GRAZ 2010 NOBIS AUSTRIA 4

Linking high-resolution environmental analyses and taxonomy: A case study on ostracods in deep time

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Per se taxonomic investigations of fossils can neither include molecular biological approaches nor the study of soft parts. Environmental parameters cannot be measured directly. Consequently, the palaeontological approach is strictly morphologically-based and environmental factors must be deduced from abiotic and biotic proxies. However, the fossil record has one striking advantage over the study of extant organisms: time! If an appropriate time-model is on hand, long- as well as short-term changes (millions of years, down to years) can be extracted. Especially, micro-fossils are of prime importance in this case. Due to their small size, ten thousands of preserved remains provide a huge dataset for profound taxonomic analyses and phylogenetical reconstructions.

The examination of a limnic–deltaic sedimentary sequence, deposited on the western margin of Palaeo-Ancient Lake Pannon (~11.3 Ma), focused on the occurrence of the mussel shrimp genus *Cyprideis* (ostracoda) and its linkage to environmental shifts. Based on the timing of the section, we achieved by our high-resolution sampling (5 mm thick rock slices) a time-resolution of only a few years. Qualitative as well as linear and geometric morphometric valve analyses allowed differentiating three co-occurring *Cyprideis* species, which were probably adapted to different microhabitats. One of them is only recognized at the peak of a limnic transgression. In contrast, one other species seems to be more euryplastic because it appears well before this event and is recorded in the regressive prodelta sediments up section likewise. The remarkable low quantity of the third species clearly reflects its diverging paleoecological demands, since it mainly occurs in the littoral facies. Size, posteroventral spines, hinge structure, ornamentation and valve outline turned out to be appropriate diagnostic characters to define these sympatric species in the sense of a multidimensional species concept. These characters enable to delineate *Cyprideis* populations in Lake Pannon as segments of evolutionary lineages and thus phylogenetic species. This is essential for any well-founded biostratigraphic zonation and further palaeogeographic models.

This is a contribution to the FWF-project P 21748-N21.