

## **Magma degassing, oxidation, and gas adsorption processes during a series of ash eruptions in progress at the Sakurajima volcano, Kagoshima, Japan**

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In order to understand magmatic processes near the top of a volcanic conduit, we examined more than 100 ash samples from the Sakurajima volcano erupted during 1981 to 2012. We describe variations in the color and the amount of leachates for ash samples that were collected shortly after an eruption without having been exposed to rain. Chemical analysis of ash leachates (Cl, F, and SO<sub>4</sub> contents) was performed using an ion chromatograph on aqueous solutions prepared from the ash and deionized water. The color analysis was performed using a colorimeter on bulk ash, on separated finer ash fractions, and on finely ground coarser ash fractions. We also obtained SEM images, XRD on finer fractions, and EPMA data on polished ash sections, as well as time and date of each eruption.

The amount of leachates extracted from ash sample varies by nearly three orders of magnitude over the entire range of sampled eruptions through time and exceeds, especially the sulfur, range of the same chemical compounds dissolved within the original melt. The long-term temporal change was observed as follows. Based on the amount of leachates present, ash samples are classified into two major groups: one is with a molar S/Cl ratio of  $\sim 10$ , and the other with S/Cl of  $\sim 1$  and that is relatively depleted in S. Ash samples erupted during 1981-1991 from the Minami-dake summit crater belong to the latter group. Ashes erupted from the Showa crater in early 2008 belong the former group, of which the S content was found to decrease systematically through time, and in 2011, ashes of the latter group erupted for the first time from this crater. Based on the coloration, ash samples in this study are classified into two groups: one is yellowish color, the other is less yellowish. The coloration of the former group can be explained by the existence of yellowish native sulfur as well as other hydrothermally altered minerals that were subsequently confirmed using X-ray diffractometer. Short-term temporal change was also defined based on the following observations: (1) positive correlations between the interval of successive eruptions and both the yellowness and the amount of ash leachates were observed; (2) the lower the total amount of ash leachates present and the lower the yellowness of the ash; and (3) the ratio of altered to the unaltered ash particles is higher in cases where the ash deposits resided for a longer repose time before the eruption, and this ratio drops correspondingly (and rapidly) with a drop in the repose time.

Our interpretation is that the observed temporal changes in volcanic ash result from a transition in the amount of fumarolic sulfur accumulation in partly solidified magma near the top of volcanic conduit, which may reflect the mean residence time of the magma. The magma probably periodically renewed in response to ash eruption and/or magma convection near the top of the volcanic conduit.