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Reconstructing Sedimentary Depositional Environment with Borehole Imaging and Core: A case study from Eastern Offshore India

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Abstract

Establishing the depositional sedimentary environment is the most important task for exploration geologists to model the reservoir heterogeneities. Interpretation of borehole images has been the key to better understanding of the sedimentary environment in the study area in Krishna-Godavari basin (KG basin) along the east coast of India. The present study aims at reconstructing sedimentary depositional environment with the help of image logs and cores and other available data set. Data analysis and integration of borehole images in 9 wells of the study area present a detailed insight into the different architectural elements of the sedimentary environment envisaged. This study helps in static modeling of the reservoir with better understanding of process sedimentology that controls the reservoir properties of sands.

The study area has been interpreted from Lower to Upper Cretaceous. The major lithofacies identified are sandstone (massive, laminated and cross-bedded), shale (thin laminated and slumped), siltstone (laminated) and heterolithics (thin alternation of sand/silt and shale). The vertical association of these facies in conjunction with azimuthal variation in dip patterns and image texture led to identification of different architectural elements of the system. The sediment paleotransport direction is governed by the rifting episodes that have subdivided the KG Basin into a complex array of horst and graben structures. The lower cretaceous formations in the study area have been interpreted to be of fluvio-deltaic setting with good sands development in channels and delta distributaries. The upper cretaceous formations are more of shallow marine setting with sand developments mostly in tidal channels, bars and sandy flats.

The study helped in understanding the heterogeneities in the petrophysical properties of different sand bodies encountered in the study area. The control of sedimentary depositional environment in spatial distribution of sand bodies and their geometries is better understood in the study area with the help of image logs.

Introduction

The eastern offshore of Indian peninsula (Figure 1) has become a major exploration target after substantial hydrocarbon discoveries of late. The study area of this work is offshore Krishna – Godavari basin (KG Basin) which has taken the centre stage after major oil and gas discoveries in thick clastic successions from Mesozoic to Cenozoic in various depositional setting.

The Krishna-Godavari basin is located in the central part of the eastern passive continental margin of India. The structural grain of the basin is northeast-southwest. The basin contains thick sequences of sediments with several cycles of deposition ranging in age from Late Carboniferous to Holocene, stretching from onland to offshore to deepwater. The basin is divided into sub basins by fault-controlled ridges. Sediments accumulated in sub basins more than 5 km thick.