EGU2020-15431
https://doi.org/10.5194/egusphere-egu2020-15431
EGU General Assembly 2020

Perturbation and recovery of shelf ecosystems during the PETM

Monika Doubrawa[1], Peter Stassen[1,2], Marci M. Robinson[3], Tali L. Babila[4], James C. Zachos[5], and Robert P. Speijer[1]

[1]KU Leuven, Geology, Earth and Environmental Sciences, Belgium (monika.doubrawa@kuleuven.be)
[2]OD Earth and History of Life, Royal Belgian Institute of Natural Sciences, Brussels, Belgium
[3]Bascom Geoscience Center, US Geological Survey, Reston, Virginia, USA
[4]National Oceanography Center, University of Southampton, Southampton, UK
[5]Earth and Planetary Sciences, University of California Santa Cruz, Santa Cruz, USA

During the early Paleogene, a long-term warming trend of Earth's climate was punctuated by a major global warming event, known as the Paleocene-Eocene Thermal Maximum (PETM) and marked by a carbon isotope excursion (CIE) and an acidification episode. The associated worldwide environmental perturbations are best studied in open marine settings, and resulted in a major extinction event in deep-sea benthic foraminifera, followed by migration and diversification. Yet, the evolutionary impact on shelf foraminiferal faunas is still poorly constrained due the inherent stratigraphic complexities in these environments. In order to understand the prelude and aftermath of peak warming during the PETM, we study the South Dover Bridge core (SDB), drilled in the US Atlantic Coastal Plain in Maryland. Here, the Paleocene-Eocene transition is stratigraphically well constrained by calcareous nannoplankton and stable isotope records. Additionally, the PETM is regionally characterized by the appearance of fine-grained sediments, known as the Marlboro Clay, contrasting with the late Paleocene glauconitic sands. Our newly generated high-resolution foraminiferal stable isotope, biotic and grain size data enable an assessment of the stratigraphic completeness of this site, and the disentanglement of the successive recovery-phases, by correlation across the paleoshelf.

The mid-shelf benthic foraminiferal assemblage we recorded in the upper Paleocene indicates well-oxygenated, continuously oligo- to mesotrophic bottom water conditions. These conditions were temporarily interrupted during a pre-PETM CIE, which initiated minor, but prominent, changes in foraminiferal assemblage. The relationship with the PETM is still unclear, but it may indicate that the latest Paleocene climate was not as stable as previously assumed and instead exhibited a more gradual change towards the PETM. At the onset of the PETM diversity decreases, as more stress-resistant benthic taxa become predominant and planktic abundances increase. This probably points to periodically dysoxic bottom waters due to river-induced stratification, resulting from enhanced regional river outflow, as well as to a shift to episodic food fluxes to the sea floor.

The studied expanded SDB sequence also presents an excellent and nearly complete record of the PETM isotope recovery phase. Throughout this recovery phase a third, more diverse foraminiferal assemblage starts to prevail, indicating a gradual return to sustained high food levels and

increasing oxygen levels, related to a decrease of river influence. Species, dominant during the core phase of the PETM, like *Anomalinoides acutus* or *Pseudouvigerina wilcoxensis*, show strongly declining numbers in the recovery phase. Other taxa, like *Cibicidoides alleni*, returned to the shelf ecosystem, after disappearing nearly completely from the sediments during the initial PETM CIE interval. This coincides with reduced planktic foraminiferal abundances and a tendency towards more silty and less clayey sediments, linked to renewed bottom current activities and winnowing.

The lack of severe benthic extinction among shelf-dwelling benthic foraminifera and the observed lateral variability in environmental conditions, demonstrate how foraminiferal shelf communities can adapt to massive global carbon perturbations. As more regional data will become available, these will enable more constraints on environmental parameters and variations along the Atlantic Coastal Plain prior and during the PETM.