Paleoproductivity estimates during the PETM using nannofossil absolute abundances

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The Paleocene-Eocene Thermal Maximum (PETM; ~56 Ma) is an hyperthermal event likely triggered by a rapid rise in atmospheric CO2 levels. Until recently, the major drop in CaCO3 contents recorded across the PETM in deep-sea sediments has been solely attributed to the shoaling of the lysocline and the carbonate compensation depth resulting from the initial carbon injection. This purely chemical model assumes a constant CaCO3 export and hence steady carbonate paleoproductivity, whereas the abundance of coccolithophores and foraminifera, the two mains pelagic CaCO3 producers, are highly dependent on the environment they live. This study contributes, thanks to the analyses of the fragmentation and absolute abundance of calcareous nannofossil (coccolithophores and *incertae sedis*) obtained using the settling methods, to quantify the overlooked biological feedbacks on the carbon cycle. A decoupling between the nannofossil accumulation rate and the dissolution is observed at the ODP (Ocean Drilling Program) Site 1263 (South Atlantic) and at the ODP Site 865 (Equatorial Pacific). Our results show that the nannofossil accumulation rate decreased by 80-85% during the PETM at ODP Site 1263 and 120 ka before the PETM at the ODP Site 865. This decrease at ODP Site 1263 is not entirely explained by higher dissolution rates and thus attributed to a drop in primary productivity in the surface ocean. Nannofossil assemblages at ODP Site 865 being characteristic of strongly stratified warm oligotrophic waters, decreased nutrient availability could explain the fall of coccolithophores abundances prior to the PETM. This paleoproductivity decrease during the PETM associated with carbon injection probably led to a rise of the lysocline and carbonate compensation depth. On the longer-term, the alkalinity buildup due to this protracted drop in CaCO3 export could explain the overshoot recorded during the PETM recovery interval.

Keywords : Carbon cycle, PETM, Coccolithophores, Paleoproductivity, Oceanography

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