Magma feeding system in subduction-related arc magma :a case study of Miyakejima Volcano.

Kenji Niihori[1]

[1] Graduate school of Science and Technology, Chiba Univ.

The genesis of mafic magma in subduction-related arcs has been difficult to explain. This results, in part, from the rare direct measurements of the pre-eruptive major elements and H2O contents of mafic arc liquids. To investigate the differentiation processes and the variation of dissolved water content in subduction-related magma, compositions of volcanic rocks and melt inclusions from Miyakejima Volcano, Izu-Mariana arc, were measured. Miyakejima Volcano was a suitable study area for the investigation of a series of differentiation processes, because eruption history and whole-rock chemistry were reported, and melt inclusions in magnesian olivine(Fo78-84, Fo=Mg/(Mg+Fe)x100) were present.

The variation of whole-rock Mg# (=Mg/(Mg+Fe)x100) versus erupted age show an abrupt increase of the ratio with a mild decrease. Abrupt increase of whole-rock Mg# suggests that undifferentiated magma was supplied to the magma plumbing system underneath the Miyakejima Volcano, which was slowly differentiating. This undifferentiated magma carried olivine (Fo78-84) and plagioclase (An88-93, An=Ca/(Ca+Na+K)x100) phenocrysts from deeper magma reservoir. Major elements and H2O were analyzed in melt inclusions of these phenocrysts with EDX and FTIR, respectively. These analyses indicate that these phenocrysts crystallized under H2O-rich condition (about 2wt.%) in deeper magma reservoir. On the other hand, a mild decrease of whole-rock Mg# can be explained basically by fractional crystallization under H2O-poor condition (less than 1wt.%) in shallower magma reservoir.

A model for magma feeding system in Miyakejima Volcano: 1, H2O-rich, undifferentiated magma ascends from deeper magma reservoir at the beginning of the petrological stage. 2, H2O-rich magma would mix with differentiated magma. 3, Mixed magma would differentiate by fractional crystallization.

In other subduction-related volcanoes, it is known that calcic plagioclase (An88-) and magnesian olivine (Fo78-) phenocrysts occur. The compositions of melt inclusions in these phenocrysts are consistent with those of Miyakejima Volcano and similar phenomena are suggested to occur in subduction-related volcanic system.