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A short note on middle Miocene pteropods from Northern Croatia

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Holoplanktic gastropods (Pteropoda) with aragonitic shells („sea butterflies“) are in fossil record usually present as casts and molds, but they are important for paleo-bio-stratigraphical, paleoecological and paleogeographical research. Their findings in the Central Paratethys area are the most common in the middle Miocene deposits corresponding to the peaks of Badenian transgressive-regressive cycles. Pteropods are found in the Badenian deposits of Austria, Czech Republic, Poland, Hungary, Slovenia, Croatia, Romania, Bulgaria and Ukraine. The most diverse and numerous genera are *Limacina* Bosc, *Vaginella* Daudinand and *Clio* Linnaeus. In Northern Croatia they are mostly recorded in the middle Miocene (Badenian) deposits of the Medvednica Mt. in vicinity of Zagreb (Gorjanović-Kramberger 1908; Kochansky 1944; Bosak 2017; Bošnjak et al. 2017; Derežić 2018). During the middle Miocene this area paleo-geographically belonged to the southwestern margin of the Central Paratethys, and geotectonically to the Pannonian Basin System. In the Badenian outcrops of the Medvednica Mt. several pteropod species have been recorded so far: *Vaginella austriaca* Kittl, *Limacina valvatina* (Reuss), *Clio pedemontana* (Mayer) and *Clio fallauxi* (Kittl).

Recent pteropod research in Northern Croatia was mostly focused on the oldest marine Badenian deposits, exposed in Čučerje area (central part of the Medvednica Mt.) (Bosak 2017; Bošnjak et al. 2017; Derežić 2018). The most numerous species in „pteropod marls“ at this locality is *Vaginella austriaca*, which is in accordance with other findings from the Central Paratethys. Fragments of *Clio pedemontana* were also collected. For the first time we documented the occurrence of the representatives of the family Cavoliniidae and ?Creseidae in this area of Northern Croatia.

Nannoplankton and foraminifera analyses were done in order to determine the age of the deposits and paleoenvironmental conditions. Nannoplankton analyses indicate the NN5 nannozone, as described in the available papers. The recorded foraminifera assemblages point to the deep-marine environmental conditions, based on the findings of foraminifera *Bathysiphon* and *Rhabdamina* and selective dissolution of aragonite tests (Derežić 2018).

Pteropod research in Northern Croatia contributes to the knowledge of pteropod distribution within the Central Paratethys, and their possible migration routes, including the possible short-term connection with the North Sea during the Early Badenian (Langhian) age.

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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.

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