Geophysical Research Abstracts
Vol. 19, EGU2017-19239, 2017
EGU General Assembly 2017

A geochemical approach for assessing the possible uses of the geothermal resource in the eastern sector of the Sabatini Volcanic District (Central Italy)

Daniele Cinti (1), Franco Tassi (2,3), Monia Procesi (1), Lorenzo Brusca (4), Jacopo Cabassi (2,3), Francesco Capecchiacci (2,3), Antonio Delgado Huertas (5), Gianfranco Galli (1), Fausto Grassa (4), Orlando Vaselli (2,3), and Nunzia Voltattorni (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia (INGV), via di Vigna Murata 605, 00143 Roma, Italy, (2) Dipartimento di Scienze della Terra, Università di Firenze, via G. La Pira 4, 50121 Firenze, Italy, (3) CNR-IGG - Istituto di Geoscienze e Scienze della Terra, via G. La Pira 4, 50121 Firenze, Italy, (4) Istituto Nazionale di Geofisica e Vulcanologia (INGV), via Ugo La Malfa 153, 90146 Palermo, Italy, (5) Instituto Andaluz de Ciencas de la Tierra IACT (CSIC-UGR), avenida de las Palmas 4, 18100 Armilla, Granada, Spain

The Sabatini Volcanic District (SVD) hosts a hydrothermal reservoir heated by the post-magmatic activity that affected the peri-Tyrrhenian sector of central Italy, giving rise to a number of thermal and mineral discharges. In this study, a complete geochemical and isotopic dataset based on the composition of 215 water and 9 bubbling gases, collected from the eastern sector of this huge hydrothermal system, is reported. The main aims are to (i) investigate the fluid sources and the main chemical-physical processes controlling the fluid chemistry and (ii) construct a conceptual fluid circulation model to provide insights into the possible use(s) of the geothermal resource. The fluid discharges are fed by two main aquifers, characterized by: (1) a Ca-HCO_3 to Ca(Na)-HCO_3 composition, typical of a shallow hydrological circuit within volcanic and sedimentary formations, and (2) a Ca-HCO_3(SO4) to Na(Ca)-HCO_3(Cl) composition, produced by the interaction of CO_2-rich fluids with Mesozoic and Triassic carbonate-evaporite rocks. A thick sequence of low-permeability volcanic products represents a physical barrier between the two fluid reservoirs. As commonly occurring in central-southern Italy, CO_2 is mainly produced by thermo-metamorphic decarbonation within the carbonate-evaporite reservoir, with minor contribution of mantle CO_2. A dominant crustal source is also indicated by the relatively low R/Ra values (0.07-1.04). Methane and light hydrocarbons are mostly thermogenic, whereas H2S derives from thermogenic reduction of the Triassic anhydrites. Slightly positive 15N/14N values suggest minor N2 contribution from deep sedimentary sources. On the whole, a comparison of these geochemical features with those of the thermal fluids from the western portion of SVD highlights an eastward increasing influence of the shallow aquifer on the deep-originated fluids, likely caused by the proximity of the Apennine range from where the meteoric water, recharging the hydrothermal system, permeate. Accordingly, gas geothermometry in the CH4-CO_2-H2 and H2S-CO_2-H2 systems suggests equilibrium temperatures <200 °C, i.e. significantly lower than those measured in fluids from deep geothermal wells (300 °C). Although mitigated by the short distance from the Apennine range, the thermal anomaly recognized by fluid geochemistry in the eastern SVD makes this area suitable for direct exploitation of the geothermal resource.