Geophysical Research Abstracts
Vol. 15, EGU2013-11377-1, 2013
EGU General Assembly 2013

First in-situ rock parameters measurements at Campi Flegrei caldera from CFDDP experiment: implications for hazard and eruption forecast.

Stefano Carlino, Anna Tramelli, Monica Piochi, Renato Somma, Claudia Troise, and Giuseppe De Natale
Istituto Nazionale di Geofisica e Vulcanologia Sezione di Napoli Osservatorio Vesuviano (Italy), (stefano.carlino@ov.ingv.it)

Campi Flegrei Deep Drilling Project (CFDDP) started on July 2012, in the framework of International Continental Scientific Drilling Program (ICDP), aimed to understand the physics of volcanic processes at this area. The first drilling phase of CFDDP involved a pilot well 500 m deep, located within the easternmost border of the caldera, hosting the densely populated western part of the city of Naples (Southern Italy). Such a first drilling phase has been carried out in about 2 months, ending in December 2012.

At the bottom of the pilot well, a leak of test (LOT), specifically adapted to the solution of the main open scientific problems, was performed. The pressure vs time data have been used to evaluate, for the first time at Campi Flegrei, the in situ permeability of the rock formations and the stress level of the area. These parameters are crucial for the validation of physical models of Campi Flegrei caldera dynamics. Interpreting the large uplift of the area cumulated in the last thousands years is in fact a critical issue to understand the amount of magma accumulated in the shallow layers, which can be mobilized in a future eruption. A simple, purely magmatic model would imply, depending on the model details, the accumulation of 1 to 10 km^3 of new magma in shallow reservoirs. It would correspond to a huge eruption which would require evacuation of several millions people. An alternative hypothesis, much discussed in the recent literature, is that a large part of uplift depends from the injection of deep fluids into the shallow geothermal system. Such hypothesis is much less dramatic in terms of risk, but the real feasibility of such kind of model heavily relies on the values of average permeability at depth, which is an unknown parameter. The measured in-situ values, from $10^{-14}$to about $10^{-15}m^2$, are consistent with those required, by theoretical models, to reproduce the observed uplift in terms of perturbations of the geothermal system, thus experimentally validating, for the first time, a model alternative to a purely magmatic one. Another important measurement performed during the LOT experiment is the value of rock strength, and the minimum tectonic stress loading. Such parameters improve a lot our ability to model physical process at this area, giving a fundamental contribution also to volcanic risk assessment and mitigation.