine fauna that includes articulate and inarticulate brachiopods, bivalves, bryozoans and also the ostracod *Calcaribeyrichia torosa*. Some of these faunal elements occur in the overlying Ludlow Bone Bed Member but in general the Downton Castle Sandstone Formation is characterized by a somewhat different, reduced diversity assemblage. At the base of this formation several brachiopods disappear and *Modiolopsis* bivalves, the inarticulate brachiopod *Lingula minima* and the biostratigraphically significant ostracods *Frostiella groenvalliana*, *Londinia arisaigensis* and *Nodibeyrichia verrucosa* enter the sequence. Early land plants such as *Cooksonia* (see for example Lang, 1937; Bassett *et al.*, 1982; Edwards *et al.*, 1996), together with a diverse fish fauna (Turner, 1973; Dineley, 1999b), also occur in the Downton Castle Sandstone Formation. Of the microfossil groups, conodonts are rare, but species of *Ozarkodina* have been recovered from just below the top of the Whitcliffe Formation and from the Ludlow Bone Bed Member (Aldridge and Smith, 1985; Miller and Aldridge, 1993, 1997; Miller, 1995). Land-derived spores substantially increase in numbers in the basal part of the Downton Castle Sandstone Formation, and marine phytoplankton (mainly acritarchs), show a corresponding decrease (Richardson and Lister, 1969; Richardson and Rasul, 1990).

Of significance for the present volume, the Downton Castle Sandstone Formation here has yielded the following eurypterids: *Erettopterus brodiei* Kjellesvig-Waering, 1961 (Figure 2.43); *Erettopterus spatulatus* Kjellesvig-Waering, 1961; *Erettopterus gigas* Salter, 1859; *Eurypterus cephalaspis* Salter, 1855; *Hughmilleria? acuminata* (Salter, 1859); *Herefordopterus banksii* (Salter, 1856); *Parahughmilleria salteri* Kjellesvig-Waering, 1961; *Nanahughmilleria* sp.; *Pterygotus denticulatus* Kjellesvig-Waering, 1961; and *Stylonurus* sp. (see Kjellesvig-Waering, 1961; Manning and Dunlop, 1995; Tetlie, 2006a). *Palaeophonon lightbodyi* Kjellesvig-Waering, 1954, also from this site, was originally described as a scorpion, but later it was listed (Kjellesvig-Waering, 1961) as a eurypterid. The Ludlow Bone Member, specifically, has yielded the trigonotarbid arachnid *Palaeotarbus jerami* (Dunlop, 1996; (Figure 2.44)), aquatic scorpions (Geram *et al.*, 1990), probable terrestrial scorpions (Manning, 1993; Dunlop, 1996), the arthropleurid myriapod *Eoarthropleura ludfordensis* Shear and Selden, 1995, and unnamed kampecarid myriapods and at least two types of centipede (Ijeram *et al.*, 1990; (Figure 2.45)). The site represents the type locality for several of the above species.

## Interpretation

This overall regressive sequence was deposited on the eastern margin of the remnant Anglo-Welsh Basin (Siveter *et al.*, 1989; Bassett *et al.*, 1992). The sediments indicate a fairly quick and fluctuating change from a relatively shallow, mainly clear though sometimes turbid, proximal shelf environment (conquinoid siltstones of the Whitcliffe Group) to nearshore, 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 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 may reflect shallow subtidal to low intertidal conditions, recurrent storm reworking, and the accumulation of vertebrate-rich lags (Smith and Ainsworth, 1989). The presence of land animals and plants certainly indicates close proximity to shore. The Platyschisma Shale Member probably represents intertidal environments. The occurrence of hummocky cross-stratification sequences in the succeeding Sandstone Member 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 near land.

*Palaeotarbus jerami* and *Eoarthropleura ludfordensis* are the earliest representatives in the fossil record of trigonotarbids and arthropleurids respectively, and the centipede material is also the earliest for the group. All of these arthropods are

land dwelling. The only terrestrial body fossils worldwide to pre-date these, by just a few million years, are millipedes from the late Wenlock–early Ludlow of the Stonehaven site in the Midland valley of Scotland (Wilson and Anderson, 2004). The scorpions from the Ludford Lane site await formal description.

