Li isotopes a powerful tool to trace hydrothermal impact during chemical weathering processes

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Li isotopes has been recently used to study water-rock interactions at Earth surface. Li is a fluid-mobile element that tends to preferentially partition into the fluid phase during water-rock interaction. The relative mass difference between the two isotopes is considerable, generating large mass dependent fractionation during chemical weathering processes, even at high temperature.

In the present work, the $^7Li/^6Li$ (expressed as δ^7Li) was analyzed in Allier River, one of the major river basins of France. We have undertaken a systematic study of weathering products of the river. The lithology is dominant by granite rocks with current upstream, while it is mainly basaltic and Oligocene sediments in the downstream with hydrothermal manifestation.

Water samples were collected during several field trips. Our results show a large variation in Li isotopes within the catchment from 4.44 ‰ to 23.52 ‰. Li signature show a geographical distribution as it decreases from upstream to downstream over 400km. It appears that the upstream portion of the river present Li signature with higher fractionation with a mean value of 18 ‰ whereas it is only 6 ‰ in the downstream. This last portion of the river is impacted by hydrothermal activity, indeed these values reflect low temperature water-rock interaction in upstream and high water-rock interactions in the downstream, which the lowest values correspond to thermal mineral water plant. Li isotopes can be used here as a tracer of hydrothermalism. Moreover it seems that Li isotopes present a negative correlation with metal elements concentrations, which means that in a natural system hydrothermal activity induce liberation of those elements in the dissolved phase of the river during chemical alteration.

Those promising applications from Li isotopes to better understand chemical weathering processes will be discussed.

Identification of transboundary geothermal aquifers by hydrogeochemistry

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Problem identification and applied methodology

The transboundary character of the Mesozoic, Miocene and Pliocene geothermal aquifers in the Mura-Zala basin in the SW Hungary and NE Slovenia was investigated by various hydrogeochemical techniques. Chemical analyses of 24 cold- and thermal groundwater samples were performed in 2010 for the T-JAM project, followed by additional sampling in 2011 for the TRANSENERGY project.

Results and discussion

Main components and trace elements analyses confirm the vertical stratification of geothermal aquifers as already suggested by many [1, 2, 3], but also indicate transboundary flow systems. Hydrogeological connections and groundwater age are interpreted from the stable ($\delta^{18}O$, δD, $\delta^{13}C$) and radioactive groundwater isotope (tritium, ^{14}C) analyses.

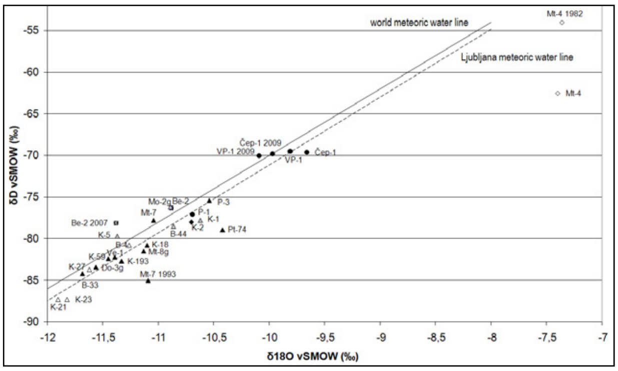

Figure 1: Distribution of $\delta^{18}O$ and δD in the samples.

Organic compounds, dissolved and separated gas, and noble gas analyses indicate differences in evolution and prevalent geochemical processes in the aquifers. Distinction between active and stagnant flow systems is also evident from our results.

[1] Kralj & Kralj (2000) *Env. Geol* **39/5**, 488–500. [2] Lapanje (2006) *Geol* **49/2**, 347–370. [3] Tóth *et al*. (2006) MÁFI Report