Geophysical Research Abstracts
Vol. 14, EGU2012-11002, 2012
EGU General Assembly 2012
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Reappraisal of the geothermal potential at Colli Albani volcano (Italy): a new approach to the volume method

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High enthalpy geothermal reservoirs are usually associated with fractured rocks. Secondary permeability is however difficult to be predicted thus making it difficult to locate the most productive volumes of the reservoirs. The calculation of the energetic potential in geothermal areas suffers of the large uncertainties associated with secondary permeability issues, facing the task of the interplay between stratification and fracturing on the anisotropic distribution of secondary permeability.
The object of this work is the research and informatization of available data for the Colli Albani (Latium, Central Italy) geothermal system, in order to propose a qualitative approach and quantitative identification and description of geothermal systems, applied to the Colli Albani area as a case history.
The identification of the rock volumes most promising in terms of industrial exploitation needs the definition of an evaluation matrix. The considered data can be placed in a three dimensional matrix with A axis that accounts for the modeling of the depth of the top of the reservoirs based on geophysical and direct data, and a B axis that accounts for the thermal modeling of the crust (i.e. T with depth) based on measured thermal gradients. Both A and B data are strongly influenced by the geological model therefore, as for the case of Colli Albani, there is certainly a lot of scope into revising existing geological reconstructions of the reservoirs in Central Italy and accordingly reconsidering the interpolation and modeling of both thermal and geophysical data. For the scope of this work, we have taken into account the maps descriptive the thermal structure and the deep distribution of the top of the geothermal reservoirs produced by ENEL and AGIP between the 1970s and 1990s for Cental Italy, and we have detailed the internal structure of the substrate, considering more recent direct and indirect data on the nature of the substratum.
Finally, we discuss the implementation of a C axis which aims at evaluating the surface data that are evidence of geothermal fluid circulation in the geothermal reservoir. We considered datasets on: i) distribution and density of tectonic lineaments (ENEL, 1972 and original data); ii) temperature and electric conductivity of groundwaters (Capelli and Mazza, 2005); iii) partial pressure of dissolved CO_2 in the groundwaters (Chiodini and Frondini, 2001). These data may give guidance on areas where the cap rocks are affected by permeable faults and fractures, and on the presence at depth of permeable fractured volumes and fluid circulation inside the reservoir.
All data sets on the A, B and C axes of the conceptual matrix have been treated in a GIS platform, and thematic maps have been calculated over a grid with 200 meters side, from a proposed general formula able to approach the feasibility of geothermal exploration on each grid cell.