Aragonite-water oxygen isotope fractionation in hot spring travertines

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$\delta^{18}O$ values of aragonites are widely used to determine their temperature of formation. Most available empirical fractionation curves are based on biogenic aragonites and are limited to a temperature range between 3 and 30 ºC. Experimental calibrations with synthetic aragonites range from 0 to 70 ºC but display very large differences in fractionation as high as 3 ‰ resulting calculated temperature offsets as high as ~13ºC [1].

In this study we analyzed a set of aragonitic travertine deposits from Italy and Hungary to extend the range of the temperature calibration and improve our understanding of the processes governing carbonate precipitation based on natural carbonate deposits. We collected samples of recently formed aragonites and their parent thermal waters at the vents and along downstream sections of travertine-depositing thermal springs. Our samples cover a temperature range between 23 and 83 ºC.

In general, the observed oxygen isotope fractionation for aragonites are lower than the empirical fractionations observed in pure calcitic travertines [2]. Above 60 ºC they fit well the extrapolated experimental curve of Kim *et al*. [3] providing an empirical equation for paleotemperature calculations in open air aragonite-water systems between 23-83 ºC. We will also discuss possible effects of CO_2 degassing and precipitation rate on oxygen isotope fractionation in these systems.

[1] Gabitov, R.I. (2013) *Chem. Geol.* **351**, 268-275 [2] Kele, S. *et al* (2011) *Sed. Geol.* **211**, 53-72 [3] Kim *et al* (2007) *Geochem. Cosmochim. Acta* **61**, 3461-3475