Are mercury anomalies a reliable proxy for LIP volcanism? Examples from the end-Permian and Early Triassic

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Mercury (Hg) is a toxic metal that preferentially forms organic complexes, with typically high concentrations in organic-rich sediments. Volcanoes are among the primary sources of Hg to the environment, so it has been suggested that Hg anomalies in the rock record, expressed as deviations from stable Hg to total organic carbon (TOC) ratios, represent periods of elevated volcanism such as the emplacement of large igneous provinces (LIPs). Several studies have since used Hg/TOC anomalies in sedimentary sequences as evidence for LIP volcanism, including the end-Permian, end-Triassic, and Cretaceous-Palaeogene mass extinction events.

However, as more data is collected it appears that the use of Hg/TOC as a volcanic proxy is more complex than first thought. Factors such as the source of organic matter, the redox properties of the water column, and distance to paleoshore all appear to affect Hg/TOC ratios, resulting in anomalies that may not be volcanic in origin. Here we focus on northern hemisphere sections from Svalbard and the Barents Sea, covering an interval from the end-Permian mass extinction to the Smithian-Spathian boundary in the Early Triassic. There are consistent end-Permian Hg/TOC anomalies in each locality that corroborate the influence of the Siberian Traps LIP as a likely cause of the mass extinction. The correlation between Hg/TOC anomalies and volcanism in the Early Triassic is much less apparent. Alternative causes for these later anomalies include variations in organic matter source and/or marine anoxia. This suggests the need for caution when interpreting Hg/TOC anomalies as a proxy for LIP volcanism.