Calcareous nannofossil fluxes and mass across the Paleocene–Eocene Thermal Maximum

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The Paleocene–Eocene Thermal Maximum (PETM, ~56 Ma) is one of the most severe greenhouse warming events in Earth's history. Thousands of petagrams of carbon were released into the atmosphere-ocean system in only a few thousand years, ultimately causing ocean acidification (Zachos et al., 2005). The gradual sequestration of this light carbon took place during the recovery phase of the event. Silicate weathering is thought to have been the fundamental negative feedback that triggered the input of carbonate ions (CO_3^-) into the oceans. While this could be expected to lead to an increase in pelagic carbonate production, the fact is that a major calcification crisis has been reported in the literature. This is a paradox because the production of pelagic carbonate is directly related to the carbonate saturation state and alkalinity of the oceans. Here, we present new data for calcareous nannofossil fluxes (nannofossils/m^2/year) and mass (picograms) that can be used to evaluate pelagic carbonate production across the PETM at ODP Site 1209 (Shatsky Rise). To calculate the nannofossil mass, we used the automated system of Beaufort et al. (2014). Calcareous nannofossils were particularly sensitive to the palaeoenvironmental changes induced by this hyperthermal event, and a significant turnover has been reported from all the basins, as well as a reorganisation of the planktonic communities (Gibbs et al., 2006; Raffi et al., 2009). While the overall response of calcareous nannofossils to the PETM is known, systematic analyses to quantify the fluxes of different genera of pelagic carbonate have not been performed to date. Through a comparison of calcareous nannofossil fluxes, mass and independent proxies, we show how their mutual interactions affected the pelagic carbonate production across the PETM.

References

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