
DEN OF FINDON, GAMRIE

OS Grid Reference: NJ796635

Highlights

The Den of Findon, near Gamrie, Grampian, has produced a fauna of 12 species of fossil fishes from nodules. The site is the easternmost at which fishes of the Achanarras horizon can be found, and it shows an example of fish life on the south-eastern margin of the great Orcadian Lake.

Introduction

The Gamrie Fish Bed is the most easterly outcrop of the Achanarras horizon and it yields 12 species of Middle Devonian fishes (see Hamilton and Trewin, 1988, p.590). Specimens from the fish bed were described early in the 19th century, and a great deal of material is now in museums around the world. Murchison came to the site in 1826, during his visit to Scotland, when he first saw Old Red Sandstone fishes in Caithness, but he failed to observe this fish bed. It was discovered during the following winter, when an overflowing mill stream caused a landslip in the blue clays containing the nodules (Murchison, 1828). Impressed by the thick rhomboidal scales and heterocercal tails of one of the Gamrie species (*Osteolepis*), Murchison compared them with the Permian palaeoniscids of Germany (Andrews, 1982), but did not recognize the resemblance between these fossils and those from Caithness, because of differences in style of preservation. The nodules were noticed by a Mr Docker of Findon Farm and James Christie, a solicitor from Banff (Prestwich, 1837), and collections were dispatched to the Geological Society in London. Murchison sent fish specimens to Joseph Pentland, in Paris, and published his descriptions of two, possibly three, new species of fishes, the so-called 'Gamrie ichthyolites', in 1828.

Gamrie then became an important collecting site. Dr Knight of Aberdeen was responsible for a large collection of Gamrie ichthyolites, which provided the materials for early descriptions of Middle Devonian fishes. Agassiz (1835) described specimens from Gamrie sent to him by Murchison, Knight and J. Torrie. From this material, he erected three new species, two of which represented new genera. Gamrie was the type locality for *Osteolepis arenatus*, *Cheirolepis uragus*, and *Cheiracanthus murchisoni*, which are now no longer valid species, the last of which, however, is common at Gamrie. Agassiz (1835) argued that the Gamrie deposits were younger than those of Orkney, and that they belonged to the Coal Formation because 'they seem to be so nearly related to that deposit that he (could not) regard them as of much more recent origin' (Agassiz, 1835, quoted in Andrews, 1982).

Prestwich (1838, 1840) supported the conclusions of Agassiz. He regarded the fish bed and conglomerate as resting unconformably upon the Old Red Sandstone below, and thought that they were probably representatives of the Carboniferous Millstone Grit or Mountain Limestone. This was challenged by Malcolmson (1842) who showed that there was no unconformity. Geikie (1878) described the geology of Gamrie, as did Read (1923). Read also gave a list of species from the fish bed compiled by Traquair (Read, 1923, p. 172). The Gamrie fauna was discussed by Hay-Cunningham (1843), Agassiz (1833–1845), Smith (1851), Gregory (1860), Traquair (1880, 1895), Edward (1889) and Woodward (1891a). Gamrie fishes have also been described repeatedly in the 20th century (Heintz, 1938; Jarvik, 1948a; Miles and Westoll, 1968; Hemmings, 1978; Pearson and Westoll, 1979).

Description

The Middle Devonian Findon Group rests unconformably on the Lower Devonian Crovie Group in the Gamrie–Pennan area (Westoll, *in* House *et al.*, 1977). The basal unit of the Findon Group is a conglomerate, followed by about 2 m of red and grey shales and clays with fossil plants and well-preserved fishes in limestone nodules, and then by reddish and chocolate-coloured breccias. The fish bed is mapped at several places in the Gamrie area, and in the past fishes have been collected from Cushnie Burn and at the head of Pishlinn Burn. Read (1923) stated that Horne also collected fish scales from shales within the conglomerate not far below the fish

bed.

