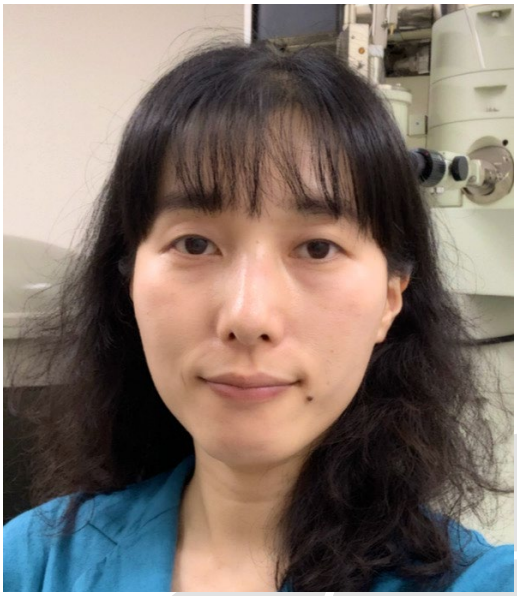
THE GEODYNAMICS SEMINAR

No 656



Dr. Sayako Inoué

Assistant Professor

Geodynamics Research Center

2026.4.17 (Fri.) 16:30 ~

Venue: Meeting Room #486

Science Research Bldg. 1, 4th floor.

Ehime Univ.

Nanoscale characterization of biotite alteration by high resolution electron microscopy

The alteration of minerals plays an important role in biogeochemical cycles. The alteration process is often associated with the formation of clay minerals. To understand the underlying reaction mechanisms, detailed characterization of alteration products is essential. High resolution transmission microscopy (HRTEM) observation enables identification of structural alteration mechanisms at a near-atomic scale. However, nanoscale to atomic scale chemical analysis remains challenging with conventional transmission electron microscope because the alteration products are typically highly beam-sensitive. This gap between the resolution of the structural and chemical analyses leaves ambiguity in understanding the reaction mechanisms, requiring optimization of conventional chemical analysis methods.

In this study, we combined the high-resolution quantitative chemical mapping using the annular energy dispersive X-ray spectrometer (EDS) equipped with scanning electron microscope (SEM) and HRTEM to understand the process of biotite alteration in the Toyama breccia pipe, Yamanashi, Japan. Nanoscale characterization of biotite revealed that a complex process of alteration. Three types of alteration were identified: 1) depletion of K accompanied by the oxidation of Fe(II), 2) incorporation of Fe and Mg in the interlayer and formation of hydroxy-interlayered vermiculite-type structure, 3) depletion of cations in the 2:1 layer. Each type of alteration will be discussed in detail during the presentation. Our results demonstrated the significance of the nanoscale to atomic scale characterization of altered minerals for clarifying the reaction mechanism.

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