

Permeability measurements of heated and unheated ash erupted from Aso Volcano

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The eruption of the Aso Volcano during 2014-2016 is mainly classified into ash eruption but Strombolian eruption, erupting scoriae rather than ash, is also observed (e.g., Yokoo and Miyabuchi, 2015). Such a transition may depend on the generation of ash and physical properties of the ash layer at shallow conduit. Ash once erupted out from the vent sometimes falls back. The reheated ash may stick together, that increases its strength and decreases its permeability. In order to characterize this process we heated the ash sampled from Aso Volcano sieved with a $53\ \mu\text{m}$ mesh at high temperature (950°C , 700°C , and 500°C) under normal stress of 26kPa . Only when the temperature is high enough (950°C), the ash stick together to be an ash plate. Next, we measured the permeability of this ash plate and unheated ash by using gas flow. The permeability of the ash plate is less than $2 \times 10^{-13}\ \text{m}^2$, while that for ash is larger than $10^{-11}\ \text{m}^2$; i.e., heating decreases the permeability of ash more than 2 orders of magnitude. Interestingly, the unheated ash particles can freely move in the container during the permeability measurements. This effect allows making pipe-like structures in the ash layer and increases its permeability with flow rate. Our measurements suggest that the sticking of ash can occur at 950°C even under low normal stress, as low as 1m thickness of an ash layer. Once the sticking of ash particles occurs, that inhibits the movement of ash particles and restrict the gas flow in the ash layer.

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