Preliminary Study on Paleostress Reconstruction Around KURT Area

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1. Introduction

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

The objective of this research is to introduce several techniques to reconstruct the paleo-stress fields and compare them, to develop the effective methodology of constructing a geological evolution model.

2. Literature investigation

2.1 Historical models of deformation in Finland

The Finnish organization for final disposal of nuclear waste, POSIVA, has conducted geological research around the site-specific Underground Research Laboratory (URL) located in Olkiluoto. To assess the long-term safety of Olkiluoto area, POSIVA researchers built regional-scale lithological models and regional-scale conceptual models of each ductile and brittle evolution history [1]. The brittle deformation model shows changes in paleo-stress field and ranges of intrusion age for each recorded magmatism from 1.7 billion years ago.

2.2 Long-term evolution models in Japan

Japan Atomic Energy Agency (JAEA) has studied the reconstruction and estimation of long-term geological evolution around URL site [2]. JAEA focused on the period of interest, ten to a hundred thousand years after closure, and constructed evolution models with major tectonic movements during the period.

3. Methods

3.1 Methodology to paleostress reconstruction

To interpret the geodynamic evolution history, it is necessary to have a complete paleostress analysis of fracture systems. In a typical case study for understanding the paleostress, the orientations are measured by stress tensor analysis, and the ages of the events are estimated by relative age analysis [3].

Microcracks can be another indicator to find out the orientation and age of paleostress [4]. A set of oriented microcracks indicates the orientation of principal stress and fluid inclusion formed within the microcracks can classify the formation age of the microcracks.

4. Paleostress reconstruction of KURT area

The research was performed around KURT (Korea Atomic Energy Research Institute Underground Research Tunnel), Daejeon, Korea. To understand the geological information around the research area, various geological surveys have been conducted, including a surface geophysical survey, geological lineaments analysis, field observations, borehole investigations, chemical analyses, age dating of the rock samples, and a structural analysis of the exposed wall and flat-cut surface inside KURT.

Compared to preceding research, it is necessary to get more data from field geometry for the paleostress reconstruction around KURT site. The deep borehole investigations and KURT observations will contribute to reconstruct more precise paleostress evolution model around the KURT site.

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