Evaluation of Stable Strontium Isotopic Fractionation during Continental Weathering Processes

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Stable Strontium (Sr) isotopes have been applied to investigate the exogenic Sr cycling and further constrain the marine Sr budget (e.g. [1]). A systematic evaluation of the stable Sr isotope ($\delta^{88}Sr$) in various natural specimens has reported a narrow range (0.24 - 0.27‰, relative to NIST SRM 987) in the bulk silicate earth materials and carbonates (0.14 - 0.27‰)[1]. Whereas, significant $\delta^{88}Sr$ variation was detected in rivers worldwide (0.23 - 0.45‰) [1] that indicates Sr isotopes fractionation in terrestrial weathering environments. In this study, a series of Quaternary loess and paleosols specimens were collected from the Chinese Loess Plateau coupled with two laboratory leaching experiments, the partial dissolution of primary rock reference materials and the Sr surface exchange using clay standard minerals, were conducted for a comprehensive understanding of Sr isotopic fractionation in nature. Based on our Sr/Ca and $^{87}Sr/^{86}Sr$ results, the carbonate fraction of the eolian dust in the Wei-nan profile is a non-primary formation and reflects contributions from primary carbonate dissolution and primary silicate weathering. Further, significant Sr isotopic fractionation was found in the carbonate fractions of loess and paleosols that is isotopically heavier than the corresponding desert source materials ($\Delta^{88}Sr$ up to 0.15‰). This indicates that potential Sr isotopic fractionation has occurred during the weathering process. In addition, the results of laboratory experiments imply that the heavier Sr isotopes were preferentially released during weathering. To further constrain the potential mechanisms that may involve to cause stable Sr isotopic fractionation, future work will focus to study the Sr isotope compositions in soil profiles and soil solutions.

[1] A. Krabbenhöft, A. Eisenhauer, F. Böhm, H. Vollstaedt, J. Fietzke, V. Liebetrau, N. Augustin, B. Peucker-Ehrenbrink, M. Müller, and C. Horn, *Geochimica et Cosmochimica Acta*, 2010, **74**, 4097–4109.