

Fracture-Swarm Sweet Spots

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Abstract

Fracture-swarm sweet spots are high-productivity zones in low-permeability (“tight”) reservoirs that are associated with high fracture density. The fractures are typically associated with faults or tight flexures. Fracture permeability allows wells drilled in these areas to produce more hydrocarbons, and at higher rates, than adjacent wells. Although fracture-swarm sweet spots may be associated with subtle structures, they can be identified using analyses of horizons mapped in 3-D seismic data. They are typically too narrow to be mapped using well control. Interference between wells can be demonstrated where more than one well penetrates a fracture-swarm.

Examples from the San Juan Basin area illustrate a variety of structural styles and techniques that can be used to identify these features. Wells drilled into normal and reverse faults in carbonates of the Pennsylvanian Paradox Group at Ute Dome (on the basin margin) have better production than surrounding wells, and interference can be seen between older and recently drilled wells. A variety of subtle structures, including grabens, horsts and normal faults (all possibly with some component of strike-slip motion) are associated with enhanced production from Cretaceous sandstones of the Dakota Fm and Mesaverde Group in the basin itself. Production interference can be demonstrated for some of the sweet-spot wells.

Not all faults or flexures are associated with high productivity. Depending on whether the fractures are open or closed (e.g., cemented), subtle structures either can be drilling targets (open fractures) or should be avoided (closed fractures – permeability barriers).