



Fates of major and trace elements in alpine watersheds from spring water compositions

Marc-Henri Derron

University of Lausanne, ISTE, Lausanne, Switzerland (marc-henri.derron@unil.ch)

In order to investigate the influence of bedrock on the chemical composition of alpine spring waters, more than 700 chemical analyses for major and trace elements have been collected (from reports and thesis). All these waters are from monolithological shallow aquifers and five types of bedrock have been distinguished: granite, mafite, ultramafite, limestone and gypseous rocks.

For major elements, it appears that dissolution properties of minerals (i.e. solubility and dissolution rate) strongly control the content in major elements of these spring waters. In particular, a low amount of a highly soluble and rapidly dissolved mineral may play the main role: gypsum or anhydrite in gypseous rocks, brucite in ultramafites, or calcite in the other rock types. The relationships between total dissolved solids (TDS) and electrical conductivities (EC) have also been refined according to the type of bedrock.

Dissolved contents of trace elements are highly variables, several orders of magnitude for most of them. There is usually no direct relationship between rock contents and concentrations in solution (except for some alkaline elements or anionic complexes). That entails that other processes than dissolution control the concentration of these elements in these water (adsorption, precipitation and complexation).

Finally, the relative mobility of each element (i.e. the ratio of molar concentrations rock / water) has been estimated, showing the importance of chemical speciation to understand water or soil chemical compositions. Based on these results, chemical denudation rates have been estimated using a kinetics numerical model of dissolution and compared to rates estimated by other means (chemical depletion of a moraine, TDS budget).