J.N.C.C.

Fossil Fishes of Great Britain

D.L. Dineley

Department of Geology
University of Bristol
Bristol, UK

and

S.J. Metcalf

Humber Estuary Discovery Centre,
North East Lincolnshire Council
Cleethorpes, UK

GCR Editor: **D. Palmer**

JOINT NATURE CONSERVATION COMMITTEE

Chapter 7

Mid- and Late Devonian fossil fishes sites of England and Wales

D.L. Dineley

INTRODUTION: PALAEOGEOGRAPHY AND STRATIGRAPHY

During Mid- and Late Devonian times, Laurussia, the Old Red Sandstone continent, extended over most of the British Isles, with its southern coastline running across southern Ireland and across England from the Severn Estuary to the Thames (Figures 7.1 and 7.2; Dineley, 1992). The coastline was not static, however, and continental facies (the Hangman Grits and Pickwell Down Sandstone) fed into north Devon from time to time as the boundary shifted south. Late Devonian marine beds are found within the Old Red Sandstone in South Wales, when the sea moved north.

The Upper Old Red Sandstone of Wales and the Welsh Borders rests unconformably on Lower Old Red Sandstones and coarse clastics prevail, reaching a maximum thickness of about 330 m in south-west Wales. Rivers flowed mainly towards the south-east, and clasts of igneous and sedimentary rock fragments suggest source areas as far as 400 km away in the Moinian–Dalradian of north-west Ireland and the Scottish Highlands. There may also have been a separate landmass on the southern side of the Bristol Channel, as indicated by some northerly palaeocurrent directions in alluvial fans feeding into South Wales. The Upper Old Red Sandstone deposits were mainly relatively thin alluvial sediments that heralded the thicker marine transgressive Carboniferous beds.

Lower Devonian continental rocks are present in south Devon and Cornwall (Dineley, 1966, 1992) and locally contain ostracoderm and other vertebrate remains. The marine Middle and Upper Devonian of Devon and Cornwall may have been deposited in a partly independent basin, although some deltaic clastic sediments fed into North Devon from time to time. Most of the sediments were fully marine, and show increasing evidence of offshore deposition to the south, with extensive limestone and reef formations in south Devon (Dineley, 1992).

Much of the stratigraphy of the Middle and Upper Devonian fish-bearing units of the Cornubian rocks (Figure 7.3) is poorly controlled. Some of the marine beds may be dated readily on the basis of conodonts, goniatites and corals, but facies containing the less stratigraphically useful corals, bivalves and brachiopods are more typical. The Old Red Sandstone is poorly dated. Here and there, fish faunas and rare palynomorphs give evidence of age, but only in general terms.

ENVIRONMENTS

Late Devonian continental deposits rest unconformably upon the Early Devonian throughout South Wales and the Welsh Borders, indicating a phase of uplift and erosion prior to a resumption of primarily fluvial deposition. The sedimentology of these Upper Old Red Sandstone rocks has been interpreted by Allen (1965). The environments of deposition ranged from fluvial and alluvial, comparable to those in Early Devonian times, to coastal delta fans and lagoons in the south. Devonian continental sedimentation was succeeded by the marine transgression of the Early Carboniferous with its transistional sequence of shales and thin limestones (Webby, 1966).

South of the Bristol Channel the Cornubian basin received several thousand metres of sediment, derived apparently from the north. Conspicuous within these strata are the thick Hangman Grits and the sandy Picknell Down Sandstone and Baggy and Upcott Beds. Diastrophism has rendered these rocks difficult to decipher for palaeoenvironments, but the general view is that all are predominantly marine proximal facies in north Devon and Somerset, but of deeper water facies in south Devon and Cornwall. Active tectonism and volcanic activity occurred throughout the southern region in Mid- and Late Devonian times.

The agnathan, placoderm and acanthodian fossils in the slates of the north Cornish coast occur in fine-grained lithologies, which elsewhere have marine fossils. They may have occupied marine habitats or at least been interred in shallow coastal lagoons or shelf environments, quite distinct from those to the north.

In the southern part of Devon the section begins with a continental facies in the Dartmouth Slate. This is a facies yielding only rare fossils, but pteraspidid and cephalaspidid fragments have been reported from many sites in South Devon and eastern Cornwall (Dineley, 1966, 1986).

FISH FAUNAS

Fossil fishes occur in the Old Red Sandstone facies and in some shallow marine sediments of

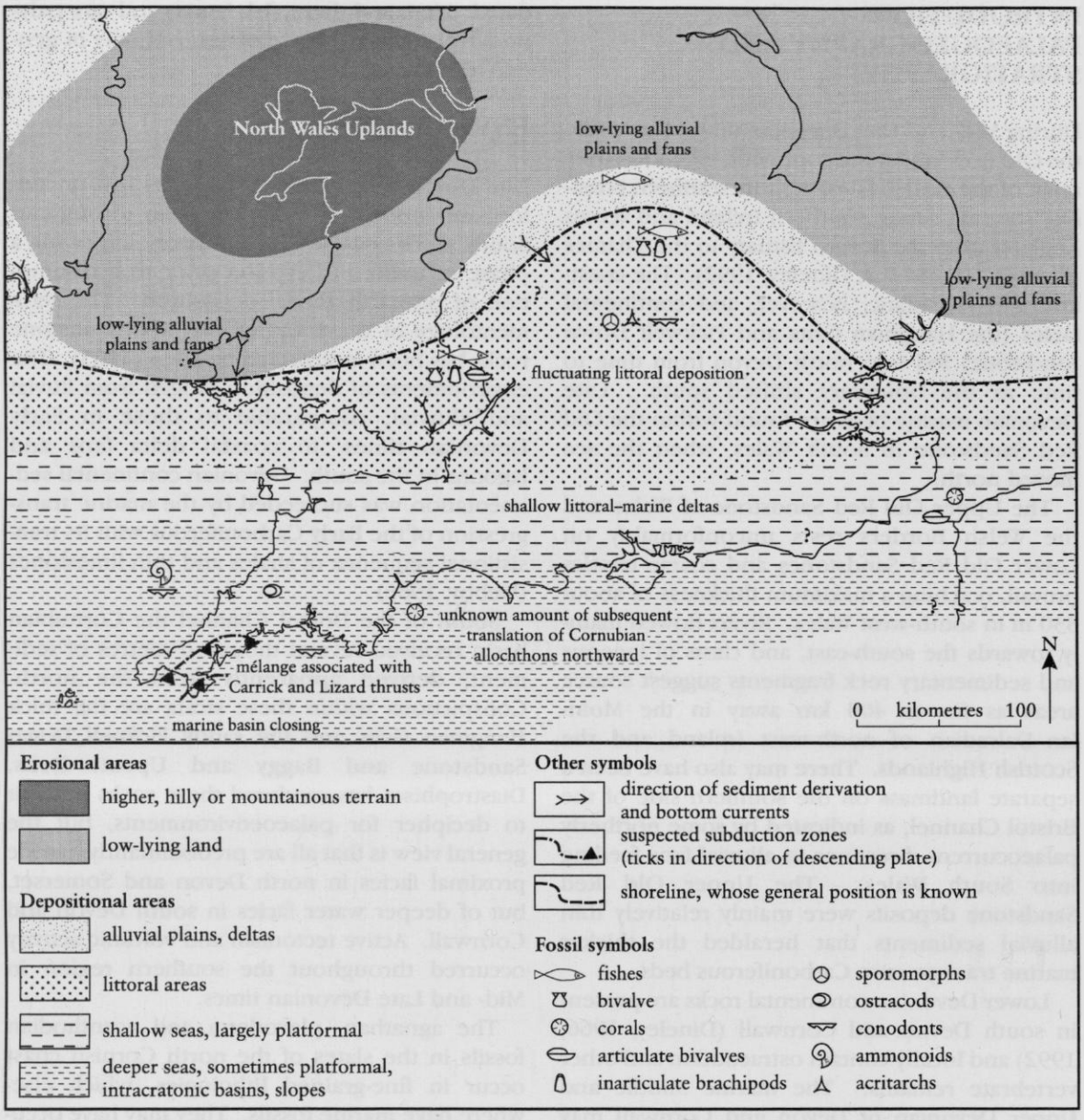

Figure 7.1 The palaeogeography of southern England and Wales during Late Devonian time (*c.* 370–365 Ma), based upon outcrop and borehole evidence (after Bluck et al., 1992).

the Middle to Upper Devonian in the Anglo-Welsh Basin and Cornubia. Interestingly, the marine fishes of Devon and Cornwall are not markedly different from those of the Old Red Sandstone of the Anglo-Welsh Basin, with the occurrence of typical Late Devonian elements, such as the placoderm *Bothriolepis* and the rhipidistian *Holoptychius*. This could indicate a broad environmental tolerance of those forms, or that they had perhaps been washed into the sea from Old Red Sandstone continent rivers, where they may have been common.

