Fluid Flow Behavior in Relay Ramps during production of Carbonates Reservoir

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Abstract

Relay Ramps (RRs) are highly deformed zones and represent preferential fluid flow paths in pre-salt reservoirs. The purpose of this work is to study the behavior of fluid flow and pore pressure in different relay ramp (RR) geometries, for injection and production scenarios of a carbonate reservoir development. Two 2D ramp models were built: soft-linked and hard-linked, assigned properties for the matrix, relay ramp and fault zone (damage zone and fault core) materials and defined initial and boundary conditions. For each model three sub models were generated, in which the position of the wells variated. Two observer points were defined, one for each model, in the center of the RRs and seven scenarios were tested. The results showed that, in general, soft-linked ramps promote greater reservoir communication than hard-linked ramps. The geometry influence of the ramp was significant in the conditions where the ramp and matrix permeability were lower and the pore pressure did not vary much, that is, in carbonate reservoirs, whose flow is mainly dominated by faults and fractures. However, as porosity and permeability increased in the ramp and matrix, as well as the variation of pore pressure, the geometry of the ramp became of secondary importance compared to the well's layout, that is, in carbonate reservoirs, whose matrix has high porosity and permeability. The fractures in RR, depending on the direction in relation to the stress field, made the flow tortuous. The study brought important information that can help in the optimization of drainage plan in carbonate reservoirs and the recovery of hydrocarbons.