Rate of spheroidal weathering determined by U-Series nuclides (Rio Icacos basin, Puerto Rico)

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Spheroidal weathering is a classical process, which often defines the transition of bedrock to saprolite in many rock types and many climatic settings. Here we propose to evaluate the rates of spheroidal weathering by analyzing U-series nuclides in weathering profiles, including a spheroidal weathering zone, developed on quartz diorite in the Rio Icacos watershed (Puerto Rico), following the approach used in other contexts [1,2]. U-series nuclides, as well as major element and trace element concentrations have been analysed along two profiles collected in the Rio Icacos watershed. Major and trace element data obtained for the two profiles confirm that chemical weathering mainly occurs at the rindlet/saprolite transition. The U-series nuclides variations along the profiles show a complex U-mobility pattern, compared to that of ^{226}Ra-^{230}Th disequilibria variation. Large Ra-Th fractionation is observed at the rindlet/saprolite transition. Modelling of the ^{226}Ra-^{230}Th disequilibrium suggests a downward migration of the bedrock-saprolite front at 8m/100ka. The variations of U-Th disequilibria in the rindlets zones constituting the bedrock/saprolite transition zone is consistent with such a fast weathering rate, and also consistent with the surface denudation rate of 6m/100ka inferred for this region by cosmogenic nuclides [3, 4]. These data therefore suggest that the weathering and erosion processes in this watershed have reached a steady state. The results emphasize the potential of combining U-series nuclides and cosmogenic isotopes to constrain the steady or transient state of alteration systems.

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