

COMPLEMENTS TO THE ANATOMICAL KNOWLEDGE OF *CYCLURUS MACROCEPHALUS* REUSS (PISCES, ACTINOPTERYGII) FROM THE EOCENE OF KUČLÍN, BOHEMIA, CZECH REPUBLIC

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Abstract. In their comprehensive worldwide revision of living and fossil Amiid fishes, Grande et Bemis (1998) “were unable to examine” the material of *Cyclurus macrocephalus* REUSS which is kept in the palaeontological collections of the Národní Muzeum. However, some of these pieces deserve interest as they show anatomical features which remained precedently undescribed, especially the ventral surface of the neurocranium and the vomer. Additionally, an undescribed well preserved skull roof confirms that this species differs from any other species of the genus *Cyclurus* AGASSIZ by its rectangular, wider than long, parietals. A caudal fin is also exposed on one of the slabs.

■ Anatomy, Fishes, Actinopterygii, Amiidae, *Cyclurus*, Eocene, Kučlín (Kutschlin), Bohemia, Czech Republic.

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Introduction

The fossiliferous locality of Kučlín, near Bílina, Bohemia, which has long been considered Oligocene in age, is famous both for its flora and for its fish fauna. The fish fauna was first studied by Reuss (1844) and then by von Meyer (1851). According to recent studies (Obrhelová, 1975; Micklich, 1990; Gaudant, 2000), it includes four taxa: an amiid, *Cyclurus macrocephalus* REUSS, a thaumaturid: *Thaumaturus furcatus* REUSS, and two percoids: *Properca uraschista* (REUSS) and an undetermined moronid.

Cyclurus macrocephalus REUSS is a large amiid species from the Middle Eocene (Bartonian ?) of Kučlín having a standard length which may exceed 350 mm. The body is elongate, its maximum height being slightly more than 1/4 of standard length. The skull roof is characterized by its reduced parietals which are wider than long; the length of which being only 0.24–0.29% of frontal length. The fourth infraorbital, which shows a convex postero-ventral outline, is larger than the fifth one. The parasphenoid has its ascending processes perpendicular to the longitudinal axis of the bone; it bears a crescent shaped tooth patch. The subtriangular is posteriorly truncated. The vertebral column consists of about 64–67 centra (70 according to Grande et Bemis, 1998: 62 preural plus 8 ural): 24–26 abdominal centra, 30–35 postabdominal centra, including 16–22 monospondylous and 13–14 diplospondylous centra, and 8 ural centra. The rounded caudal fin includes 4–5+15+5–7 rays. The dorsal fin is rather short: slightly less than 40 rays supported by at least 36 or 37 pterygiophores. The anal fin is small: ii+I+7 rays supported by seven pterygiophores.

The type material of this species includes three almost complete skeletons which were figured by von Meyer (in Reuss et von Meyer, 1851; Tab. VIII, text-fig. 5; Tab. IX, text-fig. 1–2) and two caudal regions. They are presently kept in the Palaeontological section of the Naturhistorisches Museum Wien.

