

Geochemical characteristics of slab-derived fluid acquired from a study of hot spring waters: our research history and awaiting solutions

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Active empirical researches on the relation between hot spring and deep-generated aqueous fluid accompanied by plate subduction (slab-derived fluid) have been carried out in recent years (e.g., Kazahaya *et al.*, 2014; Kusuda *et al.*, 2014). We began the pursuit of their relevance by focusing on saline hot springs along the Median Tectonic Line (Amita *et al.*, 2004; Ohsawa, 2004). In consequence, we made an educated guess at CO₂-rich Na-Cl type saline spring waters as closely related to a slab-derived fluid and it may be expected regularity between occurrence depth and Li/B or CH₄/CO₂ ratios of slab-derived fluids (Ohsawa *et al.*, 2010; Amita *et al.*, 2014). On the other hand, researches to explore the actual situation of slab-derived fluid using aqueous fluid inclusions in geological samples produced in subduction zones have been promoted (e.g., Nishimura *et al.*, 2008; Yoshida *et al.*, 2011; Yoshida *et al.*, 2015). From studies of aqueous fluid inclusions in mantle xenoliths, slab-derived fluid is estimated to be CO₂-rich Na-Cl type saline waters (Kawamoto *et al.*, 2013; Kumagai *et al.*, 2014), and from the similarity of the chemical composition of the fluid inclusions and the Arima hot spring water, commentary also began to appear that the Arima-type thermal water is originated from the slab-derived fluid.

After that, when we examined saline hot spring waters and some associated gas in Arima and surrounding areas in southwestern Hyogo Prefecture, we found the discharge of hypersaline hot spring water with similar hydrochemical facies (CO₂-rich Na-Cl type) but different hydrogen and oxygen isotope composition from Arima-type thermal water and also found that He and CO₂ with the hypersaline hot spring water are of crustal origin (Ohsawa *et al.*, 2015). This findings show that hypersaline hot spring water of Na-Cl type rich in CO₂ is not always related to slab-derived fluid, and it will be a continued issue to find a definite geochemical indicator in hot spring water which shows clearly that the origin is the slab.

Keywords: hot spring, slab-derived fluid, geochemistry, CO₂, Na-Cl, hypersaline