Calcareous nannofossils and stable isotope records from the Early–Middle Eocene North Atlantic Ocean (IODP Site U1410): Biostratigraphy, evolutionary trends and palaeoenvironmental interpretations

Carlotta Cappelli

University of Padova, Department of Geosciences, 35131 Padova, Italy; carlotta.cappelli@unipd.it

Paul R. Bown

University College London, Department of Earth Sciences, London WC1E 6BT, UK; p.bown@ucl.ac.uk

Thomas Westerhold

University of Bremen, MARUM – Center for Marine Environmental Sciences, 28359 Bremen, Germany; twesterhold@marum.de

Steven M. Bohaty

University of Southampton, Ocean and Earth Science, Southampton SO17 1BJ, UK; S.Bohaty@noc.soton.ac.uk

Martina de Riu, Veronica Lobba

University of Padova, as above; martina.deriu@studenti.unipd.it, veronica.lobba@studenti.unipd.it

Yuhji Yamamoto

Kochi University, Center for Advanced Marine Core Research, Kochi 783-8502, Japan; y.yamamoto@kochi-u.ac.jp

Claudia Agnini

University of Padova, as above; Stockholm University, Department of Geological Sciences, SE-106 91 Stockholm, Sweden; claudia.agnini@unipd.it

The Early Eocene climatic optimum (EECO, 53–49 Ma; Westerhold et al., 2018) witnessed a fundamental change in calcareous nannofossil assemblages as the Paleocene Prinsiaceae family declined to extinction and was replaced by the extant Noelaerhabdaceae family (i.e. reticulofenestrids) that likely expanded in response to global cooling and water-column destratification (Schneider et al., 2011). We present integrated calcareous nannoplankton and bulk stable isotope records ($\delta^{18}O$ and $\delta^{13}C$) across the Early–Middle Eocene interval (~52–43 Ma) from IODP Site U1410 (northwest Atlantic; Norris et al., 2012), where Middle Eocene deposits occur as clay-rich drift sediments that reflect the formation of persistent deep currents in the North Atlantic (Boyle et al., 2017). Using both light and scanning electron microscopy, this study has: 1) strengthened the calcareous nannofossil biostratigraphy for this interval; and 2) benefited from the exquisite preservation of nannofossils in the clay-rich drift sediments in their ability to provide evolutionary models for the biostratigraphically-significant *Coccolithus gigas* and *Sphenolithus furcatolithoides* groups. In addition, our assemblage data clearly show a major switch from Early Eocene warm, oligotrophic communities with high abundances of the genera *Zygrhablithus* and *Discoaster* to a Middle Eocene temperate, eutrophic community that was dominated by *Reticulofenestra* species. This transition is associated with slightly higher $\delta^{18}O$ values that likely indicate a transient cooling interval between the end of the EECO and the Early–Middle Eocene boundary. A restoration of warmer conditions characterised the lower part of the Middle Eocene, which is marked by negative stable isotope excursions, an increase in *Discoaster sublodoensis*, and major changes in the sphenolith assemblages. A comparison of our results with different datasets highlights an enigmatic scenario, in terms of the bio-chemo-magnetostratigraphy and assemblage shifts across the Early–Middle Eocene transition, and future work will serve to trace a clearer global picture of this interval.

References

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