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The extimated presence of differentiated higly explosive magmas beneath Vesuvius and Campi Flegrei: evidence from geochemical and textural studies.

Lucia Pappalardo and Giuseppe Mastrolorenzo

Istituto Nazionale di Geofisica e Vulcanologia, sezione di Napoli Osservatorio Vesuviano, Via Diocleziano, 328, 80124 Napoli, Italy. Phone: +39 0816108444, Fax: + 39 0816108351 E-mail: lucia.pappalardo@ov.ingv.it(lucia.pappalardo@ov.ingv.it)

Highly catastrophic explosive eruptions are supplied by Si-rich magmas, generated at shallower level in crust by the evolution of mantle liquids. The timescale of these evolution processes is a crucial factor, because of its control on the length of volcano repose interval leading to high explosive events.
Campi Flegrei and Somma-Vesuvius alkaline volcanic systems, located respectively at few kilometers west and east of Neapolitan metropolitan area, produced a variety of eruptions ranging from not explosive lava flows and domes to highly destructive eruptions. Both these high risk volcanoes are in repose time since the last eruption occurred in the 1538 and 1944 BP, respectively. Since that time, the volcanoes experienced fumarolic activity, low level of seismicity with rare earthquakes swarms, as well as two bradyseismic crisis (1969–1972 and 1982–1984) localized in the center of Campi Flegrei caldera, that generated a net uplift of 3.5 m around the town of Pozzuoli.
A wide low velocity layer interpreted as an extended magmatic body has been detected at 8-10 km depth beneath these volcanoes by seismic data. The capability of this reservoir to erupt explosively again strongly depends on magma differentiation degree, therefore the knowledge of the time lapse necessary at not explosive mafic liquids to differentiate toward explosive magmas is very crucial to predict the size of a possible short-term future eruption in Campanian area. Our petrologic data indicate that a multi-depth supply system was active under the Campanian Plain since 39 ka. Fractional crystallization during magma cooling associated with upward migration of less dense evolved liquids appears to be the prevalent differentiation process. Our results indicate that huge steam exolution occurred during the late stage of trachyte and phonolite crystallization thus accounting for the high Volcanic Explosivity Index (VEI) of eruptions supplied by these melts. Moreover our CSD data on phenocrysts reveal rapid crystallization and differentiation time for alkaline Campanian magmas (in the order of decades to few centuries). This evidence implies that the 400 km2 partial melting zone detected by tomography study at 8-10 km depth beneath Vesuvius and Campi Flegrei, should consist of differentiated magma already capable to produce also large scale (plinian) explosive events in case of renewal of the activity from the present closed-conduit state.