



Tracing plant-water-soil interactions at the plot scale (in the Strengbach catchment). Insights from analyses of major elements and U isotopes

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The impact of vegetal cover on the surface chemical transfers and on the weathering processes remain an important issue in Earth and environmental sciences.

We intend to investigate the interactions between chemical and biological reactions through a comprehensive study of two experimental plots (spruces and beeches plots) located in the forested catchment in temperate climate (Vosges, France). Rains, throughfalls, soil solutions as well as springs and the main stream have been periodically sampled during 2003-2005 and analysed for major and trace elements, Sr isotopes as well as U-series disequilibria.

The chemical composition in major and trace elements of plants and soils compared to that of the surface waters shows that the vegetation-induced geochemical fractionation has a significant influence on the chemical composition of waters in this catchment. In parallel, U activity ratios in trees are systematically shifted toward higher values compared to stream and spring waters. This discrepancy was not expected and should reflect additional reactions or reservoirs that are not taken into account so far. If these disequilibria are not due to rain contamination and not created by biological activity, we propose that this isotopic signature of U-series nucleids result from a two steps weathering process : weathering of minerals by plants driven by nutrient uptake, inducing $(^{234}\text{U}/^{238}\text{U}) > 1$ in the vegetation, followed by the weathering of the resulting phases by water, leading to $(^{234}\text{U}/^{238}\text{U}) < 1$ in soil solutions and waters.

The above scheme suggests that the vegetal cover plays a primary control on the mineral weathering in a forested catchment and, hence, regulates the chemical signature of surface waters.