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Assessment of hydrogeochemical processes in high temperature Aquifer Thermal Energy Storage systems by drill core analysis, column-, and batch experiments

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High Temperature Aquifer Thermal Energy Storage (ATES) can be a possibility to overcome the acyclic heat demand and supply by storing the surplus heat in an aquifer and discharging it during periods of heat deficit. Plant-related effects, such as mineral precipitation and corrosion as well as environmental impacts like mobilization of pollutants are major challenges and are being addressed. The study aims to (a) identify the reactive mineral phases by systematic elemental analysis using a portable XRF at the drilling sites, (b) estimate the permeability and changes of permeability by column experiments and (c) quantify mobilizations processes via batch experiments at different temperatures up to 90 °C. Drill cores from a Berlin ATES research well were collected from a sandy aquifer at 380 m depth and prepared immediately in field. Results show that reactive mineral phases can already be estimated in the field, permeability is changed by the temperature increase, and organics and trace elements are mobilized.