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Field Meeting Report: Fossil fish remains in the Devil's Hole section, near Morville, led by Maggie Rowlands and Peter Tarrant 10th April 1988

Sue Gibson[1]

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The purpose of the field meeting was to visit the fossil fish remains in the Devil's Hole section, near Morville.

[1]*affiliation: Member of the Shropshire Geological Society*

INTRODUCTION

The afternoon was spent in a gradual ascent of a small, very overgrown stream known as the Devil's Hole near Morville (Figure 1). Many fish fragments were found as illustrated in Figure 2. An account was presented at the recent Manchester symposium (Rowlands & Cleal, 1985).

GEOLOGICAL SETTING

The Devil's Hole section illustrates a typical Lower Old Red Sandstone sequence in the Welsh Borders. The Devil's Hole Stream (sometimes called the Lye Stream) runs in an approximately north-easterly direction, and is a tributary of the Mor Brook, which in turn is a tributary of the River Severn. It traverses about 40 metres of Downton and Ditton Group strata, (Lower Gedinnian) and clearly demonstrates the boundary between these two units.

Although much of the sequence is palaeontologically barren, a number of discrete fossil-bearing bands have been found which have provided stratigraphically diagnostic species. Fossils found here include the remains of fish, plants (including spores) and arthropods.

Geological and sedimentological evidence indicates that this is a freshwater sequence of channels and mudflats formed in a floodplain. Elsewhere in the world (Canada, Spitsbergen, etc.) fishes of this age are considered to be marine, with fish bearing horizons representing short, temporary marine incursions within the Old Red Series (A. Blieck, *pers. com.*).

The fossil-bearing rocks at Devil's Hole have been known for some time and were briefly mentioned by Ball & Dineley (1961). However, the section has only recently been studied in detail, principally by the local artist and geologist, Mr Peter Tarrant, who has built up an impressive collection of fossil fishes from here over the past 20 years (now housed in Ludlow Museum). This recent work has shown that the faunas here are far more diverse than previously reported, the fish being particularly abundant.

Unfortunately, the exposure along the stream was rather incomplete, making it impossible to place the fossil discoveries into a rigorous stratigraphical and sedimentological context. To resolve this problem the Nature Conservancy Council has made a series of excavations along the stream valley, so that the full sequence could be logged. This work has also provided extensive permanent exposures of the most important horizons. Based on these new exposures, a project has been organised to study the palaeontology, stratigraphy and sedimentology of the sequence.

This multidisciplinary study, together with comparative work elsewhere in the Welsh borders, on lower fish-bearing horizons which are indubitably marine seems to prove that most of the fish species represented in Devil's Hole lived and died under fluvial conditions although some of them probably spawned and developed to adulthood in the sea, based on morphological studies (P Tarrant, *pers. comm.*).

