



OCCURRENCE OF THE GENUS *APHANIUS* NARDO (CYPRINODONTID FISHES) IN THE LOWER MIOCENE OF THE CHEB BASIN (CZECH REPUBLIC), WITH ADDITIONAL NOTES ON *PROLEBIAS EGERANUS* LAUBE

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ABSTRACT. The revision of the Cyprinodontid fishes from the Lower Miocene of the Cheb basin leads one to the identification of the genus *Aphanius* Nardo and also to a more precise knowledge of the skeleton of *Aphanius chebianus* (Obrhelová). This species, which was initially referred to the genus *Prolebias* Sauvage, occurs in the older strata (zone III of the Cypris-series according to Obrhelová & Obrhel 1983), whereas *Prolebias egeranus* Laube has been living later in the basin (zone IV of the Cypris-series). Consequently, it appears that two different genera of Cyprinodontid fishes have been successively living in this basin during Ottnangian and/or Karpatian (= Upper Burdigalian) times. The only other known occurrence of fossil Cyprinodonts in the Czech Republic is from the Badenian of Opava region in which the genus *Aphanius* Nardo was recently identified. It should be added that the second examined species exhibits a great similarity with *Prolebias cephalotes* (Agassiz), from the Uppermost Oligocene of Aix-en-Provence, France, and with *Prolebias malzi* Reichenbacher & Gaudant and *Prolebias aff. weileri* von Salis, two species respectively known in the Upper Oligocene and in the Lower to Middle Miocene of Germany.

KEY WORDS. Fishes, Teleosts, Cyprinodontidae, Lower Miocene, Czech Republic.

INTRODUCTION

Reuss (1852) was the first to observe the occurrence of Cyprinodont fishes in the “Cypris-series” of the Cheb basin. Heckel, who determined them, considered that they belong to the species *Lebias meyeri* (Agassiz), from the Upper Hydrobia beds of Frankfurt am Main, Germany, which is presently the type-species of the genus *Aphanolebias* Reichenbacher & Gaudant (Reichenbacher & Gaudant 2003). Later, Laube (1901) believed that these fishes really belong to two new species. First, he described as *Prolebias egeranus* Laube three specimens from Trebendorf-Aag (presently Třebeň near Františkovy Lázně), whereas about 30 small fishes collected at Krottensee near Königsberg an der Eger (presently Mokřina near Kynšperk nad Ohří) were named by him *Prolebias pulchellus* Laube. Recently, Obrhelová (1985) considered that *Prolebias pulchellus* Laube is a synonym of *Prolebias egeranus* Laube and described a new species: *Prolebias chebianus* Obrhelová which, as demonstrated in the present paper, really belongs to the genus *Aphanius* Nardo.

ATTRIBUTION OF *PROLEBIAS CHEBIANUS* OBRHELOVÁ
TO THE GENUS *APHANIUS* NARDO

In her study of the Cyprinodontid fishes from the Lower Miocene (Ottungian-Karpatian) of the Cheb basin, Obrhelová (1985) described a new species of *Prolebias* Sauvage that she named *P. chebianus* Obrhelová. However, some of the characters exhibited by this species, such as the small number of postabdominal vertebrae (generally 13-15), the shape of the dentary which exhibits ventrally a spur-like medial process (cf. Obrhelová 1985, fig. 26F, G, H, K), the fact that the oral edges of the premaxillary and of the dentary bear rather long teeth (cf. Obrhelová 1985, Fig. 25H, I, K, Fig. 26D, E) and the occurrence of a unique, wide, triangular hypural plate (cf. Obrhelová 1985, Fig. 30E, G, K) indicated that this species belongs to a different genus: *Aphanius* Nardo. This impression was fully confirmed by the observation of negative casts of its oral teeth in the sediment. In fact, as shown by specimen NMP Pc 1910 from the Hv 7 borehole drilled at Starost (Pl. 1, fig. 2), the oral edge of the dentary bears a series of seven long teeth having their distal extremity wider than their base. Several of them exhibit a typical tricuspid morphology (Pl. 1, fig. 2). Additionally, among these tricuspid teeth, at least three curved conical teeth are visible.

