Keynote speech: Upwelling water from deep sources: feature, origin and flux

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Island-arc magmatic water have inherent stable isotope ratios which might be due to that those waters originated from the water dehydrated from the subducted slab (Giggenbach 1993). Arima-type thermal water discharges mainly through active faults and found in the area over 3000 km2 in Kinki district, Japan. The characteristics of the chemical and isotopic compositions are quite similar to that of the magmatic water. Temperature of the water is boiling point at the surface. Since Arima-type thermal water is concentrated in Cl which is twice greater than that of seawater, and has less contribution of meteoric water, therefore the driving force of self-spouting can not be due to potential water height from the recharge area at high elevations but due to geostatic pressure at a very deep place.

In the study area from Kobe-Osaka-Kii Peninsula, there are two types of thermal waters of non-volcanic origin, Cl- and HCO3-type. From helium isotopic compositions, the gas component derived from deeper region including upper mantle are the main contributor for both type of hot springs. Distribution of 20Ne concentration is found clearly different between Cl- and HCO3-type hot springs. The 20Ne concentrations in Cl-type hot springs are far lower than those in air saturated water (ASW) indicating that degassing occurs, while most of HCO3-type hot springs have similar or higher concentration level than ASW indicating addition of gas occurs. No clear correlation between 20Ne concentration and 3He/4He ratio were observed. Insight from the observation mentioned above, gives the relation in genesis of each type of hot spring waters. High temperature thermal brine with mantle-derived component upwells and injects into the subsurface groundwater of meteoric origin, and water-CO2 separation occurs due to depression. The separated CO2-rich mantle-derived gas is likely added to the shallower groundwater which finally makes gas-enriched HCO3-type. A wide distribution of the HCO3-type thermal waters in Kii peninsula, may indicate a wide distribution of upwelling Arima-type thermal waters.