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Hg contents of Toarcian sediments from the Marrat Formation, Saudi Arabia

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The temporal coincidence of large igneous provinces (LIP) with elevated mercury contents and Hg/TOC ratios in coeval sediments suggests that sedimentary Hg is a reliable proxy for volcanic emissions[1]. However, high Hg loading may also result by increased supply of terestrial organic matter[2], which may or may not contain Hg from coeval volcanism. These end-member scenarios and intermediate cases are clearly illustrated in multiple sections deposited during the Early Jurassic Toarcian oceanic anoxic event (T-OAE) that coincides with the eruption of the Karoo-Ferrar LIP[1, 2].

Here, we explore the application of the Hg proxy by studying Toarcian sediments exposed near Riyadh, Saudi Arabia. The Marrat Fm comprises red kaolinite-rich claystones belonging mostly to the Harp. *serpentinum* ammonite Zone, which are under- and overlain by resistive limestone beds[3]. The sediments are traditionally regarded as marginally marine deposits[3], although recent studies instead suggest shallow-marine sedimentation for the Marrat Fm claystones[4].

Preliminary data on 24 pilot samples reveal significant variations in Hg contents between 0.3 and 17.5 ppb, with the highest values detected in specific limestone units. A more detailed study including Hg, TOC, elemental and XRD data and carbon isotopes is being established to explore finer chemostratigraphic details. Our aim is to constrain the depositional conditions for these sediments with a special emphasis on understanding the Hg host within the rocks. Comparison with published Toarcian profiles can reveal whether the Hg Toarcian peaks are present in the generally shallow marine and TOC-lean studied section, whereas integration of geochemical and mineralogical data will be used to discern the dominant mechanism for Hg delivery to sediments. In turn, successful global correlations hold the potential to improve the relatively scarce biostratigraphy of the Marrat Fm.

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

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

[3] Al-Mojel et al. (2020), J. Afr. Earth Sci. 167, 103429.

[4] Al-Hussaini et al. (2021), Mar. Petr. Geol. 126, 104915.