

Experimental and field study of fractionation processes of Sr and Mg isotopes in karst aquifer of Ljubljana River (Slovenia)

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The application of isotope ratios of non-traditional elements, like Mg and Sr, in karst hydrology is based on fundamental mechanisms of element partitioning and their isotope fractionation during carbonate dissolution and precipitation in oxic and anoxic aquatic environments in karst conduits of karst aquifers, in streams and river sediments. Sr isotope composition ($^{87}\text{Sr}/^{86}\text{Sr}$) has been used for the identification of the origin of surface and ground waters and as a tracer of water-rock interactions, bedrock weathering and mixing processes, while $d^{88/86}\text{Sr}$ is used for identification of carbonate sources and precipitation. Both Mg and S, co-precipitate with CaCO_3 , and their isotopic composition ($d^{26}\text{Mg}$, $d^{25}\text{Mg}$) was used in studies of carbonate weathering and C and metal cycling in aquifers and the formation of, authigenic carbonate phases such as dripstone or fibrous microcrystal calcite, where considerable isotopic fractionation was observed.

The karst aquifer of Ljubljana River has numerous springs and sinks and represents an interesting environment for studying hydrogeological processes. The aim of the study was to obtain basic data on the isotopic composition of Sr ($^{87}\text{Sr}/^{86}\text{Sr}$, $\delta^{88}\text{Sr}$) and Mg ($\delta^{25}\text{Mg}$, $\delta^{26}\text{Mg}$) in potential sources of these two elements (soil, bedrock) and on the isotopic fractionation of Sr and Mg during processes, leading to the formation of possible authigenic carbonates (leaching from the soil, dissolution of rocks, precipitation of carbonate). The $d^{26}\text{Mg}$, $d^{25}\text{Mg}$ and $d^{88/86}\text{Sr}$ were determined by MC-ICP-MS, using DSM3 and NIST 987 as normalization standards for Mg and Sr, respectively.

Based on the obtained data, the isotopic composition of Mg and Sr in karst springs and sinks and with the help of data on the isotopic fractionation of Sr and Mg during bedrock dissolution and carbonate precipitation, we assessed whether and to what extent the CO_2 fixation in the form of authigenous carbonate in the Ljubljana aquifer occurs.