Nitrogen isotope ratios of ammonium in hypersaline hot spring waters distributed along Arima-Takatsuki fault zone.

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Recently, there has been a lot of research on the relationship between hot springs and deep thermal fluids (Slab dehydrated fluids) which are thought to be released from subducting oceanic plate (eg, Kazahaya et al., 2014; Kusuda et al., 2014). These researches shown that the water of slab dehydrated fluid is a high salinity of Na-Cl type and rich in the CO2, and that the isotope ratios of helium and carbon had the similar values as that of the mantle. On the other hand, although nitrogen (ammonium ion) is a component contained in most deep fluids, it is not clear properties and behaviors. Studies on nitrogen in rocks have been conducted since the 1960's that have been obtained many knowledge on their concentrations and isotope ratios. Haendel (1986) pointed out that the concentration and isotope ratios of ammonia nitrogen in rock, change systematically with the progression of a series of metamorphism from sediment to rock. In this relation, the nitrogen concentration decreased as the degree of metamorphism progressed, and conversely the nitrogen isotopic ratio increased. Similar trends have also been confirmed in subsequent studies (eg, Gray and Marilyn, 1991, Yiefei, 2006). On the other hand, Amita et al. (2014) pointed out the possibility that metamorphism is involved in the made of deep thermal fluids. Therefore, it is expected that we can obtain knowledge about the behavior of nitrogen in deep under the earth's surface by clarifying the relationship between the nitrogen isotope ratios of rocks and deep fluids. Therefore, as a preliminary approach to the measurement of the nitrogen isotope ratios of ammonium ion contained in the hypersaline hot spring, two hot springs distributed along the Arima-Takatsuki fault zone are selected and performed sampling survey and nitrogen isotope ratios of ammonium ion were measured. Two sampling points are part of the hot springs that the authors have performed research in the past (Osawa et al., 2015) and are well-understood hot springs whose chemical and isotopic properties. Therefore, as a preliminary approach to the measurement of the nitrogen isotope ratios of ammonium ion contained in the hypersaline hot spring, two hot springs distributed along the Arima-Takatsuki fault zone are selected and performed sampling survey and nitrogen isotope ratios of ammonium ion were measured. The hot spring water samples collected at the sampling site were immediately cooled and frozen immediately to suppress biological activity and kept until just before the isotope analysis. Pretreatment for measurement of nitrogen stable isotope ratio of ammonium ion was carried out by ammonia gas diffusion method which can suppress measurement inhibition due to decomposition of dissolved organic nitrogen. The water samples were made alkaline in a sealing vial, ammonium ion was scattered as ammonia gas, and catched to a filter paper acidified with diluted sulfuric acid, and the object was analyzed using an isotope ratio mass spectrometer (ANCA-GSL with Hydra 20-20, Sercon Ltd.). As a result of the analysis, we obtained results of +13.3 (‰) and +12.8 (‰) as nitrogen isotope ratios of two hot spring water samples. Since these results are values before data correction, careful consideration is required at the evaluation. Although, it was confirmed that the measurement of nitrogen isotopic ratios can be performed even for hyper saline hot springs where the total dissolved solids exceeds tens of thousands ppm.

Keywords: Nitrogen isotope ratios, Ammonium ion, Hypersaline hot spring

