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TITLE: "Failed" eruptions revealed by integrated analysis of gas emission and volcanic tremor data at Mt. Etna, Italy

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ABSTRACT BODY: Mt Etna in Sicily is among the most intensely monitored and studied volcanoes on Earth due to its very frequent activity, and its location in a densely populated area. Through a sophisticated monitoring system run by the Istituto Nazionale di Geofisica e Vulcanologia - Osservatorio Etneo (INGV-OE), scientists are gaining every day and in real time a picture of the state of volcanic activity of Etna. During the spring of 2007, various episodes of paroxysmal activity occurred at the South-East Crater, one of the four summit craters of Mt Etna. These episodes were always associated with a sharp increase in the amplitude of the volcanic tremor as well as changes in the spectral characteristics of this signal. Eruptive activity ranged from strong Strombolian explosions to lava fountains coupled with copious emission of lava flows and tephra. During inter-eruptive periods, recurrent seismic unrest episodes were observed in form of both temporary enhancements of the volcanic tremor amplitude as well as changes of spectral characteristics. These changes often triggered the automatic alert systems in the operation room of the INGV-OE, even though not being followed by manifest eruptive activity at the surface. The influence of man-made or meteorologically induced noise could be ruled out as a cause for the alarms. We therefore performed a multi-parametric analysis of these inter-eruptive periods by integrating seismic volcanic tremor, in-soil radon, plume SO2 flux and thermal data, discussing the potential volcano-dependent source of these episodes. Short-term changes were investigated applying pattern classification, in particular Kohonen Maps and fuzzy clustering, simultaneously on volcanic tremor, radon and ambient parameters (pressure and temperature). The well established SO2 flux and thermal radiation data were used as the "smoking gun", for certifying that the observed changes in seismic and in radon data can be considered as volcanogenic. Our results unveil 'failed' eruptions between February and April 2007 that are explained as ascending magma batches, which triggered repeated episodes of gas pulses and rock fracturing, but that failed to reach the surface.

KEYWORDS: 8419 VOLCANOLOGY Volcano monitoring, 1988 INFORMATICS Temporal analysis and representation, 8430 VOLCANOLOGY Volcanic gases, 0520 COMPUTATIONAL GEOPHYSICS Data analysis: algorithms and implementation.

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