Geochemical analysis of shallow and deep end members by use of brine discharging at Kashio area, Nagano prefecture, central Japan

*Fumitake Kusuhara, Hidemi Tanaka[1], Kohei Kazahaya[2], Noritoshi Morikawa[2], Masaya Yasuhara[3], Masaaki Takahashi[2], Yuki Tosaki[2]

1. Department of Earth and Planetary Environmental Science, The University of Tokyo, 2. Geological Survey of Japan, AIST, 3. Rissho Univ.

Hot springs in Japan are classified, mainly in terms of oxygen and hydrogen isotopic ratio of water, into four groups: green tuff type, coastal type, volcanic type, and Arima type. Arima type hot springs are considered to be formed by mixing of deep brine and meteoric water. Chemical and isotopic composition of the deep brine, however, is not revealed, and two hypotheses about the origin of it, “magma water origin” and “slab-related fluid origin”, have conflicted. It is an important goal in studies of hot springs to reveal the composition and origin of the brine. Helium isotopic ratios are as high as mantle component in some water or gas samples from Arima type hot springs, which means mantle is involved in forming or ascending processes of the deep brine. Therefore it is thought that Arima type hot spring is associated with water circulation in subduction zones. In order to understand water mass balance in subduction zones, it is necessary to estimate fluxes of the deep fluids. Kashio hot spring, discharging near the Median Tectonic Line in central Japan, is considered as one of Arima type hot springs. In this study water samples are collected at Kashio area. Then oxygen and hydrogen isotopic ratios ($\delta^{18}O$, δD), Cl^- concentrations, HCO_3^- concentrations, tritium concentrations, rare gas concentrations, and rare gas isotropic ratios of the collected samples are measured. At the same time, flow rates and Cl^- concentration of river waters at Kashio area are measured. By use of seasonal variations of values measured from the samples, it is revealed that water of Kashio hot spring is a mixture of the deep brine and young groundwater originating from meteoric water. With tritium and ^{20}Ne concentrations, chemical and isotopic composition of the Kashio deep brine is estimated as follows: $\delta^{18}O$ = -1‰, δD = -49 ‰, Cl^- = 25000 mg/L. The δD value of the brine is not explained by magma water. This oxygen and hydrogen isotropic composition might be interpreted as a result of oxygen isotopic fractionation between minerals and slab-derived fluid which occurs at relatively shallow depth inside crust. A flux of the Kashio brine is also estimated, using the flow rates and Cl^- concentrations of river waters, at 0.63 L/sec. This value is similar to that of Arima hot spring and Kobe area.

