Hydrogeological characteristics of candidate sites for high-level waste disposal in South Korea

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Geological disposal of High-Level Radioactive Waste (HLRW) is considered to be one of the best disposal methods that can stably and semi-permanently isolate high-level radioactive waste from the biosphere. In this study, three types of potential host rocks for HLRW disposal were selected and the hydrogeological characteristics were investigated using deep drilling cores collected at about 50 m intervals in the borehole of a depth of 1 km. The rocks used in this study were granites and gneiss which are crystalline rock, and mudstone which is a sedimentary rock. The results of the study showed that the average porosity of granite was 0.48\% and the permeability ranged from \(7.87 \times 10^{-19}\) m\(^2\) to \(1.39 \times 10^{-21}\) m\(^2\) except for samples outside the measurement limit (4.04 \(\times 10^{-22}\) m\(^2\)). The average porosity of gneiss was 0.49\% and the permeability ranged from \(3.62 \times 10^{-18}\) m\(^2\) to \(4.58 \times 10^{-22}\) m\(^2\). The average porosity of mudstones was 3.62\% and the values of permeability for most mudstone samples were lower than the measurement limit. For SEM-EDS analysis, many microcracks were observed in the crystalline rock samples having high permeability. On the other hand, there were almost no microcracks in crystalline rock samples having low permeability, and even if there were cracks, the cracks were filled with fillers such as clay minerals. These results indicate that the presence of microcracks or the filling of cracks in crystalline rocks has a significant effect on the flow of groundwater through the host rock.