[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-P03]Microanalytical evidence for Quaternary magma dynamics of crystal-rich and crystal-poor dacitic magma beneath Yotei Volcano, Hokkaido

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The Western Hokkaido Volcanic Complex (WHVC) is a cluster of calderas and composite volcanoes, that define one of the most frequently explosive and hazardous Quaternary volcanic fields in Japan. The youngest volcano in the WHVC is Yotei volcano a dacitic–andesitic stratovolcano, (Kashiwabara et al., 1976; Uesawa et al., 2016). Here, explosive eruptive activity during the last 50,000 years is recorded in 43 tephra units, distributed primarily eastwards, that define two distinct stages (Uesawa et al., 2016). Stage I (~54–46 ka) is characterized by crystal rich dacites (6.3–41.3 wt% crystals), while Stage II (~38–2 ka) tapped crystal poor dacite (1.4–14.5 wt%). The transition from Stage I to II also marks a major change in the magnitude and explosivity of eruptions, with Stage II being characterized by smaller more frequent eruptions. A full understanding of the volcanic hazard of Yotei therefore requires that the magma dynamics of the transition be addressed. Here we report initial results of this investigation, that focus on electron microprobe (EMP) analysis of major mineral phases from the largest eruptions of each stage, Y37 of Stage I and Y25 of Stage II, and from precursor eruptions of Y25, Y26, Y27 of Stage II.
The Y37 fall deposit (~47 ka) is composed of white pumice, grey pumice, banded pumice, and scoria. The dominant white pumice is a crystal rich (34 wt%) dacite (SiO_2 = 66.5 ± 0.7wt%) containing plagioclase, hornblende, quartz and Fe-Ti oxides. The Y25 tephra (35.8 ± 0.4 ka) is also composed of white pumice, grey pumice, banded pumice and scoria, but the dominant Y25 white dacite pumice (SiO_2

= 66.9 ± 0.8 wt%) is crystal poor (3.9 wt%) with a mineral assemblage of plagioclase, orthopyroxene, clinopyroxene and Fe-Ti oxides. Like Y25, Y26 (36.4 ± 0.1 ka) is composed of poorly-phyric white dacite pumice (SiO_2 = 65.1 ± 0.2 wt%), grey pumice, banded pumice and scoria, and the white dacitic pumice contains the same minerals as Y25. Y27 (36.5 ± 0.1) is composed of basaltic andesitic scoria (SiO_2 = 55.3 ± 0.2 wt%) and include the same minerals as Y25 and Y26. Glomerophric clots of pyroxene and plagioclase are found in all eruptions.
EMP analysis reveals their difference of mineral compositions among these eruptive products. Plagioclase in the Y37 dacite has a bimodal population of cores; one group An = 38–61 and the second group with An 70–91; whereas placioclase core in Y25, 26, and 27 reveal narrow ranges of An = 50–60, 50–68 and 72–90 respectively. Calculated P–T conditions of pre-eruptive magma of Y37 shows shallower and cooler conditions (828–852 ℃ and 99–175 MPa using Hb thermo-barometer; Ridolfi et al., 2010) than that of Y25, Y26 and Y27 (959–968 ℃, 610–730 MPa; 978–996℃, 390–580 MPa; 1048–1062 ℃, 470–480 MPa, respectively based on two-pyroxene pairs; Putirka, 2008). Calculations using Fe-Ti oxides (Ghiorso and Evans, 2008) provides lower temperature than that of other calculation methods such as 727 ℃ (Y37), 917 ℃ (Y27), 957 ℃ (Y26). Pyroxene pairs in clots show Mg#(cpx) <0.75 and some of these have K_D <0.95, suggesting sub-solidus re-equilibrium. U-Pb dating of zircon from the Y37 dacite reveals a trimodal population distribution (20–25 Ma, 6–15 Ma and younger than 3 Ma).
These data suggest systematic magma dynamics beneath Yotei volcano. The crystal-rich, large magnitude explosive Stage I represents upper crustal (~5 km) pre-eruptive conditions. The textural maturity, complex zircon U–Pb age populations and bimodal An contents of Y37 dacite suggest remobilization of older granitic precursors by recharging andesitic magma. On the other hand, Stage II dacites represent deeper condition (12 to 15 km) as well as Y27 andesite. Crystal clots appear to contain antecrysts and xenocrysts liberated from deep mafic mush zones and distributed throughout dacitic and andesitic melt extracted from parental source magmas.