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Temporal change of the helium isotopic ratios around the source region of The Iwate-Miyagi Nairiku Earthquake in 2008

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Recent results of structure on seismic tomography in northeastern Japan suggest that magmatic fluid intrusions could trigger the earthquake. However, we estimate the presence of fluid only from the geophysical information, and it is difficult to know the origin of the upwelling aqueous fluid. Thus we use helium isotopic study to confirm the origin of fluid. Helium is chemically inert and its isotope could be a good indicator to discriminate the origin of fluid because the mantle and the crust are different in $^3\text{He}/^4\text{He}$ ratio values.

The Iwate-Miyagi Nairiku Earthquake in 2008 occurred on 14 June 2008. The epicenter was 39°1.7'N 140°52.8'E with the magnitude $M_{\text{JMA}}7.2$. Horiguchi et al. (2009) collected the hot spring water and gas samples around the epicenter in May and July in 2006. After The Iwate-Miyagi Nairiku Earthquake in 2008 we collected the samples around the epicenter on June 21th and 22th 2008, only a week after the earthquake, and measured the $^3\text{He}/^4\text{He}$ ratios and He and Ne concentrations of the dissolved gases in hot springs. We compared the data with those obtained before the earthquake (Horiguchi, 2008), we found 10-85% increase of $^3\text{He}/^4\text{He}$ ratio of hot spring gas in five hot springs after the earthquake (Horiguchi and Matsuda, 2008). After half a year, we again performed the sampling and carried out the He measurement. The $^3\text{He}/^4\text{He}$ ratios decreased at the nearest point of the main shock region. Meanwhile, the isotopic ratios further increased in the northwestern part of the main shock region. After a year, it is observed that the $^3\text{He}/^4\text{He}$ ratios in the northern part still increase, but those in the southern part seem to return to the original values. These results suggest that the upwelling of magmatic fluid is the cause of the earthquake. We are planning to make measurements on these samples to see the variation of CO_2 etc. before and after the earthquake.

Keywords: helium isotope, The Iwate-Miyagi Nairiku Earthquake in 2008