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Mass extinctions, recovery and resilience

Sulfur and Mercury geochemistry of end=permian successions in China reveal terrestrial mass extinction timing and mechanisms

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The end-Permian mass extinction (EPME) is the most severe biological crisis of the Phanerozoic. The EPME was coincident with the eruption of the Siberian Traps LIP, which volcanic gases injected into the atmosphere–ocean system likely triggered a series of environmental changes that led to the biological crisis. The vast majority of the literature on the EPME is focused on marine environments whilst far less is known about the mechanisms and timing of the terrestrial EPME, and its links with the LIP eruption, due mainly to the less well-developed chronostratigraphy and poorer fossil preservation. Here we report organic C-isotope, TOC, Hg, and S-isotope data from coastal-lagoonal successions in western Guizhou – eastern Yunnan (South China), and lacustrine successions in Xinjiang (Northwest China). In the studied sections, a negative C-isotope excursion (CIE) is recorded coincident with the extinction of the terrestrial fauna and flora. Hg concentrations and Hg/TOC show a sharp peak correlated with the negative CIE, displaying a pattern similar to that of marine records. The S-isotope data of total-S and palaeosol-carbonate-associated sulfate from Xinjiang are consistent with the addition of volcanic S into the lake system as acid rain. We ran a biogeochemical box model that incorporates C and Hg cycles to test different gas injection scenarios into the end-Permian ocean–atmosphere–land system. The new geochemical and modelling results reveal the temporal and cause-and-effect relationships between the eruptions of the Siberian Traps and the terrestrial EPME, improving our understanding of the EPME mechanisms in continental ecosystems.