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# Linking climate and extinction events to LIP volcanism: the long search for the 'smoking gun'

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The concern over modern climate change has driven numerous investigations into further understanding past episodes of geologically abrupt environmental perturbation and/or mass extinction. Such events occurred frequently throughout the Phanerozoic Eon, and many of them have been linked with the formation of Large Igneous Provinces (LIPs), which represent the emplacement of millions of cubic kilometres of (chiefly tholeiitic basalt) magma within hundreds of kiloyears. The proposed link between these two phenomena is based mainly on a remarkable correlation between the radioisotopically determined ages of LIP volcanism and the inferred ages of major environmental perturbations and mass extinctions (e.g Siberian Trap volcanism and the end-Permian mass extinction), as well as the observed deteriorations in global weather following comparatively minor volcanic eruptions in the modern world.

A key part of these investigations remains finding a geochemical proxy for volcanic activity in the sedimentary record, where past episodes of environmental perturbation and/or extinction are recorded. In recent years, mercury (Hg) concentrations and isotopes, and mercury/total organic carbon ratios (Hg/TOC) have come to the fore as a potential marker of volcanic emissions in the sedimentary record. In the modern, mercury is emitted into the atmosphere as an inert gas from volcanoes, with a sufficient atmospheric residence time to be distributed globally before being removed to the terrestrial/realm and deposited in sediments bound to organic compounds. Numerous studies of many Phanerozoic events have highlighted the existence of sedimentary mercury enrichments and Hg/TOC increases, which have been interpreted as direct evidence for enhanced volcanic activity related to LIP magmatism. Here, new and published Hg data from studies of multiple environmental events will be summarised, together with possible issues facing mercury as a sedimentary marker for volcanism, and thoughts presented on the current status of this proxy as a possible 'smoking gun' for LIP volcanism.