Geophysical Research Abstracts, Vol. 9, 02537, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02537

How Mount Etna works: cause-effect relationships between magma accumulation, flank instability, and eruptions

M. Neri (1), B. Behncke (1), P. Allard (1,2), S. D'Amico (1) and S. Gambino (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania, Piazza Roma 2, 95123 - Catania, Italy (neri@ct.ingv.it), (2) Groupe des Sciences de la Terre, Laboratoire Pierre Süe, CNRS-CEA, CE-Saclay, 91191 Gif/Yvette, France

The eruptive activity of Etna has undergone significant changes during the past 14 years, and these have led to an improved understanding of the relationship between the plumbing system of the volcano and instability of its eastern to southern flanks. Following the end of the 1991-1993 eruption, a new eruptive cycle began, which so far has produced about 0.25 km3 of lavas and pyroclastics (dense-rock equivalent). The cycle evolved from initial recharging of the plumbing system and inflation, followed by powerful summit eruptions and slow spreading of the eastern to southern flanks, to a sequence of flank eruptions accompanied by accelerated flank displacement. Structurally, the volcanic system has become increasingly unstable during this period. Volcanological, geophysical and geochemical data allow the cause-effect and feedback relationships between magma accumulation below the volcano, flank instability, and the shift from continuous summit activity to episodic flank eruptions to be investigated. In this scenario, the growth of magma storage areas at a depth of 3-5 km below sea level exerts pressure against those flank sectors prone to displacement, causing them to detach from the stable portions of the volcanic edifice. Geochemical data indicate that magma remains stored below the volcano, even during phases of intense eruptive activity, thus causing a net volumetric increase that is accommodated by flank displacement. Instability can be enhanced by the forceful uprise of magma through the flanks, as in 2001, when the first flank eruption of the current eruptive cycle took place. Subsequent flank eruptions in 2002-2003 and 2004-2005, on the other hand, were in part facilitated by the opening of fractures at the head of moving flank sector, although the eruptions were significantly dissimilar from one another. Renewed inflation of the

volcano after the 2004-2005 eruption, continued displacement of the unstable flank sector, and resumption of summit activity in July-December 2006, demonstrate that the same feedback mechanisms continue to be active, and the Etna system remains highly unstable. The evolution of earlier eruptive cycles shows that a return to a state of relative stability is only possible once a voluminous flank eruption effectively drains the magmatic plumbing system.