Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MAG38-17 Room:301B Time:May 26 14:45-15:00

Characterization of mineral phases in radioactive particles collected from Fukushima contaminated soil using SR-u-XR

MOTAI, Satoko[1*] ; MUKAI, Hiroki[1] ; WATANUKI, Tetsu[2] ; OHWADA, Kenji[2] ; FUKUDA, Tatsuo[2] ;
MACHIDA, Akihiko[2] ; KURAMATA, Chisaki[1] ; KIKUCHI, Ryosuke[1] ; KIRAZAWA, Hideaki[3] ; KOGURE, Toshihiro[1]

[1]Graduate School of Science, The University of Tokyo, [2]Japan Atomic Energy Agency, [3]National Institute for Material Science

The behavior of radioactive cesium is one of important concern about Fukushima nuclear accident. Clay minerals are considered as major radioactive cesium adsorbent in soil from lab experiments reported by previous studies. However, it has been unclear what adsorbs radioactive cesium, because the amount of radiation in actual soil is too low to detect. Recently, Mukai et al. (2014) has detected the radioactive particles in actual soil using autoradiography with imaging plates (IPs). They characterized and classified these radioactive particles into three types using SEM-EDS: 1) weathered biotite, 2) aggregate of fine clay minerals, and 3) organic matter containing clay minerals particulates. On the other hand, it is not enough to identify mineralogical characteristic of particles adsorbed radioactive cesium using only SEM-EDS. Then, we identify and characterize mineral phases of radioactive soil particles using Synchrotron micro X-ray Diffraction (SR-μ-XRD) at BL22XU of SPring-8. After radioactive soil particles were separated by autoradiography and divided into above three types from SEM-EDS observation, each particle mounted on a kapton pin using micro manipulator for the XRD measurement. The incident X-ray with wavelength λ= 0.8273 $\mathring{A}$ at 15 keV were collimated to a diameter of 40 or 60 μm. Angle dispersive diffraction patterns were recorded on an imaging plate. Two-dimensional X-ray diffraction images on the IP were integrated as a function of 2θ to obtain conventional one-dimensional diffraction profiles. Spotty diffraction patterns of particles, characterized as 1) weathered biotite by SEM-EDS observation, show feature of single crystal. Broad peaks at ˜10 $\mathring{A}$, ˜14 $\mathring{A}$ and ˜7 $\mathring{A}$ appear at the low angle diffraction patterns of these weathered biotite particles. It indicates that these particles are weathered biotite with varied weathering degree from biotite, via vermiculite, to kaolinite. There is no clear relationship between the diffraction patterns of weathering biotite and amount of radiations estimated from luminescence on IP autoradiography. 2) The diffraction pattern of an aggregates minerals shows ring pattern ˜14.0 $\mathring{A}$ indexed smectite, 3) on diffraction patterns of a few organic matter containing particles, there are no clear diffraction pattern of clay minerals.

Keywords: Fukushima nuclear accident, radioactive cesium, autoradiography, clay mimerals, weathered biotite, SR-u-XRD