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AREA OF EXPERTISE: Rock Physics
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DISSERTATION TITLE: *Reaction-induced Fracturing in Confined Systems*

En bergart som opplever endringer i omgivelsene kan få oppsprekking og brudd. Dette kalles reaksjonsindusert oppsprekking og er vanlig både for naturlige og menneskeskapt materialer. Kandidaten har undersøkt prosesser og mekanismer ved sprekkdannelse under omdannelse av mineralet periklas til brucitt når vann tilføres. Studien anslår grenseverdiene for når sprekker oppstår, og hvordan sprekke ser ut fysisk.

The local stress generated by solid volume change is able to cause fracturing in material, this is referred to as reaction-induced fracturing. Reaction-induced fracturing is a common phenomenon in both natural and man-made materials. In industry, the salt growth induced fracturing can seriously damage the man-made structures. In geology, reaction-induced fracturing would contribute to the weathering process and the water cycle and rheology of the oceanic and continental lithosphere. Precipitation induced fracturing has been suggested as a way of carbon capture in ultramafic mantle rocks.

However, in natural systems, it is difficult to observe the process and mechanism directly. Therefore in this study, the candidate combined experimental work at elevated pressures and temperatures, with in-situ CT imaging and numerical modelling, to investigate reaction-induced fracturing due to hydration of periclase to form brucite. This is a rock analogue system. The key findings in this dissertation are that: 1) there is a threshold of the effective mean stress below which the reaction progresses causing fracturing, and above which the reaction is inhibited. 2) The stress applied to a rock via volume expansion due to hydration reactions results in pervasive fracturing with strong components of shear and dilatant strain. Both findings provide new results that could be compared to natural rocks from areas undergoing serpentinisation.

This PhD work is done in affiliation to the cross-disciplinary research group EarthFlows and the Njord Centre at The Faculty of Mathematics and Natural Sciences, University of Oslo.