Church Hill, Herefordshire

[SO 4120 7380]

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Introduction

This Welsh Borderland site is located about 9 km to the west of Ludlow and 0.75 km to the east of the village of Leintwardine. The sediments that crop out hereabouts belong mostly to the Ludlow Series, of late Silurian age, around 420 million years old. The ground here forms part of the northern limb of the Downton Syncline, dose to its axial trace. The southern limb of the syncline also represents the northern limb of the Ludlow Anticline that plunges to the ENE.

The geology of this general area has been discussed from at least the time of Murchison (1839, 1854) in the mid-nineteenth century, with Lightbody (1869) and Marston (1865) being other commentators at about this time on the local rocks and fossils. The site was afterwards included in the ground around Ludlow investigated by Elles and Slater (1906). However it was half a century later, through the detailed mapping of Whitaker (1962) of the Ludlow strata of the Leintwardine area, that our modern understanding of the geology of this district was established. Alexander (1936) and Cherns (1988) have also taken in middle Ludlow rocks of the area as part of their geographically more wide-ranging coverage of strata of this age in the Anglo-Welsh Basin. The area has received additional coverage in geological field excursion reports (e.g. Woodward and Dixon, 1904; Whitaker in Allender *et al.,* 1960) and guides, Siveter *et al.* (1989) being the most recent example of the latter.

Phyllocarid crustaceans and eurypterid and xiphosuran chelicerates from Church Hill Quarry were noted or described in numerous mid- to late 19th century publications by some of the leading protagonists of the day. These works included those of Salter (1857, 1859a, 1873), Woodward (for example 1865b, 1870, 1871c, 1872b, 1872), Jones (1886), Jones and Woodward (1888), La Touche (1884) and Peach (1899). In the last century, Church Hill chelicerates were covered most notably in Kjellesvig-Waering's (1961) comprehensive study on Welsh Borderland eurypterids, and they also variously featured in the publications of Størmer (1952, 1955), Hessler (1969), Eldredge (1974), Bergstrom (1975), Morris (1980), Rolfe (1980), Almond (1985), Selden (1986), Anderson and Selden (1997), Anderson *et al.* (1998) and Plotnick (1999). The crustaceans from Church Hill await modern study.

In the context of this arthropod volume Church Hill Quarry is important for having yielded a variety of non-trilobite arthropods in an unusual palaeoenvironmental setting. Eurypterids belonging to five species and at least four genera have been collected from here. The site is also one of just a few globally that have produced xiphosurans of Silurian age, and it has also yielded several phyllocarid species.

Church Hill Quarry has also recently featured in the companion GCR volumes to the present one that have identified important sites in Britain for the Silurian stratigraphy (Aldridge *et al.,* 2000), and for fossil fishes (Dineley and Metcalf, 1999); in addition to the fossil arthropod importance of this site, the area is also independently selected for the GCR for the Silurian–Devonian Chordata and Ludlow selection categories.

Description

The Church Hill Quarry site is bounded to the north and south by, respectively, the local Church Hill and Trippleton faults (Figure 2.35), and the strata here have a shallow regional dip to the ESE of around 10° or less. The general succession, up-sequence and uphill from west to east, comprises the Middle Elton, Lower Leintwardine, Upper Leintwardine and Lower Whiteliffe formations of the Ludlow Series. The Lower Leintwardine Formation, the unit that is the main focus of palaeontological interest at the site, consists of thin-bedded calcareous siltstones within which are fossiliferous bands. These siltstones are the Mocktree Shales or the Dayia Beds of earlier authors (e.g. Elles and Slater, 1906; Alexander, 1936); they are separated from the underlying Middle Elton sediments by an erosion surface (Whitaker, 1962). A variety

of sedimentary features occur in them, for example slump structures, prod, skip and groove marks, and reworked boulders of the Upper Bringewood Formation (Aymestry Limestone). The quarry exposures that form the basis of the site have been abandoned for over a hundred years (see Hawkins and Hampton, 1927), and are now reduced to a series of overgrown scars. However during the course of a recent PhD investigation by David Gladwell (University of Leicester, 2005), a new exposure and new collections have been made.

