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Mercury isotopic fractionation during precipitation of travertine

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Travertine precipitation is a very common process occurring in the ocean or on the continental surface and is largely studied because it can provide high-resolution information related to paleoclimate and palaeoenvironment. Meanwhile, recent researches also suggest that Hg isotopes may be a very good tracer to environmental change[1, 2]. As a newly developped isotope system, the direction and magnitude of mercury (Hg) isotopic fractionation during travertine precipitation still remain unknown.

In this study, two natural travertine precipitation systems where carbonates respectively form in pool and canal under different hydrodynamic condition were choosed to investigate the fractionation of Hg isotopes during travertine precipitation and see if Hg isotopes can provide useful information on the paleoclimate and palaeoenvironment. According to the XRD data, all the travertine collected were consists of pure calcite. In both systems, the δ^{202}Hg values in travertine samples are obviously lower than in water samples, suggesting that Hg isotopic fractionation exsits during travertine precipitation and lighter Hg isotopes are preferentially precipitated into solid travertine samples because of a kenitic isotope effect. In general, the magnitude of Hg isotopic fractionation between travertine and water samples decreases with increasing precipitation rate and water temperature, which could be likely explained by kinetic isotope effects controlled by variable precipitation rate. The effect of water temperature is not well identified at this stage but it may primarily impact on the precipitation rate thus indirectly influence the Hg isotopic fractionation. Finally, a surface kinetic model [3] was used to intepret Hg isotope fractionation in the whole travertine system. The observed relationship between water temperature and the magnitude of Hg isotopic fractionation may provide useful information for reconstructing paleoclimate and palaeoenvironment.

References:

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