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Place of vegetation and water rock interactions in calcium isotope fractionation in river waters : evidence from the Strengbach catchment, France

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The impact of biological activity on the Ca isotope fractionation at the soil-water-plant-atmosphere interface has never been studied in detail although it has already been shown that biological Ca isotope fractionation is an important process within the biogeochemical Ca cycle and might have a considerable impact on the Ca isotopic composition of soil, soil solutions and probably river waters (e.g.; SCHMITT et al., 2003; WIEGAND et al., 2005). In order to unravel the mechanisms leading to calcium isotope fractionation in surface environments, the main hydro-geochemical reservoirs of a small forested watershed, the Strengbach catchment in Vosges Montains (France) were analysed. These reservoirs are: atmospheric deposits, throughfalls, percolating soil solutions sampled within the soil top meter, springs and streamlet. Comparing calcium isotopic variations between these reservoirs is indeed a first straightforward approach to get new information about the nature and extend of processes that fractionate calcium isotopes in surface waters. The Ca data obtained during this study clearly emphasize that Ca isotopic compositions of soils and stream waters in this watershed are controlled by both alteration and water-rock interaction at one hand and biological activity on the other hand. Increasing biological activity in spring causes increased 40Ca-uptake by the plants root system and consequently enrichment in the 44Ca isotope in the remaining soil solution. Thus, generally speaking, waters are during spring and summer isotopically heavier than during the winter period. The effects of biological activity are counterbalanced by fractionation induced by alteration processes which operate the whole year but become especially visible during dry periods

and/or low biological activity (autumn/winter). Ca isotopes could therefore become in the future a useful hydrogeochemical tracer, enable to distinguish between deep seated water reservoirs (signal of weathering) and water reservoirs situated close to the soil surface and the vegetations sphere of influence.