Thermo-hydrodynamic modelling in silicoclastic reservoirs: case study of the Albian geothermal reservoir at Saclay, Paris Basin, France

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Résumé

Conceptual geological models aim at producing a coherent image of the investigated porous media. Such reservoir models, generally calibrated on the production data histories, facilitate predictions addressing the development of the geothermal resources. However, in order to reduce uncertainties and to improve prediction of interference between geothermal wells or early thermal breakthrough using numerical flow simulators, a custom designed approach is suggested. In the present study, the geological models were based on careful examination of historical core descriptions and well-log analysis using PETREL to obtain 3D models. These geomodels are used to simulate the mass and heat transfers via TOUGH3, ECLIPSE300 and PUMAFLOW softwares. Several calibration simulations of the temperature, pressure and flow patterns were performed, based on the last three years (2019-2022) geothermal production histories of the Saclay geothermal development site, located 20 km southwest of Paris. We show that using a high-resolution 3D grid simulation workflow constrained by sedimentary facies, it was possible to operate the simulations from different software now available. These software allow us to solve the flow and heat transfers in a structurally complex and heterogeneous multilayered geothermal reservoirs. We also compare simulation of water drawdown on different grids. TOUGH3, ECLIPSE300 and PUMAFLOW codes are used to predict the future flow and temperature evolutions, suggesting that all codes are adapted to simulate flow and thermal breakthrough. Ultimately, we were able to predict the preferential flow paths related to the heterogeneity of the targeted Albian siliciclastic reservoir in the Paris Basin. Preferential paths are recognized in the upper part of the reservoir (clean shoreface sand) and locally at the base of the reservoir where coarse sand facies are present. In the future, we recommend to produce only clean shoreface sands (*Sables de Frécambault* Formation) present in the upper part of the reservoir and the

*Intervenant

coarse channel sands (*Sables Verts*) at the base of the reservoir present locally in some wells. The rest of the reservoir contains too many clays and need to be isolated from production, thus limiting the risk of well plugging during reinjection.

Mots-Clés: Clastic, Geothermal, Reservoirs, Models, Flow simulations