Bayu-Undan – Modeling Permeability Enhancement in Fault Damage Zones

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The Bayu-Undan Field lies in the Timor Sea to the NW of Australia and is a world scale retrograde gas-condensate accumulation.

The field occurs on an eroded horst block formed between sets of east-striking normal faults that dip away from the structural high. The reservoir is intensely faulted with a dominant, east-striking set, and a subordinate north-striking set. Petrophysical analysis from 11 wells indicates that the reservoir is (1) pervasively fractured close to significant faults, (2) is under significant tectonic stress with a northeast-striking SHmax, and
(3) has horizontal stress differences that may exceed 4,000 psi.

Copious down-hole pressure response observations, compared to base-case reservoir models, show that major faults in the field introduce anisotropy resulting in permeability enhancement of x10 in the east-west direction compared to north-south. Clearly the hydraulic architecture of the field is impacted by heterogeneous fault damage zones.

To assess the distribution of fault-related permeability, elastic dislocation stress modeling was conducted on the full-field model. The analysis included model construction using RMS, fault framework analysis and stress modeling using TrapTester, and calibration and synthesis using GOCAD. It was determined that the distribution of mean stress in the reservoir matches the pattern of pressure response and can be used as a map driver for modifying base-case permeability trends to reflect the impact of fault-related deformation.