The Gamrie fish bed is now rather inaccessible because of the crumbly vertical faces of conglomerate in the ravine, and collections have always been made from the loose nodules which accumulate in the stream bed below the exposure. The section given by Read (1923, p. 171) from the Den of Findon (Figure 6.17) is:

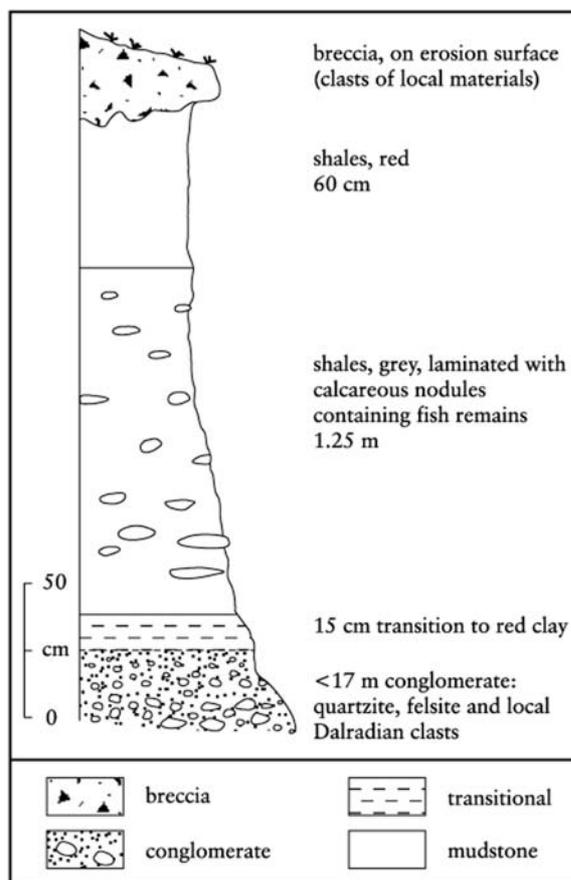


Figure 6.17: Den of Findon section (from Trewin and Kneller, 1987).

	Thickness
'Bed 7, Breccia	2–15 ft [0.6–4.6 m]
Red clay and shales	2 ft [0.6 m]
Bed 6, Grey clay with ichthyolites. The limestone nodules are restricted to the lower portion of the grey clay. Grey shales with plant remains occur locally above the underlying conglomerates	4 ft [1.2 m]
Bed 5, Conglomerates with intercalations of sandstone	50 ft [15.2 m]'

The dip is 8° ENE, and the fish bed only crops out near the top on the east side of the ravine, where it can be traced along most of the length of the ravine. Trewin and Kneller (1987) described the section and the preservation of the fishes. Fishes are found in calcareous nodules, which also preserve the fine parallel laminations of the original mud. They are preserved complete, or with only slight disturbance of the carcass, but only the parts that occur within the nodules are fossilized.

