The case of Fontana Lapilli basaltic Plinian eruption (Masaya Area, Nicaragua): deposit characterization and microtextural studies.

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The Fontana Lapilli deposit was erupted in late Pleistocene from a vent located around Masaya volcano (Nicaragua) and represents the product of one of the largest basaltic plinian eruptions. Basaltic explosive volcanism is typically characterized by an open-system magma ascent and degassing that lead to an efficient separation of low-viscosity melt and gas phases and produce lava effusion or weak hawaiian and strombolian explosions. However, the Fontana Lapilli eruption evolved from an initial sequence of short hawaiian-strombolian pulses via a moderately explosive phase to the main series of quasi-steady plinian episodes depositing fallout beds of highly-vesicular basaltic-andesite scorias (SiO_2 ~ 53 wt%).
Highly-explosive basaltic eruptions represent the most deadly basaltic phenomena because the rapid ascent rate of the associated magma means that the time between onset of unrest and eruption may be as short as a few hours, and because they are so strongly atypical of basaltic volcanism that their precursors may be ignored or misunderstood until it is too late. One of the most hazardous and unexpected products of highly-explosive eruptions at basaltic volcanoes is tephra fall, which can cause widespread damage over larger areas than typically affected by the products of effusive volcanism. The increasing awareness of the potentially highly explosive character of such volcanism and the study of possible triggering mechanisms play a key role for hazard/risk assessment of basaltic volcanoes, many of which are very close to large cities (e.g. Masaya volcano, Nicaragua).
In our study we have characterized the physical parameters of the Fontana Lapilli eruption (i.e. column height, erupted volumes, mass discharged rate, eruption duration) and the microtextures of its products in order to constrain the dynamic of the eruption and to investigate the possible mechanisms that caused the basaltic magma to erupt explosively. In particular, we have focused on the analyses of phenomena that might have altered the rheology of basaltic magma and led to disequilibrium degassing and coupling between gas and melt, permitting the development of high degrees of volatiles supersaturation in a manner analogous to more silicic magmas.
Results from our microtextural studies show that at least part of the degassing history of Fontana Lapilli melt was characterized by delayed homogeneous bubble nucleation. In fact, although all scoria clasts show an intense coalescence signature that partially hides the pattern of nucleation and the early growth of bubbles, they have a significantly higher vesicle number density than typical Strombolian products, permitting a high degree of volatile supersaturation.
In addition, post-fragmentation expansion indicated by the gradual internal textural variation within individual clasts and the common glassy groundmass texture reveal a high eruptive temperature that possibly inhibited syn-degassing crystallization and probably enhanced plume buoyancy, facilitating the wide dispersal of the deposit.

Other factors that might have enhanced the explosive character of the Fontana Lapilli eruption include: tectonic setting, conduit geometry, nature of volatile species and possible interaction with a hydrothermal system.