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The Rome gas blowout zone (Central Italy)

Maria Luisa Carapezza, Luca Tarchini, Massimo Ranaldi, and Franco Barberi
Istituto Nazionale Geofisica Vulcanologia, Sezione Roma 1, Rome, Italy (Istituto Nazionale Geofisica Vulcanologia, Sezione Roma 1, Rome, Italy (luca.tarchini@ingv.it)

Colli Albani is an alkali-potassic quiescent volcano of Central Italy that last erupted 36 ka ago. Several lahar generating water overflows have occurred from Albano crater lake, the most recent in Roman times (IV Century B.P.) and the resulting deposits form a surficial impermeable cover on its north-western flank. An important NW-SE trending volcano-tectonic fracture extends from the volcano to the periphery of Rome city. This is a leaky fracture allowing deep magmatic gas to rise toward the surface. In zones where the impervious cover has been removed by excavations, as Cava dei Selci, the gas is freely discharged into the atmosphere creating local hazardous conditions. Elsewhere, the gas dissolves and pressurizes the shallow aquifer confined underneath the impervious cover. Any time this aquifer is reached by a drilling, a dangerous gas blowout may be generated, i.e. a sudden emission of a jet of gas, nebulized water and fine loose fragments of volcanic rocks. Since 2003 four gas blowouts, from ~ 45–50 m deep drillings, have occurred at the boundary between Rome and Ciampino municipalities, a site designed as the Rome gas blowout zone. Dangerous atmospheric CO_2 and H_2S concentrations killed some animals and several families had to be evacuated because of hazardous gas concentration inside their houses. The emitted gas consists mostly of CO_2 (>90 vol.%) and contains a low but significant quantity of H_2S (0.3–0.5 vol.%); it has the highest helium isotopic R/Ra value (up to 1.90) of all Colli Albani natural gas discharges. This He isotopic value is similar or even slightly higher than in the fluid inclusions of phenocrysts of the Colli Albani volcanic rocks, suggesting a likely magmatic origin of the gas. Colli Albani volcano is characterized by anomalous uplift, release of magmatic gas and episodic seismic crises. The Rome gas blowouts represent a geochemical window to investigate deep volcanic processes. Should a volcanic unrest occur, gas hazard would increase in this densely inhabited zone, as the input of magmatic gas into the confined aquifer might create overpressure conditions leading to a harmful phreatic explosion, or increase the emission of hazardous gas through newly created fractures.