

## The first Actinopterigian (Pisces: Osteichthyes) tooth from the Bathonian (Middle Jurassic) of the Polish Jura (south-central Poland)

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with 3 figures

SMITH, A.S. & ZATOŃ, M. (2007): The first Actinopterigian (Pisces: Osteichthyes) tooth from the Bathonian (Middle Jurassic) of the Polish Jura (south-central Poland). – *Paläontologie, Stratigraphie, Fazies* (15), Freiberger Forschungshefte, C 524: 35–40; Freiberg.

**Keywords:** Actinopterygia, osteichthyes, Jurassic, Bathonian, Poland.

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### Abstract

A 12 mm long conical tooth crown is described from the Middle Bathonian (*subcontractus* Zone) deposits of the “Gnaszyn” clay-pit at Gnaszyn Dolny, Poland. The fossil represents the first reported actinopterigian (basal Neopterygii) material from the Middle Jurassic of Poland. The specimen bears a distinctive ornamentation of anastomising ridges and an acrodin cap at the apex indicating a large actinopterygian fish. The tooth morphology and size is typical of a large macrophagous predator.

### Zusammenfassung

Von der Tongrube „Gnaszyn“ bei Gnaszyn Dolny (Polen) wird aus dem mittleren Bathonium (*subcontractus* Zone) eine 12 mm lange konische Zahnlkone beschrieben. Sie stellt den ersten Nachweis eines Actinopterygiers (basale Neopterygii) aus dem mittleren Jura Polens dar. Das Exemplar zeichnet sich durch eine markante Ornamentierung aus anastomosierenden Leisten und eine acrodine Spitze aus, was auf einen großwüchsigen Actinopterygier hinweist. Zahnmorphologie und Größe sind typisch für einen großen makrophagen Jäger.

### 1 Introduction

The Middle Jurassic clays, belonging to the Ore-bearing Częstochowa Clay Formation, of the Polish Jura (see DAYCZAK-CALIKOWSKA et al., 1997; KOPIK, 1998) are widely known for their well-preserved fossil invertebrates (e.g., MATYJA & WIERZBOWSKI, 2000; ZATOŃ & MARYNOWSKI, 2004, 2006; GEDL et al., 2003; KAIM, 2004; ZATOŃ, 2007a; SALAMON & ZATOŃ, 2007), and fossil macroflora (ZATOŃ et al., 2006; PHILIPPE et al., 2006; MARYNOWSKI et al., 2007). In contrast, with the exception of sharks teeth, vertebrate fossils, especially articulated ones, have not been found in these sediments yet. This is probably not an effect of taphonomy,

because despite of the lack of complete vertebrate specimens, the taphonomic conditions favour excellent preservation of some fossil material. For example, ammonites still retain original aragonitic shell, and isolated phosphatic fossils are quite frequent, e.g. tiny (millimetres in size) shark teeth occur in the clays. It is rather caused by the lack of effort in searching for the vertebrate remains in these sediments. One exception is a report of fish remains and a plesiosaur tooth from the Middle Bathonian of the Polish Jura by REHBINDER (1913). However, these fossils have not been described or illustrated, and they can no longer be located. Here we describe a large actinopterigian (basal Neopterygii) tooth. The find is significant as it represents the first of its kind to be reported from Middle Jurassic strata in Poland.

## 2 Palaeogeographic background and material provenance

The clays of the Polish Jura were deposited in an epicratonic sea surrounded by land-massifs: Fennoscadian to the north, Belorussian and Ukrainian to the east, pre-Carpathian to the south and Bohemian to the south-west (see ZIEGLER, 1990). The depth of the sea during the Bathonian age might have reached 200 m or more, as evidenced by palaeontological data (e.g. gastropods, Dr. ANDRZEJ KAIM 2005, pers. inf.) and by stable isotopic studies (ZATOŃ, 2007a). Geochemical analyses of the host clays indicate predominantly oxic, but periodically dysoxic bottom-waters (ZATOŃ & MARYNOWSKI, 2004; SZCZEPANIĆ et al., 2007; ZATOŃ, 2007a).

