



How does magma move inside the shallow feeder systems in basaltic volcanoes? The exceptional example of the 1809 Etna eruption (Italy)

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The detection and understanding of the movement of magma at very shallow levels remains one of the most fascinating challenges of modern volcanology, since such information allows us to identify and circumscribe the most probable location for the opening of future eruptive vents. Unfortunately, it is rarely possible to observe in any detail the internal structure of the feeder system of recent eruptions. In this paper, we describe the 1809 eruption of Mt. Etna, Italy, which represents one historical and rare case where it is possible to closely observe the internal structure of the feeder system. The 1809 eruption is fairly typical of the flank eruptions occurring along the NE Rift of Etna, but with a fundamental difference: the development of the fracture field was characterized, in its central sector, by an abrupt change in eruptive style (from effusive/Strombolian to explosive phreatomagmatic), testified by the outcrops exposed along the inner walls of some craters. This transition also created the formation of cavities in the feeder system. Phreatomagmatic activity was probably triggered by the interaction between the magma and the aquifer of the volcano, precisely when the magma was migrating abruptly downwards. The understanding of these mechanisms sheds new light on a) the propagation mechanism of eruptive fractures in basaltic volcanoes such as Mt. Etna, b) how magma moves inside the feeder systems and c) how the dynamic of the magma creates conditions of variability of eruptive styles during the same eruption. These results are also useful in terms of hazard assessment, since they allow predicting different eruptive scenarios according to the dynamics of the structural system feeding the eruptions, a crucial factor in highly urbanized volcanoes.