



## The eccentric cones Monte De Fiore, Monti Rossi, Monte Spagnolo and the 2002/2003 eruption, Mt. Etna: evidence for magma mixing

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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 Alkaline 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 whole rock and mineral chemistry of the lavas from three eccentric cones (Monte Spagnolo, Monte Fiori and Monte Rossi) and the 2002/2003 southern flank lava flow. All lavas are characterized by trachytic texture with variable modal composition of olivine, clinopyroxene and plagioclase phenocrysts. Euhedral and skeletal olivine phenocrysts can be distinguished into three main groups; a) normal zoning, b) inverse zoning, and c) patchy appearance with melt inclusions of andesitic and trachytic composition. The Monte Spagnolo whole rock composition has an Mg# ranging between 52-54 and 10.7 wt% CaO, being are the most primitive lavas among the sampled outcrops whereas the Monte De Fiore lavas are the most evolved since the Mg# ranges from 48.6 to 49.2 and the CaO content from 11 to 11.2 wt%. Both, Monti Rossi and the 2002/2003 lava flow are more evolved than the Monte Spagnolo since they have Mg# ~ 50 and 49-49.3 respectively. The CaO concentration in both outcrops is relatively constant ranging around 10.5 wt%.

The olivine compositions follow the same trend as their whole rocks. The most MgO-rich olivine (Fo=88.9 %) was found in the Monte Spagnolo lavas. This olivine is of magmatic origin and cannot be considered as mantle derived xenocryst since the NiO content is low (NiO=0.17 - 0.2 wt%) and

the CaO-content high (CaO=0.24 – 0.26 wt%). The most evolved lavas from Monte De Fiore have the lowest Fo-content (Fo=75 - 78 %). Olivine from all samples has a characteristic inverse zonation with, at Monti Rossi and 2002/2003 lava flow, Fo-content in the core ranging from 69% to 75% and in the rim from 77% to 80% respectively.

In conclusion, the studied eccentric cones show extensive magma mixing as can be inferred from the olivine inverse zoning. Monte Spagnolo lavas represent the most primitive magma formed at high temperatures (olivine skeletal growing) and the Monte De Fiore lavas the most evolved magma.

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