Microbial populations of clay formations and their interactions with uranium

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Clay formations are considered a very important part of many deep geological repository designs for the final geological disposal of radioactive wastes. The present work describes the culture-dependent bacterial diversity of two different bentonite samples (BI and BII) recovered from clay deposits of 'Cortijo de Archidona' (Almeria, Spain), chosen as potential host rock model for the deep geological disposal of radioactive wastes. The mineralogy of these two samples dominated by smectite phases, slightly differs by the presence of the iron sulphate mineral phase, jarosite (KFe^{3+}_3 $(SO_4)_2$ $(OH)_6$), for the sample BII. The culture dependent microbial diversity studies were performed using media based on clay porewater supplemented with different organic carbon sources, oligotrophic media, etc. The evaluation of aerobic bacterial populations clearly indicated the presence of high numbers of cultivable bacteria in both samples. Bacteria belonging to *Actinobacteria* (*Arthrobacter*, *Micrococcus*, *Amycolotapsis, Kocuria, Isoptericola*), *Gammaproteobacteria* (*Pseudomonas*, *Stenotrophomonas*), *Bacilli* (*Bacillus*), etc. were identified. The interactions of selected isolated bacteria with uranium were studied using a combination of spectroscopic, microscopic and microbiological techniques. A high fraction of the bacterial population (e.g. *Stenotrophomonas* sp.) was able to tolerate high concentrations of uranium up to 10 mM, etc. U precipitation as uranium phosphate mineral phases (e.g. meta-autunite) was involved in the bacterial tolerance to this radionuclide and in the immobilization of this element in the environment.

Geochemical evidence of mud volcano activity in the West Alboran Sea

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A broad field of mud volcanoes ('MVs') and pockmarks occur in the West Alboran Sea behind of the Gibraltar Arc. These sea-floor structures appear upon a major sedimentary depocenter encompassing Miocene to Holocene sedimentary sequences more than 7 km thick. The MVs are rooted at diapirs formed by undercompacted units from the older sediments, as demonstrated by geophysical data. Here we provide geochemical results of pore waters obtained with rhizons from two gravity cores drilled in the Southern Mud-volcano Field: the Carmen MV ('CMV') and the Unnamed Pockmark ('UPM'), which locates SW near CMV. In order to estimate their actual activity and determine if fluid composition is influenced by the presence of hydrocarbons, dissolved anions (SO_4^{2-}, Cl^-, I^-, and Br^-) and major and trace cations (Li^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mn^{2+}, Fe^{2+}), besides boric acid and silica, were analysed using IC and ICP-OES. CMV fluids are depleted with depth in SO_4^{2-}, Mg^{2+}, K^+ and Br^- and enriched in Li^+ and B. Such dissimilarities evidence that CMV is active. Furthermore, CMV fluids show freshening at depth, similar to results found at active MVs from the Gulf of Cadiz, which suggests that the decrease in chlorinity is related with gas hydrate dissociation. By contrast, the UPM fluids show constant vertical trends for dissolved concentrations of non-metabolites. The profiles of salinity and conservative ions (Na^+ and Cl^-) indicate Mediterranean seawater as the major source at the UPM and therefore no clear evidence for seepage activity at present. Our results point to the close coexistence of active -methane emission- and inactive seepages structures in the Southern Mud-volcano Field of the Alboran Sea.

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