The Lower Leintwardine Formation here boasts an especially interesting fauna (see Siveter 2000d). In addition to non-trilobite arthropods, and early fishes, it includes in particular complete starfish specimens. Other notable faunal elements include current aligned graptolite specimens, annelid material, and beautifully preserved crinoids. Trilobites, brachiopods and bryozoa form part of the associated, more standard invertebrate fauna.

Xiphosura is represented by *Limuloides limuloides* (Woodward, 1865, (Figure 2.36)), *Cyamocephalus loganensis* Currie, 1927 and *Pseudoniscus* sp. (see Eldredge, 1974), and, according to a recent study (Anderson, 1999), *Limuloides sperratus* (Woodward, 1872) and *Bunodes salweyi* (Woodward, 1872). The eurypterids present are *Pterygotus arcuatus* Salter, 1859, *Erettopterus marstoni* Kjellesvig-Waering, 1961, *Necrogammarus salweyi* Woodward, 1870 (note: publication date is probably 1871), *Carcinosoma punctatum* (Salter, 1859), and *Salteropterus? longilabium* Kjellesvig-Waering, 1961. The phyllocarids have been assigned to *Ceratiocaris* and include *C. attenuata, C. cassioides, C. gigas,* and *C. halliana* (all established in 1886 by Jones; see Morris, 1980), *C. ludensis* Woodward, 1871, *C. murchisoni* (Agassiz, 1839), and *C. pardoeana* La Touche, 1884 (Figure 2.37) and (Figure 2.38). The site stands as the type locality for nearly all of these species.

Interpretation

Alexander (1936) was the first to suggest that there is an erosional discontinuity marking the bottom of the Lower Leintwardine Formation, the sediments of which infill a channel, at Church Hill. The subsequent investigation of Whitaker (1962; see also 1994) demonstrated that the Church Hill channel was one of six in the area, all of which he interpreted as submarine canyon heads (Figure 2.35). They trend in an ENE–WSW direction, from the shelf edge at the western margin of the Midland Platform, towards the deeper water areas of the Welsh Basin. The Church Hill Channel has a gradient of 10°, cutting out to the west successively older Ludlow strata. The channel margin, showing Lower Leintwardine Formation channel fill resting unconformably on Middle Elton Formation sediments below the channel base, is present at Trippleton Lane.

The fauna of Church Hill channel as a whole is very distinctive and is mirrored closely or identically in the other five channels, with the combination of faunal composition and palaeoenvironmental setting being unknown outside rocks of this age and this part of the Welsh Borderland. Both Whitaker (1962) and Hawkins and Hampton (1927) thought that the fauna was indigenous to the channels, though the latter authors mistakenly placed them in a shallow lagoonal, rather than truly marine, situation. Goldring and Stevenson (1972), however, believed that the fauna was transported into the channels. Publication of Gladwell's research into the special nature of the channel fauna offers the possibility of addressing this and related questions. Kjellesvig-Waering (1961) assigned the eurypterid fauna of Church Hill to his Carcinosomatidae–Pterygotidae biofacies, the most open marine of the three phases that he identified for Siluro-Devonian eurypterid faunas.

The eurypterid and the two (probably synonymous; Anderson, 1999) *Limuloides* species from Church Hill are unknown elsewhere. *Pseudoniscus* records globally are very rare, the genus being known from just a few specimens of Silurian age from the Baltic, the USA, and Scotland. *C. loganensis* is known from just three specimens. *N salweyi* was determined as a pterygotid eurypterid only relatively recently (Selden, 1986); previous authors suggested either a crustacean (Salter, 1959a; Woodward, 1870, Hessler 1969) or myriapod affinity (Peach, 1899; Rolfe, 1980; Almond, 1985). The phyllocarids from Church Hill need revision before their distribution can be assessed. The xiphosurids and eurypterids were benthic in habit, and the phyllocarids probably swam in the bottom waters (Rolfe, 1984).

