Petrological characteristics of basaltic pyroclastic flow deposits from the northeastern flank of Aso Naka-dake volcano

Naoyuki Hori[1]; Masaya Miyoshi[2]; # Toshiaki Hasenaka[3]

[1] Dept. Earth Sci. Kumamoto Univ.; [2] Grad. Sch. Sci. &Tech., Kumamoto univ.; [3] Dept. Earch Sci. Kumamoto Univ.

Two contrasting types of volcanic eruption modes are observed for dacitic and rhyolitic magma, i.e. (1) gentle eruption represented by lava dome formation and (2) explosive eruption represented by pyroclastic flows. The difference is believed to be the result of different degree of degassing process in the volcanic conduit during magma ascent to the surface. In contrast, eruption mode for basaltic magma is mostly gentle, as represented by the effusion of lava flows. A rare case of pyroclastic flow is reported from Aso volcano whose young volcanic products from central cones are mainly basaltic. In this case, the different degree of degassing process does not cause the contrasting eruption modes because the viscosity is too small to make the difference.

The volcanic products are named as Izumikawa pyroclastic flows by Miyabuchi et al. (2006). These pyroclastic flow deposits are poorly sorted, and contain gas segregation pipes. The pyroclastic flow deposit is characterized by an existence of contraction cracks in the essential volcanic blocks and cauliflower-shape bombs. The lava flows from Nakadake old volcanic edifice are distributed in the north to south region around Nakadake crater, and partially overlies the Izumikawa pyroclastic flow deposits.

The phenocryst assemblage (Plagioclase + Olivine + Clinopyroxene +- Orthopyroxene), modal composition (Plagioclase = 30 vol. %, Olivine + Pyroxenes = 10 vol. %, Groundmass = 60 vol. %), bulk-rock geochemical characteristics (SiO_2 = 49-54 wt. %) and Loss on ignition (0.5-1 wt. %) of Izumikawa pyroclastic flow deposits are similar to those of the lava flow from Nakadake old volcanic edifice. These observations indicate that both have similar source magma compositions.

Crystal Size Distributions (CSDs) were majored for plagioclase, and CSD patterns were drawn both for Izumikawa pyroclastic flow deposits and lavas from Nakadake old volcanic edifice. Both patterns show a combination of two lines with different slopes. Pyroclastic rocks have an inflection point at smaller size than lavas. In addition, the slope of smaller crystal segment is steeper for pyroclastic rocks than for lavas. The contrasting CSD patterns indicate that the procession of crystallization is less for Izumikawa pyroclastic flow deposits compared with Nakadake lavas, which implies quenching of Izumikawa samples.

One considerable factor of the quench of magma is probably water-cooling. The interaction between water and magma frequently causes the phreatomagmatic explosion in Nakadake. Surge deposits commonly observed around Nakadake crater are one of the evidence of this hypothesis. Therefore, the phreatomagmatic explosion probably played an important roll for the formation of Izumikawa pyroclastic flow eruption.