Representation of the Upper Devonian in the Old Red Sandstone of southern Britain was established in mid 19th century from the evidence of its fossil fishes. Comparison with the better known faunas of Scotland was made by the early authors. The Upper Devonian fossil fish assemblages of England and Wales are dominated by remains of *Bothriolepis* and *Holoptychius*, but a relatively small number of other species also occurs. Most are predators. The British Late Devonian continental faunas seem to be far less diverse than those elsewhere.

Bothriolepis is a cosmopolitan antiarch genus known from over 100 described species. These fossils were for a long time the only means of dating otherwise barren strata, but floras and palynomorph assemblages now aid this task.

FISH SITES

Isolated scales of *Holoptychius* and plates of *Bothriolepis* have been found at many localities in the Upper Old Red Sandstone of the Welsh Borders and South Wales and, more rarely, in the Upper Devonian of north Cornwall and north Devon. Five sites are selected as GCR fish sites for the Mid- and Late Devonian (Figure 7.2), Bedruthan Steps, Cornwall, and Mill Rock, north Devon, in the marine beds of the south-west, and in the Upper Old Red Sandstone, Afon Y Waen, Clwyd, Portishead in Avon and Prescott Corner, Shropshire. Each of them has yielded a distinctive assemblage of fossils, and occurs in a distinctive facies, and with differing modes of preservation and accumulation, they are not all exactly coeval, but represent accumulations at different depths and distances from land, or sediment source areas. They are all important in the history of investigation of the Devonian rocks of southern Britain.

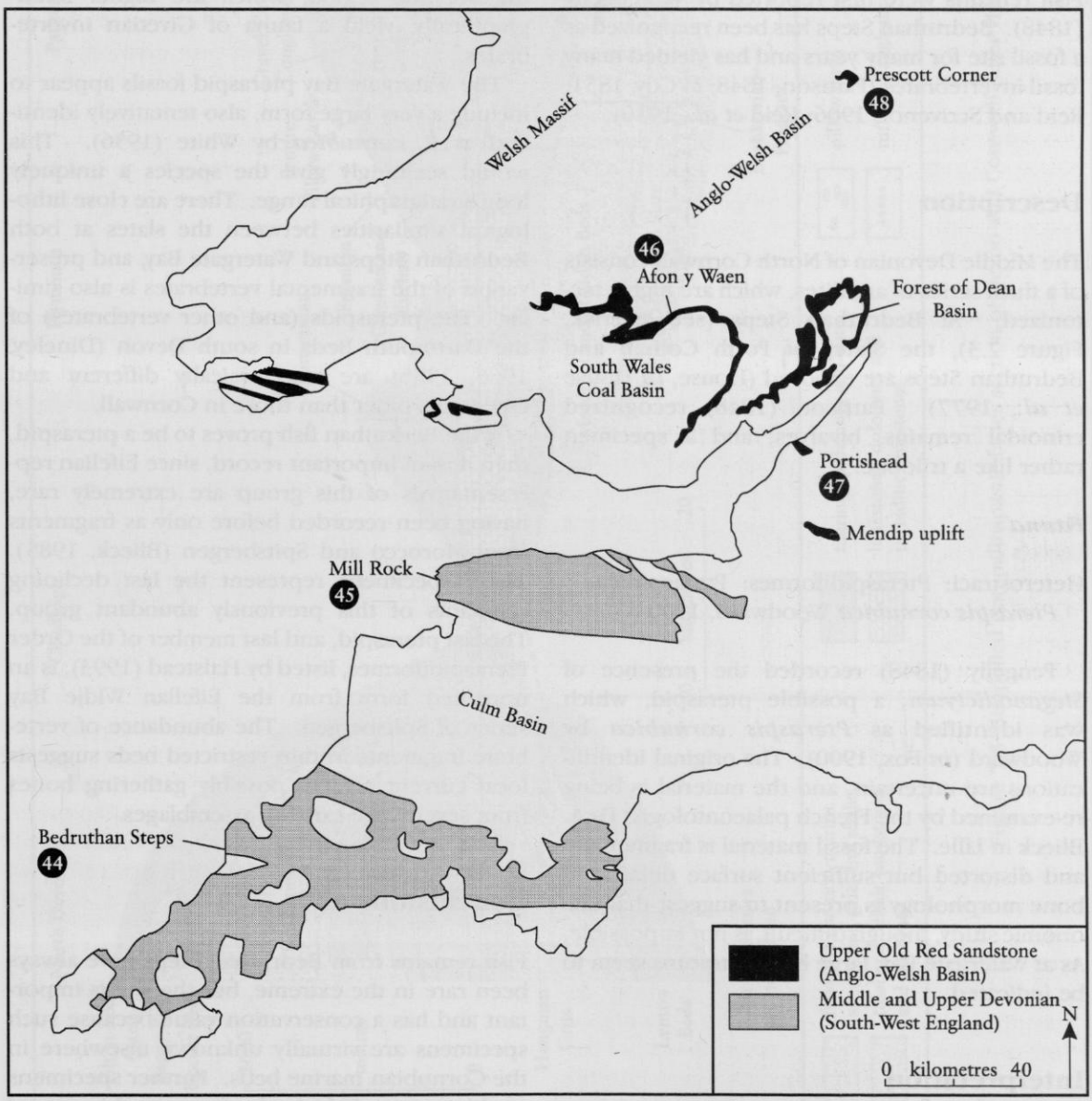

Figure 7.2 Distribution of Mid and Late Devonian outcrops and GCR sites in England and Wales (site numbers as in Table 1.2).

BEDRUTHAN STEPS (SW 849695)

Highlights

Bedruthan Steps, Cornwall, is the source of rare fish specimens representing possibly a late and large pteraspid. The importance of the specimens is raised because they are rare elsewhere in north Cornwall, and because these may be some of the last recorded pteraspids.

Introduction

Fish remains were first reported by W. Pengelly (1848). Bedruthan Steps has been recognized as a fossil site for many years and has yielded many fossil invertebrates (Pattison, 1848; M'Coy, 1851; Reid and Scrivenor, 1906; Reid *et al.*, 1910).

Description

The Middle Devonian of North Cornwall consists of a thick series of argillites, which are highly tectonized. At Bedruthan Steps (see asterisk, Figure 7.3), the Slates of Porth Cothan and Bedruthan Steps are exposed (House, *in* House *et al.*, 1977). Pattison (1848) recognized crinoidal remains, bivalves, and a specimen rather like a trilobite.

Fauna

Heterostraci: Pteraspidiformes: Pteraspididae
Pteraspis cornubica Woodward, 1900

Pengelly (1848) recorded the presence of *Steganodictyum*, a possible pteraspid, which was identified as *Pteraspis cornubica* by Woodward (*in* Fox, 1900). The original identifications are uncertain, and the material is being re-examined by the French palaeontologist Dr A. Blieck in Lille. The fossil material is fragmentary and distorted but sufficient surface detail and bone morphology is present to suggest that taxonomic study, though difficult, is not impossible. As at Watergate Bay, large heterostracans seem to be indicated.

