

Toarcian mercury anomalies record terrestrial disturbance rather than volcanic activity

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Mercury (Hg) enrichments in ancient sedimentary successions are currently used to directly link the emplacement of large igneous provinces (LIPs) to environmental change and biological turnover in the geological record. It is suggested that increases in [Hg] and [Hg] normalized to total organic carbon (TOC), or Hg/TOC, is direct evidence for a LIP. However, there are several other major sources of Hg to the oceans that could operate on these timescales: i) enhanced hydrological cycle and weathering of continental material, ii) biomass burning and subsequent soil loss, and iii) thawing of permafrost. Furthermore, any changes in local sedimentary redox, which is a hallmark of many extinction events, can also affect local Hg signatures. Mercury isotopes have also recently been utilized to identify different potential sources of Hg during some of these events, but isotopic overlap between these sources complicates their differentiation.

Here, we generated and compiled Hg concentration and isotope data from 11 globally distributed sites across the Toarcian Oceanic Anoxic Event (T-OAE; ~183 Ma). The T-OAE Hg enrichments have been interpreted to be the result of Hg sourced from the Karoo-Ferrar LIP. However the data show a relationship between the proximity of the sites to landmasses and Hg enrichment. This notion is in agreement with the Hg isotope signatures from northeastern Panthalassa that suggest a terrestrial source of Hg. These data suggest that sedimentary Hg anomalies may not be a direct proxy for LIP emplacements, but instead can be the product of other feedbacks from LIPs.