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Noble gas geochemistry of hot-spring waters and gases in Korean Peninsula

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Noble gases are very useful tracers to investigate volatile elements circulation, because of their unique isotopic compositions in various reservoirs of the Earth. Depth of the subducting plates becomes large beneath Korean Peninsula, where is a transitional area from back arc region of subduction zone to continental plate. Hence, data on mantle-derived volatiles such as noble gases are very important to understand comprehensive view of volatile circulation between atmosphere and Earth's interior driven by mantle convection.

We started to investigate noble gas isotopic compositions in ground waters such as hot-springs in Korean Peninsula. Preliminary research has been carried out for 16hot-springs and underground water samples from Daejeon and its near areas in Korea last January 2004. The second survey has been performed in July from the northern to southern areas along the eastern side of the Korean peninsula. 27 water samples and 3 gas samples were collected. Noble gases dissolved in water samples were extracted in an all metal Toepler Pump system, which enabled us to measure noble gases under the condition of low blank level. The noble gases extracted from the water samples and those from the gas samples were purified by two Ti-Zr getters and separated into three fractions He, Ne and Ar-Kr-Xe by using charcoal traps and cryogenically cooled sintered stainless steel trap. He, Ne and Ar isotopic ratios and absolute abundances of all noble gases (He, Ne, Ar, Kr and Xe) were measured on a modified VG5400 noble gas mass spectrometer in the Laboratory for Earthquake Chemistry, University of Tokyo. 3He/4He ratios are in a wide range from 0.04 (Hongsung) to 3.3 (Osaek) in the unit of 10-6, though most of the hot-spring waters and gases have 3He/4He ratios lower than the atmospheric value of 1.4x10-6, suggesting dominated radiogenic 4He contribution from crustal rocks to the ground waters. 40Ar/36Ar ratios are close to or slightly higher than the atmospheric value of 296. The highest 40Ar/36Ar ratio of 309.50.31 was also found in the gas sample from the Osaek hot-spring.

By comparing with the abundant isotope data of volatiles in Japanese islands, the 3He/4He ratios of Korean hot-springs are relatively lower than those of Japan. However, most samples