TYNET BURN, ELGIN

OS Grid Reference: NJ383618

Highlights

Tynet Burn, Grampian, has been a famous source of Mid-Devonian fossil fishes since the 1830s. Up to 16 species of fossil fishes have been found at several levels along the stream section, and they demonstrate the nature of vertebrate life at the time on the southern margins of the great Orcadian Lake (innermost Moray Firth).

Introduction

There are, or were, many Middle Devonian fish sites in the Moray Firth area which have yielded numerous fossils since the 1830s. Most of these lie at the Achanarras level, and they produce similar specimens to those from Achanarras. The fish bed at Tynet Burn was discovered by G. Gordon and J. Malcolmson on 15 November 1838, on the same day that they discovered Dipple Brae Fish Bed, by ‘following the Strata of the Dipple Beds into Banffshire' (Gordon, 1859), although since then these two beds have been shown to represent different horizons. Later, Malcolmson discovered the Lethen Bar fish site (no longer exposed), and concluded that the fishes from the newly discovered Moray Firth fish beds were the same genera and species as those that came from the fish beds in Orkney, Caithness, Cromarty and Gamrie. The specimens were sent to Agassiz for examination and description (Agassiz, 1833–45, 1835, 1840) and a paper about the geology and relationships of the fish beds was prepared by Malcolmson in 1839, but not published until long after his death (Malcolmson, 1842, 1859).

The background and early research on the Moray Firth Fish Beds is given in Andrews (1982). The geology of the site has most recently been described by Peacock *et al*. (1968). Fishes from Tynet Burn have been described by many workers, including Duff (1842), Traquair (1895) and Watson (1935), and modes of preservation by Wallace (1885) and Traquair (1895).

Description

The Tynet Burn section exposes conglomerates, sandstones, and shales with calcareous nodules, all of Mid-Old Red Sandstone age. The Mid-Devonian sequence in the Elgin–Forres area lies unconformably on the Early Devonian Buckie Beds, and is overlain, unconformably by a number of Late Devonian sequences (see Chapter 8). Within the Middle Devonian rocks of the area (Westoll, *in* House *et al*., 1977) are two fish-bearing levels, those in Tynet Burn, which appear to correlate with the Achanarras horizon, and the higher Dipple Fish Bed (q.v.).

The Tynet Burn fish bed is a sequence of shales with calcareous nodules, and it is exposed behind Lower Mills of Tynet in the meander scars of the incised Tynet Burn. The best section occurs in the so-called ‘Main Cliff', some 12 m high, on the right bank of the stream where the stream takes a sudden change of direction from north to south-west, opposite a ruined saw mill (NJ 384620). The total section consists of 30 m of northerly dipping shales, some with calcareous concretions, which are interstratified with red sandstones and conglomerates. Peacock *et al*. (1968) describe a Lower Nodule Bed and an Upper Nodule Bed, separated by 16 m of sandstones, shales, and conglomerates (Figure 6.19).

