Changning paleo-environments of the Lutetian to Priabonian beds of Adelholzen (Helvetic Unit, Bavaria, Germany)

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The Adelholzen Section is rich in planktic and benthic foraminifera. Planktic foraminifera form up to 80% of the total foraminiferal assemblages in the Stockenletten, but also the basal nummulitids mark 20% of planktic species. The ratio of planktic to benthic foraminifera is considered to be a good estimator also for paleo-water depth estimations at least during the Cenozoic. The percentage of planktic foraminifera in the assemblages points to depth ranges from 50 m (inner shelf) at the base of the section to a maximum of c. 650 m (upper bathyal) in the Stockenletten. Nummulitids and macro-fossil assemblages (oysters, sponges, sea urchins, sea urchins, crabs, bristlies, shark teeth) point to shallower paleo-water depths for the basal and middle lithologic units.

The succession shows four or five distinct increases in paleo-water depth (transgressive phases) within the Assinula-sands, possibly in the lower part of the Nummulites-sands, during the Discocyclina-mlit sedimentation and two incomplete cycles in the brown sand and the Stockenletten. The number of heterotrophic planktic and benthic foraminifera is largely coupled to primary surface productivity as these groups either feed directly on diatoms, coccolithophores or other algae (planktic foraminifera) or depend on the organic chain that reaches the seafloor (benthic foraminifera). Foraminiferal abundance is therefore a good estimator for paleo-productivity of ancient eco-systems. The rather parallel curves for planktic and benthic foraminiferal abundance are both pointing to at least two major transgressive phases that resulted in increased nutrient mobilization and subsequent increased numbers of foraminifera. The second one coincides with a climatic optimum shortly before the Mid-Eocene Climatic Optimum (MECO). The ben- thic foraminiferal assemblages are dominated by large plancoconics or lenticular species (Odobinides, Gaviniella, Lentillicula etc.) pointing to oxygen conditions at the seafloor.

All samples from the section contain very rich calcareous nanofossil assemblages with the dominance of small rhabdoliths, Reticulofenestra dacytis and Cyclocyclusforinensis. Small rhabdoliths generally dominate nanofossil assemblages along continental margin. High amounts of Reticulofenestra minute can be interpreted as indicator of warm, well-stratified water column. Low percentages of Coquol-