# Preferred orientation of phenocrysts during lava dome growth

# Miyuki Nonaka[1]; Setsuya Nakada[2]

[1] ERI, U-Tokyo; [2] ERI, Univ. Tokyo

Unzen Volcano was active between November 1990 and February 1995. During five years, magma of 0.21 c.km was extruded and about half of the total amount remained as lava dome (Heisei-Shinzan) at the top.

Although thirteen dome lobes and one big endogenous dome were formed during this activity, lobe 11 grown exogenously in 1993 and 1994, endogenous dome and the spine extruded at the center of the latter in late-1994 are accessible now. Calculated effusion rate of magma (Nakada et al., 1999) shows that lobe 11 as well as other lobes grew in the rate as much as 100 to 200 thousand c.meter, while the spine intruded in the lowest rate. Relationship of dome growth pattern with magma supply rate is similar to analog experiments by Fink et al., (1998); lobate and spiny in medium and low supply rate respectively. Generally, lava flows record many evidence of fluxion during thier emplacement; crystal and vesicle alignment, microlite and bubble number density and shear structure. Using the textural information, we should be able to estimate the stress pattern of their growth. Castro et al. (2002) analyzed microlite preferred orientation of obsidian lava flows, California and showed that near-vent lava experienced pure shear by injection force of magma, while flow front lava experienced simple shear by flow. In this study, we aimed to show distribution of stress in lava domes from analysis on crystal shape preferred orientation of Heisei-Shinzan.

Lava blocks on Heisei-Shinzan can be divided into three groups; massive, vesicle and sheared (cataclasitic). Massive lavas forming petals and spine have weak alignment of phenocrysts and vesicles. Vesicular rocks are observed in pyroclastic mounds on the endogenous dome and as a part of spine, the latter of which are welded on top and outer wall of the spine. Cataclasitic rocks have planar matrix and linear fabric of phenocrysts fractured, fine fragments and vesicles elongated in one direction on shear plains.Pyroclatic mound including cataclasite are limited within 50 m from the spine.

3D crystal orientation was determined on polished thin sections in three different dimensions for 20 rock samples from petals and spine.

Aspect ratio and angle of long axis of phenocrysts were scanned on thin section, using Scion Image Beta 4.01. Microlites and microphenocrysts smaller than 0.1x0.1 mm were ignored. Since hornblende records mostly preferred orientation, it was used in this study.Foliation (planar concentration) of hornblende which is normal to both flow direction and surface is evident for lava petals. For the spine, planar concentration parallel to the outer wall and linear concentration inclined to the north were confirmed.

According to phenocrysts preferred orientations, it is considered that petals experienced pure shear due to injection force of lava from vent prior to extrusion. It is likely that the outer part of spine experienced simple shear against the conduit wall and the inner part experienced pure shear as petals did. Simple shear against the conduit wall resulted from high-viscosity of the lava.