Geophysical Research Abstracts, Vol. 8, 04887, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04887

The giant oyster *Crassostrea gryphoides* as a trans-Miocene climate archive

M. Harzhauser (1), **W. E. Piller** (2), S. Müllegger (2), O. Mandic (1)

(1) Natural History Museum Vienna, Austria, (2) Institute of Earth Sciences - Geology and Paleontology, Graz University, Austria (werner.piller@uni-graz.at)

The huge shells of the estuarine oyster *Crassostrea gryphoides* may record lifespans of up to 40 years. Within the European part of the Central Paratethys Sea, this species existed from the Late Oligocene up to the late Middle Miocene in many coastal environments. The originally calcitic nature of the shells made them comparably insensible for diagenetic alterations. Seven shells of successive time intervals have been collected from the Vienna Basin and the Styrian Basin (Austria) for sclerochronology. The shells have been cut along the ligamental area and up to 200 sample-points per shell have been analysed for stable isotopes (oxygen, carbon). One of these specimens represents the largest *Crassostrea*-shell ever recorded, measuring more than 100 cm in length. Due to its ecological requirements as a mainly estuarine species, this oyster is expected to have coped with strong seasonality. Freshwater influx during wet seasons and elevated salinity and warming surface waters during droughts should be reflected in the sclerochronologic data.

All specimens from the Mid-Miocene Climate Optimum (16.5, 15.0, 14. 5, 14.0 my) display a very well developed seasonal signal for both stable isotopes. The correlation between carbon and oxygen ranges from 0.5 to 0.9 pointing to nearly parallel trends. A much weaker correlation between 0.05 and 0.3 is observed in Sarmatian shells, which derive from post-MMCO deposits. A zero-correlation value is also evident for an Early Miocene shell. This low correlation is based only on very irregular signals in the carbon record. In contrast, the oxygen values seem to indicate reliable seasonal cycles throughout the Miocene. Seasonal signals and high δ^{18}O/ δ^{13}C correlation during the MMCO is obvious even in strongly freshwater exposed systems. For instance, a 14.0 my old shell from the Styrian Basin with strongly depleted values around –5 to -7‰ displays an 18 year seasonality-record with high δ^{18}O/ δ^{13}C coupling. Aver-

age δ^{18}O values fluctuate throughout the Miocene reflecting mainly the differences in local influence of riverine influx. In contrast, the δ^{13}C average is quite stable during the Early and early Middle Miocene with a majority of values between 0 and -1‰. This stability breaks with the late Middle Miocene Sarmatian when the carbon record shows a strong shift towards +1 to +2‰. A comparable carbon anomaly was also detected in aragonitic marine molluscs from Sarmatian deposits (own investigations). The mechanism for this carbon spike, e.g. outgassing or shifts in the C3/C4 plant relation, is not yet understood.

The range between minima and maxima in individual shells is constantly higher for oxygen (1.5 - 3.0‰) compared to the low range of 0.5 - 1.5‰ for carbon. Throughout the Miocene this value is quite stable for the oxygen record pointing to a generally constant “stable-isotope-window” in which the oysters could grow. The complex interference of freshwater-influx versus temperature in such estuarine settings makes it difficult to define this “stable-isotope-window” in respect to these factors. Moreover, the annual oyster-archive has to be expected to be incomplete as this genus is known to cease growth below 10˚C and above 27˚C. During the MMCO the cuspate tops (heavy values) and convex lows (depleted values) of the curves suggest continuous growth during the warm and/or wet season but some cessation during cooler and/or dry periods.

The oyster archive, therefore, documents a very clear seasonality during the Mid-Miocene Climate Optimum. Both investigated stable isotopes trace the seasons. Thereafter, the carbon record lacks any seasonal signal. The individual ages of the oysters seem to reflect the optimum phase as well. *Crassostrea gryphoides* attained an age of 17 to 40 years during the early Middle Miocene but did not survive more than 10-14 years in the late middle Miocene. Correspondingly, the giants of 40-100 cm length are restricted in the Paratethys Sea to the early Middle Miocene but did not exceed 20 cm in length during the late Middle Miocene.