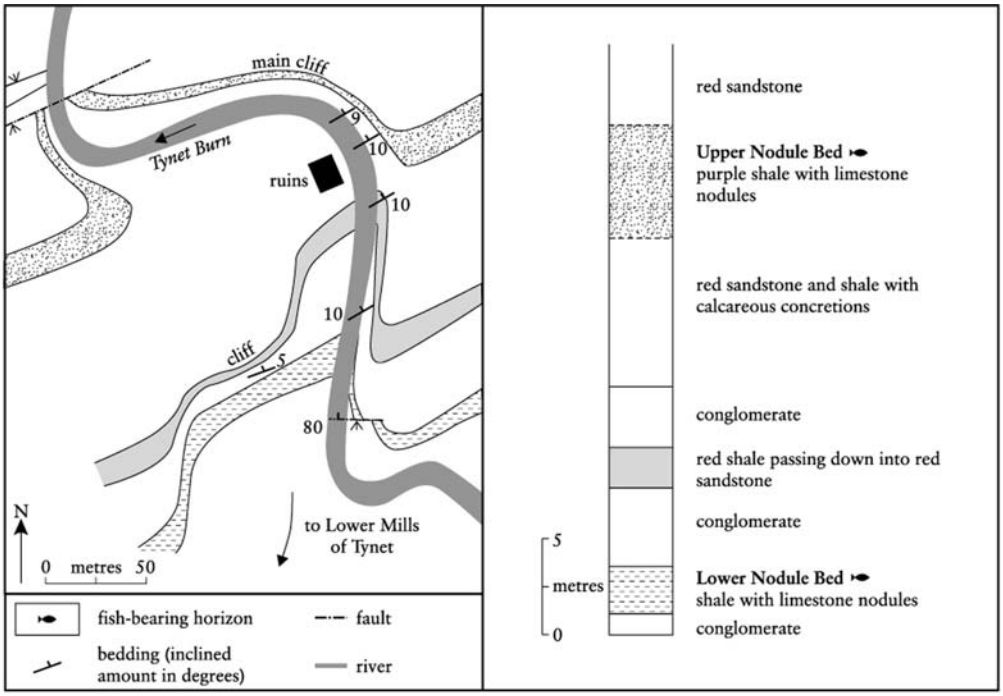


Figure 6.19: Tynet Burn, map of the GCR site and section through the fish-bearing beds.

The Upper Nodule Bed, 5–7 m thick, outcrops along the top of Main Cliff, rather inaccessibly, and also occurs further downstream in a meander scar in the left bank of the stream (NJ 382620), on the southern side of a series of faults that form the northern boundary of this section. The lower unit of this Upper Nodule Bed is called the *Osteolepis* Bed' by Mahood (1919). It yields *Cheirolepis*, *Dipterus*, *Pterichthyodes* and *Osteolepis*. The upper unit could be referred to as the Acanthodian Bed because it is very rich in those fishes. It also yields *Pterichthyodes* (Mahood, 1919), '*Diplo-pterus*' (i.e. *Gyroptychius*) and *Cheirolepis* (Gregory, 1860). Mahood (1919) also distinguished between the two beds on lithological grounds; the Acanthodian Bed is described as 'red clay or shale with cream coloured limestone nodules containing fossils', the *Osteolepis* Bed as a soft shale with nodules.

A third fish bed at Tynet Burn, the *Coccosteus* Bed, may represent partings of the Lower Nodule Bed (Peacock *et al*., 1968). It is not described in the measured section, but is equated with Bed 4, a red shale passing into red sandstone, 10 m below the base of the Upper Nodule Bed. The *Coccosteus* Bed was described by Malcolmson (1859) as less than 50 ft (15 m) below the upper fish bed, by Gordon (1859) as 20 ft (6 m) below, by Wallace (1885) as 40 ft (12 m) below, and by Mahood (1919) as 20 ft (6 m) below. The *Coccosteus* Bed has not been exposed for many years, and may be a worked-out fossiliferous part of the Lower Nodule Bed.Mahood (1919) described it as 'difficult of access because it is below the level of the burn' (presumably at Main Cliff, although they do not say so). Gregory (1860) and Wallace (1885) described an excavation site into the *Coccosteus* Bed near Tynet Mill, and Wallace states that 'specimens of *Coccosteus* have been dug out from under a thick deposit of gritty conglomerate a short distance from the mill door'. Gregory (1860) distinguishes this excavation site from another outcrop of the *Coccosteus* Bed lower downstream. These old descriptions imply that this unit did not have a consistent lateral extent like the other nodule beds, and hence it may have been worked out.

A fourth nodule bed 230–250 mm above the upper fish-bearing unit in the Upper Nodule Bed was referred to as the 'Dummy-Bed' by Mahood (1919), presumably because of its lack of fossils. However, Malcolmson (1859) gave a section from NJ 384620, which clearly shows three beds of 'shales with ichthyolites'.

The Lower Nodule Bed yielded only unidentifiable fish scales, and *Coccosteus* is the only fish described. Rare specimens of other species may have been found there, since Malcolmson (1859) mentioned a fine specimen of *Dipterus* from a red slatey sandstone in the unit beneath the Upper Nodule Bed. All the other specimens that have been extracted from Tynet Burn are

from the two beds of the Upper Nodule Bed, mainly collected from Main Cliff, either from loose nodules lying below the cliff, or *in situ*.

The limestone nodules from Tynet Burn can produce very beautifully preserved fish fossils, and each nodule site has a distinctive colour and mode of preservation. The fishes are stained shades of crimson and lie within pale grey limestone within the flattened fish-shaped nodules. Nodules frequently show veins of sparry calcite with predominantly vertical lineations (Gregory, 1860), possibly related to the tectonic activity that caused local faulting. The veins cause the nodules to break into several pieces, which are generally rounded at the edges, look like perfect nodules and lie apart in the rock. This led Gregory to warn collectors to split the nodules on the spot to avoid missing parts of a specimen, and for this reason Tynet Burn has been described as the most difficult fossil bed of the north to work (Wallace, 1885).