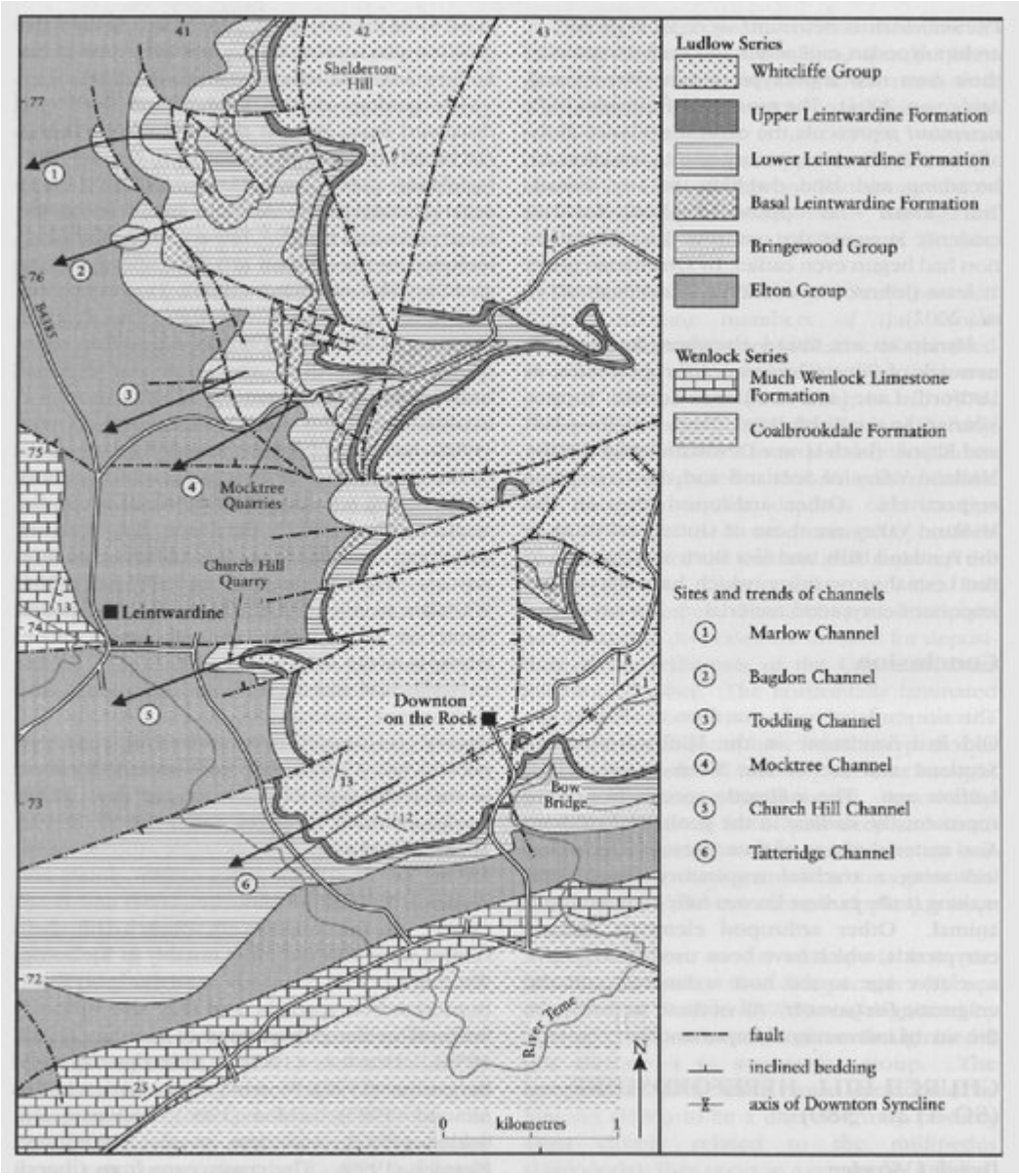
Church Hill Quarry is one of four closely related GCR Silurian arthropod sites in the compact Ludlow–Downton–Leintwardine area, the others being those of the Whitcliffe, Ludford Lane and Ludford Corner, and Tin Mill Race. The strata at Church Hill, early Ludfordian in age, are slightly older than the late Ludfordian to early P■ídolí

