Geophysical Research Abstracts
Vol. 17, EGU2015-10382-4, 2015
EGU General Assembly 2015

Anatomy of a volcanic district in a carbonate fold-and-thrust belt: the northern Volsci Range (Italy)

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The Volsci Range is a carbonate fold-and-thrust belt crossed by important normal faults in places associated with explosive volcanic deposits and hydrothermal ongoing activity within a moderately active seismic area (e.g., Latina earthquake 2012, Mw=3.8). Though distribution of volcanites is known, origin, volume and field characterization of a previously unstudied volcanic district is far to be addressed and it is the topic of this work. Several monogenic phreatomagmatic vents occur at the edges of the chain and within its backbone. The most relevant ones are characterized at the base by well welded to zeolitized tuffs, followed either by incoherent tuffs or by surges (e.g., Patrica, Valvisciolo) and locally by lavas (i.e. Giuliano di Roma, Pofi, Terracina) and finally by late Quaternary slope deposits. Most explosive units are largely composed by local Mesozoic platform carbonate litic clasts, showing different degrees of rounding and decarbonation. Micropalaeontology and facies analysis confirm that clasts are not older than late Jurassic and not younger than Cenomanian (Upper part of the Ostracoda and Miliolidae biozone). Therefore considering the stratigraphy beneath the vent points, litics could come from depths of about 400-600 meters. Juvenile litics of different composition, accretionary lapilli and the above mention carbonate litic clasts testify for a complex conduct composition and for the rupture of the carbonatic aquifer during eruption. Right at the southern slope of the Lepini Mounts (northern Volsci Range), as detected from the analysis of the n-2 residual gravity anomalies, monogenic circular vents (tuff rings) occur buried under Quaternary deposits or are just barely cropping out as necks (Doganella di Ninfa). Further south, despite the occurrence of pyroclastic deposits in boreholes, thickness and shape of volcanic deposits below the Pontina Plain is still unconstrained, providing a challenge for further geophysical studies. However, the occurrence of an anomalous geothermal gradient and the type of hydrothermal activity suggests the presence of an important volume of intruded magma also below the Pontina Plain. In conclusion we found that: 1) phreatomagmatic eruptions may have been accompanied by earthquake-related fracturing possibly triggered by the pressure of the uprising magma emplacement underneath the future vent zone, causing the break of the aquifer and the consequent eruption; 2) what observed in the northern Volsci Range could help providing a model to explain the structures buried below the Pontina Plain and in similar settings.