Fauna

Acanthodii: Climatiformes: Diplacanthidae

Diplacanthus striatus Agassiz, 1835

D. tenuistriatus Traquair, 1894.

D. (Rhadinacanthus) longispinus (Agassiz,
1844–1845)

Acanthodii: Acanthodiformes: Acanthodidae

Cheiracanthus murchisoni Agassiz, 1835

C. latus Egerton, 1861

Placodermi: Antiarchi: Pterichthyodidae

Pterichthyodes milleri Miller, 1841

Placodermi: Arthrodira: Coccosteidae

Coccosteus cuspidatus Miller, 1841

Osteichthyes: Actinopterygii: Cheirolepididae

Cheirolepis trailli Agassiz, 1835

Osteichthyes: Sarcopterygii: Osteolepidiformes: Osteolepididae

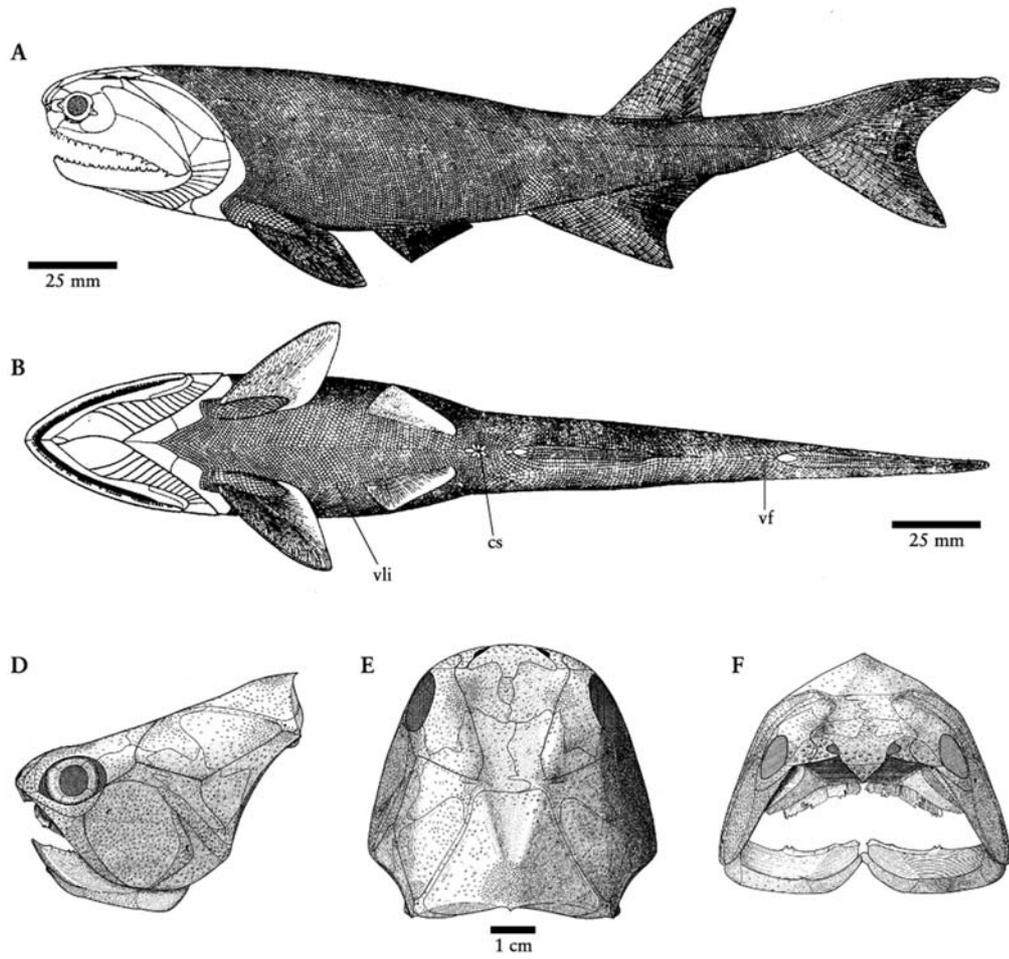
Glyptolepis leptopterus Agassiz, 1844

Osteolepis macrolepidotus Agassiz, 1835

Gyroptychius 2 n. sp.

Acanthodians are common at Gamrie, which is the type locality for *Cheiracanthus murchisoni*, and the source of two of the three syntypes of *Diplacanthus tenuistriatus* (the other is from Orkney). The placoderms *Pterichthyodes*

milleri and *Coccosteus cuspidatus* are also common at Gamrie (Figure 6.18). Gamrie is one of only four sites from which specimens of *Pterichthyodes* were good enough for morphometric measurements, which proved that all Scottish *Pterichthyodes* specimens belong to one species, *P. milleri* (Hemmings and Rostron, 1972).



