
Besom Farm Quarry

[SO 6076 8194]

Highlights

Besom Farm Quarry in Shropshire is the source of a variety of fossil fishes, including the first-found (type) specimens of some species, as well as some that have never been found elsewhere. It is the most prolific fish site in the Upper Dittonian of the area.

Introduction

Besom Farm Quarry is a small quarry east of Besom Farm that yields from the upper part of the Ditton Series (Ball and Dineley, 1961) a diverse fauna, including the type specimens of many species. There are remnants of small quarries on the south-east-facing slopes to the east of Besom Farm. The fish have been described by White (1956, 1960, 1961, 1969) and referred to by Whittard (1953), Denison (1956, 1970, 1978), Ball and Dineley (1961), Dineley and Loeffler (1976), Westoll (1979), Blicek and Jahnke (1980) and Blicek (1980, 1982b, 1984).

Description

There are two intraclast conglomerate ('cornstone') bands in Besom Farm Quarry (Figure 4.19). The upper unit is a concretionary corn-stone overlain by a layer of conglomeratic reworked nodules, which are rich in plates and large fragments of vertebrates. This unit is weathered and stratified, easily worked and is probably the band that yielded most material in the past. It is separated by just over 1 m of unfossiliferous sandstone and siltstone from the lower 0.4–0.6 m thick unit of massive intraclast conglomerate, which is extremely hard and difficult to work.

To the south of Besom Farm Quarry, a band of hard concretionary conglomerate can be traced down the slope to the stream. It contains many small bone fragments. This may be the lateral continuation of the lower 'cornstone' bed. Other thin bands outcrop in the stream at [SO 6075 8160] and [SO 6097 8162], but no outcrop of rock resembling the upper 'cornstone' bed could be found in this area.

The lower 0.4–0.6 m thick unit of massive and cross-bedded cornstone is extremely difficult to work, but contains fragmentary fossil remains, with rare finely preserved plates of *?Althaspis* sp. The only major work done here (Ball and Dineley, 1961) describes their collection of fishes as coming from the 'cornstone exposed at the top of old quarry, on the southern side', without any doubt the Upper 'Cornstone' Bed described above.

Fauna

AGNATHA

Thelodonti: Thelodontiformes: Turiniidae

'*Turinia pagei* fauna' (see (Table 4.1))

Heterostraci: Pteraspidiformes: Pteraspidae

Althaspis leachi White, 1934

Europrotapsis crenulata White, 1961

Osteostraci: Benneviaspidae

Benneviaspis salopiensis White, 1961 cf. *Kiaeraspis* n. sp.

GNATHOSTOMATA

Placodermi: Arthrodira: Arctolepidae

cf. '*Plataspis*' sp.

Placodermi: Arthrodira: Actinolepidae

Wheathillaspis wickhamkingi (White, 1961)

Heightingtonaspis anglica (Traquair, 1890)

H. willsi (White, 1961)

Acanthodii incertae sedis

Onchus ?besomensis White, 1961

O. wheathillensis White, 1969

Nodonchus bambusifer White, 1961

'*Plectrodus*' type tooth

climatiid shoulder girdle

Besom Farm Quarry is the type locality for the pteraspid species, *Europrotaspis crenulata* (White, 1961; (Figure 4.20)). This is a well-known species, founded on plentiful material, mainly from this site. White (1961) based *Protaspis* (*Europrotaspis*) *crenulata* on specimens from Besom Farm Quarry, Prescott Reaside, Farlow Brook Bridge and Upper Overton Quarry: The lectotype is an imperfect eroded dorsal shield with a fractured rostrum, and most of the right orbital plates were lost before fossilization, during which time *Spirorbis* shells colonized the under surface of the shield. The specimen is preserved in the round, but present-day weathering had removed the whole of the dorsal disc, and the dorsal side of the right branchial.

