Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06343, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06343
EGU General Assembly 2008

Interaction between deep and shallow fluids and carbon dioxide degassing at Mt Amiata region.

F. Frondini (1), S. Baldini(1), R. Balestra(1), S. Caliro (2), C. Cardellini(1), G. Chiodini(2), M. Donnini(1), D. Granieri (2), N. Morgantini(1)

(1) Dipartimento di Scienze della Terra, Università di Perugia, Perugia, Italy, (2) INGV-Napoli, Osservatorio Vesuviano, Napoli, Italy (frondini@unipg.it / Fax: +39 0755852603)

Quaternary volcanic complex of Mt. Amiata is located in the southern Tuscany and represents the most recent manifestation of the Tuscan Magmatic Province. The region is characterised by thermal anomaly resulting in a high geothermal gradient of 80-150 ˚C/km with local peaks up to 300 ˚C/km which are in correspondence of the the Piancastagnaio and Bagnore geothermal fields where heat flow reaches values up to 600 mW/m2. Two main hydrothermal systems are present, located at increasing depths, in carbonate and metamorphic formation respectively. The thermal anomaly is strictly related to the presence at relatively shallow depth of intrusive magmatic bodies. Seismic data shows the presence at depth between 5-7 km (up to 15 km) of a discontinuous reflector (K-horizon), which can represents a level where overpressured fluids are present. The area is characterised by the presence of numerous CO_2-rich gas emissions and geothermal features, mainly located at the periphery of the volcanic complex. Chemical and isotopic compositions of groundwater, gas and geothermal fluids together with measurements of CO_2 diffuse degassing from gas emissions where combined to investigate the interaction between deep and shallow fluids to define the relations between tectonic and volcano-tectonic structures control and mass and energy exchanges, and to quantify the amount of deeply derived CO_2 transferred to the surface.

Locations of gas manifestations and chemical isotopic composition of groundwaters reveal that the fluids pathways is strongly controlled by the geological-structural setting of the area. The degassing mainly occurs outside the volcanic complex due to

presence of low permeability flysch formation at the base of the volcanic products. Only minor features within the volcanic complex are probably connected to the old magmatic fissures and to the buried carbonate structures. Hence, the deep hydrothermal CO_2 rich fluids appear to be "isolated" respect to the overlaying volcanic aquifer. Moreover, the deeper hydrothermal system transfers heat and vapor but not the liquid phase to the shallower one. The amount of deeply derived CO_2 transferring to the surface has been estimated summing in the CO_2 released by five gas emissions by diffuse degassing ($\sim$ 150 t/d), the CO_2 associated to sulphate-acid waters ($\sim$90 t/d), the CO_2 dissolved in to the cold and thermal groundwaters of peripheral carbonate aquifers ($\sim$ 20 t/d) resulting in about 260 t/d. In addition, basing on conductive heat flux, enthalpy and CO_2 concentration of hydrothermal fluids, and on the aerial extension of the geothermal fields of Piancastagnaio, Bagnore and Poggio Nibbio a CO_2 flux of $\sim$ 21 t/d was estimated be associated with hot fluid circulation in the deep hydrothermal systems. Finally considering also the CO_2 released by the geothermal power plants, a total CO_2 flux of about 1100 t/d can be estimate for the volcanic-geothermal area of Mt. Amiata.