F and Cl-rich, high-K_2O magma batch injection into crystal-rich reservoirs of andesitic volcanoes in back-arc of central Japan: Melt inclusion evidence for source heterogeneity

Y. YAMAGUCHI[1]* AND H. HARADA[1]
[1]Shinshu University, Matsumoto 390-8621, Japan
(*correspondance: yoshia_ygutti@d4.dion.ne.jp)

In andesitic rocks from back-arc volcanoes in central Japan, observations of small-scale heterogeneities of the groundmass reveal that high-K_2O magma often injected into the crystal-rich reservoir beneath the volcano. The high-K_2O magma batches mostly mingled with the semi-solidified calc-alkaline crystal mush and partly remained unmixed as the isolated high-K_2O domains in the interstices of the mush. Medium to high-K_2O andesitic rocks (Myoko, Kumonotaira, Tateyama, and Shirouma-kazafukidake volcano) commonly include small-scale high-K_2O domains (quenched glass + fine micro-crystalline anorthoclase), in addition to the ordinary medium-K_2O matrix glasses.

Melt inclusions of high-K_2O basaltic-andesitic compositions (51-64 wt% SiO_2) are trapped in olivine and/or clinopyroxene phenocrysts from Asama (1108 A.D.), Myoko (40 ka), and Shirouma-kazafukidake volcanoes (40 ka). The melt inclusions have characteristically high-K_2O(3.6-5.7 wt%, absarokite-shoshonite series) and high Cl (2300-13000 ppm) concentrations, and occasionally contain high F (240-2000 ppm), S (300-3000 ppm) and P_2O_5 (0.5-1.7 wt%).

Kannoki Scoria (40 ka) in Myoko volcano typically has the F and Cl-rich, high-K_2O melt inclusions and the heterogeneous groundmass. The scoria samples include two different types of clinopyroxene phenocryst, a clear clinopyroxene and a dusty clinopyroxene. The former is free from the high-K_2O melt inclusion. In contrast, the later dusty clinopyroxene shows strong zoning by repeated corrosion and growth, entrapping the F and Cl-rich, high-K_2O melts of absarokite-shoshonite compositions in the growth zones. In addition, the scoria also includes two types of olivine phenocrysts. Olivine (68-75 Fo%) includes ordinary medium-K_2O basaltic melts (1.0-1.5 wt% K_2O), whereas low-Fo olivine (55-61 Fo%), by contrast, traps the similar high-K_2O basaltic-andesitic melts (1.9-5.0 wt% K_2O).

These observations and microprobe analyses likely suggest that the F and Cl-rich, high-K_2O magmas generated in a metasomatized deep mantle wedge (above the subduction slab of 150-220 km depth), possibly veined by phlogopite and/or apatite-bearing dykes. Probably, the high-K_2O magma repeatedly input into the crustal reservoirs and contribute to the increase in K_2O content of andesitic products in the back-arc region of central Japan.