Field studies of deformed carbonates in northern Oman (Implications for modeling structural permeability)

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Field Studies of Deformed Carbonates in Northern Oman: Implications for Modeling Structural Permeability in Carbonate Reservoirs.

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Cretaceous outcrops in Northern Oman provide an opportunity to investigate the different processes that accommodate strain variations in carbonates and the factors that influence their timing and distribution. Such knowledge is critical for predicting the impact of structures on carbonate reservoir performance. Preliminary field observations in the Jebel Akhdar region emphasize several important factors for flow modeling in deformed carbonates. Mechanical stratigraphy is an important control on fracture heights and densities. However, fractures confined to individual beds may not impact reservoir flow as much as higher-order fractures that have longer vertical extents and wider spacing. Stratal stacking patterns as well as the mechanical properties of individual beds are important controls on these distinct fracture populations. Our observations of fractures in gently folded strata indicate that curvature does not always provide a suitable proxy for fracture densities or orientations. The folding mechanism and the timing of fracture formation relative to folding are key controls on fracture density gradients around folds. Fracture corridors and discrete, low-displacement faults are also potential fluid flow conduits. Preliminary estimates of the displacement-height scaling relations for the very tall but narrow faults indicate that faulting mechanisms in carbonates may differ from those in clastics. Such differences could impact the reliability of subseismic fault prediction in carbonates. Seismic imaging is also unlikely to resolve these faults, which may be omitted from flow simulations as a result. These observations, combined with the style and scale of strain partitioning and variable fault zone characteristics are key considerations for representing structural permeability in flow simulations of deformed carbonate reservoirs.