Oral | Symbol H (Human Geosciences) | H-TT Technology & Techniques

# [H-TT35_1PM1]Developments and applications of AMS techniques for earth and human environmental research

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Accelerator mass spectrometry (AMS) is a technique developed in 1977, to detect and count the small amount of nuclides in the environment, and to measure precisely the isotope ratios of the nuclides. In particular, by means of measuring rare radioisotopes in the environment, AMS techniques are applied for age measurement of samples from various application fields, such as geology, archeology and cultural properties. AMS can measure isotope ratios in the order of as low as 1.0E-10 to 1.0E-16, by the process of producing negative ions of specific nuclides by an ion source, accelerating the ions by a tandem accelerator, analyzing mass of the isotope ions by an analyzing magnet, and identifying the specific nuclides by an ionization detector. Thus AMS is used to measure isotope ratios of natural radionuclides of quite low natural abundances. AMS can be applied for studies of materials recycling and environmental science by using rare isotopes as a chemical tracer, and investigations of time sequence of tephra layers, land deposits, lacustrine and ocean sediments that are quite important for Quaternary research. This session offers a brief outlook of present status on technical progresses going on present days and interesting application programs, given by specific researchers and students engaged in AMS studies.

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## △[HTT35-P14_PG]Study on monitoring of volcanic activity using $^{129}$I / $^{127}$I ratios in crater lake and hot spring at Zao volcano

3-min talk in an oral session

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Keywords:Zao volcano, volcanic activity, crator lake, hot spring, $^{129}$I / $^{127}$I, AMS

Volcanic tremors and mountain gradient changes have been detected at Zao volcano in Miyagi and Yamagata since January 2013, volcanic activity began to intensify although Zao volcano will not erupt immediately[1]. Since the water quality of crater lake are correlating with volcanism changes[2][3], basic water quality of crater lake and hot spring at Zao volcano have been studied by the group of Tohoku University from September 2013. As a part of this project, we are trying to monitor the volcanic activity using $^{129}$I / $^{127}$I ratios (atomic ratio of radioiodine and stable iodine) in crater lake and hot spring of Zao volcano. Natural $^{129}$I (half-life: 15.7 million year) are produced by nuclear spallation reaction of $^{129}$Xe with cosmic ray in the atmosphere and spontaneous fission of $^{238}$U in the geological layer. In the ocean, steady-state $^{129}$I / $^{127}$I ratio of the seawater is estimated to be $1.5 \times 10^{-12}$[4]. Sunken iodine by the ocean plate having lower $^{129}$I / $^{127}$I ratio (older $^{129}$I age) compared to the steady-state ratio of seawater, are

supplied to the atmosphere mainly via magmatic activity. In general, $^{129}I$ / $^{127}I$ ratio in hot spring water and brine water are used as indicator of origin and behavior of iodine in the water[5][6]. $^{129}I$ / $^{127}I$ ratio of hydrothermal at Zao volcano are considered to become lower by the supply of chronologically-old iodine in terms of global iodine cycle. In September 2013, water samples of 2 L were collected from the surface of crater lake (Okama, diameter: 350 m, maximum depth: 35 m) located at 1,560 m in elevation and hot spring (Kamoshika Hot Spring) located at 1,230 m in elevation in the eastern side of Zao volcano. Water temperature and pH were measured on site. After water samples were filtered by 0.2 μ m filter, $^{129}I$ / $^{127}I$ ratio were measured for the isotopic diluted water samples by adding carrier ($^{127}I$ standard) at MALT, The University of Tokyo. $^{127}I$ concentrations were measured by ICP-MS, and original $^{129}I$ / $^{127}I$ ratio of water samples were estimated. Water temperature and pH were 10.2℃ and 3.3 at Okama; 40.0℃ and 3.3 - 4.0 at Kamoshika Hot Spring. $^{129}I$ / $^{127}I$ ratios of Okama and Kamoshika Hot Spring were respectively, estimated to be $(1.5 \pm 0.4) \times 10^{-9}$ and $(0.78 \pm 0.2) \times 10^{-9}$, 500 - 1000 times higher than the steady-state ratio of sea water ($1.5 \times 10^{-12}$)[4]. Since $^{129}I$ / $^{127}I$ ratio of anthropogenic metric water were over $9.0 \times 10^{-12}$[7], surface water of Okama and Kamoshika Hot Spring water were very likely to be strong affected by the meteoric water including anthropogenic $^{129}I$. For the monitoring of volcanic activity using $^{129}I$ / $^{127}I$ ratio, it is necessary to decide the site as few anthropogenic $^{129}I$ as possible through the measuring of $^{129}I$ / $^{127}I$ ratio of the Okama bottom water and some hot spring around Zao volcano. Continuous water quality survey of 1 - 2 times for Okama and 1 time per 1 - 2 months for hot springs are planned from June to November of this year.[1] Japan Meteorological Agency (2013) Monthly Volcanic Activity Report.[2] Ohba et al. (2000) Journal of Volcanology and Geothermal Research, 97, 329-346.[3] Ohba et al. (2008) Journal of Volcanology and Geothermal Research, 178, 131-144.[4] Moran et al. (1998) Chemical Geology, 152, 193-203.[5] Snyder and Fehn (2002) Geochimica et Cosmochimica Acta, 66, 3827-3838.[6] Muramatsu et al. (2001) Earth and Planetary Science Letter, 192, 583-593.[7] Tomaru et al. (2007) Applied Geochemisty, 22, 676-691.