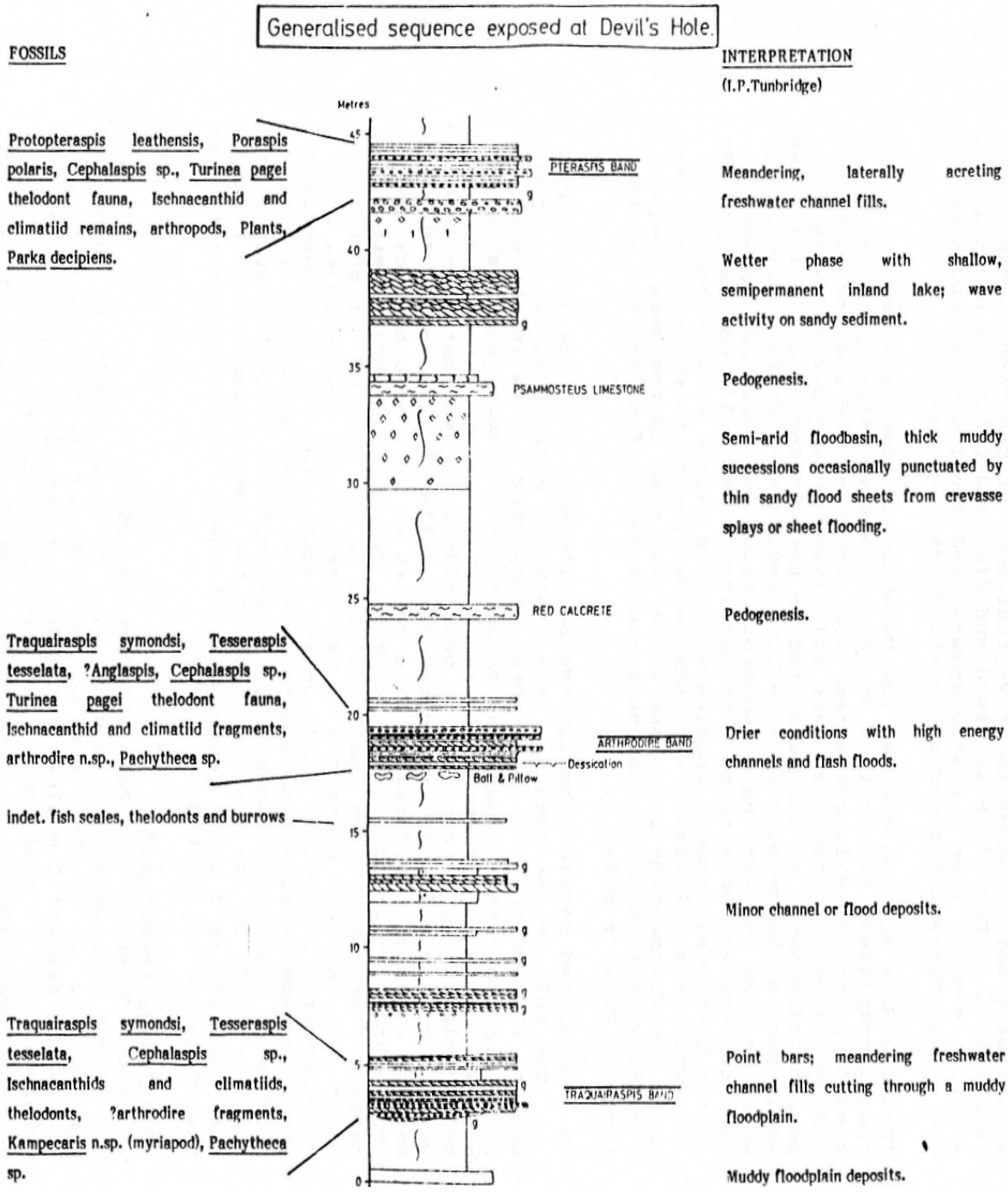

Figure 1: Generalised stratigraphic column for Devil's Hole, Morville.

