Geotectonic Evolution and Stratigraphy of the North Coast Belt, Jamaica: New Insights on the Structure and Petrophysical Characteristics of Eocene-Miocene Successions

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Abstract

The geotectonic evolution of the North Coast Belt holds the key to unravelling the sequence stratigraphic framework of Eocene-Miocene successions of north central Jamaica and to understanding the structural and tectonic controls for Jamaica and the Upper Nicaraguan Rise. Using a combination of geological mapping and sedimentological/stratigraphic analysis, the depositional environments, reservoir/seal potential and correlative biostratigraphy of Eocene-Miocene carbonates have been produced. Structural interpretations, fault kinematic solutions, seismic datasets and geophysical techniques are incorporated into interpretations for the field area. New geological mapping has identified Pliocene Coastal Limestones and elevated reefs, the Eocene-Middle Miocene White Limestone Group, the Eocene Yellow Limestone and Upper Cretaceous conglomerates/ undifferentiated volcaniclastics of the fault-bounded pre-Tertiary Sunderland Inlier. Emphasis has been placed on the Eocene-Miocene successions, these carbonate facies exhibiting distinct lithological and sedimentary character changes from the central Clarendon Block across the north coast trough. Eight formations within the White Limestone Group have been identified with five different facies: grainstones (Gst), packstones (Pst), wackestones (Wst), chalky marls/biomicirites (ChM) and chalks with chert (Chct). Depositional environments deduced show a transition from platform carbonates through shelf edge and open shelf to lower shelf. The presence of lepidocyclid assemblages and several milliolid species define an Eocene-Miocene age. A *Eulepidinia undosa*-rich assemblage within the grainstones of the shallow water formations indicates an Oligocene age. Petrophysical analysis of the grainstones and packstones display good secondary porosity (~15-35%) in the platform carbonates. with thick marls and the Coastal Group providing excellent tight seals. Structural interpretations reveal Late Miocene transpressional regimes, strike-slip faulted-folded successions, NW-SE and N-S striking normal faults and NE-SW striking reverse faults. The relative structures in surface geology do not display significant E-W offsets along the previously interpreted left-lateral strike-slip Duanvale Fault Zone. Fault kinematic solutions yield a compressional E-W stress direction and an extensional regime propagated along NW-SE and N-S faults. This research emphasises that structural signatures of the Late Miocene transpressional event of the Northern Caribbean Plate Boundary are expressed onshore (north coast belt) within the White Limestone Group as a series of sheared anticlines and synclines. This project is significant to ongoing offshore hydrocarbon exploration, to the mining sector in Jamaica and to advances in northern Caribbean tectonics and seismic research.