Early Pliocene Shoreface Sedimentation in Response to Intra-Shelf Tectonic Instability, North Coast Marine Area, Trinidad & Tobago

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Abstract

The early Pliocene shallow marine reservoirs of the North Coast Marine Area, offshore Trinidad and Tobago, are sand-prone deposits of progradational shoreline to inner shelf sequences within a dominantly outer shelf mudstone succession. These sand-prone deposits, part of the informally-named “M series sands”, are reservoirs in the producing dry-gas fields of the BG-operated NCMA-1 licence block. The M0 sand is the youngest part of the clastic wedge and is the reservoir in Cassra Field, located within the Centrica-operated Block 22 licence in the northeast part of the area.
Sedimentary facies are consistent with deposition associated with a storm and wave-influenced shoreface to outer shelf system with minimal tidal influence. The M0 Sands display well developed coarsening- and cleaning-upward sedimentary facies trends consistent with a depositional profile from the mud-prone outer shelf to a progressively more sandy transition zone setting generated between fair-weather and storm wave base.

Depositional modelling tied to a detailed seismic interpretation suggests the M0 Sand was deposited through repeated build-out and retreat of a high wave-energy clastic shoreline that generated a series of step-wise parasequences, informally numbered 1 to 10. Seismic mapping of these parasequences shows a broad east-west orientation. The presence of higher-order clinoform geometry records the more complex advance of the depositional system at least within the main area of Cassra, where the section is at its thickest. Continued falling relative sea-level resulted in successive clinothems being arranged in a down-stepping (negative) trajectory with the result that, in a general sense, the youngest deposits located in the northern part of the discovery exhibit the most proximal facies belts.

The main part of Cassra Field is represented by Parasequence 6. A tectonically-driven event resulted in failure of the shelf over the northern part of Cassra, resulting in the creation of a slumped unit. The slump induced creation of accommodation space and a relatively more rapid advance of the depositional system than had previous phases of sedimentation. Regional mapping from seismic surveys suggests that slump generation took place away from the shelf edge in an intra-shelf setting. The supply of sediment directly to the shoreline is postulated to have been through the advance of fluvial channels to the area, at the same time bypassing and eroding the relatively older M0 Sands of Parasequences 4 and 5. This paper presents a summary of the stratigraphic, sedimentological and depositional interpretations used as the basis for capturing sandbody geometry and connectivity within field-based reservoir models.