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Physically-based validation of numerical codes for solute transport involving mineral dissolution

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Solute transport in deep groundwater is a complex process, involving mineral dissolution, geochemical reactions, dispersion, aqueous brine advection and density driven convection. Flow and transport solutions for solute transport are non-linear and unstable and best represented by numerical model codes. Current benchmark problems used to validate solute transport models do not consider the salt mineral but represent the salt as an aqueous boundary condition. Mineral dissolution is important in deep sedimentary groundwater systems, including flow over salt domes and for deep geothermal projects. The aim of this project was to create a physically-based numerical benchmark for the validation of model codes for projects which involve salt dissolution. This was done by creating a laboratory model in which salt mineral cores were dissolved and salt concentration measurements were collected. The physical data were then entered into a numerical model, and compared to aqueous phase results. Thus, we developed a new solute transport validation benchmark which involves the dissolution of the salt mineral.