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New insights on the structural setting of the Pisciarelli fumarole field (Campi Flegrei caldera): implications for evolution and eruptive scenarios

Roberto Isaia[1], Maria Giulia Di Giuseppe[1], Jacopo Natale[2], Francesco D'Assisi Tramparulo[1], Antonio Troiano[1], and Stefano Vitale[1,2]

[1]Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Vesuviano, Napoli, Italy (roberto.isaia@ingv.it)
[2]Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse (DiSTAR), Università di Napoli Federico II

The Solfatara-Pisciarelli area, located in the active Campi Flegrei caldera (Italy) hosts an intense hydrothermal activity, whose shallower expression is controlled by a complex pattern of fractures and faults. Volcanological and structural studies may be the key to disclose the relationships between brittle structures and hydrothermal activity, as well as to understand the dynamic processes and possible eruption scenarios. For this purpose, we present the results of a volcanological and structural survey combined with Electrical Resistivity Tomography (ERT) and Self Potential data. Three ERT surveys has been performed in order to reconstruct the Pisciarelli structural setting and the relationships of the main fractures and faults with the underground fluid circulation. Two measured profiles crossing the main mud pool and fumaroles of Pisciarelli and has been repeated every three months to evaluate the possible influence of seasonal effects on the hydrothermal system. These profiles performed during the last year have been compared with a first ERT prospection carried on in correspondence of a 100 m long survey line, which crosses along the W-E direction the Pisciarelli permanent mud pool and its main fumarole. The comparison of the results with temperature, geochemical data and rainfall rates allowed to separate the areas dominated by seasonal effects from areas where deeper injected gasses cumulate in the subsoil. Further indication on the fluid circulation and structures derived by a mapping of the self-potential anomaly realized for the whole Solfatara-Pisciarelli area. The rocks exposed in the Pisciarelli area host a large number of faults and fractures, the latter often related to fault damage zones. Cross-cutting fault and fracture relationships and their relations with the volcanic sequences suggest that NW-SE and NE-SW trending faults are sealed by Solfatara deposits (4.28 ka); whereas E-W and N-S trending faults cross-cut the youngest volcanic succession (Astroni deposits, 4.25 ka). Several landslide deposits were recognized in the higher part of the Pisciarelli fumarole field, mainly due to intense rock fracturing, hydrothermal alteration, mud-pool activity and steep relieves surrounding the mud pool. Ancient landslide deposits overlying mud sediments, similar to those nowadays forming within the active mud pool, cropping out along the slope, at about 5 meters above the present mud pool level. New landslide phenomena could seal off the mud pool and fumaroles of Pisciarelli, with a possible consequence to trigger an hydrothermal explosions as described for other hydrothermal systems in the world.