The fossil tooth described here was found on the floor of the ‘Gnaszyn’ clay-pit at Gnaszyn Dolny near Częstochowa (Fig. 1). The pit cuts through a succession (ca. 20 m) of monotonous dark-grey clays intercalated with carbonate concretions (Fig. 1C). *Tulites cadus* BUCKMAN found at the floor of the clay-pit (ZATOŃ, 2007b) precisely indicates the Middle Bathonian age (Subcontractus Chron; see e.g. MANGOLD & RIOULT, 1997). Above, the Middle Bathonian Morrisi Zone and Upper Bathonian sediments occur (ZATOŃ et al., 2006; MATYJA & WIERZBOWSKI, 2006). Generally, the Gnaszyn and neighbouring area of Kawodrza are well known for the numerous active clay-pits. Within the pits, outcrops of uppermost Bajocian – Bathonian clays occur, intercalated with carbonate concretions and massive sideritic layers (see MATYJA & WIERZBOWSKI, 2000, 2006; MAJEWSKI, 2000; ZATOŃ & MARYNOWSKI, 2004).

The specimen is housed at Department of Ecosystem Stratigraphy, Faculty of Earth Sciences, University of Silesia, under catalogue number GIUS 8-2849.

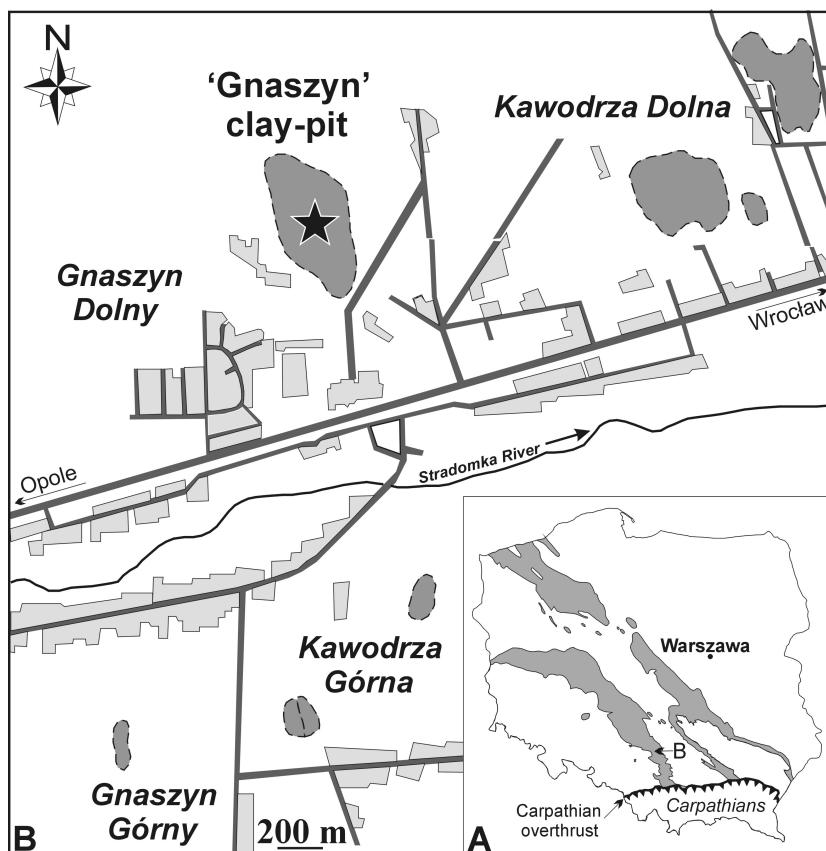


Fig. 1: A – Map of Poland with Jurassic deposits indicated (shaded areas), B – Location map of the clay-pit investigated (asterisk), C – Schematic litho-stratigraphic section of the clays intercalated with carbonate concretions at the ‘Gnaszyn’ clay-pit, with the tooth found indicated (arrow); scale bar equals 1 m.

### 3 Systematic Palaeontology

Class Osteichthyes  
 Subclass Actinopterygii  
 gen. et sp. indet.

**Description:** GIUS 8-2849 is an isolated conical tooth crown measuring 12 mm long from base to apex and 3 mm in maximum diameter (across the base) (Fig. 2). The tooth crown is slightly recurved, tapers to a sharp tip and is perfectly circular in cross section along its entire length. A pulp cavity is not discernable and there is a translucent enameloid or acrodin-cap covering the tooth apex.

