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Relationship between eruptive style and fragmentation derived from the all grain size analysis for juvenile fragments

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1. Introduction

Phreatoplinian eruption is one of the phreatomagmatic eruption that occurs by the contact of vesiculated and fragmented felsic magma with external water. This eruption produces extremely fine-grained ash particles (Self and Sparks,1978), it is typical characteristics. On the other, Hayakawa(1985) makes a point that plinian eruption, the magmatic eruption, produces fine-grained ash same as phreatoplinian eruption, though a large quantity of fine particles have been lost.

Although, there are many of all grain size analysis with a number of eruption, it does not come to a conclusion (i.e. Walker,1980;1981). However, these all grain size analysis intendes all components of eruptive products, containing accidental lithic fragments. So there are some inaccuracy to degree of fracturing for juvenile fragments.

This study compare the degree of fracturing between magmatic eruption and phreatomagmatic eruption by only juvenile fragments.

2. Candidate and Method

Heian eruption, the latest silicic volcanism at Towada volcano, began with magmatic eruption, thereafter repeated magmatic and phreatomagmatic eruptions alternately within a short period, approximately a half days (Hiroi and Miyamoto, 2010). The products mainly consist of pumice fragments. Because there are very few blocky glass shards, magma has already vesiculated and fragmented before contacting external water.

This study analyzed the unit OYU-1 and OYU-2b in Heian eruptive sequence. OYU-1 is the magmatic plinian pumice fall deposit. It contains many accidental lithic fragments. Lithofacies such as grainsize and component are homogeneous, though eruptive rate is estimated to constant. Eruptive volume is about 0.21km^3. OYU-2b is the phreatomagmatic base-surge deposit, proceeded from OYU-1 almost continuous. It contains many of fine-grained ash, and eruptive volume is about 0.27km^3.

This study based on detail field surveys. We made isopach map of OYU-1 and distribution map of OYU-2b. Samples are sieved to each grain size and separated to juvenile fragments, accidental lithic fragments, and free crystals. We made isograde maps for juvenile fragments and free cryastals about each grain size, and calculated the eruptive weight about them. Fine grained ash lost by the diffused process in air are estimated by crystal method (Walker,1980), and we got all grain size distribution only juvenile fragments.

3. Result and Discussion

The lost fine grained ash are six times as many as existent coarse fragments left in OYU-1 deposits and twice in OYU-2b, and the amount of ash finer than 1mm in total eruptive weight is about 89% both of OYU-1 and OYU-2b. It shows that there is little difference between magmatic and phreatomagmatic eruption for the amount of produced fine grained ash. Yamamoto(1994) pointed out that the large volume production of fine grained ash in phreatoplinian eruption have to be deny, and this result supports this opinion. And Hayakawa(1985) pointed out that the fine grained ash are predisposed to deposit by aggregation of external water in phreatoplinian eruption, and this result is consistant with this opinion. The eruption of Mt. St. Helens in 1980 occurred plinian eruption in rainfall, and the deposit is rich in fine grained ash as phreatoplinian eruption (Carey and Sigurdsson,1982). This grain size feature is the very important instance to confirm these previous indications and this study.

Keywords: magmatic eruption, phreatomagmatic eruption, extent of fragmentation, all grain size analysis