Downton Castle area: Downton Castle Bridge, Tin Mill Race, Forge Rough Weir and Castle Bridge Mill

[SO 445 742], [SO 460 754], [SO 456 752], [SO 443 743]

Highlights

Quarries and small exposures in the Downton Castle area in Herefordshire have for some time yielded vertebrate remains, including acanthodian fragments and the osteostracan *Hemicyclaspis.* The most important recent discoveries have been substantial specimens of the unusual osteostracan *Sclerodus.*

Introduction

Several exposures in the Downton Castle Estate have yielded early fossil fishes. A network of four of these sites has been selected as good sources of fossils, and as representatives of the stratigraphical range of fishes that may be found in this small area: New Forge Rough Weir, Castle Bridge Mill Quarry, Downton Castle Bridge and the Tin Mill Race. The geology of these localities has been described by, amongst others, Elles and Slater (1906), Whitaker (1962), Holland *et al.* (1963), Allen (1974), Antia (1981), Lawson (1982), Bassett *et al.* (1982), and Siveter *et al.* (1989). Fossil vertebrates from this area have been studied by Turner (1973), Antia (1981) and Forey (1987).

Description

Elles and Slater (1906) divided the Upper Silurian of the Downton Castle area into the Aymestry Group, the Upper Ludlow Group (with the Ludlow Bone Bed at the top), and the Temeside Group. The Temeside Group was subdivided into the Downton Castle or Yellow Sandstones and the overlying Temeside or Eurypterid Shales. This corresponds to the Upper Gorstian (Stage) Bringewood Group, through Ludfordian (Stage) Leintwardine and Whitcliffe Groups to the lower part of the P■ídolí, Downton Castle Sandstone Formation and Temeside Shales Formation (Siveter *et al.,* 1989, p. 62). The Ludlow Bone Bed Member is taken as the basal unit of the P■ídolí.

Fauna

The fossil vertebrate remains from these several localities listed include much material that is too poor to be identified even at generic level.

AGNATHA

Osteostraci: Sclerodontiformes:

Sclerodontidae

Sclerodus pustulliferus Agassiz, 1839

Osteostraci: Ateleaspidiformes: Ateleaspididae

Hemicyclaspis murchisoni (Egerton, 1857)

Hemicyclaspis sp.

Thclodonti: Thclodontida: Coelolcpididac

Thelodus parvidens Agassiz, 1839

T. costatus (Pander, 1856)

T. bicostatus (Hoppe, 1939)

Thelodonti: Thelodontida: Loganellidae

Loganellia ludlowiensis Gross, 1967

GNATHOSTOMATA: Acanthodii

acanthodians indet.

New Forge Rough Weir [SO 456 752] shows a fine exposure of the Ludlow Bone Bed, the Downton Castle Sandstone Formation and a discrete Downton Bone Bed. Both bone beds are thick consistent units, unlike those at Ludford Corner (q.v.). Both bone beds contain quantities of thelodont denticles and acanthodian spines, and *Hemicyclaspis* sp. has also recently been found here. This site has also yielded important arthropod specimens (Manning, 1992). The section as a whole illustrates the environmental transition from marine to estuarine conditions which is also seen at Ludford Corner.

Castle Mill Quarry [SO 443 743] has recently provided a relatively abundant collection of *Sclerodus pustuliferus* material (Figure 3.21). The quarry, exposing the Downton Castle Sandstone Member of the Downton Castle Sandstone Formation (Bassett *et al.,* 1982), exhibits a massive, parallel-laminated pale yellow to pale olive, coarse micaceous siltstone showing channelling and uneven scoured surfaces. Two small, laterally impersistent bone beds with abundant *Platyschisma helicites,* separated by 0.7 m of siltstone, in the base of this section have yielded specimens of *Sclerodus.*

