

$^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios and Sr concentrations hydrogeochemical modeling of spring waters in the Strengbach catchment (France)

YANN LUCAS¹, FRANCOIS CHABAUX², ALAIN CLEMENT³, BERTRAND FRITZ⁴, CORALIE RANCHOUX³, JULIEN ACKERER⁵, ERIC PELT² AND ANNE-DÉSIRÉE SCHMITT⁶

¹ITES - CNRS Strasbourg

²ITES CNRS - Université de Strasbourg France

³université de strasbourg

⁴ITI-Geo-T Geosciences for the Energy Transition; Institute Terre et Environnement de Strasbourg, CNRS, EOST, UMR 7063, University of Strasbourg

⁵ITES EOST

⁶Université de Strasbourg - ITES CNRS

Presenting Author: yucas@unistra.fr

To discuss the spatiotemporal variations in Sr concentrations and isotopic compositions of spring waters at the Strengbach catchment scale, we integrated the modeling of the Sr concentration and $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratio into the hydrogeochemical code KIRMAT previously developed to study the chemical composition of the spring and borehole waters of the catchment between 1990 and 2010. The simulation results show that the 1990–2010 decrease in Sr concentrations in the spring waters can be explained by the response of mineral weathering to the pH increase of the incoming solutions during the same period, resulting from the acid rain decrease. This pH increase reduces the water path proportion characterized by a high flux of apatite and biotite dissolution. Consequently, it reduces the Sr concentration of the outgoing spring waters. $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios of the springs varied little or not at all on average from 1990–2010, but they varied significantly during a hydrological cycle and from one spring to another. The modeling results show that the constancy of the average $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios over several years results from a water path sufficiently long for soil solution pH variations to no longer influence the water at the emergence of the spring. The simulation results also imply that the isotopic variations observed in the springs during a hydrological cycle can be explained by differences in the transit time of the water in the substratum between high and low waters and the modifications that they entail on the degree of saturation of the water with respect to biotite and apatite. Similarly, the different average isotope ratios from one spring to another can be explained by the more or less long residence times in the bedrock of the waters feeding the different springs. These results highlight that at the scale of an upstream basin such as the Strengbach catchment, the Sr isotopic variations observed in the spring waters do not systematically indicate lithological differences.