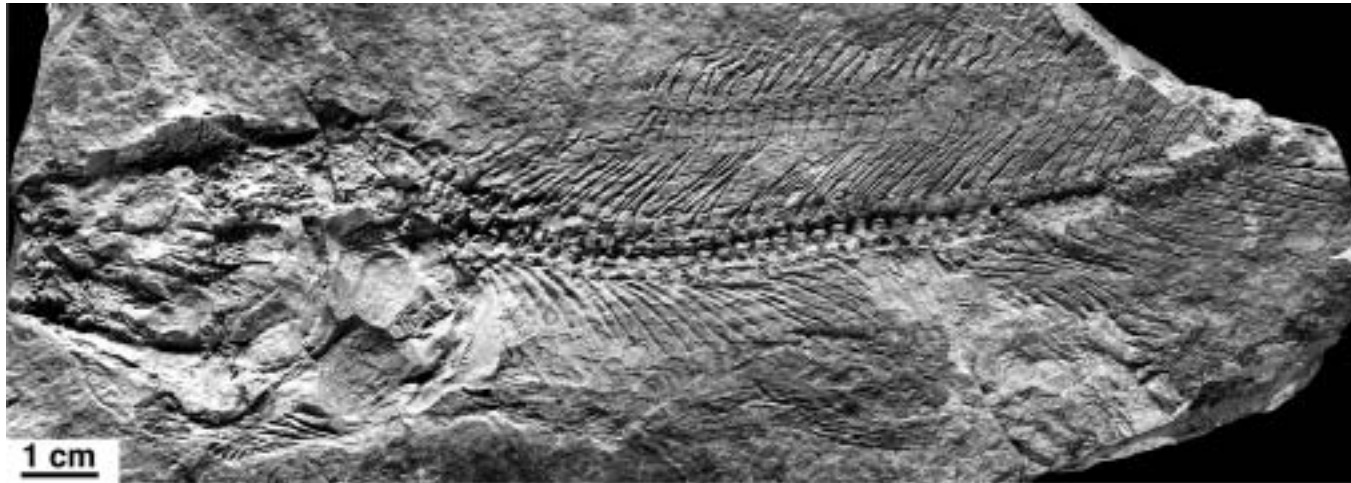
It is proposed to use as a lectotype the specimen NHMW 1864-XL-966 (von Meyer, 1851, Tab. IX, text-fig. 1) (Text-fig. 1).

According to a radiometric analysis of the remnants of a tephritic flow overlying them, the age of the fossiliferous strata of Kučlín is older than 38.3 ± 0.9 Ma. That means that this locality is Middle Eocene and possibly Bartonian (Bellon et al., 1998).

History

Reuss (1844) created and described the species *Cyclurus macrocephalus* Reuss from the “Polierschiefer” of Kučlín, originally diatomitic sediment transformed in opal CT (“Halbopal”). Contrary to Agassiz (1839) who included the genus *Cyclurus* Agassiz among the Cyprinids, Reuss referred it to the “Esoces” because these fishes exhibit “jaws provided with teeth” and “a number of branchiostegal rays which greatly exceeds three”. A few years later, von Meyer (1848, and in Reuss et von Meyer, 1851) considered that these fishes belong to the family “Halecoideen” (i.e. among our Halecomorphi), making a decisive step toward their correct assessment.

In his study of the vertebrate fauna from the lignitic formation of Bohemia, Laube (1901) was able to describe the first complete specimen of *Cyclurus macrocephalus* REUSS,



Text-fig. 1. *Cyclurus macrocephalus* REUSS. General view of lectotype. Specimen N.H.M.Wien 1864-XL-966. [Photograph D. Serrette]

and a second one, almost complete. Both are kept in the Staatliches Museum für Mineralogie und Geologie zu Dresden (Laube, 1901, Taf. I). Laube recognized the relationship of this species with the recent genus *Amia* LINNAEUS, so that he named it *Amia macrocephala* (REUSS) and included this species in the family Halecomorphidae that he considered as belonging to the Amioidei.

