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Petrological constraints on the evolution of the eccentric cones Monte Maletto, Monte Frumento and Monte Nuovo – Mt. Etna

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Mt. Etna is one of the most protrusive features of the eastern coastline of Sicily, Italy. As Europe's most active volcano it has been studied extensively to reveal its geodynamic setting, plumbing system and due to the constant monitoring of the volcano edifice the prediction of the risk future events is sophisticated at Mt. Etna.
The eruptive activity has been divided according to the age into 6 stages: (1) "Tholeiitic Stage", was active between 600-320 ka ago, (2) the "Timpe Stage" between 220 and 110 ka ago, (3) the "Ancient Alcaline Volcanism" between 110 and 65 ka ago and (4) the "Ellittico Stage" between 57 and 15 ka ago (5) the "Mongibello Stage" from 15 ka ago until 1971 and (6) the "post -1971 Stage" active since 1971 (Casetta et al., 2019).

The lava propagating through the Etnean plumbing system generated a complex network consisting of sills and dykes responsible for the formation of the summit craters and a plethora of eccentric cones that cover the flanks of the volcano.

We studied using whole rock and mineral analyses the lavas from three eccentric cones (Monte Maletto, Monte Nuovo and Monte Frumento) and the 2001 eruption on the south flank from the main crater. All lavas are characterized by trachytic texture with variable modal composition of olivine, clinopyroxene and plagioclase phenocrysts. The Monte Maletto whole rock composition with an Mg# ranging between 56-58 and a CaO content of 12.0 wt% are the most primitive lavas among the sampled outcrops whereas the Monte Frumento lavas are the most evolved since the Mg# ranges from 43 to 46 and the CaO content from 9.5 to 10.8 wt%. Both, Monte Nuovo and 2001 eruption are more evolved than the Monte Maletto since they have Mg# ~ 50 and 51.5-52.9 respectively. The CaO concentration in both outcrops is relatively constant ranging from 9.8 to 10.7 wt%.

The olivine compositions follow the same trend as their whole rocks. The most MgO-rich olivine (Fo=87.5 %) found in the Monte Maletto lavas. This olivine is of magmatic origin and cannot be considered as mantle derived xenocryst since the NiO content is low (NiO=0.16 wt%) and the CaO-content high (CaO=0.22 wt%). The most evolved lavas from Monte Frumente have the lowest Fo-

content (Fo=64-68 %). Olivine from both, Monte Nuovo and 2001 eruption have a characteristic inverse zonation with Fo-content in the core ranging from 69.9 to 75 and in the rim from 78.2 to 81.7 respectively.

In conclusion, the Monte Maletto lavas represent the most primitive magma formed at high temperatures (skeletal growing of the olivine) and the Monte Frumento lavas the most evolved magma. The Monte Nuovo and 2001 eruption experienced magma mixing as inferred from the olivine inverse zonation. Monte Nuovo can be considered a flank eruption of lava deviated from the central conduit rather than an eccentric cone.

Casetta, Federico, et al. "The evolution of the mantle source beneath Mt. Etna (Sicily, Italy): from the 600 ka tholeiites to the recent trachybasaltic magmas." International Geology Review (2019): 1-22.