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Anhydrite precipitation in seafloor hydrothermal systems

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The composition and metal concentration of hydrothermal fluids venting at the seafloor is strongly temperature-dependent and fluids above 300°C are required to transport metals to the seafloor (Hannington et al. 2010). Ore-forming hydrothermal systems and high temperature vents in general are often associated with faults and fracture zones, i.e. zones of enhanced permeabilities that act as channels for the uprising hydrothermal fluid (Heinrich & Candela, 2014).
Previous numerical models (Jupp and Schultz, 2000; Andersen et al. 2015) however have shown that high permeabilities tend to decrease fluid flow temperatures due to mixing with cold seawater and the resulting high fluid fluxes that lead to short residence times of the fluid near the heat source.
A possible mechanism to reduce the permeability and thereby to focus high temperature fluid flow are mineral precipitation reactions that clog the pore space. Anhydrite for example precipitates from seawater if it is heated to temperatures above ∼150°C or due to mixing of seawater with hydrothermal fluids that usually have high Calcium concentrations.
We have implemented anhydrite reactions (precipitation and dissolution) in our finite element numerical models of hydrothermal circulation. The initial results show that the precipitation of anhydrite efficiently alters the permeability field, which affects the hydrothermal flow field as well as the resulting vent temperatures.

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