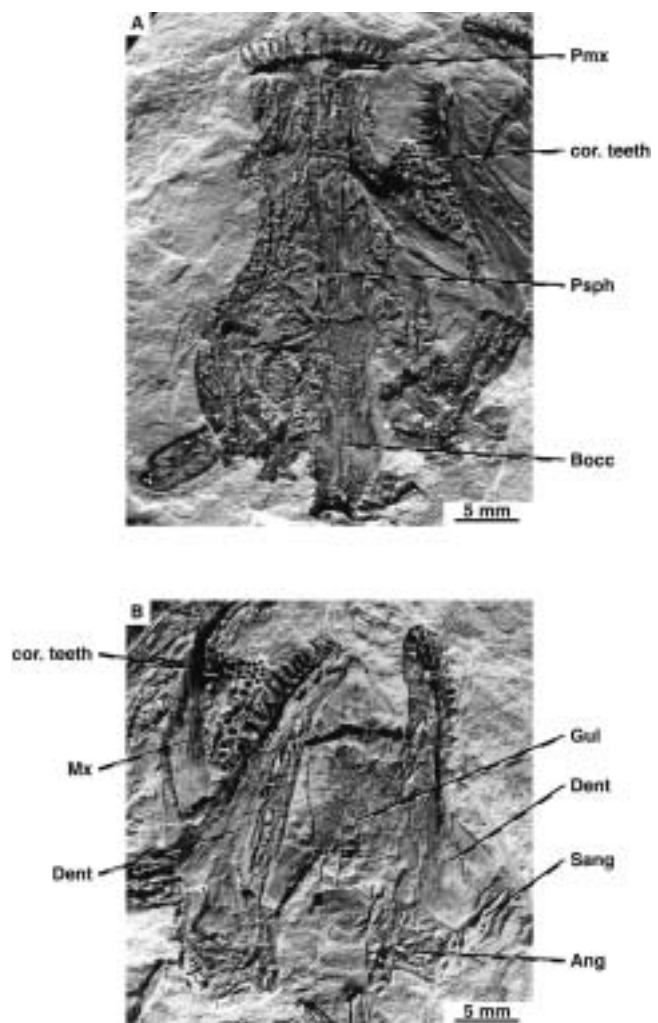
More recently, some additional anatomical data were brought to light by Gaudant (1987) who first noted the occurrence of “styliform”, crushing vomerian and coronoid teeth, i.e., according to Boreske (1974), having a rounded — instead of sharp — distal end, the possession of “very short parietals, the length of which is approximately only one fourth of the frontal length”, the great development of the fourth infraorbital, which is significantly larger than the last one, and the presence of a short, subtriangular gular which is posteriorly truncated”.

Finally, in their comprehensive worldwide study of living and fossil Amiid fishes, Grande et Bemis (1998: 305) “were unable to examine” the fossil material of *Cyclurus macrocephalus* from Kučlín which is kept in Prague, in the palaeontological section of the Národní Muzeum. The purpose of the present paper is to describe it because, among the undescribed specimens, there are some pieces which throw additional light on the anatomy of this species.

Additions to the anatomical knowledge of *Cyclurus macrocephalus* REUSS

The most significant specimen is the slab numbered N.M.P. Pc 2847 which shows the ventral surface of a neurocranium, the two branches of the mandible, the gular and the inner surface of a left cleithrum.

In front of the neurocranium, the oral processes of both premaxillaries are preserved (Text-fig. 2A). They bear 6 or 7 strong sharp teeth (6 on the left premaxillary and 7 on the right one). The most important feature exhibited by the neurocranium is the parasphenoid which is prolonged backwards by the basioccipital. Its ascending processes are perpendicular to the longitudinal axis of the bone which bears a more or less crescent shaped tooth patch (Text-fig. 3), like in *Cyclurus kehreri* (ANDREAE) (Grande et Bemis, 1998; Gaudant, 1999).