The first fragments of this form were discovered by L.J. Wills and used as an index fossil for post-*Rhinopteraspis crouchi* Zone Dittonian strata (White, 1950a). The ornamentation on the plates of the carapace and on the scales is of the typical pteraspid ridge and furrow type, but is coarser than most and unlike any other British species. The ridges are arranged approximately parallel to lines of growth (Denison, 1970), and they appear to be beaded, a feature also seen in *Europrotaspis arnelli* from Podolia.

Europrotaspis crenulata is the only described British species. *Protaspis* sp. was recorded from Watergate Bay, Newquay, by Denison (1956) but the material is in need of revision. *Europrotaspis* also occurs in Podolia (*E. arnelli*), Belgium (*E. wiheriesiensis*) and Germany (*E. rotunda*). These last two species remain poorly defined and their generic attribution is not certain (Blieck and Jahnke, 1980; Blieck, 1984).

White (1961) erected the subgenus *Europrotaspis* for *Protaspis crenulata* and *P. arnelli* from Podolia, and separated them from the American protaspids because of the differing position of the branchial opening and the form of the cornual plate. Denison (1970) concluded that *Europrotaspis* and *Protaspis* differed only slightly, but he retained both in his revised classification of the Pteraspidae. *Europrotaspis* was raised to the level of genus by Blieck and Jahnke (1980) and Blieck (1984), with *E. crenulata* designated as the type species. It was defined (Blieck and Jahnke, 1980; Blieck, 1984) as a medium-sized pteraspid with a large dorsal shield. Blieck (1984) listed *Europrotaspis* in the Family Pteraspidae, with closest similarity to *Rodenaspis* from the Lower Devonian of Wyoming, and he erected a new subfamily, the Protaspinae, for *Protaspis*. *Europrotaspis* remains in the Pteraspinae as it retains the cornual plate, a

feature lost in protaspidines.

Althaspis leachi White, 1938 is the only other pteraspid from Besom Farm Quarry. Its type locality is Swanlake Bay, Dyfed, but it also occurs at Mitcheldean Quarry, various sites in the Clee Hill area and in France and Belgium. Thus it provides a useful means of correlation with continental strata of Pragian age, partially filling a stratigraphical gap between the 'crouchi-rostrata' Zone of the Dittonian and the 'dunensis' Zone of the Breconian (White, 1956, 1960). *Althaspis* is defined by the presence of an extensive subrostral surface covered with dentine ridges, and lacking a preoral field (Denison, 1970; Dineley and Loeffler, 1976). It was redescribed by White (1961), based mainly on material from Besom Farm Quarry. The other British species of *Althaspis* is *A. senniensis* Loeffler and Thomas, 1980 from the Senni beds of Powys (Figure 4.21).

The osteostracan species *Benneviaspis salopiensis* White, 1961 is based on a single specimen discovered in 1952 in the Upper Cornstone band (Whittard, 1953). This is a distorted, badly preserved cephalic shield of moderate size lacking cornua, but showing eyes and sensory fields (White, 1961). *Benneviaspis* is also known from Spitsbergen. White suggests a closer relationship between *B. salopiensis* and the Wood Bay Series Spitsbergen benneviaspids than with the other English species, since the former taxa have a distinctive, wide median dorsal sensory field, whereas the other English species have a narrow dorsal field, as do the benneviaspids from the earlier Red Bay Series of Spitsbergen.

Rare arthrodire fragments from Besom Farm Quarry are important since they represent some of the earliest British material of this group. Three species, and other unspecified fragments, have been found at this quarry, which is the type locality for *Heightingtonaspis ?willsi* and *Wheathillaspis wickhamkingi*. These have been reported from the higher (cornstone) level only, but two forms of arthrodire fragments occur in the two beds associated with *Althaspis leachi* and *Europrotaspis crenulata* (White, 1961), and those from the lower unit may be new species.

