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Hydrogeochemical alteration of groundwater due to a CO_2 injection test into a shallow aquifer in Northeast Germany

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The accidental release of CO_2 into potable aquifers, for instance as a consequence of a leakage out of a CO_2 store site, can endanger drinking water resources due to the induced geochemical processes. A 10-day CO_2 injection experiment into a shallow aquifer was carried out in Wittstock (Northeast Germany) in order to investigate the geochemical impact of a CO_2 influx into such an aquifer and to test different monitoring methods. Information regarding the site investigation, the injection procedure monitoring setup, and first geochemical monitoring results are described in [1]. Apart from the utilization of the test results to evaluate monitoring approaches [2], further findings are presented on the evaluation of the geophysical monitoring [3], and the monitoring of stable carbon isotopes [4]. This part of the study focuses of the hydrogeochemical alteration of groundwater due to the CO_2 injection test.
As a consequence of the CO_2 injection, major cations were released, i.e. concentrations increased, whereas major anion concentrations – beside bicarbonate – decreased, probably due to increased anion sorption capacity at variably charged exchange sites of minerals. Trace element concentrations increased as well significantly, whereas the relative concentration increase was far larger than the relative concentration increase of major cations. Furthermore, geochemical reactions show significant spatial heterogeneity, i.e. some elements such as Cr, Cu, Pb either increased in concentration or remained at stable concentrations with increasing TIC at different wells. Statistical analyses of regression coefficients confirm the different spatial reaction patterns at different wells. Concentration time series at single wells give evidence, that the trace element release is pH dependent, i.e. trace elements such as Zn, Ni, Co are released at pH of around 6.2-6.6, whereas other trace elements like As, Cd, Cu are released at pH of 5.6-6.4.

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