Interpretation

It has proved impossible to date the Slates of Porth Cothan and Bedruthan Steps, partly because of the rarity of biostratigraphically useful fossils, and partly because the sediments are so tectonized. The invertebrate fauna suggests an Eifelian age, and the large pteraspid fish, if such it is, would suggest a maximum age limit of Eifelian. The Purple and Green Slates of Watergate Bay, which lie at the bottom of this succession, have produced rare fish remains that might indicate Pragian age (White, 1956). The Staddon Grits may be Emsian in age (House, *in* House *et al.*, 1977), hence bracketing the Slates of Porth Cothan and Bedruthan Steps as Emsian to Eifelian. The Trevose Grits of the neighbouring Trevone region, which are higher stratigraphically, yield a fauna of Givetian invertebrates.

The Watergate Bay pteraspid fossils appear to include a very large form, also tentatively identified as *P. cornubica* by White (1956). This would seemingly give the species a uniquely long stratigraphical range. There are close lithological similarities between the slates at both Bedruthan Steps and Watergate Bay, and preservation of the fragmental vertebrates is also similar. The pteraspids (and other vertebrates) of the Dartmouth Beds in south Devon (Dineley, 1966, 1986) are taxonomically different and essentially older than those in Cornwall.

If the Bedruthan fish proves to be a pteraspid, then it is an important record, since Eifelian representatives of this group are extremely rare, having been recorded before only as fragments from Morocco and Spitsbergen (Blieck, 1985). These specimens represent the last declining remnants of this previously abundant group. The last pteraspid, and last member of the Order Pteraspidiformes, listed by Halstead (1993), is an unnamed form from the Eifelian Widje Bay series of Spitsbergen. The abundance of vertebrate fragments in thin restricted beds suggests local current activity, possibly gathering bones from several pre-existing assemblages.

Conclusion

Fish remains from Bedruthan Steps have always been rare in the extreme, but the site is important and has a conservation value because such specimens are virtually unknown elsewhere in the Cornubian marine beds. Further specimens could come to light in the future at this coastal site.

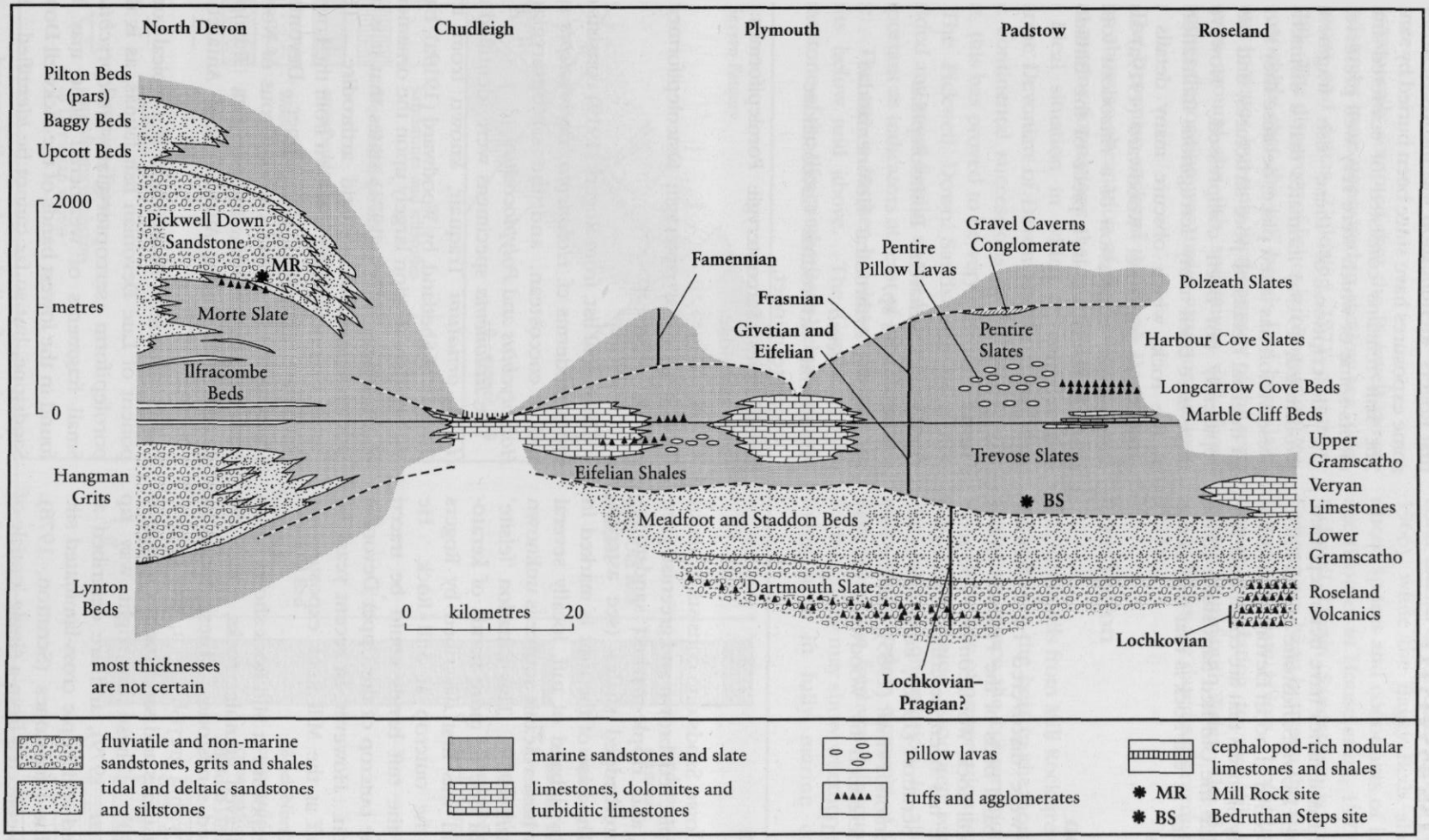

Figure 7.3 Simplified non-palinspastic facies section of Devon and Cornwall (after House, 1975).

MILL ROCK (SS 45544311)

Highlights

Five species of fossil fishes have been reported from the Pickwell Down Sandstone of Mill Rock, the only such record in north Devon. The fishes include a variety of forms that are commoner farther north within the Old Red Sandstone continent. Their value at Mill Rock is that they occur in marine beds.

Introduction

Fish remains were discovered by Inkerman Rogers in the basal beds of the Pickwell Down Sandstone at Mill Rock, Woolacombe. The geology of the site has been described by Rogers (1919, 1926), Scrutton (1978), Edmonds *et al.* (1979), and Edmonds *et al.* (1985), and the fish fossils were described by Woodward (1919a) and Miles (1971).

Description

The Pickwell Down Sandstone consists of about 1000 m of purple, red, brown and greenish grey, cross-bedded and ripple-marked sandstones with some interbedded shales (see asterisk, Figure 7.3). The base of the unit is marked in many places by a band of tuff, locally several metres thick, whose volcanic source is unknown (Edmonds *et al.*, 1985). This Bittadon 'felsite' Tuff consists of one or more bands of keratophyric tuff and was first described by Rogers (1926) from the outcrop at Mill Rock. He believed that the tuff bands could be traced throughout the outcrop of the Upper Devonian of north Devon. However, in recent years no undoubted tuff at the Mill Rock exposure has been observed.

