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Eruptive and geodynamic activity at Mt. Etna (Italy) monitored through continuous soil radon measurements

M. Neri, M. Burton, S. Giammanco, B. Behncke, E. Privitera, D. Condarelli

Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania, Piazza Roma, 2 - 95123 Catania, Italy

Soil radon emission monitoring is a potentially useful tool for predicting earthquakes and volcanic eruptions and furthermore aided in determining the location of active faults. Continuous radon monitoring was carried out at the Southeast Crater, one of the four summit craters of Mt. Etna (Italy) in September-November 1998, during a period of frequent eruptive episodes at that crater. The location of the monitoring station was at the abandoned Torre del Filosofo (TdF) mountain hut, about 1 km south of the crater. Radon anomalies were detected when eruptive episodes and the accompanying volcanic tremor became increasingly intense: no anomalies in radon activity were observed during the first five, and weaker, eruptive episodes, whereas significant spikes in radon activity preceded the latter five episodes by ąÝ46 hours. The peak values of radon activity recorded during that period were slightly above 1500 Bq/m3. During that period the anomalies in radon activity probably reflected a combination of increased gas leakage through fractures intersecting the shallow plumbing system and increased porosity of the fractures themselves, as gas/magma pressure in the Southeast Crater conduit became higher with time. A few months after the radon monitoring campaign, the cone of the Southeast Crater fractured during the last eruptive episode of the series, giving rise to a new eruptive period from effusive vents at its base. This event confirms that the conduit of the crater had become increasingly unstable and permitted increased gas leakage. A new permanent radon monitoring station was installed in July 2005, not far from the 1998 measuring site, during a period of eruptive quiescence at Etna. This station is equipped with a Barasol probe buried at a depth of 1.6 m within pyroclastic deposits, at the margin of an area with persistent fumarolic activity. Recording began on July 12 and showed initial values of radon activity of

about 2500 Bq/m3, but a first sharp rise to about 24,000 Bq/m3 occurred two days later. During the following four months (July-October 2005), there were five major peaks in radon activity, with values reaching unprecedented values up to 200 million Bq/m3. Four of these peaks seemed to coincide roughly with periods of heightened seismicity on the main fault systems cutting through the flanks of Etna. In particular, seismic activity generally preceded radon anomalies by a few hours to about a day. In spite of the spectacularly high values of radon activity and the possible link to increased seismicity, the significance of the acquired data remains inconclusive thus far.