Freshwater gobies (Teleostei, Gobiidae) from the early Miocene of Klinci (Serbia), with otoliths in situ

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Freshwater gobies (Teleostei, Gobiidae) from the early Miocene of Klinci (Serbia), with otoliths *in situ*

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Here we present a rich assemblage of goby fishes from the late early to early middle Miocene of Serbia, based on articulated skeletons with otoliths *in situ*. They were obtained from the thin-bedded marly deposits of Klinci (Valjevo freshwater lake) of the Valjevo-Mionica Basin in western Serbia. This basin covers an area of 350 km² and represents the western part of the so-called Valjevo-Mionica-Belanovica Graben that had formed during the Ottnangian-Karpatian, and later became inverted (Marović et al. 2007).

We studied 21 skeletons, 19 of which had otoliths *in situ*. The fish remains are classified in three new genera with a total of four species, thereof three new. One species was established by Gaudant (1998) as *Gobius serbiensis* (Fig. 1). The finds of otoliths *in situ* in these goby fishes further allowed to review early to middle Miocene otolith-based freshwater gobiid otoliths described in the past from various Paratethyan basins and of fishes from the southeastern Europe. The key findings are:

- Articulated skeletons with otoliths *in situ* allow a more detailed systematic classification than isolated otoliths or skeletons without otoliths would do.
- The freshwater community of goby fishes from the early to early middle Miocene of southeastern Europe documents the presence of a lost early Miocene freshwater fish fauna, which in the case of the gobies studied is not related to the present day Ponto-Caspian fish fauna.
- This early freshwater goby community witnessed in Klinci probably gave way to an early Ponto-Caspian stem at about 14 Ma, after the Miocene Climate Optimum.

