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Mercury isotope constraints on the timing of intrusive-extrusive magmatism during the end-Triassic mass extinction

XIA HUA[1], RUNSHENG YIN[2], DAVID B. KEMP[1], CHUNJU HUANG[1] AND JUN SHEN[3]

[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)

Presenting Author: xiahua@cug.edu.cn

The End-Triassic Mass Extinction (ETME) was broadly coincident with the emplacement of Central Atlantic Magmatic Province (CAMP), which has led to the suggestion that voluminous carbon released during CAMP emplacement triggered global environmental perturbation and biological crisis. Evolutionary phases of CAMP magmatism have been previously recognized, i.e., prolonged major shallow intrusive activity and later extrusive pulses. However, the nature and relative tempo of CAMP phases and their relationship to the ETME is not clear due to the geographic separation between CAMP records and the sedimentary record of extinction. Mercury (Hg) and its isotopes are now commonly used as a paleovolcanism proxy in sedimentary rocks, and have the potential to link volcanic signals and extinction events from sedimentary successions. Here, a high-resolution record of changing magmatic activity is established from a new composite Hg-isotope record across a Late Triassic to Early Jurassic sedimentary succession in the UK, on the northern flank of CAMP. Successive negative and positive mass independent fractionation (MIF) of odd Hg isotope across the ETME interval are revealed. Combined with mass balance calculations and correlations to available CAMP ages, we propose that a transition from thermogenic release of sedimentary Hg from intrusive heating of organic-rich sedimentary rocks (Δ^{199}Hg <0‰) to explosive input of volcanogenic (mantle sourced) Hg (Δ^{199}Hg ~0‰) occurred across the ETME. The major biological crisis likely did not happen before the onset of extrusive volcanic input. Mass balance constraints suggest modest volumes (<200 Mg) of thermogenic and volcanic Hg input are required to drive the observed negative and positive shifts, respectively. These modest inputs could at least partly explain the lack of significant sedimentary Hg enrichment during ETME in our section, which may also underline how Hg isotopes are a more robust paleovolcanism proxy than Hg concentration alone.