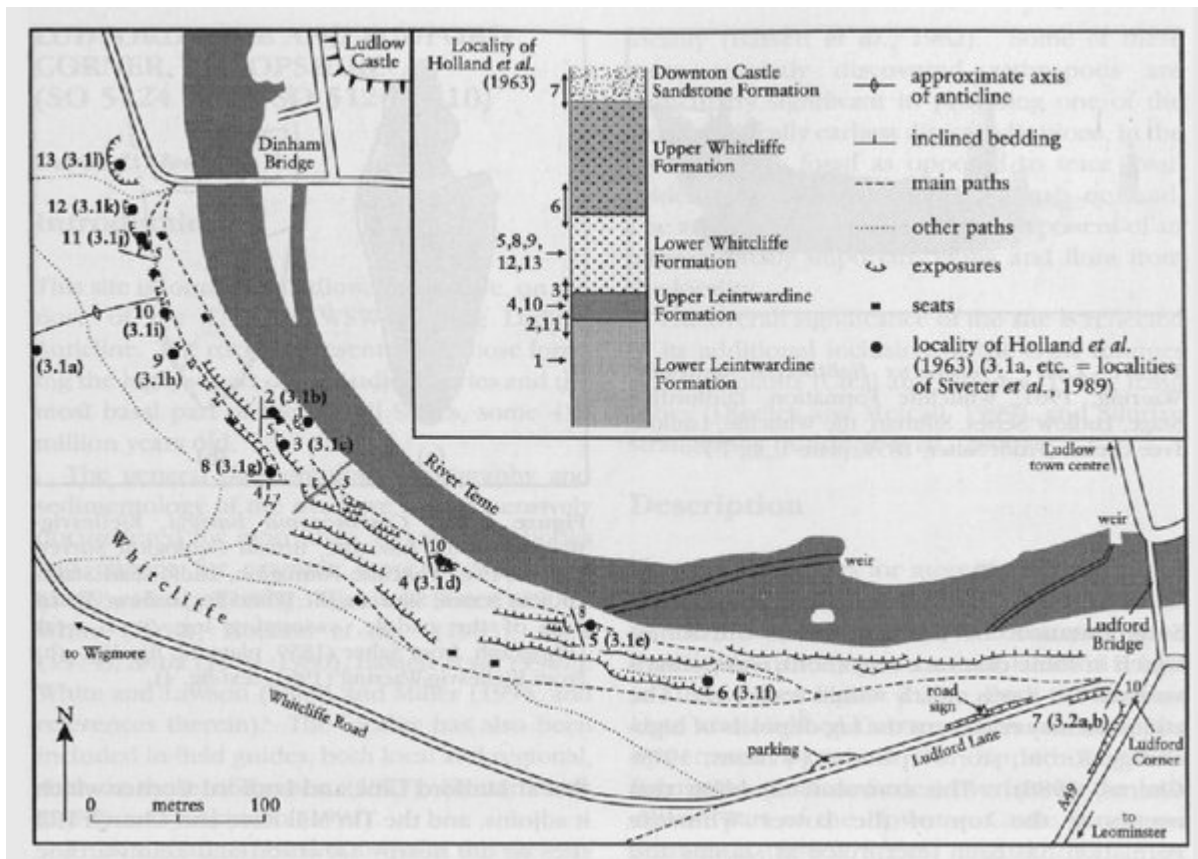
The eurypterid species from this locality are diverse. Also, eurypterid respiratory organs have been recovered from here that suggest that these chelicerates had a dual respiratory system: lamellate book gills, which are homologous with those of modern xiphosurans and arachnid book lungs, together with a Kiemenplatten on the roof of the branchial chamber. The Kiemenplatten is interpreted as an accessory aerial respiratory organ, and thus these eurypterids may have been partially terrestrial (Manning and Dunlop, 1995).

This site is closely linked with respect to its eurypterid fauna to several others in the Welsh Borderland: Tin Mill Race in the nearby Downton Gorge area and, to the south, Bradnor Hill near Kington and Perton Lane in the Woolhope Inlier. All of these sites are Pridoli in age and share several species in common. The Church Hill and Whitcliffe arthropod sites, the latter adjacent to the present site and the former nearby in the Leintwardine area, and both of Ludlow age, have eurypterid faunas but they are different to that from Ludford Lane and Ludford Corner. Also, of the arthropods from all of these sites only Ludford Lane has some which indicate for certain that animals had by this time moved onto land, and hence it is arguably the most important of this group. In addition to Ludford Lane and Ludford Corner, other Siluro-Devonian sites described in the present volume that include arthropod elements indicative of terrestrialization are all from Scotland: Stonehaven, Turin Hill and Rhynie. The eurypterid faunas found at the Scottish Siluro-Devonian arthropod sites of Gutterford Burn, Dunside, Slot Burn and Turin Hill all include a greater representation of stylonuroids than the single record (*Stylonurus* sp.; Manning and Dunlop, 1995) from Ludford Lane and Ludford Corner. In addition to the latter record, however, three specimens of *Stylonurus megalops* (Salter, 1859) are known from the Downton Group of the nearby Ludlow Railway Cutting (Kjellesvig-Waering, 1961), and the monotypic *Parastylonurus sigmoidalis* Kjellesvig-Waering (1971) from the same stratigraphical unit some 6 km to the north-west in Corve Dale.

