1. Research activity (max 1.000 words)

The study of explosive volcanism is generally focused in near-vent deposits, which provide abundant information for evaluating depositional processes, eruptive dynamics and volcanic edifice evolution. However, due to the nature of the deposits and the dynamics of volcanic explosive activity, these proximal “archives” may result “lacunose” and incomplete, since only the most recent and/or volumetrically significant part of a volcano history are recorded (Giaccio et al., 2014).

In this framework, distal archives represent a powerful tool, that allows a more rigorous and complete reconstruction of the stratigraphy associated to the explosive activity of a certain volcanic centre. An increasing number of recent publications (e.g. Giaccio et al., 2012, 2013a, 2013b, 2014, 2017; Lowe et al., 2011; Petrosino et al., 2014; Smith et al., 2011; Tamburrino et al., 2012) have shown the wide availability and utility of distal archives for volcanological purposes. As matter of fact, the applicability of the method requires (i) long and continuous sedimentary successions, that can preserve tephra, located in a good range of distance from (ii) sources of intense and recurrent explosive activity. These conditions are both satisfied in central-southern Apennine, where, during Quaternary, large lake systems hosted in intermountain basins (e.g. Fucino and Sulmona), recorded tephra deposition from the peri-Tyrrhenian and insular volcanic districts, including Vulsini, Vico, Sabatini, Alban Hills, Somma-Vesuvius, Phlegrean Fields, Eolian Islands and Etna (Pecerillo, 2017), that were characterised by an intense and recurrent explosive activity.

These basins have been almost continuously documenting the sedimentary history since the Late Pliocene-Early Pleistocene (Giaccio et al., 2013b, 2015b) and are in a favourable position with respect to the prevailing eastward direction of the stratospheric winds and in a good range of distance (100 to 150 km) downwind of the peri-Tyrrhenian volcanic districts, thus being the perfect candidate to recover a long and continuous record (Giaccio et al., 2017). Among the Apennine intramountain basins, the Fucino and Sulmona ones were found to host a rich tephrostratigraphic record (Giaccio et al., 2012, 2013b, 2017) of the peri-Tyrrhenian explosive activity. However, the two lacustrine successions have been only partially studied and further stratigraphical, geochemical and geochronological analyses are required.

Research Objectives

The main goal of this PhD project is to improve the general knowledge of tempo, dynamics and evolution of the peri-Tyrrhenian Quaternary explosive volcanism by combining field investigations and laboratory analyses of tephra layers both hosted in the mentioned intermountain basins (distal deposits) and found in near-vent (proximal) deposits.

Work Plan

Major, minor, trace element and isotope analyses will be carried out using several analytical techniques (i.e. EPMA, LA-ICP-MS, TIMS) at both national and foreign institutes. Furtherly, $^{40}Ar/^{39}Ar$ analyses will be performed on pristine sandine or leucite crystals (grain size > 250 μm) from some selected tephra layers to constrain the time of eruption of tephra suitable for this kind of analyses (i.e. tephra with abundant and relatively coarse K-rich crystals). Bayesian statistic age modelling will be also applied for determining the age of not directly dated tephra layers, interbedded in long lacustrine successions containing other radio-isotopically dated tephra.

These analyses will provide me a series of microtextural, geochemical and geochronological data that altogether will concur in "fingerprinting" the tephra, thus allowing me to identify the volcanic sources and possibly the individual equivalent eruptive units and/or distal tephra (some tephra markers are in fact known only in distal settings).

Finally, eruption parameters modelling will be performed at the INGV, Osservatorio Vesuviano (Naples, Italy), under the supervision of Dr A. Costa, using an appropriate bi- (HAZMAP) and/or three-dimensional (FALL3D) ash-dispersal Eulerian model for transport and deposition of volcanic ashes, which solves equations for advection, diffusion and sedimentation of particles in two or three dimensions. The HAZMAP or FALL3D software will be applied to the main and most widespread tephra, for which a discrete number of outcrops are known in both proximal and distal areas.

References:

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Regattieri et al., 2015. Journal of Quaternary Science, 30, 19-31.

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2. Research products

a) Publications (ISI journals)
b) Publications (NON ISI journals)
c) Manuscripts (submitted, in press)
d) Abstracts