The State-of-the Art of the Geological Evolution Research to Verify the Long-Term Safety of Disposal Site

Soolim Jung* and Sung-Hoon Ji

Korea Atomic Energy Research Institute, Daedeok-daero989ben-gil 111,Yuseong-gu, Daejeon, Republic of Korea

*sljung@kaeri.re.kr

1. Introduction

Disposal facilities for radioactive waste should be sited to provide isolation from the accessible biosphere for several hundreds to thousands of years after closure. For safety assessments of the repository, the long-term natural evolution and possible events of the site, which can cause disturbances to the facility over the period of interest, should be considered. Understanding the history of paleo-geological evolution is one of the key factors to verify long-term safety of the given area.

2. Nations investigated

The cases of Finland, Sweden and Japan were investigated. Finland and Sweden are the most advanced nations for geological research on disposal sites. Both nations had launched radioactive waste disposal project for over 30 years using their own deep Underground Research Laboratories (URL). The host rock types of the two countries were crystalline rocks. Japan is a neighboring country to Korea, and a geologically active region. Relatively strong tectonic events and fast plate movement shall affect the researches in Japan. The host rock type of Mizunami URL in Japan is granitic rock, which is being considered as the most safe rock type for geological disposal in Korea.

3. Researches on tectonic evolution

Research on history of tectonic evolution and possibility of consequent events, which can cause disturbances to the repository, is one of the fundamental procedures to verify the long-term safety of the site.

Technologies for the research were nearly same for most of nations. Surface-based lithological investigations were performed to increase accuracy of the evolution history. Borehole geophysical surveys have been performed to collect geological information of the deep underground, and the drilling core samples were taken for structural analyzing and age dating. Brittle and ductile deformation histories were evaluated using structural analysis data from the field works, geophysical surveys and drilling core investigations.

On the other hand, visualizing ways of the results were varied by country. Sweden used detailed age-dating data for constructing each deformational history with a graphic chart. Finland indicated the evolution of paleostress, several tectonic events, and age-dating data at the same chart.

4. Future geological evolution

To produce more precise and specific results, the nuclear advanced nations have constructed quantitative models for future geological evolution. Each nation applied different approaches and

techniques to estimating long-term geological evolution of the disposal site, which were developed suitably for their site characteristics. Finland and Sweden, countries located high latitude area, constructed climate and glacial estimating model, whereas hydraulic evolution with geographic changes was applied to the Mizunami site composed of granitic body and active tectonic regime.

5. Conclusion

From the results, it is suggested that the development of Korean own techniques for long-term geological evolution and its safety assurance depending on Korean geological characteristics should be conducted in near future. The advanced methodologies for understanding geological evolutions and evaluating long-term safety can contribute to develop Korean own technologies.

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