DYNAMIC RESERVOIR SIMULATION OF A CARBONATE PLATFORM WITH MASSIVE DIAGENETIC ALTERATIONS

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Abstract:

Prediction of carbonate reservoir performance is a challenging task due to the uncertainty associated with geological heterogeneity. Identifying key depositional, diagenetic and structural heterogeneities that control fluid flow and hydrocarbon recovery is a fundamental aspect for forecasting production by means of numerical simulations. The study and modelling of outcrop analogues is a useful tool to understand the impact of geological heterogeneity on fluid flow, and to improved predictions of subsurface cases in which data is scarce. This MSc thesis discusses the effects of depositional and diagenetic heterogeneities on two-phase fluid flow simulations based on the partially-dolomitized Aptian-Albian carbonate ramp of the Benicàssim Outcrop Analogue (Maestrat basin, Spain). For this purpose, a series of systematic oil & water fluid flow simulations are performed on a pre-existing structural and facies model by Shuqinq Yao (University of Aberdeen). A total of 24 simulation scenarios were created to investigate the influence of facies distributions and the presence of stratabound dolostones on oil production. The following parameters have been varied in order to capture the key controls on fluid flow: (i) relative variation of petrophysical properties of mud-dominated versus grain dominated facies, (ii) presence or absence of dolostone geobodies and (iii) production with and without waterflooding. The main conclusion of this study is that hydrocarbon recovery and fluid flow is related to diagenetic control of the spatial facies distribution and permeability relations among facies.