HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF ROBL-CRG	**Experiment title:** Mn(II) sorbed on montmorillonites: surface-mediated redox reactions	**Experiment number**: 20-01 734
Beamline: BM 20	**Date of experiment**: from: 27.09 to: 30.09.17	**Date of report**: 23.02.17
Shifts: 12	**Local contact(s)**: A. Scheinost	*Received at ROBL:*
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The experiments with Mn^{II} did not work out, instead Fe on natural montmorillonites were measured. The results of this study were published as a peer reviewed article:

Soltermann, D., Marques Fernandes, M., Baeyens, B., Dähn, D., Josh, P.A., Scheinost, A.C. and Gorski, C.A. (2014) Fe(II) Uptake on Natural Montmorillonite under Anoxic Conditions. I. Macroscopic and Spectroscopic Characterization. Environmental Science & Technology 48, 8698-705

ABSTRACT

Iron bound to clay mineral surfaces is an important redox-active phase that is ubiquitous in both engineered and natural environments. In this study, the retention mechanism of Fe(II) on clay minerals was investigated using macroscopic sorption experiments combined with Mössbauer and extended X-ray absorption fine structure (EXAFS) spectroscopy. Sorption edges and isotherms were measured under anoxic conditions on natural Fe-bearing montmorillonites (i.e. STx, SWy and SWa) having different structural Fe contents ranging from 0.5 to 15.4 wt % and different initial Fe redox states. Batch experiments indicated that, in case of low Fe-bearing (STx) and dithionite-reduced clays, the Fe(II) uptake follows well the sorption behavior of other divalent transition metals, whereas Fe(II) sorption increased by up to two orders of magnitude on the unreduced, Fe(III)-rich montmorillonites (SWy and SWa). Mössbauer spectroscopy analysis revealed that nearly all the sorbed Fe(II) was oxidized to surface-bound Fe(III) and secondary Fe(III) precipitates were formed on the Fe(III)-rich montmorillonite, while sorbed Fe is predominantly present as Fe(II) on Fe-low and dithionite-reduced clays. The results provide compelling evidence that Fe(II) uptake characteristics on clay minerals are strongly correlated to the redox properties of the structural Fe(III). The improved understanding of the interfacial redox interactions between sorbed Fe(II) and clay minerals gained in this study is essential for future studies developing Fe(II) sorption models on natural montmorillonites.