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A global mercury signal recorded in a Toarcian shallow marine succession, Marrat Fm, Saudi Arabia

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Elevated mercury contents and Hg/TOC ratios in the sedimentary record are often attributed to elevated atmospheric Hg from coeval volcanism from large igneous provinces (LIPs). For instance, Hg and Hg/TOC peaks are recorded in multiple (but not all) marine sections deposited during the Early Jurassic Toarcian oceanic anoxic event (T-OAE) that coincides with the eruption of the Karoo-Ferrar LIP[1, 2]. It remains unclear whether these Hg peaks are a direct response of atmospheric Hg loading[1] or they form after absorption by terrestrial biomass and its subsequent recycling and delivery into marine sediments[2].

Here, we present a geochemical study on outcrop samples collected near Riyadh city, Saudi Arabia. The samples cover ~120 m of stratigraphy from the top of the Upper Triassic Minjur Formation (sandstone), the Lower (siltstone-dolomite), Middle (shale-siltstone) and Upper (limestone) Units of the Marrat Formation, and the lower part of the overlying Bajocian Dhurma Formation (marl-dominated). Most samples have between ~1-3 ppb Hg, but a prominent Hg peak up to 26 ppb is detected within the red beds of the Middle Marrat Formation. This Hg peak can be correlated with globally recognized Hg peaks during the T-OAE and hence be used to refine regional and global stratigraphic correlations. Importantly, the Hg peak is entirely constrained within a 5 m monotonous interval of red shales and siltstone, which eliminates lithological changes or local redox variations as potential sources of increased Hg loading.

Preliminary isotopic data suggest that the Hg peak samples are characterized by lower (negative) δ^{202}Hg and δ^{199}Hg relative to background values. These results are inconsistent with Hg-delivery to the atmosphere and sediments through direct volcanic emissions. Rather, they argue for a recycled, terrestrial source of the extra Hg (vegetation, soil, coal), which may also be related to concurrent LIP volcanism through increased Hg supply to the atmosphere followed by enhanced erosion.

[1] Percival et al. (2015), EPSL. 428, 267-280.

[2] Them II et al. (2019), EPSL. 507, 62-72.

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