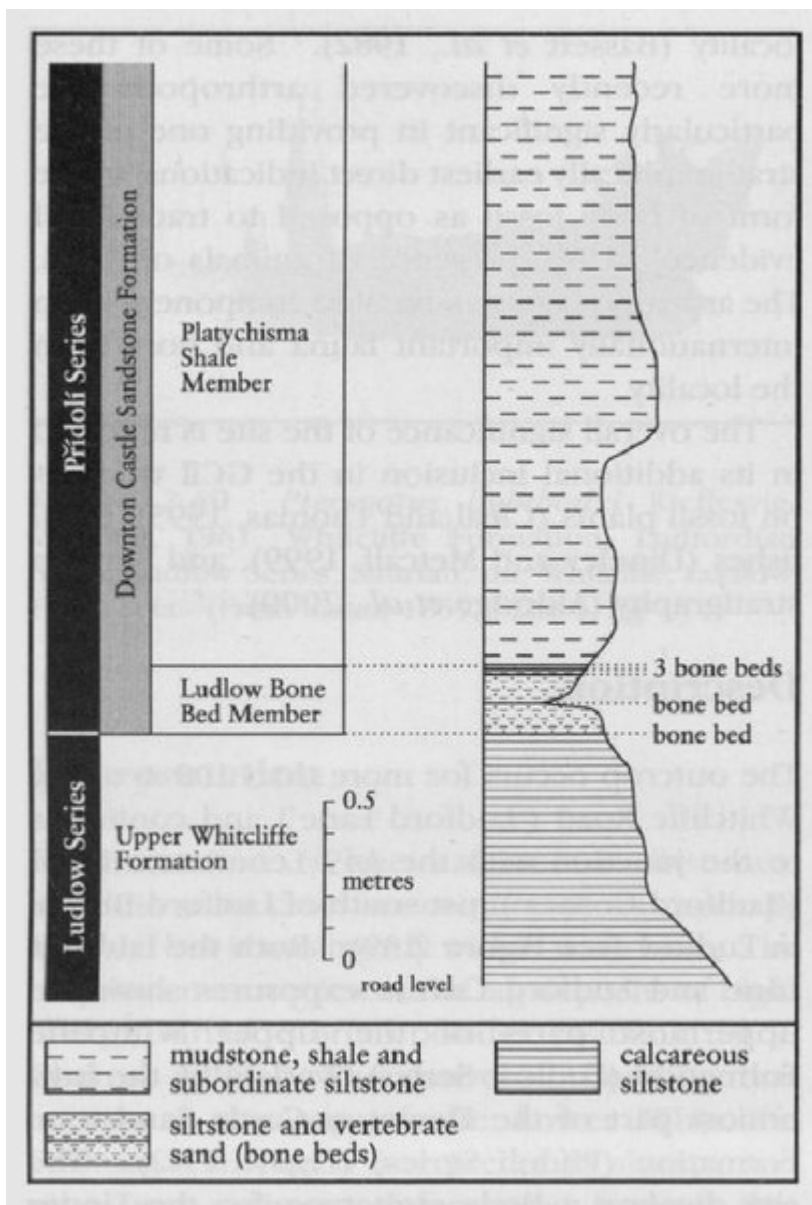
## Conclusions

This upper Silurian locality is a front rank site within the context of the present volume. The Downton Group here contains a trigonotarbid arachnid, together with centipede, arthropleurid and kampecarid myriapods that provide very rare, and stratigraphically early body fossil evidence for the terrestrialization of animals. Additionally, all these arthropods are the earliest representatives of their groups. The site also yields early scorpion arachnid material. The eurypterid fauna is diverse and allied to other Welsh Borderland faunas of Pridoli age. Exceptionally preserved elements of eurypterid respiratory organs have also been discovered from here. It is the type locality for several arthropod species and arthropod specimens from the site have been described in the literature from the mid-nineteenth century onwards. It is also an outstandingly important site for fossil fishes, early land plants, and Silurian stratigraphy.

