Paleogeography, paleobiogeography and bathymetry based on fish, particularly otoliths

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Neogene otoliths have to be taxonomically compared with recent species. Otoliths from nearly 6000 Recent species are known (NOLF 1985). For localities with 50-60 species several hundred or thousand kg of sediment is usually needed, therefore samples from drilling cores or boreholes are not reliable for a sufficient interpretation of otolith faunas. All over the world there are only 10 specialists working on otoliths, but the knowledge of the European Neogene basins is quite good. The North Sea Basin belongs to the best investigated basins. In the Aquitanian Basin there is a low level of knowledge in the Serravallian and a very high one in the Langhian and earlier times (Fig. 2).

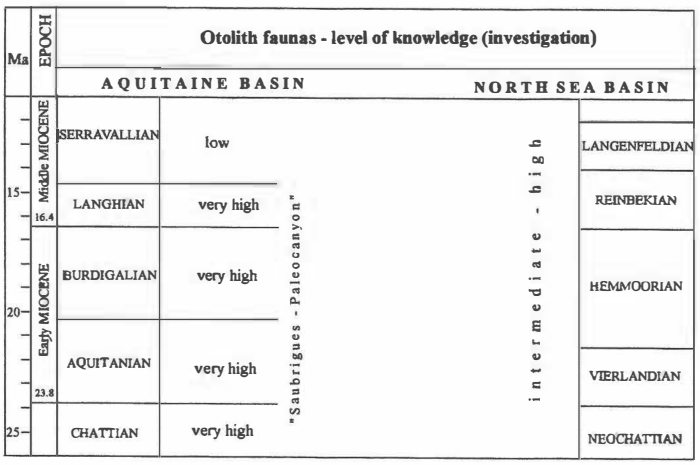

Fig. 1: Level of knowledge of otoliths in North Sea and Aquitanian Basin.

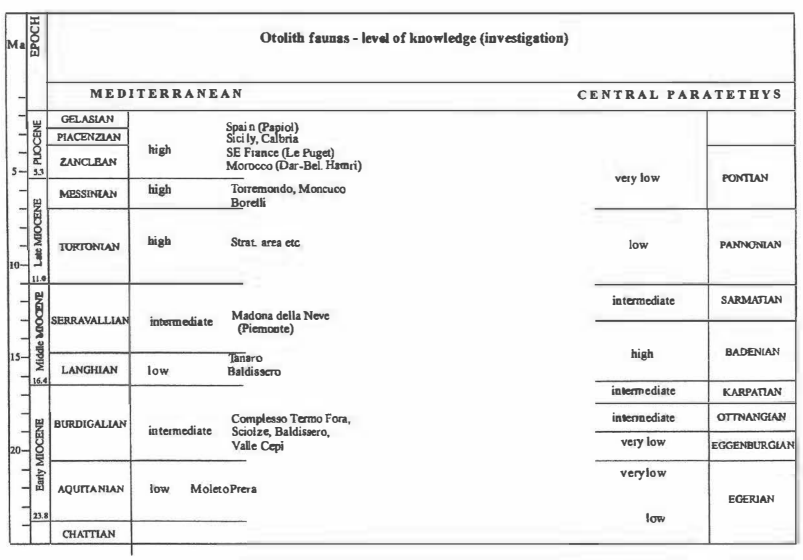

Fig. 2: Level of knowledge of otoliths in the Mediterranean and in the Central Paratethys.

In the Mediterranean there is a low level of knowledge in the Aquitanian and Langhian, intermediate in Burdigalian and Serravallian and high in Tortonian, Messinian and younger stages. In the Central Paratethys there is a low level of knowledge in the Egerian, Eggenburgian, Pannonian, Pontian, intermediate in Sarmatian, Karpatian, Ottnangian and high in Badenian (Fig. 2). Knowledge of otolith faunas is quite unsufficient in the Eastern Paratethys. Otolith associations can be used for bathymetric reconstruction. A generalized approach to the paleobathymetry (neritic – bathyal) can be refined on the basis of the method suggested by NOLF & CAPPETTA (1989) and discussed by NOLF & BRZOBOHATY (1994). This method was used for a paleobathymetric evaluation of the Lower Badenian Carpathian Foredeep (20 localities) in South Moravia (BRZOBOHATY 1997). Four bathymetric associations were proved in the Lower Badenian clay (Fig. 3). Two graphs (Fig. 4) document examples of the deepest association (Brno - Kralovo Pole) and the shallowest one (Kralice n. O.). Results in the map of the Carpathian Foredeep illustrate a proposed paleobathymetry for the Lower Badenian Sea (Fig. 5) and preliminary isobaths (Fig. 6).

