Statistical properties of background fractures observed at the deep borehole in KAERI Underground Research Tunnel(KURT)

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1. Introduction

According to the geological model of the KURT site, the hydrogeological units in the site were categorized to the hydraulic soil domains (HSDs), the hydraulic rock domains (HRDs) and the hydraulic conductor domains (HCDs). In this study, we analyzed the properties of background fractures observed at DB-1, which is a deep borehole located in KURT with the depth of 500 m, and characterized the HRDs in the site.

2. Methods

The boerehole log data from the acoustic televiewer logging was analyzed to characterize the properties on density and orientation of the background fractures. Based on the analyses, the HRDs of the site were defined. Then, the characteristics of fracture transmissivity of the background fractures in each HRD were analyzed.

3. Results

3.1. Characteristics of fracture density and orientation distribution

The open/semi-open background fractures, which are very likely to be water conductive fractures, were rare in the depth of 300 ~ 500 m, and P10 of that interval was below 0.01, where P10 is defined as the number of fractures crossed unit length of the borehole. However, they were about 0.05 and 0.20 in the depth of 0 ~ 45 m and 60 ~ 300 m, respectively (Fig. 1).

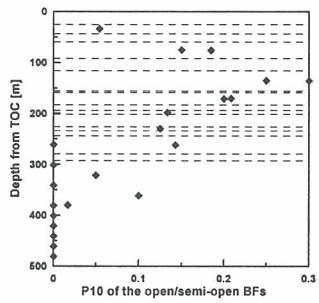

Fig. 1. P10 of the open or semi-open background fractures observed in DB-1 borehole.

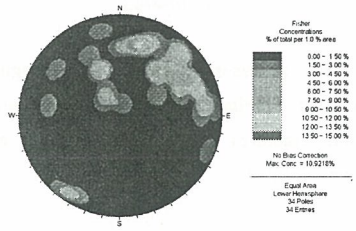

Fig. 2. Distribution of poles of the open or semi-open background fractures in DB-1

The orientations of the open/semi-open fractures had little correlation with depth, and showed N-W trends, which can be fitted to the Fisher distribution with the characteristic parameter of 8.62 and mean dip trend/plunge of 199.6/66.0 (Fig. 2). Based on the results of the analyses on fracture density and orientation, the region below 293 m from the bottom of KURT was defined as HRD-1 while the regions between 60 ~ 280 m and above 45 m HRD-2 and HRD-3, respectively.

3.2. Characteristics of fracture transmissivity distribution

To determine the P10 and the fracture

transmissivity distribution characteristics of the water conductive background fractures in each HRD, the fixed interval packer test results were analyzed using OxFilet code [1]. Under the assumptions that the transmissivity for a given interval is the sum of the transmissivities of the water conductive back ground fractures in it and the intervals whose transmissivities lower than a threshold have no measurable water conductive background fractures, the fracture transmissivity distribution was estimated. In this study, the threshold was assumed as $3.0x10^{-8}m^2/sec$, which was similar to the minimum measured transmissivity in the intervals without any fracture. The analysis results show that the suggested water conductive background fracture transmissivity distribution of HRD-1 followed the normal distribution of log with the mean and standard deviation of -7.48 and 0.08, respectively, while HRD-2 the normal distribution of log with the mean standard deviation of -7.88 and 0.50.

4. Summary

From the analyses of borehole logging and hydraulic test results, the statistical properties of background fractures were characterized, and the HRDs were defined.

5. Acknowledgement

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6. References

[1] Dershowitz, W., Lee, G., Geier, J., Foxford, T., LaPointe, P., Thomas, A., 1998. FracMan Interactive Discrete Feature Data Analysis, Geometric Modeling, and Exploration Simulation, User Documentation, v 2.6, Golder Associate Inc., Seattle.