



Radon surveys and monitoring at active volcanoes: an open window on deep hydrothermal systems and their dynamics

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The behavior of fluids in hydrothermal systems is critical in volcano monitoring and geothermal prospecting. Analyzing the time series of radon emissions on active volcanoes is strategic for detecting and interpreting precursory signals of changes in volcanic activity, eventually leading to eruptions.

Radon is a radioactive gas generated from the decay of U bearing rocks, soils and magmas. Although radon has been regarded as a potential precursor of earthquakes, radon anomalies appear to be better suited to forecast volcanic eruptions since we know where paroxysms may occur and we can follow the evolution of volcanic activity. Radon mapping at active volcanoes is also a reliable tool to assess diffuse and concentrated degassing as well as efficiently detecting earthquake-volcano interactions.

Systematic radon monitoring has been shown to be a key factor for evaluating the rise of volcanic and hydrothermal fluids. In fact, the decay properties of radon, the duration of radon anomalies together with sampling rates may be cross-checked with the chemistry of hydrothermal fluids (and their transport properties) to constrain fluids ascent rates and to infer the permeability and porosity of rocks in sectors surrounding the active conduits. We hereby further discuss the data of radon surveys and monitoring at Somma-Vesuvius, Stromboli and La Soufrière (Guadeloupe, Lesser Antilles). The integrated analysis of seismic and geochemical data, including radon emissions, may be successfully used in testing temperature distributions and variations of porosity and permeability in volcanic hydrothermal systems and can be used as a proxy to analyze geothermal reservoirs.