Hydrogeologic investigations at a deep borehole, Mizunami Underground Research Laboratory

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Methodologies for determining the location and characteristics of major water-conducting features (WCFs) in deep boreholes located in fractured rock (Toki Granite) have been developed.

Flowing electric conductivity (FEC) logging techniques were applied for identifying the location of WCFs. The method involves replacing borehole fluids with de-ionized water and then measuring changes in electrical conductivity with time while pumping water from the borehole. Hydrotesting methods were developed with the use of an improved testing tool and a sequential test method. Improvements to the testing tool included enlarging and straightening the inner flow path to reduce flow losses and the addition of closed pumping techniques. Sequential test methods were developed for selecting the appropriate test for the test-section based on the results of conducting a series of pulse, slug and pumping tests. Pressure derivative techniques were applied during data collection to monitor test progress and during analysis to aid in identifying the appropriate analysis methods.

The results of applying these methodologies to the MIU site are summarized below:

- More than 50 WCFs were identified and located with high resolution by the FEC logging method indicating the efficiency of the method.

- A wide range of reliable transmissivity results were obtained, especially at higher transmissive sections (10-4 m2/s), indicating the efficiency of the testing tool.