Application of Borehole Image Logs in Predicting Sand Body Trend of Warcha/Dandot Formation in Adhi Field – a Case Study

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Abstract

Adhi Field, being located about 70 Km south of Islamabad, in the Eastern Potwar region, is a salt-cored typical pop-up structure bounded by thrusts. Currently the field is producing oil from Sakesar carbonates (Eocene) and condensate from Tobra conglomerates (Permian) and Khewraclastics (Lower Cambrian) which are the primary plays. However, in order to replace reserves and add production Warcha/Dandot, Jutana and Kussak formations of Permian age are being analysed and considered as secondary plays.

This paper aims at understanding the Warcha/Dandotfacies variation, sand body trend (architecture of channel sands), re-construction of depositional environment based on integration of seismic, drilling data, OH logs, specifically the High resolution microresistivity images and finally to assess its hydrocarbon potential in southernmost part of Adhi structure.

The Warcha/Dandot formation is deposited in fluvial environment (Iqbal et al, 2013) and could be very deceptive due to high facies variation within Adhi field and Eastern Potwar area. The key workflow steps include construction of lithotypes using OH logs/Mud logs, identification of sedimentary features on high resolution images, definition of depositional facies, paleocurrent analysis, mapping of sand body trend/channel architecture and building of conceptual depositional model. Furthermore, the methodology adopted can be served as a standard template for future studies to predict the sand body trend and understand the channel architecture of fluvial sands.

Available data for the study includes; OH Logs of 4 wells (Adhi-18, Adhi-19, Adhi-20 and Adhi-21), high resolution images (FMI/FMIHD) at three wells (Adhi-19, Adhi-20 and Adhi-21) and Seismic dip lines across all 4 wells.

High resolution microresistivity images (FMI/FMIHD) are not only very good at giving information/resolving structures beyond the vertical resolution of other logs but also provide directional attributes of sedimentary features. Identification and classification of these features are very important and is key step in defining depositional facies and link these facies to construct depositional environment. In addition, the azimuthal information extracted from the images helps in deciphering/establishing the paleocurrent direction and understanding the paleoflow patterns.

Using the above information, four depositional facies i.e. flood plain deposits, channel sands, sand bars and channel lags are established and their correlation is made. The paleocurrent direction is found to be NW and NE (dominant NE) in Adhi-19, whereas NW, SSW and SSE in Adhi-20, suggesting a high sinuosity channel flow.

Moreover, sands with well-developed cross stratification are missing in Adhi-21 indicating a low density/high sinuosity of channels in the field.

The Warcha/Dandot sands are interpreted to be deposited in fluvio-deltaic settings and are trending dominantly in NW-SE and NE-SW direction. However, it is recommended to acquire High Definition Image Log FMIHD in upcoming wells to better map the channel directions/trend.