

## **2D reactive transport modeling of Opalinus Clay-OPC-bentonite interaction**

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The Cement-Clay Interaction (CI) Experiment is carried out at the Mont Terri underground research laboratory to complement the current knowledge on the influence of cement on Opalinus Clay (OPA) and bentonite (MX) [1]. Cores including the interface of OPA, cement (OPC) and MX that interacted for 4.9 years were successfully retrieved after drilling and detailed analyses were performed to evaluate possible mineralogical changes. A previous study reported on the alteration of MX at the contact with OPC being characterized by dissolution of montmorillonite and cristobalite, precipitation of calcite and Mg-bearing phases and an increase in exchangeable Ca and Mg, which were extracted using a 1M NH<sub>4</sub>Cl solution [2]. All these changes occurred near the interface (within a few mm) [2].

Since alteration of OPC was not reported in this previous work [2], chemical composition of OPC was measured by EPMA showing that sulfur content gradually increased toward the interface, indicating some precipitation of sulfur-bearing phases.

2D reactive transport modeling of the interaction between OPA-OPC-MX was carried out to reproduce the measurements using the CrunchFlow code [3]. Preliminary numerical results show that the volume fractions of montmorillonite and cristobalite have decreased near the interface and precipitation of calcite and Mg-bearing phases occur. Recent reports suggest M-S-H as a likely phase to form in the clay-cement interactions. Hence, saponite and talc have been considered as secondary phases as Mg-bearing phases in the modeling. Regarding the volume fractions of sulfur-bearing phases in OPC, that of ettringite increased while that of monosulfate decreased toward the interface, suggesting that the observed distribution of sulfur by EPMA would be caused by ettringite precipitation.

[1] A. Jenni, U. Mäder, C. Lerouge, S. Gaboreau, and B. Schwyn (2014) *Phys. Chem. Earth*, 70-71, 71-83.

[2] S. Yokoyama, Y. Watanebe, A. Jenni and U. Mäder (2015) *Book of abstracts for Clay Conference 2015*. 236-237.

[3] C.I. Steefel (2009) *User's Manual*, Berkeley, USA.