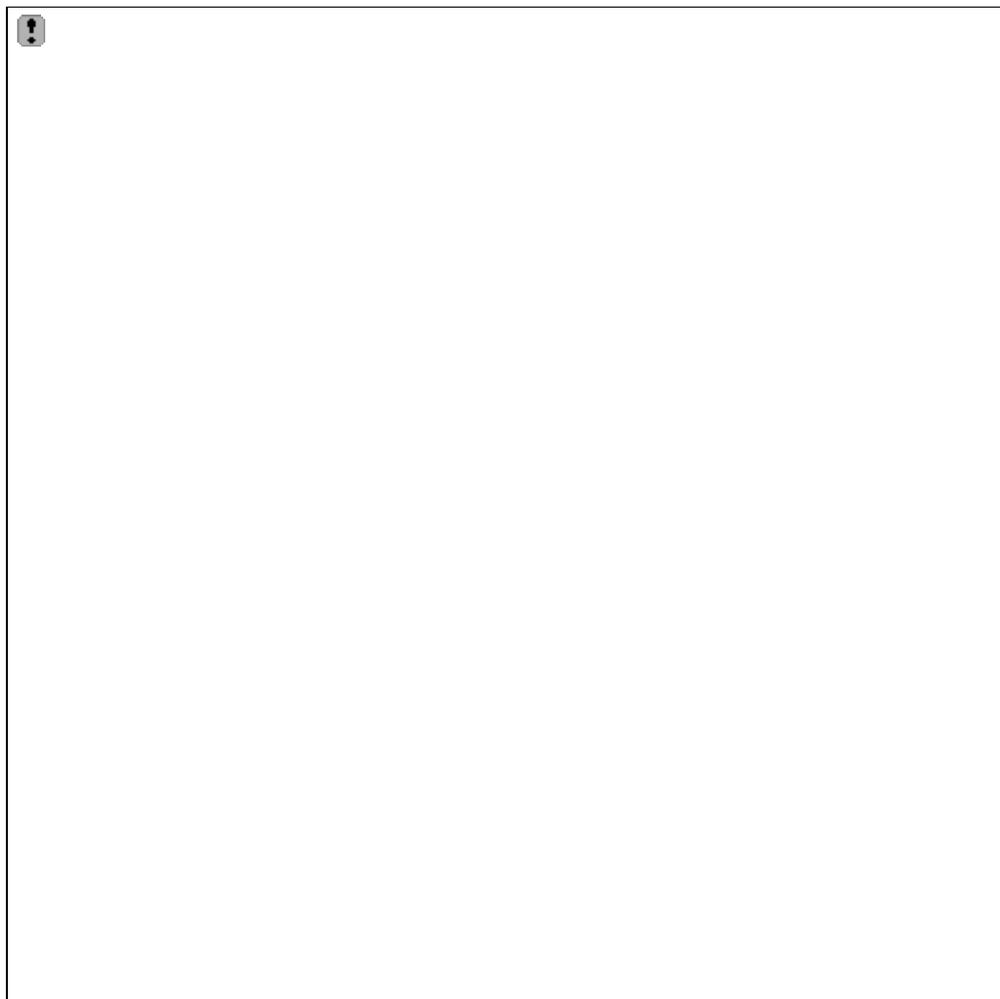


Figure 6.18: Fishes from the Den of Findon. (A), (B) *Cheirolepis trailli* Agassiz, restorations of lateral and ventral views respectively (from Pearson and Westoll, 1979). (C)–(E), *Coccosteus cuspidatus* Agassiz: (C) restoration of the fish head in lateral view; (D) restoration of the head and trunk shields in dorsal view; (E) restoration of the skull in anterior view (after Miles and Westoll, 1968). (F) *Cheirolepis trailli* Agassiz, a more or less complete specimen in lateral view, T00382/A, $\times 0.75$ (Photo: courtesy The Natural History Museum, London).

