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# Pennyland

[ND 114 687]–[ND 102 695]

## Highlights

The coastal section at Pennyland in Caithness (Highland) has produced nine species of fossil fishes from high in the Middle Devonian succession. One of the more important fishes from here is the placoderm *Millerosteus minor*.

## Introduction

Robert Dick, the Thurso baker, first collected fishes in the area in 1835. He began correspondence with Hugh Miller, and in 1845 sent him a collection of Caithness fish, which included material from 'Thurso'. Some of these were described by Miller (1849). Dick's material went to the RSM, where it was studied by Traquair from 1875 onwards, and Saxon (1978) has given revised faunal lists based on recent collecting. Geological sections of the site are given in Crampton and Carruthers (1914, p. 96), Donovan (1978, p. 46), and Donovan and Sanderson (1979, p. 129).

## Description

Middle Devonian flagstones are exposed in a long section on the foreshore between Thurso and Scrabster. The sequence of 150 m of sediments is transitional between the Mey Subgroup of the Upper Caithness Flagstone Group and the John o'Groats Sandstone Group, and is poorly exposed because of faulting.

Donovan and Sanderson (1979) described a total of 20 laminites in the section, of which 16 contain fishes. However, most of these only yield small fragments, and only seven or eight laminites contain complete plates or complete fishes. Where subaqueous shrinkage cracks are well developed within the fish bed, the fossils tend to be entirely fragmentary. Complete headshields and fishes are only found where there has been a thick development of calcareous laminite with no cracks. Some bedding planes are rich in well-preserved heads and plates of fish, with very few finely broken or disarticulated fragments. Complete *Dipterus* are fairly common. Usually *Millerosteus minor* (Figure 6.27) is found as disarticulated, or semi-disarticulated plates, which at Pennyland are very well preserved in the lower part of the section, between [ND 113 688] and [ND 110 692]. Articulating surfaces and other structures important for reconstructions can be seen in fine detail.

## Fauna

Acanthodii: Acanthodiformes: Acanthodidae

*Mesacanthus pusillus* Agassiz, 1844

Acanthodii: Acanthodiformes: Diplacanthidae

?*Rhadinacanthus longispinus* Agassiz, 1844 ( — Diplacanthus; see Denison, 1979, p. 32)

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Placodcrmi: Arthrodira: Homostcidac

*Homosteus milleri* Traquair, 1888

Placodermi: Arthrodira: Coccosteidae

*Millerosteus minor* Miller, 1858

Osteichthyes: Sarcopterygii: Osteolepiformes: Osteolepididae

*Osteolepis ?panderi* Jarvik, 1948

Osteichthyes: Sarcopterygii: Porolepiformes: Holoptychiidae

*Glyptolepis* cf. *paucidens* Agassiz, 1844

*Thursius pholidotus* Traquair, 1888

Osteichthyes: Sarcopterygii: Dipnoi: Dipteridae

*Dipterus* sp.

A typical Mey Beds fauna can be collected in these fish beds. *Millerosteus minor* is by far the commonest element of the fauna. *Thursius* and *Glyptolepis* occur, and complete specimens of *Dipterus* are fairly common. *Osteolepis* and *Homosteus* are rare. *Asterolepis orcadensis* occurs in Orkney in beds of equivalent age to the upper part of this sequence, but has not yet been discovered on the mainland of Scotland.

*Millerosteus minor* is a small coccosteid with an average length of 50–64 mm, although larger 150 mm specimens are known (Desmond, 1974) (Figure 6.27). The skull is typically coccosteid in most respects, but retains some primitive features (Denison, 1978). *Millerosteus minor* was named *Coccosteus minor* by Miller (1858), and the type locality is Kirkwall, Orkney. It was redescribed by Woodward (1891a) and Heintz (1938), and the monotypic genus *Millerosteus* was erected by Stensiö (1959); the Family Millerosteidae Stensiö (1963) was not given status by Denison (1978). Desmond (1974) redescribed *M. minor* based mainly on new material from Pennyland and Murkle Bay in Caithness. *M. minor* occurs in the Orkneys (Rousay Beds), Caithness (Mey Beds) and near Dalcross, Inverness, but Pennyland has greater abundances than any other Caithness site. *Millerosteus* also occurs in the Middle Devonian of the Baltic, and possibly also of Germany.

