Cesium sorption into single-crystalline mixed layer biotite/vermiculite and diffusion in the interlayer space

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Compared to detailed investigations of the sorption behavior at macro scale, experimental researches on the Cs sorption at a micro scale are not sufficient yet. In this study, the Cs sorption behavior into weathered biotite, which is actually mixed layer biotite/vermiculite ('B/V'), and Cs distribution inside the mineral were investigated at wide range of Cs concentration in solutions (10^{-2} – 10^{-13} M).

Single-crystalline B/V grains from Palabora in the Transvaal, South Africa Republic, was used for sorption experiments. Based on scanning electron microscopy, this has distinct chemical heterogeneity among individual grains. The amount of the sorbed Cs were estimated by autoradiography with imaging plate (IP) and radioactive cesium (^{137}Cs) as a tracer.

Relationship between sorbed Cs and K originally contained in the grains depended on the Cs concentrations in the solution. At higher concentrations (> 10^{-5} M), negative correlation between K content and Cs in the mineral was observed, while such relation was obscure at lower concentration (< 10^{-7} M). Cs distributions inside the crystals were determined by repetition of grinding and IP-autoradiography. The depth profiles with a duration one week indicated that Cs was homogeneously incorporated inside the crystals down to ~300 μm in depth. On the contrary, the specimen sorbed Cs from 10^{-11} M solution for one day showed a gradient of the concentration along the depth. The apparent diffusion coefficient estimated from this profile was 1.3×10^{-13} m^2s^{-1}, which is the same magnitude as that of the specimens sorbed Cs at 10^{-2} M.