



Are Avellino (4365 cal BP) and Pompeii twin plinian eruptions? Pre-eruptive constraints and degassing history

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Somma-Vesuvius activity started 35 ky ago and is characterized by numerous eruptions of variable composition and eruptive style, sometimes interrupted by long periods of unrest. The main explosive eruptions are represented by four plinian eruptions: Pomici di Base eruption (22 cal ky), Mercato (~8900 cal BP), Avellino (4365 cal BP) and Pompeii (79 AD). The 79 AD eruption embodies the most famous eruption since it's responsible of the destruction of Pompeii and Herculaneum and it's the first described eruption. The Avellino eruption represents the last plinian event that preceded the Pompeii eruption. The eruptive sequence is similar to the 79 AD plinian eruption, with an opening phase preceding a main plinian fallout activity which ended by a phreatomagmatic phase. The fallout deposit displays a sharp colour contrast from white to grey pumice, corresponding to a magma composition evolution.

We focus our study on the main fallout deposit that we sampled in detail in the Traianello quarry, 9 km North-North East of the crater, to investigate the degassing processes during the eruption, using volatile content and textural observations. Density and vesicularity measurements were obtained on a minimum of 100 pumice clasts sampled in 10 stratigraphic levels in the fallout deposit. On the basis of the density distribution, bulk geochemical data, point analytical measurements on glasses (melt inclusions and residual glass) and textural observations were obtained simultaneously on a minimum of 5 pumice clasts per eruptive unit. The glass composition, in particular the Na/K ratio, evolves from Na-rich phonolite for white pumices to a more K-rich phonolite for grey pumices. The pre-eruptive conditions are constrained by systematic Cl measurements in melt inclusions and matrix glass of pumice clasts. The entire magma was saturated relative to sub-critical fluids (a Cl-rich H₂O vapour phase and a brine), with a Cl melt content buffered at ~6000 ppm, and a mean pre-eruptive H₂O content depending of the magma composition. Most of the pumices of the different eruptive units show that H₂O degassing during the eruption followed a typical closed-system evolution as expected for plinian eruption. Contrary to H₂O, Cl was not efficiently degassed during the plinian phase of the eruption: the matrix glass composition remains close to the pre-eruptive content. Compared to the 79AD eruption the degassing processes showed by the whole Avellino plinian phase is more homogeneous and similar to the white pumice phase of the Pompeii eruption whereas the open-system degassing mode identified from the grey pumices of the 79AD eruption is not represented during the Avellino eruption.