Li isotope fractionation in weathering regimes: understanding interlayer sites on clay minerals

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Chemical weathering, especially silicate weathering, plays an important role in regulating Earth's carbon cycle and stabilising the global climate on geological time-scales [1]. Lithium isotopes (δ^7Li) have been developed as an effective tracer of silicate weathering in the past decades [2].

Dissolution of primary minerals or transportation of dissolved load does not appear to appreciably affect Li isotopic signature. In contrast, the formation of secondary minerals significantly fractionates Li ratios. The light isotope (^{6}Li) is preferentially incorporated in the structural lattices of secondary minerals, leaving a heavier signature in water [2]. However, in some minerals such as clays there are more than one mineralogical sites for the Li, such as within the octahedral structures, or loosely bound in the interlayer sites. Recent work suggests that these two sites have contrasting Li isotope fractionation factors [3]. Interlayer Li is expected to equilibrate with the solution relatively fast and hence often referred as "exchangeable sites".

Here we present initial the Li isotope (δ^7Li) data on water and sediments at different depths from one of the world's largest rivers, the Mekong River. We measured Li isotopic signatures in water, exchangeable fraction and silicate fraction in a range of tributaries spanning the entire reach of the basin, revealing the variation from upstream to downstream and from surface to bottom. Our data provides important insights on Li fractionation on exchangeable sites and improves the interpretation of Li isotopes in weathering regimes.

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