



## **Paleocene-Eocene Thermal Maximum triggered by Volcanism revealed by Mercury anomalies**

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The Paleocene-Eocene Thermal Maximum (PETM,  $\sim 55.8 \pm 0.2$  Ma) is marked by a global drop of 2-6‰ in  $[\delta^{13}C]$  values and rapid warming of 4-5°C in tropical surface waters and 4-8°C in high latitudes. Climate warming persisted for several tens of thousands of years and resulted in rapid diversification in terrestrial mammals and marine planktic foraminifera. Deep-water bathyal benthic foraminifera suffered a mass extinction ( $\sim 40\%$  species) but no significant extinctions occurred shallow shelf environments. Benthic extinctions are commonly explained as the effects of the initial stage of climate warming due to North Atlantic Volcanic Province volcanism (NAVVP), which triggered methane release from ocean sediments causing global warming and ocean acidification. But the relationship between NAVVP and the PETM events are not clearly demonstrated. Several studies [1-4] demonstrated the relationship between Hg anomalies in sediments and LIP activity associated with mass extinctions. We investigated the mercury (Hg) content of several sections located in deep bathyal (Zumaya, Trabakua, N-Spain) and outer shelf environments (Dababiya GSSP, Duwi, Egypt). At Zumaya the PETM is marked by a red clayey and marly interval poor in organic matter and coincident with a pronounced  $\delta^{13}C$  negative shift. A comparable clay interval with low TOC content is also present in the Dababiya section in the lower part of the negative  $\delta^{13}C$  shift, whereas the upper part of it is enriched in TOC, reflecting increased productivity. A significant but unique Hg enrichment is observed at the onset of the PETM just below the carbon isotope shift in Spain as well as in Egypt. This increase, which is not correlated with clay or total organic carbon contents, suggests the Hg anomaly resulted from higher atmospheric Hg input into the marine realm, rather than organic matter scavenging and/or increased run-off. This Hg anomaly at the onset of the PETM provides the first direct evidence that volcanism played a crucial role in triggering the PETM events by initiating the warming that likely released methane gases that accelerated greenhouse warming and ocean acidification.