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Mapping Fractures in KAERI Underground Research Tunnel using Ground Penetrating Radar

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The proportion of nuclear power in the Republic of Korea occupies about 40 percent of the entire electricity production. Processing or disposing nuclear wastes, however, remains one of biggest social issues. Although low- and intermediate-level nuclear wastes are stored temporarily inside nuclear power plants, these temporary storages can last only up to 2020. Among various proposed methods for nuclear waste disposal, a long-term storage using geologic disposal facilities appears to be most highly feasible. Geological disposal of nuclear wastes requires a nuclear waste repository situated deep within a stable geologic environment. However, the presence of small-scale fractures in bedrocks can cause serious damage to durability of such disposal facilities because fractures can become efficient pathways for underground waters and radioactive wastes. Thus, it is important to find and characterize multi-scale fractures in bedrocks hosting geologic disposal facilities. In this study, we aim to map small-scale fractures inside the KAERI Underground Research Tunnel (KURT) using ground penetrating radar (GPR). The KURT is situated in the Korea Atomic Energy Research Institute (KAERI). The survey target is a section of wall cut by a diamond grinder, which preserves diverse geologic features such as dykes. We conducted grid surveys on the wall using 500 MHz and 1000 MHz pulseEKKO PRO sensors. The observed GPR signals in both frequencies show strong reflections, which are consistent to form sloping planes. We interpret such planar features as fractures present in the wall. Such fractures were also mapped visually during the development of the KURT. We confirmed their continuity into the wall from the 3D GPR images. In addition, the spatial distribution and connectivity of these fractures are identified from 3D subsurface images. Thus, we can utilize GPR to detect multi-scale fractures in bedrocks, during and after developing underground disposal facilities. This study was supported by Korea National Research Foundation (NRF) grants NRF-2012M2A8A5007440 and NRF-2013R1A1A1076071 funded by the Ministry of Science, ICT & Future Planning, Korea.