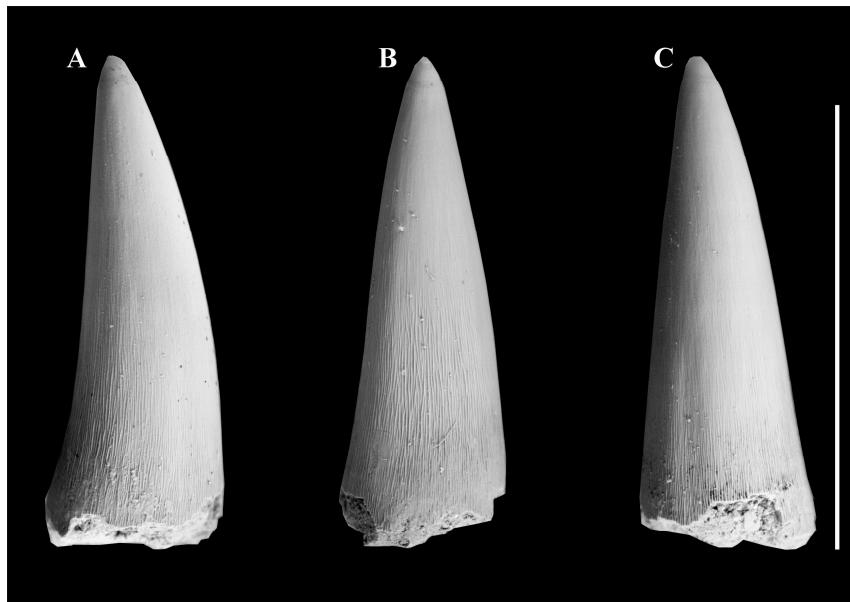


Fig. 2: Actinopterigian tooth-crown (GIUS 8-2849) from the Middle Bathonian of the Polish Jura. A – lateral view, B – lingual view, C – labial view; scale bar equals 10 mm.

spaced longitudinal ridges (approx. 10 per mm). These ridges occur around the whole circumference of the tooth and are all roughly equal in width and length. Together they form a distinct pattern (Fig. 3) – the tips of most ridges closely approach the edge of adjacent ridges, whilst some even diverge/converge, contacting each other at shallow angles. The areas in between the ridges often appear like the ‘eye of a needle’.

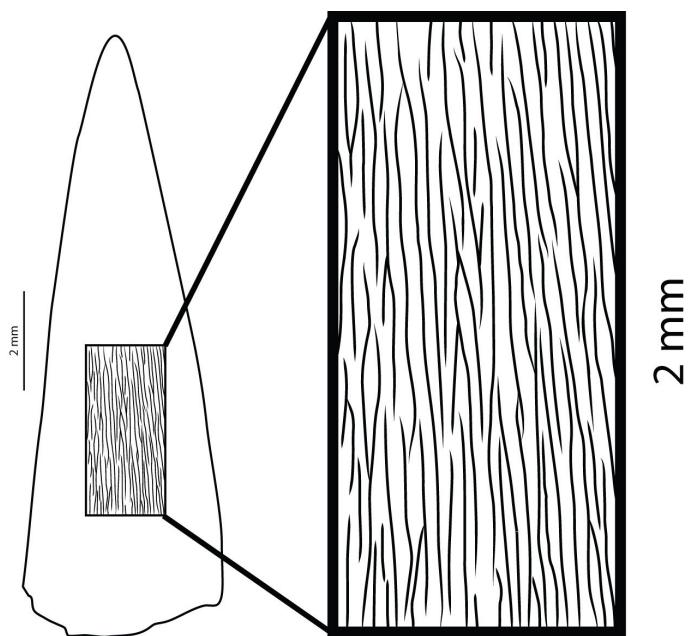


Fig. 3: Ornamentation pattern of the tooth (GIUS 8-2849) in the ‘eye of a needle’ form.

