

Early Jurassic large-scale carbon release drove rapid increases in terrestrial mercury fluxes

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The Toarcian Oceanic Anoxic Event (T-OAE, ~183 Ma) was a major hyperthermal event characterized by significant carbon-cycle perturbation. A global negative excursion of the carbon-isotope values of exogenic carbon reservoirs during this event has been linked to the large-scale release of ¹²C-enriched carbon, perhaps mainly related to large-scale magmatism. Carbon emissions drove elevated atmospheric CO₂ and global warming, triggering extinction, oceanic deoxygenation, and globally enhanced continental weathering. However, the mechanisms underlying the response of the global hydrological cycle and weathering processes to such rapid carbon release remain poorly constrained, presenting a critical knowledge gap that holds substantial implications for understanding Anthropocene-scale (millennial to submillennial) climate change. Here, we use high-resolution sedimentary mercury (Hg) isotope and concentration data to track changing sources and fluxes of Hg to seawater during the T-OAE from the Yorkshire (UK) section. Our results show changes in Hg-isotopes consistent with a marked increase in terrestrially-sourced Hg across the T-OAE negative carbon isotope excursion, driven by enhanced weathering. In detail, we show that this overall increase in terrestrial Hg comprised a series of sharp increases coeval with previously recognized abrupt negative shifts in organic carbon isotopes that were attributed to discrete, millennial-scale pulses of carbon release. The synchronous coupling between carbon release and enhanced terrestrial Hg fluxes underline the rapidity (<3000 years) with which Earth's hydrological system can respond to large-scale carbon release and warming.