Osteolepis and *Cheirolepis* are relatively rare at Gamrie. The species *Osteolepis arenatus* and *Cheirolepis uragus*, erected by Agassiz (1835), differ from the Orkney species *O. macrolepidotus* and *C. trailli* only because of differing preservation, and the Orkney names take precedence (Traquair, 1888b). *Glyptolepis* is fairly common at Gamrie, but *Gyroptychius* is rare. Westoll (1937) noted that material labelled '*Diplopterax*' from Gamrie seems to be distinct from *Gyroptychius*, so two species of *Gyroptychius* may be present.

Interpretation

The evidence at Gamrie (Trewin and Kneller, 1987) indicates that the deposition of the fish bed, over a period of about 4000 years, was followed by uplift and an influx of locally derived breccias. Probably the fish bed was eroded away in many places, leaving the breccia lying directly above the conglomerates, as for example, near The Snook and at Pennan.

There are differences in faunal assemblage between Gamrie and other sites; for example *Dipterus*, which is common elsewhere, is entirely absent from the extensive collections from Gamrie.

Conclusions

The Gamrie fish bed is historically important as one of the first prolific Scottish Old Red

Sandstone fish sites to be exploited. Gamrie specimens have been widely studied, and they form the basis for much recent taxonomic and anatomical work on acanthodians, placoderms and bony fishes. Today fish specimens can be found only at the Den of Findon site, on the east side of a ravine at Geordie Craigs, but sufficient good specimens still come to light to justify the continuing importance and conservation value of the site.

Reference list

- Agassiz, J.L.R. (1833–1845) *Recherches sur les Poissons Fossiles*, 5 volumes, and atlas 5 volumes, Imprimerie Petitpierre, Neuchatel, France, 1420 pp.
- Agassiz, J.L.R. (1835) On the fossil fishes of Scotland. *Report of the British Association for the Advancement of Science*, British Association for the Advancement of Science, Edinburgh.
- Andrews, S.M. (1982) The discovery of fossil fishes in Scotland up to 1845 with checklists of Agassiz's figured specimens. *Royal Scottish Museum Studies*, 87 pp.
- Edward, G. (1889) The Old Red Sandstone of Caithness and its fossils. *Transactions of the Manchester Geological Association*, **19**, 374–81.
- Egerton, P. de M.G. (1861) British fossils. (Descriptions of *Tristichopterus*, *Acanthodes*, *Climatius*, *Diplacanthus*, *Cheiracanthus*.) *Memoirs of the Geological Survey of the United Kingdom (British Organic Remains)*, Dec. **X**, 51–75.
- Geikie, A. (1878) On the Old Red Sandstone of western Europe. *Transactions of the Royal Society of Edinburgh*, **28**, 345–452.
- Gregory, W. (1860) Notes of fossil fish localities of the Old Red Sandstone of the east of Scotland. *The Geologist*, **III**, 142–4.
- Hamilton, R.F.M. and Trewin, N.H. (1988) Environmental controls on fish faunas of the Middle Devonian Orcadian Basin. In *Devonian of the World, III, Proceedings of the Second Symposium on the Devonian System, Calgary, Canada* (eds N.J. McMillan, A.F. Embry, and D.J. Glass), Canadian Society of Petroleum Geologists, Memoirs 14, pp. 589–600.
- Hay-Cunningham, R.J. (1843) Geognostical account of Banffshire. *Transactions of the Highland Agricultural Society of Scotland, N.S.*, **8**, 447–502.
- Heintz, A. (1938) Notes on Arthrodira. *Norsk Geologisk Tidsskrift*, **18**, 1–27.
- Hemmings, S.K. (1978) *The Old Red Sandstone Antiarchs of Scotland: Pterichthyodes and Microbrachius*. *Palaeontographical Society (Monograph)*, 64 pp.
- Hemmings, S.K. and Rostron, J. (1972) A multivariate analysis of measurements on the Scottish Old Red Sandstone antiarch genus *Pterichthyodes* Bleeker. *Biological Journal of the Linnean Society*, **4**, 15–28.
- House, M.R., Richardson, J.B., Chaloner, W.G. *et al.* (1977) *A Correlation of Devonian rocks in the British Isles*. *The Geological Society, London, Special Report* **8**, 110 pp.
- Jarvik, E. (1948a) On the morphology and taxonomy of the Middle Devonian Osteolepid fishes of Scotland. *Kungliga Svenska Vetenskaps Akadaemiens Handlingar, Stockholm*, **25**, 1–301.
- Malcolmson, J.G. (1842) On the relations of the different parts of the Old Red Sandstone, in which organic remains have been recently discovered, in the counties of Murray, Nairn, Banff and Inverness (Abstract). *Proceedings of the Geological Society of London*, **3**, 141–4.
- Miles, R.S. and Westoll, T.S. (1968) The placoderm *Cocosteus cuspidatus* Miller et Agassiz from the Middle Old Red Sandstone of Scotland. *Transactions of the Royal Society of Edinburgh*, **67**, 373–476.
- Murchison, R.I. (1828) Supplementary Remarks on the Strata of the Oolite Series and the Rocks associated with them, in the Counties of Sutherland and Ross, and in the Hebrides. *Transactions of the Geological Society*, **2**, 353–68.
- Pearson, D. and Westoll, T.S. (1979) The Devonian actinopterygian *Cheirolepis*. *Transactions of the Royal Society of Edinburgh*, **70**, 337–99.
- Prestwich, J. (1837) On the structure of the neighbourhood of Gamrie, Banffshire, particularly on the deposit containing ichthyolites. *Transactions of the Geological Society of London* **5**, (2), 139–48.
- Prestwich, J. (1838) Observations on the ichthyolites of Gamrie in Banffshire, and on the accompanying red conglomerates and sandstones. *Proceedings of the Geological Society of London*, **2**, 187–8.
- Prestwich, J. (1840) On the structure of the neighbourhood of Gamrie, Banffshire, particularly on the deposit containing ichthyolites. *Transactions of the Geological Society of London* **5** (2), 139–48.

