

Maldonado Triple-Junction Rifting Structure Offshore Uruguay: Characteristics and Petroleum Implications

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Abstract

The processes of continental rifting generally begin with the development of triple joint structures. Usually, in the development of these structures, two of the arms continue the extension process developing oceanic crust, while in the remaining arm, the extension does not continue, generating thus an aulacogen.

The fragmentation of the southern Gondwana supercontinent, during the Upper Jurassic to Early Cretaceous, developed in this way from several triple joint rift structures that merged and eventually generated the Atlantic Ocean.

In offshore Uruguay two main basins are recognized (Punta del Este and Pelotas) that are part of the continental fragmentation and separation process that continues up to this day.

Punta del Este Basin, interpreted as an aborted rift, develops in the west segment of the Uruguayan offshore. It is characterized by NW-SE trending half-graben structures and NE-SW seaward dipping reflectors (SDRs) wedges in the distal part.

Pelotas Basin develops in the Eastern segment of the Uruguayan offshore and continues through southern offshore Brazil. It is the portion of the margin that continued its extension and evolved into a passive margin. Unlike Punta del Este, Pelotas Basin does not have large graben structures, instead it develops a thick NE-SW trending SDRs sequence in its central part.

In the shallower region, both basins, are separated by a basement high (Polonio High) which was active during the Cretaceous. The limit between these basins in the central and distal part of the offshore is not so clear. No SDRs wedges were developed in the transition zone between these basins.

Soto et al. (2011) proposed that a set of NW-SE trending faults, which develop in this transition zone, constitute a transfer system called Rio de la Plata Transfer System (RPTS). According to these authors the RPTS would have generated the interruption and/or sinistral displacement of the SDR wedges of Punta del Este and Pelotas basins.

Later, Thompson et al. (2018) proposed the development of a triple joint rift structure called Maldonado Triple Junction (MTJ). Several evidences show that the MTJ operated and controlled the continental fragmentation in the region of offshore Uruguay during the Early Cretaceous.

The consequent geometry associated with the MTJ would be defined by the SDR packages of Punta del Este and Pelotas basins, which represent the rift arms that evolved, and an aborted central rift that represents the aulacogen structure (Figure 1).

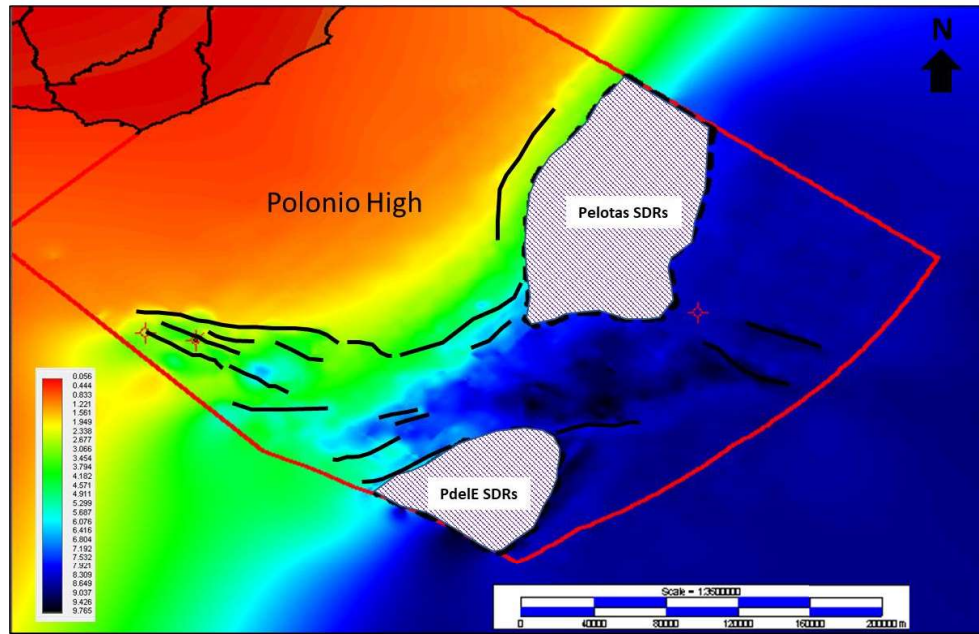


Figure 1: Top basement structural map (TWT) offshore Uruguay with location of Punta del Este and Pelotas basins SDR wedges and main synrift and early postrift faults

It is postulated in this work that the presence of this central aborted rift structure is the reason why SDRs in the offshore Uruguay are segmented, since conditions for SDRs formation were not developed in the aulacogen structure.

Through the integration and analysis of geophysical data, including 3D seismic and gravity, we analyzed this area in the central offshore Uruguay region from a Petroleum System perspective. The aulacogen structure developed unique structural and sedimentary characteristics for the Early Cretaceous that are different from the surrounding areas of the offshore. These distinctive features had important implications in the deposition of source rocks, maturation, generation, expulsion and accumulation of hydrocarbons.

Key words: Triple Junction, Offshore Uruguay, Petroleum Systems.

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