

Abstract

Integrating P-Wave and S-Wave Seismic Data to Improve Characterization of Oil Reservoir

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Seismic stratigraphy is one of the principal tools to detect and characterize internal heterogeneities within complex oil reservoirs. This research program will develop a new approach to reservoir characterization that is referred to as vector-wavefield seismic stratigraphy.

When applied to the characterization of oil reservoirs, conventional seismic stratigraphy is limited by two facts: (1) its concepts and principles have developed and demonstrated using only compressional (P) wave seismic data, and (2) its applications have been verified using only P-wave seismic technology. The complete science of reservoir characterization can be realized only by expanding its principles and applications to vector-wave field seismic data in which geologic systems are interpreted using both P-wave and shear (S) wave images of subsurface sequences. This statement is made because in some instances spatially coincident P and S seismic profiles do not exhibit the same reflection sequences or the same lateral variations in seismic facies character. This observation leads to the conclusion that in complex geologic environments, the sedimentary record must be described by one set of P-wave seismic sequences (and facies) and also by a second, distinct set of S-wave seismic sequences (and facies). A complete understanding of the geologic environment cannot be made in such a situation until both P and S sequences (and facies) are integrated into a unified seismic stratigraphy interpretation.

Prairie View A&M University proposes to demonstrate the advantages and limitations of integrated P and S seismic data in the characterization of complex oil reservoirs. This research will be done in partnership with the Bureau of Economic Geology, a research unit of The University of Texas at Austin, Visos Exploration, a private oil and gas company in Austin, Texas and Seismicmicro Technology; Inc., in Houston, Texas. The involvement of the Bureau, Visos and Seismicmicro, Technology is critical because Visos will donate the 3-D, 9-component seismic data and subsurface geologic and engineering control required for the research study, the Bureau will process these data and provide the hardware and Seismicmicro Technology will provide the software licenses for Prairie View researchers. The subsurface geologic data were recorded by Visos over an oil field in the Morrow Formation, Lower Pennsylvanian, southwest Kansas, where there is sufficient well control to define subsurface sequences and facies relationships.