Magmatism and varying sequestration pathways control sedimentary Hg enrichment during the T-OAE (Réka Valley section, Mecsek, SW Hungary)

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Abstract

The Phanerozoic is interspersed with major environmental change and mass extinction events, many of which have a temporal link to Large Igneous Province (LIP) volcanism. However, their causal relationship is not uniformly accepted, partly because of a scarcity of sections with direct evidence for both magmatism and biological/environmental change.
Elevated sedimentary mercury concentrations have, in recent years, been increasingly used as a proxy for LIP volcanism, because volcanism is the dominant natural source of mercury in the present-day Hg-cycle. Mercury is a volatile element, which is emitted in its elemental (Hg0) form into the atmosphere during an eruption and if it reaches the stratosphere, it can be globally distributed. Through wet and dry deposition, Hg can be deposited into both the terrestrial and marine sedimentary records. Within the sediment, Hg is commonly associated with organic matter, but elevated sedimentary mercury concentrations (up to ppm-levels) have also been detected in organic-lean (carbonate) sedimentary records, possibly linked to the occurrence of sulfide phases.

For this study, we analyzed a lower Toarcian record from Réka Valley (Mecsek, SW Hungary). The record represents an open marine/deep basin depositional environment, and consists of marl with sandstone intercalations, and black shales representing the Toarcian Oceanic Anoxic Event (T-OAE). New mercury data, spanning the Lower Toarcian (including the T-OAE) shows an increase in concentration parallel to the decrease in δ13Corg values (indicative of the T-OAE negative carbon isotope excursion), suggesting a temporal correlation between carbon cycle disturbance and Karoo-Ferrar LIP (KaFLIP) magmatism.
Furthermore, thermal-alteration experiments on the studied samples, combined with the integrated dataset of organic and inorganic geochemical proxy data for the same sample set allowed assessment of the affinity of sedimentary Hg with possible host-phases, to shed light on (changes in) the dominant Hg-sequestration pathways across this time-interval.

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