Today the exposure at Mill Rock shows bands of strongly cleaved granular rocks, which are metamorphosed sandstones. These bands lie concordantly within greyish green, grey or purple shales, siltstones and sandstones dipping at about 60°/190°. These are right way up (Edmonds *et al.*, 1979), and are described as wavy, laminated and ripple cross-laminated siltstones and fine sandstones (Scrutton, 1978). Rogers (1919) collected from a single lenticle of tuff, no longer to be seen, which suggests either that Rogers' identification was incorrect, or that some exposures have since been buried by sand. The fish remains consisted of scattered fragments some of which were very well preserved. The description of these fish fragments (Woodward, 1919a) intimates that a distinctive preservation has taken place, because they show all internal details of pore structures, and have apparently not been compressed. However, there have been many 'ferruginous infiltrations' in the rock, which obscure many details of microscopic structure. Woodward (1919a) also mentions an impression of a rhizodont tooth *(Polyplocodus)* within a piece of the Bittadon Tuff.

Fauna

Placodermi: Antiarchi: Bothriolepidae
Bothriolepis sp.
Placodermi: Arthrodira: Holonematidae
cf. *Holonema*
Placodermi: Arthrodira: Coccosteidae
coccostean indet.
Osteichthyes: Sarcopterygii: Porolepiformes: Holoptychiidae
Holoptychius sp.
Osteichthyes: Sarcopterygii: Osteolepiformes
Polyplocodus sp.

The faunal list, from Rogers (1919) consists of the placoderms cf. *Holonema*, *Bothriolepis* sp. and a coccostean, and the sarcopterygians *Holoptychius* and *Polyplocodus*.

The *Holonema* specimens were identified as *H.* cf. *ornatum* Traquair, known from the Givetian of Shetland, by Woodward (1919a), basing his identification largely upon the ornament of the plates. Miles (1971) states that it is an indeterminate holonematid arthrodire. The Family Holonematidae is known from the Lower Devonian (Pragian) to Upper Devonian (Famennian) or Lower Carboniferous of North America, Greenland, Spitsbergen, Europe, Russia, Iran, India, Australia and Antarctica (Denison, 1978).

The placoderm *Bothriolepis* is a typical component of Late Devonian fish faunas, as is the porolepiform sarcopterygian *Holoptychius*. Small fragments of weathered bone may be found in the lowest bands of the Pickwell Down Sandstone, but so far cannot be identified. No other macrofossils have been discovered.

Interpretation

It is generally accepted that the Pickwell Down Sandstones were deposited in shallow sea, tidal lagoons and deltas (Goldring, 1971; Scrutton, 1978). The discovery of fishes led Rogers (1926) to conclude that the tuff bands had been laid down in water, but only further study of the sediments around the fish specimens will show whether deposition was under water or subaerial.

The Devonian rocks of the north Devon outcrop show an alternation of shallow marine and non-marine formations that would seem to be an ideal situation in which to correlate the marine Devonian of Devon and Cornwall with the continental successions farther north. In fact, this has proved to be very difficult.

The Pickwell Down Sandstones have not yielded any zonal fossils, so the fishes have been important as indicators at least of Late Devonian age. The age is further bracketed by datable units below and above. The Combe Martin Limestone of the Ilfracombe Beds below displays coral faunas of Givetian aspect (Webby, 1965b, 1966), while the Baggy Beds above have produced spores and conodonts of late Famennian age (House, *in* House *et al.*, 1977). Hence, the Pickwell Down Sandstone is dated as early Famennian, lying between the Givetian and late Famennian date points. Unfortunately nothing closely correlating to the Mill Rock fauna is known from South Wales. The Plateau Beds faunas in Wales are dated as Famennian (Hall *et al.*, 1973).

Conclusion

The fish fossils from Mill Rock are not abundant, but they are the best in the north Devon Late Devonian, hence the conservation value of the site. The mode of preservation is uncommon in this region, being associated with tuff bands. The faunal composition is also intriguing, including as it does elements of the Upper Old Red Sandstone freshwater faunas to the north. Further study may show whether the fishes were living here in fully marine conditions, or

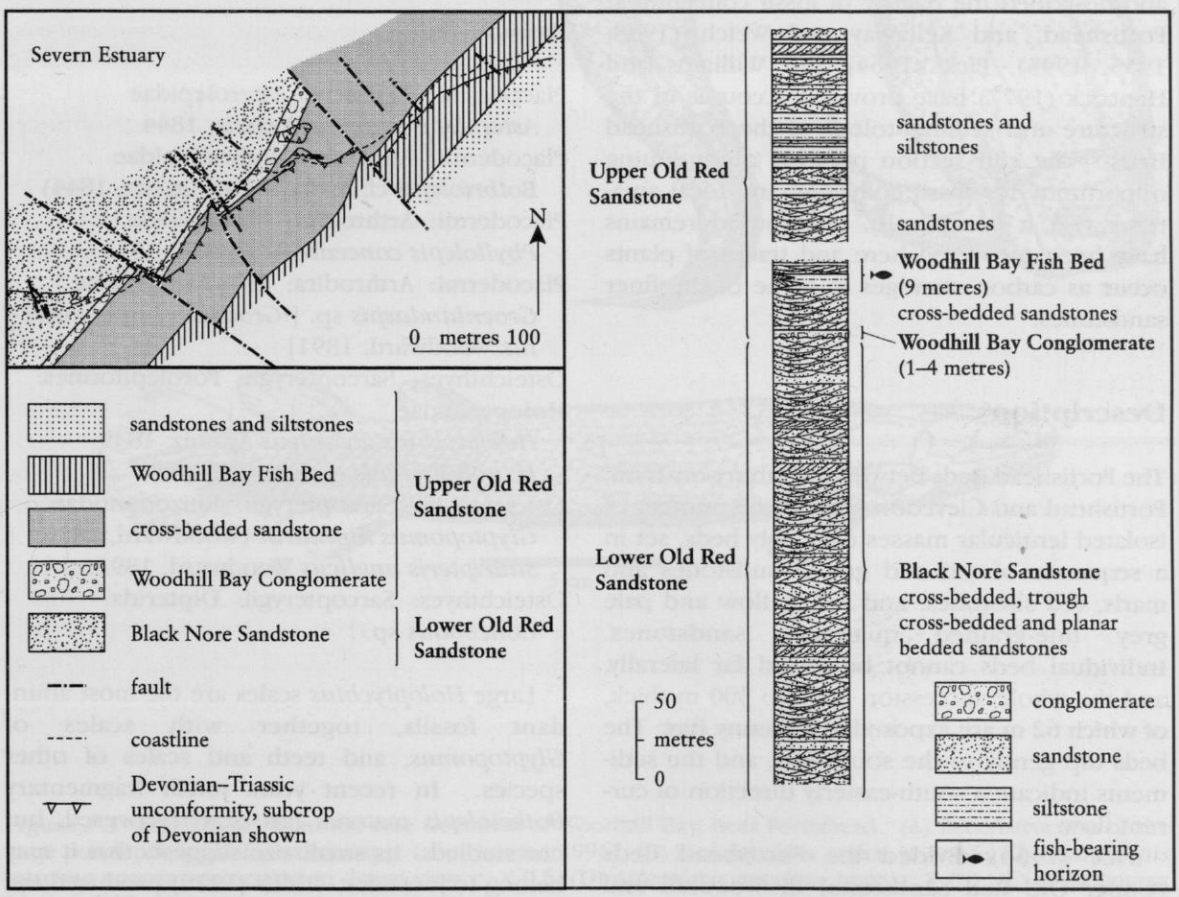

Figure 7.4 Sketch map and section through the Late Devonian near Portishead (after Pick, 1964).

whether they had been washed out to sea from the neighbouring land.

PORTISHEAD (ST 461770)

Highlights

The Woodhill Bay Fish Bed at Kilkenny Bay, Portishead, in Avon has yielded 12 species of fossil fishes, including the only British record of *Groenlandaspis*, a widespread form known otherwise from Ireland, Greenland, the Catskill Mountains, Pennsylvania, the Middle East, Australia and Antarctica.