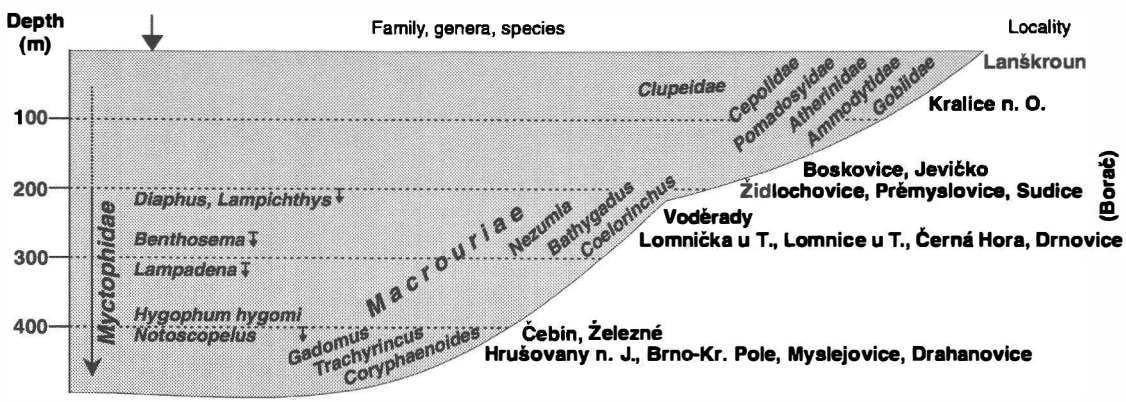

Fig. 3: Actual bathymetric repartition of important teleost taxa represented in the Lower Badenian and their reflexion in localities of the Carpathian Foredeep (South Moravia).

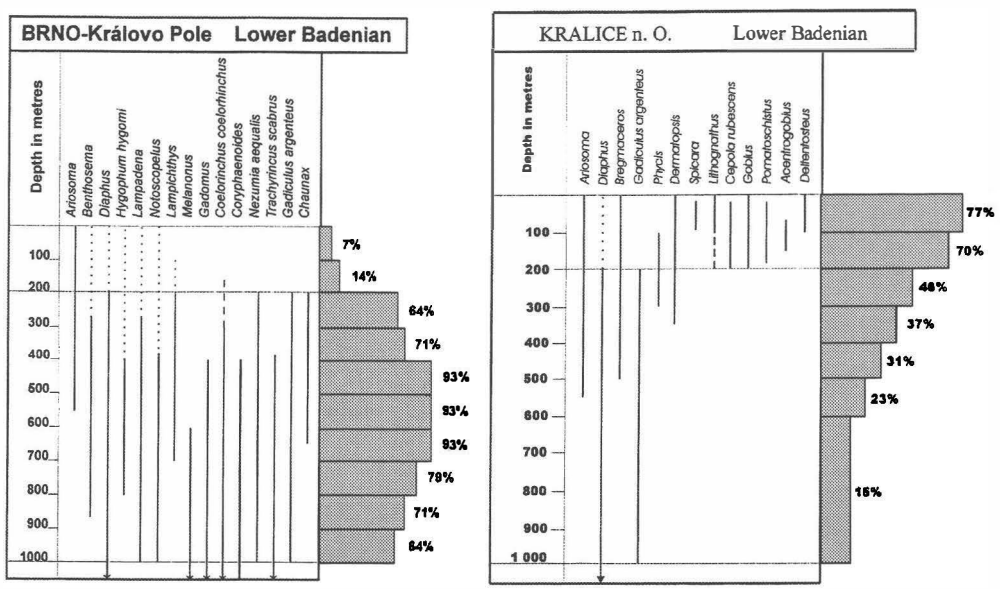

Fig. 4: Actual bathymetric repartition of teleost taxa represented in the Lower Badenian from Brno-Kralovo Pole and Kralice n. O.

