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Origin of arsenic contamination of rock glacier springs in alpine headwaters of the Seckauer Tauern Range (Austria)

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Arsenic mobilization in groundwater is a worldwide problem. The influencing factors for a contamination of water are widespread and for most locations individual. Four dominant mechanisms are known, two are associated with adsorption processes on metal oxides or clay under an alkaline environment or a reductive environment. The others are sulphate oxidation and evaporation of geothermal waters. Sediment basins and geothermal springs were of special interest in recent years due to high arsenic contamination and thus related serious health problems in these areas. This work aims to understand the processes of arsenic mobilization in low contaminated settings bound to periglacial landforms such as rock glaciers in alpine regions. Recent research in the Seckauer Tauern Range led to new questions related to arsenic contamination of spring water bound to these landforms. Water temperatures between 2-4°C, short retention times (hours – several months) and neutral pH values are not very favorable conditions for dissolution and mobilization. Furthermore, the overall total cation concentration is less than 13,8 mg/l, where Ca^{+2}, Si^{4+}, Mg^{2+}, Na^{+1} and K^{+1} dominates. Anions such as SO_4^{-2}, NO_3^-, NO_2^-, Cl^- and PO_4^{3-} are also extremely low concentrated ($\sum \quad < 7{,}2$ mg/l). Nevertheless, the arsenic concentrations in some spring waters exceed 10 μg/l, which is the recommended threshold (parameter value) for drinking water according to the WHO. The important questions related to this context are: (i) Is an influence discernible due to the hydrogeological behavior of rock glaciers? (ii) What are the dissolution and the transport mechanisms? Therefore seasonal water sampling for isotopic and hydrogeochemical analysis as well as rock sampling and structural analysis of the investigated area were done in order to investigate the dissolution and mobilization processes. Additionally PHREEQC will be applied for inverse modelling, by using the hydrogeochemical data in combination with geochemical and mineralogical data from exposed lithologies of the catchment areas. Thus, this work contributes to a better understanding of the origin and fundamental process of arsenic pollution in crystalline basement areas.