Biogeochemical changes induced by uranyl nitrate in a uranium waste pile.

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Response of the subsurface soil bacterial community of a uranium mining waste pile to treatments with uranyl nitrate as well as the fate of the added U(VI) were studied under anaerobic conditions corresponding to the natural environment. We demonstrated that the incubation with uranyl nitrate for four weeks resulted in a strong reduction of the most predominant bacterial groups in the original samples. Instead of them diverse denitrifying and uranium resistant populations, mainly of *Rahnella* spp. from *Gammaproteobacteria* and of *Firmicutes* occurred. Longer incubations of fourteen weeks with uranyl nitrate resulted in proliferation of populations intrinsic for the untreated sample and also of some additional, possibly uranium sensitive bacterial groups which replaced the above mentioned uranium resistant denitrifyers. This result indicated that U(VI) was no longer bio-available. Mössbauer spectroscopic analysis revealed increased Fe(III) reduction with increasing the incubation time from four to fourteen weeks. The latter signified that after the reduction of the added nitrate, Fe(III) was the main electron acceptor used by the bacterial community established at the later stages of the treatment. Time-resolved laser-induced fluorescence spectroscopic analysis demonstrated that most of the added U(VI) was bound by phosphate phases of biotic origin.