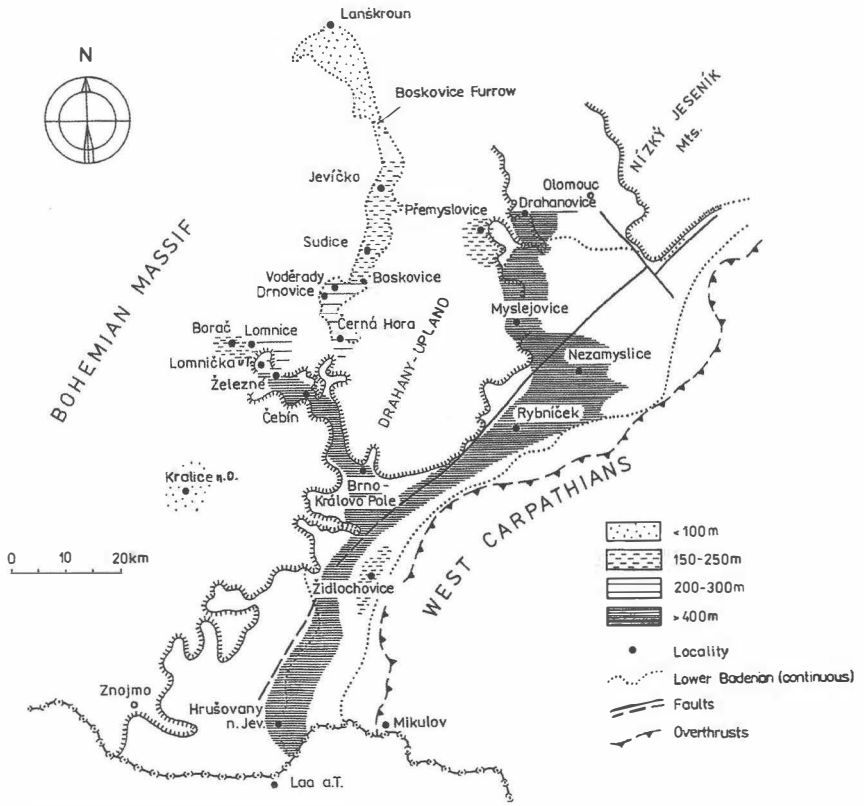

Fig. 5: Position of the Lower Badenian localities in the Carpathian Foredeep (South Moravia) and the paleobathymetric reconstruction.