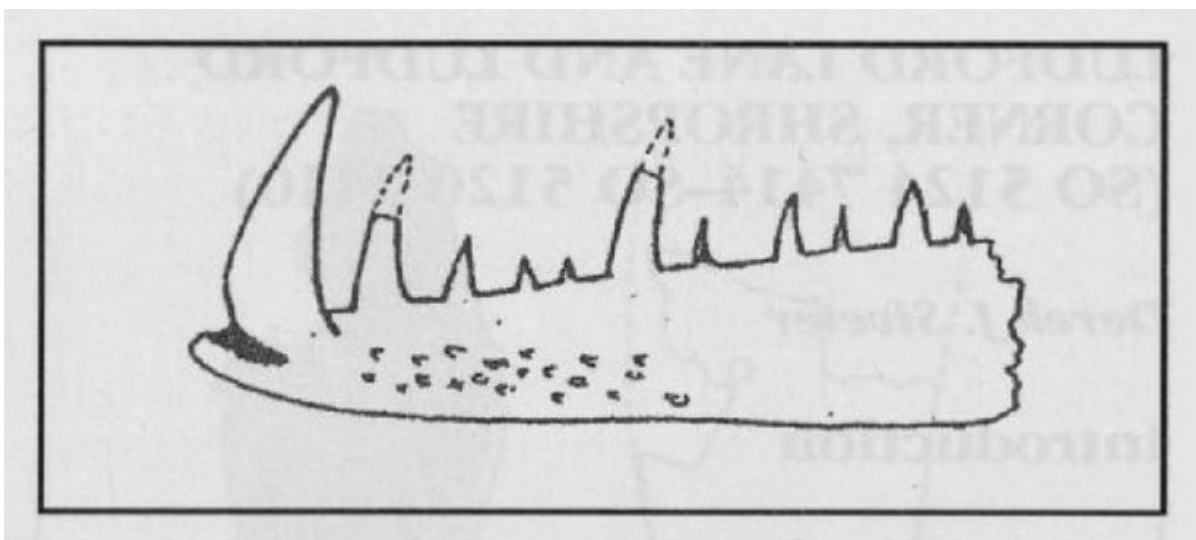
## [References](#)



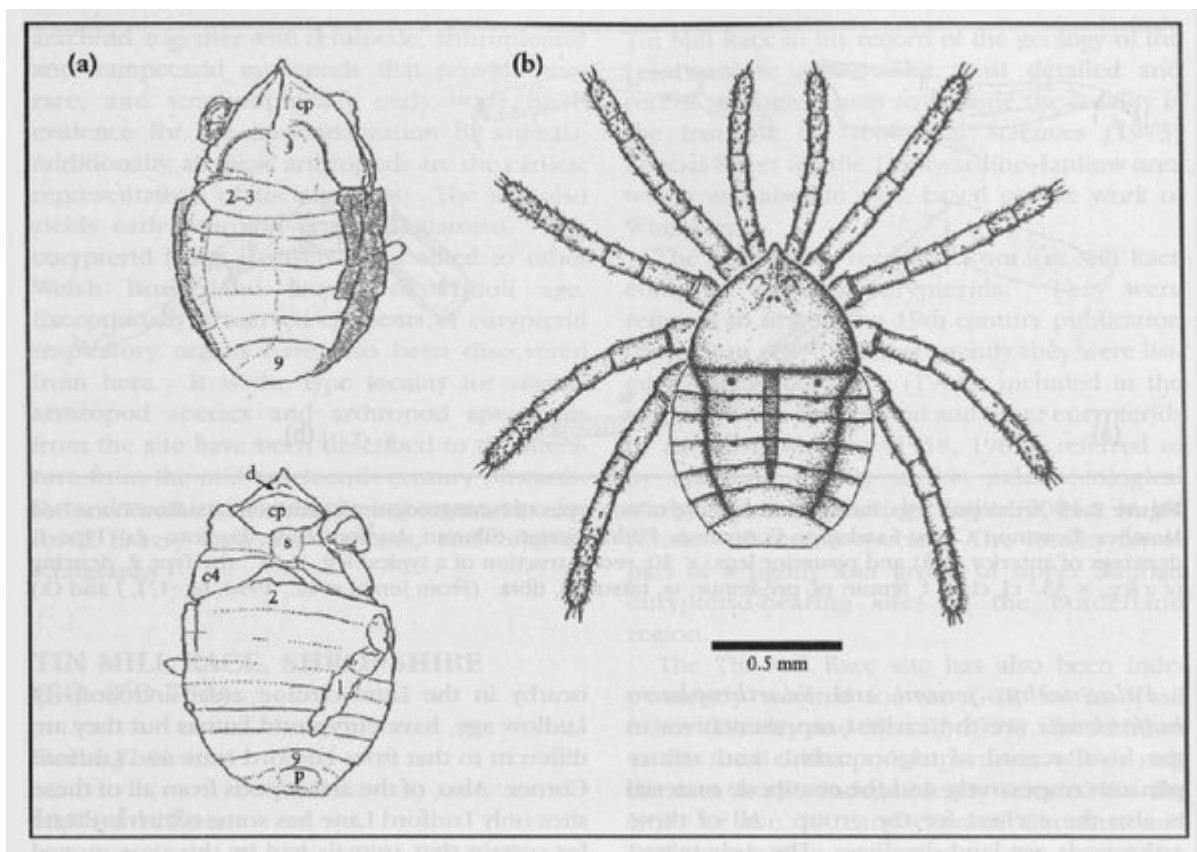
(Figure 2.39) Location and general stratigraphical position of localities at the Whitcliffe and Ludford Lane and Ludford Corner GCR sites, Ludlow, Shropshire. (After Siveter, 2000c.)



