Abstract

This thesis deals with genesis of the Cretaceous thermal waters in the Ústí nad Labem. These thermal waters are interesting in that are very different from other Cretaceous thermal waters, which also appear in Benešov-Ústí aquifer system of the Bohemian Cretaceous Basin in Děčín. Thermal waters in the Ústí nad Labem area more than chalk waters resemble the thermal waters in Teplice, which are associated with body of Teplice rhyolite.

Many authors studied thermal waters in the Ústí nad Labem, but isotope analysis and inverse geochemical modeling were not used for their study. Results based on water chemistry, water δD and $\delta^{18}O$, $^{87}Sr/^{86}Sr$ ratios, and dissolved sulfate $\delta^{34}S$ and $\delta^{18}O$ values, indicate mixing of ground water from aquifers of the Bohemian Cretaceous Basin with ground water derived from crystalline rocks of the Erzgebirge Mts. Unlike thermal waters in Děčín are Ca-HCO_3 type (160 mg/L), in Ústí nad Labem there are two types of thermal waters, Na-HCO_3 type with higher TDS values (over 1 g/L) and Na-(Ca)-HCO_3-SO_4 type with lower TDS values (approximately 600 mg/L). Carbon isotope data and speciation and inverse geochemical modeling suggest a significant input of endogenous CO_2 at Ústí nad Labem. Besides CO_2 input, both silicate dissolution and cation exchange coupled with dissolution of carbonates may explain the thermal waters origin equally well. This is a consequence of similar $\delta^{13}C$ and ^{14}C values in endogenous CO_2 and carbonates (both sources have ^{14}C of 0 pmc, endogenous CO_2 $\delta^{13}C$ around -3 ‰, carbonates in the range -5 to + 3 ‰ V-PDB). The source of Cl^- seems to be either a relict brine formed in Tertiary lakes, which infiltrated into the deep rift zone and is flushed out, or a mobilization of brine from Carboniferous-Permian sediments, underlying the Bohemian Cretaceous Basin east of the study area. The difference between higher and lower TDS thermal waters in Ústí nad Labem is caused by location of the higher mineralization groundwater wells in CO_2 emanation centers. The values $\delta^{34}S$ and $\delta^{18}O$ of dissolved SO_4 in thermal water with higher and lower TDS also varies considerably. While the sulfur in thermal waters with higher TDS probably comes from brines in the second group of thermal waters sulfide minerals are main sulfur source.

The study clearly demonstrates potential problems encountered at sites with multiple sources of carbon, where several evolutionary ground water scenarios are possible.