Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19805

Occurrence and origin of dissolved Selenium in a depleted limestone aquifer in central Jordan.

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Selenium (Se) is known to be an essential micro-nutrient for humans, but can be toxic at high levels of intake. Since, the quality of groundwater in Jordan is already under pressure (overexploitation, fertilizers, improper wastewater storage/treatment), high dissolved levels of geogene trace elements in groundwater, such as Se and Mo, represent an increasing challenge for the sustainable drinking water supply in Jordan. In frame of Jordan-German technical cooperation, a case study investigates the origin and the responsible processes resulting in high dissolved Se levels up to 260 µg/L, observed in production wells which tap a large limestone aquifer in the Karak governorate (central Jordan).

In te whole working area, high Se wells representing dissolved Se levels above the WHO guideline value of 40 µg/L have been identified. The high Se wells tap the B2/A7 limestone aquifer, which represents a nationwide groundwater resource. The groundwater of the underlying sandstone aquifer generally shows low dissolved Se. Aquifer material as well as intercalated/overlying rocks, incl. limestone, phosphorite, basalt and bituminous shale, have been sampled in order to identify the Se content as well as relevant Se-containing mineral phases. According to the XRF-measurements, the phosphoritic limestone has Se content within the low ppm range (1-5 ppm), whereas the non-phosphoritic and partly silicified limestone as well as the basalt samples show Se levels <1 ppm. Only the bituminous shale shows high Se content up to 250 ppm, however, its limited occurrence in the central part and downstream of the working area does not explain high dissolved Se levels in vicinity of the western uplands, where major groundwater recharge occurs.

The presented, preliminary results aim to identify the Se-bearing mineral phases in the host rock based on geochemical analysis, including µ-XRF/SEM analytics and sequential extraction experiments. Evaluation of hydrogeological and hydrochemical data indicates relevant geochemical processes promoting Se mobilization and transport within the limestone aquifer. The resulting conceptual understanding concludes into the discussion about the origin of the dissolved Se and possible mitigation measures, e.g. an appropriate well management.