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Insights into the oceanic Zn cycle across the Paleocene-Eocene transition

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The Paleocene-Eocene Thermal Maximum (PETM) was a period of transient global warming, during which vast amounts of isotopically light carbon were released into the atmosphere-ocean system over just a few kyr [1]. This perturbation of the carbon cycle precipitated severe changes to global climate, and the marine and terrestrial ecosystem, such as an intensified hydrological cycle, ocean acidification and expanded seafloor anoxia. Enhanced primary productivity is thought to play a major role in the carbon sequestration that eventually led to the stabilization of the climate (e.g. [2]).

Marine carbonate sediments provide a widespread geochemical archive that is increasingly exploited for trace metal isotope studies. Zinc (Zn) isotopes have only just begun to being used to investigate past geochemical cycles, and to track changes in the trace metal sources and sinks in the ancient ocean during periods of climatic upheavals (e.g. [3-5]). Here, we present the first coupled trace element and Zn isotope datasets for the PETM, in bulk carbonate samples from the equatorial Pacific (ODP Site 865), the North Atlantic (DSDP Site 401), and the Southern Ocean (ODP Site 690).

All sites record various levels of enrichments in isotopically light Zn across the PETM but with different temporal trends. These could reflect local source-related influences (such as continentally derived Zn, volcanogenic input), or local redox changes. Generally, negative excursions in δ^{66}Zn are coupled to higher Zn/Ca, which may also represent a source effect or variations in the controlling factors for trace metal incorporation into the carbonate lattice, i.e. temperature, pH, salinity. However, the Zn isotope trend from the Pacific appears to capture a basin-wide, or even global ocean signal. In a similar manner to carbon isotopes, constant pre-PETM Zn isotopic values are disrupted by a negative isotope excursion at the PETM onset, followed by a rapid return to pre-excursion values during the PETM recovery interval.

[1] Kennett & Stott (1991), *Nature* 353, 225-229. [2] Gutjahr et al. (2017), *Nature* 573, 573-577. [3] Kunzmann et al. (2013), *Geology* 41, 27-30. [4] Liu et al. (2017), *Geology* 45, 343-346. [5] Sweere et al. (2018), *Geology* 46, 463-466.