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Mg isotope constraints on silicate weathering mechanisms: constraints from soil pore fluid water δ^{26}Mg.

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Magnesium (Mg) is one of the most concentrated cations in natural fresh waters, but the source of the Mg, and the processes which control the release of solid-phase Mg bound in a mineral lattice to Mg dissolved as a cation in a river water remain surprisingly enigmatic. Mg has three stable isotopes and measurement of their ratios (expressed as δ^{26}Mg) are emerging as a powerful tool for constraining both the source of the Mg in the dissolved load, and the processes which may have affected it. Recent work has provided strong evidence for a fractionation of the isotope ratios of Mg during the chemical weathering of silicate rocks, based on a comparison between Mg isotope ratios in river waters, in “pristine” bedrock and in soil (Tipper et al., In press). However, riverine systems are inherently complex because of the large number of degrees of freedom. Here we have undertaken a study of Mg isotope ratios in a series of soil chronosequence and complementary pore water samples from Santa Cruz, California. The samples have previously been well characterised (White et al., 2007) making them an ideal sample suite to better understand the mechanisms controlling Mg isotope ratios in the weathering environment. In particular, the Mg is thought to be of silicate origin, with no carbonate input. The new data support the previous evidence for the fractionation of Mg isotope ratios during the chemical weathering of silicate material, with soil pore water systematically enriched in ^{24}Mg compared to solid material. A vertical pore fluid profile (of contemporaneous samples) shows a very coherent trend, with the shallowest samples having the lowest δ^{26}Mg. This suggests that at shallow depths, either a different source of Mg is present, or that the processes acting

are distinct from those deeper in the regolith. Processes such as vegetation cycling of Mg at shallow depths will be discussed.

References

Tipper E. T., and Galy A., and Bickle M. J., Calcium and Magnesium isotope systematics in rivers draining the Himalaya-Tibetan-Plateau region: Lithological or fractionation control? (2008), Geochim. et Cosmochim. Acta, In press, DOI: 0.1016/j.gca.2007.11.029.

White A. F., Schulz M. S., Vivit D. V., Blum A. E., Stonestrom D.A., and Anderson S. P., (2008) Chemical weathering of a marine terrace chronosequence, Santa Cruz, California I: Interpreting rates and controls based on soil concentration-depth profiles, Geochim. et Cosmochim. Acta, 72, 36-68, DOI:10.1016/j.gca.2007.08.029.