Introduction

The Woodhill Bay Fish Bed was first described by Sanders (1863), having been discovered by the Rev. B. Blenkiron from loose blocks on the foreshore. Fossil fish collections were reported by Bailey (1865), Gardiner (1894), Wallis (1928) and Ritchie (1975). Wallis (1928) gave a section and described the history of fossil collecting at Portishead, and Kellaway and Welch (1948, 1955, 1993), Pick (1964) and Williams and Hancock (1977) have provided accounts of the structure and sedimentology of the Portishead Beds. The cliff section presents a continuing opportunity for fossil collecting and local amateurs visit it periodically. Eurypterid remains have been recovered here and traces of plants occur as carbon smudges in some of the finer sandstones.

Description

The Portishead Beds between Westbury-on-Trym, Portishead and Clevedon consist of a number of isolated lenticular masses of pebbly beds, set in a sequence of red and green mudstones and marls, red siltstones, and red, yellow and pale grey fine-grained quartzose sandstones. Individual beds cannot be traced far laterally, and the whole succession is up to 300 m thick, of which 62 m are exposed in Kilkenny Bay. The beds dip gently to the south-east, and the sediments indicate a south-easterly direction of current flow.

Pick (1964) divided the Portishead Beds (Upper Old Red Sandstone) in Woodhill and Kilkenny Bays into nine units, which are separated from the Black Nore Sandstones (?Lower Old Red Sandstone) by an unconformity, and are overlaid unconformably by Triassic Dolomitic Conglomerate. At the base of the Portishead Beds is the Woodhill Bay Conglomerate, a 4–4.5 m thick unit of poorly sorted clasts of vein quartz, chert and red quartzite, which rests on an eroded surface on top of the Black Nore Sandstone (Figure 7.4).

The Woodhill Bay Fish Bed (Williams and Hancock, 1977) is unit F of Pick (1964), and represents Beds 5–10 of Wallis (1928). It is 10 m thick, and consists of red micaceous siltstones and quartzitic sandy siltstones with a few thin green siltstone beds. Sandstones become more common in the middle and upper part of the unit and there are four prominent fine-grained sandstone beds that can be traced across the outcrop. The pebbly sandstones rest on erosion surfaces cut into the finer-grained sandstones of this unit, showing evidence of channel deposits fining up into overbank or floodplain deposits. Figure 7.4 is a representation of the Portishead Beds section at Woodhill Bay.

Fauna

Placodermi: Antiarchi: Asterolepidae
Asterolepis maxima Agassiz, 1844
Placodermi: Antiarchi: Bothriolepidae
Bothriolepis cf. *hydrophila* (Agassiz, 1844)
Placodermi: Arthrodira: Phyllolepida
Phyllolepis concentrica Agassiz, 1844
Placodermi: Arthrodira: Phlyctaenaspidae
Groenlandaspis sp. [?*Groenlandaspis disjectus* Woodward, 1891]
Osteichthyes: Sarcopterygii: Porolepiformes: Holoptychidae
Holoptychius giganteus Agassiz, 1839
H. nobilissimus Agassiz, 1839
Osteichthyes: Sarcopterygii: Rhizodontidae
Glyptopomus kinnairdi (Woodward, 1859)
Sauripteris anglicus Woodward, 1891
Osteichthyes: Sarcopterygii: Dipterida
Conchodus sp.

Large *Holoptychius* scales are the most abundant fossils, together with scales of *Glyptopomus*, and teeth and scales of other species. In recent years much fragmentary *Bothriolepis* material has been recovered, but not studied. Its small size suggests that it may belong to juveniles. Wallis (1928) produced the following faunal list from the Woodhill Fish Bed:

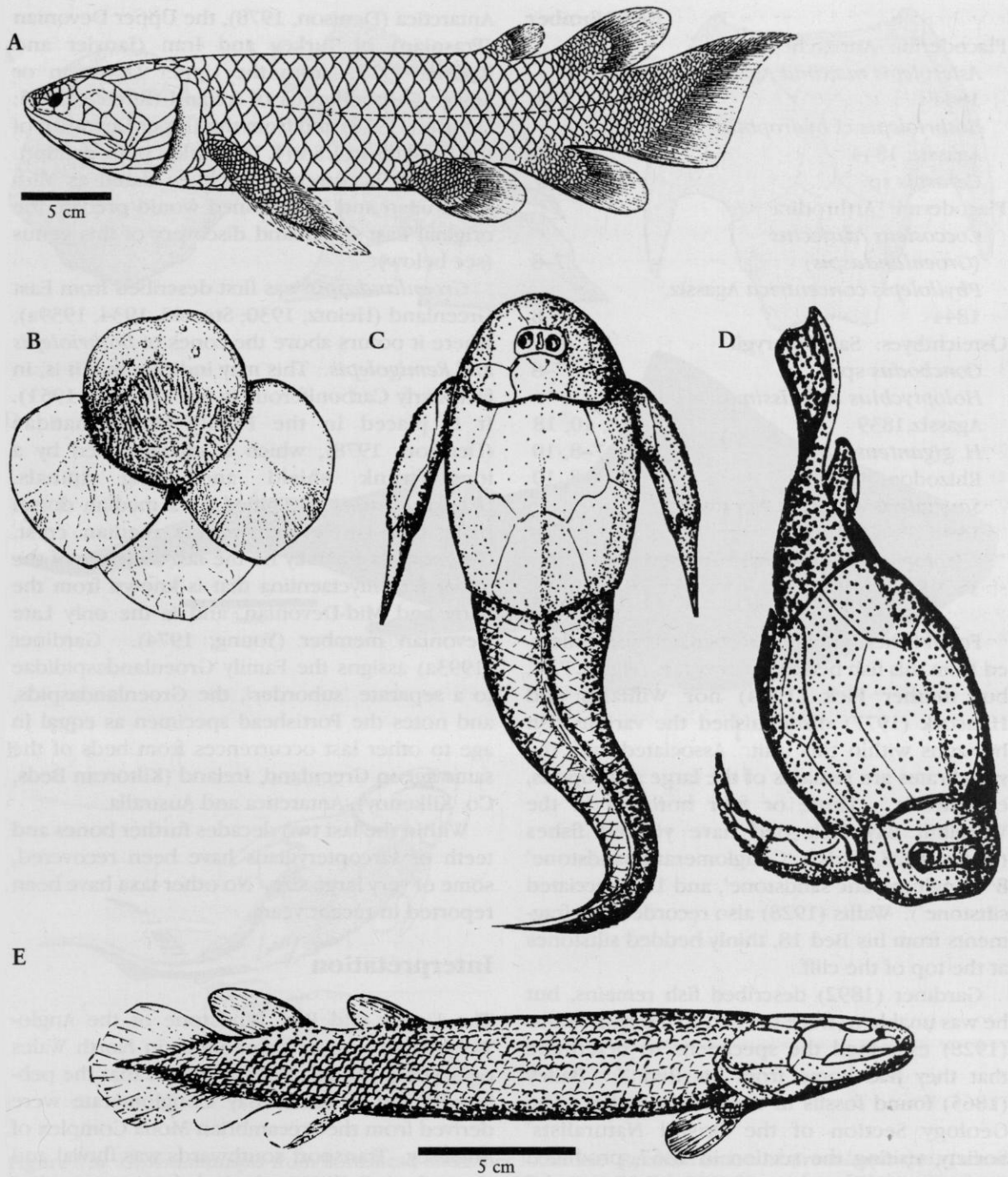

Figure 7.5 Fossil fishes from the Late Devonian of Woodhill Bay, near Portishead. (A) Reconstruction of the large porolepiform *Holoptychius* spp. (after Janvier, 1996); (B) *Holoptychius* scales, *c.* × 0.5; (C) *Bothriolepis maxima* Agassiz, restoration in dorsal view, *c.* × 0.5; (D) *Asterolepis maxima* Agassiz, × 0.3; (E) *Glypopomus kinnairdi* Woodward restoration after Jarvik.

