Role of crystallization and conduit structure on small transitions of Strombolian eruption at Suwanosejima volcano, SW Japan

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Suwanosejima volcano is one of the most active and continuously fresh magma-fed volcanoes in Japan. The whole rock composition of this volcano is basaltic andesite with almost constant SiO2 content ca. 56 wt.%. Eruption activity in recent decades is classified into four stages; quiescent, strombolian, intermittent, and explosion stage in order of sequence. The sequence has been repeated for years with each stage from days to months of duration. During the last 20 years of activity, ash samples have been collected with some volcanic bombs landed around the active vent that covers the products of the four stages.

Ash samples are mainly consists of glassy vesicular and crystalline denser particles with some amount of isolated crystals. The classification threshold of the two types is the crystallinity of about 45vol.% which is calculated from K2O content of the matrix glass. The ratio of the two main components change with eruptive activity. Vesicular types are up to 80% during Strombolian stage whereas they decreases down to about 50% during intermittent stage and then to ca. 30% during explosion stage. In addition, the crystallinity of the glassy particles gradually increased and eventually indistinguishable with crystalline types when number of explosion increased. During each stage, the products of larger size had characteristic shapes respectively. Fluidal or vesicular spatters are common in Strombolian stage with large amount of flaky scorias. Vesicular blocky bombs are dominant during intermittent stage, some of which are fragments of conduit breccia. Then, blocky dense bombs are common in explosion stage.

From these findings, it is concluded that transition into explosive activities from strombolian is due to the change in magma property by crystallization up to more than 45%. Then, intermittent ash emitting activity begins when the crystalline part of ascending magma in a conduit exceeds ca 50vol%. Strong explosion seems to begin when crystalline part exceeds 70% with highly crystalline glassy part. Such temporal changes of short interval in the ratio of crystalline part of magma could be explained only by crystallization at shallow level with small conduit radius that upcoming fluidal magma can seal the vent breccia with small amount to raise pressure of gas pocket just beneath the vent.

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