

Rheological control on the eruptive style during the 472 CE “Pollena” Subplinian eruption (Somma-Vesuvius)

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The reference scenario adopted by the Italian Department of Civil Protection in case of renewal activity at Vesuvius considers a subplinian-type eruption (VEI = 4; Column Height 15-20 Km) similar to that occurred at 472 CE (Pollena eruption). The eruption involved a complex sequence of events with abrupt shifts in eruptive style. We focused this study on the fall-out products (L1-L8) of the first two eruptive phases (Phases I and II), before the onset of the final phreatomagmatic phase (Phase III). Phase I was characterized by unsteady magma discharge resulting in an oscillating convective column, whereas Phase II involved pulsating activity with alternation of sustained and collapsing columns. To evaluate the role of textural variability in controlling magma rheology (and therefore variations in magma discharge), we performed a detailed textural analysis of the juvenile products.

During the oscillating column of Phase I, pyroclast textures record a variable degree of outgassing efficiency and lateral textural stratification of magma in the conduit, related to differential magma ascent rates and resulting in variable eruption intensity. At least two episodes of magma stalling were recognized (both during Phase I and II), where magma crystallized and outgassed. Subsequently, the restoration of a sustained column and energy climax (L3 and L8) were promoted by further decompression of the outgassed high-viscosity magma. Progressive incorporation of denser, slower-moving, outgassed magma in the eruptive column seems to be the main responsible of fall-PDC transition at the end of Phase I and during the pulsatory activity of Phase II.