Heightingtonaspis White, 1969 is probably the oldest, and one of the most primitive, British arthrodires (Denison, 1978). There are two species, occurring at Besom Farm Quarry, and one species from the Upper Lochkovian of Maine, USA. *Heightingtonaspis anglica* (Traquair, 1890), the genotype, is from Cradley, Worcestershire. White (1961) reassigned this form to *Kujdanowiaspis anglica*, but later separated the English species from the Podolian *Kujdanowiaspis* (White, 1969, p. 305). *Heightingtonaspis anglica* occurs rarely but widely in the Welsh Borders and at Longhope, Gloucestershire. In the Clee Hills it is the only vertebrate species common in both the 'crouchi' and 'leache' beds (White, 1969). *Heightingtonaspis ?willsi* White, 1961 was established as a new species *Kujdanowiaspis willsi*, based on several fragments from Besom Farm Quarry, the holotype being a small spinal plate (25 mm long). A single specimen from Goldtops, Gwent, is referred to this species or subspecies by White (1969). The status of *H. ?willsi* is hard to resolve with so little material.

White (1961) based *Wheathillaspis wickhamkingi* on a small specimen consisting of an anterior ventro-lateral plate with part of the spinal plate attached. This is the only known locality for *W. wickhamkingi*, with the exception of an anterior ventro-lateral plate from Upper Overton Quarry, Clee Hills, (now overgrown). The only distinguishing feature is the large oblique pectoral fenestra that is preserved in the holotype.

Besom Farm Quarry is the type and only locality for three species of acanthodian, based on three different types of spine. *Ischnacanthus (?) anglicus* White, 1961 was erected for an isolated fin spine and a small, finely ribbed spine showing the inserted part. *Ischnacanthus* occurs in the Upper Silurian and Lower Devonian of Canada, Scotland and the Welsh Borders, and ischnacanthids occur in the Early Devonian of Australia (Long, 1986). *Onchus wheathillensis* (White, 1961) was based on a single symmetrical and slightly arched median fin spine, ornamented by narrow, sharp, smooth ribs separated by deep and wide grooves, from Besom Farm Quarry. *Onchus ?besomensis* White, 1961 was also based on a single fragment of a large spine with long narrow ribbing.

Interpretation

Investigations into the fish fauna of this and other high Dittonian sites has shown geographical differences. Specimens of *Althaspis* from the Clee Hills area have finer ornamentation than those from Swanlake Bay, while those from Belgium have coarser ornamentation. White (1961) thought that this series represents a coarsening of ornamentation through

slightly younger forms, but Blicek (1982b) credited the difference between the British and the French *A. leachi* to the differing local ecological conditions, as with *Rhinopteraspis crouchi* and *Pteraspis rostrata* (Blicek, 1980; Blicek and Jahnke, 1980). The fauna, comprising ptera-spids, cephalaspids, arthrodiere and acanthodians, maintains the level of diversity of older Dittonian levels, and a similarity of vertebrate community structure probably existed.