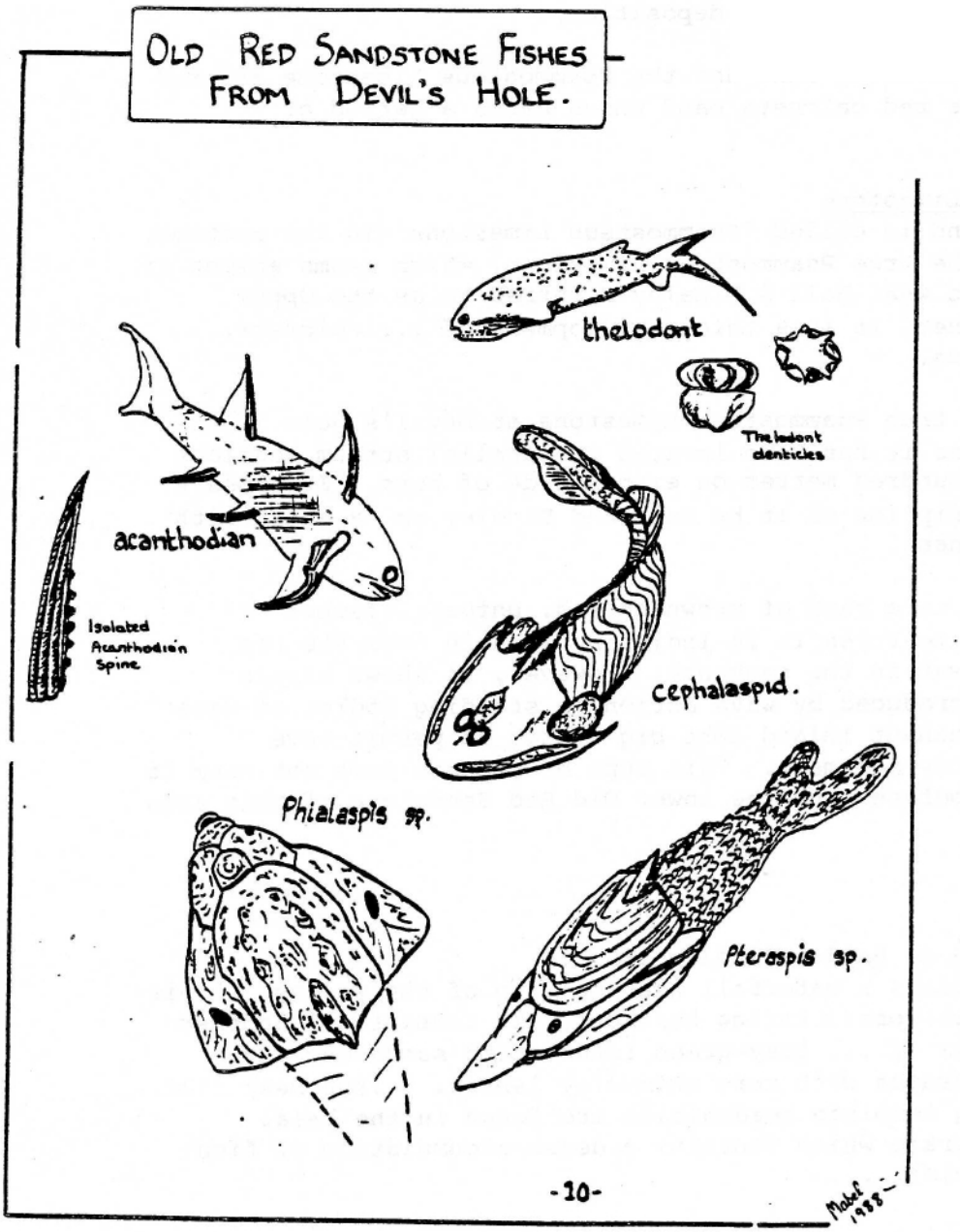

Figure 2: Typical fossil fish to be found in the Devil's Hole section, Morville.

The Devil's Hole section crosses the *Psammosteus* Limestone; the faunas change completely across this horizon. This is demonstrated very clearly by the fossils collected from each fish bed. If the fish were all living in the sea and were periodically swept up and deposited on the Old Red flood plains, then how would such a change occur? It is envisaged that *Protopteraspis*, which is rare beneath the *Psammosteus* Limestone, probably spawned in the sea, and was able to move in and occupy an ecological vacuum left by the previously common species which had become extinct at this horizon. This correlates with the marked change to wetter conditions above the *Psammosteus* Limestone which gave rise to the more frequent fluvial sandstone and cornstone channels (which form the top of the ridge at Devil's Hole).

The bulk of the Devil's Hole sequence (about 60%) is made up of usually poorly bedded, red and mottled siltstones. They show little in the way of structure other than occasional green reduction spots and possibly burrows. With the exception of rare fish fragments, these beds are palaeontologically barren. It is generally believed

that such deposits were formed in a floodplain environment (Allen & Williams, 1979). The rest of the sequence consists of a series of what have been called 'hard bands', principally of sandstone, cornstone, conglomerate or calcrete, and which form small features in the valley. It should be noted that the term cornstone is used here in the local sense: for conglomeratic rocks with abundant mud clasts, and not as in Scotland where it usually refers to limestones or similar deposits. The most notable of these hard bands is the *Psammosteus* Limestone, used as a marker roughly at the junction between the Downton and Ditton beds.

The following is a brief description of these 'hard bands' starting at the bottom of the section.

The Traquairaspis Band

(This is Lye Brook 1 of Ball & Dineley, 1961).

