Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SVC063-13 Room: 201B Time: May 24 13:45-14:00

Magmatic system of historic eruptions of Sakurajima volcano

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Sakurajima is a post caldera volcano of Aira Caldera, southern Kyusyu. It repeated plinian eruptions and effusion of lava flows from flank craters in 764AD, 1471AD, 1779AD, 1914AD and 1946AD, and then vulcanian eruption started mainly from the summit area since 1955AD. We analyzed whole-rock and mineral compositions of eruptive products since 1471AD and clarified the mixing components of each eruption. The historic rocks of Sakurajima volcano consist of SiO2 =59-68 wt.% andesitic and dacitic rocks with plagioclase, orthopyroxene, clinopyroxene, magnetite, and minor olivine phenocrysts only after the 1914AD eruptions. The SiO2 contents of these rocks decrease with time and whole-rock compositional trends of historic lavas are divided into 1471AD and 1779AD, and after 1914AD. All of these rocks have evidences of magma mixing and phenocrysts are classified into 3 types: most felsic F-type (An55 plagioclase, Mg#=65 orthopyroxene, Mg#=70 clinopyroxene and Mg/Mn=5 magnetite), intermediate A-type (An80 plagioclase, Mg#=70 orthopyroxene, Mg#>72 clinopyroxene and magnetite) and basaltic B-type (An>85 plagioclase Fo74~80 olivine). Examining the phenocrysts of each eruption, there usually exist crystal-clots consisting of the F-type and A-type phenocrysts in all the historic eruptions. During the 1471AD and 1776AD eruptions, the F-type and A-type magmas mixed homogeneously to form phenocryst rims of constant composition. In opposite, the B-type magma also related to the eruptions after 1914AD. The rim compositions of these rocks are widely scattered, suggesting that magma mixing would have occurred just before the eruptions. We also recognized that the amount of the A-type phenocrysts increase and the F-type phenocrysts become more mafic since 1 471AD. From these evidences, we suppose that geophysical magmatic systems of 10km depth of Aira caldera that continuously tapped from the deeper part correspond to the petrologically recognized F-type and A-type magmas, respectively. The ratio of A-type magma should increase and F-type magma became more mafic by the intrusion of A-type magma. The B-type magma would intrude from the deeper south to the shallow magmatic system beneath Sakurajima volcano just before the eruption. The 1914AD lavas that relatively abundant in B-type phenocrysts have low Sr isotopic ratio, suggesting that a primary magma of the B-type magma is different from the F-type and A-type ones.

Keywords: Sakurajima volcano, historic eruptions, magmatic system, structure, evolution