Radionuclide mobility determining processes investigated by STXM

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Transport of pollutants can occur in the aqueous phase or for strongly sorbing pollutants associated on mobile solid phases spanning the range from sub- nanometers up to approx. ~1μm; usually called colloids or nanoparticles [1] [2]. A challenge with respect to understand and predict the contaminant mobility is the contaminant speciation, the aquifer surface interaction [3] and the mobility of nanoparticles. Especially for colloid/nanoparticle associated contaminant transport the metal sorption reversibility is a key element for long-term mobility predictions [4]. The spatial resolution needed is clearly demanding for nanoscopic techniques and new post processing methods [5]. Furthermore, high energy resolution is needed to either resolve different chemical species or the oxidation state of redox sensitive elements [6]. For successful planning of remediation strategies for contaminated sites this chemical information is categorically needed.

The presentation will give examples of nano-particles nucleation and the radionuclide speciation during the formation of these newly formed phases, the effect of surface roughness and charge heterogeneity on nanoparticle mobility and the sorption of organic nanoparticles on mineral surfaces leading to functional group fractionation and consequently different metal binding environment. Furthermore, aquifer flow path heterogeneity is driving the mobility/retention of colloids/nanoparticles, which can be resolved by tomographic (CT) methods. Reactive transport models use usually simplified geometrical assumptions which are essential to properly predict pore clogging [7]. Here, implementation of 3D μCT information will overcome these shortcomings. Based on the examples given current challenges and potential new directions will be highlighted in the presentation.

[1] Schäfer et al. (2012) *Appl. Geochem.* 2012, **27**, 390.; [2] Kretzschmar & Schäfer (2005) *Elements* **1**, 205.; [3] Grangeon et al. (2015) *Appl. Geochem.* **52**, 155.; [4] Huber et al. (2015) *GCA* **148**, 426.; [5] Lerotic et al. (2014) *J. Synchrotron Radiat.* **21**,1206.; [6] Marsac et al., (2015) *GCA* **152**, 39. [7] Chagneau et al. (2015, in review) *Geochem. Transact.*