Magmatic aggregate of basaltic ash particles

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Dynamics of volcanic cloud and jet at the vent is largely controled by a grain size of pyroclast. The grain size is considered to be determined by primary fragmentation of magma, and subsequent breakup of pyroclasts due to therir collsions in upper conduit (Dufek et al. 2012). However, whether the breakup occurs or not depend on viscoelastic responce of magma (Dingwell and Webb, 1989).
In this study, we report aggregate of ash particles which is formed in magmatic temperature. We observed basaltic ash samples from Stromboli volcano, Italy, and Aso volcano, Japan. The “magmatic aggretate” shows texture that numerous small guest particles (< 200 μm) adhere or stick on a host particle (> 1 mm). All the host particles are catergorized to sideromelane having fluidal morphology. The guest particles are on fluidal surface of the host particle, and show fluidal and dense morphology. These characteristics found in the magmatic aggregate can be explaned by collision and aggretation of ash particles in high temperature condition. Here we model formation of the magmatic aggregates as passing of two frying particles bearing viscoelastic nature, by using viscosity of magma estimated (10^4-10^5 Pa s). When the relative velocity of the two particles falls the critical value, the two particles behave as viscous material, coalsece each other, and then form the magmatic aggregate. The result of calculation demonstrates that the critical relative velocity is approximately 10^{-2} m/s, and implies the magmatic aggregation is difficult to occur for silisic magma with highly viscosity. Thus we conclude that the collision can increase average grain size of pyroclast in basaltic system.

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