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Improving tight reservoir definition using seismic object detection within the Woodford Formation.

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Accurate evaluation of reservoir thickness and extent is crucial for drilling risk and economic development decisions. Often, this can be performed using available well logs integrated with high resolution 3D seismic data. Typically, acoustic impedance inversions are computed to mitigate wavelet effects and to better define the reservoir units directly, allowing a more straightforward interpretation of reservoir thickness, porosity and extent in terms of the sonic-density parameters. However, with thinner, tighter, more challenging geologies, the single attribute interpretation of acoustic impedance per se may not be refined sufficiently for unresolved seismic reservoirs with spatially varying lithologic properties. More progressive techniques such as seismic object detection involve multiple attributes, including prestack simultaneous inversion volumes and regularly better identify potential reservoirs, their extent and thickness, by classifying the interval geologies into seismic facies.

Seismic object detection is used to identify and define the silt and shale members of the Woodford Formation and the bounding Mississippian and Devonian carbonates of the Midland Basin in West Texas. The Woodford Silt is the reservoir of interest which is seismically-thin and has porosity ranges of 1% to 8% that varies laterally across the 110 square mile study area. Identifying carbonate, shale and silt seismic facies through multi-attribute object detection techniques facilitates better interpretation of the variable porosity silt deposits, and better differentiation from the underlying lower-impedance shale. Object class and relative probabilities of each facies are incorporated into the interpretation process to better assess the tight reservoir definition.