Evaluating the Frontier Petroleum Potential in the Bay of Bengal, Offshore Bangladesh

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Abstract

The Bay of Bengal contains the world's largest deepwater fan and is an exciting frontier province for petroleum exploration. Several wells have proven a working petroleum system on the shelf, but the deepwater area remains completely unexplored. We present an integrated analysis of the offshore petroleum systems using 2D seismic, gravity and magnetics data, acquired in 2023. This regional data set covers the present-day shelf through to the slope and upper fan, offshore Bangladesh. Detailed integrated geological interpretation of the data alongside well data from the shelf has provided a regional framework for the whole evolution of the basin, from rifting to the evolution of the fan system.

Depth imaging down to 12 km, in conjunction with the gravity and magnetics, provides high resolution imaging of the deep basement and early rift sedimentary sequences. Enhancing our understanding of the early evolution of the basin, timing of rifting and the nature of the crust beneath the deepwater area and the shelf is critical in modelling source potential in the area. Although expectations are for biogenic gas as seen in Myanmar, these data allow for the basin modelling of proven and analogue source rock intervals, demonstrating the high potential for these units to be currently active within both the oil and gas window. Further proof of a highly active petroleum system is evident in the numerous direct hydrocarbon indicators (DHI's) and gas events within the data.

Detail within the shallower seismic data has allowed interpretation into the evolving architectural elements of the fan system, from shelf to slope and upper fan. Deposition of the Bengal Fan initiated in the early Eocene and continues to present day. The feeder systems of the Bengal Fan have migrated westwards since the Eocene to their present position, where sediment input is largely restricted to a considerable submarine canyon known as the "Swatch of no Ground". Mapping the migration of the sediment input points throughout the fan history is essential in predicting reservoir potential in the older units. Identification of a predictable series of spatially and chronostratigraphic architectural elements has been possible, showing the changing composition of the evolving fan. Discrete facies systems have been mapped in a three dimensional context across the AOI. Extensive mapping shows a downslope evolution from prograding sequences with confined incised canyons, to confined channel complexes and mass transport complexes (MTC's) to isolated channels, amalgamated channel levee systems and layered sheet sandstones. Defining the chronostratigraphic and spatial elements of the fan systems has significant implications for the prediction of potential reservoir systems.

Integrated geological studies offshore Bangladesh have provided new insight into the basin history of the Bay of Bengal and establishes the significant petroleum potential of the area. Detailed mapping of the extensive fan demonstrates the predictable nature of the evolving facies systems, allowing for greater confidence in reservoir prediction in both a chronostratigraphic and spatial interpretation. These new integrated geological studies illustrate the huge petroleum potential of the Bengal Fan offshore Bangladesh, which currently remains one of the world's most underexplored and frontier basins.