**Identification:** A conical tooth from this horizon (Middle Bathonian, Subcontractus Zone) could potentially belong to an actinopterygian fish, pterosaur, ichthyosaur, crocodile, plesiosaur, or theropod dinosaur. The size of GIUS 8-2849 is roughly consistent with all of the above, but most of these taxa can be discounted based on morphology. Theropod dinosaur teeth are typically bucco-lingually flattened; ichthyosaurs are not particularly recurved and always bear coarse ridges, pterosaur and plesiosauroid plesiosaur teeth are typically far more slender and elongate with coarse ridges, crocodile teeth are typically oval in transverse cross-section (not circular), and bear coarse ridges. The overall shape is most similar to pliosauroid plesiosauroids and predaceous actinopterygian fishes; both may possess robust recurved teeth with circular transverse cross sections. However, the conspicuous translucent acrodin-cap

is absent in pliosaurs, and is a diagnostic character of actinopterygian fishes (HALL & WOLBERG, 1989). This character has been documented in (much smaller: up to 3.5 mm long) conical teeth of a number of known and unknown Mesozoic teleosts, including the order Elopiformes (SHIMADA et al., 2006). Also, a comparison of the pattern of ridges of GIUS 8-2849 with pliosaurs and actinopterygians finds a closer match with the fish. There is a large degree of variation amongst the teeth of pliosaurs, but all Middle Jurassic pliosaurs typically have coarser ridges and carinae (TARLO, 1960).

A similar anastomosing pattern was observed in the conical recurved tooth of an actinopterygian (identified as Halecomorphi) from the Hettangian of Belgium (DELSATE et al., 2002, pl. 14 C, D). However, that tooth (specimen HE243 F010B) differs in the overall crown structure, being rather more blunt and less conical. To conclude, GIUS 8-2849 shares a number of characters seen in other Mesozoic actinopterygians and can be identified as such. The overwhelming similarity between the pattern of ridges on this tooth and HE 243F010B, leads us to the conclusion that GIUS 8-2849 belongs to a hitherto unknown large predaceous actinopterygian fish, unfortunately the tooth cannot be confidently identified to a higher taxonomic level.

#### 4 Discussion

The actinopterygian tooth, together with tiny shark teeth embedded in the sediments, the description of which is currently underway (Dr. ANDRZEJ KAIM, pers. inf. 2004), represents the only direct evidence of predators living in the Bathonian Polish Basin. However, there are also other indicators of predators in the sediments under discussion. In the ‘Gnaszyn’ clay-pit, distinct aggregations of crushed or disarticulated remains belonging molluscs (gastropods, bivalves, belemnites), brachiopods and echinoderms (asteroids, crinoids, echinoids) (ZATOŃ et al., 2007a, b) are discernable. Furthermore, asteroid ossicles often bear distinct tooth-marks on their surface (ZATOŃ et al., 2007b). MERTA & DREWNIAK (1998) have also noticed similar accumulations and interpreted them as vertebrate excrements. However, crushed and non-abraded, but still well-recognizable fossils remains, as well as statistically-based comparative taphonomy of echinoderm remains from these accumulations and host clays, indicate that they represent vertebrate regurgitates (ZATOŃ et al., 2007b). They were produced by benthic-feeding generalists, e.g. demersal sharks or durophagous fishes. Regurgitates and coprolites are of great palaeobiological importance, revealing direct evidence of predator diet, in addition to predator-prey relationships (see e.g., POLLARD, 1990; SATO & TANABE, 1998; NEUMANN, 2000; CHIN, 2002; NORTHWOOD, 2005). However, fossilized vertebrate remains (teeth, bones, scales) provide the most direct evidence of the morphological features of the actual predators. The tooth described here belongs to a large predaceous actinopterygian, which, in addition to sharks or rays, may be considered as another potential producer of the contemporary regurgitates. The morphology of the tooth is consistent with the ‘general’ feeding guild identified for some marine reptiles (MASSARE, 1987). This feeding guild is suitable for catching a wide range of prey, in particular, fish and cephalopods (MASSARE, 1987). The tooth therefore, beside the sharks, provides the first direct evidence for the identity of a macrophagous predator in these deposits, a large actinopterygian fish.

#### Acknowledgements

Thanks to GARETH DYKE (Dublin) for reviewing an early version of the manuscript and to JÜRGEN KRIWET (Berlin) for providing very useful comments. M.Z. thanks the Foundation for Polish Science for financial support (grants for young scientists 2007).

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