The southern river bank at Downton Castle Bridge [SO 445 742] shows two fish-bearing exposures. One on the west side of the path that goes south to Hunstay Cottage, exposes the Ludlow Bone Bed and the Downton Bone Bed. Elles and Slater (1906, pp. 208–9) and Holland *et al.* (1963, p. 135) describe this site. An old quarry and disturbed ground show the Ludlow Bone Bed 4 ft (1.2 m) above the level of the road with the Downton Bone Bed about 2 ft (60 cm) higher. This has been known as a fossil site for many years, having been visited by the Woolhope Naturalists Field Club in 1854. Close by, and separated by a fault from the first (Siveter *et al.,* 1989, p. 62), at the west end of the track, which branches off to follow the south side of the river, are exposures of the Temeside Shale Formation. One such small exposure has yielded well-preserved headshields of *Hemicyclaspis* sp. from the basal Temeside Beds. The site has been known to yield fishes for many years. Banks (1893) reproduced a letter from Lightbody in 1860, who compared the cephalaspids from Oakley Park and Tin Mill with those from a new drive that had just been cut opposite Downton Castle in which he found 'cephalaspid' heads.

Tin Mill Race [SO 460 754] is a historically important site that has yielded fossil fishes together with abundant eurypterid remains to collectors for many years. The section exposed here in the old mill race (Figure 3.22) was first described by Lightbody (1870); he named the beds the 'Tin Mill Shales' and correlated them with the Ledbury Shales (basal Ledbury Formation). Marston (1870) provided a list of the fossils collected from the 'upper bone bed' at this site. This is the bone bed equated with the Temeside Bone Bed at Temeside (q.v.) by Elles and Slater (1906, p. 213). The lower bone bed lies near the base of the section and contains generally smaller fragments of acanthodian spines.

At all Downton Castle sites, acanthodian remains predominate, together with *Pterygotus* fragments. Turner (1973) listed the very phosphatized thelodont scales from the bone bed at Tin Mill Race. The faunal list, compiled from Elles and Slater (1906), Whitaker (1962) and Turner (1973), includes acanthodians, an anaspid scale and thelodonts. Most of these fishes are described in the Ledbury, Ludlow and Temeside reports (q.v.), and only *Sclerodus* is discussed in part here.

Sclerodus pustuliferus Agassiz, 1839 is an extremely rare and poorly known osteostracan which is usually found as small fragments. Very few specimens have been collected, and recent finds of well-preserved large fragments in the Downton Castle area are important. *Sclerodus pustuliferus,* the sole representative of the aberrant Family Sclerodontidae Fowler, 1947, is known only from the Downtonian of the Welsh Borders. Forey (1987) listed all known sites for the 55 specimens that show any detail. The history of interpretations of *Sclerodus* is given in the Ludford Lane report (q.v.).

The characteristic and unusual feature of *Sclerodus,* its long 'cornua', are about twice as long as the cephalic shield measured medially, and project directly to the rear (Figure 3.21). The inner cornual margin is not as well defined by thickened bone or cusps as in other cornuate cephalaspids. Stensiö (1932) considered this to be a true cornuum, and reconstructed *Sclerodus with* a pectoral sinus. On the other hand, Denison (1951a) and Janvier (1985a) thought that it was really the lateral margin of the cephalothorax, the remainder of which was probably unarmoured. Forey (1987) confirmed this, for reasons of its shape, lack of ornament on inner sides, and the lack of evidence of insertion of pectoral fins. This area is well seen on several of the Downton Castle Quarry specimens. There are no pectoral sinuses, thus *Sclerodus* cannot have had pectoral fins. Instead the 'cornua' seem to thin slowly to the inner edge that must have consisted merely of a thin wedge or 'flap' of unstrengthened bone. It is hard to see such a fragile but large structure being self-supporting and functional as a cornu-al 'fin'. Forey (1987) also pointed out the lack of canals in the cornua, and suggested that, like *Trematas*pis or *Oeselaspis* (forms with a long cephalothorax), the exoskeleton was coextensive with the endoskeleton which probably curved to line the edge of the shield.