Fauna

The faunal list of fishes from Tynet Burn has not changed much since Traquair's (1895) compilation. Unfortunately, this list, and others of that age, do not distinguish the precise bed from which specimens come. Such precise identification of faunas might be possible by sedimentological study of museum specimens.

Acanthodii: Climatiiformes: Diplacanthidae

Diplacanthus striatus Agassiz 1835

D. sp.

D. (Rhadinacanthus) longispinus (Agassiz, 1844)

Acanthodii: Acanthodiformes: Acanthodidae

Mesacanthus pusillus (Agassiz, 1844)

*C. murchisoni*Agassiz, 1835

*C. latus*Egerton, 1861

Placodermi: Antiarchi: Asterolepidae

Pterichthyodes milleri Miller, 1841

Placodermi: Arthrodira: Coccosteidae

Coccosteus cuspidatus Miller, 1841

Rhamphodopsis trispinatus Watson, 1938

Osteichthyes: Actinopterygii: Cheirolepidae

*Cheirolepis trailli*Agassiz, 1835

Osteichthyes: Sarcopterygii: Osteolepidiformes: Osteolepididae

*Osteolepis macrolepidotus*Agassiz, 1835

Gyroptychius sp. 1 *Gyroptychius* sp. 2

Osteichthyes: Sarcopterygii: Porolepiformes: Holoptychidae

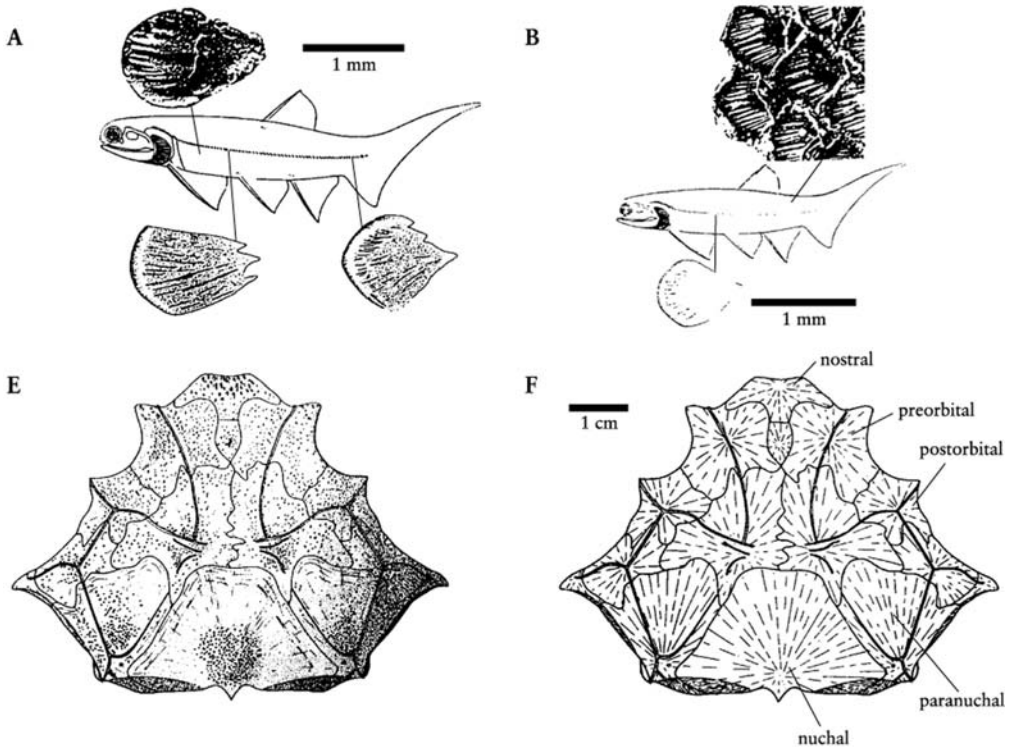
Glyptolepis leptopterus Agassiz, 1844

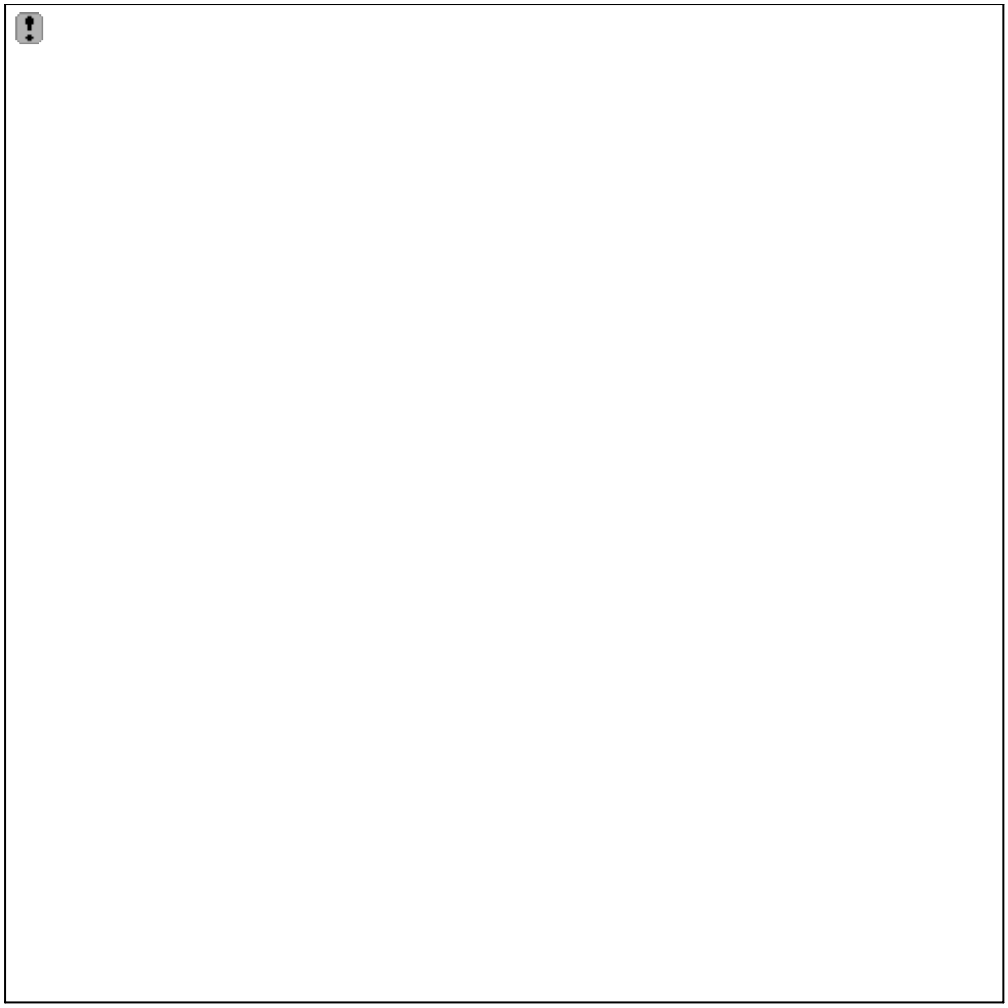
Glyptolepis paucidens Agassiz, 1844

Osteichthyes: Sarcopterygii: Dipnoi: Dipterida: Dipteridae

Dipterus valenciennesi Sedgwick and Murchison, 1828

The fish material includes type specimens of *Diplacanthus striatus* and *Rhamphodopsis trispinatus* Watson, 1938, and possibly also *Cheiracanthus latus* Egerton, 1861. It is sufficiently well preserved for Young (1995) to distinguish the scale morphology of several acanthodian species (Figure 6.20).





