

## DEUTERIUM AS REFERENCE IN A MULTITRACING EXPERIMENT IN A KARST SYSTEM – A COMPARATIVE STUDY

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Deuterium was used as a reference tracer for a multitracer experiment in a karst cave system in the Central Styrian Karst, Austria. As tracers two fluorescent dyes (Na-Fluorescein and Sulphorhodamine G), one inorganic salt tracer (Sodium Bromide) and one isotopic tracer (Deuterium) were used in a comparative study.

The karst cave system which is situated in paleozoic limestone allows access to open underground galleries with active channel flow, and therefore offers a good opportunity to control the boundary conditions during injection, such as the flow conditions during the experiment and the specific details of channel topology.

The objective was to compare different types of tracers, their behaviour during transport and the degree to be classified as conservative or non-conservative. The tracer transport in the underground channel was monitored with different systems, but also water samples were collected by automatic samplers for later laboratory analysis. Fluorescent dye tracers were measured online with a 2-channel fiber optic fluorometer with built-in data-logger and the sodium bromide tracer was measured for Bromide with a Br-selective electrode. To have parallel sample records the collected water samples were analyzed quantitatively with a laboratory scanning-fluorometer for the dye tracers, separately for Sodium and Bromide by ion-chromatography and for Deuterium by mass spectrometry.

In addition to the tracers of interest flow conditions (water level with a pressure probe) and physical parameters (electrical conductivity and water temperature) were monitored. The latter as well as the Bromide data were recorded with data-loggers.

The achieved breakthrough-curves of individual tracers were compared to each other and analyzed for shape and characteristic time-marks (e.g. first appearance, peak and center-of-gravity), for retardation and mutual cross-over effects.

The result was, that Deuterium and Bromide showed the highest degree of conservativeness. Na-Fluorescein and moreover Sulphorhodamine G showed retardation compared with Deuterium and Bromide. A direct comparison was difficult due to the different sensitivity of the analytical procedures, because sensitivity of dye tracer analytics as well as Bromide and Deuterium analytics differ from each other over several order of magnitudes.