Reconstruction of the BC3400 caldera-forming eruption of Numazawa volcano from the pyroclastic deposit characteristics

Yoshiko Masubuchi[1]; Yasuo Ishizaki[2]

[1] Earth Sciences, Toyama Univ.; [2] Earth Sci., Univ Toyama

The BC 3400 caldera-forming Numazawako eruption at Numazawa volcano, NE Japan, provides a good case to investigate the causes of the transitions between types of silicic explosion. The Numazawako eruption included four eruption units; in ascending order, these are the voluminous, pyroclastic flow unit (Unit I; ˜80 % of the magma erupted during the Numazawako eruption deposited as the Unit I), the plinian pumice-fall unit (Unit II), the wetpyroclastic surge unit (Unit III), and the final plinian scoria-fall unit (Unit IV) (Yamamoto, 1995, 2003). The shift from Units I and II to Units III and IV activity also included dramatic changes in magma composition (Unit I-II eruptives are mostly dacite whereas Unit III-IV eruptives are mostly andesite). This suggests that the Numazawako eruption tapped a stratified magma chamber in which a porphyritic dacitic magma overlies a near aphyric andesitic magma.

Textural, componentry, and chemical characteristic of the eruption products of the Numazawako eruption are used to infer eruption dynamics. The Numazawako eruption is unique; contrary to the other caldera-forming eruptions that firstly generate sustained eruption column, the Numazawako eruption began with the generation of the voluminous pumice flows (Yamamoto, 1995). This suggests that the eruption activity reached its climax (in terms of eruption volume) soon after the beginning of the eruption, and subsequently began to gradually subside. As a result of eruption warning, the conduit wall began to collapse, causing an increase in the shear stress in the flowing dacitic magma. The high shear stress at the conduit walls promoted the crystal brecciation, forming a distinctive anhedral (broken) crystal-rich dacitic magma for the meanwhile. The vent blockage could be responsible for the transition to the Unit II sustained plinian column. The marked increase of the lithic component together with the increase in the degree of fragmentation of erupted component suggest the magma-water interaction started at the latest stage of the Unit II activity and continued during the whole Unit III activity. The presence of lithic-enriched surge layers in the Unit III and the lack of lithic component in the Unit IV scoria fall deposits reflects the clearing the once-blocked conduit during the Unit III stage. Eventually, the high magma discharge condition was restored by the reopening of the conduit and a plinian column with associated scoria fallout (Unit IV) began anew.