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What drives large-scale basic Plinian eruptions? Insights from textural and rheological studies on the Pozzolane Nere eruption (Colli Albani, Italy)

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The Pozzolane Nere formation (PNR) represents one of the largest explosive events in the history of the Colli Albani volcano (407 ka, Vulcano Laziale phase). The PNR is characterized by a basal scoria fallout deposit showing an east-trending axis of dispersion overlain by a widespread low aspect ratio ignimbrite, estimated at 30 km^3 as bulk volume. PNR magmas are very undersaturated, tephri-phonolitic in composition and represent the basic end-member of the spectrum of explosive caldera-forming chemical compositions. We carried out a combined investigation of textural, physical and chemical characteristics of scoria clasts (density, Vesicle Size Distributions, Crystal Size Distribution, viscosity), structural features of the deposits (grain-size, maximum clast size, composition) and eruption parameters (ejected volume, column height and discharge rate) in order to understand the role of the internal properties of magmas in influencing and guiding the dynamics of magma ascent and eruption.

Vesicle Number Densities (VNDs) are higher than those observed in literature for basic explosive eruptions and are more comparable to VNDs pertaining to explosive eruptions of evolved composition. As far as a PNR eruption is concerned, we demonstrated through numerical simulations that, at very fast decompression rates, despite the physical and chemical conditions (e.g. mafic composition, low viscosities and

porosities) we are able to achieve the condition necessary for fragmentation. We postulated that water-magma interaction triggered the eruption, generating the fast decompression rates that allowed it to initiate and to progress into a purely magmatic stage. Changes in vent/conduit geometry are hypothesized to be responsible for the transition fallout-ignimbrite. We suggest opening of fractures and caldera collapse as responsible for an increase in mass discharge rates and a decrease in ascent velocities which produced a final column collapse leading to the generation of great intensity ignimbrite, such as that relating to the PNR eruption.

Keywords : Colli Albani, ignimbrites, textures, rheology