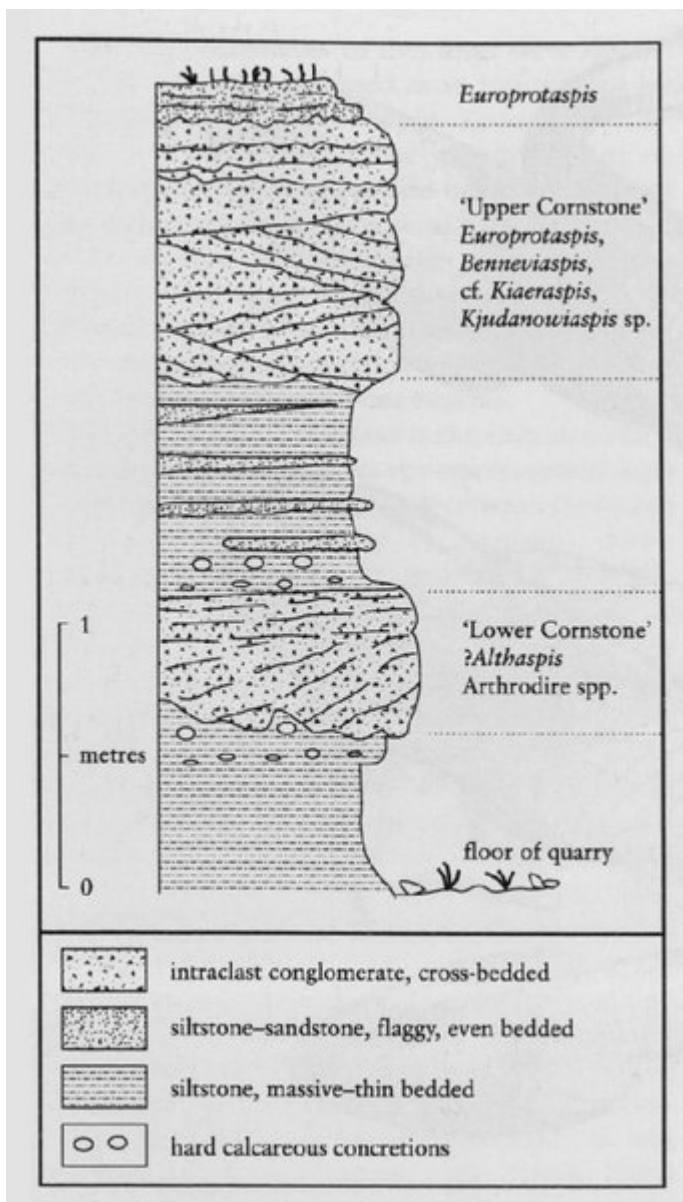
Comparison with other localities

At high levels within the Ditton Group and its equivalents in Wales there are relatively few highly fossiliferous sites with *Althaspis* (*Pteraspis*) *leachi*. Mention is made above of the occurrence of the species in South Wales and Belgium. In Shropshire the species occurs also at Bockleton Brook (Ball and Dineley, 1961). Localities with *Europrotaspis crenulata* in the Clee Hills area are at Upper Oventon Quarry, Prescott Reaside and Farlow Brook Bridge (Ball and Dineley, 1961). In none of these localities is the fauna so extensive as at Besom Farm.

Conclusion

Besom Farm Quarry has yielded a diverse and rich fish fauna, and it is the location for seven type specimens of heterostracan, osteostracan and acanthodian fishes; it is the sole locality for five of them. This site yields the most prolific fish fauna in the Dittonian of the area, hence its conservation value. The productive level is virtually worked out in Besom Farm Quarry, occurring as a well-weathered bed at the top of the southern side of the quarry, but there is potential for further collecting.

