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Orbitally forced variability in Early Jurassic mercury deposition

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Mercury concentration in sedimentary rocks has been increasingly used as a proxy for volcanic activity in the geological past. Increases in Hg concentration around the world have been found to be coeval with emplacement of known Large Igneous Provinces (LIPs), including during the Jurassic Toarcian Oceanic Anoxic Event (T-OAE).

However, there are few datasets examining variability in Hg deposition over geological timescales in the absence of large-scale volcanic events. Without similarly high-resolution data to resolve background Hg cycle variability, it is impossible to determine the uniqueness of the signals seen during LIP emplacement. We investigate Hg deposition during periods considered to be without LIP influence by (a) testing whether there is any variability in the Hg data that reflects Milankovitch forcing and (b) if so, whether the Hg signal is a function of changing organic-carbon deposition or an independent response of the Hg cycle.

We present a very high stratigraphic resolution (3 cm, ~2 ka) Hg concentration record spanning 24 m (~1.5 Myr) of the Lower Jurassic Belemnite Marls, Dorset, UK. The Belemnite Marls are a sequence of orbitally forced marl-limestone couplets deposited in a shallow-marine epicontinental basin, well-constrained by ammonite biostratigraphy. We focus on the lower 16 m of the *jamesonii* biozone, in which the couplets have previously been linked to the precession (~20 kyr) cycle.

We compare the Belemnite Marls record with literature data interpreted to show signals of LIP activity across the T-OAE. Hg peaks interpreted to be LIP-derived are higher in amplitude than most variability exhibited in the Belemnite Marls record; however, the latter still contains a few comparably high Hg concentration values. We find that, as opposed to volcanic signals, Hg in the Belemnite Marls systematically varies on orbital timescales, linked with precession and possibly orbital eccentricity. The observed cyclicity is not solely driven by TOC concentration, but also appears in Hg values that have had covariation with TOC statistically corrected. Our data suggest that orbital forcing of the surface Hg cycle may impact both Hg concentration and normalized Hg records and that therefore cyclic behaviour in Hg records and its meaning requires careful consideration.