sediments that variously occur at these other sites. They are also fully marine, whereas the sediments at Ludford and Tin Mill Race are at least in part quasi-marine, this succession reflecting the late stage infilling of the Anglo-Welsh Basin. All of these sites have important eurypterid faunas, but the uniqueness of that from Church Hill and the fact that only this of all these sites has for certain yielded phyllocarids, marks it out. Church Hill also has links with two other upper Silurian Anglo-Welsh Basin GCR arthropod sites: Perton Lane in the Woolhope Inlier and Bradnor Hill near Kington, both of which are of P■ídolí age and have yielded significant eurypterid faunas. The Scottish Siluro-Devonian Gutterford Burn, Slot Burn, Dunside, and Turin Hill sites all yield eurypterid faunas, but unlike Church Hill these other localities notably include stylonuroid forms.

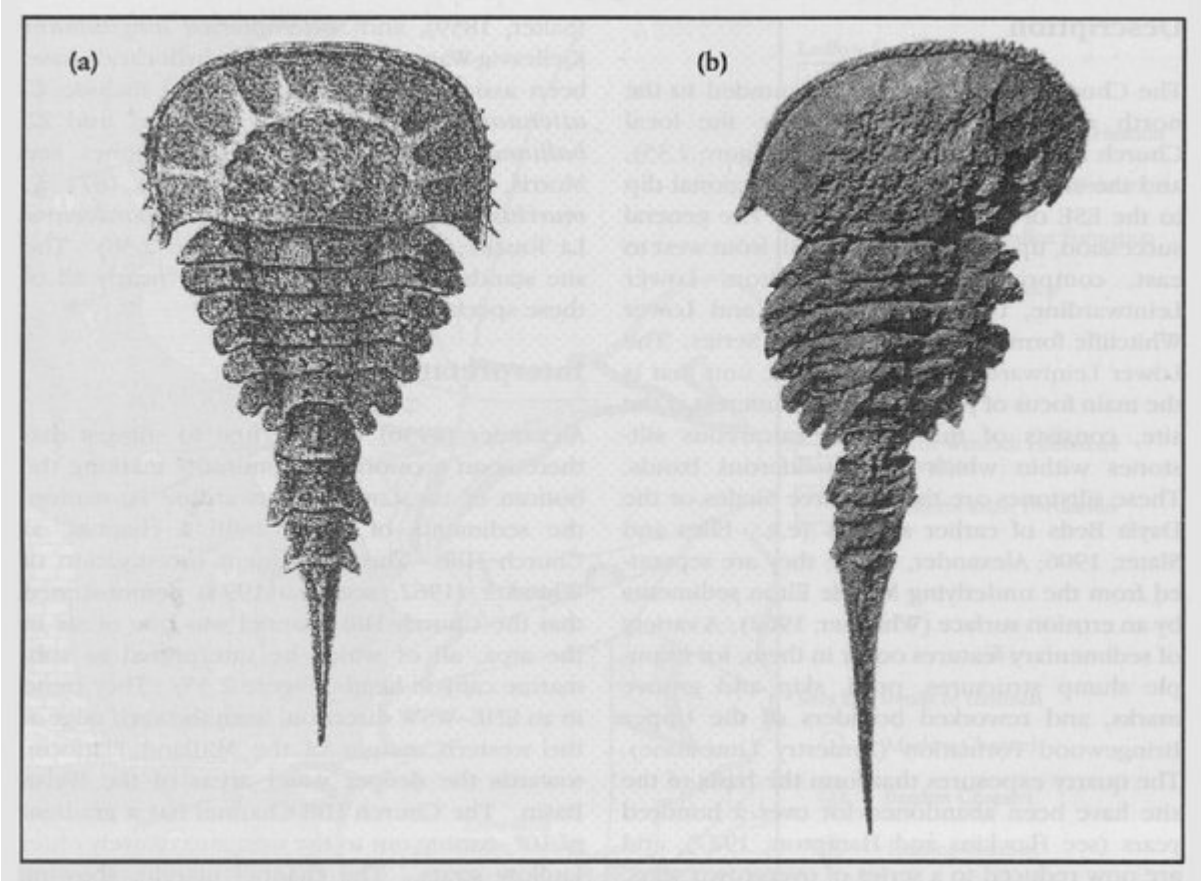
Conclusions

This very important site, of upper Silurian, Ludlow Series, lower Ludfordian age, has yielded a rather individual and varied suite of fossil arthropods that inhabited a distinctive palaeoenvironmental niche — that of a submarine canyon head. There are least four eurypterid species unique to the locality, which at the same time forms part of a network of upper Silurian eurypterid sites in the Welsh Borderland and, farther afield, in Scotland. Rare xiphosuran material belonging to three genera, and at least seven phyllocarid species, have also been recorded from the site. Church Hill stands as the type locality for numerous of these early chelicerate and crustacean species. The quarry figured heavily in the works of leading 19th century authors, thus also giving it historical significance. It has been recently re-excavated and this has provided the basis for new faunal investigations at the locality.

