Geophysical Research Abstracts, Vol. 7, 09022, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09022

Grain-size reduction during block-and-ash flow emplacement

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Realistic models of eruptive behaviour require knowledge of the density distribution in active conduits and domes. As no direct access is possible to an active volcanic conduit, the density distribution is best achieved via quantitative investigation of a statistically reliable number of representative samples from within the eruption deposits. We made detailed field-based density analyses of block-and-ash flow deposits from the 1990-1995 eruption of Unzen (Japan) which allowed us to estimate the spatial density distribution and the relative abundances of statistically determined density populations (Kueppers et al., in press). Transport-related processes may have changed the original density distribution. In order to investigate the grain-size reduction during block-and-ash flow emplacement, we performed experiments on four sets of variously porous clasts (5.7, 20.5, 35.0, and 53.5 vol.%) in a rotational tumbler at ambient temperature. We used experimental durations much longer than natural run-out times in order to allow for the highly energetic nature of block-and-ash flows. The increase in generated fine particles (< 250 μm) was quantified and evaluated as a function of experiment duration (between 15 and 120 minutes) and the open porosity of the samples. The results reveal the paramount influence of the porosity on the vulnerability of the pyroclasts to abrasion. The degree of abrasion is highest in the first 30 to 45 minutes. Dense samples (5.7 vol.% porosity) are less easily abraded and the increase in generated fine particles with time is minor (< 1 wt.%). The amount of generated fine particles increases with sample porosity and is as high as 6 wt.% for the most porous samples in 120 minute experiments. These results have important implications for the interpretation of density distributions as porous samples might be under-represented.

Kueppers U, Scheu B, Spieler O, and Dingwell DB. Field-based density measurements

as tool to identify pre-eruption dome structure: set-up and first results from Unzen volcano, Japan. JVGR, published online 17 November 2004