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The summit activity at Mt. Etna from 1995 to 2001: a multidisciplinary approach to investigate the long-term processes in the plumbing system

Daniele Carbone, Rosa Anna Corsaro, Francesco Guglielmino, and Giuseppe Puglisi
INGV, Osservatorio Etneo, sezione di Catania, Catania, Italy (corsaro@ct.ingv.it)

The integration of volcanologic observations with petrologic, microgravity and ground deformation data acquired at Etna from 1995 to 2001, provide the opportunity to investigate the long-term dynamics of Mt. Etna during a period when the activity was restricted to the summit craters.
Temporal patterns of major and trace elements indicate that the variability of bulk rocks composition is due to fractional crystallization and mixing between residing and new intruding magmas. Microgravity data show that from late-1996 to mid-1999 and from late-2000 to mid-2001, phases of strong gravity decrease occurred, centered on the upper southeastern sector of the volcano. The gravity decreases coincide with increases in the rate of the seismic strain release. Ground deformation show, from 1994 to the onset of the 2001 eruption, an almost continuous expansion of the volcano mainly due to magma accumulation into the western sector of the volcano. Therefore, the anti-correlation between gravity and seismicity in the eastern flank is not strictly connected to movements of magma and/or change of its chemical and physical properties. Conversely, these data suggest an increase of micro-fracturing along the NNW–SSE structural trend, implying a local density (gravity) decrease coupled with an increase in the release of seismic energy.
From 1996 to 1999 the ascent of conspicuous magma volumes promoted the reactivation of the South-East and Voragine summit craters, that showed an intense explosive and effusive activity until the end of 1999. The increase in the rate of fracturing from late-2000 to mid-2001 enhanced the formation of a preferential path for magma ascent to the surface and the onset of the July 2001 flank eruption.