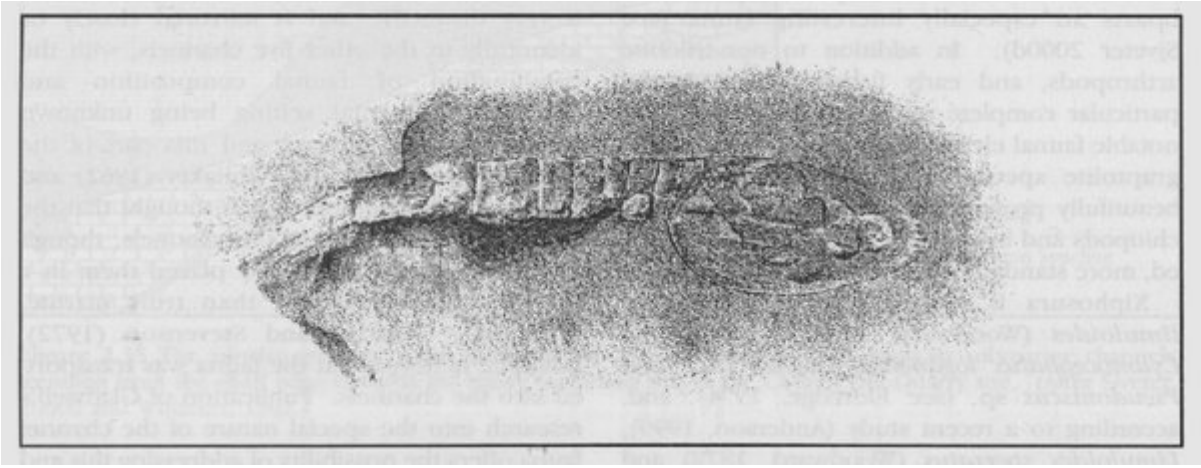
References



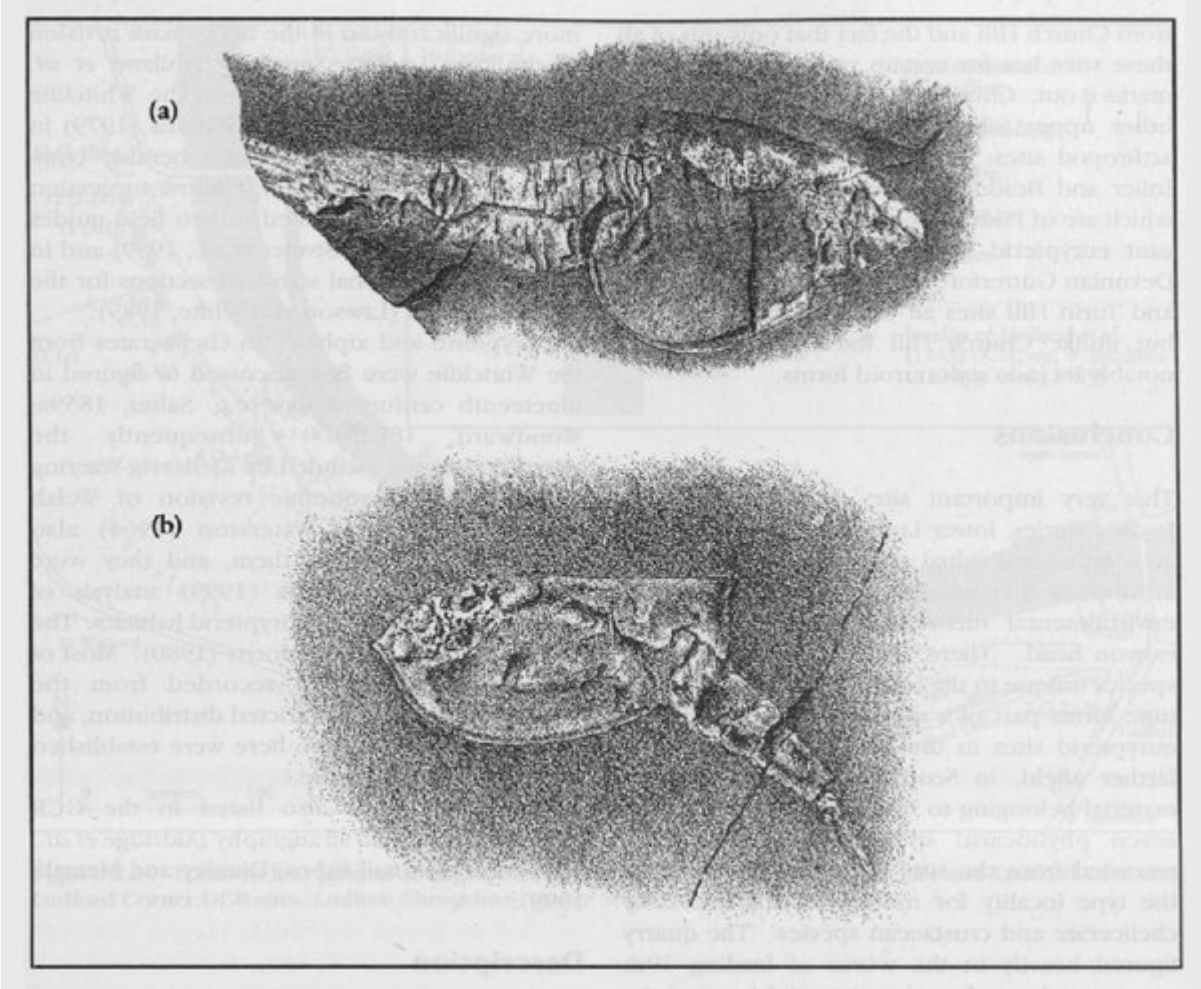
(Figure 2.35) The Silurian geology of the Leintwardine area, Herefordshire, showing six submarine channels trending from the shelf edge towards the basin, including that at the Church Hill Quarry site. (After Siveter, 2000d and Whitaker, 1962.)



(Figure 2.36) Limuloides limuloides Woodward, 1865; holotype, British Geological Survey, GSM 32393; Lower Leintwardine Formation, Ludlow Series, Silurian, Church Hill, Leintwardine area, Herefordshire. (a) Reconstruction (from Woodward, 1865b, plate 14, fig. 7a). (b) Photograph, x 1.95 (from Bergstrom, 1975, plate 1, fig. 7).



(Figure 2.37) Ceratiocaris halliana Jones, 1886; syntype, Natural History Museum, London, In.43891, x 1.5; Lower Leintwardine Formation, Ludlow Series, Silurian, Leintwardine area, Herefordshire. (Lithograph, from Jones and Woodward, 1888, plate 5, fig. 6a.)



(Figure 2.38) Ceratiocaris pardoeana La Touche, 1884; Lower Leintwardine Formation, Ludlow Series, Silurian, Church Hill, Leintwardine area, Herefordshire. (a) Natural History Museum, London, In.43889, natural size (b) Holotype, In.43894b, natural size. (lithographs from Jones and Woodward, 1888, plate 5, figs 1 and 2.)