Study on halogen element in basalts from the Australian-Antarctic Ridge (AAR)

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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) and the overlapping zones of MOR and seamounts (KR1 mixing). Determination of halogen concentrations and ratios in basaltic glasses from 52 primitive magma (> 6 wt% MgO) and 3 evolved magma from Australian-Antarctic Ridge (AAR) provide insight into the mantle metasomatism and its volatile recycling.

K_2O and Th/Sc contents broadly correlate decreasing MgO concentration. The Br/Cl ($\times 10^{-3}$) ratios tend to decrease in the in-axis and increase in the KR1 mixing during decreasing MgO concentration. Incompatible element ratios like La/Sm in magma differentiation are constant so the ratios are important to understand mantle composition. The glasses contain La/Sm ratios are 0.95 ~ 3.28.This ratios suggest that AAR basalts are classified T-MORB and E-MORB. La/Sm ratios well correlate strongly incompatible elements such as U, Ba, Nb, whereas weakly compatible elements such as Sc, Eu, Mg is reversely correlated and Cl/Sm ratios in low variation is similar to pattern of weakly compatible elements.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 Cl/Br and Th/Sc ratios in the in-axis region and in the KR1 mixing region show positive and negative correlations, respectively. 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 because Br is enriched in the ocean and oceanic crust.

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)) and Pacific MORB. The AAR region closely located Balleny hotspot and Pacific-Antarctic Ridge. K_2O/Nb and Zr/Nb ratios are very low in comparison with near Pacific-Antarctic Ridge and Southeast Indian Ridge and also similar to the Balleny hotspot.

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