Family Cyprinodontidae Agassiz, 1834

Genus *Aphanius* Nardo, 1827

***Aphanius chebianus* (Obrhelová, 1985)**

(Pl. 1, fig. 1-2)

The revision of the original material of *Prolebias chebianus* Obrhelová has made possible an emendation of its specific diagnosis that was necessitated by the fact that Obrhelová (1985) had obviously integrated in the original diagnosis an excessive variability of the meristic characters which mainly results from the imperfect preservation of the studied material. Consequently we propose here the following emended diagnosis:

EMENDED DIAGNOSIS. Small *Aphanius*, the standard length of which is less than 50 mm and is generally ranging from 20 to 30 mm. Body elongated: maximum height of body generally included 4-5 times in standard length. Vertebrae: 24-26, 13-15 postabdominal. Caudal fin truncated, 5-6+7-6/6-7+5-6 rays. Dorsal fin beginning slightly in front of anal (antedorsal distance usually 64-68% of standard length) ; ii+6-9 rays; 7-9 pterygiophores. Anal fin: ii+8-10 rays; 9-10 pterygiophores; anteanal distance generally 68-72% of standard length. Pectoral fins rather large; 14-15 rays. Pelvic fins small situated nearer origin of anal fin than pectoral base.

HOLOTYPE. Specimen Pc 2717 from Povodí (drilling Hv 10), kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague.

MEASUREMENTS of the holotype (mm). total length = 33.5, standard length = 25.5, maximum height of body = 5, length of head = 8, antedorsal distance = 16.5, anteanal distance = 17.5, antepectoral distance = 9.5, antepelvic distance = 14, length of anal fin = 6, length of pectoral fins = 6, length of pelvic fins = 3.5, basal length of anal fin = 2.5,

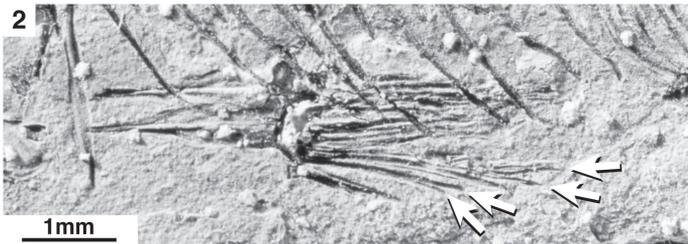
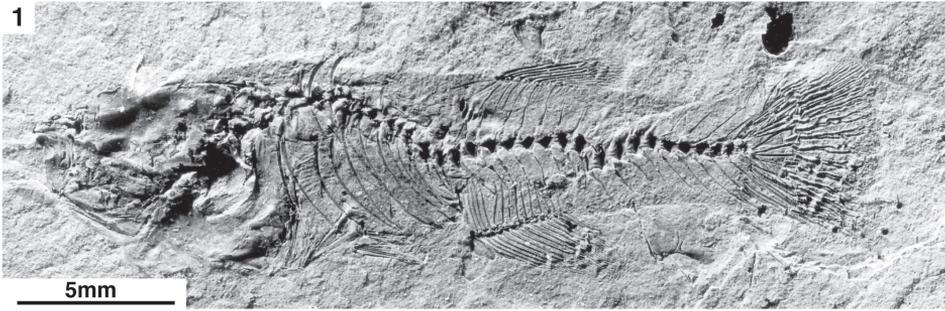


Plate 1. *Aphanius chebianus* (Obrhelová)

Fig. 1. General view of specimen NMP Pc 2718 (counterpart of the holotype), from Povodí (drilling Hv 10), kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague.

Fig. 2. Teeth borne by the dentaries of specimen Pc 1910 from Starost (drilling Hv 7), kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague. Additionally to the tricuspid teeth, some arched conical teeth are present (arrows).

length of caudal pedicle = 5, height of caudal pedicle = 4. The following dimensions were not measured: length of dorsal fin and basal length of dorsal fin.

MATERIAL. Specimens Pc 1870, 1873-1881, 1891, 1907-1910, 1919, 1922, 1930, 1934, 1953, 2717-2718, kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague.

DISTRIBUTION. This species is only known from the Cypris series (Zone III of Obrhelová & Obrhel 1983, Obrhelová 1985) of Cheb basin.

PALAEOECOLOGICAL CONSIDERATIONS

Obrhelová (1985) interpreted the Cheb basin as a closed lake during the deposition of the Cypris series. The environment was confined, as shown by the occurrence of pyrite in the sediment. A stratification of waters was responsible for the formation of sapropels, whereas a seasonal increase of sulphate concentration, indicated by the occurrence of gypsum, was taking place during the dry season, so that Cyprinids, which are present in the lower part of the Cypris series, are missing in these strata.

