Diffusive infiltration of hydrogen into plagiocalse xenocryst taken by H_2O-rich rear-arc basaltic melt

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Plagioclase is one of the most common phenocrysts in basaltic rocks and one of nominally anhydrous minerals (NAMs) that accomodates hydrogen up to around hundred wt. ppm H_2O. Hydrogen diffusivity in volcanic plagioclase can be applied to estimate degassing process of erupting magmas. In addition to losing hydrogen from plagioclase, hydrogen may infiltrate into plagioclase from ambient hydrous magma. In this paper, an example of diffusive infiltration into plagioclase xenocryst taken by hydrouys arc basaltic magma is presented.

Kuritani *et al*. (2013, *Mineral. Petrol.*) and Kuritani *et al*. (2014, *Contrib. Mineral. Petrol.*) estimated genetic condtions of primary arc magmas beneath Iwate volcano (a frontal arc volcano in NE Japan arc) and Sannome-gata volcano (a rear-arc volcano in NE Japan arc) based on geochemical analyses of volcanic rocks and numerical simulation. They estimated that H_2O concentrations of primary melts are 4-5 wt.% beneath Iwate volcano and 6-7 wt.% beneath Sannome-gata volcano, respectively. Their arguments mean that primary melts beneath frontal-arc volcanoes and rear-arc volcanoes are both H_2O-rich, yet there has been no direct evidence to support their arguments at Sannome-gata volcano because volcanic rocks are either almost aphyric and/or almost no melt inclusions were found.

In this study, plagioclase xenocrysts were separated from scoria which erupted from the Sannome-gata volcano 20,000-24,000 years ago. Composition of the core is homegeneous and ranges from An30 through An35. The rim is 150 to 200-μm-thick dusty zone whose composition is around An60, suggesting rapid crystallization from degassed basaltic melt. The profile of infrared absorption area pear unit thickness across the plagioclase core were obtained using Fourier Transform InfraRed spectrometer (FTIR). The inner core contains hydrogen about 30 wt. ppm H_2O, and hydrogen concentration elevates at outer core. Hydrogen concentration at the outermost core of plagioclase is >100 wt. ppm H_2O, suggesting that plagioclase xenocrysts were taken by hydrous basaltic melt (H_2O>5 wt.%) and hydrogen diffused into plagioclase before the eruption. These analytical results confirm that rear-arc primary magmas are H_2O-rich as well as that of frontal-arc magmas at NE Japan arc.