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Understanding of groundwater mineralization changes in a chalky aquifer affected by a mixture of chlorinated aliphatic hydrocarbons.

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At an abandoned industrial site in Belgium, groundwater quality in a chalky aquifer had been impacted by a mixture of chlorinated aliphatic hydrocarbons inducing a significant change in hydrochemistry that is not fully understood.

In previous investigations close to this site within the contaminant plume, an important increase of Ca^{2+}, HCO_3^- and Cl^- was observed. In addition, SO_4^{2-} showed concentrations up to five times the background concentrations in this aquifer.

In one hand, degradation of 1,1,1- trichloroethane by hydrolysis (HY) and dehydrohalogenation (DH) in the chalky aquifer explains partially the change of hydrochemistry. On the other hand, the backfill soil of this industrial site may also release compounds that migrate to the groundwater.

The aim of our study is to clarify mechanisms that influence the groundwater mineralization in this context and quantify the part of each process. We combined analyses of groundwater quality with tests for backfill characterization. Water samples were collected from the existing groundwater monitoring network for chemical analyses (major ions and chlorinated aliphatic hydrocarbons). Backfill soil characterization was conducted by a combined mineralogical analysis: X-Ray Diffraction (XRD) with Scanning Electron Microscopy (SEM), and a leaching test. Furthermore, we compared $\delta^{34}S$ and $\delta^{18}O$ of SO_4 in the backfill leachate with those in the contaminated groundwater.

The results confirm the increase of calcite dissolution as a consequence of degradation reactions (HY and DH) of 1,1,1- trichloroethane. A second source of hydrochemical change is the migration of sulfate calcium with water recharge, from the backfill to the groundwater.

Based on the collected data, calcite dissolution was estimated by batch geochemical simulations, whereas release capacity of the backfill has been experimentally obtained from the leaching test.