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Characterization of medium enthalpy geothermal system in the Campania region (southern Italy): from geological data to resource modelling

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Within the framework of the VIGOR project, a characterization of medium enthalpy geothermal resources have been carried out in the Campania region (southern Italy), with a focus on the "Guardia dei Lombardi" area (province of Avellino).
The VIGOR project began on the basis of an agreement between the Ministry of Economic Development and the Italian National Research Council, and it deal with the exploitation of innovative uses of geothermal energy in the so-called "regions of convergence"(Campania, Calabria, Puglia and Sicilia).
Thanks to the intense hydrocarbon exploration, carried out particularly during the 1956-1996 period, an extensive data set made up by deep wells and seismic reflection profiles exist in the study area. The previous exploration demonstrated the presence of a fractured carbonate reservoir, mainly belonging to the Cretaceous section of the Apulian shallow water carbonate platform (e.g. Scrocca 2010 and references therein), which is deformed to shape a buried antiformal stack. The culmination of the uppermost thrust unit reaches a depth of about 200 m SSL (i.e. about 1100 m below the ground level). The reservoir fluids are made up by a CO_2 gas cap, which rests above an accumulation of fresh water in the central and upper part of the culmination of the deep carbonatic acquifer (e.g., Monte Forcuso 1 and 2 wells), and a saline water along the flank of the buried anticline (e.g., Bonito 1 Dir, Ciccone 1 wells). Medium enthalpy geothermal resources with a reservoir fluid temperature up to 100°C have been estimated in previous assessments at depth of 2000 m below ground level (ENEL 1987; 1994).
However, the presence of thermal springs (e.g. Terme di S. Teodoro) in the area suggests the presence of an active hydraulic circuit and provide further constraints about the geochemical characteristics of the reservoir waters, and the geothermometers investigation (Duchi et al. 1995) give a possible reservoir fluid temperature up to about 124 °C.
In this study, the overall reservoir/caprock system structural-stratigraphic setting has been defined based on the integrated interpretation of surface geology, public and available seismic reflection profiles, and composite well logs. In particular, a careful assessment of temperature field at depth has been carried out analyzing the well logs through Horner plot construction (Rider, 1996 and reference therein). Where the temperature data data were scarce or poorly constrained, the approach proposed by Della Vedova, et al. (2001) has been applied. On the basis of well tests, cores and mud losses/absorptions, the reservoir permeability was also re-estimated, confirming quite good permeability values for the fractured carbonate reservoir.
One of the main results of this research is the development of an integrated 3D geological model which provides the base for a detailed assessment of the possible geothermal exploitation of the carbonate reservoir. The preliminary results of our analysis suggest that "Guardia dei Lombardi" can be indicated as an interesting area for the geothermal medium enthalpy exploitation, although the presence of the CO_2 gas cap and the scaling capability of the deep fluids should be carefully evaluated.

From the 3D geological model, we put a sounding basis for a numerical model of hot fluid extraction (made by TOUGH/TOUGHREACT) in which some reasonable hypothesis on the reservoir exploitation may be evaluated.