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# Fluid transport in reaction induced fractures

Ole Ivar Ulven (1), WaiChing Sun (2), and Anders Malthe-Sørenssen (3)

(1) University of Oslo, Physics of Geological Processes, Oslo, Norway (o.i.ulven@fys.uio.no), (2) Columbia University, New York, USA, (3) University of Oslo, Physics of Geological Processes, Oslo, Norway

The process of fracture formation due to a volume increasing chemical reaction has been studied in a variety of different settings, e.g. weathering of dolerites by Røyne et al.[4], serpentinization and carbonation of peridotite by Rudge et al.[3] and replacement reactions in silica-poor igneous rocks by Jamtveit et al.[1]. It is generally assumed that fracture formation will increase the net permeability of the rock, and thus increase the reactant transport rate and subsequently the total rate of material conversion, as summarised by Kelemen et al.[2]. Ulven et al.[5] have shown that for fluid-mediated processes the ratio between chemical reaction rate and fluid transport rate in bulk rock controls the fracture pattern formed, and Ulven et al.[6] have shown that instantaneous fluid transport in fractures lead to a significant increase in the total rate of the volume expanding process. However, instantaneous fluid transport in fractures is clearly an overestimate, and achievable fluid transport rates in fractures have apparently not been studied in any detail. Fractures cutting through an entire domain might experience relatively fast advective reactant transport, whereas dead-end fractures will be limited to diffusion of reactants in the fluid, internal fluid mixing in the fracture or capillary flow into newly formed fractures. Understanding the feedback process between fracture formation and permeability changes is essential in assessing industrial scale $CO_2$ sequestration in ultramafic rock, but little is seemingly known about how large the permeability change will be in reaction-induced fracturing.

In this work, we study the feedback between fracture formation during volume expansion and fluid transport in different fracture settings. We combine a discrete element model (DEM) describing a volume expanding process and the related fracture formation with different models that describe the fluid transport in the fractures. This provides new information on how much reaction induced fracturing might accelerate a volume expanding process.

## References

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