



## **Hydro-geochemical modeling of the spatial and the temporal geochemical variations of the granitic Strengbach catchment springs (Vosges massif, France)**

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Regular analysis of the major element concentrations in waters from springs emerging on the Strengbach catchment is made for more than 20 years (OHGE, Observatoire Hydro-Géochimique de l'Environnement). These data confirm the spatial variability of geochemical characteristics of the Strengbach springs linked, at least partly, to the lithological variability of the substratum (Pierret et al., 2014). The data also indicate that at the first order, the geochemical fluxes exported from each spring are mainly linked to the spring discharges, without significant variations of the relationships linking these two parameters between 1990 and 2010. There is also no observation of significant variations for the dissolved silica and for most of the cationic concentrations with time. Only a significant decrease of the Ca concentrations is observed for the Strengbach springs from 1990 to 2010. Numerical simulations, performed with the KIRMAT hydro-geochemical code, show that such a decrease can be considered as the response in the "bedrock" of the water-rock interactions to the variations of the soil solution chemical compositions recorded over the last 20 years, marked by a significant increase of pH and decrease of Ca concentrations. In particular, the modeling results show that the Ca concentration decrease is controlled by the couple apatite/clays, and that significant modifications of the apatite dissolution rate and clay compositions occurred between 1990 and 2010. This study shows that the temporal evolution of the Strengbach spring chemistry cannot be explained by the only variations of the clay mineral compositions, i.e. a modification of the chemical composition of the precipitated clays or a modification of the ionic exchange capacity of the clay minerals, but that it is definitely the interrelations between the apatite and the clay minerals that are involved.