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Permeability Structure of an Exhumed Faulted and Folded Reservoir: A Study of the Navajo Sandstone and the Teasdale Fault

Packages of deformation bands associated with faults in porous and permeable sandstone create complex permeability structures that affect subsurface flow in sandstone reservoirs. Study along sections of the 40-km long Teasdale Fault of Utah, USA, in the aeolian Navajo Sandstone provides an assessment of reservoir quality based on geometric characteristics of permeability structures. Outcrop to simulation studies of permeability structures were built of the transpressional reverse fault and fault propagation fold associated with the Teasdale Fault. Permeability structures created by faulting may act as baffles, barriers or conduits to fluid flow. Faulting of high porosity, permeable sandstones often creates heterogeneous features in the form of deformation bands. Understanding how fault structures influence groundwater and hydrocarbon reservoir systems is essential for proper management of faulted and fractured groundwater and hydrocarbon reservoirs. Deformation band packages are modeled first as planar features in discrete fracture network employing FRACMAN software based on field measurements. Modeled fracture network blocks are then probed by intersecting counting lines that sum the total deformation band thickness and assess effective permeability of the block and permeability in the X, Y, and Z directions. Results from counting probes are utilized in single-phase fluid flow groundwater modeling simulations to determine overall reservoir compartmentalization and permeability structure of the Teasdale Fault.