Using Geophysics to Optimize Horizontal Well Performance in the Bakken

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GeoConvention 2012:Vision

Salt collapse structures and salt dissolution are considered the most prominent geological features of the subsurface of SE Saskatchewan. Having 3D seismic surveys provides knowledge of the locations and dimensions of salt collapse structures which is essential to avoid drilling into them. Seismic can also identify high salt dissolution and heavily fractured areas due to the presence of Winnipegosis reefs or salt collapses nearby.

In areas where salt collapse features are prevalent, it is necessary to identify large natural fractures and help the Completions Engineer pinpoint where to place hydraulic fracture stimulations to reduce the risk of height growth into water bearing formations.

Natural fractures are inferred from seismic by observing dramatic structural changes within the Bakken horizon. The horizon smoothing attribute called “Gradient” calculates the magnitude of the dip of the Bakken horizon and helps detect any major vertical change between its immediate neighbor traces.

The gradient attribute map for the study area in SE Saskatchewan shows a large natural fracture with a N-S orientation. Wells that were inadvertently drilled and completed across this large natural fracture have an average IP of 100 bbls/day and 90% water cut. After acquiring 3D seismic and detecting the large natural fracture, the completion was tailored to avoid stimulating this section of the horizontal wellbore, resulting in wells having an average IP of 200 bbls/day and 30% water cut.