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Key terms: Campanian Ignimbrite; magmatic degassing; residence time; caldera collapse

The late Pleistocene trachytic Campanian Ignimbrite (CI; 300 km3 DRE) covers the Campanian Plain near Naples, and is found behind ridges more than 1,000 m high at 80 km from source, the Campi Flegrei caldera (CFc). Distal ignimbrite deposits reveal downhill and/or downvalley flow directions prior to deposition, whereas in the absence of significant topography, deposition came from a flow moving in a roughly radial direction. These features point to very dilute currents, that together with the huge amount of discharged magmatic material, suggest a magma reservoir highly enriched in volatiles, rather than fluid entrainment from hydrothermal bodies or seawater.
Petrologic and geochemical modelling of erupted products and their chemical and textural zoning, together with MI-based studies of gas-melt saturation, corroborate this view and show that the CI huge volume differentiated and mixed at shallow depth (6-3 km). With respect to compositionally similar but also smaller CFc eruptions (e.g. Agnano-Monte Spina, A-MS), the large amount of volatiles discharged by IC was likely due to fractional crystallization and longer residence times of volatiles sourced by the subducting Appennininc slab. This yielded high-water contents (up to 6-7 wt%), as well as high void fractions (~70-80% for IC, ~45% for A-MS) and also produced an overpressurized CO2-dominated gas cap (about 150 km3), uniformly distributed at the top of the magma chamber. The onset of the eruption tapped this cap, with consequent depressurization and fast volume decrease that facilitated or even drove the caldera collapse, and allowed the water-rich magma to be discharged during the pyroclastic current phase. The gas saturation-based estimates of the tapped foamy magma are compatible with the extent of magma chamber roof collapse, strong expansion revealed by textural data and transport and deposition mechanisms, reflecting depressurization and magma inflation within the collapsed and laterally confined caldera.

I3-6 Orale Gaeta, Mario

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CALCITE-BEARING FOIDITIC LAVA FLOWS FROM COLLI ALBANI VOLCANIC DISTRICT

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Key terms: Lava flows; Calcite; Colli Albani

The Colli Albani (hereafter CA) ultrapotassic volcanic district (near the city of Rome, Central Italy) belongs to the Roman Province whose magmatism is thought to result from the combined effects of crystal fractionation and crustal assimilation on a parental magma derived from a metasomatized mantle source. The CA district represents one of the most peculiar volcanic districts on the Earth because of its liquid line of descent characterized by differentiated, low silica (≦45wt%), K-foiditic magmas. Field, geochemical, and experimental studies have demonstrated that such a differentiation trend, starting from trachybasaltic parental magma, is mainly due to magma-carbonate interaction (Gaeta et al. 2009 and references therein). Despite many studies have investigated petrological and geochemical features of the Colli Albani magmas, several questions remain unanswered. One of these concerns the occurrence of calcite crystals in the groundmass of some lava flows. In general all CA lava flows are made up of leucite and clinopyroxene phenocrysts; some deposits (corresponding to less evolved products) also contain forsteritic olivine. The groundmass, is generally made up of leucite, clinopyroxene, and Ti-magnetite; more evolved products may also contain amphibole or, and these are the object of our study, calcite, usually associated with nepheline.
The textural study of calcite-bearing lava flows, by means of Field Emission SEM, revealed that calcite usually occurs as interstitial phase, intergrows with nepheline and, in some cases, contains inclusions of oxide (e.g. hematite) or fluorite. Calcite is also present: i) as spherical "ocelli" with tangentially arranged crystals of clinopyroxene; ii) interstitial at clinopyroxene rim and leucite; and iii) rarely, around coronitic texture of leucite produced at the expense of K-feldspar xenocrysts. All these textural features indicate that calcite occurring in the lava flows groundmass crystallize above the solidus temperature.
The high activity of calcium in the lava flow groundmass is also supported by the mineral chemistry of silicate phases. For example, olivine crystals in groundmass are enriched in FeO and CaO (up to 4 wt.%) and a positive correlation between CaO in olivine and melt differentiation (i.e. Mg#) is observed. Carbon and oxygen isotope values, as well as trace elements abundance, have been determined on calcite and phenocrysts occurring in the CA lava flows. Oxygen isotope values (25-26 ‰ SMOW) result higher than that of phenocrysts (6-8‰ SMOW) and, interestingly, coupled with very low carbon isotope values (-14.4 - -15.7‰ PDB). Trace elements abundance in calcite is lower than abundances measured in both clinopyroxene phenocrysts and bulk rocks (LREE≦100 chondrite). Textural and mineral chemistry data indicate, unambiguously, that calcite in the CA lava flows has crystallized from a carbonate-bearing melt in a magmatic environment (Freda et al., 2011). Although carbon isotope values could suggest a mantle origin for the carbonate-bearing melt, oxygen isotopic composition and trace element abundance suggest a different origin. We propose that calcites in CA lava flows form as result of a mingling process between Ca-rich melts, originating in skarn environment and/or during sin-eruptive carbonate assimilation, and potassic magmas.

