Retention of arsenic, chromium and boron on an outcropping clay-rich rock formation (the Tégulines Clay, eastern France)

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In many countries, environmental impact of toxic chemicals has to be considered for the implementation of industrial facilities. The assessment of the toxic chemical environmental impact for a given facility requires evaluating the mobility of the various toxic chemicals potentially involved in the industrial activity in its surrounding environment. Numerical evaluations of the migration of the identified toxic elements from the industrial facilities toward the biosphere necessitate a good parametrization of their retention behavior. Outcropping clay-rich formations are considered as a potential host for a radioactive waste repository in many countries. Radioactive waste can contain toxic chemicals such as As, Cr and B leading to evaluate their migration in such clay systems. Sub-surface clay-rich rocks are notably characterized by redox transitions, which can influence the migration of many contaminants[1].

The retention behavior of arsenic (As), chromium (Cr) and boron (B), was investigated for an outcropping clay-rock formation, the Albian Tégulines Clay (France, Aube) currently studied as potential a host-rock for long-live low activity level (LL-LL) radioactive waste At the vicinity of the surface, Tégulines Clay is affected by weathering processes leading to contrasted geochemical conditions with depth. One of the main features of the weathering is the occurrence of a redox transition zone near the surface. Batch sorption experiments of As(V), As(III), Cr(VI) and B were performed on samples collected at two depths representative either of oxidized or reduced mineral assemblages. Batch sorption experiments highlighted a distinct behavior of As, Cr and B oxyanions. The *in-situ* redox state of the Tégulines Clay samples has a significant effect on Cr retention (Cr(VI) heterogeneous reduction reactions followed by Cr(III) precipitation). On the contrary, As(V) reduction into As(III) is moderate and its retention slightly affected by the *in-situ* redox state of the Tégulines Clay. As(V) retention is higher than As(III) retention. Boron retention is strongly influenced by its natural abundance in the Tégulines clay samples and the distribution coefficient of B (Kd) is expected to be very low for *in-situ* conditions due to the significant amount of natural B in the pore water[2]. The comparison of the retention properties of two Tégulines Clay samples towards three oxyanions with contrasted chemical properties highlighted the roles of clay mineralogy, natural abundance, and reducing capacity of the investigated materials.

References:
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