Modelling metal cation-phosphate competitive interactions on iron oxides

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The role that iron (oxyhydr)oxides play in the speciation and bioavailability of environmental importance species such as phosphate, arsenate, sulphate, metal cations of trace elements or contaminants, has been extensively studied [1]. These mineral oxides have demonstrated to effectively retain important amounts of inorganic anions and metal cations on their surface and the mechanism of the process has been succesfully explained using surface complexation models. However, the modelling sometimes fails when trying to explain adsorption data for ternary systems of the type iron oxide – inorganic anion – metal cation [2]. The enhancement of metal cation retention on iron oxides by coexisting inorganic anions has been reported by several authors [1,3]. Most of them agree that it is very difficult to establish the mechanism that produces this enhancement and three possibilites have been proposed: electrostatic enhancement, surface precipitation or formation of a ternary complex [1].

The following competitive adsorption experiments have been conducted using synthetic iron oxides: goethite – PO_4 – Cu, ferrihydrite – PO_4 – Cu, hematite – PO_4 – Cu and the same experiments were performed using natural samples with high content of iron and aluminum oxides. Attempts have been made to correct the modelling predictions for binary systems so that the interaction and mutual effect of inorganic anions and metal cations are considered and taken into account.

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Geoneutrinos and the interior of the Earth

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The deepest hole that has ever been dug is about 12 km deep, a mere dent in planetary terms. Geochemists analyze samples from the Earth's crust and from the top of the mantle. Seismology can reconstruct the density profile throughout all Earth, but not its composition. In this respect, our planet is mainly unexplored.

Geo-neutrinos, antineutrinos from the progenies of U, Th, and K decays in the Earth, bring to Earth's surface information coming from the whole planet. Differently from other emissions of the planet (e.g., heat, noble gases), they are unique in that they can escape freely and instantaneously from Earth's interior.

Detection of geo-neutrinos has become practical as a consequence of two fundamental advances that occurred in the last few years: a) development of extremely low background neutrino detectors and b) progress on understanding neutrino propagation.

Geo-neutrinos look thus a promising new probe for the study of global properties of Earth, such as the amount and distribution of long lived radioactive elements in the Earth's reservoirs.

The talk is intended as an introduction to the field, explaining to geo-scientists how geo-neutrinos are detected by physicists and to physicists why geo-neutrinos are relevant to geoscience.

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