The acanthodian *Machaeracanthus* from the Lower Devonian Hunsrück Slate of the Hunsrück region (Germany)

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with 4 figures


Abstract: Two recently collected slabs from the Lower Devonian Hunsrück Slate of Bundenbach, Hunsrück region, Germany, with spines of the acanthodian *Machaeracanthus hunsrueckianum* n. sp. are described. Both are associations of large and small spines and are the first to show groupings of symmetrical pairs; the spines are not homologous with those of other acanthodians. A pair of small spines of *Machaeracanthus peracutus* NEWBERRY, 1857 from the Karschheck quarry near Oberkirn, Hunsrück region, Germany, is articulated with the pectoral girdle and is the first such complex to be described. The only spines which *Machaeracanthus* appears to have had were a pair of large and small pectoral spines on each side of the body. These spines could have helped to prevent the fish from sinking into the mud while resting on the sea floor.

Keywords: Acanthodii • *Machaeracanthus* • Lower Devonian • Lower Emsian • Hunsrück Slate • Germany


Schlüsselwörter: Acanthodii • *Machaeracanthus* • Unterdevon • Unterems • Hunsrückschief er • Deutschland

Introduction

The acanthodian fish *Machaeracanthus* is known from the Early to early Late Devonian (BURROW et al., submitted). The genus was very successful in the Early Devonian and had a wide distribution in the southern hemisphere of that time. These occurrences vary from cold to warmer and from deeper to shallower waters.

The Pragian and early Emsian German deposits were subtropical, with the Hunsrück Slate at Bundenbach (the *Machaeracanthus* n. sp. localities) representing muddy facies formed at a water depth which did not exceed 200 m. At Oberkirn (the locality for the smaller *M. peracutus* NEWBERRY, 1857) the slate is more silty, having been deposited closer to the shore in a water column of around 30 m (SÜDKAMP 2005, accepted).

The description of different *Machaeracanthus* species is mainly based on the cross-sectional shape of the isolated fin spines (ZIDEK 1981; BURROW & YOUNG 2005). Further finds of associated scapulocoracoids, scales and tooth whorls may belong to the same fish. Here, two newly discovered specimens of associated pairs of spines and one articulated shoulder girdle complex (scapulocoracoid plus one pair of spines), from the Lower Emsian Hunsrück Slate of the Hunsrück region in Germany, are described. The associated pairs of spines were found in the conservation lagerstätte at Bundenbach (Eschenbach-Bocksberg and Herrenberg, Germany).
quarries) and are described as *Machaeracanthus hunsrueckianum* n. sp. The articulated shoulder girdle with spines is assigned to *M. peracutus*. This slab does not belong to the famous Bundenbach strata and was collected by the author in an old tip heap of the Karschheck quarry near Oberkirn, which is situated around 5 km to the north of Bundenbach. See SÜDKAMP (accepted) for further information concerning the palaeoenvironment of this location.

*Machaeracanthus hunsrueckianum* n. sp. is possibly endemic to the Lower Emsian strata of the Hunsrück Slate of the Hunsrück region, the source of the material described here. The Pragian Taunus-Quarzit in the Taunus region, on the other side of the Rhine, and the Pragian to Lochkovian (WAGNER 2004; GAD 2005) Hunsrück Slate in the south-east Eifel region, also yielded *Machaeracanthus* spines, but none can be reliably assigned to *Machaeracanthus hunsrueckianum* n. sp. because the Taunus-Quarzit fossils are incomplete and badly preserved, and the numerous spines from the Eifel are older and larger than *M. hunsrueckianum* n. sp. The Pragian to Lochkovian spines from the Eifel reach a length of more than 40 cm and vary in shape and size, suggesting a range of acanthodians (BARTELS et al. 1998: 238).

The terminology used in the description follows that of ZIDEK (1981).

