Bacterial community analysis of contaminated soils from Chernobyl

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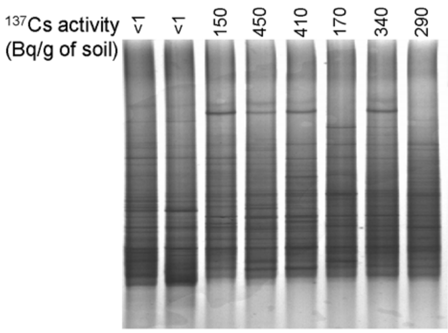
Shortly after the Chernobyl accident in 1986, vegetation, contaminated soil and other radioactive debris were buried *in situ* in trenches. The aims of this work are to analyse the structure of bacterial communities evolving in this environment since 20 years, and to evaluate the potential role of microorganisms in radionuclide migration in soils. Therefore, soil samples exhibiting contrasted radionuclides content were collected in and around the trench number 22 [1].

Bacterial communities were examined using a genetic fingerprinting method that allowed a comparative profiling of the samples (DGGE), with universal and group-specific PCR primers. Our results indicate that Chernobyl soil samples host a wide diversity of Bacteria, with stable patterns for *Firmicutes* and *Actinobacteria* and more variable for *Proteobacteria*.



A collection of 650 aerobic and anaerobic culturable isolates was also constructed. A phylogenetic analysis of 250 heterotrophic aerobic isolates revealed that 5 phyla are represented: *Beta-, Gammaproteobacteria, Actinobacteria, Bacteroidetes* and spore-forming *Firmicutes*, which is largely dominant. These collection will be screened for the presence of radionuclide-accumulating species in order to estimate the potential influence of microorganisms in radionuclides migration in soils.

[1] Dugai *et al*. (2005) *Environ. Geol*. **47**, 869–881.

Biomineralization of Fe^{II}-Fe^{III} species in porous heterogeneous medium of sand/iron oxyhydroxide/bacteria

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The synthesis of the mixed iron oxide Fe^{II}-Fe^{III} carbonated green rust (GR) in closed reactor (batch) from Fe^{III}-oxyhydroxide and *Shewanella putrefaciens* was investigated in the presence of different grain size fractions of quartz sand. A series of test was conducted with lepidocrocite (γ-FeOOH) as Fe^{III}-substrate mixed with SiO_2-quartz particles to mimic naturally occurring mineral assemblages.

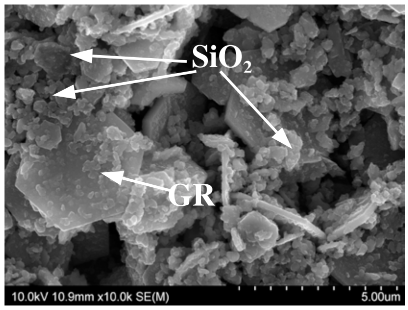

Figure 1: Hexagonal green rust crystals with sand particles.

The results showed that the sand loading, the grain size or the specific surface area of the quartz particles affect strongly the nature of the secondary iron mineral (magnetite (Fe_3O_4) or GR). The possible release of silicate from sand surface due to the dissolution of very fine quartz particles may control the secondary iron mineral formation. Biomineralization experiments with several concentrations of aqueous silica showed also that the $Si(OH)_4$ can support the GR formation. All these results allowed us to define the experimental conditions (i.e. sand loading or silicate concentration, cell density) at which the green rust was preferentially generated as the main secondary iron mineral in place of magnetite (Fig. 1). This behavior could be explained by the adsorption of dissolved silicate on the lateral faces of the GR preventing its transformation into magnetite and leading to the stabilization of GR structure. In addition, small particle sizes, irregular surfaces and patchy distribution of nanoporous aggregates in lepidocrocite/sand system may affect the diffusion processes and therefore the GR biomineralization mechanism.

These results suggest that the presence of Si-bearing minerals in soils and sediments may constitute a favorable chemical microenvironment for GR mineralization.