# The relationship between magmatic-phreatomagmatic transition and vesicularity in Heian eruption of Towada Volcano

Yoshimi Hiroi[1], Tsuyoshi Miyamoto[2]

[1]Graduate School of Science, Tohoku University, Japan, [2]Center for Northeast Asian Studies, Tohoku University, Japan

E-mail: hiroxi27@cneas.tohoku.ac.jp

The occurrence of phreatomagmatic eruption is considered to be controled by mass ratio of external water and magma (Wohletz and McQueen,1984). However, on felsic explosive erup-tion, magma is in already vesiculated and fragmented before contacting with water, and it seems to be one of the controlling factors on eruptive style through the difference of contact surface area (Yamamoto,1989). This study examines the factor causing the transition from magmatic to phreatomagmatic eruption other than magma-water ratio.

Heian eruption at Towada volcano began with magmatic eruption, thereafter repeated magmatic and phreatomagmatic alternately. Through this activity the vent was in caldera lake (Kudo,2010) and the magma always contacted with water.

From the steadiness of grain size distribution with time, the first plinian phase (pumice fall: unit OYU-1) kept constant magma discharge rate, and magma-water ratio can be regarded as constant (Koyaguchi and Woods,1996). Following few hours, the eruption proceeded to phreatomagmatic one rapidly (base surge: unit OYU-2).

Phreatoplinian eruption produces extremely fine-grained ash deposit (Self and Sparks,1978) mostly consisting of plate-like shards originated from large expanded bubble wall (Heiken and Wohletz,1985). Because external water hinderes bubble growth by rapid cooling, bubbles should grow before contacting with external water. We classified glass shards into large expanded bubble group and small bubble group, and proved successive bub-ble growth through OYU-1 and OYU-2 stages.

Pumice clast from magmatic eruption has low density than that from phreatomagmatic one (Walker,1981;Heiken and Wohletz,1985), that is in harmony with the density measurements for pumices of Heian eruption, but seems to be in conflict with vesicularity expected from the degree of bubble growth derived from glass shards analysis. This implies vesicularity differ-ence occurrs after the magma-water contact.

Since the surface of pumice should hold their texture at fragmentation, we focused on their bubbly and foamy portions ratio to investigate the difference of bubble portion on pumice surface. Contrary to the shards, however, their increase is not successive throughout but de-creased temporarily at the transition from OYU-1 to OYU-2. It may be the result of superpo-sition of additional vesiculation on inherent vesicularity increase with time on OYU-1 unlike pumice surface.

Fine-grained shards hold the information at fragmentation, but pumice on phreatomagmatic eruption freezes its texture immediately before magma-water contact rather than at fragmen-tation, and pumice on magmatic eruption may loose both of them to some degree by further vesiculation after the ejection.

The increase of large expanded bubble, suggested by fine-grained shards analysis, is an important factor for the transition from magmatic to phreatomagmatic eruptions through the efficient heat transfer from magma to water by increasing contact surface.