	Bed Number
Placodermi: Antiarchi	
Asterolepis maxima Agassiz, 1844	7–8
Bothriolepis cf *hydrophila* Agassiz, 1844	7–8, 10
Ceraspis sp.	7–8
Placodermi: Arthrodira	
Coccosteus ?disjectus (*Groenlandaspis*)	7–8
Phyllolepis concentrica Agassiz, 1844	7–8
Osteichthyes: Sarcopterygii	
Conchodus sp.	7–8
Holoptychius nobilissimus Agassiz,1839	7–8, 10, 18
H. giganteus	7–8, 10
Rhizodontids	7–8, 10
Sauripteris anglicus Woodward, 1891	7–8
Glyptopomus kinnairdi Huxley, 1859	7–8, 10, 18

Fossil fishes had been recognized and collected from this fish bed for many years (Figure 7.5), but neither Pick (1964) nor Williams and Hancock (1977) distinguished the various fish horizons within this unit. Associated with the vertebrates are remains of the large arthropods, eurypterids. Three or four horizons in the Woodhill Bay Fish Bed have yielded fishes (Wallis, 1928, Beds 7 'Conglomeratic sandstone' 8 'Conglomeratic sandstone', and 10 'Brecciated siltstone'). Wallis (1928) also recorded fish fragments from his Bed 18, thinly bedded siltstones at the top of the cliff.

Gardiner (1892) described fish remains, but he was unable to trace the bed to the cliff. Wallis (1928) examined the specimens to determine that they had come from his Bed 7. Bailey (1865) found fossils in the cliff in Bed 8. The Geology Section of the Bristol Naturalists' Society, visiting the section in 1867, produced the Martyn Collection in BRSMG, all from Bed 8 (Wallis, 1928). The first specimens came from Bed 10 on the foreshore (Bailey, 1864; Wallis, 1928).

A more recent record (Ritchie, 1975) from the Woodhill Bay Fish Bed is the arthrodire placoderm *Groenlandaspis* sp. (Figure 7.6), the only English record of this genus, which is known from the Middle Devonian of Australia (Long, 1983), the Upper Devonian of Ireland (Woodward, 1891a), Greenland, Australia and Antarctica (Denison, 1978), the Upper Devonian (Frasnian) of Turkey and Iran (Janvier and Ritchie, 1977), from the Upper Devonian or Lower Carboniferous of Ireland (Ritchie, 1975; Denison, 1978) and from the Upper Devonian of the Catskills in USA (T. Daeschler, pers. comm.). The latter occurrence has been dated as Mid-Famennian and if confirmed would predate the original East Greenland discovery of this genus (see below).

Groenlandaspis was first described from East Greenland (Heintz, 1930; Stensiö, 1934, 1939a), where it occurs above the zones of *Bothriolepis* and *Remigolepis*. This may indicate that it is, in fact, Early Carboniferous in age (Westoll, 1951). It is placed in the Family Holonematidae (Denison, 1978), which is characterized by a long trunk shield and long spinals. *Groenlandaspis* is typified by a median dorsal plate that is elevated into a median crest. *Groenlandaspis* may be the last member of the Suborder Phlyctaeniina that is known from the Early and Mid-Devonian, and is the only Late Devonian member (Young, 1974). Gardiner (1993a) assigns the Family Groenlandaspididae to a separate 'suborder', the Groenlandaspids, and notes the Portishead specimen as equal in age to other last occurrences from beds of the same age in Greenland, Ireland (Kiltorcan Beds, Co. Kilkenny), Antarctica and Australia.

Within the last two decades further bones and teeth of sarcopterygians have been recovered, some of very large size. No other taxa have been reported in recent years.

Interpretation

The Upper Old Red Sandstone of the Anglo-Welsh Basin has its provenance in North Wales or beyond. Wallis (1928) believed that the pebbles in the Woodhill Bay Conglomerate were derived from the Precambrian Mona Complex of Anglesey. Transport southwards was fluvial and vigorous. Sedimentological features suggest that the sediments accumulated in wide alluvial plains with continual reworking of the sediments. Pedocal limestones above and below the Lower–Upper Old Red Sandstone unconformity were deposited during periods of emergence in humid tropical environments. The fish fauna includes a majority of large predatory species; their prey was presumably largely of invertebrates. No other such fossil fish community is known from southern Britain, though the

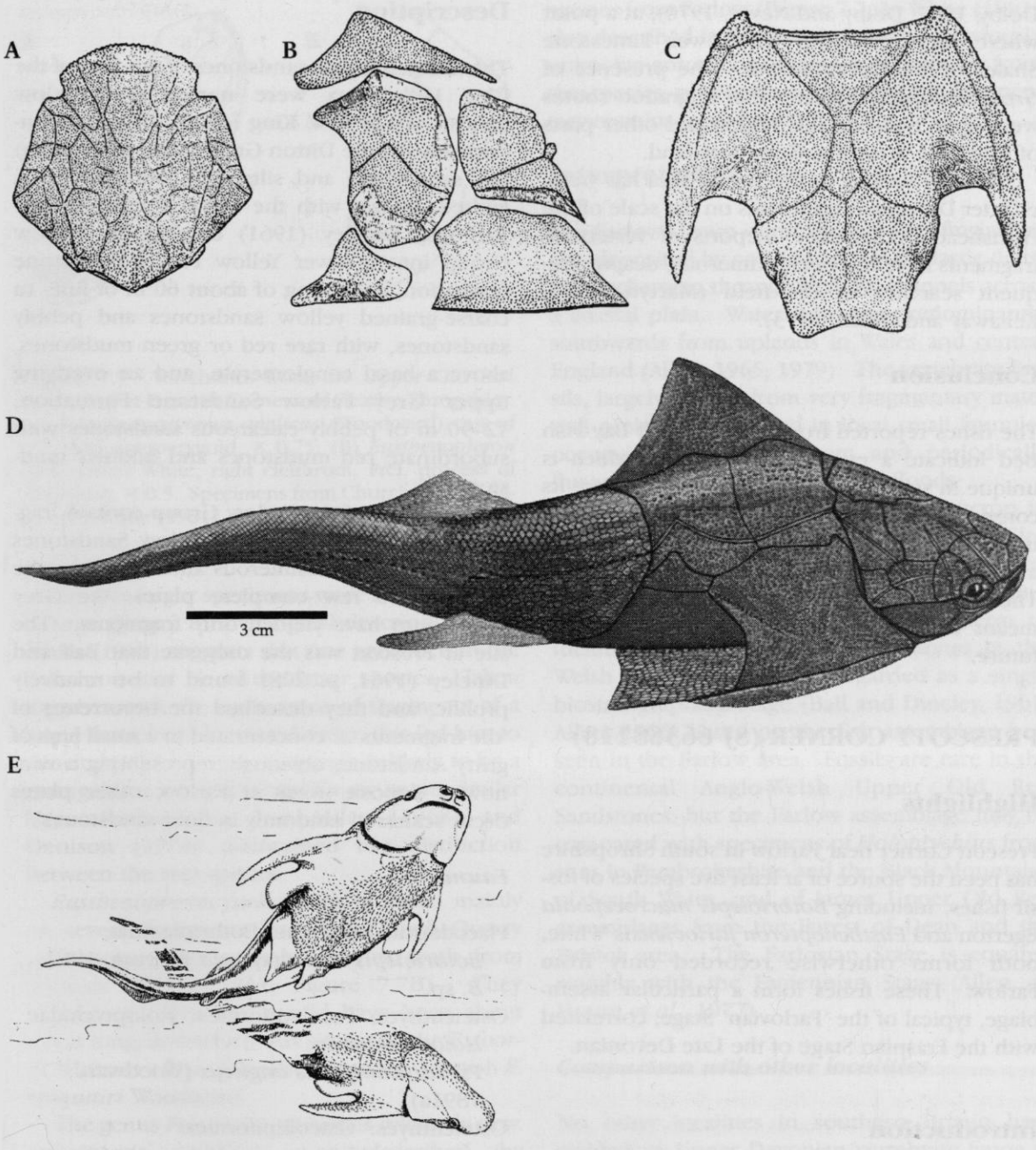

Figure 7.6 *Groenlandaspis* from Portishead and other localities. Reconstruction of *Groenlandaspsis* (taken with permission from J. Long, 1995), length of animal *c.* 25 cm. (A) Dorsal view of cranial roof plates; (B) plates of the trunk armour in lateral view; (C) trunk armour in ventral view (after Ritchie, 1974), (A)–(C) × 0.5; (D) reconstruction (after Long, 1995); (E) reconstruction of *Groenlandaspsis* showing ventral surface, by Ritchie (1971).

