An age model for the Lutetian to Priabonian beds of Adelholzen (Helvetic Unit, Bavaria, Germany)

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The 18 m thick Adelholzen Section, located southwest of Siegsdorf in southern Bavaria, Germany is part of the Helvetic (tectonic) Unit and comprises six lithologic units: 1) marly, glauconitic sands with predominantly *Assilina*, 2) marly bioclastic sands with predominantly *Nummulites*, 3) glauconitic sands, 4) marls with *Discocyclina*, 5) marly brown sand (units 1-5 "Adelholzener Schichten" or Kressenberg Formation), and 6) Stockletten (marls without established formal name). The Adelholzen-Section is rich in planktic foraminifera. Reworked specimens from older deposits commonly occur, whereas most zonal markers were not found within the investigated samples; other potential index species show a rather sporadic occurrence instead of a continuous record. Consequently, our age model is based mainly on calcareous nannofossils and nummulitids and one zonal boundary only is based on planktic foraminifera. All investigated sediments contain very rich and well preserved calcareous nannoplankton assemblages, dominated by reticulofenestrids. All samples are characterized by low percentages of reworked taxa. Quantitative analyses were used to refine our age model.

Unit 1 (*Assilina*-sand) contains the transition from the uppermost Shallow Benthic Zone (SBZ) 13 (late early Lutetian) to SBZ 14. Accordingly, calcareous Nannoplankton Zone NP15 is indicated by the nannofossils assemblages and the investigated planktonic foraminifera point to zones P10 (E8) to P11 (E9). The micro- and nannofossil assemblages as well as the larger benthic foraminifera fauna of units 2 (*Nummulites*-sand) and 3 (glauconitic sand) indicate a middle Lutetian age (NP15, P11 (E9), and SBZ 14 and 15 p.p.). Unit 4 (*Discocyclina*-marls) is of late Lutetian age, indicated by SBZ 15, NP15, and P12. The planktic foraminifera boundary E10 to E11 was found in the uppermost part of this unit. Unit 5 (brown sand) also belongs to the late Lutetian (SBZ15, NP16, P12 (E11). The Stockletten (unit 6) did not yield larger foraminifera anymore and spans a wider biostratigraphic range (NP16 to NP20, corresponding to upper P12 (E11) to P15/16 (E15)). However, Zone NP 17 is missing and we therefore assume a stratigraphic gap (at least 3 Ma) in the lower part of the exposed Stockletten. This assumption is supported by the almost complete disappearance of acarinids (planktic foraminifera) in the overlying strata, pointing to a strong change in paleoceanography. A prominent decrease in bulk rock $\delta^{18}O$-values indicates the Mid-Eocene Climatic Optimum-Event around the brown sand (unit 5) and confirms our biostratigraphic zonation. The $\delta^{13}C$-curve shows characteristic patterns, which could be directly related to the global carbon isotope record and helped to refine our age model. The overall sediment-accumulation rate was at least 1.8 mm/Ky.

Lack of first and last occurrences, evidence of stratigraphic gaps, and reworked planktic foraminifera specimens complicate the construction of a consistent biostratigraphic framework. As reported from other sections elsewhere, planktic foraminifera, calcareous nannoplankton and larger benthic zonations did not always correlate well with established zonal schemes. Application of independent approaches however enabled us to overcome these difficulties.