Permeability measurements of lava dome speciments of Yakedake

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The style of volcanic eruption is controlled by the amount of volatile components (mainly H2O). A volatile-rich magma will erupt explosively, on the other hand, a volatile-poor magma will erupt effusively. In most cases, magmas at the depths contain a sufficient amount of volatile components to cause explosive eruption. The volatile amount at the surface is controlled by the competition between the magma ascent and the escape of volatile components. In order to understand the escape mechanisms of gas, we investigated the permeability and the pore structure of lavas with relatively low porosity.

Specimens are andesitic or dacitic lavas from Yakedake (Gifu and Nagano Prefectures). Three cylindrical specimens (D=25mm, L=30mm), which are perpendicular each other, were cut from one collected rock sample. The steady-flow method was employed for measuring the permeability. The Nitrogen gas (Maximum pressure = 1MPa) was used as a working fluid. The porosity was estimated from the bulk density and the average density of andesitic magma (2.6 g/cm3).

The permeability steeply increases from 1e-17 to 1e-12 (m2) as the porosity increases from 20 to 40 %. This implies that the connectivity of pores increases with the increase in the pore volume. Microstructural observation was done with three specimens with the similar porosity (22-27%) and different permeabilities (6e-16, 3e-15, 3e-14 m2). The specimen with higher permeability has larger and more deformed pores, suggesting that the deformation of pores accompanying their growth contributes to the interconnectivity of pores.