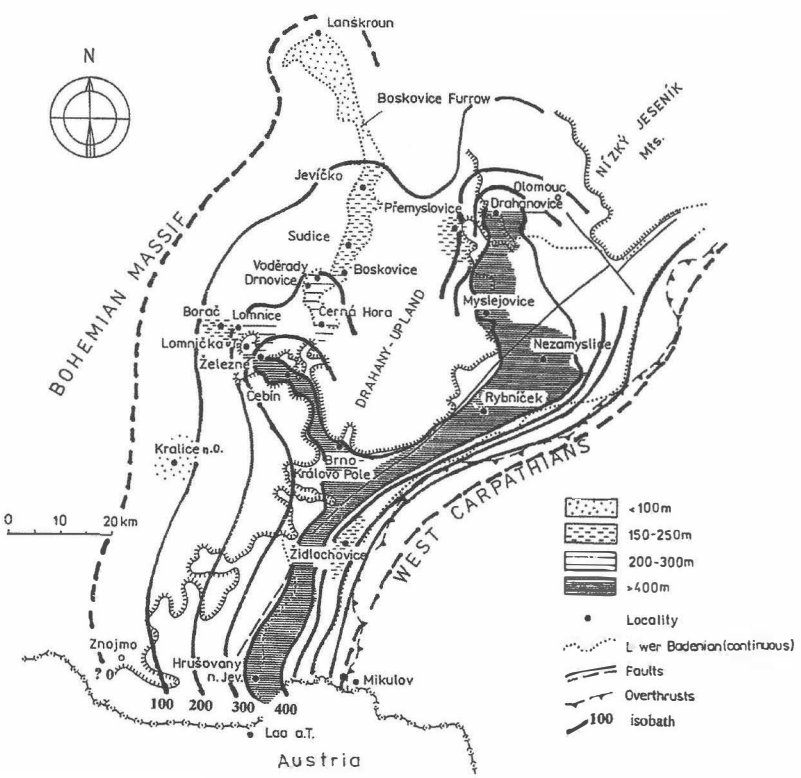

Fig. 6: Preliminary isobath lines in the Lower Badenian Sea of the Carpathian Foredeep (South Moravia).

The Lower Badenian Sea flooded all the relief and archibenthic (Macrouridae) and mesopelagic (e.g., Myctophidae) fauna penetrated through deep depressions to the north and

western margin of the basin. Mesopelagic taxa could end up in shallow depths (usually with juvenile specimens, e. g., Kralice n. O.) (Fig. 7).

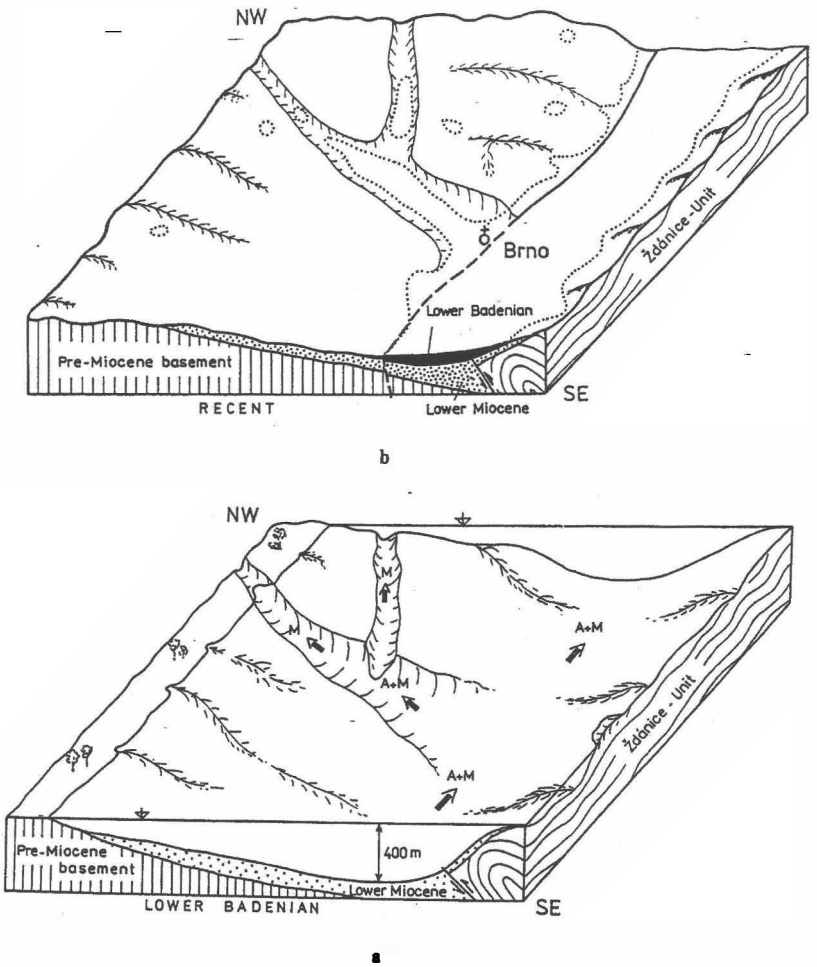

Fig. 7: a = Lower Badenian Sea (A – macrourids, M – mesopelagic fauna), b = recent Carpathian Foredeep with denudation remnants of Lower Badenian deposits.

Comparison of eastern and western parts in the Lower Badenian Central Paratethys shows that in the western parts there are higher numbers of genera and species in Macrouridae and Myctophidae, while in the eastern part Macrouridae are missing and only a low number of genera and species of Myctophidae is present. The Polish Foredeep and the Romanian part of the Central Paratethys seem to be generally shallower than the western part of the Central Paratethys.

References

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