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Lithium release from deep sedimentary rocks: Hydrothermal experiments with Permian and Triassic sandstones of the North German Basin.

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Forecasts predict a significant increase in demand for lithium (Li) for lithium-ion batteries to store surplus renewable energy. Therefore, Li extraction from brines in deep sedimentary basins is explored as an additional way of Li production [1]. In this process, brines containing hundreds of ppm of Li are produced from depth to the surface and Li is recovered by different extraction methods – either together with heat production in a geothermal power plant or as standalone operation. The Li-depleted brine is then reinjected into the reservoir.

To investigate the geochemical interaction between the reinjected fluid and selected sandstone reservoirs, hydrothermal batch experiments were conducted in small gold capsules and flexible Au-Ti cells under in-situ conditions (140 °C and 370 bar) using drill core material of reservoirs. Experiments were carried out with both bi-destilled water or synthetic brine for a duration of up to 30 days. The results show a higher percentage of Li was released into the fluid from Permian Rotliegend sandstones (median of 7.1 and up to 26%) compared to the Triassic Bunter sandstone (on average 2.2% and up to 2.5%). In addition, the Li concentrations in the fluid were influenced by the starting fluid composition (brine vs. bi-distilled water) and depend on the mineralogy of solid samples.

Li content in mineral phases and rock components were quantified by fs-LA-ICP-MS analyses. High Li concentrations were found in authigenic and detrital phyllosilicates as well as rock fragments with up to 260 ppm, 1570 ppm and 170 ppm, respectively.

Ongoing work involves the investigation of Li release rates and contribution of desorption and halite cement dissolution to the released amounts of Li.

[1] Alms, K., Heinelt, M., & Groeneweg, A. (2025). Lithium prospectivity and capacity assessment in Northern Germany. *Geothermics*, *127*, 103207.