Compared behavior of boron, lithium and uranium series isotopes fractionement during the weathering of granite (Strengbach catchment, France)

J.E. NEGREL[1], D. LEMARCHAND[1], F. CHABAUX[1]

[1]LHyGeS/CNRS, Univ. Strasbourg, France.
Correspondance : justine.negrel@etu.unistra.fr

Boron, lithium and uranium-thorium-radium isotopes have been most often used independently of each other for the purpose of deciphering reactions and rates of water-rock interactions in weathering profiles. Here, we evaluate whether a comprehensive study of their respective isotopic fractionation provides consistent information about the processes that control the development of two distinct weathering profiles developed on granitic bedrock in the Strengbach watershed (Vosges Mountain, France). B and Li isotopic ratios and U-series nuclides have been determined in parallel in the same samples from two weathering profiles. For each sample both bulk-sample and clay size fractions were analyzed.

Measured Li, B and U-series concentrations in the two weathering profiles show enrichment in clay-size samples relative to their respective bulk regolith horizons. In the two weathering profiles, the B-isotopic ratio ($\delta^{11}B$) shows a gradual evolution with depth, with more negative, closer to the bedrock, values in the deeper part of the profile than in the surface.

We also observe a clear relationship between B isotopic ratios and the mineralogy of the clay size fraction suggesting the presence of two generations of clay minerals mixed in different proportions with depth: inherited clays encapsulated in the granite rockforming minerals, with $\delta^{11}B$ lower than -30‰ and pedogenic clays with $\delta^{11}B$ around -20‰. The preliminary $\delta^{11}B$ and ($^{234}U/^{238}U$) ratios measured in the clay fractions suggests an apparent consistency between the variation of both ratios: more negative $\delta^{11}B$ values, lower ($^{234}U/^{238}U$) activity ratios. Such results might derive from the weathering reactions currently active and indicate a relatively homogeneous “pedogenic” U-B isotopic signature in the clay fraction of the weathering profiles.