

Helium isotopes in groundwaters in the southeast part of the Gunma Prefecture, Japan.

*Noritoshi Morikawa¹, Masaya Yasuhara², Akihiko Inamura¹, Masaaki Takahashi¹, Takeshi Hayashi³, Akinobu Miyakoshi¹

1.Geological Survey of Japan, AIST, 2.Rissho University, 3.Akita University

Three distinct regions in the Kanto plain, central Japan, are recognized as the region existing lumps of groundwaters with high Cl⁻ concentrations: (1) central parts of the Kanto plain (eastern part of Saitama Prefecture), (2) south-east parts of the Gunma Prefecture along the middle reaches of the Tone river north of the Area (1), (3) floodplains and diluvial uplands along the lower reaches of the Tone river (Ibaraki and Chiba Prefectures).

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 × 10⁻⁶, (b) ⁴He concentrations show positive correlation with chloride concentration (Morikawa et al., 2006). Morikawa et al (2014) investigated the noble gases in the deeper groundwaters (hot springs) in the central parts of the Kanto plain and the high-chloride groundwaters from southeast part 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, the groundwaters from observation wells for land subsidence in the southeast parts of the Gunma Prefecture are somewhat similar to those in the groundwaters in the central part of the Kanto Plain. However, the correlation between chloride and helium concentrations was relatively weak with relatively large ³He/⁴He variation.

In this study, we further conducted complementary investigation for the groundwaters in the southeast part of Gunma Prefecture. The results revealed that groundwater with high chloride-⁴He concentrations were also observed along the left bank of the Tone river. This region, however, is limited in an area of about 15 km from west-northwest to east-southwest and 5 km from north to south. The groundwaters from the outside of this region contained relatively low ⁴He concentration with weak chloride-⁴He correlation. This observation implies that high He concentration with moderately high ³He/⁴He components in groundwaters are originated in the south-east portion, near the Tone river, of Gunma prefecture and may relevant to a geological structure in deeper region of this region.

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

Keywords: Helium, Groundwater, Tone River, Kanto Plain, Chloride Ion, Noble Gas