

Abstract

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

Innocent J. Aluka

Students:

Shawnte L. Mitchel

Demequa L. DeRousselle

Eboni Godine

Prairie View A&M University

P.O. Box 2516, Prairie View, TX 77446

936-857-4510 (Phone)

936-857-4148 (Fax)

innocent_aluka@pvamu.edu

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The internal complexities and heterogeneities within the oil reservoir can be characterized with seismic stratigraphy. Traditionally, most oil reservoir characterization are done with only compressional P-wave seismic data. The full science of reservoir characterization can be achieved by incorporating the principles and applications of vector-wave field seismic data in which geologic systems are interpreted using both P-wave and shear (S) wave images of subsurface stratigraphy. This is so, because, sometimes spatially coincident P and S seismic profiles do not show the same reflection sequences or the same lateral variations in seismic facies character.

Therefore, the principal investigator is carrying out the study to demonstrate the application of both P-wave and S-wave seismic data in the characterization of oil reservoirs. The Bureau of Economic Geology, a research section of The University of Texas at Austin is providing hardware and processed 3-D, 9-component seismic data acquired from the Morrow Formation, Lower Pennsylvanian, southwest Kansas. This oil field has sufficient well data, subsurface sequences and facies to carry out this study. The Seismic Micro-Technology, Inc; (SMT) is providing the software licenses to the principal investigator.

The main service software package provided by Seismic Micro-Technology, Inc; (SMT) include 2d/3dPAK data interpretation, The Kingdom Suite SynPAK, The Kingdom Suite VuPAK, The Kingdom Suite TracePAK, The Kingdom Suite ModPAK, and the EarthPAK. The forty nine well locations were loaded with their x, y coordinates, using the dialog input of 2d/3dPAK software of SMT-Kingdom Suite to create the basemap. The x,y coordinates (latitude and longitude) were

defined. The latitudes are within 38.1625 to 38.5 degrees and the longitudes are within -102.0 and -102.125 degrees. Also, the name, identification, number, elevation (KB), starting and ending depth for each well were established.

The log data were also loaded from single and multiple LAS file with the 2d/3dPAK. The logs loaded included caliper, gamma ray, sonic, bulk density, induction-deep, induction-medium, porosity, and spontaneous. The 3d seismic survey was also loaded into the SMT Kingdom Suite from the CD provided by the Bureau of Economic Geology. From the loaded 3d seismic data, several 3d seismic lines were generated from some inlines. Fault surfaces and formation tops from different horizons have been mapped from the 3d seismic lines. More work is being done to find good seismic reflectors from extracted sections in order to map more horizons at various levels throughout the seismic volume. From the seismic sections, structural maps and isochronal maps will be constructed. Attribute extraction will be done between two mapped horizons via the envelope extraction tool of SMT-kingdom Suite. The maps will be used to determine which attributes (P-wave and S-wave) are facies sensitive in the area of investigation. The extent of their sensitivity will be determined. Also, vertical and lateral facies distribution at various intervals in the oil reservoir in the study area will be determined.