FRACTURE MODELING FOR FAULT DAMAGE ZONE GEOMETRY AND ITS ROLE IN FLUID FLOW

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ABSTRACT: Usually, traditional flow simulation models accounts permo-porosity properties from facies' matrix provided by geological conceptual models. However, this method is not recommended for reservoirs which streaming lines and hydrocarbon sweep are controlled by fracture network's porosity and permeability instead matrix, e.g. closed carbonates, shale, etc. This approach can result in non-realistic forecast of reservoir production behavior. Also, in some reservoirs, fracture network can be expressed by fault damage zone architecture which has its framework attached to kinematics and deformational history of the area. In order to provide a flow simulation model that represents the structural pattern related to fault damage zones, we describe a detailed workflow for construction of natural fracture models using fault damage zone concept and its impact on streaming lines and saturation in dynamic models. We used a synthetic facies model with interlayered beds of tight mudstones and low porosity wackstones/grainstones in a shoal/lagoon carbonate environment. The workflow comprises: 1 – from seismic interpretation, modeling of structural framework with two intervals and four main faults. 2 - Geometry and kinematics interpretation of the main faults and its associate fault damage zone. 3 – Multi scale stair step gridding with grid refinement along fault damage zone geometry. 4 – Fracture modeling for regional deformation and fault damage zones. Setting fracture parameters of dimension, geometry, density, porosity, permeability and aperture for each set of fracture considering a current stress in E-W direction. 5 – Streaming lines and flow simulation for one pair of injector and producer wells. The geometry and kinematics interpretation shown an N-S set of faults resulted of an oblique system in a normal-dextral sense of shear. The fracture modeling for regional deformation resulted in two sets of fracture: one around N-S direction (set 1) and another one around NW-SE direction (set 2). The fractures of set 1 were nearly parallel to the main faults and seemed to be closed due to direction of current stress. The fractures of set 2 were associated to tip and linking damage zones areas and shown high values of permeability and aperture also due to the direction of current stress. Streaming lines and flow simulation realizations shown that the main faults and fractures of set 1 (N-S direction) worked as flow barriers, meanwhile high drainage occurs along tip and linking damage zones and fracture of set 2. This synthetic model allows an insight of production in a tight carbonate environment where reservoir sweep and drainage is controlled by different sets of fractures and fault damage zone architecture.

KEYWORDS: FAULT DAMAGE ZONE, STREAMING LINES, FLOW SIMULATION