PREDICTING STRUCTURAL PERMEABILITY IN THE DEEP COAL PLAY, TIRRAWARRA-GOORANIE FIELDS, COOPER BASIN

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The Tirrawarra-Gooranie oil and gas field complex in the Cooper Basin, South Australia has produced from a large number of vertically stacked conventional and unconventional targets. The unconventional Permian coal seams remain largely untapped, with only a limited number of hydraulic fracture stimulation trials commingled within conventional vertical wells. Variability in the coal zone frac treating pressures, gas rates and EURs has been observed. This is thought to be driven by variability in the in-situ reservoir properties; local stress field; occurrence of natural fractures; stimulation design and the interaction between these factors.

In a 2D study, a numerical stress model based on the distinct element method (DEM) was applied to a rigorous structural framework model, in order to understand how paleo- and present-day regional stress fields have interacted with faults in the Tirrawarra-Gooranie structure at the Patchawarra VC40/50 coal horizon. Areas of high differential stress are interpreted to be more prone to natural fractures, which may improve the coal productivity but may also require different stimulation treatments to areas with lower permeability. The model was calibrated against well data including 1D mechanical earth models, fracture initiation pressures, image logs and drill cores. Predicting areas of enhanced structural permeability using DEM is shown to be useful for early stage appraisal of unconventional reservoirs requiring large amounts of hydraulic fracture stimulation, and is also informative in helping to predict potentially problematic areas with higher breakdown and treating pressures.