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The Colli Albani caldera: structure, stratigraphy and petrology.

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New stratigraphic, structural and petrologic data on the Colli Albani volcano (Roma, Italy) surveyed for the realisation of the New Geological Map of Italy at the scale 1:50,000 (CARG Project), integrated with a full review of previous data, give new insights on the evolution of the caldera.

The Colli Albani is a quiescent volcano, which started its activity approximately at 600 ka. The chemical composition of its products throughout its volcanic evolution is remarkably constant and mafic ($<$ 50% SiO_2). The volcano is made of the superposition of different edifices or lithosomes. The older lithosome is a 1600 km^2 plateau with a central caldera, named Vulcano Laziale (VL), and is mainly constituted by large volume low aspect ratio ignimbrites ($>$355 ka; 10-100 km^3involume), to which the caldera is related.

After the eruption at approx. 355 ka of the last large volume ignimbrite, the Villa Senni ignimbrite, two complex edifices were built within the caldera area: 1) the Tuscolano-Artemisio (TA) lithosome forms a horse-shoe shaped morphology, made by coalescing fissure-related lava domes and flows, interbedded with scoriae cones, cut by dykes; the fissure system was fed by regionally controlled-peri-calderic fractures and forms two distinct segments, one WNW-trending and one NE-trending, which form a sharp edge; 2) The Faete lithosome is a steep-sided stratovolcano which filled in the caldera and presently reaches 949 m a.s.l.

The Tuscolano-Artemisio and the Faete edifices are partly interfingered and were emplaced between approximately 350 and 250 ka. Their products indicate a remarkable

reduction of erupted volumes respect to the Vulcano Laziale lithosome and a change in eruption style to effusive and mildly explosive.

The most recent and still active, although quiescent, phase of activity of the volcano has been characterised by eccentric phreatomagmatic activity, which has formed several maars and tuff cones located along the western and northern slopes of the volcano.

The history of the Colli Albani caldera is poly-phased and can be reconstructed as the result of the following volcano-tectonic events:

1) The eruptions relative to the large volume ignimbrites forming the Vulcano Laziale lithosome originated a cluster of nested calderas, but the present shape of the caldera is related to the last eruption, which was the largest (> 50 km^3 of products);

2) The emplacement of the following Tuscolano-Artemisio lithosome, although related to peri-calderic fissure eruptions, is stratigraphically unrelated to the caldera collapse: it seals a morphologically stabilised caldera wall over which is present a paleosoil. The activation of the peri-calderic fractures must therefore refer to a volcano-tectonic event independent from the caldera collapse. We believe that the reduction of magma eruption rate testified by the reduced volume of deposits forming the TA and the Faete lithosomes respect to the VL, may correspond at depth to the reduction of the magma chamber recharge rate, which may in turn have induced a long standing period of deflation of the caldera floor and the opening of outward-dipping peri-calderic fractures. Following this interpretation, the TA lithosome would represent the surface expression of a cone-sheet system at depth. The absence of similar fissure-structures along the western and southern caldera rim may relate to the deep geometry of the ring-faults likely inward dipping and therefore not favourably oriented for magma intrusion during a period of general subsidence.

3) Lava samples have been collected at the base and top of stratigraphic packages bounded by unconformities within the TA lithosome. The lavas bear dominantly leucite (lc), clinopyroxenes (cpx) and minor biotite (bt) and magnetite. Classical petrological and PERs (Pearce Element Ratios) analyses indicate that lavas are co-genetic and show a differentiative trend upthrough stratigraphy driven by crystal fractionation of the lc-cpx-bt paragenesis. The degree of differentiation of these lavas does not reach that of the large volume ignimbrites of the underlying VL lithosome, suggesting a shorter residence time of magma at depth. This may be explained by the high permeability of the fractures of the densely fractured caldera floor during this eruptive period characterised by subsidence, and may also explain the mainly effusive/open conduit eruptive style.

4) The shift to the west of the locus of the volcanic activity afterwards, which formed

the eccentric maars, may indicate the definitive crystallisation at depth of the caldera-related magma chamber.