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Cl constrains on shallow plumbing system and pre-eruptive conditions of the Phlegrean Fields.

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The bay of Naples is known to concentrate several dangerous volcanoes that erupted a lot of times in prehistorical and historical periods: Vesuvius, Phlegrean Fields and Ischia Island.
Phlegrean Fields produced voluminous high-magnitude eruptions including: the Campanian Ignimbrite (39 ka BP), one of the two largest explosive eruptions of the Mediterranean region during the last 200,000 years, with 300 km3 of magma emitted, and the Neapolitan Yellow Tuff (15 ka BP), the second major eruption (40 km3 of magma emitted). The Ischia Island is located in the Bay of Naples and its eruptive history has been recently detailed.

We present a geochemical investigation of volatile components on the fallout products of the major explosive eruptions of Phlegrean Fields: the Campanian Ignimbrite (39 ka BP), the Neapolitan Yellow Tuff (15 ka BP), the Pomici Principali (10 ka BP; 0.38 km3 DRE magma), the Agnano Monte-Spina (4.1 ka BP; 0.60 km3 DRE magma); the Astroni 6 (3.8 ka BP; 0.70 km3 DRE magma); the Monte Nuovo (1,538 AD), which is the most recent eruption of the Phlegrean Fields (0.04 km3 DRE magma), and for comparison the Cretaio eruption of the Ischia Island (1,800 a BP; 0.02 km3 DRE magma).
Volatiles of magmas (H_2O, CO_2, SO_2, Cl, F) are informative not only because they play a key role in the eruptive dynamic but also because they, and especially chlorine, may allow estimating the pressure of localization of the magma storage and pre-eruptive water content (prior the eruption). In the alkaline magmas involved during the Phlegrean Fields eruptions, H_2O is the main volatile species but Cl behaviour is particularly interesting to study. Experimentally, it has been demonstrated that in a pressure, temperature and composition domain a water-saturated magma may be in equilibrium with a fluid phase consisting of a water-rich vapor and a chlorine-rich brine. In that case, the Cl content in magma is buffered. This effect allows determining the pressure of localization of superficial magma reservoir using the Cl solubility law that perfectly matches the magma composition studied. Using the H_2O solubility law of the same composition it's also possible to estimate the pre-eruptive H_2O content dissolved in the magma prior eruption. The systematic analysis performed in this study evidences a reproducible Cl buffering effect within the superficial magma reservoirs at the Phlegrean Fields. This characteristic allows us to precise a complex geometry of the shallow plumbing system between 35 and 165 MPa.