

Textural Analysis of Volcanic Ash: Preliminary Results and Implications for Water Retention and Gas Scavenging in Eruption Plumes

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A detailed understanding of gas scavenging pathways in eruption plumes is necessary to account for the atmospheric impact of volcanoes. Interaction of silicate ash with gases is believed to be a significant pathway for SO₂ and HCl removal, possibly through dissolution into condensed water. Knowledge of the textural properties (specific surface area and porosity) of volcanic ash is a prerequisite to quantify this process. Such data have been obtained by conducting N₂ and water vapor adsorption experiments on six ash samples (< 100 microns). The results of the N₂ adsorption-desorption isotherms indicate that the ash had small surface areas ranging between 1 and 2 m²/g, except one sample with a surface area of 10 m²/g. Calculated pore size distributions for the ashes suggest that macropores with sizes greater than 400 angstroms are predominant. Consequently, gas adsorption onto ash should occur predominantly as multilayer adsorption. The ash surface areas determined from the water vapor adsorption experiments were comparatively higher, with values in the range 3.7-14.0 m²/g. This behavior is attributed to hydration of the ash surface or access of water to internal and trapped porosity. The main implication of this study is that more water may condense on ash surface in volcanic eruption plumes than expected on the basis of the estimated ash surface area alone. Consequently, more SO₂ and HCl may be scavenged too.