Noble gas hydro-geochemistry of groundwaters from central part of Kanto Plain

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Dissolved noble gases in groundwater become potential tracers in isotope hydrology. In particular, helium is useful for both groundwater dating and exploration of groundwater origin. Mechanism for helium dissolution, however, still remains unsolved questions in view of helium flux from deeper region, diffusion in groundwater, quantitative understanding of helium isotopic ratio, etc. In this study, we report a preliminary result of helium isotopes in groundwater from the Kanto Plain, central Japan, to obtain better understandings of noble gas hydro-geochemistry.

Chemical and stable isotopic studies revealed that groundwaters with high chloride concentrations are distributed in central part of the Kanto Plain (Yasuhara et al., 2005). These high chloride groundwaters with a maximum value of 216 mg/l are extending from northwest to southeast belt like area. These groundwaters are also characteristic of low hydrogen and oxygen isotopes, low d-values and high carbon isotopic ratios. This belt-like area may correspond to a region so-called Motoarakawa tectonic belt which is divided by two NW-SE faults, Ayasegawa (south-western side) and Kuki (north-eastern side) faults (Shimizu and Horiguchi, 1981).

The results of helium are as follows; (1) there is a tendency of high 4He concentration in the groundwaters inside the tectonic belt and region outer side from the Kuki fault, (2) helium isotopic ratios (3He/4He) inside the tectonic belt are relatively homogeneous with an end member of 0.8-1.1 x 10ˆ-6. The helium isotopes in groundwater in the region out side of the tectonic belt show distinctly low ratio relative to those in the tectonic belt. The end-member of helium which is incorporated into the groundwater inside of the tectonic belt is different from those produced inside the aquifer, because helium isotope production ratio may less than 1 x 10ˆ-7 from the chemistry of sandstone. Helium-4 concentration in groundwaters inside the tectonic belt show clear positive correlation with chloride concentration. Combined with this correlation and characteristics of helium isotopic ratio, it is inferred that the groundwater from the tectonic belt is a mixture of meteoric water and high chloride saline water bearing with high 4He or is stagnant old groundwater and that the groundwater flow system is distinct from those from outside of the tectonic belt. These results are consistent with the concept inferred from the chemical and stable isotopic results of groundwater flow system in the tectonic belt.