

## Continuous in-situ monitoring of dissolved gases for the characterization of the Critical Zone with a MIMS

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In the perspective of a temporal and spatial exploration of the Critical Zone, we developed an in situ monitoring instrument for continuous dissolved gas analysis (N<sub>2</sub>, O<sub>2</sub>, CO<sub>2</sub>, CH<sub>4</sub>, He, Ne, Ar, Kr, Xe). With a large resolution (5 orders of magnitude) and a capability of high frequency multi-tracer analysis (1 gas every 1.5 seconds), the MIMS (Membrane Inlet Mass Spectrometer) is an innovative tool allowing the investigation of a large panel of physical and biogeochemical processes.

First of all, this study presents the results of groundwater tracer tests using dissolved gases in order to evaluate transport properties of a fractured media in Brittany, France (Ploemeur, ORE H<sup>+</sup>). The tracer test experiment showed that the MIMS is perfectly suitable for field work. The instrument provides precise measurements accurate enough to produce breakthrough curves during groundwater tracer tests. The results derived from <sup>4</sup>He data gives transport parameters in good agreement with the results obtained with a fluorescent tracer.

Combined with a pump and a multi-parameter probe, the MIMS is also capable to perform accurate dissolved gases well-logs allowing a real-time estimation of recharge conditions (temperature, excess air), aquifer stratification, redox conditions and groundwater residence time by <sup>4</sup>He dating.

Therefore, the MIMS is a valuable tool for in situ characterization of biogeochemical reactivity in aquatic systems, the determination of aquifer transport properties, the monitoring of groundwater recharge conditions and the characterization of aquifer-river exchanges.