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How soil redox status modify selenium partition on solid phases

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Selenium (Se) is a redox sensitive element (oxidation state ranging from +6 to -2) which is both an essential nutriment and a chemio-toxic trace element for living organisms with a very narrow margin between beneficial and toxic concentrations. Moreover Se is also present, as long-lived ^{79}Se, in the high level nuclear wastes. Therefore, understanding Se behaviour in soils is of major concern for both eco- and radio-toxicologists. In soils, Se underwent abiotic and biotic reductions/oxidations but also sorptions/desorptions on solids. This study aimed at identifying the main abiotic and biotic processes involved in the Se retention in contrasted redox conditions (regulated by the soil geochemical features and microbial activities). Partition of Se within the soil was studied over a 1-month incubation period under various controlled conditions. The soil was a sandy soil. It was preliminary sterilised and/or amended or not before incubations. Amended solutions consisted in a mixture of electron acceptors (SO_4^{2-},NO_3^-) and donors (glucose, cellulose). Additional incubations were performed after supplying either a bactericide or a fungicide. Three incubation conditions were tested: strict aerobiose, strict anaerobiose and non-controlled atmosphere. Radio-labelled selenite (Se IV*) at 10^{-6} mol/L was supplied at the beginning of the incubation. Se distribution was characterized in the aqueous, gaseous and solid phases for which sequential extractions were performed. Other analyses included E_H, pH, gases, solution chemistry and soil microbial status. First results on the raw soil in the non-controlled atmosphere condition showed an increase of Se sorption with time and a higher affinity of Se for the solid phases. Se was mainly recovered into two fractions, extracted by K_2HPO_4 and NaOH, with a shift in time from the K_2HPO_4 to the NaOH fractions. The comparison between sterile and non-sterile soils showed that Se partition resulted from interacting or coupled geochemical and biological processes.