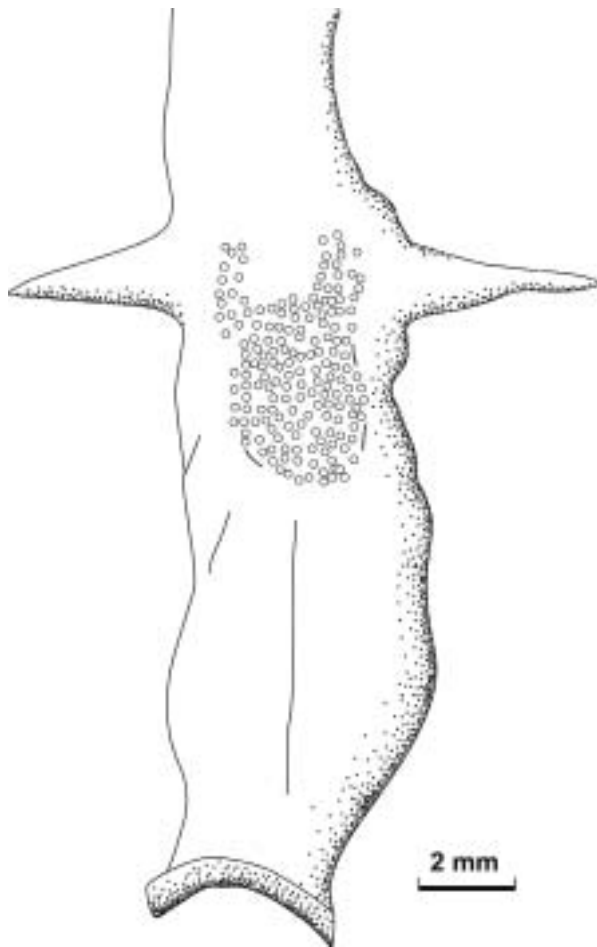


Text-fig. 2. *Cyclurus macrocephalus* REUSS. Specimen NMP Pc 2847.

A: Ventral view of neurocranium. Bocc: basioccipital; Pmx: premaxillary; Psph: parasphenoid; cor. teeth: coronoid teeth. B.: Lower jaw and gular. Ang: angular; Dent: dentary; Gul: gular; Mx: maxillary; Sang: supraangular; cor. teeth: coronoid teeth. [Photographs D. Serrette]

The gular is preserved between the two branches of the mandible (Text-fig. 2B). As suggested by one of the syntypes (N.H.M.W. 1864-XL-967) figured by von Meyer

(1851, Tab. VIII, text-fig. 5) and Gaudant (1987, text-fig. 4A), it is subtriangular. The ratio between its length and its width equals 0.5. Its posterior edge which is feebly convex is perpendicular to the longitudinal axis of the bone.



Text-fig. 3. *Cyclurus macrocephalus* REUSS. Specimen NMP Pc 2847. Ventral surface of the parasphenoid, showing its tooth patch.

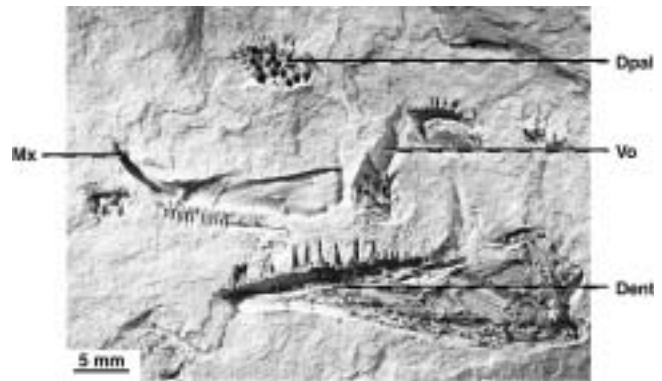
Coronoid teeth are present near the oral edge of the right dentary on which one can see the pores of the mandibular canal. In the symphyseal region, three pores are present just under the oral edge of the dentary.

A second important specimen is another slab (Pc 2848) bearing several disarticulated skull bones: especially a maxillary, a vomer, a mandible and a dermopalatine (Text-fig. 4).

The maxillary shows its mesial surface. Its oral process bears about 19 teeth: the twelve anterior teeth are significantly larger than the posterior ones. Additionally, one can see the dorsal process for the articulation of the supramaxillary and the notch on the posterior edge of the bone (not visible on Text-fig. 4).

The mandible is elongate: its maximum height is about one third of its length. The limits of its components are not clear. About 13 large teeth — three of which are missing, — and 5–6 smaller ones were present on the oral process of the dentary.

A left vomer exhibits its ventral surface, showing the tooth patch which consists in the sockets of about 18 teeth, a number which is similar to that observed in *Cyclurus kehreri* (ANDREAE) (Gaudant, 1999, Pl. 3, text-fig. 4).

