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Silicon stable isotope profiling of an extinct sinter mound from the El Tatio geothermal field, Chile; implications for the interpretation of early siliceous deposits

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Silicon stable isotope compositions can provide important information regarding Si sources and depositional processes in modern and ancient siliceous sediments, however there exist relatively few studies of modern geothermal sinter deposits. Here we report a chemostratigraphic study of the major element, trace element, and silicon stable isotope compositions through an extinct sinter mound from the El Tatio geothermal field in Chile. This mound was previously studied by [1], who established a depositional model on the basis of its sedimentology, mineralogy, and presence of distinct sinter facies at different distances from the paleo-spring as well as at different depths. For this study, samples were procured from drill core obtained by portable backpack drilling to a depth of >5 m that terminated in the underlying glacial till. The δ^{30}Si compositions span from +1 to -3‰ over 5 m and show clear secular variations between the different sinter lithofacies. They also follow the magnitude of shale-normalized Eu anomalies, an independent indicator of high-temperature hydrothermal activity. Combined, these results suggest that evolving fluid temperature at the time of deposition led to variable sinter deposition rates, and in turn, variable degrees of kinetic Si isotope fractionation. These results confirm previous observations of strong kinetic control over Si isotope fractionation in hot spring systems [2] and should help inform the interpretation of Si stable isotope data from ancient siliceous deposits.

[1] Wilmeth *et al*., *Sedimentary Geology* 406, 105726 (2020).

[2] Geilert *et al.*, 2015, *Geochimica et Cosmochimica Acta* 164, 403–427 (2015).