

Helium isotopes in groundwaters from the middle and lower reaches of the Tone River, Japan.

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There exist three regions in the Kanto plain, central Japan, whose groundwater is characterized by a high Cl⁻ concentration: (1) floodplains and deluvial uplands along the lower reaches of the Tone rivers (Ibaraki and Chiba Prefectures), (2) south-east parts of the Gunma Prefecture along the middle reaches of the Tone rivers, (3) central parts of the Kanto plain, south east of the Area (2).

The high-chloride groundwaters from the central parts of the Kanto plain are characterized by the following features; (a) helium isotopic ratios (³He/⁴He) are relatively homogeneous with an end member of 0.8-1.1 x 10⁻⁶, (b) helium-4 concentration show positive correlation with chloride concentration (Morikawa et al., 2006). Morikawa et al (2014a) investigated the noble gases in the deeper groundwaters (hot springs) in the central parts of the Kanto plain and the high-chloride groundwaters from south-east parts of the Gunma Prefecture to elucidate the origin of water and chloride component. Low ³He/⁴He ratios in the hot springs indicate that there is almost no interconnectivity between the high chloride groundwater and hot spring water around these regions. In contrast, both ³He/⁴He ratio and correlative ⁴He and Cl⁻ concentration in the high-chloride groundwaters from south-east parts of the Gunma Prefecture are similar to those in the groundwaters in the central part of the Kanto Plain. They suggest that these groundwaters and their constituents are closely related to each other in their origin. Although there is no hydrogeological connectivity, groundwaters from some part of the lower reaches of the Tone river also show similar helium isotopic ratios (³He/⁴He) and positive ⁴He-Cl correlation (Morikawa et al., 2014b).

In this study, we further conducted complementary investigation for the groundwaters between the region of middle reach and lower one of the Tone River. Low Cl⁻ with low ⁴He groundwaters exist in this region. Combined with previous and present results, the groundwaters along the Tone River implies a mixture of young meteoric water and high chloride saline water bearing with high ⁴He which seems to be stagnant nature.

References: Morikawa et al. (2006) JPGU 2006, H121-004, Morikawa et al. (2014a) JPGU 2014, AHW25-12, Morikawa et al. (2014b) JAHS 2014, P18.

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