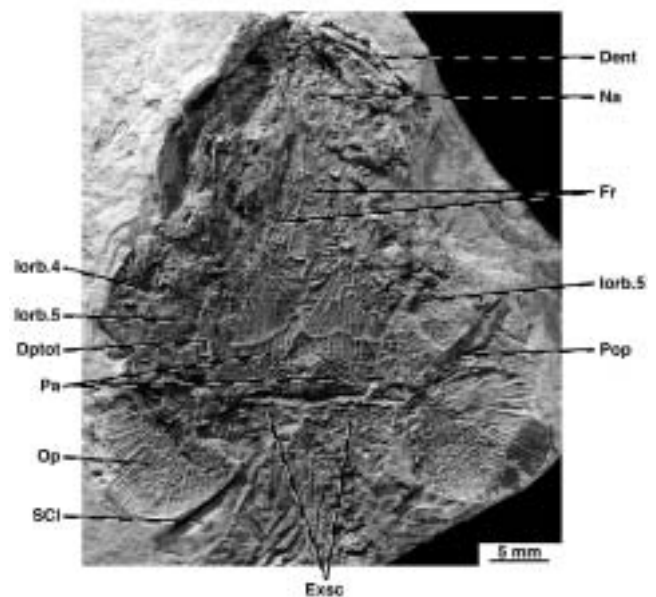


Text-fig. 4. *Cyclurus macrocephalus* REUSS. Isolated skull bones. Specimen NMP Pc 2848.

Dent: dentary; **Dpal:** dermopalatine; **Mx:** maxillary; **Vo:** vomer. [Photograph D. Serrette]

Finally, one can recognize a right dermopalatine showing a row of six lateral sharp teeth and the tooth patch showing the sockets of about 18 teeth.

In the Národní Muzeum is also kept an old undescribed specimen (Pc 2833) which exhibits a skull roof and the two opercula (Text-fig. 5). In the skull roof the parietals are wider than long: the ratio width/ length equals 1.1 and 1.25 on both parietals. Their length is only 0.33 of the frontal length. The maximum width of the frontal is 0.4 of its length. Both dermopterotics are also preserved. On both sides it is possible to recognize the rectangular shape of the fifth infraorbital. Finally, both extrascapular are present behind the skull roof.



Text-fig. 5. *Cyclurus macrocephalus* REUSS. Skull roof. Specimen N.M.P. Pc 2833.

Dent: dentary; **Dptot:** dermopterotic; **Fr:** frontal; **Iorb. 4:** fourth infraorbital; **Iorb. 5:** fifth infraorbital; **Na:** nasal; **Op:** operculum; **Pa:** parietal; **Pop:** preoperculum; **Scl:** supracleithrum. [Photograph D. Serrette]

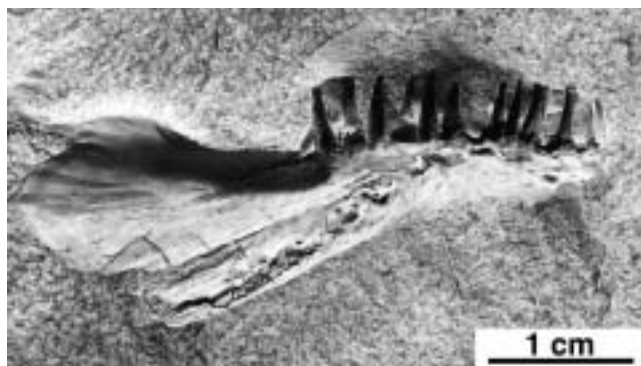
The slab Pc 2846 bears an isolated right operculum (Text-fig. 6), the width of which equals 83% of its maxi-

mum height. Its lateral surface is ornamented with a series of rather weak ridges radiating from a point situated near the articular facet for the opercular process of the hyomandibular.



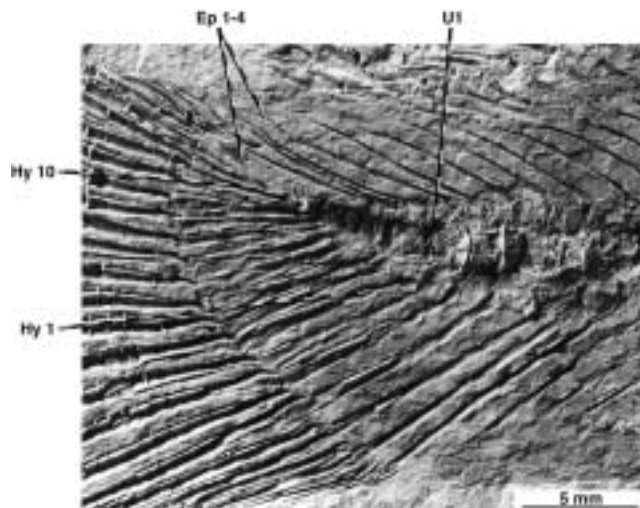
Text-fig. 6. *Cyclurus macrocephalus* REUSS. Specimen NMP Pc 2846. Right operculum. [Photograph D. Serrette]

