FROM 2D TO 4D FRACTURE NETWORK MODEL, STRUCTURAL MODELING OF A COMPLEX THRUST TRAP: IMPLICATIONS FOR TOP SEAL: A CASE STUDY FROM THE TARIJA BASIN, ARGENTINA

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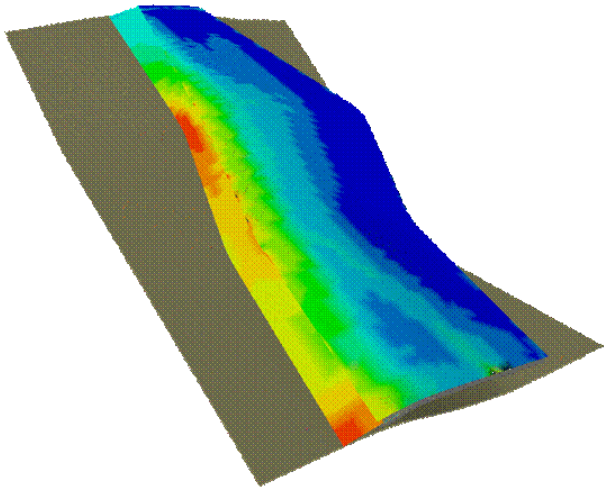
High gas production rates from the Santa Rosa Formation in the Tarija basin, Argentina, indicate the presence of naturally fractured reservoirs whose reservoir's production potential is dominated by the secondary porosity and permeability. A consistent structural model and a good knowledge of the fracture systems is therefore of key importance in reducing risk in the exploration and development strategies of these settings. The structural evolution of the Santa Rosa reservoir through time forms the basis for understanding the development of the 3D fracture system. A total of nine 2D balanced cross sections were used to build a 3D geological model of the San Pedrito and Tuyunti structures. The fault blocks that compose the Santa Rosa Formation reservoir were subsequently restored to their pre-deformation states using 3D structural modeling software. From here, the structures were kinematically forward modeled in 10 time steps to simulate the structural evolution of the reservoirs. At each time step the dilatational strain was calculated and cumulatively added throughout the modeling history. The resulting total strain maps record the total spatial variation in strain in the reservoir due to its structural history. The benefit High gas production rates from the Santa Rosa Formation in the Tarija basin, Argentina, indicate the presence of naturally fractured reservoirs whose reservoir's production potential is dominated by the secondary porosity and permeability. A consistent structural model and a good knowledge of the fracture systems is therefore of key importance in reducing risk in the exploration and development strategies of these settings. The structural evolution of the Santa Rosa reservoir through time forms the basis for understanding the development of the 3D fracture system. A total of nine 2D balanced cross sections were used to build a 3D geological model of the San Pedrito and Tuyunti structures. The fault blocks that compose the Santa Rosa Formation reservoir were subsequently restored to their pre-deformation states using 3D structural modeling software. From here, the structures were kinematically forward modeled in 10 time steps to simulate the structural evolution of the reservoirs. At each time step the dilatational strain was calculated and cumulatively added throughout the modeling history. The resulting total strain maps record the total spatial variation in strain in the reservoir due to its structural history. The benefit of this technique over for example traditional curvature analysis is that the structural evolution of the trap is taken in account, a factor that likely dominates fracture formation. Together with well data, the resulting accumulative strain maps were used to simulate geologically realistic discrete fracture networks.



Final Cumulative Dilational Strain map on top Santa Rosa formation. Red / yellow colours indicate high strain. Underlying fault in grey.