



## **Chemical and isotope characteristics of a tufa-precipitating stream in Karwów (south-central Poland)**

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Chemical and isotope composition of a tufa-precipitating spring located in Karwów (south-central Poland) is described with the emphasis on the  $\text{CO}_2\text{-H}_2\text{O-CaCO}_3$  system. Carbonate solution is formed with participation of biogenic carbon dioxide and appears at the surface close to saturation state with respect to calcite. At the outflow of the spring the water is characterized by long-term stability of physical and chemical parameters. Along the course of the spring the tufa bed is formed as a result of  $\text{CO}_2$  outgassing. The carbon and oxygen isotope investigations were performed both on water solutions and the tufa calcite precipitated on  $\text{CaCO}_3$  plates exposed in water for different periods of time. In general, results of the  $^{13}\text{C}$  analyses and numerical modeling using NETPATH code suggest that calcite is precipitated close to carbon isotope equilibrium conditions except for the situations when the extreme outgassing of  $\text{CO}_2$  takes place. Several measured precipitate samples have shown distinctly lower  $\delta^{18}\text{O}$  values than expected for tufa formation under equilibrium conditions. This cannot be explained by kinetic effects known from karstic caves or lake studies as they lead to higher  $\delta^{18}\text{O}$  values of precipitated carbonates than at isotope equilibrium. Also, short-term fluctuations of water temperature cannot be responsible for the observed deviations in oxygen isotope composition of measured tufa samples from equilibrium values. Further work is needed to better understand the factors controlling  $^{18}\text{O}$  isotope composition of tufa deposits.