The specimen Pc 313 is a right dentary (Text-fig. 7) which was bearing 14 teeth (one is missing). A series of pores of the mandibular canal is clearly visible on it. A positive cast of this specimen was already figured by Laube (1901, Taf. VIII, text-fig. 2)



Text-fig. 7. *Cyclurus macrocephalus* REUSS. Specimen NMP Pc 313. Right dentary. [Photograph D. Serrette]

Finally, a well preserved caudal fin is exposed on the slab Pc 315 (Text-fig. 8). It shows that the caudal fin which was posteriorly rounded, as already demonstrated by the specimen NHMW 1864-XL-968 (Grande et Bemis, 1998, text-fig. 200), consists of 15 principal branched rays in front of which five marginal rays take place dorsally and ventrally. The caudal endoskeleton includes 16 components: six hemapophyses borne by the preural vertebrae, the last one



Text-fig. 8. *Cyclurus macrocephalus* REUSS. Specimen NMP Pc 315. Caudal axial skeleton
Ep 1-4: epurals; Hy 1, Hy 10: hypurals, U 1 first ural centrum. [Photograph D. Serrette]

being named parhypural, and ten hypurals. There are eight ural centra. The first one articulates with the first hypural whereas the following centra are fused with the corresponding hypural. Additionally, there is a posterior hypural which seems to be free in relation with the extreme reduction of the last ural centrum. Dorsally, the preural centra bear six long neurapophyses which do not support the caudal fin. Behind them, three neurapophyses are borne by the anterior ural centra. Four epurals are present above the last hypural, in front of the base of the dorsal marginal rays of the caudal fin.

Relationships of *Cyclurus macrocephalus* REUSS

Cyclurus macrocephalus REUSS exhibits a great similarity with the slightly older species *Cyclurus kehleri* (ANDREAE) from Messel and the Geiseltal (Germany). This similarity is especially impressive when considering their meristic characters (Table 1).

The most significant difference between them is obviously the shape of the parietals which are square-shaped in *Cyclurus kehleri* (ANDREAE) instead of being rectangular and wider than long in *Cyclurus macrocephalus* REUSS, as already emphasized by Grande et Bemis (1998). On the contrary, it is not demonstrated that the other difference between both species noted by Grande and Bemis (1998) is really significant. In fact, an elastomere cast of the skull roof described above shows that the ornamentation of the frontals and parietals does not really differ from that of *Cyclurus kehleri* (ANDREAE).

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Table 1. Comparison between the meristic characters of *Cyclurus macrocephalus* Reuss and *Cyclurus kehleri* (ANDREAE).

| | <i>Cyclurus macrocephalus</i> REUSS | <i>Cyclurus kehleri</i> (ANDREAE) |
|----------------------------|-------------------------------------|-----------------------------------|
| Number of vertebral centra | ca. 64-67 (?) | (63-64) 65-69 (70) |
| Abdominal centra | 24-26 | 24-26 (27-28) |
| Postabdominal centra | 30-35 | (30-31) 32-37 (38) |
| Monospondylous centra | 16-22 | 19-22 (24) |
| Diplospondylous centra | 13-14 | (12) 15-16 |
| Ural centra | 8 | 7.IX |
| Caudal branched fin rays | 15 | 15-16 |
| Dorsal fin rays | less than 40 [36-37 Pt.] | (31) 34-38 [32-37 Pt.] |
| Anal fin rays | 10 [7 Pt.] | 8-10 [7-8 Pt.] |

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