[EE] Evening Poster | S (Solid Earth Sciences) | S-VC Volcanology

[S-VC39]Pre-eruptive magmatic processes: petrologic analyses, experimental simulations and dynamics modeling

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Processes leading to volcanic eruptions are central and yet still enigmatic issues in volcanology. Recent advances in understanding thermo-mechanical and open-system behavior of magma reservoirs and mineral zoning stratigraphy allow us to take a step forward to reveal the complex incubation processes during volcanic dormancy and following magma chamber tapping. This session aims at putting together recent knowledge on magmatic processes including 1) magma chamber evolution through magma reintrusion, crystallization-induced volatile exolution, magma mixing and gas fluxing, 2) externally-driven eruption trigger mechanisms, and 3) conduit processes and controls on eruption styles such as outgassing, dehydration-induced crystallization, fragmentation and rheological transition of ascending magmas. We welcome contributions based on petrological, mineralogical and geochemical analyses of pyroclasts and volcanic gasses, experimental simulations of magma reservoir conditions and conduit flow dynamics, and numerical modeling to integrate the elementary processes.

[SVC39-P10]Preeruptive magmatic process inferred from compositional zoning of pyroxenes: In the case of Sakurajima volcano, Japan.

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Sakurajima volcano, located in southern Kyushu, is one of the most active volcanoes in Japan. The large plinian eruptions followed by lava flows occurred at the flank in 1471-1476, 1779 and 1914-1915. After the lava effusion in 1946, the vulcanian eruption started at the summit crater in 1955. After that, the summit eruptions have been continued until 2017. We carried out petrological investigations and indicated that the 1471-1476 and 1779 juvenile materials are the mixing products between dacitic and andesitic magmas, and that basaltic magma has been also active since the 20th century. Repeated input of basaltic magma could induce the vulcanian eruptions at the summit. However, the detailed preeruptive magmatic process (magma accumulation and eruption process, etc) during the historical activity is still unknown. In order to examine the magmatic process before each eruption, we focus on the zoning profiles of pyroxene phenocrysts.

Sakurajima historical juvenile rocks are augite-hypersthene andesite and dacite. The juveniles since 20th century also have a small amount of olivine phenocrysts. The core compositions of orthopyroxene phenocrysts in the 1471-1476 and 1779 rocks are Mg#58-65 with a peak of Mg#63 and Mg#63-68 with a peak of Mg#65, respectively. The former show normal zoning, whereas the latter have normal and reverse zoning. In contrast, in the 1914-2015 rocks, orthopyroxenes show relatively wide core compositions, in the range of Mg#63-78 with a peak of Mg#67. Their rims also show wide variations.

Most of them range Mg#65-75 showing normal and reverse zoning. The phenocrysts showing reverse zoning with Mg# >70 rims increase in younger rocks, and the ratio of phenocrysts with reverse zoning is larger than those with normal zoning in the 2009-2015 rocks.

On the BEIs and line profiles of orthopyroxene phenocrysts, the phenocrysts in the 1471-1476 and 1779 rocks show gradual compositional zoning from the inner part (Gradual type). Similar types of phenocrysts are also found in the 1914-1915 rocks. However, some of them have relatively clear reverse zoning at c. 50 micron from the rim, which often become less magnesian again in the outermost part (Reverse type-1). This type is also present in the 1955-1999 rocks and their population increase. In addition, we recognize several phenocrysts having thin (less than 10 micron) magnesian rim (Reverse type-2) in the 1955-1999 rocks. Reverse type-2 are often found in the 2009-2015 rocks, which show sometimes repeated reverse zoning.

Considering the compositional zoning of orthopyroxene in addition to our previous petrological studies, we interpret their variations as follows. Because mixing between dacitic and andesitic magmas occurred a long time before the eruption, elemental diffusion progressed in the orthopyroxene in the 1471-1476 and 1779 rocks, resulting in the formation of Gradual types. Those in the 1914-1915 rocks could be also formed under the similar process. The long dormancy among these large eruptions (~ several hundred years) suggesting magma accumulation is consistent with our interpretation. In contrast, basaltic magma also injected into magma system since the 20th century. This input is recorded as reverse zoning. Reverse type-1, relatively wide reverse mantle with normal zoning in the outermost part, suggests the there is some amount of time from input of basalt to eruption. Reverse type-2 indicates the basalt input just before the eruption. Reverse type-1 is often found in the 1914-1915 rocks, and Reverse type-2 is occurred in the 1955-1999 and the 2009-2015 rocks. This suggests that it took a relatively longer time to occur the 1914-1915 eruption after basalt input than the vulcanian eruptions at the summit, which occurred immediately after the repeated basalt input. This might reflect the difference of magmatic process between plinian and vulcanian eruptions in Sakurajima volcano.