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THREE DIMENSIONAL VISUALIZATION OF A STRUCTURALLY AND STRATIGRAPHICALLY COMPLEX RESERVOIR CAN IMPROVE DEVELOPMENT STRATEGY

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ABSTRACT

Analysis of 1100 wells has provided the basis for identifying and mapping complex structural compartmentalization of a Terry Sandstone reservoir in a 70 Section area of the Denver Basin, Colorado. A dominant northeast-trending fault system, with a secondary northwest-trending system, divides the Terry Sandstone into numerous relatively small fault blocks. The stratigraphy of the Terry Sandstone in this area is also complex, consisting of at least seven mappable parasequences, with at least two orientations.

This combination of structural and stratigraphic complexity is difficult to visualize in 2D space. To better visualize this reservoir style, and hence to test how 3D imaging can optimize development strategy, the data were input into a 3D geospatial modeling system. Because the faults are relatively steep (> 50 degrees), little data exists for the faults except for their pattern on one horizon. This limited information was used to construct a model of 55 fault surfaces, clearly showing the complex nature of the fault/fault intersections. The stratigraphy was added to the fault model, resulting in a compartmentalized, layered model.

The complexity of the fault compartmentalization makes 2D juxtaposition analysis extremely difficult. 3D real-time visualization of the layered model clearly shows possible seals and multiple fluid contacts. Since many of the fault blocks are isolated compartments, vertical wells would drain only a limited area. Drilling strategies to optimize recovery, by targeting multiple fault blocks with a single well, were easily developed and evaluated by working with the 3D model.

Although these reservoir complexities were identified using abundant well control, the 3D geospatial model, and resultant development strategies, can be applied to similar geologic settings in areas with fewer wells but with other data types such as 3D seismic.

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