C009-P005 Time: May 28 17:00-18:30

Residual pressures of CO2 fluid inclusions in mantle xenoliths from Oki-Dogo island using Raman spectroscopy

Yoko Kawakami[1], Junji Yamamoto[2], Hiroyuki Kagi[3]

[1] Lab. Earthquake Chem., Grad. School Sci. Univ. Tokyo,, [2] LEC, Univ. Tokyo, [3] Lab. Earthquake Chem., Grad. School Sci. Univ. Tokyo

http://www.eqchem.s.u-tokyo.ac.jp/lec.html

[Introduction]

Raman spectrum of CO2 has two peaks at 1285cm-1 and 1388cm-1 due to Fermi resonance. It is known that the separation of wavenumber between the higher and the lower frequency peaks and the intensity ratio of the two peaks increase with pressure. These relationships are applicable to geological samples. Yamamoto et al. (EPSL, in press) determined density of small CO2 inclusions (5 micron) in the mantle xenoliths from eastern Siberia using a micro Raman spectrometer. According to their works, the pressures estimated from the equilibrium temperature and density of the fluid ranged from 0.96 to 1.04 GPa corresponding to depth of up to 30km, and the xenoliths may have been derived from the upper most mantle xenoliths. Residual pressures of fluid inclusions were specific to the individual host minerals (spinel, pyroxene and olivine in the order of decreasing pressure). Such difference in density of CO2 among the host mineral species can be explained by plastic deformation. That is, the pressure was decreased by plastic deformation of host mineral on the cooling process.

[Samples and Methods]

In Japan, the occurrence of spinel lherzolite as xenolith from Oki-Dogo island was reported. Fluid inclusions in mantle xenoliths from Oki-Dogo island were investigated using a Raman spectrometer in this study.

Mantle xenoliths were sampled at Kuroshima, Oku and Taira in Oki-Dogo island in August 2001. Samples were singly polished to the thickness of 300 micron. Melt inclusions and CO2 inclusions were observed in the thin slab of the samples. The states of CO2 inclusions were gas, liquid and gas+liquid. Raman spectra of CO2 inclusions were measured with an excitation beam of Ar ion laser (514.5nm). The beam size was 2 micron in diameter.

[Results and Discussion]

The density of CO2 fluid inclusions depends on the area where the samples were collected. (Taira, Kuroshima and Oku in the order of decreasing pressure). With regard to the samples from Kuroshima, densities of CO2 inclusions in pyroxene were higher than those in olivine. On the contrary, regarding to Oku, no systematic difference in the density of fluid inclusions between the two mineral species. These results throw light on the ascending process and the origin of mantle xenoliths. The degree of plastic deformation can be estimated from difference in the density of fluid among host minerals species. Actually, as to samples from Oku, ascending process was so fast that plastic deformation resulting in the difference in fluid pressure specific to minerals did not occur. On the other hand, the difference in fluid pressure specific to minerals was observed for the samples from Kuroshima. This ascending process for Kuroshima was so slow that the deformation around fluid inclusions occurred. Since fluid densities of Oku samples are lower than those of Kuroshima by comparison between the same host minerals, fluids in Oku samples were trapped to host minerals at a shallower depth than those in Kuroshima samples.