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Mercury as a proxy for Large Igneous Province volcanism: A comparison of Mesozoic events

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Mass extinction events and other episodes of palaeoceanographic and palaeoclimatic upheaval, such as Ocean Anoxic Events (OAEs), have punctuated global climate throughout the Phanerozoic Aeon. Many of these events from the last 300 million years have been causally linked with Large Igneous Provinces (LIPs), which represent the geologically abrupt emplacement of millions of cubic kilometres of (chiefly) basaltic material. Evidence for such a relationship comes both from a coincidence in radiometrically determined ages of many LIPs with the apparent age of an extinction/climate perturbation, and also from the sedimentary record, where stratigraphic horizons recording palaeoclimatic events commonly also record perturbations in sedimentary proxies for volcanism.

Numerous recent studies have highlighted Hg/TOC (mercury/total organic carbon) excursions in both terrestrial and marine sedimentary archives recording mass extinctions. Because the main natural source of mercury to the modern environment is volcanic outgassing, such Hg/TOC excursions have been used to support a precise temporal link between many major environmental perturbations and the formation of LIPs. Here, we present new Hg/TOC data from the end-Triassic extinction and Late Cretaceous OAE 2, and compare it to previously published data from records of the end-Permian, end-Triassic, Early Toarcian OAE, Early Aptian OAE 1a, Cenomanian–Turonian OAE 2, and end-Cretaceous events. Comparing the mercury records of multiple events is crucial to further understanding of the controls on Hg/TOC as a volcanic proxy, as well as the processes governing relationships between different environmental perturbations and LIPs. Of particular interest is the influence of LIP location (e.g. subaerial vs subaqeous; low- vs high-latitude), and the potential generation of additional thermogenic volatiles during LIP emplacement.