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The 1974 "eccentric" eruption at Etna: dynamics and eruptive style of primitive magmas

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So-called eccentric eruptions on Etna are triggered by fast intrusion of undegassed and sub-aphyric magmas that bypass the central conduits system and erupt explosively [1,2]. Such eruptions are quite uncommon, but two of them successively occurred in 2001 and 2002-2003. They produced volatile-rich primitive K-basalt that (i) was extruded during powerful lava fountains and (ii) differs from all pre-1970s lavas in its higher alkali content and Rb/Th, K/Cl, H2O/Cl, S/Cl ratios [3,4]; iii) represents a new end-member responsible for the gradual change of Etna lavas in last three decades. A first batch of this magma was first extruded during the eccentric 1974 eruption [5,6], which than constitutes a benchmark in the recent history of Mt Etna and for local hazard assessment. We have undertaken more detailed investigations of the 1974 eruption initiated on 30 January from an eruptive fissure opened on the western slope of the volcano. It was characterised by two distinct eruptive phases (first one: 30/01-17/02, second one 11-19/03) and a high explosivity with discontinuous powerful lava fountains. Explosive activity built successively two close-spaced scoria cones (Mt. De Fiore I and II). Moreover, a minor effusive activity produced short, poor-fed lava flows that travelled downhill for a few hundreds meters. Our systematic sampling, in addition to R. Romano's collection (who personally followed the eruption), allow us to provide a detailed geochemical and mineralogical study of the bulk rocks in time and space, and of their olivine-hosted melt inclusions. The 1974 products are aphyric. They contain ˜5% vol. of olivine microphenocrysts (Fo82 to Fo75 from the core to the rim) that are in equilibrium with their bulk rocks. The morphology of olivines from scoriae and lapilli demonstrate their crystallisation during magma ascent. Plagioclase and clinopyroxene occur in the groundmass whose glassy to intersertal texture depends on sample cooling rate. Bulk rocks show very little variation in major and trace elements, involving nearly 3% fractional crystallisation. In particular, ratios between trace elements verify that the 1974 magma strongly differed from contemporaneous products from the summit craters and resembles the basalt-trachybasalts that were erupted in the 2001 by lower vents [7] and 2002-2003 by southern fissures [8]. Melt inclusions fully confirm the volatile richness of the 1974 magma (>=4 wt%, with H2O=2.5-3.5 wt%, CO2 up to 0.3; S/Cl ˜1.9), typical of that of the present-day Etna basalt [3,4]. By analogy with the 2001 and 2002 eruptions [3,4], we conclude that the 1974 eruption prevalently resulted from closed system ascent and degassing of this volatile-rich primitive magma. However, some melt inclusions and embayments (gulfs) evidence that, prior to erupting, this magma partly mixed with the K-poorer magma emplaced in the plumbing system. According to their high amount of dissolved H2O and CO2, such a mixing, although not being a dominant process, may have occurred at pressure ˜300 MPa or depth ˜10 km b.s.l. This confirms the coexistence of two different magmas in Etna plumbing system about 30 years ago. Today, the K-rich magma first erupted in 1974 predominates in the plumbing system of Etna [3,4].

[1] Rittman,1965, Nuovo Cimento, 1117-1123; [2] Patanè, et al., 2003, Science 299, 2061-2063; [3] Métrich et al., 2004, Earth Planet. Sci. Lett. 228, 1-17; [4] Spilliaert et al., J. Geophys. Res. in press; [5] Tanguy & Kieffer, 1976, Bull. Volcanol. 40, 239-253; [6] Bottari et al. 1975, Rivista Mineraria Siciliana, 154-156, 175-198 [7] Calvari and INGV-CT staff, 2001, EOS Transactions, AGU 82, 653-656 ; [8] Andronico et al., 2005, Bull. Volcanol., 67, 314-330.