

## Identification Of Stratigraphic Play Potential Within The Jalangi Formation Using High Resolution Sequence Stratigraphy In The Shelfal Part Of Bengal Basin, India

Pinaki Basu<sup>1</sup>, H. S. Vachak<sup>1</sup>, Kumar Vivek<sup>1</sup>, A. Sai Kumar<sup>1</sup>, and Dr. Harilal<sup>1</sup>

<sup>1</sup>ONGC Ltd. India.

### ABSTRACT

The Bengal Basin is a pericratonic basin and holds large thickness of sediments starting from the Mesozoic to the Recent times. Since the inception of exploration activities in Bengal Basin, several wells have been drilled in the shelfal part of the basin with significant number of hydrocarbon indications observed in different stratigraphic units, starting from Gondwana sequence to Miocene sequence, but none of them has been economically viable. Earlier the thrust of exploration were mostly aimed at probing the fault closures, reefal buildups and shallow level channel sands, most of which failed to provide the break through, mainly owing to absence of any structural entrapment conditions. In absence of any significant structural traps, it is now believed that future of Bengal Basin lies in the exploration and exploitation of the hydrocarbon accumulations mainly in stratigraphic traps.

Modern exploration of hydrocarbons is primarily focused on both conventional and unconventional traps using large 3D seismic datasets. This is becoming common because explorations for stratigraphic traps are challenging and require sophisticated techniques and softwares to properly image and make valid interpretations. The shelfal part of Bengal Basin which is an onland basin was selected for the application of sequence stratigraphy using a high resolution and automated method of seismic interpretation.

In the present study, the primary focus was concentrated on the possible stratigraphic plays within Paleogene sequences due to the presence of good source and reservoir facies as evident from the drilled wells vis-a-vis considerable number of hydrocarbon shows observed in the basin. While studying the Paleocene section (Jalangi Fm.) of the Bengal shelf, it is understood that the Jalangi Fm. is a complex one and its depositional environment is a combination of subaqueous delta to lagoonal to shallow marine and different depositional processes were working together simultaneously and each had its influence on the other.

Analysis of a window based RMS amplitude attribute generated on 3D seismic volume for the middle and lower part of the Paleocene sequence clearly brought out few high amplitude elongated features/geobodies aligned parallel/ low angle with respect to the paleo coastline prevailing at that time.

A high resolution seismic chronostratigraphy approach was introduced to assess the geometric relationships of depositional cycles and lithologic associations of these geobodies in response to relative sea-level changes. The main step entailed seismic interpretation using closely spaced semi automatically generated seismic horizons from seismic reflection data. A 3D seismic chronostratigraphy cube was built to interactively assess the basin history through the Paleocene sequence (Jalangi Fm.) of Bengal Shelfal part, because it provided a technique to

assess the varied stratal architectures of the sequence. The auto tracked seismic horizons were further used to carry out 3D “Wheeler transformation”. Wheeler transforms is an equivalent of the Wheeler diagram onto a seismic data set. Wheeler diagram had long been used by geologists for better understanding of the depositional history of the sedimentary packages. The stratigraphic features are best understood when studied simultaneously in the “Wheeler domain” and in the depositional domain/structural domain. This integrated technique represents a unique methodology for exploration of stratigraphic traps. Based on this study the geo-bodies have been identified as barrier bar part of the barrier island system. These are narrow bodies of sediments, elongated parallel to the depositional strike, or strike of the shoreline. This body of sediment is composed predominantly of sand that originates on the beach shoreface, foreshore, and backshore and is commonly tens to hundreds of meters broad, up to hundreds of kilometers long, and 10m to 20m thick (Reineck and Singh, 1980). It may be interrupted in many places along its length by deltaic, estuarine, bay, and other deposits where these features cut across the beach.

In order to understand what type of Barrier Bar; transgressive barrier bar or a regressive barrier bar, the whole depositional process in light of sequence stratigraphy “System Tracts interpretation” was carried out. To perform a system tracts interpretation, Four Tract depositional sequence model (Catuneanu, 2002) was selected. Once the interpretation was completed a “Base level” curve was generated alongside the system tracts which give the clear picture of transgression and regression cycle within the package. Then the interpreted system tract with colour coding was overlaid on the seismic. The combined seismic section suggests that the Barrier Bar was part of “Transgressive System Tract (TST)”. The bodies observed on seismic clearly suggest that there were stack of bars deposited at some places within the basin while at upper to middle part of the sedimentary pack there were signatures of landward migration of bar. It was also observed that these bars were separated by thin layer of transgressive shale that might act as a good cap rock for these geo bodies.

Since, the geo bodies are within the Jalangi Fm., the distribution of which is wide spread in Bengal Basin and was deposited during a transgressive-regressive sea level cycle. During that time, thick marine shale packages, occasionally with thin coal seams were deposited in the shelfal part. Earlier studies suggest that the Jalangi Formation shale has good source rock potential over the entire shelf part and thought to have greatest potential for oil generation in Bengal Basin. Therefore, any hydrocarbon generation within this sequence is likely to charge these stratigraphic features/ geo-bodies which can act as a good reservoir and enhance the stratigraphic play potential of the formation.