Tectono – Stratigraphic Events of the Northern Caribbean Offshore, Colombia*

O. Mantilla1, J. Castellanos1, V. Ramirez1, D. Hurtado1, and C. Rubio1

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1Ecopetrol S.A, Vicepresidencia de Exploración, Bogotá, Colombia (oswaldo.mantilla@ecopetrol.com.co)

Abstract

Colombian Caribbean offshore is located at the boundary between the Caribbean and South American plates, which have a relative movement towards the ESE and WNW, respectively, producing an oblique convergence of this margin and driving the major tectonostratigraphic features of the area. The occurrence of several tectonic events throughout geologic time, have generated different provinces and structural styles turning this area into a geologically complex region. These events also controlled both the distribution and type of plays and the timing of the petroleum systems in the basin; hence, their study is the key to understand the tectonic evolution of the Colombian Caribbean offshore, aiming to reduce the exploratory risk in this basin. Taking this into account, the goal of this work was to perform a tectono-stratigraphic analysis in the offshore Guajira using 2D and 3D seismic data, biostratigraphy, sedimentology and well logs. Six tectono-sequences from the Mesozoic to the Pliocene separated by five major unconformities were recognized. Some of these were previously documented by other authors (Guajira, Falcon and Maracaibo Basin), evidencing the regional tectonic control on depositional and structural trends of the interpreted sequences. These sequences reflect the next regional events: (1) Rift Jurassic - Early Cretaceous (opening of the proto-Caribbean); (2) Sedimentary deposition within a passive margin environment during the Late Cretaceous; (3) Interaction of Caribbean and South American plates in the Colombian Caribbean during the late Cretaceous - Paleocene with accretion of oceanic lands; (4) Late Eocene deformation event - early Oligocene (Guajiro Orogeny and Guarao); (5) Eustatic changes that generated a paraconformity of strata during the late Oligocene - early Miocene; and (6) deformation event during the late Miocene – Pliocene.
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**TECTONIC SETTING OF THE CARIBBEAN**

The Colombian Caribbean offshore is located at the boundary between the South American and Caribbean plates. The most important geological features are: the Hess escarpment, the Beata Ridge, the Aves Ridge and the Caribbean Deformed Belt. The occurrence of several deformation events results in a geologically complex area, characterized by diverse structural styles such as thrust belts and rotated blocks controlled mainly by transpressive strike-slip movements related to the oblique plate convergence generated as the Caribbean Plate advances in an E-SE direction relative to the South American Plate.

**STUDY AREA**

The Guajira Basin is located in the Caribbean Sea, at the northern corner of Colombia covering an area of nearly 50,000 km² including both onshore and offshore areas. The basin is bounded to the north and northwest by the Caribbean Deformed Belt (CDSB), to the south by the Oca Fault and to the east by the Curacao, Bonaire, and Aruba basement highs. The Guajira Basin is traditionally divided into two basins: the Upper Guajira Basin to the north and the Guajira Basin to the south, separated by structural feature of the Cuiza Fault with an E-W trend.
This chronostratigraphic scheme allowed the identification of four diachronic hiatuses in the Upper Guajira Basin. In the sense of the sequences from oldest to youngest, the first gap identified is related to the Late Cretaceous – Paleogene time interval, which is well recognized in San Jose 1 well. The second gap encompasses the Late Eocene – Oligocene time interval and was recognized in the Chimare 2-1 well, with a missing time span of approximately 2.2 Ma. The third hiatus interrupts sequences deposited in the Late Oligocene – Early Miocene, representing a time interval of approximately 1.2 Ma. This unconformity was observed in the majority of the wells tested. The fourth identified gap was found between the Middle Miocene – Late Miocene time representing a missing time span of about 2 Ma. The last gap occurred in the Late Miocene – Early Pliocene sequences. This hiatus is not clear in the biostratigraphic record as the previous ones because the paleo-environmental analysis indicates shallow marine to transitional environments where foraminifera recovery is not robust enough.
**TECTONO – STRATIGRAPHIC EVENTS OF THE NORTHERN CARIBBEAN, OFFSHORE COLOMBIA**

**MANTILLA, O.; CASTELLANOS, J.; RAMIREZ, V.; HURTADO, D.; RUBIO, C.**
Ecopetrol S.A, Vicepresidencia de Exploración, Bogotá, Colombia

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**TECUTONO-STRATIGRAPHIC SYNTHESIS**

**EVOLUTIONARY SCHEME PROPOSED**

1. Tectonic: Early Cretaceous and passive margin during Late Cretaceous.
2. Interaction of the Caribbean and South American plates from Late Cretaceous to Paleocene.
3. Early Oligocene unconformity due to tectonic changes.
4. Late Oligocene – Early Miocene unconformity.
5. Late Miocene – Pliocene unconformity.

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**REFERENCES**

2. Gorney et al., 2007. Chronology of Cenozoic tectonic events in western Venezuela and the Leeward Antilles based on integration of offshore seismic and land-based geological data.