World Academy of Science, Engineering and Technology
International Journal of Geological and Environmental Engineering
Vol:12, No:02, 2018

Application of Multilinear Regression Analysis for Prediction of Synthetic Shear Wave Velocity Logs in Upper Assam Basin

Authors : Triveni Gogoi, Rima Chatterjee

Abstract : Shear wave velocity (Vs) estimation is an important approach in the seismic exploration and characterization of a hydrocarbon reservoir. There are varying methods for prediction of S-wave velocity, if recorded S-wave log is not available. But all the available methods for Vs prediction are empirical mathematical models. Shear wave velocity can be estimated using P-wave velocity by applying Castagna's equation, which is the most common approach. The constants used in Castagna's equation vary for different lithologies and geological set-ups. In this study, multiple regression analysis has been used for estimation of S-wave velocity. The EMERGE module from Hampson-Russel software has been used here for generation of S-wave log. Both single attribute and multi attributes analysis have been carried out for generation of synthetic S-wave log in Upper Assam basin. Upper Assam basin situated in North Eastern India is one of the most important petroleum provinces of India. The present study was carried out using four wells of the study area. Out of these wells, S-wave velocity was available for three wells. The main objective of the present study is a prediction of shear wave velocities for wells where S-wave velocity information is not available. The three wells having S-wave velocity were first used to test the reliability of the method and the generated S-wave log was compared with actual S-wave log. Single attribute analysis has been carried out for these three wells within the depth range 1700-2100m, which corresponds to Barail group of Oligocene age. The Barail Group is the main target zone in this study, which is the primary producing reservoir of the basin. A system generated list of attributes with varying degrees of correlation appeared and the attribute with the highest correlation was concerned for the single attribute analysis. Crossplot between the attributes shows the variation of points from line of best fit. The final result of the analysis was compared with the available S-wave log, which shows a good visual fit with a correlation of 72%. Next multi-attribute analysis has been carried out for the same data using all the wells within the same analysis window. A high correlation of 85% has been observed between the output log from the analysis and the recorded S-wave. The almost perfect fit between the synthetic S-wave and the recorded S-wave log validates the reliability of the method. For further authentication, the generated S-wave data from the wells have been tied to the seismic and correlated them. Synthetic share wave log has been generated for the well M2 where S-wave is not available and it shows a good correlation with the seismic. Neutron porosity, density, AI and P-wave velocity are proved to be the most significant variables in this statistical method for S-wave generation. Multilinear regression method thus can be considered as a reliable technique for generation of shear wave velocity log in this study.

Keywords : Castagna's equation, multi linear regression, multi attribute analysis, shear wave logs
Conference Title : ICGG 2018 : International Conference on Geology and Geophysics
Conference Location : Barcelona, Spain
Conference Dates : February 27-28, 2018