

Permeability and continuous gradient temperature monitoring of volcanic rocks: new insights from borehole and laboratory analysis at the Campi Flegrei caldera (Southern Italy).

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The pilot borehole recently drilled in the eastern caldera of Campi Flegrei (Southern Italy), during the Campi Flegrei Deep Drill Project (CFDDP) (in the framework of the International Continental Scientific Drilling Program) allowed (i) estimating on-field permeability and coring the crustal rocks for laboratory experiments, and (ii) determining thermal gradient measurements down to ca. 500 m of depth. We report here a first comparative in situ and laboratory tests to evaluate the rock permeability in the very high volcanic risk caldera of Campi Flegrei, in which ground deformations likely occur as the persistent disturbance effect of fluid circulation in the shallower geothermal system. A large amount of petro-physical information derives from outcropping welded tuffs, cores and geophysical logs from previous AGIP's drillings, which are located in the central and western part of the caldera. We discuss the expected scale dependency of rock permeability results in relation with well-stratigraphy and core lithology, texture and mineralogy. The new acquired data improve the database related to physical property of Campi Flegrei rocks, allowing a better constrain for the various fluid-dynamical models performed in the tentative to understand (and forecast) the caldera behavior. We also present the first data on thermal gradient continuously measured through 0 - to 475 m of depth by a fiber optic sensor installed in the CFDDP pilot hole. As regards, we show that the obtained values of permeability, compared with those inferred from eastern sector of the caldera, can explain the different distribution of temperature at depth, as well as the variable amount of vapor phase in the shallow geothermal system. The measured temperatures are consistent with the distribution of volcanism in the last 15 ka.