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Sr and U isotope ratios in soil waters as tracers of weathering dynamic in soils (Strengbach catchment – Vosges-mountains; France).

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It is proposed in this study to highlight the interest of multi-tracer geochemical approaches combining measurement of major and trace element concentrations along with U and Sr isotopic ratios to constrain the characterization of the present-day weathering processes controlling the chemical composition of waters and soils in natural ecosystems. This is important if we want to predict and to model correctly the response of ecosystems to recent environmental changes. The approach is applied to the small granitic Strengbah Catchment, located in the Vosges Mountain (France), used and equipped as a hydro-geochemical observatory since 1986 (Observatoire Hydro-Géochimique de l'Environnement; http://ohge.u-strasbg.fr). This study includes the analysis of major and trace element concentrations and (U-Sr) isotope ratios in soil solutions collected within two soil profiles located on two experimental plots of this watershed, along with the analysis of soil samples and vegetation samples from these two plots.

The depth variation of elemental concentrations of soil solutions confirms the important influence of the vegetation cycling on the budget of Ca, K, Rb and Sr, whereas Mg and Si budget in soil solutions are quasi exclusively controlled by weathering processes. Variation of Sr, and U isotopic ratios with depth also demonstrates that the sources and biogeochemical processes controlling the Sr budget of soil solutions is different in the uppermost soil horizons and in the deeper ones, and clearly influence by the vegetation cycling. From the obtained data, it can be therefore proposed a scheme where in addition to the external flux associated to the decomposition of organic matter and throughfall, occurs a double lithogenic flux: a surface flux which can be associated to dissolution of secondary minerals contained in fine silt fractions and a deeper one, controlled by water-rock interactions which can mobilize elements from primary minerals like plagioclases or orthose.

These results shows also that the Strengbach watershed is in a transient state of weathering with an important loss of nutriments such as Ca in soils solutions since 15years, associated with an increase of a lithogenic flux indicating a recent modification of weathering/dissolution reactions involved in the soil horizons. The origin of the weathering modification could be the consequence of the acid rains on weathering granitic bedrock or a consequence of forest exploitation incompatible with the nutriment reserve of soils with recent plantations of conifer, which impoverish soils.