Geophysical Research Abstracts
Vol. 12, EGU2010-8522, 2010
EGU General Assembly 2010

Water chemistry, carbon isotopic characterisation, fluid-rock interaction processes and new estimates of deep temperatures in the Alban Hills volcano, central Italy

luca pizzino, daniele cinti, nunzia voltattorni, alessandra sciarra, and fedora quattrocchi
Istituto Nazionale di Geofisica e Vulcanologia, Seismology and Tectonophysics, Rome, Italy (luca.pizzino@ingv.it, ++39-0651860507)

In the framework of a two-years (2005-2007) multidisciplinary project funded by the Italian "Dipartimento della Protezione Civile", a detailed geochemical survey in groundwater was carried out in the Alban Hills volcanic district (central Italy), sampling a total of 183 water sites (springs and wells). Physical-chemical parameters, main chemistry, minor and trace element contents, as well as dissolved gases, were analyzed. Moreover, isotopic analysis on dissolved carbon were performed. The study had the main goals to: i) characterise the chemical background of the discharging fluids, gathered in a period with low seismicity; ii) define the main gas-water-rock interaction processes presently ongoing, iii) discriminate the different origin of the dissolved carbon and iv) give reliable estimates of the deep aquifer temperatures, never performed till now.

The bulk of the samples fall in the field of the earth (alkaline)- bicarbonate waters, while some of them show alkaline-bicarbonate and acid-sulphate chemistry. Earth (alkaline)-bicarbonate waters have a relatively fast circulation in and a limited interaction with the shallow volcanic rocks in a low temperature environment; in some sectors of the volcano they receive a huge gas input from depth (mainly CO2), increasing their salinity. Waters with longer interaction with volcanic rocks and/or clays, in presence of CO2, evolve towards the alkaline-bicarbonate field. Acid-sulphate waters are formed by dissolution of acid and reducing gases (CO2, H2S) into oxygen-rich shallow aquifers and pools fed by rainwater. CO2 and N2 are the principal dissolved gases. Nitrogen, in particular, characterises shallow waters (atmospheric component), while calculated carbon dioxide isotope composition points out either an organic or a high-temperature deep origin. H2S, He and H2 show very low contents, while methane was found both in same CO2-rich waters and shallow samples.

The main gas-water-rock interaction processes and their extent were assessed by means of activity plots. Waters can be divided into two main groups: i) earth (alkaline)- bicarbonate waters fall in the field of kaolinite, representing the early stage of the silicate weathering. They show undersaturation with respect to the main rock-forming minerals, and are considered as "immature"; ii) alkaline-bicarbonate waters show a partial equilibrium with the main clay minerals, representing an evolution towards more "mature" terms. Acid-sulphate waters are out of any equilibrium with the host rocks and were not considered. Physical-chemical parameters and observed chemistry fully fit this chemical scenario.

The estimate of deep temperatures, based on the applications of solute geothermometers, allowed to define the geothermal system beneath the volcano as characterised by a medium-low enthalpy, with temperatures comprised in the range 110-140°C.