Petrogenetic study of dense fragments included in pumice-fall eruption; case study of Asama volcano at 1108 and 1128 eruptions

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In the pumice fall deposits of A.D. 1108 and A.D. 1128 eruption of the Asama volcano, central Japan, a large amount of dense and angular lava clasts (lithic fragments) are contained. These are mostly juvenile. To investigate the fragmentation mechanism of dense fragments during continuous formation of eruption column, we estimated their formation conditions.

The lithic fragment samples were collected at ca. 5km east from the vent (Koze tollgate) in the deposits of the 1108 eruption (total mass=0.95km^3, Takahashi et al., 2008) and at 5km northeast from the vent (Katahuta-gawa) generated in the deposit of the 1128 eruption (total mass=0.2km^3). The lithic fragments consist ca. 40 wt. % of larger than 0.4 cm (in diameter) clasts in the 4th subunits of the both eruptions. The clast densities show bimodal frequency distribution, with peaks at 1.0 g/cm^3 (pumice) and 2.3 g/cm^3 (lithic fragment). A density of 1.7 g/cm^3 was boundary between pumice and lithic fragment. The lithic fragments include broken phenocrysts and show welded structure. The crystallinity of the matrix glass in the pumices are 40 vol. %, whereas 50 - 70 vol. % in the middle and high-density clasts.

The higher matrix crystallinity of the lithic fragments indicates the longer residence time in the shallow conduit, compared to the magma that generated the pumices. The broken crystals, sheared structure and annealed cracks in the samples imply their clastogenic origin near the conduit wall, in which degassing would have proceeded efficiently due to shear-induced fragmentation and channeling formation (Okumura et al., 2008, Gonnermann and Manga, 2003). Since the lithic fragments rarely surrounded by vesiculated pumiceous matrix, it is assumed that they were captured into a dispersed flow after the shear-induced fragmentation. This suggests that these processes occurred near the fragmentation depth.