Volcanic gas composition of Sakurajima volcano, Japan

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Sakurajima is the most intensively degassing volcano in Japan with large SO_2 flux and frequent eruptions for several decades. We conducted volcanic gas composition measurements applying Multi-GAS and alkaline-filter techniques at Sakurajima volcano. W cannot access to the summit area of the volcano because of the frequent eruption and we applied various techniques to approach the volcanic plume at Sakurajima, including 1) air-borne measurement with a Cessna aircraft, 2) air-borne measurement with an unmanned helicopter and 3) automatic measurement at a flank of the volcano. Accuracy of the estimated gas composition depends on measured volcanic gas concentration which is quite variable depending on wind speed, direction, volcanic activity and distance from the summit crater.

We started the measurement in 2012. Until the early 2015, Sakurajima volcano continues the intensive persistent degassing with SO_2 flux larger than 1,000 t/d and with frequent explosions at Showa crater, but SO_2 flux decreased to around 100 t/d in the late 2015 with quite limited number of explosions. The volcanic gas compositions were more or less constant during the high flux period. The estimated average composition is; CO_2/SO_2 = 0.5, H_2O/SO_2=110, SO_2/H_2S=8, H_2/SO_2=0.15 and SO_2/Cl=10 (mol ratio). This composition is similar to composition of other high-temperature gases in Japan with an exception of larger H_2O/SO_2 than others (i.e., about 40 at Asama, Miyake and Aso volcanoes). The SO_2/Cl ratios vary 5-20, which is consistent with the SO_2/HCl ratios measured in 2009-2013 by FT-IR for the gas plume from the Showa crater (Mori et al., 2004). During the low flux period in the late 2015 and the early 2016, we obtained much lower SO_2/H_2S ratios of 0.6-2.5 than those during the high flux period. The low values can be caused by various reasons, however, most likely cause might be pressure difference of magma degassing. Since SO_2/H_2S ratio at constant oxygen fugacity and temperature inversely proportional to pressure, 10 times increase of the degassing pressure can cause the ten times decrease of the SO_2/H_2S ratios.