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The Campi Flegrei caldera-hosted high-temperature and high-saline geothermal system in the Southern Italy: the implication of the geothermal resource as derived by the present state of the knowledge through 70 years of volcanological, structural, petrological, geochemical and downhole researches.

M. Piochi, M.A. Di Vito, A. Mormone, G. De Natale, A. Tramelli, C. Troise, and S. Carlino
Istituto Nazionale di Geofisica e Vulcanologia, sezione Osservatorio Vesuviano, Napoli, Italy (monica.piochi@ov.ingv.it)

The Campi Flegrei caldera (Italy) hosts a geothermal system characterized by: i) high thermal gradient (temperature up to 420°C at 3050 m b.s.l.), ii) high temperature (up to ∼90-150°C at very shallow depth) fumaroles, iii) multiple meteoric to brine (TDS up to 33 g•l^{-1}; temperature up to 95 °C) aquifers and iv) at least 1500 tonnes per day of CO_2 emissions. This area is highly urbanized despite the repeated occurrence of ground deformation phenomena accompanied by seismicity with volcano-tectonic and long-period micro-earthquakes. The caldera has been widely studied by geologist and geophysicists. In particular, since '40s, the caldera has drawn scientific interest for its geothermal capability inducing the companies AGIP (Azienda Geologica Italiana Petroli) and SAFEN (Società Anonima Forze Endogene Napoletane) to drill more than one hundred 80-to-3100 m deep wells. However this experience did not reach the exploitation phase due to technological and communication problems. The geothermal potential (thermal and electric) is evaluated of about 6 GWy. The recent Campi Flegrei Deep Drilling Project [De Natale and Troise, 2011], sponsored by the International Continental Scientific Drilling Program, foresees the realization of medium-to-deep wells in the caldera with the ambition of stimulating interest in geothermal energy exploitation and technology development and, in addition of installing downhole monitoring systems. The geological knowledge of the area is the benchmark for the drilling sites selection. We reconstructed a multi-disciplinary conceptual model updated on the basis of the most recent scientific results and findings. In particular, the constrains (the most important are listed in brackets) comes from: i) boreholes (litho-stratigraphy, aquifer location, depth-related temperature), ii) fieldwork (stratigraphy, location of structural fractures and eruption vents), iii) petrology and melt inclusions (pressure and temperature of magma with implications regarding the magma reservoir location and arrest levels of ascending magma), iv) hydrothermal facies distribution (mainly at depths affected by thermo-metamorphism), v) elastic parameters (mainly Vp and Vp/Vs) of cored rocks measured in laboratory; vi) surface fluid emissions (as the surface expression of faults and fractures), vii) hydrogeology (location of thermal aquifers and general water circulation), and viii) seismology (location of main geophysical discontinuity and of seismic wave anomaly, seismogenetic and attenuation volumes). Our model evidences the lack of information from deep layers in the eastern caldera sector, i.e. the Bagnoli Plain and in the Pozzuoli Gulf. Investigations of these sites would add important information to our present knowledge of the geothermal system, as well as of the caldera structure and related magma-system behavior. Furthermore, the Bagnoli Plain is one of the largest Italian dismantled industrial areas, affected by metal contamination and undergoing to reclamation. It is, presently, a sparsely inhabited zone within the city of Naples, which therefore allows deep volcanological and geothermal investigations as well as requalification in terms of clean and renewable resource use, in contrast with the other peripherals areas where the high-population density poses strong limitations to the research and to the possibility to plan new rational use of the land and of its resources.