

# 溶存希ガスと長半減期核種を地球化学的トレーサーとした地下水 水の滞留時間の推定と地下水起源の検討

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**Estimation of Groundwater Residence Time and Evaluation of the Origin of Groundwater Using  
Dissolved Noble Gases and Natural Radionuclides with a Long Half-life as Geochemical Tracers**

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## Abstract

The residence time and origins of groundwater are key factors accounting for its behavior in deep stratum. In this paper, various groundwater behaviors are discussed by focusing on dissolved noble gases and natural radionuclides with a long half-life as geochemical tracers. The concept and history of noble gas hydrology, which is a field of hydrology using noble gases dissolved in groundwater as tools to trace groundwater movements in strata, are summarized by comparing past studies. Current applications and future studies are presented. The main subjects of noble gas hydrology are groundwater dating and estimating the origins of groundwater. The residence time ranging over million years can be determined using excess dissolved  $^4\text{He}$  concentration and the accumulation rate of  $^4\text{He}$  calibrated with  $^{36}\text{Cl}$  (half-life  $t_{1/2} = 3.01 \times 10^5$  y). On the other hand, dissolved noble gases (*i.e.*,  $^3\text{He}$  or  $^{85}\text{Kr}$ ) should also be used to determine a short range of groundwater residence time of less than 100 years to exploit groundwater resources and overcome water shortages in the 21st century. The origins of groundwater can be estimated from characteristic changes of  $^3\text{He}/^4\text{He}$  ratios in regional groundwater flows. Furthermore, paleotemperature, which aims at reconstructing paleo-climate information, is another key subject in noble gas hydrology.

**Key words :** dissolved He concentration, helium isotopic ratio,  $^{36}\text{Cl}$ , secular equilibrium ratio, groundwater dating, groundwater origin

キーワード : 溶存 He 濃度, He 同位体比,  $^{36}\text{Cl}$ , 放射平衡比, 地下水年代測定, 地下水の起源

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