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I3-7 Orale Viccaro, Marco

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LONG-TERM VS. SHORT-TERM GEOCHEMICAL CHANGES OF MT. ETNA LAVAS: THE PUZZLING EFFECT OF A VARIEGATED MANTLE

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Key terms: Southern Italy; Volcanism; Mantle heterogeneity; Metasomatism; FOZO

Mt. Etna volcano fascinated the scientific community during the last decades due to its unusual geodynamic location and geochemical signature of the erupted lavas. Although the edifice is placed above the front of a compressive regional tectonic setting, volcanic products have a marked intraplate signature. The volcano has shown a complex geochemical variability during the half-million years of life, with sub-alkaline products erupted during the early stage of volcanism up to ~220 ka ago, then followed by a Na-alkaline stage. The alkaline stage displays long-term geochemical variations, as a result of evolutionary processes acting at various levels of the feeding system. The Etnean lavas also exhibit short-term changes in some periods. For example, an increase in some LILEs and volatiles together with marked changes of the Sr-Nd-Pb-Hf isotope ratios are observed since the 1971 (Viccaro and Cristofolini, 2008; Viccaro et al., 2011). Mt. Etna can surely be considered as one among the most studied volcanoes on Earth, although the features of the source are still matter of discussion. The absence of mantle material (xenoliths), which is efficiently fractionated in the deep levels of the feeding system, makes more intricate the picture. Thus, indirect information can be only attained from magma compositions. The behavior of incompatible trace elements for mantle-equilibrated magma compositions of the Ellittico (60-15 ka) and Recent Mongibello (15 ka-present), and of their enrichment ratio show that the Etnean magmas are produced by a variable, low degrees of partial melting. The enrichment ratio also reveals that magmas can be generated from a classic garnet peridotite variably enriched by metasomatic mineral phases (amphibole-phlogopite). The Zr/Nb vs. Ce/Y and Ba/Th vs. Lu/Hf diagrams highlight the enriched signature of the Etnean mantle. The Zr/Nb vs. Ce/Y diagram evidences the progressive contribution of metasomatic phases with time. The Ba/Th vs. Lu/Hf diagram shows the short-term coupled increase of the contribution by metasomatic agents and partial melting degree during the last 400 years of volcanic activity. In terms of mantle components, the integration of Sr-Nd-Pb-Hf isotopic ratios suggested that FOZO is the dominant component in the Etnean source (Viccaro et al., 2011). However, the FOZO component is not able to fully account for the isotopic changes from the Ellittico to Recent Mongibello magmas. Indeed, the isotopic compositions of the Ellittico and Recent Mongibello volcanic products can be explained by addition of an EM1-type component (up to 10%) to a dominant FOZO. The integrated analysis of Sm/Hf and Th/Hf ratios, together with Hf isotope ratios, gives evidence that the enriched component may be metasomatizing silicate melts. Long-term vs. short-term compositional changes at Mt. Etna are here related to partial melting of a recycled, altered oceanic lithosphere, infiltrated by metasomatizing silicate melts. Variable amounts of the enriched component participating to partial melting are able to affect its degree and the geochemical signature of the produced magmas.

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I3-8 Orale Corsaro, Rosa Anna

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RELATIONSHIP BETWEEN MAGMATIC PROCESSES IN THE PLUMBING SYSTEM OF MT. ETNA AND THE DYNAMICS OF THE EASTERN FLANK: INFERENCES FROM THE PETROLOGIC STUDY OF THE PRODUCTS ERUPTED FROM 1995 TO 2005

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Key terms: Mt. Etna; Magmatic processes; Flank instability; Recent eruptive activity

Mt. Etna is located in a quite complex tectonic context and large sectors of the eastern and south-eastern flanks of the edifice move downward at very different rates. During last years, the flank slip has been somehow related to the magmatic intrusions refilling the shallow and deep portion of the volcano plumbing system, suggesting a feed-back between flank dislocation and magma emplacement within the volcano. The petrologic studies performed during last decades at Mt. Etna, evidenced that the plumbing system of the volcano has a quite complex geometry, variable in space and time and consisting of storage zones at different depth, where magma ascending to the surface experiences complex processes such as mainly fractional crystallization and mixing.
In this framework it's quite interesting to further investigate if a possible cause-effect relationship exists between the displacement of the volcano East flank and the pre-eruptive magmatic processes in the plumbing system. We went into this matter with a petrologic study of the products erupted in the decade 1995-2005. In particular we analyzed the petrography, mineral chemistry, geochemistry, Sr and Nd isotopes emitted by the four summit craters of Mt. Etna (South-East, North-East, Bocca Nuova and Voragine) from 1995 to 2001 and integrated them with petrologic data already available in literature for the investigated decade. This approach allowed us to better constrain the temporal evolution of the main magmatic processes occurring in the plumbing system of Mt. Etna (mainly mixing between compositionally distinct magmas and fractional

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