Accepted Manuscript

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PII: S0883-2927(17)30246-9

DOI: 10.1016/j.apgeochem.2017.06.014

Reference: AG 3916

To appear in: *Applied Geochemistry*

Received Date: 4 April 2017

Revised Date: 23 June 2017

Accepted Date: 27 June 2017

Please cite this article as: Cinti, D., Tassi, F., Procesi, M., Brusca, L., Cabassi, J., Capecchiacci, F., Delgado Huertas, A., Galli, G., Grassa, F., Vaselli, O., Voltattorni, N., Geochemistry of hydrothermal fluids from the eastern sector of the Sabatini Volcanic District (central Italy), *Applied Geochemistry* (2017), doi: 10.1016/j.apgeochem.2017.06.014.

GEOCHEMISTRY OF HYDROTHERMAL FLUIDS FROM THE EASTERN SECTOR OF THE SABATINI VOLCANIC DISTRICT (CENTRAL ITALY)

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Abstract

This study reports a complete geochemical dataset of 215 water and 9 gas samples collected in 2015 from thermal and cold discharges located in the eastern sector of the Sabatini Volcanic District (SVD), Italy. Based on these data, two main aquifers were recognized, as follows: 1) a cold Ca-HCO_3 to Ca(Na)-HCO_3 aquifer related to a shallow circuit within Pliocene-Pleistocene volcanic and sedimentary formations and 2) a deep CO_2-pressurized aquifer hosted in Mesozoic carbonate-evaporitic rocks characterized by a Ca-$HCO_3(SO_4)$ to Na(Ca)-HCO_3(Cl) composition. A thick sequence of low-permeability formations represents a physical barrier between the two reservoirs. Interaction of the CO_2-rich gas phase with the shallow aquifer, locally producing high-TDS and low-pH cold waters, is controlled by fractures and faults related to buried horst-graben structures. The $\delta^{18}O$-H_2O and δD-H_2O values indicate meteoric water as the main source for both the shallow and deep reservoirs. Carbon dioxide, which is characterized by $\delta^{13}C$-CO_2 values ranging from -4.7 to +1.0‰ V-PDB, is mostly produced by thermo-metamorphic decarbonation involving Mesozoic rock formations, masking possible CO_2 contribution from mantle degassing. The relatively low R/R_a values (0.07-1.04) indicate dominant crustal He, with a minor mantle He contribution. The $CO_2/^3He$