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Characteristics of Hg concentrations and isotopes in terrestrial and marine facies across the end-Permian mass extinction

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The end Permian mass extinction (EPME) is the greatest among the “Big Five” extinctions of the Phanerozoic, and is believed to have been triggered primarily by the Siberian Traps Large Igneous Province (STLIP). This hypothesis is supported by the temporal correlation of STLIP with the EPME by radiometric ages and Hg enrichments in sedimentary rocks. However, how signatures of volcanic Hg emissions are preserved in sediments, and how this may vary from deep basin to shelf to terrestrial successions, remain unclear. We compiled Hg data and carbon isotopes from 13 marine and terrestrial sections in South China and other regions from the world. They all show two pulses of Hg enrichments that are coupled with two negative excursions in carbon isotopes and immediately precede the PTB. implying that there were two major injections of Hg and ^{13}C-depleted CO^2 into the atmosphere–land–ocean system, affecting global Hg and carbon cycles. These events correspond with the Siberia Traps Large Igneous Province, which was the likely cause of these injections into the Earth's surficial environments at this time and resulted in end-Permian terrestrial disturbance and the following marine environmental and biological crisis. $\delta^{199}Hg$ values at the horizon of the initial Hg peaks from the sections have similar characteristics to one another, all showing positive values, which is indicative of a predominant atmospheric-derived signature of volcanic Hg. However, they show different characteristics at the horizon of second Hg peak related to differing depositional environments. In terrestrial setting, they display negative or near zero values, in marine-terrestrial transition facies and in nearshore marine they have positive values, and then a decreased trend in relatively deep-water environments. These varying responses in Hg values indicate the elevated involvement of terrestrial Hg due to increased weathering after the collapse of the terrestrial ecosystem with the atmospheric Hg signature overwhelmed in nearshore or terrestrial aquatic realm.