Relationship between Active Deformation, Stress Heterogeneity, and Fracture Permeability in the Suban Gas Field of South Sumatra, Indonesia

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Suban Field is located in the actively deforming South Sumatra basin. The field's most productive elements are fractured igneous and metamorphic rocks and overlying carbonates. The complex architecture of Suban was unraveled using PSTM and PSDM seismic volumes. The structure is a composite of Paleogene extensional elements modified by Neogene contraction to produce basement-rooted forced folds on one flank and shallowly-detached fault-propagation folds on the other.

Well test, wellbore image, and drilling data were integrated into a geomechanical framework to develop a stress and fracture characterization. Regionally SHmax trends NE but areas of the field show significant variation such that SHmax trends NW, paralleling local structural grain. We interpret these stress rotations to result from outer arc extension in active folds and/or the result of coseismic stress relaxation.

Natural fractures were differentiated into hydraulic classes based on reconciliation of petrophysical character with drilling, well test, and other petrophysical data. DFN models were constructed to characterize the fractures in their correct spatial framework. Field-wide the spacing of all fractures varies from 0.45 to 1.52 fracs/m. The spacing of fluid-conductive fractures is an order of magnitude less. Undifferentiated, fracture density has no relationship to well productivity while the density of the largest fluid-conductive fractures is strongly correlative. Fluid-conductive fractures occur mainly in fault damage zones and domains of tight folding but their productivity is most clearly controlled by the interaction of stress and local structural elements. The vast majority of fluid-productive fractures occur in an envelope that trends 60° around SHmax.