The influence of mineral-originated microorganisms on the sorption of uranium

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Experiments on commercially available quartz, orthoclase and muscovite showed the presence of microorganisms in these minerals. So the question arose, if and how these microbes affect the sorption of uranium onto them.

Experimental work

To promote the bacterial growth 0.2 g of the minerals were incubated with 10 ml of two different culture media (NB and R2A). Directly after adding the culture media and after three weeks shaking in an incubator at 30°C, the optical density at 600 nm (OD_{600}) was measured.

To estimate the influence of the microorganisms on the uranium sorption, batch experiments were performed under conditions inhibiting growth, e.g. darkness, autoclaving; use of laminar flow boxes; or addition of sodium azide. The amount of uranium sorbed at pH 7 was determined by ICP-MS.

Results

All three minerals show an increase in OD_{600} during incubation. This increase varies for the three minerals and two nutrients, pointing to different microbial communities.

The batch experiments indicate that the various treatments clearly affect the microbial influence on uranium sorption. In the case of orthoclase, the biggest change is induced by the sodium azide treatment. For quartz, the use of laminar flow boxes has the largest consequences. But in both cases the changes have the same direction: destroying the microbes also stops them actively suppressing uranium sorption. In case of muscovite, the combination of autoclaving, laminar flow box and darkness affects sorption the most – but in the opposite direction. Here, the microbes obviously enhance sorption (dead or alive).

This findings show that on the three investigated minerals different microorganisms are present, and that their effect is difficult to predict. Thus, a separate investigation of microbial effects is recommended for each mineral. In addition, any autoclaving may directly change the mineral surface, e.g. by creating new or altering existing sorption sites.