Stable Isotope Analyses on Miocene Molluscs from the East Alpine Region: A Proxy for Paleoenvironmental Reconstructions

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In the framework of the FWF-project cluster "Changes in Eastern Alpine Miocene Ecosystems and their Geodynamic Control" a cooperative study within the projects "Stable isotopes and changing Miocene palaeoenvironments in the East Alpine region" and "Evolution versus migration: Changes in Austrian Miocene molluscan paleocommunities" was performed.
The Miocene of the East Alpine region is characterised by distinct changes in fossil communities. These bio-events can be detected in nearly all groups of organisms. Changes of environmental parameters, like temperature, water chemistry, salinity as well as alkalinity, water circulation, water depth, food supply etc., are considered as the main driving forces for such bio-events, and may reflect local or regional conditions, or even be related to global changes. The East Alpine region is an area well suited for studying these changes because of its richness in fossils and its differences in fossil biotopes. As most of the parameters cannot be reconstructed directly, the method of analysing stable isotopes in carbonate shells is a powerful tool in paleoecology. Oxygen isotope data are used as proxies for water temperature and salinity, and carbon isotope data as proxies for paleosalinities, reconstruction of water masses and productivity.
Molluscs are well suited for stable isotope analyses as it is supposed that molluscs precipitate their shells in isotopic equilibrium. Especially gastropods and bivalves were chosen for this study. Gastropod shells are built of metastable aragonite, therefore the ability of shell preservation is strongly reduced but diagenetic overprinting can be easily detected. If aragonitic shell material and primary aragonite crystals can be recognized, stable isotope signals can be considered as primary. Therefore the shells used for stable isotope analyses are examined for diagentic overprinting by x-ray diffraction and electron microscopy. Bivalves are also often used for stable isotope analyses, although they are aragonitic or calcitic and some have mixed layered shells. Within super-families their mineralogy and shell structure remains constant. In this study we used shells of pectinids, which are mainly calcitic. Thin sections of the shells were cut for analysing the internal structure. From each gastropod as well as pectinid shell, several samples were drilled.
Various gastropod species (*Granulolabium* sp., *Ocenebra* sp. and *Turritella* sp.) with different life habitats of different localities were used for this study. Variations between different time slices can only be detected within one species in a constant environment. Many localities are also influenced by freshwater which affect the isotope signals of shells. Data from different time slices (Eggenburgium, Ottnangian, Karpatium, Badenium, Sarmatium) and localities will be presented. Special focus is given to shells from localities with constant marine conditions and from species which prefer fully marine environments.
Within the Central Paratethys the Early Badenian is a time of marine transgression. The location of Grund (Lower Badenian) represents a normal marine environment without any significant freshwater influx. It is located in the Molassezone north of the Danube. Mammal faunas indicate a biostratigraphic correlation with middle-late MN5, marine faunas indicate the Lower Lagenid Zone, and magnetostratigraphy shows normal polarity. Therefore the estimated

correlation from magnetostratigraphy is with chron C5Cn1 (Daxner-Höck, 2001). From Grund different gastropod species were measured, especially shells of *Ocenebra credneri* and *Turritella* sp. Additionally, stable isotope data of pectinid shells of *Pecten subarcuatus* and *Crassodoma multistriata* were established. Oxygen data from the bivalve shells vary within 3‰, but do not show the same maximum and minimum values. Especially the carbon isotope data exhibit some differences between the shells of *Pecten subarcuatus* and *Crassodoma multistriata*. Generally, *Turritella* sp. shows the highest oxygen and carbon values, and the values of *Ocenebra credneri* are similar to *Crassodoma multistriata*. These data can be compared with other Badenian localities and may help to understand local environmental differences.

References

Daxner-Höck, G., (2001): Early and Late Miocene correlation (Central Paratethys). – In: C. Latal, W.E. Piller (eds.): Environments and Ecosystem Dynamics of the Eurasian Neogene (EEDEN) – Stratigraphy and Paleogeography. Workshop Graz, 15. – 18. 3. 2001 – Ber. Inst. Geol. Paläont., K.-F.-Univ. Graz, 4, 60S, Graz 2001.

Use of $\delta^{15}N$ and $\delta^{18}O$ isotope ratios to identify sources of nitrate in the unsaturated zone.

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Anthropogenic nitrogen inputs have led during the last three decades to increased loads of nitrate in ground water in many regions of Europe.
Also, in the Leibnitzer Field in the south part of Styria a strong increase of the nitrate concentrations in the ground water could be observed during the past decades. The Leibnitzer Feld aquifer is extremely susceptible to surface derived contamination because of its largely unconfined nature and highly permeable sands and gravels. The source of nitrate contamination in the aquifer is attributed to local, long term agricultural land use practices such as spreading big amounts of liquid manure (mainly pig manure) above the soils. To determine what action should be taken to reduce nitrate contamination of the groundwater, it is important to identifying the source(s) and the origin of nitrate in unsaturated zone.

Several microbiological and isotope investigations were carried out in the unsaturated zone to assess these processes. In the result of the microbiological investigations, it was possible to show that nitrifying bacteria are located in the whole profile of the unsaturated zone. But the intensity of the nitrification process decreased under the top soil layer strongly. However, also soil samples from a depth of 1.8m have shown still a considerable potential nitrification rate. This conflicts with the widespread idea that nitrification in soils is limited to the root zone only.

To verify these results with a independent second method we have used $\delta^{15}N$ and $\delta^{18}O$ isotope ratios of nitrate in percolation water samples. The percolation water was sampled repeatedly at the outflows of the suction plates and cups between May 1998 and April 1999 for determining concentrations, $\delta^{15}N$ values, and $\delta^{18}O$ values of nitrate. The application of the $\delta^{15}N$ and $\delta^{18}O$