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Electromagnetic outline of the Solfatara-Pisciarelli hydrothermal system, Campi Flegrei (Southern Italy)

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We describe the results from a combined CSAMT and MT survey carried out in the Solfatara-Pisciarelli area, located in the central part of the Campi Flegrei composite caldera, west of Naples, Southern Italy. The Solfatara-Pisciarelli area represents the most active zone within the CF area, in terms of hydrothermal manifestations and local seismicity. Since 1969, the caldera is experiencing ground deformation, seismicity and geochemical fluid changes, which are particularly evident in this area. A 1 km long, nearly W-E directed CSAMT-MT profile crossing the fumaroles field was carried out with the aim of deducting an EM model of the structural setting of the hydrothermal system in the first 3 km depth. An interpretation of the EM modelled section is given in this paper, taking advantage from already existing seismic, gravity and geochemical data in the same area. Three well distinct EM zones have been outlined. The first EM zone is a very shallow, electrically conductive body localized beneath the westernmost segment of the profile, which, within a short distance of about 100 m, dips westwards from near surface down to some hundred metres depth. Mostly accounting for the very low resistivity (1-10 Ωm) and the exceedingly high values of vP/vS (>4), this shallow zone has been ascribed to a water-saturated, high-pressurized geothermal reservoir. The second EM zone, which has been localized below the west-central portion of the EM transect, appears as a composite body made of a nearly vertical plumelike structure that escapes at about 2.25 km depth from the top edge of the east side of a presumably horizontal platelike body. The plumelike structure rises up to the free surface in correspondence of the fumaroles field, whereas the platelike structure deepens at least down to the 3 km of maximum EM exploration depth. The combined interpretation of resistivity, wave velocity, gravity and geochemical data indicates the plumelike portion is likely associated with a steam/gas-saturated column and the platelike portion to a high temperature (>300°C), over-pressurized, gas-saturated reservoir. Finally, the third EM zone, which has been localized beneath the eastern half of the EM transect, from about 1.2 km down to about 3 km of depth, is also characterized by the lowest resistivity values (1-10 Ωm). When jointly interpreted with seismic and gravity data, this feature can be associated to a hydrothermally mineralized, clay-rich body.