BIOGEOGRAPHICAL REMARKS ON THE DISTRIBUTION OF *APHANIUS* IN CENTRAL EUROPE

The occurrence of *Aphanius* skeletons in the Lower Miocene (Ottngian-Karpatian) of Central Europe is not really surprising as *Aphanius* otoliths described as *Aphanius* sp. 1 have previously been reported from the “Inflata Schichten” and the “Untere Hydrobien-Schichten” (Burdigalian) of the Mainz and Hanau basins (Reichenbacher 2000)¹. *Aphanius* otoliths are also known in the upper part of the Kirchberg beds (Ottngian-Karpatian transition) outcropping near Illerkirchberg, Württemberg, Germany); among them Reichenbacher (1988) described two new species (*Aphanius maderae* Reichenbacher and *Aphanius konradi* Reichenbacher). These otoliths are also present in the Karpatian of NE Switzerland, Württemberg and Bavaria which has yielded *Aphanius konradi* Reichenbacher and a new species, *Aphanius gubleri* Reichenbacher (Reichenbacher 1993). Another species (*Aphanius moraviae* Brzobohatý had been described earlier from the Eggenburgian (or Ottngian?) of Dobšice and Ivančice, Moravia (Brzobohatý 1969).

Additionally, skeletons of *Aphanius* Nardo were found in the Middle Miocene (Badenian) of the Nördlinger Rieskrater, Bavaria (Rückert-Ülkümen & Müller 1999) and also in the evaporitic Badenian of Opava, at the western extremity of the Carpathian fore-deep (Gaudant, 2006). From a comparison with the situation known in the Miocene of the Mediterranean basin, it clearly appears that the distribution of the genus *Aphanius* Nardo is directly related to the proximity of the marine realm, as shown for example by the occurrence of this genus in the evaporitic Burdigalian of Vilobí del Penedes, Catalunya, Spain (Gaudant & Rovira-Sendrós 1998), in the Burdigalian of Corsica (Cubells et al. 1994) and in the Middle Miocene of the Bicorn basin, near Valencia, Spain (Gaudant unpublished observation). The situation is still more demonstrative in the evaporitic Messinian of the Mediterranean basin as the species *Aphanius crassicaudus* (Agassiz) colonized the lagoons which were widely developed at that time along its shores (Gaudant 1979, Gaudant & Ott d'Estevou 1985).

REMARKS ON *PROLEBIAS EGERANUS* LAUBE

Obrhelová (1985) studied a rich material of *Prolebias egeranus* Laube collected in the Karpatian of the Cheb basin, especially at Kaceřov, and also the specimens found in the cores of the boreholes drilled in this basin (Hv 1 to Hv 18). When studying the cores, she noted that these fishes are always found in younger sediments than those yielding *Aphanius chebianus* (Obrhelová), as demonstrated by their respective depths that she carefully listed (Obrhelová 1985, cf. p. 87 and 109). Some of the characters of these fishes show a striking similarity with those of several Upper Oligocene and Lower Miocene species of the genus *Prolebias* Sauvage, especially *Prolebias cephalotes* (Agassiz), from the Uppermost Oligocene (or Lowermost Miocene) of Aix-en-Provence, France (Gaudant, 1981), *Prolebias malzi* Reichenbacher & Gaudant from the Upper Oligocene of the Upper Rhinegraben (Reichenbacher & Gaudant 2003) and *Prolebias* aff. *weileri* von Salis,

¹ The otoliths from the Lower Miocene of the Upper Rhinegraben described by Reichenbacher (2000) as *Aphanius germaniae* Weiler belong to a different genus named *Aphanolebias* Reichenbacher & Gaudant.

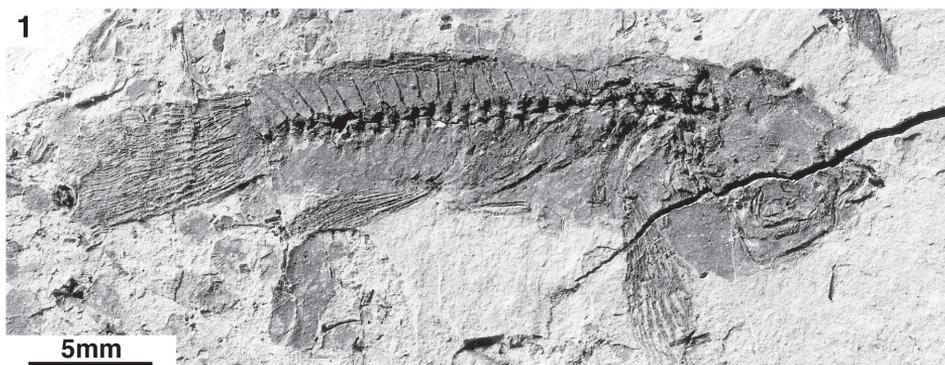


Plate 2. *Prolebias egeranus* Laube

Fig. 1. General view of specimen NMP Pc 1882, from Kaceřov, kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague.

