TRANSIENT BENTHIC FORAMINIFERAL ASSEMBLAGE FLUCTUATIONS DURING EARLY EOCENE HYPERTHERMALS AT DSDP SITE 401, BAY OF BISCAY, NORTH EAST ATLANTIC

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During the early Paleogene "hothouse" (60-50 Ma), earth experienced the warmest conditions of the Cenozoic (Zachos *et al.*, 2008). Tropical temperatures were slightly higher than today, but middle and high latitude temperatures were much higher. For instance, the sedimentological and paleontological record suggests sea surface temperatures of ~20°C near the Arctic (Weijers *et al.*, 2007). Superimposed on this warm climate mode was a series of transient periods (<200 kyr) of extreme global warming, known as hyperthermals (Thomas and Zachos, 2000). The most prominent and best documented hyperthermal is the Paleocene-Eocene Thermal Maximum (PETM; ~55.5 Ma), during which global temperatures rose by an additional ~5°C. This event left a major mark on the biogeosphere evolution: many protists flourished, floral communities changed (Wing *et al.*, 2005) and mammals experienced an accelerated evolution (Gingerich, 2006). However, the benthic foraminifera suffered: up to 50% of all species went extinct (Thomas, 2007). The deep-sea record shows that this climatic anomaly is associated with changing oceanic circulation and a severely disrupted carbon cycle. In early Eocene deposits worldwide, additional smaller hyperthermals have been detected, primarily based on stable isotope records and physical properties of sediment cores (Cramer *et al.*, 2003). Yet the biotic aspects remain largely unexplored, up till now.

The focus of this study is to investigate whether or not these recently discovered hyperthermals (Lourens *et al.*, 2005; Nicolo *et al.*, 2007) display similar biotic patterns as during the PETM, specifically concerning benthic foraminifera. Lower Eocene deep-sea sediments from DSDP Site 401 in the Bay of Biscay (paleodepth ~2000m) show a well-developed cyclicity in sediment color and carbonate content in calcareous nannofossil Zone NP11. In this interval, several darker, marly levels stand out in the otherwise grayish-brown calcareous chalks. The δ13C and δ18O records on Nuttallides truempyi and Oridorsalis umbonatus and on bulk material clearly show the iconic isotopic excursion of the PETM and five additional negative excursions of up to ~0.85‰ throughout Biozone NP11.
Some of these isotopic excursions can be correlated to short-lived, yet strong benthic foraminiferal assemblage changes. A rapid shift to impoverished faunas and the replacement of bathyal species with abyssal species suggest a severe disruption of the trophic regime at this location. On a longer time scale, a small but significant assemblage shift remains. Also, the fact that only the largest carbon cycle perturbations and temperature rises are associated with these faunal changes implies the existence of certain climatic thresholds.
The lithological, isotopic and quantitative foraminiferal data appear to confirm the idea that these early Eocene hyperthermal events produce similar, yet smaller, biotic changes as observed for the PETM worldwide.

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