Hugh Miller's mainland specimens of *Homosteus* (*Homostius*) *milleri* (his '*Asterolepis*') were collected by Dick, but no records exist of the exact locality; Miller (1849, p. 63) stated that they were found '...in the north and west of Caithness', which has been interpreted by Kinnear (1893b) as somewhere between Thurso and Murkle (i.e. to the east of Thurso). The collection probably came from several localities, possibly including Pennyland. Bowie and Atkin (1956) reported an unusually radioactive *Homosteus* from Thurso, and many Caithness fossil fish are now known to be radioactive.

## Interpretation

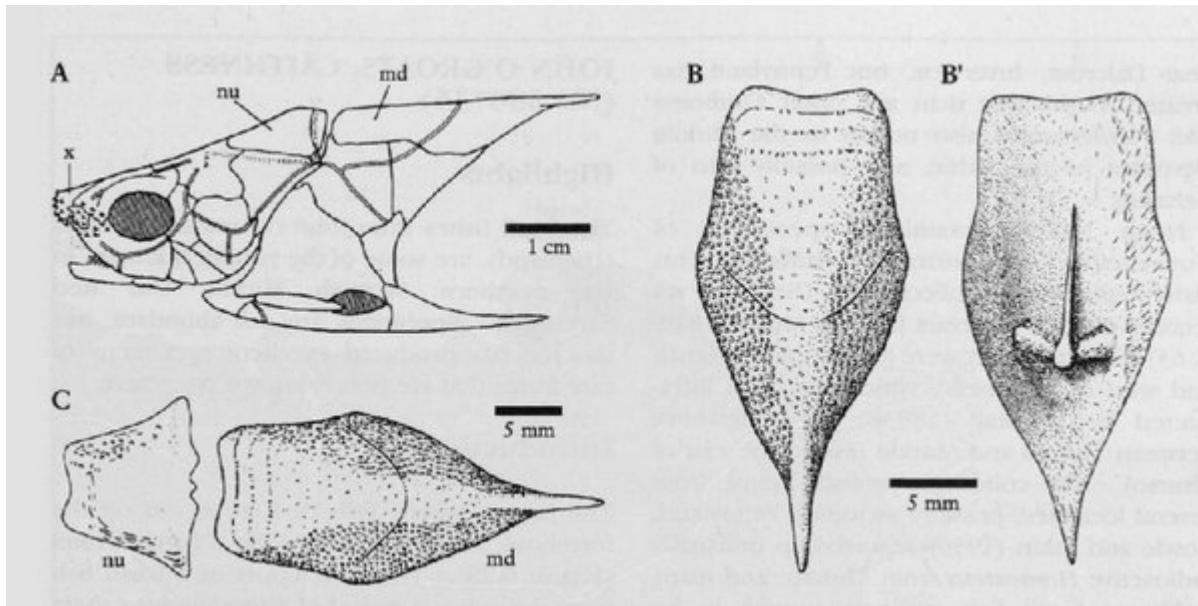
There is a gradual transition from predominantly lacustrine siltstones upwards into a more flu-vially dominated sequence in the John o'Groats Group. Above the lower calcareous laminates, the lacustrine–fluvial cycles become increasingly dominated by fluvial beds represented by cross-bedded sandstones and penecontemporaneously deformed siltstones. Laminites are rarer than lower down in the Caithness Middle Devonian sequence, and they are dominated by subaqueous shrinkage cracks.

Locally *Millerosteus minor* is not present in beds which yield other members of the typical Mey Beds faunal assemblage, possibly because it was more sensitive to environmental controls than other cohabitants of the Orcadian Lake. It may have hunted in shoals (Desmond, quoted in Saxon, 1978).

## Conclusion

The Pennyland succession has produced many fossil fish specimens from several horizons. Its importance and conservation value rests in the good-quality material of several species of placoderm and sarcopterygian, and in the fact that these faunas are dated as high in the Givetian, where good fish sites are rarer than for the lower horizons. Exposure is in wave-beaten low cliffs, and new specimens may be found at any time as a result of continuing erosion.

## References



(Figure 6.27) The arthropod *Millerosteus minor* (Miller). (A) Reconstruction in lateral view of the head and thoracic region of this species from the Mey and Ackergill Beds, Thurso Flagstone Group, of Caithness and Orkney (after Desmond, 1974); md, median dorsal plate; nu, nuchal plate; x, rostrum. (B) median dorsal plate, external aspect; (B') median dorsal plate, internal aspect. (C) Nuchal plate, external aspect.