Geophysical Research Abstracts
Vol. 15, EGU2013-3397-1, 2013
EGU General Assembly 2013

The ICDP-CFDDP Project: Understanding caldera dynamics and mitigating the extreme risk of the most urbanised volcano in the World

Giuseppe De Natale (1), Claudia Troise (1), Stefano Carlino (1), Renato Somma (1), Monica Piochi (1), Mauro Di Vito (1), Roberto Isaia (1), Sandro De Vita (1), Marco Sacchi (2), Maria Josè Jurado (3), Thomas Wiersberg (4), Jochem Kueck (4), Flavia Molisso (2), Joerge Erzinger (5), Christopher R.J. Kilburn (6), Agust Gudmundsson (7), Jean Pierre Burg (8), Alba Zappone (8), and David P. Hill (9)

(1) INGV, Osservatorio Vesuviano, Napoli, Italy, (2) CNR-IAMC, Napoli, Italy, (3) CSIC, Barcelona, Spain, (4) ICDP, Potsdam, Germany, (5) GFZ, Potsdam, Germany, (6) UCL, London, UK, (7) Royal Holloway, London, UK, (8) ETH, Zurich, Switzerland, (9) USGS, Menlo Park, USA

The Campi Flegrei Deep Drilling Project (CFDDP) entered the operative phase during the second half of 2012, with the pilot hole drilling. The Project was initiated to address two kinds of problems: 1) purely volcanological, to understand in detail the dynamics of the most explosive and yet mostly unknown volcanism on the Earth with the potential to generate global catastrophes, and 2) to mitigate the highest volcanic risk in the World, namely the one associated with the metropolitan area of Naples where more than 3,000,000 people are exposed to extreme risk. The CFDDP Project offers the only direct means to understand the physics driving the on-going ground uplift affecting the area since at least six centuries, through in situ and laboratory measurements of rock rheology and permeability. In particular, direct investigation at depth by drilling is essential for understanding the extent that shallow magma intrusion is involved in the uplift of 15 to 20 m accumulated over the last centuries. Such a high cumulative uplift corresponds to 1-10 km3 of new magma intruded into the system, depending on details of the model used. Such an erupted volume should be conservatively assumed as the worst scenario for a future eruption. This corresponds to a massive eruption, largest than any other one after the caldera-forming Yellow Tuff eruption of 15,000 y BP and not much smaller than that, which would anyway require evacuation of some millions people. An alternative possibility is that the cumulative uplift is mostly due to shallow geothermal perturbations as described in several recent publications. Both possibilities, each with widely differing hazard implications, rely strongly on as yet poorly known conditions at depth beneath the caldera. It is thus crucial to discriminate between these two opposing possibilities in order to clarify the worst scenario for a future eruption and to provide an invaluable tool for civil defence at this densely populated area.
This presentation describes preliminary results obtained from CFDDP pilot hole, reaching a final depth of 502 m, which show considerable promise in answering the main open questions. From a volcanological point of view, they enlighten in an unprecedented way the dynamics of the Bagnoli-Fuorigrotta plain, the easternmost part of the caldera and the most densely populated because it includes the city of Naples. Furthermore, they allowed for the first in-situ measurements, at 500 m of depth, of loading stress and fluid-dynamical parameters like permeability, thus already representing a large step forward towards a complete fluid-dynamical interpretation of the ground uplift episodes called ‘bradyseism’.