Petrographic assessment on possible drainback processes of the andesitic lava filled in the crater of Shinmoedake, 2011 eruption of Kirishima volcano

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Drainback of emplaced lava in vent and crater is common phenomena for basaltic magmas (e.g., EPR, Kilauea, and Izu-Oshima). This is consistent with small supercooling and viscosity increase of basaltic magmas by magma degassing and crystallization during extrusion. In contrast, dacitic and rhyolitic magmas tend to show large increase of viscosity by degassing and crystallization during eruption, thus prohibiting magma drainback to the conduit and chambers. (e.g., Mt. Unzen, Mt.St.Helens). This work examines the case of andesitic lava emplaced in the 850m diameter crater of Shinmoedake, Kirishima volcano after three subplinian eruptions in January, 2011 eruption of Shinmoedake, Kirishima volcano group. The emplaced andesitic lava is ca. 600m in diameter and ca. 130m thick. We analyzed the blocks thrown from the crater-filled lava by subsequent Vulcanian explosions to evaluate the possible drainback processes of the crater-filled lava. The andesitic blocks have SiO2 contents of ca 57-58 wt% coinciding with the brown pumice of the subplinian ejecta, both of which are the mixing products of more mafic and silicic magmas. The SiO2 contents of the matrix glass in the block is 71-73 wt%, slightly higher compared with 67-69 wt% of the matrix glass of the brown pumice of the subplinian eruption. Crystal contents of the block is 20-35 vol% for phenocryst and 40-45 vol% for microlite. The temperatures of the lava blocks were estimated by the compositions of pyroxenes and iron-titanium oxides giving values from 950 to 1020 degree C. The water content of the matrix glass was estimated to be 0.1-0.4 wt% from the measurements of bulk water contents. The viscosity of the crater-filled magma just after the extrusion was estimated to be ca. $10^{9\text{-}11}$ Pas. The conduit radius is constrained by the eruption rate of the sub-Plinian eruptions at ca. $2\text{-}3*10^{6}$ kg/s to be 12-16m by using the conduit model of CONFLOW. Simple drainback rate of the lava by their weight including the thickness of the extruded lavas is estimated at $5.9\text{-}13.6*10^{-2}$ m^3/s. This rate of drainback causes less than 1.6 percent of the total amount of the effused lava within a month. SAR observation did not show evidence of drainback after the eruption, possibly partly sustained by refilling of the chamber as observed by GNSS measurement of the volcano by NIED. This work suggests that degassing and crystallization of the andesitic magma during emplacement may cause increase of the magma viscosity by 6 orders of magnitude, prohibiting drainback of the crater-filled lava after the emplacement.