References

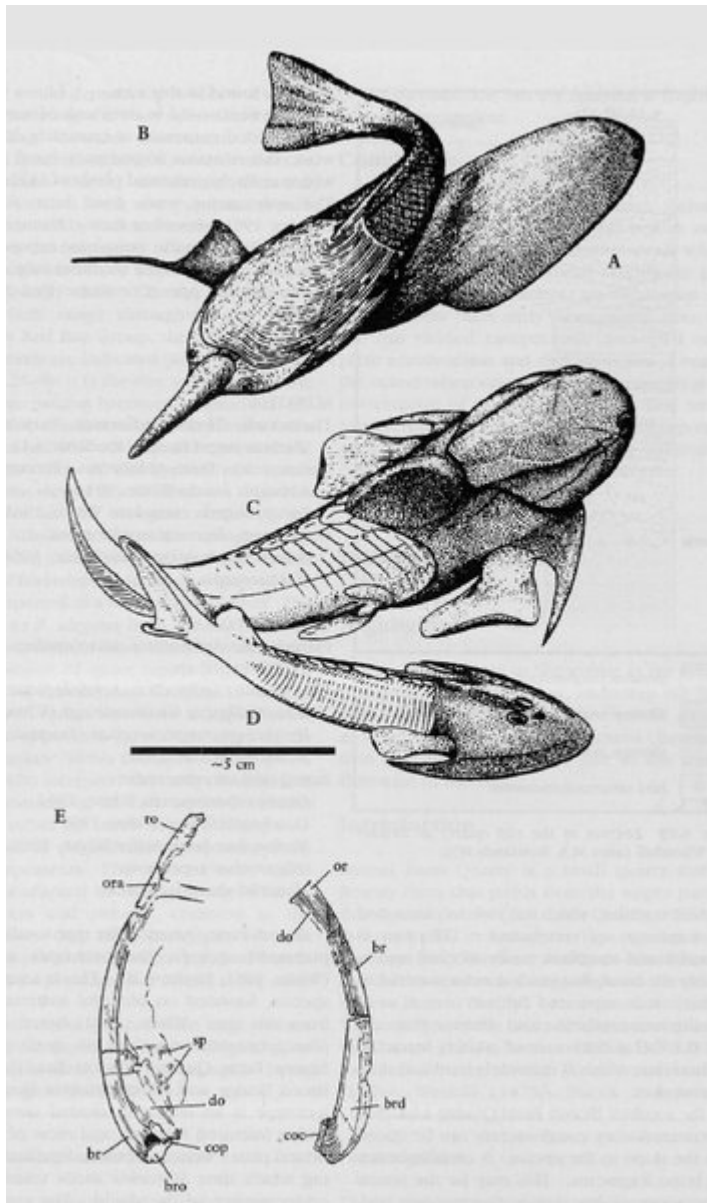


(Figure 4.19) Section in the old quarry at Besom Farm, Wheathill (after M.A. Rowlands MS).

Thelodont fauna	Stratigraphical Formation
<i>Turinia paget</i> <i>T. paget</i> fauna with <i>Apalolepis</i>	Ditton Group ' <i>Psammosteus</i> ' Limestone Lower Ditton Group
<i>Goniporus</i> , <i>L. kummerowi</i> , <i>Katoporodus</i> sp. with <i>L. cuneata</i>	Upper Red Downton Group
Acanthodians only	(M. Downtonian) Holdgate Sandstone Group
<i>Thelodus parvidens</i> fauna, with <i>G. alatus</i> and <i>K. tricavus</i> <i>T. parvidens</i> fauna, including <i>L. ludlowiensis</i> , <i>T. bicostatus</i> , <i>T. trilobatus</i> , <i>T. pugniformis</i> , and <i>T. costatus</i> <i>T. parvidens</i> , <i>L. ludlowiensis</i> and <i>T. bicostatus</i> <i>T. parvidens</i> and <i>L. ludlowiensis</i>	Lower Red Downton Group

(Table 4.1) Thelodont faunas in the Upper Silurian-Lower Devonian Old Red Sandstone of the Anglo-Welsh Basin. They are based on scale species (largely after Turner, 1973): recent discoveries, as yet unpublished, show that other fish

groups are also represented by scales and may be of similar stratigraphical value.



(Figure 4.20) Restorations by Blicek and Janvier (1989) of vertebrates occurring in the Lower Devonian at Artois, France. The same species (A, B, C, D, E) and *Pattenaspis* occur in South Wales and the Welsh Borderland. (A) *Turinia pagei* (Powrie); (B) *Rhinopteraspis crouchi* (Lankester); (C) *Kujdanowiaspis* sp.; (D) *Pattenaspis artesensis* (Agassiz); (E) *Protaspis* (*Europrotaspis*) *cremulata* White, the holotype (NHM P28801) an imperfect dorsal shield c. x 0.66. br, Branchial plate; bro, branchial opening; brd, branchial duct; coc, cornual contact surface on branchial plate; cop, cornual plate; do, dorsal disc; or, orbital plate; ora, orbit; ro, rostrum; sp, shells of spirorbis attached to undersurface of dorsal disc (after White, 1961).



(Figure 4.21) *Althaspis senniensis*:(A) rostral plate from Hoel Senni Quarry; (B) a ventral disc from Hoel Senni Quarry (after Loeffler and Thomas, 1980), both approximately natural size.