One of the most common minerals in granitic rocks, sediments, and soils is muscovite. Therefore, muscovite surfaces may influence the mobility of uranium(VI) in the environment (waste deposits, mining sites). The aim of the present project is to investigate the sorption of uranium(VI) on muscovite.

**Experimental**

Samples for EXAFS spectroscopy were prepared under ambient conditions using 200 mg of fine grained muscovite, dispersed in 1000 ml of 0.01 N NaClO₄ solution. The suspensions were equalibrated for two weeks to adjust the pH value of 5.8 or 8.0, respectively. The initial uranium(VI) concentrations were $1 \times 10^4$ M U(VI) for pH 5.8 samples, and $6 \times 10^{-4}$ M U(VI) for pH 8.0 samples. In addition, two samples were prepared under N₂-atmosphere with an initial uranium(VI) concentration of $2 \times 10^{-5}$ M. After a sorption period of approximately 40 hours, the suspensions were centrifuged and the sorption samples were prepared as wet pastes in Teflon sample holders for XAS measurements.

The X-ray absorption measurements were performed at the ROBL-CRG in fluorescence mode using a 4-element germanium solid state detector. The EXAFSPAK program was used to extract and fit the EXAFS data. The
theoretical phase shifts and backscattering amplitudes were calculated with FEFF8.

Results

Figure 1 shows the X-ray absorption spectra before and after preedge subtraction for U(VI) adsorbed on muscovite at pH 5.8 in a 2·10⁻⁵ M U(VI) solution. The high absorbance in the preedge region is caused by Rb Kα fluorescence radiation (Rb Kα1 13395 eV), which was simultaneously recorded with U Lα (U Lα1 13615 eV) by the germanium solid-state detector. The extracted U LIII edge EXAFS shows a large noise and is not evaluable. However, the Rb is located within the structure of muscovite (1700 mg/kg) and cannot be removed by sample preparation procedures.

Fig 1.: X-ray absorption spectrum of U(VI) adsorbed on muscovite at pH 5.8 in a 2·10⁻⁵ M U(VI) solution.

The U LIII-edge EXAFS of the uranium(VI) sorption sample prepared in 1·10⁻⁴ M U(VI) solution indicates that the equatorial oxygens shell (R = 2.37±0.02 Å) is strongly disordered, which can be interpreted as inner-sphere surface complexation. In contrast, at a higher uranium(VI) concentration of 6·10⁻⁴ M a uranium-uranium backscattering at a distance of 3.87±0.02 Å suggest the (surface) precipitation of uranium(VI).

Fig 2.: U LIII-edge k³-weighted EXAFS spectra and related Fourier Transforms of uranium(VI) sorbed on muscovite.