Fracture characterization in the accretionary complex from the view point of mass transfer

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Introduction
As most of the basement rock of Japan is thought to be composed of accretionary complexes (Kano et al., 1998), accretionary prisms should not be ignored for the site selection of geological disposal of high-level radioactive waste. Because of many discontinuous structures such as faults and fractures formed due to the subduction of the plate in the accretionary complex, radioactive materials may migrate in the discontinuous structure together with the groundwater flow. Therefore, it is important to understand the characteristics of the mass transfer in along the discontinuous structure in the accretionary complex. In this study, we have carried out geological observation, permeability test in the laboratory, etc. using the samples containing discontinuous structures in the Neogene and Pre-Neogene accretionary complex (Takeuchi et al. 2018).

The study areas are Chichibu Belt (Akiruno City, Tokyo) for the Pre-Neogene accretionary complex, and Miura Group Misaki Formation (Miura City, Kanagawa Prefecture) for the Neogene accretionary complex. In the Misaki Formation, plain-less fault (Ijiri et al., 1955) in the mudstone are widely distributed. On the other hand, argillaceous matrix rock in the mélange which characterizes the accretionary complex are widely distributed. An optical microscope, scanning electron microscope (SEM) observation, X-ray fluorescence micro-scanner (XGT) analysis, permeability test, etc. have been were carried out using those samples.

2. Neogene accretionary complex

In the Miura Group Misaki Formation exposed to the southern tip of Miura Peninsula, plain-less faults are widely distributed. It was confirmed by SEM observation and XGT observation that there has been no change in the element distribution, although the host rock was granulated due to a cataclastic fracturing in the fault zone (Takeuchi et al. 2018). The porosity of the host rock and faults has been measured using SEM images. As a result of measurement, the porosity in the fault zone is about 1.2%, and that of the host rock is about 2.7%. In addition, hydraulic conductivity of the host rock without plain-less fault and the specimen perpendicular to the plain-less fault is estimated by the permeability test. As a result, the former is about 6 E - 9 (m / s), and in the latter is about 2E - 8 (m / s). This suggests hydraulic anisotropy in the formation with plain-less fault. From the above results, it is expected that a barrier effect on the mass transfer within the area surrounded by the plain-less fault.

3. Pre-Neogene accretionary complex

As a result of observation of thin sections, scaly cleavage due to shear deformation can be observed in the mudstone. In addition, concentrations of Fe have been confirmed along the cleavage from the XGT analysis. The concentration of Fe (the count number of XGT analysis) perpendicular to the cleavage shows almost restricted to the cleavage part, and diffusion has not been observed in the adjacent area. As a result of permeability test in the laboratory, the hydraulic conductivity parallel to the cleavage is estimated

about 4E - 8 (m / s), on the other hand, that perpendicular to the cleavage is about 2.5 E-8 (m / s). From the result above, it is assumed that faint hydraulic anisotropy exists in the mudstone matrix part. The reason for the small difference in hydraulic conductivity is thought to be connectivity of the curvature scaly cleavage or the weathering at the surface.

From the above results, it is considered that cleavage planes in the mudstone matrix can be selective migration pathways for mass transfer.

4. Summary

From this study, we have constructed a conceptual model showing the characteristics of material transfer in discontinuous structures in Neogene and Pre-Neogene accretionary complex. In the future, we have to improve the conceptual model from the mass transfer point of view properly by using deeper samples.

Keywords: Geological disposal, Accretionary complex, Neogene, Pre-Neogene, Mass transfer

