3D modeling of the geothermal reservoir of Rosario de La Frontera (La Candelaria Ridge, Salta province, NW Argentina)

R. MAFFUCCI (*), S. BIGI (**), S. CORRADO (*), L. DI PAOLO (*) & G. GIORDANO (*)

(*) Dipartimento di Scienze, Università degli Studi "Roma Tre", 00146 Roma. Email: roberta.maffucci@uniroma3.it
(**) Dipartimento di Scienze della Terra, Sapienza Università di Roma, 00185 Roma.

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Fracture Modeling consists of three-dimensional deterministic or combined stochastic/deterministic (*discrete fracture network*) representation of fractures network that characterizes natural fracture systems. DFN (*discrete fracture network*) analysis is widely applied in geothermal exploration and development since it provide input parameters for static and dynamic reservoir modeling. Fractures system characterization represents, in fact, an important tool to predict the anisotropy of the permeability in a geothermal reservoir and its effect on fluid flow.
We are applying this computer modeling approach to study the geothermal system of *Rosario de La Frontera*, in the Salta province (NW Argentina) with the aim to check the productivity of the reservoir and the effectiveness of its cap-rock.
This active geothermal system lies within the structural province of the Santa Barbara System, in the Sub-andean foreland thrust belt, and is characterized by several hot springs, with surface temperatures ranging between 50°C and 99°C. These manifestations are located close to the city of Rosario de la Frontera, to the north of La Candelaria Ridge that consists of a broad anticline structure uplifted by fault planes dipping to the west with a top-to-the-east sense of transport. It exposes low grade metasedimentary Precambrian strata that are unconformably overlain by a thick sequence of predominantly continental Cretaceous to Paleogene strata (Salta Group) related to the Cretaceous rift stage (Salfity and Marquillas, 1981, 1994). The permeable levels of the syn-rift strata belonging to the Salta Group (Pirgua subgroup) has been interpreted as the reservoir of the active geothermal system (Moreno Espelta et alii, 1975). The post-rift (Balbuena and Santa Barbara subgroups) and syn-orogenic impermeable levels (Metán Subgroup Anta Fm.), that are related to an inversion tectonic phase, provide the cap rock of the geothermal system (Bianucci et alii, 1981, Cominguez and Ramos, 1995, Gebhard et alii, 1974).
With the aid of a dedicated software (Move – Midland Valley Ltd.), a 3-D geological model of the *La Candelaria* anticline was built in order to extract a 3-D geocellular volume of the deep reservoir to constrain the fracture network model.
Structural study on outcrops of the reservoir rocks allowed us to elaborate a deterministic fractures network model and to calculate the input parameters for the generation of the DFN. Field work was dedicated to a quantitative and qualitative analysis of the fractures and faults, defining diagnostic parameters such as orientation, dimension, spatial distributions, surface texture, and to calculate their density distribution within the regional fold.
According to orientation, the observed discontinuities were classified as longitudinal, transverse and oblique with respect to the fold axis trend (e.g. Stearns, 1968; Hancock, 1985; Cooper, 1992), and in turn grouped into six sets. In conclusion, DFN models were generated for each fractures set in order to evaluate their influence on the distribution of the permeability in different portions of the studied anticline.