-
- Read, H.H. (1923) *The Geology of the Country around Banff, Huntly and Turriff* (Sheets 89 and 96). Memoirs of the Geological Survey of Great Britain, HMSO, London, 200 pp.
- Smith, S.J. (1851) Remarks on the fossil fishes of the Old Red Sandstone of Gamrie. *Zoologist*, **9**, 2993–5.
- Traquair, R.H. (1880) Report on a collection of fossil fish remains from Nairnside, made by Messrs Thomas D. Wallace and Alexander Ross of Inverness. *Transactions of the Edinburgh Geological Society*, **30**, 15–71.
- Traquair, R.H. (1888b) Notes on the nomenclature of the fishes of the Old Red Sandstone of Great Britain. *Geological Magazine*, **5**, 507–17.
- Traquair, R.H. (1895) The extinct vertebrate animals of the Moray Firth area. In *A Vertebrate Fauna of the Moray Basin, Vol II* (eds J.A. Harvie-Brown and T.E. Buckley), Douglas, Edinburgh, 309 pp.
- Trewin, N.H. and Kneller, B.L. (1987) Old Red Sandstone and Dalradian of Gramrie Bay. In *Excursion Guide to the Geology of the Aberdeen Area* (eds N.H. Trewin, B.C. Kneller and C. Gillen), Scottish Academic Press, pp. 113–25.
- Westoll, T.S. (1937) The Old Red Sandstone fishes of the north of Scotland, particularly of Orkney and Shetland. *Proceedings of the Geologists' Association*, **48**, 13–45.
- Woodward, A.S. (1891a) *Catalogue of fossil fishes in the British Museum. Part II. Containing the Elasmobranchi (Acanthodi), Holo-cephali, Ichthyodermalites, Ostracodermi, Dipnoi and Teleostini (Crossopterygii), and Chondrosteian Actinopterygii*, British Museum (Natural History), London, 567 pp.