Benthic foraminiferal assemblage fluctuations during early Eocene hyperthermals at DSDP Site 401, Bay of Biscay, North East Atlantic

Simon D'haenens[1,*], André Bornemann[2], Peter Stassen[1], Robert P. Speijer[1]
[1] Department of Earth and Environmental Sciences, K.U.Leuven, Leuven, Belgium
[2] Institut für Geophysik und Geologie, Universität Leipzig, Leipzig, Germany
* simon.dhaenens@ees.kuleuven.be

Contrary to the Paleocene Eocene thermal maximum (PETM; ~55.5 Ma), which is well-known for its benthic foraminiferal extinction (BFE; e.g. Thomas, 2007), foraminiferal records of early Eocene hyperthermals are scarce and incomplete (e.g. Lourens *et al*., 2005), limiting our understanding of these global warming events and the early Paleogene climate system as a whole.

Here, we present geochemical and quantitative benthic foraminiferal records from the early Eocene of Deep Sea Drilling Project Site 401 (Bay of Biscay, North East Atlantic). The pelagic sediments at this site (paleodepth ~2000 m) show a well-developed cyclicity. Throughout Biozone NP11, several thin marly levels stand out in the otherwise grayish-brown calcareous chalks. The $\delta^{13}C$ and $\delta^{18}O$ records (*Nuttallides truempyi*, *Oridorsalis umbonatus* and bulk material) clearly show five transient negative excursions of up to ~ 0.80 ‰ associated with these dark marly levels. These values are comparable to the observed values of the isotopic H1 and K excursions - which are linked to hyperthermals - even more so when compared with localities from the Northern Hemisphere.

Although the smaller isotope excursions are not correlated with any significant faunal perturbations, the larger isotope excursions display strong benthic foraminiferal assemblage changes, suggesting the existence of certain paleoceanographic thresholds. During the largest negative excursion, an incursion of abyssal-related taxa (e.g. *Nuttallides umbonifera*, *Globocassidulina subglobosa*, *Gyroidinoides* spp., *Stilosomella* spp. and *Cibicidoides ungerianus*) takes place, followed by a recovery composed mainly of lower-middle bathyal taxa (e.g. *Cibicidoides eocaenus*, *Brizalina carinata*, *Angulogerina muralis, Bulimina virginiana*, *Pseudoparrella minuta*,). A detailed statistical and ecological study reveals that the assemblage changes are mainly due to fluctuations in the C_{org} flux to the seafloor, with oligotrophic and oxic conditions prevailing during the isotopic excursions. Furthermore, the assemblage changes appear to be tracking lysocline shoaling and subsequent overdeepening (e.g. Leon-Rodriguez and Dickens, 2010) as well. The aftermath of this intense event includes a pronounced and seemingly permanent shift in benthic foraminiferal composition at this site. This implies that hyperthermal events have the potential to disrupt and reshape the benthic deep-sea communities on both short and longer time scales. We conclude that the regional faunal patterns of the hyperthermals observed at Site 401 strongly resemble those observed in many deep-sea PETM deposits worldwide. As such, this may support the hypothesis that early Eocene hyperthermals are very similar to the PETM and are causally linked.

References:

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