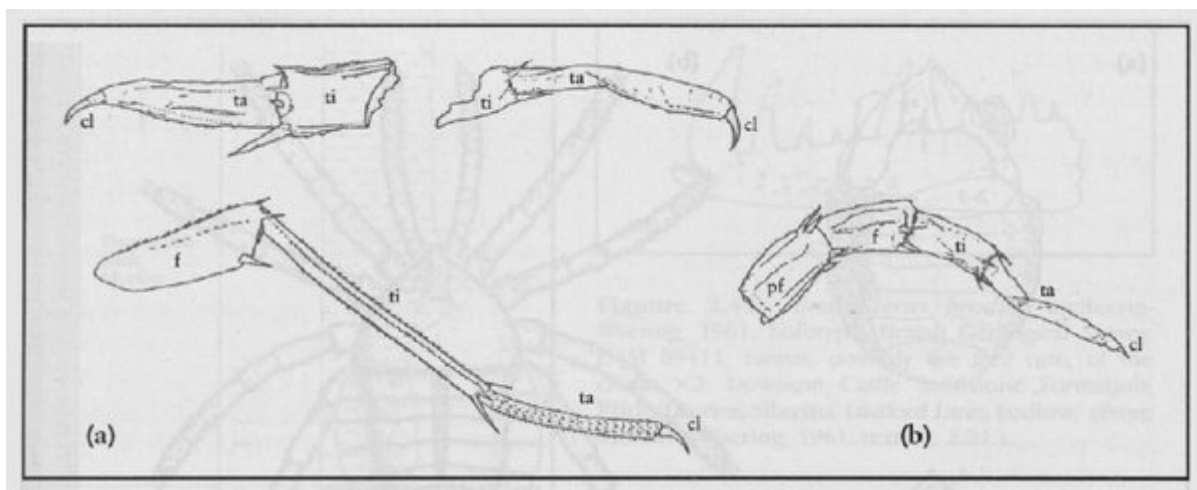
(Figure 2.42) Stratigraphy of the Ludlow Series (Whitcliffe Group)/Přídolí Series (Downton Group) boundary section, Ludford Lane and Ludford Corner site, Ludlow. (After Siveter, 2000f.)



(Figure 2.43) *Erettopterus brodiei* Kjellesvig-Waering, 1961; holotype, British Geological Survey, GSM 89411, ramus, possibly the free one, of the chela, x2; Downton Castle Sandstone Formation, Přídolí Series, Silurian, Ludford Lane, Ludlow. (From Kjellesvig-Waering, 1961, text-fig. 2.21.)



(Figure 2.44) *Palaeotarbus jerami* (Dunlop, 1996); holotype, Ulster Museum, Belfast, K25850; Ludlow Bone Bed Member, Downton Castle Sandstone Formation, Pridoli Series, Silurian, Ludford Lane, Ludlow. (a) Interpretive drawings of specimen, dorsal (left) and ventral views, x 31 (from Jeram et al., 1990, fig. 1, B and D). cp, carapace; c4, coxa of fourth leg; d, doublure; 1, leg; p, pygidium; s, sternum; 2, 2–3, etc. indicate either tergite (dorsal) or sternite (ventral) number. (b) Reconstruction. (From Dunlop, 1996, text-fig. 3.)



(Figure 2.45) Arthropod legs, interpreted as those of two types of ?scutigermorph centipede; Ludlow Bone Bed Member, Downton Castle Sandstone Formation, Pridoli Series, Silurian, Ludford Lane, Ludlow. (a) Type 1, drawings of anterior (left) and posterior legs, x 30; reconstruction of a typical leg, x 21. (b) Type 2, drawing of a leg, x 33. cl, claw; f, femur; pf, pre-femur; ta, tarsus; ti, tibia. (From Jeram et al., 1990, fig. 1, I, J and O.)