

## Calibration on groundwater model using groundwater dating

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In the safety assessment of radioactive waste disposal, groundwater scenario is one of the most important scenarios, which evaluate transportation of radionuclides by groundwater. Therefore, groundwater flow is a key issue in the feasibility of a disposal facility. In this study, groundwater dating results ( $^4\text{He}$  and  $^{14}\text{C}$ ) were used for groundwater model calibration. It was normally performed by water level and water pressure, but groundwater dating ( $^4\text{He}$  and  $^{14}\text{C}$ ) were also used in this study.

The study area is the Tono area, Gifu Prefecture, where has been investigated by Japan Atomic Energy Agency (JAEA). More than a dozen deep boreholes have been drilled in this area, and water pressure monitoring and groundwater dating have been conducted. Using these data, the groundwater model was calibrated by inverse analysis.

As a result of calibrating the groundwater model using not only hydraulic pressure but also  $^4\text{He}$  and  $^{14}\text{C}$ , the estimation error of hydraulic conductivity using  $^4\text{He}$  and  $^{14}\text{C}$  was smaller than that using only hydraulic pressure. The hydraulic conductivity estimated by inverse analysis was almost the same as that obtained by in-situ experiments. The error estimated by inverse analysis was also smaller than that of the hydraulic conductivity tests. Furthermore, the effective porosity could be estimated by using the groundwater age. Because  $^4\text{He}$  and  $^{14}\text{C}$  are transported with real velocity, which closely related to the effective porosity. From these results, using groundwater dating will play important role for groundwater model calibration. This study was carried out under a contract with the Ministry of Economy, Trade and Industry (METI) as part of its R&D supporting program titled "Research and development on groundwater flow evaluation technology in bedrock (2021 Fy) Grant Number JPJ007597.

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