Optimizing Channel Sand Delineation using Full-Wave Seismic Interpretation

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Abstract

Upper Cretaceous fluvial systems of the Mannville Group are often attractive gas plays in East-Central Alberta. Traditional seismic techniques and attributes like spectral decomposition can readily identify major channel systems as stratigraphic highs, enhanced by differential shale compaction. While structural relief is a gross indicator of channel thickness, considerable uncertainty and ranging drilling results, arise from high variability in both sand quality and gas saturation. The challenge is to drive better well targeting by developing methods to more reliably predict sand quality, thickness and gas saturation within these channel sequences.

A Full-Wave (multi-component) seismic survey was acquired over an active channel gas play in 2004, to determine if better diagnostic measurements could be developed. Traditional PP and "mode-converted" PS seismic data were obtained and processed with considerable care, with emphasis on high-resolution velocity analysis, detailed statics and 3D prestack time migration. Initial, qualitative analysis revealed that PP seismic structure and PS seismic amplitudes could offer the possibility for identifying gas "sweet-spots".

Effective Full-Wave seismic interpretation requires the removal of timing ambiguity between the multiple seismic volumes, through "registration" of PS data to PP data time scales. An interactive registration technique was developed to simplify the dynamic correlation PS and PP data. Preconditioning of data to match well-based synthetics and enhance seismic frequency content, coupled with the use of amplitude and inversion attributes, proved to be essential for data matching. Integrated analysis of the PP and PS data, morphed to PP times, show promising correlation with historical and new drilling results.