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Interpreting variability in Hg concentrations and Hg-isotopes across intervals of large-scale volcanism: A case study from the end-Triassic

XIA HUA[1], DAVID B. KEMP[1], RUNSHENG YIN[2], JUN SHEN[3], XIN JIN[4], YI SONG[5] AND CHUNJU HUANG[1]

[1]State Key Laboratory of Biogeology and Environmental Geology and Hubei Key Laboratory of Critical Zone Evolution, School of Earth Sciences, China University of Geosciences (Wuhan)

[2]State Key Laboratory of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences

[3]State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences (Wuhan)

[4]State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation and Key Laboratory of Deep-time Geography and Environment Reconstruction and Applications of Ministry of Natural Resources, Chengdu University of Technology

[5]Coral Reef Research Center of China, School of Marine Sciences, Guangxi University

Presenting Author: xiahua@cug.edu.cn

Large igneous province (LIP) eruptions have been temporally correlated to most of the so-called “Big Five” mass extinctions of the Phanerozoic, and could be causally linked to mass extinctions by the extensive release of volcanic gases, which can perturb the Earth's surface system by cascading effects, i.e., ocean acidification, ocean anoxia, and global warming. The end-Triassic extinction (ETE) is genetically linked to the broadly coeval Central Atlantic Magmatic Province (CAMP) – the most voluminous and extensive Phanerozoic LIP. Because volcanism is the largest natural emission source of mercury (Hg), elevated Hg in sedimentary rocks is commonly used for tracing ancient volcanism, and has been applied to the ETE to confirm the volcanism trigger on mass extinction. Mercury isotopes have also been used, albeit less commonly, to trace the pathways of volcanic Hg entering the ocean, based on the Hg isotopic differences between wet and dry deposition pathways. Nevertheless, because sediment Hg levels are affected by sedimentary environments, the efficacy of using Hg abundance to trace LIP eruptions is debated. Equally, given Hg from natural sources can have overlapping isotopic signals, the use of Hg isotopes as a direct volcanic proxy is not yet fully validated. Triassic-Jurassic boundary sections in southwest England encompass a range of sedimentary environments (non-marine to marine, oxic to anoxic), which offer a natural laboratory to investigate the mechanisms and causes of Hg concentration and isotopic composition variability. Here, we generate new data on Hg concentration and isotopic composition, and polycyclic aromatic hydrocarbon concentrations. Our results highlight how previously published Hg concentration may not represent an effective fingerprint of CAMP volcanism as originally suggested, and that Hg-isotopes offer a more robust proxy for volcanism even in the presence of clear source and redox changes. Overall, our work helps to confirm a tight correlation between large-scale CAMP volcanism and the end-Triassic mass extinction.