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# The self-purification potential of karst groundwater systems: Linking processes to hydrogeology

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Since karst groundwater systems are highly vulnerable to contamination, groundwater projection and self-purification is a major challenge. Sulfate–reducing microorganisms contribute extensively to the mineralization of organic contaminants, implying the importance of bacterial sulfate reduction for biodegradation of contaminants in groundwater systems. Moreover, hydrogen sulfide derived from microbial sulfate reduction has also been documented to serve as electron donor during denitrification.

The karst system of the Franconian Alb represents a double porosity system that contains stagnant water in the porous rock matrix and more mobile water in the fractures. We found that around 95% of the total water volume in this karst system is stored in the porous rock matrix. Therefore, the rock matrix represents the dominant reservoir for water in this groundwater system. Moreover, we suggest that the porous rock matrix is suitable for microbial growth and enhance the occurrence and affectivity of microbial degradation processes in the Franconian karst aquifer. Chemical and isotope analyses on groundwater sulfate indicate that in karst systems with matrix porosity, bacterial (dissimilatory) sulfate reduction may occur. Although we found no isotopic evidence for denitrification processes in the karst system we have enough thermodynamic and chemical evidence that also denitrification may have occurred. Therefore, we suggest a model to explain the small isotope fractionation effects of nitrate during denitrification in groundwater systems controlled by matrix diffusion processes.

Natural attenuation processes of karst groundwater systems including anaerobic microbial degradation of organic contaminants could become increasingly important in karst systems with matrix porosity, for protecting these groundwater reservoirs as future drinking water resources.