Lankester (1870) thought that the four large fenestrae on each side in the lateral part of the shield were cells within the exoskeleton and were roofed and floored by bone. Stensiö (1927) interpreted them as remnants of the lateral sensory field; Stensiö (1932), Denison (1951a) and Forey (1987) realized that they were holes which passed right through the shield. These marginal perforations have thick vertical inner walls, which are ornamented by tubercles in the same way as the rest of the dorsal surface of the cephalic shield. This feature is not seen in other osteostracans. The only obvious analogue is with the lunules of modern-day clypeasteroid echinoids (sand-dollars), in which they improve stability in currents and during burial in shallow water environments. Forey (1987) suggested that if *Sclerodus* were subject to varying water speeds, the fenestrae would provide stabilization to compensate for overall body shape.

Interpretation

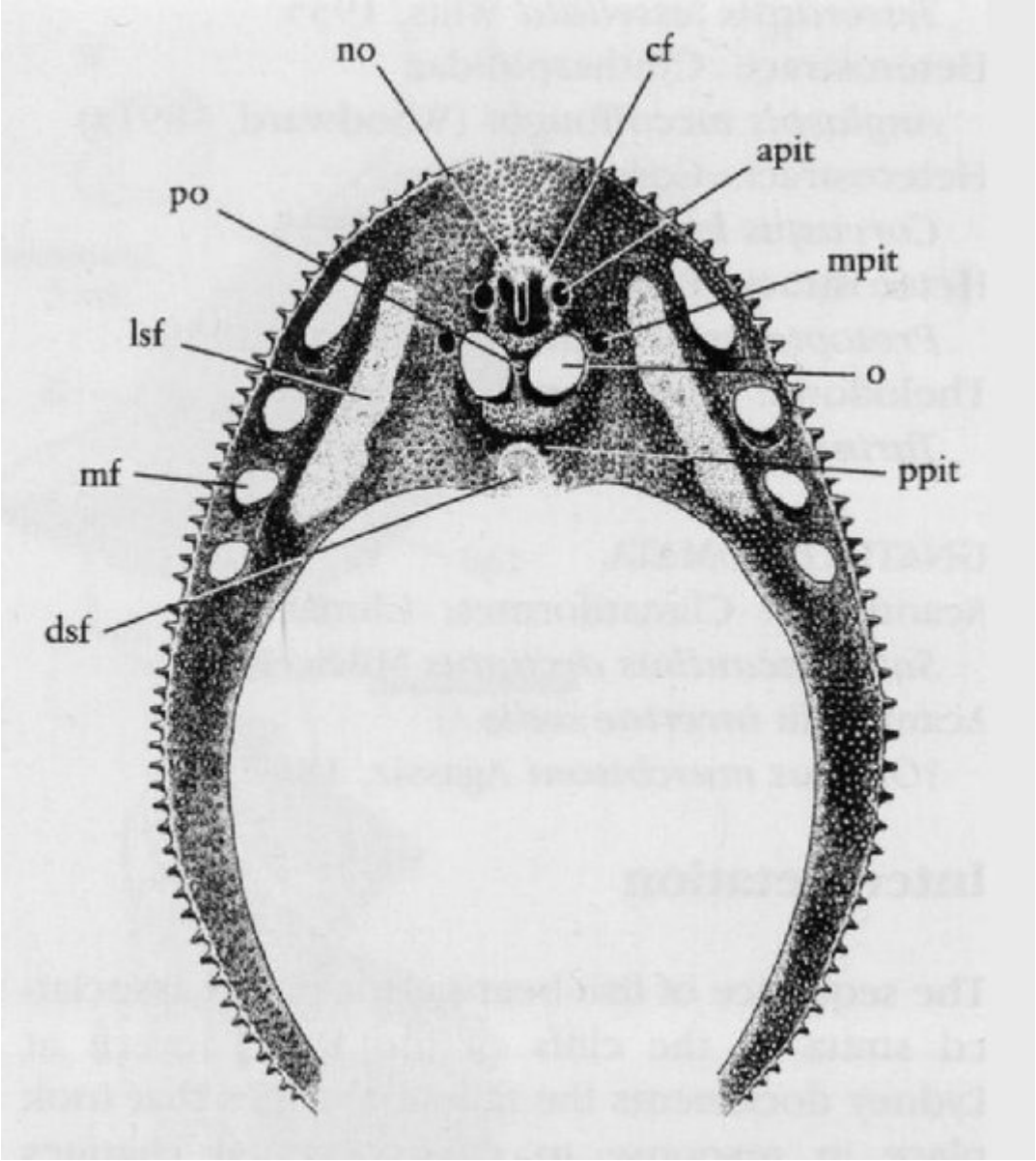
The Downton Castle Bridge fish beds are probably at a slightly lower horizon than those at Temeside (q.v.), and the lithology also differs. The headshields of the hemicyclaspids were slightly smaller (Ludlow Museum specimens) and variations in form possibly related to slightly different environments. *Sclerodus* may have inhabited areas with soft sandy substrates subject to vigorous currents.

