

## **Atrazine degradation in a karst aquifer: What lessons can we learn from intensive hydrogeological investigations and compound specific isotope analysis?**

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The detection of the herbicide atrazine and its metabolite desethylatrazine (DEA) in drinking water wells and springs is a national problem in Germany. Furthermore, the pollutant represents one of the most commonly detected herbicides worldwide. Nearly 10% of the monitoring network in South Germany is polluted with atrazine at concentrations above the maximum contaminant level for drinking water (0.1 µg/L), or show increased values of both, atrazine and DEA.

Particularly, karst aquifers are highly vulnerable to contamination and often show highly polluted groundwater. Karst aquifers have complex hydrogeological characteristics, which make them very different from porous aquifers: high heterogeneity and matrix porosity create high flow velocities up to several kilometres/day and complex mixing processes, but also high storage of water and contaminants in the more immobile rock matrix over decades and centuries. Compound specific isotope analysis (CSIA) may identify sources and detect degradation of groundwater contaminants such as atrazine and DEA over long time scales.

We found some evidence using CSIA and intensive hydrogeological investigations including the estimation of mean transit times by <sup>3</sup>H time series that degradation of atrazine and DEA in the karst system took place. However, long mean transit times – as controlled by rock-matrix diffusion processes – did not correlate with the degradation of atrazine and DEA. These findings were found by comparing the results of two karst springs with mean transit times of less than 10 years and up to 100 years. Therefore, we suggest that the herbicide and its metabolite DEA do not undergo further degradation in the karstic, porous aquifer, but were most likely degraded in the upper part of the vadose zone (soil zone and epikarst) of the karstic system.