Time scale of weathering processes and sediment transfers based on U-series disequilibria

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The potential of U-series radioactive disequilibria as tracers and chronometers of weathering processes results from the dual property of the U and Th series nuclides: (1) they are fractionated during water-rock interactions and (2) they have half lives of the same order of magnitude as the time scales of weathering processes and chemical transfers in soils and in river basins. Recent technical developments made in the measurement of the medium half-life nuclides of U-series (i.e. ^{234}U-^{230}Th-^{226}Ra) have stimulated the application of the U-series to the study of weathering and surface hydrology.

Here we present recent advances that the analysis of the U-series disequilibria in river products have allowed for constraining the duration and the rates of chemical weathering at the scale of watershed scale and for determining the sediment transfer time in river and alluvial plains. This potential is clearly highlighted by the results obtained on the Mackenzie, Amazon and Himalayan basins (e.g.; Vigier et al.,2001; 2005; Dosseto et al., 2006; submitted; Granet et al., submitted). These studies also outline how these estimate depend on the model used for describing the U-Th-Ra fractionation during weathering and sediment transport in the river. New constrains can be obtained from U-series in weathering profiles and in the different mineralogical and granulometric fractions of river sediments. The timescales of sediment transport in rivers suggests that suspended sediment are deposited and remobilized. These studies will help construct a dynamical picture of erosion processes at the scale of watersheds.

References

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