Investigation of Strained Carbonates Exposed in Northern Oman: Constraints on Structural Permeabilit SubTitle

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Outcrop observations of the relationship between fractures and reservoir scale strain can be used to predict the impact of structures on carbonate reservoir performance. The Jebal Akhdar region of Northern Oman has outcrops of Cretaceous rocks that are equivalent to key productive horizons in Middle East oil accumulations. Preliminary field observations of fracture distribution and strain at Jebal Akhdar provide insight into the strain accommodation process and factors that influence fracture timing and distribution. Such outcrop-based observations can be used to develop models for structural component of permeability architecture

Mechanical stratigraphy appears to have a major influence on the distribution of strata-bound fractures. Higher order fractures that cross stratal boundaries will have a larger influence on connectivity and flow. These larger fractures appear more influenced by stratal stacking patterns than mechanical properties of individual beds. Curvature does not appear to be a good predictor of fracture intensity at the kilometer to meter scale flexures investigated. Additional considerations such as strain mechanisms and timing of fracture formation may be more important controls on fracture distribution than fold shape.

Fluid conduits created by fracture corridors and long, small-displacement faults (5-10 m) will influence large-scale vertical and lateral connectivity. Preliminary analysis of fault offset-to- height relationships shows that faults with throws less than 5 meter have heights ranging between 100 to 800 m. This relationship is different from that seen in clastics. Prediction of sub-seismic faults in carbonate rocks may require different throw-to-fault-size relationships than for clastics. Strain associated with discrete small throw faults is variable, ranging from single sharp breaks to broad diffuse zones that accommodate displacement. Accurate modeling of permeability in carbonates needs to incorporate the impact of reservoir strain paths on permeability evolution.