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

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

convener:Michihiko Nakamura(Division of Earth and Planetary Materials Science, Department of Earth Science, Graduate School of Science, Tohoku University), Akihiko Tomiya(Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology), Shanaka L de Silva (共同), Fidel Costa(Earth Observatory of Singapore, Nanynag Technological University)

Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

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-P09]Very shallow magma storage depths at Sakurajima Volcano revealed from melt inclusions and plagioclase-melt hygrometer

*Naoki Araya[1], Michihiko Nakamura[1], Satoshi Okumura[1], Atsushi Yasuda[2], Daisuke Miki[3], Masato Iguchi[3], Nobuo Geshi[4] (1.Department of Earth Science, Graduate School of Science, Tohoku UniversityUniversity, 2.Earthquake Research Institute, University of Tokyo, 3.Sakurajima Volcano Research Center, Disaster Prevention Research Institute, Kyoto University, 4.Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology)

Keywords:Sakurajima Volcano, magma storage depths, water content, melt inclusion, plagioclase-liquid hygrometer

To understand the mechanism of present eruptive activity and to forecast possible future eruptions at Sakurajima Volcano, it is crucial to understand pre-eruptive magmatic conditions of recent Vulcanian and historic Plinian eruptions (AD 1471–1476, 1779–1782, and 1914–1915). Araya et al. (2017, IAVCEI) reported volatile contents of melt inclusions in pyroxene and plagioclase phenocrysts in Plinian pumices (1.4–3.0 wt% H_2O in >95% of inclusions, no detectable CO_2). These water contents correspond to saturation pressures of 19–74 MPa and 0.9–3.3 km depth. To further constrain pre-eruptive melt water contents, we applied the plagioclase-liquid hygrometer from Waters and Lange (2015, Am. Mineral.) to plagioclase phenocryst rim and neighboring interstitial groundmass glass pairs obtained from historic Plinian and some recent Vulcanian pumices. Calculated melt water contents are interpreted to record final magma emplacement depths at which the phenocryst rims grew. Groundmass glass is dacitic to rhyolitic in composition. Core zones of plagioclase phenocrysts show complex zoning patterns with a wide compositional range ($An_{\sim 50\–90}$). Marginal zones are relatively chemically uniform, with a compositional distribution peak around $An_{53\–60}$. Melt water contents for three Plinian eruptions were calculated to be 1.1–3.6 wt%, irrespective of eruption age, and are in good agreement with water contents determined from melt inclusions. In contrast, calculated melt water contents for Vulcanian eruptions (1.5–3.0 wt%) are higher than measured contents of melt inclusions (mostly less than 1.5 wt%; Sakauchi et al., 2017, JpGU). This is probably related to slower rates of magma ascent in the Vulcanian eruptions compared to the Plinian eruptions. Here, melt inclusions were subjected to diffusive dehydration, whereas dehydration-induced growth of plagioclase rim did not catch up with decompression.

Our petrological investigation demonstrates that both Plinian and Vulcanian magmas were stored at similar depths of ~1–3 km. This storage depth is shallower than previous estimates based on the pressure source for geodetic deformation upon Vulcanian explosions, a seismic attenuation anomaly, and an aseismic zone (4 km; Iguchi et al., 2013, Bull. Volcanol. Soc. Japan). Rather, our analyses suggest storage in a conduit. This is consistent with the observation that the present conduit has a diameter broad enough to supply the historic Plinian eruptions (300–500 m; Iguchi et al., 2013, Bull. Volcanol. Soc. Japan). Earlier work on the 1914–1915 Plinian eruption suggested that magma ascended from the main deep magma reservoir beneath the Aira caldera (~10 km in depth), as ground subsidence was detected around the caldera after the eruption. However, our petrological analyses indicate that the historic Plinian eruptions were fed directly from the thick conduit rather than the main deep reservoir, which recharged the shallower magma feeding system after the eruption. Detailed observation on the shallow conduit system, in addition to the main deep magma reservoirs, may provide essential information to forecast the next large eruption.