Geophysical Research Abstracts
Vol. 17, EGU2015-12823, 2015
EGU General Assembly 2015

Mineralogical and sulfur isotopic characterization of the sulfur-bearing mineralization from the active degassing area of Campi Flegrei caldera (southern Italy)

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The Campi Flegrei caldera is a site of persistent hydrothermal circulation and gaseous emissions inside the Pozzuoli town and nearby the city of Napoli (Italy). The solfataric phenomena are associated with episodes of low-magnitude seismicity and vertical ground displacement since Roman times, evolving to the Monte Nuovo eruption in the 1538 AD. Pronounced geochemical anomalies, uplift rates up to 1 m/y and up to ten thousands microearthquakes per year also characterized the four most recent decades of unrest. The degassing phenomena are concentrated within the Solfatara crater, although, since 2006, the hydrothermal activity strongly increased in the Pisciarelli district, i.e. on the north-east slope of the tuff.
We investigated sulfur-bearing mineral precipitates sampled from the active fumaroles both within the Solfatara and along the Pisciarelli slope. Mineral assemblage, texture and chemistry were determined for the efflorescence precipitated nearby the fumaroles and along the mud pool by x-ray diffraction, back-scattered electron microscope and electron diffuse microanalysis. δ34S compositions were also determined on separated sulfur-minerals. The new data have been compared with scattered literature data, including few existing for the previous '70 and '80 unrest episodes.
Native sulfur and alunite are the main mineral phases that associate with alunogene, and, locally, pickeringite and potassium alum. Sporadically mereiterite, amarillite, and pyrite have been found as neogenesis mineralization along the outcropping rocks. The mud pool is rich in gypsum, potassium alum and pyrite. δ34S values range from -5.48 to 0.0‰ being slightly lower than previous data.
The obtained results suggest that the Pisciarelli area is characterized by magmatic-hydrothermal, magmatic-steam and steam-heated environments, developed on a argillitic hydrothermal facies that thickens in correspondence of the degassing area. These environments develop and continuously evolve in relation to fracturing conditions that determine the ability of i) gases to rise from deeper levels and ii) meteoric water to filter from the surface to depth.