

Intersection of Geoscience and Technology in the Development the Bakken Unconventional Oil Reservoir, Sanish/Parshall Field Area, Mountrail County, North Dakota

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The Sanish/Parshall Field Area in south-central Mountrail County has proven to be the most prolific portion of the 15,000 square mile Bakken/Three Forks unconventional oil reservoir. Key geologic factors contributing to the exceptional performance of this area include excellent stratigraphic trapping conditions in the Middle Bakken dolomitic siltstone along the eastern edge of the basin, active generation and expulsion of oil from organic mudstones (upper and lower Bakken Shale) into vertically adjacent Middle Bakken and Three Forks reservoir intervals, and fracture enhanced permeability associated with tectonic and bed-scale fracturing. The rapid evolution of drilling and completion technologies has continued to improve well performance and program efficiency. Modern well designs employed in Sanish Field include 10,000' horizontal wells with up to 30 stage artificial fracture stimulations. A permanent 152 square mile subsurface geophone array designed to monitor and spatially resolve microseismicity associated with fracture stimulations reveals the orientation, spacing and distribution of natural and induced fractures as well as fracture half-lengths, thus providing insight into stimulation efficiency and well bore drainage area. Production curves from 150 Whiting operated wells in Sanish Field exhibit hyperbolic decline with initial rates primarily affected by the presence of natural fractures and stimulation technique. Production results to date suggest that ultimate recovery is dependant on matrix reservoir storage, horizontal wellbore length and a more uniform distribution of induced fractures.