

Eruptive sequence of Eruptive episode B in Towada volcano

*Tsuyoshi MIYAMOTO¹, Yoshimi HIROI²

1. Center for Northeast Asian Studies, Tohoku University, 2. Tohoku University (present:Nuclear Regulation Authority)

Towada volcano is an active volcano, and explosive volcanism has occurred at least eight times during recent 11,000 years. By previous studies it was proved that the volcanic activity in almost of them started with magmatic eruption and followed by phreatomagmatic eruption (Kudo and Sasaki, 2007). But the process occurring each phreatomagmatic eruption differs between episode A (915 A.D.) and episode C (7.6 ka) (Hiroi et al., 2015; Izawa and Miyamoto, JGU2017), it is important to reveal the volcanic phenomena at each episode. Although the activity of Eruptive episode B (2.8 ka) also has progressed from magmatic eruption to phreatomagmatic eruption (Hayakawa, 1985), the detail eruptive sequence is unclear. Thus to reveal the volcanic phenomena in Eruptive episode B, we investigated the episode B products and reconstruct the eruptive sequence.

The products of Eruptive episode B consist of the following two units in ascending order: Mayogatai pumice fall (BM) and Sobe ash fall (BS) (Hayakawa, 1985). BM is a stratified lithic-rich pumice fall deposit intercalated by multiple thin volcanic ash layers. At the outcrop (5.5 km away from the source) above wall of Towada caldera situated on the dispersal axis, BM is divided into five pumice layers (BM-P) by four intercalated thin ash layers (BM-A). BM is about 47 cm of the total thickness at this point and each BM-A is less than 1 cm. The pumice clasts in BM-P are white colored and fine vesiculated. Cauliflower pumices are contained in the lowest BM-P just above a soil. The grain size of constituents in almost BM-P layer gently increases to upper part. Only in one layer of BM-P the fragment size sharply decreases at the uppermost part. BM-A is brown colored and consists of fine particles of less than 1 mm. BM-A mantles along the surface of lower pumice layer. BS is dark blue colored ash, and resembles to BM-A. But BS is a thick deposit by the accumulation of thin volcanic ash layer of a few cm, the total thickness of BS is about 50 cm at the outcrop above caldera wall. BS shows the feature of vesiculated tuff at the many point. At the exposure within caldera BS buries the topographic low on the surface, indicating to be surge deposits. Inversely BS at caldera outside is poor in the feature of surge deposit.

The particles of less than 250 μm were observed under a microscope. The kinds of component in both BM-A and BM-A are same, containing the pumice shards, lithic and crystal fragments. Armored lappili are recognized from the bottom to the top of BM. Though many pumice shards in BM-P are highly vesiculated, BM-P contains the diverse type from fibrous high vesicular to blocky low vesicular. Otherwise pumice shards in BM-A are poorly vesiculated, the high vesicular shards are rare. The component of BS is mainly non-vesiculated lithic clasts, not contained pumice shards.

The cauliflower pumice in first stage of BM, armored lappili in BM and vesiculated tuff in BS are evidences of magma-water contact, suggesting that lake water existed within crater through episode B.

Although BM-A is similar to BS, the difference of components in each unit implies that both layers are not derived by same process. Because BM-A consists of same component with preceding BM-P, BM-A is a surge deposit caused by the eruption column collapse. But the difference of vesicularity in pumice shards between BM-P and BM-A indicates that both deposits were derived from distinct eruption columns. The vertical grain size variation in BM-P suggests a rise and fall of the eruption column, BM was the intermittent activities forming eruption column taking BM-P. In addition a surge occurred by collapse of a

low-height column during hiatus of BM-P. Because BS mainly consists of only non-vesiculated lithic clasts and shows the evidence of magma-water contact, BS is a phreatomagmatic explosion deposit caused by the contact with lava dome and lake water.

The formation of Nakanoumi caldera, which is the source crater in this episode, started at the time of episode C (Izawa and Miyamoto, JPGU2017). Kanegasa pumice (KP) and Utarube ash (UA) in episode C are products just after caldera formation starting. The eruptive sequence from KP to UA is very similar to that of episode B. In addition, the total magnitude of both KP and UA is as same order as episode B. Both BM and KP are rich in lithic fragments, suggesting that source caldera continued to be enlarged by these activities. Overall the same activities progressing from intermittent pumice fall to phreatomagmatic explosions with magma-water contact have been repeated after caldera formation starting. These might indicate that both eruptions have occurred under the same conditions such as the size of a vent and a conduit on the way to form Nakanoumi caldera.

Keywords: Towada volcano, Eruptive episode B, Nakanoumi caldera, phreatomagmatic eruption