The lowest prominent band consists of a 5 m thick complex of channel deposits. It is the lowest of the bands to yield abundant fossils and can be traced 90 m along the banks and bed of the Lye Stream. The conglomerates hold the largest concentrations of fossil fish. *Traquairaspis symondsi* is particularly common here and shows evidence of having been current sorted (Ball & Dineley, 1961). The whole channel complex fines upwards. The higher bands have local concentrations of fossil fish. Above this is a series of thin green and red sandstones with burrows – so far they have yielded indeterminate fish scales and thelodonts. They probably represent minor channel or flood deposits.

The Arthrodire Band

(This is Lye Brook 3 of Ball & Dineley, 1961).

The second set of fossil-bearing rocks has been designated the *Arthrodire* Band. It is broadly similar in composition to the *Traquairaspis* Band and thus presumably formed under similar conditions. It is 15 m below the *Psammosteus* Limestone and forms a waterfall in the stream. It consists of a 2 m thick channel complex of up to 5 similar stream channels.

The lower 20-40 cm of each unit is made up of conglomerates (cornstone) which grade up, and also laterally, into fine grained sandstones and mudstones which commonly have desiccation cracks. These desiccation cracks often mark the onset of the next channel into the cornstone.

Overlying the cornstones are laminated brown sandstones and soft cornstones. The fossils are confined to the hard cornstones, and are almost exclusively fish.

The *Arthrodire* material represents one distinct species with long spinal plates. More spinal plates are found here than anything else because of water selection during deposition.

Between the *Arthrodire* Band and the *Psammosteus* Limestone are red silts with a notable red calcrete band which marks a period of pedogenesis.

The *Psammosteus* Limestone

The next highest band is called *Psammosteus* Limestone in the section. It is in fact not the true *Psammosteus* Limestone, which appears to be absent at Devil's Hole, but is what Ball & Dineley referred to as the Upper *Psammosteus* Limestone. It is a thick development of calcrete. It is unfossiliferous.

The absence of the true *Psammosteus* Limestone at Devil's Hole is rather curious, since it has been located in parallel stream sections running only a few hundred metres on either side of here. It appears to confirm the description of it by Ball and Dineley as 'a sheet with holes and thin patches'.

Some way above this is a band of brownish-red, unfossiliferous sandstone. In most features it is indistinguishable from the red sandstones found lower in the sequence. However, it shows ripple cross-laminations produced by wave action in standing bodies of water, probably a semi-permanent inland lake big enough to permit wave activity to work sandy sediment. This type of deposit does not seem to have been reported before from the Lower Old Red Sandstone of this area (I.P. Tunbridge, *pers. comm.*).

The *Pteraspis* Band

(This is Lye Brook 4 of Ball & Dineley, 1961).

The *Pteraspis* band forms a waterfall near the top of the valley. It is the third of the main fossil-bearing horizons. It consists of another major channel complex of grey-green interbedded sandstone and 'cornstone' conglomerates with rare thin clay lenses. The best fish specimens,

including complete head shields are found in the basal 'cornstone' conglomerate which contains a dense accumulation of fish (mainly *Protopteraspis*).

Plants tend to be concentrated in certain bands, where the fish are less abundant. One of these bands is in fact so densely packed with plant material that it starts to approach the quality of an impure coal.

The highest part of the *Pteraspis* Band is quite different from the rest. It consists of buff coloured, parallel laminated sandstone, and contains well preserved forking plant axes and large discs of *Parka decipiens*. There are also numerous arthropod fragments, probably of *Pterygotus*.

Some clay bands occur between some of the channels in the *Pteraspis* Band. So far these are the only horizons in the Devil's Hole sequence to have yielded microfossils. They are presently being studied by Dr Richardson who has identified some 30 species.

The numerous collections of *Protopteraspis leathensis* made from this site has formed the basis of a new description of the genus by Peter Tarrant who is reinterpreting the life style, swimming mode and feeding habits of this animal.

Disclaimer - The information contained in this account has been prepared from notes taken during the field meeting. Its sole aim is to provide a record of what was seen and provide an insight into the diversity of geology outcropping in the vicinity of Devil's Hole, near Morville. It should not be used for any other purpose or construed as permission or an invitation to visit the sites or localities mentioned.

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