Conclusion

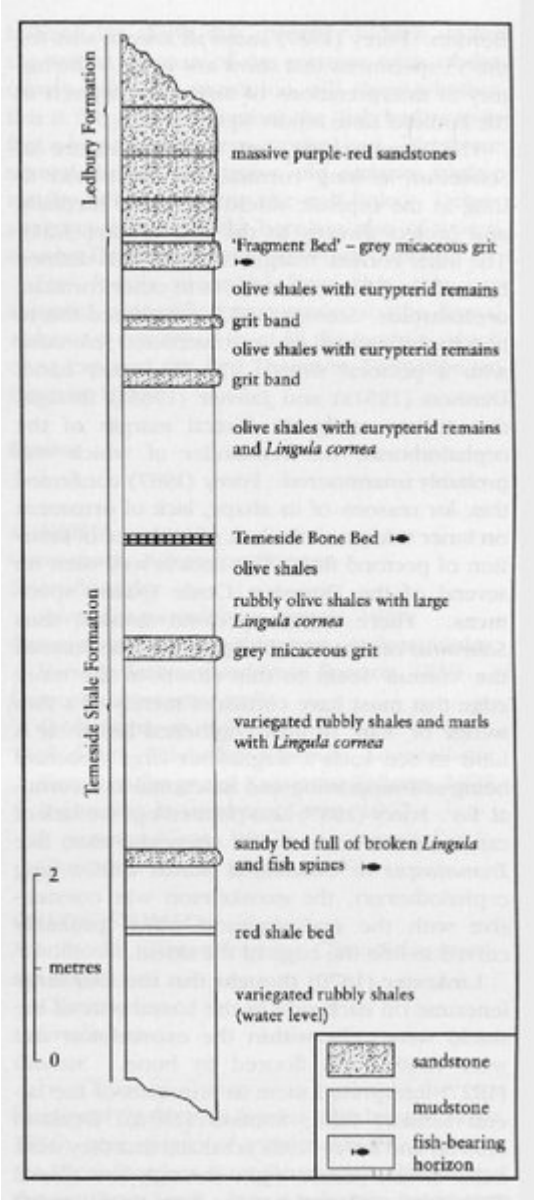
Together, the sites in the Downton Castle area give information on the environments and fish faunas of the latest Silurian, hence their importance and conservation value. The area as a whole has good exposure and the relationships between the groups of rocks can be well seen, unlike the situation which occurs in other, better-known sites that have yielded fish fossils of this type and age (e.g. Temeside, Ludlow and Ledbury railway cutting).

Recent finds of well-preserved large pieces of the head shield from the quarry at Downton Castle have enhanced our knowledge of the enigmatic osteostracan *Sclerodus.*

References



(Figure 3.21) Sclerodus pustuliferus, cephalic shield in dorsal view; apit, anterior pit; cf, central field; dsf, dorsal sensory field; lsf, lateral sensory field; mf, marginal foramen; mpit, median pit; no, nasal opening; o, orbit; po, pineal opening; ppit, posterior pit; approximately natural size (after Forey, 1987, © The Natural History Museum, London).



(Figure 3.22) The stratigraphical section at Tin Mill Race (after Elles and Slater, 1906).