Scottish Late Devonian faunas, e.g. Hawks Heugh (q.v.), may have been similar.

The Woodhill Bay fish species have been used to help to date the Old Red Sandstone beds of the Bristol Channel area. The find of *Coccosteus* links the Woodhill Bay Fish Bed with the Bittadon Tuff at the base of the Pickwell Down Sandstone of Mill Rock (q.v.), according to Kellaway and Welch (1993), and hence suggests a Mid-Famennian age. The topmost part of the Portishead Beds have been dated as low Tournaisian on the basis of spores (Neves and

Dolby, 1967; Dolby and Neves, 1970), at a point where they pass into the Lower Limestone Shales of the Carboniferous. The presence of *Groenlandaspis* indicates that migration routes were open between this region and other parts of Laurussia as well as Gondwanaland.

No other locality in the Bristol area has yielded later Devonian vertebrates on the scale of the Portishead occurrence. Reports of vertebrate fragments have not been numerous, despite frequent searches in the field (Martyn, 1875; Kellaway and Welch, 1993).

Conclusion

The fishes reported from the Woodhill Bay Fish Bed indicate a rather diverse fauna, which is unique in southern Britain and gives the site its conservation value. The fauna contains some unusual elements, in particular *Groenlandaspis*, a placoderm not otherwise known in Britain. The continuing coastal erosion of the fish bed means that more specimens may be found in future.

PRESCOTT CORNER (SJ 66368118)

Highlights

Prescott Corner near Farlow in south Shropshire has been the source of at least five species of fossil fishes, including *Bothriolepis macrocephala* Egerton and *Eusthenopteron farloviensis* White, both forms otherwise recorded only from Farlow. These fishes form a particular assemblage, typical of the 'Farlovian' Stage, correlated with the Frasnian Stage of the Late Devonian.

Introduction

At Prescott Corner a small roadside exposure of Upper Devonian conglomerates lies within a series of yellow sandstones that are seen in cliffs nearby. This site has yielded an assemblage of Upper Devonian fishes which, although restricted and fragmentary, is equivalent to the assemblage that was discovered from a similar horizon from a quarry in Farlow in 1856 (Morris and Roberts, 1862). The geology of the vicinity has been described by King (1925), Ball and Dineley (1961), Allen (1965) and Greig *et al.* (1968).

Description

The distinctive pale sandstones of this part of the Clee Hills area were named the Farlow Sandstones by W.W. King (1925). They unconformably overlie Ditton Group (Early Devonian) red sandstones and siltstones and there is a faulted contact with the Lower Carboniferous. Ball and Dineley (1961) divided the Farlow Group into a lower Yellow Farlow Sandstone Formation, consisting of about 60 m of fine- to coarse-grained yellow sandstones and pebbly sandstones, with rare red or green mudstones, above a basal conglomerate, and an overlying upper Grey Farlow Sandstone Formation, 12–90 m of pebbly calcareous sandstones with subordinate red mudstones and nodular mudstones.

Both units of the Farlow Group contain fragments of fossil fishes. The Yellow Sandstones are rather more fossiliferous and have been the source of a few complete plates; the Grey Sandstones have yielded only fragments. The site at Prescott was the only site that Ball and Dineley (1961, p. 208) found to be relatively prolific, and they described the occurrence of 'the fragments ... concentrated in a small lens of gritty sandstone, obviously representing a winnowed deposit ... as at Farlow, other plates occur scattered randomly in finer sandstones'.

Fauna

Placodermi: Antiarchi: Bothriolepidae
Bothriolepis macrocephala Egerton, 1862
B. sp.
Osteichthyes: Porolepiformes: Holoptychidae
Holoptychius sp.
Pseudosauripteris anglicus (Woodward, 1891a)
Osteichthyes: Osteolepiformes: Eusthenopteridae
?Eusthenopteron farloviensis White, 1961
Dipnoi and other indeterminate sarcopterygians

Bothriolepis macrocephala is only recorded from Farlow, its description by Egerton (1862) having been based on material collected from Church Quarry. The specimens represent a small, or juvenile, *Bothriolepis* with a relatively large head, closely related to the larger *Bothriolepis hydrophilia* (Agassiz) from Dura Den, Scotland (Woodward, 1891a; Stensiö,

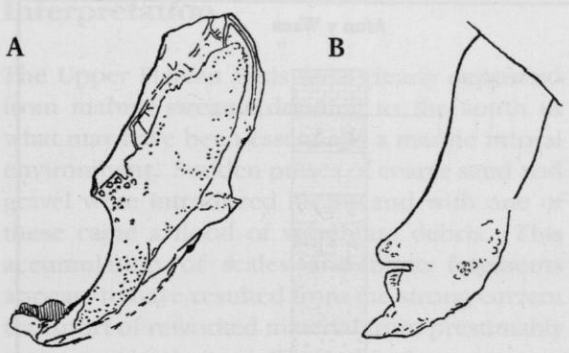

Figure 7.7 Vertebrates from the Upper Old Red Sandstone at Prescott Corner and nearby, Shropshire. (A) *Pseudosauripterus anglicus* (Woodward) cast of the right entoperygoid, × 0.75; (B) *Eusthenopteron farloviensis* White, right cleithrum, Prcl, process of cleithrum, × 0.5. Specimens from Church Quarry, figures by White (1961).

1948). No larger specimens were recorded from Church Quarry in the original descriptions, but White (1961) suggests that one specimen in the collection may be of the latter species. Taken together with the occurrence of fragments of a larger form from Prescott Corner, this led him to concludes that *B. macrocephala* is likely to be a young form of *B. hydrophila* or some similar large *Bothriolepis*, but Miles (1968) and Denison (1978) maintained the distinction between the two species.

Eusthenopteron farloviensis is based mainly on several fragments from the Church Quarry collections, plus a jaw-bone with teeth from Prescott (White, 1961; Figure 7.7B). They belong to a fish that would have been about 0.8 m long, and which was similar to the *E. foordi* Whiteaves from Canada, and to the Scottish *E. traquairi* Woodward.

The genus *Pseudosauripteris* is relatively new. *Sauripteris anglicus* was described by Woodward (1891a), based on fragmentary material of scales and teeth from the Church Quarry collection. The ornament of the scales is well preserved. *Sauripteris* is a genus of rhizodont from the Catskill red beds of eastern North America. In redescribing the Farlow material, including newly collected specimens from Prescott Corner, White (1961) identified it as holoptychiid because of radiating lines of tubercles on the overlapped part of the scales, which are characteristic of the group. He erected the new genus *Pseudosauripterus* for the single species from Farlow (Figure 7.7A). White (1961) also described from Church Quarry a previously unknown entopterygoid which is probably from this species, plus some other imperfect fragmentary remains from Prescott.

Interpretation

The Farlow Group is interpreted as of fluvial origin, deposited by episodic floods of clastic detritus discharging through shallow channels across a coastal plain. Water flow was predominantly southwards from uplands in Wales and central England (Allen, 1965, 1979). The vertebrate fossils, largely known from very fragmentary material, probably originated in local small faunules occupying the river system and periodically flushed downstream by episodic floods.

