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Modelling and Optimization of Geothermal Energy in the Gulf of Suez

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Abstract : Geothermal energy in Egypt represents a significant untapped renewable resource that can reduce reliance on conventional power generation. Exploiting these geothermal resources depends on depth, temperature range, and geological characteristics. The intracontinental rift setting of the Gulf of Suez (GoS)-Red Sea rift is a favourable tectonic setting for convection-dominated geothermal plays. The geothermal gradient across the GoS ranges from 24.9 to 86.66 °C/km, with a heat flow of 31-127.2 mW/m². Surface expressions of convective heat loss emerge along the gulf flanks as hot springs (e.g., Hammam Faraun) accompanying deeper geothermal resources. These thermal anomalies are driven mainly by the local tectonic configuration. Characterizing the structural framework of major faults and their control on reservoir properties and subsurface hydrothermal fluid circulation is vital for geothermal applications in the gulf. The geothermal play systems of the GoS depend on structural and lithological properties that contribute to heat storage and vertical transport. Potential geothermal reservoirs include the Nubia sandstones, which, due to their thickness, continuity, and contact with hot basement rocks at a mean depth of 3 km, create an extensive reservoir for geothermal fluids. To develop these geothermal resources for energy production, defining the permeability anisotropy of the reservoir due to faults and facies variation is a crucial step in our study, particularly the evaluation of influence on thermal breakthrough and production rates.

Keywords : geothermal, October field, site specific study, reservoir modelling
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