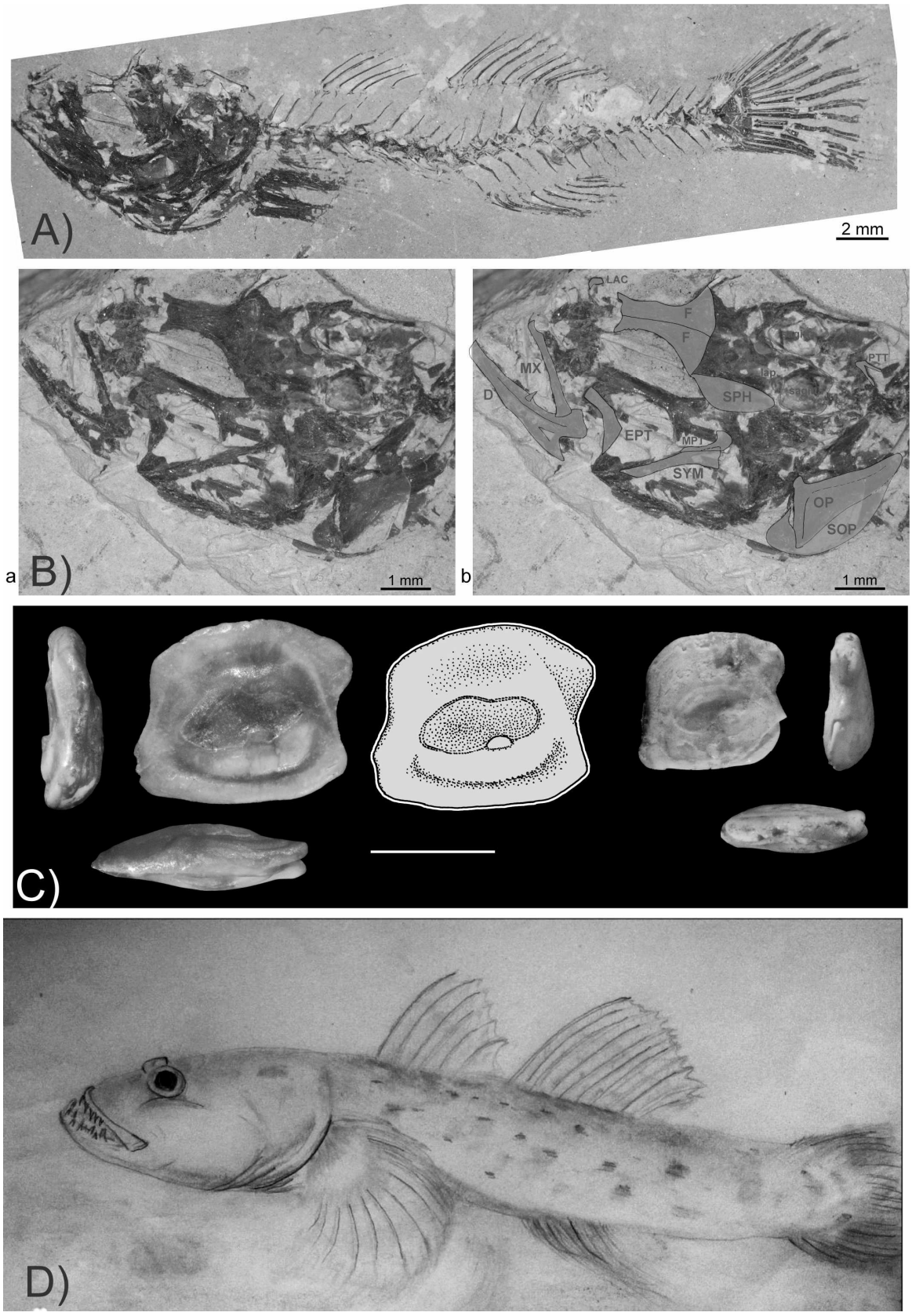

Fig. 1. Detail photographs and drawings of *„Gobius" serbiensis*: A – articulated skeleton; B (a and b) – dentations of jaws; C – otoliths; D – reconstruction

- The gobies of Klinci document a variety of high adaptive levels, e.g. with putative ambush predators of small fishes, invertebrate feeders that can maneuver in narrow space like between vegetation and putative suction feeders with the adaptive ability for a wide snout opening.
- The fish fauna from Klinci represents an endemic paleobioprovince characteristic to the ancient Serbian Lake System (SLS).
- The calibration of otoliths *in situ* facilitates a better interpretation of isolated otolith-based species recorded in the past and a better understanding of the distribution of freshwater gobiid fishes in time and space during the early to early middle Miocene of Europe (Bradić-Milinović et al. submitted).

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The Early Badenian tuff level in the borehole Kaczyce K2/07 (Carpathian Foredeep Basin, Poland): its radioisotopic 40Ar/39Ar age and biostratigraphic position

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The Early Badenian (Langhian) in the Central Paratethys is characterized by a major marine transgression into the Pannonian and Carpathian Foredeep basins. Profiles containing a full sequence of the Lower Badenian sediments are relatively rare, and are mainly known from boreholes.

We present new results on samples taken from such a borehole (Kaczyce K2/07) located in the vicinity of Cieszyn, a bordered town in southern Poland. In this borehole Badenian sedimentation started with conglomerates (Dębowiec Fm.), passed into an up to 1000 m-thick series of claystones and mudstones with rare interbedded sandstones (Skawina Fm.). A thick layer of pyroclastic material (tuff and tuffite) occurs within marly clays of the lower part of Skawina Fm. The tuffite represents typical vitroclastic and vitrophyric texture and parallel-laminated, fine to coarse grained structures. Volcanic glass shards and smaller proportions of crystals biotite, plagioclases, sanidine, and pyroclastic quartz are dominating. Occasionally, heavy minerals as zircon, allanite (mineral of epidote group), and apatite occur. The chemical composition of volcanic glass was typical for the ashes of rhyolithic origin. The weighted mean radioisotopic ($^{40}Ar/^{39}Ar$) age for sanidine separates from the tuff provided an age of 14.27 ± 0.03 Ma (Bukowski et al. 2018).