Bacterial community changes induced by uranyl nitrate treatment under aerobic conditions

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The deep geological repository (DGR) of radioactive wastes is the safest internationally accepted option for the disposal of these hazardous materials. For the planned Spanish DGR, Cabo de Gata National Park bentonite formations are used as artificial barriers analogue. High microbial diversity of these bentonites was observed using culture dependent and independent based techniques (clone libraries and Illumina-sequencing)[1,2]. In addition, selected microbial isolates showed their ability to sorb Cm(III) through carboxyl groups, and to precipitate U(VI) as U phosphate mineral phases.To simulate a scenario where the mobilization of uranium from the planned repository to the clay formations may occur, long-term bentonite microcosms were elaborated. The microcosms were treated with uranyl nitrate to evaluate the response of the subsurface bacterial community of the bentonites, to the addition of this radionuclide. By using Illumina sequencing, it was demonstrated that the structure of the bacterial community of the uranyl-treated microcosms differs to that of the control microcosms (non-treated and nitrate-treated). *Pseudomonas* and *Bacillus*, already described for their ability to precipitate uraniun as U phosphate mineral phases with a structure similar to that of meta-autunite through phosphatase activity, were highly enriched due to the uranyl treatment. Therefore, a novel approach was applied to create a database of the acid phosphatase catabolic genes, with the aim of fulfilling the uranium bioprecipitation process.

The microbial diversity changes and the probable biomineralization of U will be discussed taking in account the speciation of U(VI) in the U-treated bentonites determined by TRLFS spectroscopy and STEM/HAADF analysis.

[1] López-Fernández M. et al. (2014), *Applied Geochemistry* **49**, 77-86. [2] López-Fernández M. et al. (2015), *Microbial Ecology* (in press)