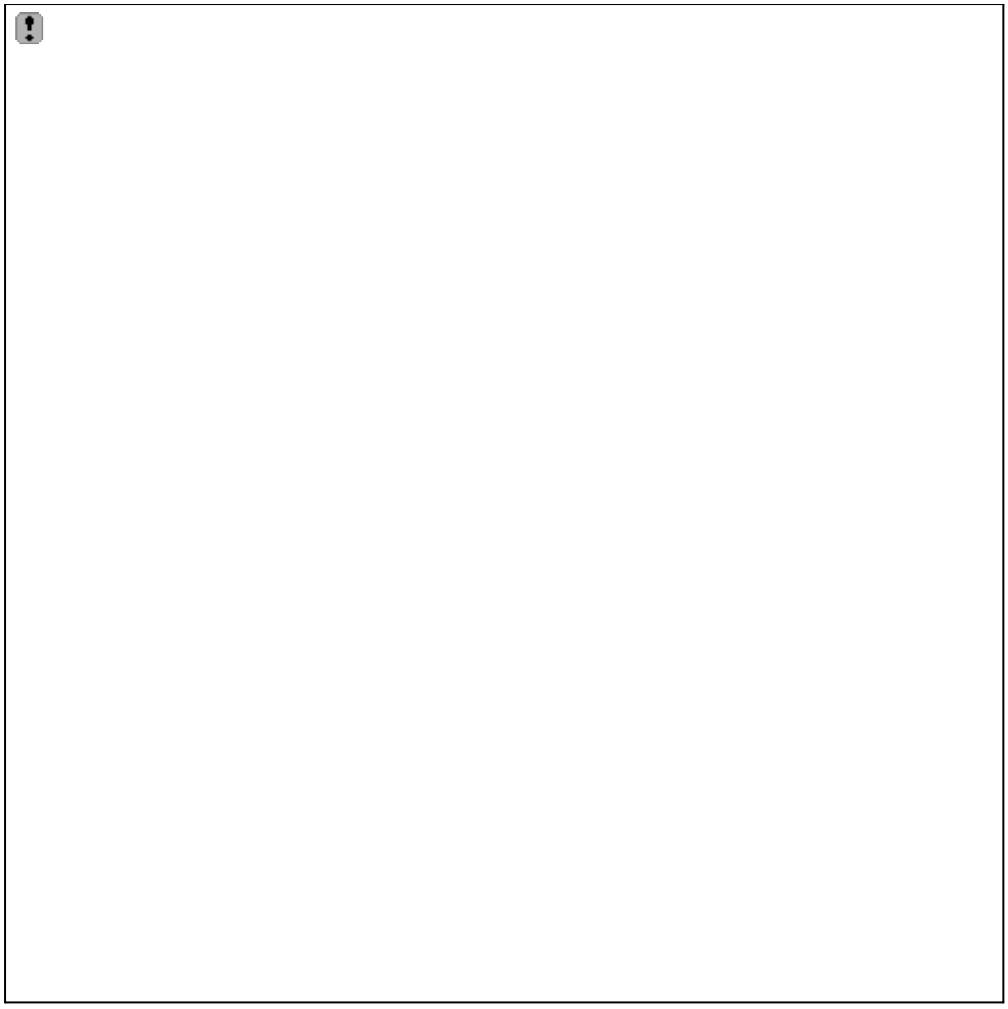


Figure 6.20: Fossil fishes from Tynet Burn. (A) Cheriacanthus latus Egerton, a restoration based upon NHM P 15286 with scales from below and above the lateral line; (B) Cheiracanthus murchisoni Agassiz, a restoration based upon NHM P 6189 with scales from above and below the lateral line ((A) and (B) from Young, 1995); (C) T04134R of Cheiracanthus× 2 (Photo: courtesy The Natural History Museum, London); (E), (F) Reconstructions based on species from Tynet Burn: (E) skull roof with surface ornamentation and lateral line canal grooves; (F) in outline with radiation centres shown. (D) photograph GLAHM V3573, of Mesacanthus pusillus (Agassiz) × 2.5, specimens preserved in nodules.

Interpretation

As Hamilton and Trewin (1988) showed, the Tynet Burn succession accumulated in a zone where coarse fluvial detritus gave way to finer alluvial deposition with lacustrine ingressions. Fish Beds with carbonate nodules indicate a marginal position in Lake Orcadie, since such nodules form only in shallow evaporating waters. The nodules probably formed preferentially around fish carcasses because of the chemical changes associated with decomposition. Carbonate ions migrated towards the fish bodies and invested some of the soft tissues, and the surrounding sediment. Hall and Donovan (1978) concluded that nodules would form during periods of lacustrine regression, when partial carbonate dissolution could have taken place whilst acid oxidizing, or mildly reducing, groundwaters were circulating.

Carbonate nodules are not found at equivalent horizons in Orkney and Caithness, where the fishes are preserved flattened, in flagstones. The localities farther north indicate deeper-water lacustrine sedimentation coupled with more strongly alkaline waters. The Tynet Burn nodules are noticeably flatter than those from other sites.

Conclusions

The conservation value of the three or four fish beds in Tynet Burn results from the production

of a rich fauna of acanthodians, placoderms and bony fishes, and the site is historically very important because of finds dating from the 1830s. The quality of preservation is generally good, and specimens from Tynet have been widely used in anatomical and systematic work on Devonian fishes. Collecting at Tynet Burn had been at a halt for some years, because of the steepness and instability of the cliff faces, and difficulty of reaching the fish beds, but was recently resumed on a modest scale by S.P. Wood (N. Trewin, pers. comm.).

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