**Systematic palaeontology**

Order Ischnacanthiformes BERG, 1940  
Family Machaeracanthidae BURROW & YOUNG, 2005  
Genus *Machaeracanthus* NEWBERRY, 1857

*Machaeracanthus hunsrueckianum* n. sp.  
Figs. 1–2

**Holotype:** Hunsrück-Museum, specimen H.M. 2003.21 (slab here designated H), Simmern, Germany (Figs. 1A, B).

**Type locality:** Bundenbach, Obereschenbach opencast mine, Rhineland-Palatinate, Germany.

**Type stratum:** Hunsrück Slate, Lower Emsian, Ulmen Substage, Kaub Formation, Wingertshell Member.

**Other material:** Specimen (slab here designated S) in private collection G. Beicht, Bundenbach, Germany. Tip heap find in the Hans Member (SÜDKAMP 2007), from the Herrenberg quarry near Bundenbach (Figs. 2A–C).

**Diagnosis:** *Machaeracanthus* with left and right pairs of spines, each pair comprising a smaller spine ca. 90–130 mm long and a larger spine 140–270 mm long. The more tapered proximal ends of the spines have a bulb-shaped tip. The distal ends are broader and fractured. In cross-section, the ?dorsal surface is relatively flat, with only a short subtriangular swelling over the central canal; the ?ventral surface is only flat towards the edges, with a wide convex median swelling, the rounded longitudinal ridge. The keels on the leading side are narrow (2–5 mm) and the wings on the trailing side are broad (10–12 mm). Fine longitudinal striations ornament the spines. The small-calibre “central” canal (diameter 2.0–2.5 mm) is positioned directly under the ridge distally, but deeper and more central/proximally.

**Description:** The two slabs are from the strata deposited in the more pelagic part of the Wisper Trough where the famous Hunsrück Slate fossils are normally found. Both show associated pairs, each comprising a large and a small spine. All of the spines are asymmetrical, with an arc-shaped outline. The longer spines on slab S are incomplete, being broken off on the edge of the slab, thereby exposing their transverse sections (Figs. 2B, C). These sections show that one of the sides is deeply convex, but thinning towards one edge, and the other side is flatter with only a narrow rounded ridge near the centre-line. The spine tips could not be completely prepared, as they are in a sandy lens, and the tip of one of the smaller ones is overlain by a larger spine. Their visible lengths are thus less than for complete spines.

The two pairs of spines on slab S are 138 and 87 mm long (left two spines in Fig. 2A, sides with thin ridge exposed) and 141 and 98 mm long (right two spines in Fig. 2A, deeply convex sides exposed); the greatest width is 21 mm farthest away from the tip of the spine on the broken off edge of the slab. The spines show only slight longitudinal curvature. The spine pairs on slab H are 110 and 250 mm long (left two spines in Fig. 1A, convex side of small spine and flatter side of large spine exposed) and 270 and 132 mm long (right two spines in Fig. 1A, flatter sides exposed), with a greatest width midspine of 21.5 mm. The large spines show moderate curvature, tapering slightly towards the tips. The distal ends of all the spines appear to be fracture surfaces, indicating that they are incomplete and at the other, moderately acute, tips they show a terminal (proximal) bulb. See further interpretation under “Orientation” below.

The keels are relative narrow (slab H: 2–5 mm) along the leading/convex side of the spines and the wings are two to six times wider (slab H: 12, respectively 10 mm) along the trailing/concave sides, where they extend for the whole length. The ?dorsal ridge extends the whole length of the spines and is very constant in width (slab H: 4.0–6.5 mm on the large spines). The small spines on both slabs have a narrower ridge, which varies in width from 3.5 to 5 mm at the tip to about 2 mm near the base. The convex ridge on the ?ventral side slopes up more steeply towards the leading edge and more shallowly at the rear.

Unevenly distributed, fine longitudinal striations ornament the spines. The flatter wings have five to eight striations, and the rounded surfaces on the exposed opposite sides of the two smaller spines of both slabs have 12 to 14 striations per 5 mm. The spines also have fine oblique stripes and cracks at varying distances, but these are thought to be of diagenetic origin.