Mineral-geochemical investigation in order to determine the arsenic bearing mineral in the stream sediments at the Kuhsorkh polluted area, NE Iran

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The studied area is located at 35 km of north Kashmar, NE Iran. The main geological formations in the area consist of Tertiary volcanic rocks with basaltic andesite to rhyodacite composition. In this area As-Sb-Au mineralization occurred in acidic tuff and further more than two hot springs was observed. In some villages at Khuhsorkh district concentrations of arsenic in spring water samples were determined to range between 10 – 650 ppb, exceeding EPA and WHO (2007) limits. Then 4 stream sediment from polluted district was sampled in order to distinguish the arsenic bearing minerals in the sediments. Concentration of arsenic in these samples has been measured between 8-65.3 ppm that correlate with the Fe contents in the samples. Mineralogical investigations with the help of reflected microscopy show that the main ore minerals that may contain arsenic are magnetite, hematite, oxidized pyrite and arsenopyrite. Based on XRD results quartz and calcite are the main minerals in the sediments also albite, muscovite, montmorionite, hematite and gypsum are the subordinate minerals. Oxidized pyrite, iron oxides, arsenopyrite, gypsum and carbonate in the sediments samples seem to be as the main arsenic sorbent minerals. Detail mineralogical investigation to find arsenic concentration in the above minerals is measuring by EPMA and SEM.

Ionic diffusion and retardation in Horonobe sedimentary rock: Clay-based model approach

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Sorption and diffusion of radionuclides in the deep geological environment are key processes to be understood for the safe geological disposal of radioactive waste. To set reliable parameters for the safety assessment, it is necessary to establish a reliable method for experimental evaluation and model prediction of sorption and diffusion. The aim of the present study is to provide a comprehensive experimental and modeling approach to evaluate the ionic diffusion and retardation parameter for the sedimentary rock in the Horonobe generic underground research laboratory in the northernmost region of Japan.

Diffusion coefficients (D_e) and rock capacity factors (α) of $^{137}Cs^+$, $^{125}I^-$ and HTO in the intact rock samples (HDB-6, -546m) were measured under different salinity conditions by through diffusion tests coupled with multiple curve analysis including tracer depletion, breakthrough, and depth concentration curves. The D_e values obtained for Cs were on the orders of 10^{-10} m^2/s and decreased as salinity increased, and those for I were on the order of 10^{-11} m^2/s and showed the opposite dependency. The D_e values for HTO were not depend on the salinity. Batch sorption tests for ^{137}Cs were also conducted to confirm sorption kinetics and concentration dependence. The distribution coefficients (K_d) of Cs showed a consistent decreasing trend with salinity between diffusion and batch sorption tests.

Diffusion and sorption behaviors were modeled based on the clay-based approach, assuming clay components of smectite and illite as dominating mineral for diffusion and sorption mechanism. The electrical double layer model was applied to explain the observed D_e trends, the effects of cation excess and anion exclusion. For sorbing Cs, sorption behavior was modeled by using the additive ion-exchange model of smectite and illite. The model predicted the D_e and K_d values obtained by the series of experiments reasonably well, implying the key contribution of the clay particle and nano-size pore for ionic migration in the rock.

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