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# An experimental investigation on the factors governing the genesis of basaltic ash.

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To investigate the factors controlling the genesis of ash during different styles of basaltic explosive activity, we experimentally fragment basaltic melts under different conditions and then compare the experimental results with observations of eruptions and eruption products. The experiments, performed at the Physikalisch Vulkanologisches Labor, Würzburg, Germany, focus on the role of groundmass crystallization on the behaviour of magma at fragmentation. As a starting material we use well-characterized bombs from the 2002 explosive activity of Mt. Etna (Sicily, Italy). Heating the starting material along variable time-temperature paths we obtain melts with a range of crystal-liquid ratios similar to those of natural products. Before fragmentation, we always adjust temperature to a fixed value, corresponding to the estimated eruptive temperature. Compressed gas released below the melt provokes fragmentation, while force, pressure, electric, and seismic sensors, plus camcorders, monitor the experiment. After each set of experiment with variably crystallized melts we determine the texture and size distribution of particles as well as the degree of crystallinity and the nature of the phases crystallized. Natural and experimental particles display the same range of shape, crystallinity, and mineralogical assemblage. All other conditions being the same, the results of fragmentation experiments change dramatically as a function of groundmass crystallization. If poorly crystallized, the bulk of the melt reacts as a liquid when compressed gas is injected. Ductile behaviour reflects in the morphology of the melt left in the crucible and in a high proportion of fluidal morphologies in the clasts "erupted". If extensively crystallized, brittle cracking dominates during fragmentation of the melt, as testified by the appearance of large cracks

and dominant blocky shape of fragments. In detail, we observe an inverse correlation between the crystallinity of the experimental products and the time delay between gas injection and melt fragmentation. This correlation suggests that increased crystallization reduces the ability of the melt to dissipate stress by ductile deformation, possibly by a combination of increased SiO2 content of the liquid (and thus a longer relaxation time) and earlier interlocking of the crystals during viscous flow.