Fig. 2. Pelvic fin of specimen Pc 573, from Mlýnek, kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague. Arrows point to claw-like distal extremities of fin rays.

from the Lower Miocene or basal Middle Miocene of the Randecker Maar (Germany) (Gaudant et Reichenbacher 2002). Especially significant are the relative position of the dorsal and anal fins, the advanced position of the pelvic fins which are situated nearer the base of the pectorals than origin of anal (Pl. 2, fig. 1), the remarkable structure of the pelvic fin rays, the distal extremity of which is frequently looking like claws (Pl. 2, fig. 2), and also the structure of the caudal axial skeleton, in which two distinct triangular hypural plates are fused by their base, as shown by Obrhelová (1985, fig. 13B, D).

Although it exhibits important similarities with the species of the genus *Prolebias* Sauvage mentioned above, *Prolebias egeranus* Laube slightly differs from them mainly in the composition of its dorsal fin which is supported by 9-11 pterygiophores, instead of 8-10 in *P. cephalotes* (Agassiz) and 7-8 in *P. malzi* Reichenbacher & Gaudant. Additionally, its anal fin is supported by 13-16 pterygiophores, instead of 13-15 in *P. malzi* Reichenbacher & Gaudant and 12-14 in *P. cephalotes* (Agassiz). It should be noted that the composition of the dorsal and anal fins is similar in *P. malzi* Reichenbacher &

Gaudant and in *P. aff. weileri* von Salis but that both species clearly differ in the morphology of their sagitta.

The revision of the holotype described by Laube (1901) and of the material studied by Obrhelová (1985) leads one to propose an emended diagnosis for *Prolebias egeranus* Laube. This emendation emphasizes the remarkable structure of their pelvic fin-rays: "Small *Prolebias*, the standard length of which does not exceed 32 mm (generally 20-25). Body is slender, its maximum height being 1/4 to 1/6 of standard length. Vertebral column including (30) 31-32 (33) vertebrae, 19-20 (21) of which being postabdominal. Caudal fin slightly rounded distally, 7+6-7?/7?-6+8 rays. Dorsal fin smaller than anal fin; i-ii+I+8-9 rays; 9-11 pterygiophores. Antedorsal distance usually 63-67% of standard length. Anal fin rather large beginning in front of the origin of dorsal fin; ii-iii+I+11-14 rays; 13-16 pterygiophores. Anteanal distance generally 59-63% of standard length. Pectoral fins moderate, about 12 rays. Pelvic fins inserted nearer the base of pectorals than from the origin of anal fin; 6 rays frequently with claw-like distal extremities".

HOLOTYPE. NMP Pc 273, from Třebeň near Františkovy Lázně, kept in the Department of Palaeontology of the National Museum (Národní Muzeum), Prague.

MEASUREMENTS of specimen NMP Pc 1822 collected at Kaceřov in the "Cypris series" (mm). total length = 26, standard length = 23, maximum height of body = 6, length of head = 7, antedorsal distance = 14.5, anteanal distance = 14, antepectoral distance = 8, antepelvic distance = 10, length of dorsal fin = 3.5, length of anal fin = 4, length of pelvic fins = 2, basal length of dorsal fin = 2.5, basal length of anal fin = 3, length of caudal pedicle = 5.5, height of caudal pedicle = 3. Length of pectoral fins was not measured.

CONCLUSION

The revision of the Cyprinodontid fishes from the Lower Miocene (Ottangian-Karpatian) of the Cheb basin has, for the first time in Central Europe, given the opportunity to know the main characters of the Lower Miocene *Aphanius* skeletons, which are the first to be observed in this area. It has also confirmed that the genus *Prolebias* Sauvage and *Aphanius* Nardo have been living during the same period in Central Europe. In fact, we already know that *Prolebias* survived in Central Europe up to the Middle Miocene of Szurdokpüsköpi, Hungary (Gaudant 1991) and that it was also present in the Lower or basal Middle Miocene of the Randecker Maar, Würtemberg, Germany (Gaudant & Reichenbacher 2002), although the presence of the genus *Aphanius* Nardo is already documented by otoliths as soon as the Burdigalian of the Mainz basin and the Ottangian of Illerkirchberg. Consequently, the coexistence of the two genera lasted at least about 10 My in Central Europe.

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