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Physical volcanology of small scale subplinian eruptions: the AD 512 event of Vesuvius (Italy)

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Mid intensity explosive eruptions span a very large spectrum of eruption styles and scenarios (from violent strombolian, to vulcanian, to subplinian), and this variability is also well recorded in the products of Somma-Vesuvius activity. Differently from high intensity eruptions, in which a prolonged phase of sustained discharge prevails, mid intensity eruptions are generally characterized by complex, long-lasting sequences, with repeated, short-lived phases of intense magma discharge alternated with prolonged phases of lower intensity. While the main processes driving the activity of large eruptions of Vesuvius have been deeply investigated in the past, both as regards their field volcanology as well as from the modelling side, the deposits of only few mid-intensity eruptions have been thoroughly studied in the recent years. However, due to their potentially heavy impact on a complex urban fabric like the Neapolitan area, the detailed analyses of the main parameters controlling these events cannot be overlooked.

Scoria fall deposits ascribed to an eruption possibly occurred in AD 512 are described in detail. These deposits were first recognized by Johnstome-Lavis (1884) and briefly described by Andronico et al. (1995), and Rolandi et al. (1998). The stratigraphic sequence of the eruption comprises alternating lapilli and ash beds, generally dispersed toward the East. The deposits have been recognized and described at more than 30 sites up to a distance of 20 km from the vent. They directly overlie the ash-rich deposits of the final phase of the AD 472 Pollena eruption. No paleosol or strongly humified horizon is present at the top of the underlying Pollena deposits. The contact between the two is characterized by only minor reworking and decimeter- to meter-sized, U-shaped channels and scours. We have subdivided the AD 512 stratigraphic succession into eight Units, each formed by several beds or laminae. Each Unit has been characterized by its stratigraphy, dispersal, and sedimentological, compositional and lithological features. The stratigraphic record of the eruption clearly demonstrates the prevalence of short-lived pulses of magma output over long-lived periods of sustained magma discharge. The 8 different units show contrasting dispersal and sedimentological features, testifying to the occurrence of a repeated variation of the eruption style during the event. As for other events of Somma-Vesuvius we can distinguish several phases in the eruptive sequence, each characterized by distinct eruption styles: opening phase, subplinian phase, pulsatory phreatomagmatic phase, violent strombolian phase, final, ash-dominated phase.

The causes of the repeated changes in eruption style are not simple to assess. Many parameters concur to define the eruption mechanism, as the magma composition and rheology, the shape and geometry of the reservoir and plumbing system, the possible role of magma feeding from the depth. Using field and physical volcanology data on the deposits, coupled with morphological, compositional and textural data on the products from the different phases of the eruption, the variability of the eruption dynamics is discussed in terms of the relative roles of phreatomagmatism, fragmentation processes, oscillatory magma supply rate, and syn-eruptive degassing.