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Hydrochemistry and noble gas origin of geothermal waters of Icheon and Pocheon area in South Korea

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Hydrochemical, stable isotopic (18O and D) and noble gas isotopic analyses of seven geothermal water samples, eleven groundwater samples and six surface water samples collected from the Icheon and Pocheon area were carried out to find out hydrochemical characteristics, and to interpret the source of noble gases and the geochemical evolution of the geothermal waters.

The geothermal waters show low temperature type ranging from 21.5 to 31.4 [U+2103] and the pH value between 6.69 and 9.21. Electrical conductivity of geothermal waters has the range from 310 to 735 μS/cm. Whereas the geothermal in the Icheon area shows the geochemical characteristics of neutral pH, the Ca-HCO3(or Ca(Na)-HCO3) chemical type and a high uranium content, the geothermal water in the Pocheon area shows the characteristics of alkaline pH, the Na-HCO3 chemical type and a high fluorine content. These characteristics indicate that the geothermal water in the Icheon area is under the early stage in the geochemical evolution, and that geothermal water in the Pocheon area has been geochemically evolved. The 18O and D values of geothermal waters show the range of -10.1∼-8.69%■ and from -72.2∼-60.8%■, respectively, and these values supply the information of the recharge area of geothermal waters.

The 3He/4He ratios of the geothermal waters range from 0.09×10-6 to 0.65×10-6 which are plotted above the mixing line between air and crustal components. Whereas the helium gas in the Icheon geothermal water was mainly provided from the atmospheric source mixing with the mantle(or magma) origin, the origin of helium gas in the Pocheon geothermal water shows a dominant crustal source. 40Ar/36Ar ratios of geothermal water are in the range of an atmosphere source.

Key words: hot spring water, hydrochemical composition, low temperature type, 3He/4He ratios, crustal source