Sr isotope fractionation in a karst river: case study of Krka, Croatia

Sonja Lojen1, Qasim Jamil2, Tea Zuliani1,2, Leja Rovan1,2, Tjaša Kanduč1, Polona Vreča1, Marko Štrok1, Elvira Bura Nakić3, and Neven Cukrov

1Jožef Stefan Institute, Department of Environmental Sciences, Ljubljana, Slovenia (sonja.lojen@ijs.si)
2Jožef Stefan Postgraduate School, Ljubljana, Slovenia (qasim.jamil737@gmail.com, leja.rovan@ijs.si, tea.zuliani@ijs.si)
3Ruđer Bošković Institute, Division for Marine and Environmental Research, Zagreb, Croatia (elvira.bura.nakic@irb.hr, ncukrov@irb.hr)

Precipitation of calcite from water fractionates strontium (Sr) isotopes because of preferential incorporation of light (86Sr) isotopes into the solid phase, making continental carbonates one of the most 88Sr depleted reservoirs. It was suggested that carbonate precipitation is the most likely process controlling δ88/86Sr composition of karst water. Therefore, the 88Sr enrichment of river water could be used for the estimation of Sr and carbonate precipitation at catchment scale.

In the present study, we report on trace element partitioning and Sr isotope fractionation between tufa and water in the groundwater fed karst river Krka (Croatia). Water and tufa along with samples of bedrock and soil as the main contributors of dissolved and particulate Sr at seven main waterfalls and cascades along a 33 km section of the river were analysed for trace element and Sr isotope composition (δ88/86Sr).

The highest δ88/86Sr values were measured in soils and in siliciclastic rocks, while in limestone, the δ88/86Sr values were similar to those of old tufa precipitated in the period between 96 and 141 ky BP. Recent tufa, however, was considerably depleted in 88Sr. The isotope fractionation between water and recent tufa varied a lot and was inversely correlated with Mg and Sr partitioning coefficients, while correlations with precipitation rates and temperature were rather weak. The δ88/86Sr of recent tufa was strongly correlated with the stable isotope composition of organic carbon, which indicates that apart from hydrochemical, hydraulic parameters and temperature, plants and microbial communities that knowingly stimulate the tufa formation also affect the isotope fractionation of Sr.