Geochemical and Stable Isotopic Studies of the Hwacheon Granite
(화천 화강암에 대한 지화학 및 안정동위원소 연구)

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Oxygen and hydrogen isotopic data of whole rocks and mineral separates generally provide constraints on the nature of hydrothermal systems. We here report preliminary results of analyses of samples taken from the peraluminous granitic rocks and banded gneiss country rocks in Hwacheon area. Oxygen isotopic values for quartz and feldspar separates from the granitoids in Hwacheon area range from 8.2 to 10.6‰ and 5.8 to 8.5‰, respectively. Whole rock $\delta^{18}O$ values for banded gneiss country rocks range from 8.1 to 8.6‰. Whole rock and biotite δD values range from -84 to -113‰ and -107 to -113‰, respectively. Sulfur isotopic values for whole rocks from the granitoids and banded gneiss country rocks range from 3.47 to 8.56‰ and -4.77 to 3.01‰, respectively. Sulfur contents of whole rocks from the granitoids and banded gneiss country rocks range from 276 to 403 ppm, and 485 to 1985 ppm, respectively.

Whole rock $\delta^{18}O$ values of the granitoids in Hwacheon area are estimated to be between 6.8 and 9.6‰, which are calculated using mineral mode and $\delta^{18}O$ values of major mineral constituents of quartz and feldspar which comprise about 95 volume % of the granitic rocks of the study area. Considering that other constituent minerals such as biotite, muscovite, garnet, and chlorite tend to prefer ^{16}O to ^{18}O compared to quartz and feldspar, whole rock $\delta^{18}O$ values are not expected to be heavier than the computed $\delta^{18}O$ values. $\delta^{18}O$ values of 6.8 to 9.6‰ for the whole rocks are low compared to 'normal' value for the fresh peraluminous granitic rocks which generally have $\delta^{18}O$ values between 9.5 to 14 ‰.

In order to evaluate if the isotopic variation and low $\delta^{18}O$ values in the granitoids in the study area reflects magmatic history or if subsolidus isotopic exchange during interaction with externally derived fluids modified the isotopic systematics, $\delta^{18}O$ values of feldspar against the $\delta^{18}O$ values of quartz are plotted(Fig. 1). The spread of the data points parallel to the isotherms is explained by either crystallization and cooling of an isotopically heterogeneous pluton or significant interaction at equilibrium with an externally derived fluid. Part of the quartz-feldspar pairs indicate temperatures are probably too low to be magmatic. Quartz-feldspar Δ values $>$ 1.5‰ suggest subsolidus isotopic exchange with externally derived fluid.

Both oxygen and hydrogen isotopic data suggest that the hydrothermal systems developed in Hwacheon granites and surrounding metamorphic country rocks involved meteoric water.

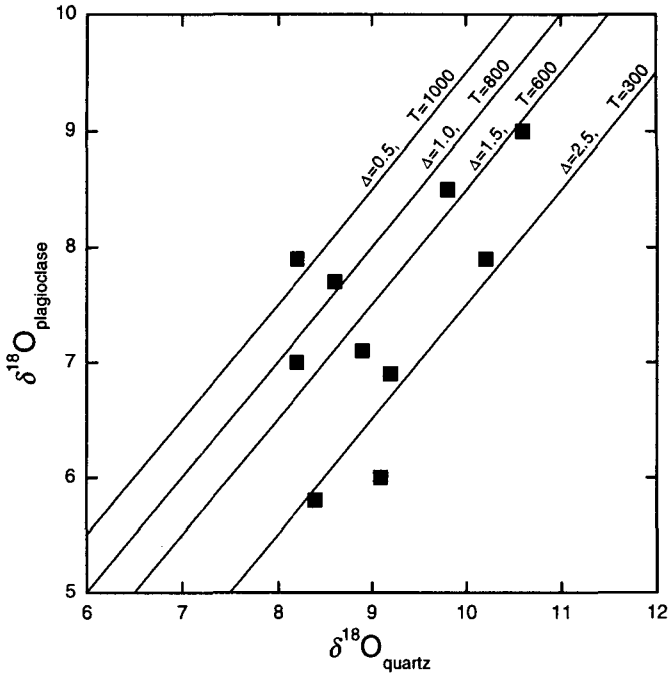

Fig. 1. Plot of the quartz vs. feldspar $\delta^{18}O$ values in granitoids from the Hwacheon area. Lines represent mineral pairs in equilibrium at different temperatures(T: ℃).