

## Sources and sinks of acetate in an acidic peatland

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Acetate in anoxic environments originates from fermentation of organic matter or the reduction of CO<sub>2</sub> using the acetyl-CoA pathway (acetogenesis). As a key intermediate acetate is consumed by various anaerobic microorganisms which complicates unraveling its turnover in pore waters. This study aimed to i) determine proportions of acetate forming processes via stable carbon isotope analysis of acetate and ii) to identify the acetogens in an acidic fen (pH ~4.8) located in northern Bavaria, Germany. Assessing the functional *fhs* gene involved in the acetyl-CoA pathway revealed sequences of potentially novel acetogens like a phylotype related to *Eggerthella* present only in surficial soil layers. The presence of active acetogens in peat soil was suggested by <sup>13</sup>C-depleted acetate (-37‰ vs VPDB) in H<sub>2</sub>/CO<sub>2</sub> supplemented microcosms compared to acetate with -14‰ vs VPDB in an unsupplemented control. Peat pore water profiles showed acetate concentrations from 0-170 μM with δ<sup>13</sup>C values of -17.4‰ up to -3.4‰ vs VPDB. The <sup>13</sup>C-enrichment of acetate relative to peat TOC (-26‰ vs VPDB) suggested the predominance of sinks which are preferentially consuming <sup>12</sup>C-acetate. Depth profiles of δ<sup>13</sup>C<sub>CH<sub>4</sub></sub> point towards acetoclastic methanogenesis as a sink for acetate prevailing mainly in the upper fen soil layers. Additionally, iron and sulphate reduction appeared to play a role in acetate turnover at this acidic fen.

## The variability in formation water composition and the implications for CO<sub>2</sub> storage conditions

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### Background and motivation

The prediction of CO<sub>2</sub> storage conditions and safety requires a range of information. The emphasis of this study is the composition of formation water and its control on the long-term distribution of injected CO<sub>2</sub> and the different CO<sub>2</sub> trapping mechanisms in the reservoir. Formation water composition was compiled for basins from the USA, Canada, Norway, Germany and Australia and the data was then used to make inferences on a) the density-driven convection of fluid due to differences in the CO<sub>2</sub> concentration, b) CO<sub>2</sub> solubility (fluid trapping) and c) long-term fluid-rock reactions leading to the immobilization of CO<sub>2</sub> (mineral trapping).

### Preliminary results

The reported formation water composition is highly variable between basins with total dissolved solid (TDS) concentrations ranging from 340 to 355,000 mg/L. The lowest TDS concentrations are in the drinking water range and are found in Australian basins, while the highest concentrations are found in formations in near proximity to salt deposits. The CO<sub>2</sub> solubility decreases by approximately 50% from lowest to highest TDS concentrations. The fluid density increase due to CO<sub>2</sub> saturation follows an exponential function with the highest density increase in freshwater. The latter leads to significantly more rapid convective mixing. The combined effect of higher solubility and more rapid convection means a more effective CO<sub>2</sub> trapping in the fluid and its downward transport in reservoirs with low TDS fluids. The prediction of CO<sub>2</sub> mineral trapping capacity is dependant on the water and mineral composition in the reservoir. Examples for differences in mineral trapping capacity with variable water and mineral composition will be given.