The Farlow Group has a limited outcrop in the Farlow area to the east of Titterstone Clee Hill, and because of uncertain stratigraphical relationships was termed the 'Farlovian' by King (1934) who used this stratigraphical term to include all Upper Old Red Sandstones in the Welsh Borders. This was regarded as a single biostratigraphical stage (Ball and Dineley, 1961; Allen, 1965) based on the fish assemblage best seen in the Farlow area. Fossils are rare in the continental Anglo-Welsh Upper Old Red Sandstones, but the Farlow assemblage may be compared with specimens of *Holoptychius* from sites in Pembrokeshire and the Black Mountains of South Wales, and of larger Upper Old Red assemblages from the Forest of Dean and the Bristol area. The Farlovian Stage is equated roughly with the Famennian Stage (Allen, *in* House *et al.*, 1977).

Comparison with other localities

No other localities in southern Britain have yielded an Upper Devonian vertebrate fauna as extensive as that at Prescott Corner. Devonian localities in Scotland have provided the nearest comparable fish assemblages (Chapter 8).

Conclusion

The Farlovian fish assemblage from Prescott Corner is a localized fauna, containing some unique species. The assemblage has been important in characterizing a stage in the continental Devonian of the Welsh Borders, but many

of the original quarries are no longer accessible. The conservation value of Prescott Corner lies in its potential for future collection of the unusual fish assemblage.

AFON Y WAEN (SN 976147) (POTENTIAL GCR SITE)

Highlights

The Afon y Waen Fish Bed in Powys is probably the most continuous and productive vertebrate-bearing unit in the Upper Plateau Beds of South Wales. It contains the typical late Devonian fish genera *Bothriolepis* and *Holoptychius* at a horizon some 15 m below the base of the Carboniferous Limestone on the north-eastern rim of the South Wales coalfield.

Introduction

The highest Devonian formation in Breconshire, South Wales, is the thin (< 2 m) Grey Grits. It is underlain by the much more laterally and vertically variable Plateau Beds of which the upper part contains a number of thin, but distinctive, fish beds and *Lingula* Beds (Hall, Thomas and Taylor, 1973). These and the presence of marine fossils at the base of the unit support Allen's suggestion (1965) that the upper part of the Plateau Beds is of marine origin.

Description

In the Afon y Waen valley exposures of arenaceous strata occur over a distance of about 24 m with the Afon y Waen Fish Bed present at the base of a conspicuous conglomeratic unit, about 4 m thick. The fish bed is a medium- to fine-grained, friable conglomerate with quartz pebbles and reddish mudstone clasts together with abundant fish plate and scale fragments, in all about 0.15 m thick (Figure 7.8).

Fauna

Placodermi: Antiarchi: Bothriolepidae
Bothriolepis sp.
Osteichthyes: Sarcopterygii: Porolepiformes: Holoptychiidae
Holoptychius sp.

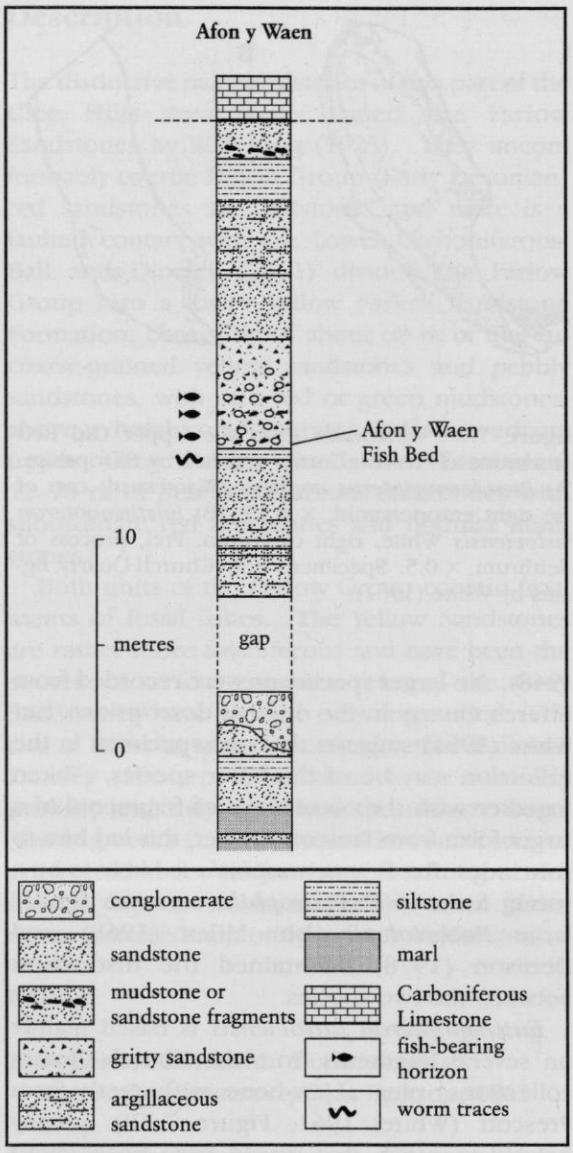

Figure 7.8 Stratigraphical section in the stream at Afon Y Waen (after Hall *et al.*, 1973).

The vertebrate remains are not accompanied by marine invertebrates and appear to be a water-transported thanatocoenose, or death, assemblage of the antiarch *Bothriolepis* sp. and the porolepiform sarcopterygian *Holoptychius* sp. At the nearby Nant Mawr and Nant y Cwm, however, lingulids have been reported from this fish bed (Dunham, 1972). The scales of *Holoptychius* reach a diameter of 40 mm, indicating a large fish. Other small bone fragments are present but so far are not allocated to particular taxa. At some levels along the exposure this material is very common.

Interpretation

The Upper Plateau Beds were clearly deposited from mature streams draining to the south in what may have been essentially a marine littoral environment. Sudden pulses of coarse sand and gravel were introduced locally and with one of these came a flood of vertebrate debris. This accumulation of scales and bone fragments appears to have resulted from the strong current transport of reworked material from presumably more proximal sites. While this does not confirm a non-marine origin for the fishes, it does not rule out the possibility of their local fluvial or lagoonal habitat. So far no valid biostratigraphical data are derived from this occurrence of vertebrates, but they clearly precede the onset of marine conditions and the beginning of Carboniferous time by very little.

A Farlovian date is suggested by Hall *et al.* (1973), but confirmation that this is Famennian is so far not possible. The site is comparable to others in the vicinity (Hall, *et al.*, 1973), but the fossils are more numerous.

Conclusion

The exposures in Afon y Waen show some of the latest continental facies prior to the basal Carboniferous transgression. They derive their conservation value from this stratigraphical significance and the occurrence of the late Devonian fish *Bothriolepis* and *Holoptychius* sp. Further search for biostratigraphically useful fossils may reveal palynomorphs to determine the precise age of the local Plateau Beds and the environment of deposition.

COMPARISON WITH OTHER REGIONS

Compared to the fauna of equivalent age in Scotland, the Anglo-Welsh Basin has a small number of vertebrate taxa. It may have had a more distant and tenuous link with the Scottish–Baltic realm and with North America where placoderms are much more in evidence. The Late Devonian accumulations of continental beds in Wales and the heart of England are of small bulk and uncertain chronology (Wills, 1950, p. 30–2; Allen, 1965). The Late Devonian–Early Carboniferous transgression was rapid and the late removal of earlier (i.e. Devonian) deposits may have been extensive prior to the deposition of transgressive beds within the vicinity of the Bristol Channel.

South of the Bristol Channel the Devonian is undoubtedly of impressive thickness, but is largely barren of vertebrates. Biostratigraphy has to rely upon conodont and other faunas and on palynology. There are, however, lenticular thin bone beds in the Pilton Formation which yield a microvertebrate fauna that is yet to be studied.