Relationship between eruption place and syneruptive magma ascent-example from 1977 and 2000 eruptions of Usu volcano-

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Rate and stagnation in syneruptive magma ascent can determine eruption place (summit or flank). Along with height of summit, density of magma beneath summit controls eruption place (higher density is preferable for flank eruption) (Ida, 2000). The density changes with depth and time, due to vesiculation and gas phase escape from the system. Generally, faster magma ascent prohibits the gas escape, resulting in lower density. Using volcanic ejecta, we can discuss whether or not ascent conditions control eruption place. In Usu volcano, four Plinian eruptions occurred at summit in 1977, while one phreatomagmatic event occurred at flank (West Nishiyama) in 2000. Suzuki and Nakada (2001, 2002) revealed all dacitic magma issued in the phreatomagmatic event ascended in similar timescale and style. For comparison, we selected pumices in the first eruption (Big-1) of 1977 activity. The Big-1 event probably determined eruption place through 1977 activity, by forming a new conduit. Depth of magma reservoirs were similar in two eruptions (e.g. Tomiya and Miyagi, 2002).

In 2000, magma ascended beneath summit at first, and then moved toward West Nishiyama without change in depth (2 km). This implies ascent to 2 km depth determines eruption place. To focus on such stage, we use groundmass microlite (especially plagioclase) because this helps us extract ascent condition of specific timing. In explosive felsic magma eruptions, crystallization does not record ascent condition after fragmentation, because of increased melt viscosity and magma acceleration. Indeed, syneruptive crystallization of 2000 magma was completed before acceleration beneath West Nishiyama (Suzuki et al., 2006). Furthermore, pressures of nucleation start, which reflects ascent rate, can be compared using core compositions of microlites (Suzuki, 2006).

Plagioclase microlites in 2000 ejecta are skeletal and lack compositional zoning (An45-50). In decompression experiments to simulate magma ascending from reservoir (125 MPa) to 2 km depth (50 MPa) (Suzuki et al., 2006), the skeletal form was reproduced when decompression was completed in less than 1.5 hour and sample was additionally held at the final pressure. An content of experimental plagioclase microlite decreased with increasing decompression rate and approached that in ejecta when decompression is as short as 1.5 hour, being in accordance with constraint from the form. Regardless of pumice color (white, bright gray, dark gray; Nakamura et al., this meeting), plagioclase microlites in 1977 ejecta resemble those in 2000 ejecta in form and composition; magma erupted in 1977 activity was held at a constant depth after fast ascent, as in 2000. The stagnation is highly possible, because the ascent before eruption initiation should have take place along with conduit formation. Also, composition data implies similar depth of stagnation, as An content of plagioclase microlite can be dependent on final pressure in fast decompression. Accordingly, magma ascent condition beneath summit does not change with final eruption place. However, efficiency of gas escape in the stagnation may have been different. One possible cause to have changed the efficiency is difference of intruded magma volume between them. If total volume of ejecta is considered (8.3 x 10^{-2}km^3 and 2 x 10^{-4}km^3, for 1977 and 2000, respectively; Katsui et al., 1988 and Takarada, 2003), the volume of magma intruded before Big-1 of 1977 may have 2 orders magnitude larger than that before 2000 event. In the end, CSDs of plagioclase microlites from 1977 ejecta constrains the stagnation shifted to summit eruption in shorter timescale than 12 hours. The CSDs indicate that nucleation of plagioclase microlite was in progress at the final moment of the stagnation (Nakamura et al., this meeting). Experimental results in Suzuki et al. (2006) shows the nucleation can be stopped in 12 hours at least, when magma is held at 50 MPa after fast decompression from 125 MPa.