Structural variation of the feeder dikes of explosive eruptions in Miyakejima, Japan

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Basaltic eruptions exhibit wide variation about its explosivity, from stable lava effusion, mild-violent strombolian eruption, to plinian eruption. Complex behavior of magma during flow within the conduit may one of the controls of the style of the eruption activities, and the structure of the conduit may also control the behavior of the ascending magma through the conduit.

We describe various type of the cross section of vent, from feeder dike to its surface products, in the caldera wall of Miyakejima, Japan. Many basaltic dikes fed fissure eruptions in Miyakejima during the last 10,000 years. The AD 2000 caldera truncated a basaltic stratovolcano with numerous feeder and non-feeder dikes. The depth of diatreme and the horizontal size of its pyroclastic cone represent the difference of explosivity. Some feeder dikes connect directly to the lava flow without any pyroclastic cone, indicating the effusive eruption. Some feeder dikes connect to pyroclastic deposit, indicating pyroclastic eruption. Some feeder dikes connect to the base of small and conical scoria cone, with 100- 200 meters across and several tens meters high. Size and internal structure of the scoria cone indicates the mild strombolian activity. Uppermost ten meters of these feeder dikes shows upward-flaring (widen the dike thickness to the surface), which infers the magmatic erosion of the dike wall by explosive activities within the conduit. More explosive activities formed some diatremes. The depth of these diatreme reaches 100 meters from the original ground surface. Typically, these diatremes connect to very-flat scoria cone and wide-spread thick scoria-fall deposit, which indicates the highly explosive activities. The sizes of these flat scoria cones are comparable to that of the scoria cones which was built by sub-plinian eruption (e.g., Izu-Oshima 1986). Upward flaring structure of the diatreme indicates the effective mechanical erosion of the dike wall by the explosive activities. The wider feeder dikes for lager diatreme suggests the higher magmatic overpressure for the explosive activities in comparison to the less-explosive feeder dikes. Comparison of the structures of these feeder dikes indicates that the variation of the depth of fragmentation (or explosion) controls the explosivity of the basaltic eruption. The fragmentation depth of mild strombolian feeders are relatively shallow (<10 m), whereas the deep rooted diatreme of the sub-plinian feeders indicates the deep fragmentation more than 100 meters from the original ground surface. The structural variation of feeder dikes suggests that the differences of magmatic overpressure and the fragmentation depth may control the eruption behavior.