Petrology and eruption dynamics of compositionally heterogeneous lavas of the Stage II eruption of Niigata-Yakeyama volcano

Yasuo Ishizaki[1]

[1] Earth Sci., Univ Toyama

The Stage II eruption (ca. 1000 years B.P.) of Niigata-Yakeyama volcano, central Japan, began with explosive shedding of pyroclastic flows now known as the Hayakawa pyroclastic flow deposit (HPFD) and ended with effusion of a blocky lava flow named the Maeyama lava (ML). The HPFD is a typical block-and-ash flow deposit, and consists mainly of dense juvenile lava clasts along with fine-ash particles. The ML is a double-leveed lava flow and has a steep 250-m-high flow front and well-developed flow ridges (ogives).

The HPFD is made up of three types of juvenile lava clast: light-colored, homogeneous porphyritic dacite (white dacite; phenocryst assemblage = plagioclase + amphibole + orthopyroxene + quartz + Fe-Ti oxides,) clast showing little or no evidence for magma mixing, dark-colored hybrid andesite (black andesite) clast with disequilibrium phenocryst assemblages (e.g., quartz + olivine) and textures (e.g., sieve-textured plagioclase), and banded lava clast with dacite and hybrid andesite streaks, the latest being predominant (˜70-90 % of the lava clasts). The subsequent ML is a composite of dacitic and andesitic compositions. The flow front of the ML is composed of banded lava whereas the central stream and margins (levees) of the ML are composed mainly of white dacite and black andesite, respectively. Ovoid basaltic andesitic enclaves with vesicular interiors up to 10 cm are found in the ML.

The black andesite lava contains all phenocryst types present in the white dacite but in partly resorbed and reacted forms. These petrologic features suggest that the black andesite formed by hybridization between dacitic and mafic end members. Compositional data from phenocryst minerals and whole-rocks identify a basaltic magma (˜53 wt% SiO2) and dacitic magma (˜64 wt% SiO2), similar in composition to the white dacite, as end members of mixing. The textural and compositional relations of the Stage II eruptives provide evidence of multiple stages of magma interaction events. Initially a pre-eruptive mixing between the dacitic end member stored in the crustal magma chamber and the newly replenished basaltic end member occurred at the base of the chamber, forming stratification in the chamber with the dacitic upper layer and a hybrid andesite lower layer. Then, the syn-eruptive mingling and consecutive viscous segregation of the hybrid andesitic magma and the dacitic magma occurred in the volcanic conduit, forming the heterogeneous banded lava and composite lava flow, respectively.