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Modelling of gas recovery from South African shale reservoirs

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Abstract

Mathematical models for a triple-porosity continuum describing the distribution of pressure-the driving force for gas flow during gas production-were developed on the basis of the continuity equation from first principles, focusing on the South African shales of the Karoo Basin. The triple-porosity continuum incorporated the matrix, the natural fracture network, and the hydraulic fracture network; the matrix and the natural fracture network systems were considered two dimensional, while the hydraulic fracture system was considered one dimensional. The three developed mathematical models are in the form of the general diffusion or heat equation, thus the numerical Finite difference method (FDM) was employed in solving the triple-porosity model. MATLAB software was used to develop and solve the FDM simulation or algorithm of each system of the triple-porosity model; results for each system are presented and discussed in chapter 6 of the research report. The results generated agree with models previously developed and validated with their respective field data, substantiating the reliability of the model developed in this research report. Currently the South Africa's Barnett shale does not have field data, hence the field data from literature was used to validate the developed model. The model is thus a guide onto describing the gas flow behaviour for the South African shale gas reservoirs, and not specifically for the Barnett shale.