

Identifying influence factors on permeability of granite core samples

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A safe geological disposal of high-level radioactive waste for long term requires to evaluate the stability of facilities based on the estimation of groundwater flow and mass transport. For the evaluation, it is indispensable to understand a regional groundwater system and a slow diffusion phenomenon of radionuclide in the matrix of the rock body. However, the relation between a permeability and macro/micro cracks in the rocks has not yet been clarified and the estimation accuracy of flow path is low. The main purpose of this study is to clarify the relationship by measuring spatial variation of permeability of granite rocks and examining the dependence of permeability upon crack systems with different scales.

For the purpose, we used the core samples taken from a borehole in the Tono area (Gifu, central Japan) drilled by Japan Atomic Energy Agency (JAEA). This area is mainly composed of Toki granite. Fault zones were drilled through the borehole. First we measured the permeabilities of the 36 cores and compared them with the geological features. Next, in order to identify the influence factors on the permeability of the rock matrix, thin-sections were produced from the cores after the infiltration of fluorescent into the cores and cracks were extracted from the thin-section images. Furthermore, micro-scale features of the rocks were compared with anisotropy of the permeability. We defined mesocrack as a visible crack with cm scale and microcrack as an invisible cracks with mm scale, respectively. As the result, the permeabilities were enhanced in accordance with the degradation of rocks by the advanced weathering and alteration and the presence of faults. High permeabilities were also measured in the parts of thin-sections in which the mesocracks were developed. As for the microcracks, although the fluorescent infiltrated into the microcracks, their attributes such as length, density, and angle did not have clear relationship with the magnitude of permeability.

These results suggest that mesocracks act as a path of fluids, while individual microcrack cannot have this function: formation of continuous network of microcracks is needed to enhance the permeability. Our next step is to add samples and undertake image analyses more in detail to verify the interpretation.

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Keywords: Permeability, Granite, Tono Area, Image analysis, Crack characteristics

Estimates of a sediment yield and a outflow of radioactive Cs with 3D laser scanner

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For an estimate of movement from forest to living spheres, it is important to understand value of movement of soil and radioactive Cs from forest. We measured volumes of deposit with 3D laser scanner in an erosion control dam in Fukushima prefecture on August 29, 2013 and December 3, 2014.

As a result of measurement, an amount of increase of sediment for 15 months is 0.5 m³. A denudation rate is 0.02 mm/year. This value is on the same level with denudation rates in meadows and forest, 10-2 - 10-1 mm/year (Fujiwara et al, 1999). And it is estimated that a variation of radioactive Cs is Cs-137:200,000,000 Bq, Cs-134:80,000,000 Bq.

Keywords: F-TRACE project, accident at the Fukushima Daiichi Nuclear Power Station, 3D laser scanner, denudation rate