

MODEL BASED VELOCITY INVERSION IN DHULIAN ANTICLINE BY INTEGRATED GEOPHYSICAL DATA SET, UPPER INDUS BASIN, PAKISTAN

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Abstract

Potwar sub basin is considered to have a significant hydrocarbon potential among all basins due to variation in sedimentary deposition and salt tectonism. The conventional exploration methods applied, particularly for Paleocene, Eocene and Miocene deposits have been tested by many companies over the past decades. This paper mainly focuses on the reservoir characterization and sedimentary characteristics of Dhulian Anticline based on porosity calculation through velocity inversion technique and attribute analysis. Dhulian Anticline is a regional symmetrical East West trending anticline extending in the subsurface which is also having surface exposure near Pindi Gheb in central Potwar, Upper Indus Basin and is one of the major oil producing fields of Pakistan. Tectonically, it is a part of compressional regime resulted due to thrust faulting caused by the collision of Indian and Eurasian plate. Basically, the structure is considered as a salt cored anticline developed due to salt tectonics phenomenon. Pop up Anticline can be clearly observed in the seismic lines acquired in that area. Targeted reservoirs in the area are mostly Carbonates (Chorgali, Sakesar and Lockhart Formations) precipitated in non-clastic settings of Paleocene and Eocene age. The porosities calculated through petrophysics and seismic inverted data have been correlated to a satisfactory level. For delineating the subsurface, seismic structural interpretation has been performed which shows eastward plunging anticline and thrust faulting which were further confirmed by the mapping of the targeted strata. Seismic Attribute Analysis is performed for the better upsurge of the reservoir which affirms the hydrocarbon anomaly at the Chorgali and Sakesar level. Instantaneous amplitude highlighted the high amplitude zone embaded between low zones but no bright spot was detected. Low frequency patches and high energy zones are also encountered at different Limestone levels indicating the presence of fluid. Petrophysical analysis on well Dhulian-43 is performed for marking the hydrocarbon bearing zones that can produce fluid. The log data of Chorgali Formation was not provide but one zone in Sakesar Limestone was marked having thickness of 5.1m with average effective porosity 8-10%, average Vsh 18-20% and average Sh 45%. Velocity Inversion is performed along the Control line for evaluating the trend of porosities in Reservoir Formations particularly at Chorgali and Sakesar formations. Velocity pull ups were encountered on the control line which represents relatively high porosity zones having good reservoir characteristics and correlation with that of porosity calculated from the well. The porosity calculated from a single well point is interpolated over the entire cube of reservoir zone with confidence.

Key Words: Dhulian Antcline, Model Based Inversion, Eocene Carbonates, Velocity Inversion, Porosity.