Li isotopic analyses of subduction-related mantle xenoliths from Avacha volcano, the Kamchatka arc

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Recent studies have proposed Li isotopes as a significant tracer providing geochemical information on the mantle heterogeneity and material recycling. Although recent results of Li isotopic studies on mantle xenoliths have been accumulated, it has not been clearly understood yet the behavior of Li isotopes during arc-related mantle metasomatism and/or partial melting, especially extremely light Li isotopic signature by dehydration reaction of subducting slab (Nishio et al, 2004; Zack et al, 2003). In order to elucidate the behavior of Li isotopes during subduction-related mantle matasomatism, we determined, with MC-ICP-MS, the Li contents and its isotopic ratios of mantle xenoliths from Avacha volcano, which is supposed as a fragment of mantle wedge of the Kamchatka arc.

Olivine and pyroxene grains were hand-picked carefully under a binocular microscope from harzburgite xenoliths and pyroxenite vein samples, and ultrasonically washed for 50 min in Milli-Q water in order to eliminate surface contamination. Digestion of powdered mineral separates and column separation of Li principally followed the procedure by Nishio and Nakai (2002). In order to recover all Li and minimize co-existent ions, elution pattern of Li was examined. Purified Li solutions were analyzed with MC-ICP-MS at Earthquake Research Institute, University of Tokyo, and the intensity of 7Li ions for 50 ng g-1 Li solution was 11 pA, and for background 0.4 pA, respectively. Delta values (delta7Li) of samples were calculated by normalization of isotopic ratios of 50 ng g-1 Li standard solution (NIST L-SVEC).

As a preliminary result, the Li contents and delta7Li values of olivine grains from harzburgite xenoliths range from –1 to +4 permil with about 1 ppm of Li contents, and clinopyroxene separate from pyroxenite vein represents delta7Li value of about +2 permil. No distinct difference of the Li contents and delta7Li values was observed between olivine grains of primary harzburgite xenoliths and metasomatized ones. All analyzed samples are depleted mantle xenoliths, and give delta7Li values slightly lower than that of average MORB (the depleted mantle), +4 permil. Together with the intermediate delta7Li values of pyroxenite vein, these lower delta7Li values of olivine grains suggest that slight fractionation of Li isotopes may occur during partial melting or result from primitive heterogeneity of the mantle, rather than during mantle metasomatism that involves the hydrous metasomatic agent released from the subducting slab. Further Li isotopic analyses of pyroxene co-existing with olivine, will also provide more specific constraints on the behavior of Li isotopes during mantle metasomatism because olivine is affected by later process such as alteration more easily than pyroxene. Investigation on Li isotopic fractionation among minerals during the formation of mantle xenoliths as well as its fractionation during metasomatism will also be proposed as a further study.