



Acidulous ground water – chemical and isotopic evolution

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Ground waters in North Hesse (Germany) are conspicuous by high amounts of dissolved inorganic carbon (DIC) at low pH. The DIC is received from the uptake of soil CO₂ and CO₂ of volcanic origin and the subsequent dissolution of Triassic and Permian limestone and dolomites. The volcanic CO₂ is related to Miocene basaltic magma which has liberated gaseous CO₂ during the breakthrough to Triassic and Permian sediments. The volcanic CO₂ ($-6 < \delta^{13}\text{C}_{\text{CO}_2} < -3\text{‰}$, PDB) was trapped within pore spaces and intra- and intergranulars of Permian evaporites and Triassic sandstones and was stored within such reservoirs until recent times. The uptake of volcanic CO₂ occurs as ground water migrates through such reservoirs.

The ¹³C/¹²C-signatures of the DIC indicate mixture of soil-CO₂ and CO₂ of volcanic origin for the dissolution of marine limestone and dolomites. The obtained two types for CO₂ of volcanic origin with $\delta^{13}\text{C}_{\text{CO}_2}$ -values of -10 ± 3 and $+2 \pm 2 \text{‰}$ can be explained by diffusion of CO₂ through micropores, faults, and interfaces of solids. This mobilisation of CO₂ is accompanied with a kinetic fractionation of $\approx -9 \text{‰}$. ¹³C-depleted CO₂ is liberated from the reservoir, whereas ¹³CO₂ is accumulated in the residue.