

Seismic stratigraphic analysis of Tumbes-Progreso basin (NW Peru) and E&P implications

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The Tumbes-Progreso forearc basin (Neogene) located in northwestern Peru, reports the first well drilled in South America (11/1863). It has hydrocarbon producing fields and an active petroleum system. The stratigraphic record exceeds 7000m of sediments which is related to the rapid eustatic variations. The result of intense transtensional faults activity directly associated with terrane accretion (Cretaceous), the active margin, oblique subduction and the Dolores-Guayaquil-Patallanga Megashear system, Pull-apart basins have been generated as Talara and Tumbes-Progreso.

Due to the lack of integrated regional studies, and as part of understanding the basin evolution, a detailed regional seismic stratigraphic analysis was carried out with 2D & 3D seismic data, biostratigraphy, stratigraphic columns and exploratory wells. A comprehensive approach is applied where an automated process delivers faults and horizons respectively from signal discontinuities and reflections. A relative geological time model is built using this comprehensive approach and allows the delineation of key surfaces by combining attributes and generating Wheeler diagrams. A chronostratigraphic chart of Tumbes-Progreso basin is interpreted by detailing main sequence boundaries associated with three NE-SW regional fault systems (Amotape, Zorritos and Banco Peru). Those faults networks impacted sediment sources of the basin.

We suggest that, besides inheriting a pre-Tertiary structural framework, the basin is opening at 33 Ma until 10 Ma, presenting two progradational systems and a transgression (main source rock). At 10 Ma the basin shows a change in its structural configuration, it is restricted by four structural highs (Zorritos, Banco Peru, Barracuda and Punta Sal) generating a main depocenter (Cabo Blanco trough). The basin acquires a pull-apart geometry with an intense sedimentation recorded by progradational system with sediment supply from SE to NW and from E to W, controlled by syn-sedimentary faults, with roll-over structures, growth strata and tilted blocks that favored the generation of local depocenters.

The seismic stratigraphy analysis allows reconstructing the basin evolution and gets a better grip reservoir prediction. The complex structural framework controlled the sedimentation and favoured the generation of structural, stratigraphic and mixed traps, that may present great exploration potential. This work opens a new panorama of Tumbes-Progreso basin regional exploration.