Effects of discontinuities on a performance assessment of geosphere of HLW disposal

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It is very important to evaluate hydraulic and transport characteristics of discontinuities as well as geometry in order to perform a performance assessment (PA) of geosphere. However, most of fracture observations have not been conducted at the scale required for PA but at a smaller scale of a several meters. We investigated trace length distribution of discontinuities based on fracture maps observed at various scales, and then found that the fracture trace length follows power law distribution. As a conclusion, since relatively large discontinuities will exist in repository area, how to detect large discontinuities in a real site and how to incorporate large discontinuities into a performance assessment are key issues for the future repository.

It is very important to evaluate hydraulic and transport characteristics of rock for a performance assessment of geosphere of high-level nuclear waste (HLW) disposal. It was noted that discontinuities have great influences on hydraulic and transport characteristics of rock in regardless of rock types [e.g., Ijiri et al., 1999]. Therefore, it is necessary to understand hydraulic and transport characteristics of discontinuities as well as geometry of discontinuities in order to assess a performance of deep rock formation.

A number of fracture observations have been conducted at various sites in Japan, and characteristics of fracture geometry have been investigated. Most of fracture observations, however, have been conducted at limited area within a several meters scale. A scale of performance assessment tends to be from a few hundred meters to a few kilo-meter scale and is much larger than the observation scales. Therefore, when a large-scale performance assessment model is created from the characteristics obtained at small scale, it is crucial to evaluate trace length of discontinuity which is most affected by an observation scale.

We investigated trace length distribution of discontinuities based on fracture maps observed at various scales from a few tens meters to a several hundreds meters. It was found that the fracture trace length obtained from various regions and rock types follows the almost same power law distribution [e.g., Ijiri et al., 2000; Sawada et al., 2000]. In other word, a size of discontinuity distribute consecutively from small to large in rock. Therefore, relatively large discontinuities will exist in repository area.

From the preliminary radionuclide migration analysis using discrete fracture network model with power law distribution of fracture radius, it was also found that hydraulic and transport characteristics of large discontinuities have a great impacts on a radionuclide release from a repository [Ijiri et al., 1999]. We conclude that how to detect large discontinuities in a real site and how to incorporate large discontinuities into a performance assessment are key issues for the future repository.