Halogen (Cl, Br, I) geochemistry in Mid-Ocean Ridge basalts from the Australian-Antarctic Ridge (AAR)

Yun Seok Yang

Yun Seok Yang[1,2], Jung Hun Seo[2], Sung Hyun Park[1], Taehoon Kim[1]

[1]Korea Polar Research Institute, Korea
[2]Inha university, Incheon, Korea

zinid@kopri.re.kr and seo@inha.ac.kr

ABSTRACT

Australian-Antarctic Ridge (AAR) is an extension of easternmost SE Indian Mid-Ocean Ridge (MOR). We collected basaltic glasses from the in-axis of the MOR (**in-axis**: KR1 axis and KR2 axis), the off-axis seamounts (**seamount**), and the overlapping zones of MOR and seamounts (**KR1 mixing**). Halogen concentrations and ratios in the basaltic glasses are important to understand a mantle metasomatism and its volatile recycling. (Kendrick et al., 2012) Previous qualitative analyses of halogen elements by SIMS indicate that the basaltic glasses from the AAR contain detectable halogens (F, Cl, Br, I). We synthesized the halogen-bearing glasses, and determined its halogen concentrations by Rutherford Backscattered Spectroscopy (RBS) and LA-ICP-MS. The synthesized basaltic glasses (SRM 5 and SRM test 7) were adopted as the external standard reference materials (SRM) for LA-ICP-MS microanalyses of the halogens in the natural AAR basaltic glasses.

The AAR basaltic glasses contain MgO of 1.7~8.3 wt%. The concentrations and ratios of K_2O, Cl, Br, I and Th/Sc in the glasses increase during decreasing MgO concentrations (magma fractionation), while the patterns in the K_2O and Th/Sc are different between the in-axis and the KR1 mixing. Halogen concentrations in the glasses of the KR1 mixing area are relatively higher compared to the in-axis and the seamount area. The Br/Cl ($\times 10^{-3}$) ratios tend to decrease in the in-axis and increase in the KR1 mixing during decreasing MgO concentration. The Cl/Br and Th/Sc ratios in the in-axis region and in the KR1 mixing region show positive and negative correlations, respectively. While the halogens contents in the AAR glasses change in all regions, the Cl contents are the least variable compare to the other halogens such as Br and I. The glasses in the KR1 mixing contain higher Br concentrations compared to the other area, indicating somewhat different magma sources in the in-axis area and the KR1 mixing area. The Br-rich glasses in the KR1 mixing zone might be explained by a recycled Br-rich oceanic slab of paleo-subduction or by a hydrothermal alteration in the AAR. The K/Cl and K/Ti ratios in the AAR glasses are similar to the basalts from the Galapagos Spreading Center (GSC), a well-known area for an interaction between MOR and hotspot magma (Geldmacher et al., 2010).

The halogens and the trace elements in the basaltic glasses suggest a geochemically complicated upper mantle underneath the AAR.