Improvement of tritium detarmination by the ^{3}He ingrowth method

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Residence time of groundwater is an important parameter to elucidate groundwater flow system. The ^{3}H-^{3}He method is one of methods to determine groundwater residence time ranging from several months to 120 years. The best advantage of this method is that it is applicable to accurately determine an age of young water compared to other methods (CFC & SF_6 method and ^{36}Cl method, etc.), because initial ^{3}H concentration is directly determined as the sum of ^{3}He and ^{3}H in the water at present, if the groundwater flow system has been a closed system for ^{3}He and ^{3}H until its discharge [1]. We have been developing the method to investigate the groundwater flow system in the Fukushima Prefecture, Japan, where there is concern about contamination by anthropogenic radionuclides released by the accident at the Fukushima Daiichi Nuclear Power Plant triggered by the earthquake of 11 March 2011 off the Pacific coast of Japan and the subsequent tsunami [2]. However, the reliability of the determined residence time is still insufficient to discuss the groundwater residence time because of difficulty with tritium concentration determination by the in-growth ^{3}He method.

We tested accuracy of our tritium determination by analyzing standard water samples provided by IAEA with known tritium concentrations. The ^{3}He/^{4}He and ^{4}He/^{20}Ne ratios of samples which had been degassed and stored for a month suggested insufficient degassing and contamination from the ambient air. Therefore, we improved the equipment for degassing and method for storage, and succeeded in preventing atmospheric helium contamination. This presentation will discuss how this method is applied to analyze groundwater samples from Izu-Oshima Island and Fukushima Prefecture in Japan.

[1] Takaoka & Mizutani (1987) *EPSL* **85**, 74-78. [2] Sakuraba *et al.* (2017) Goldschmidt 2017 abstract.