Combining Multiple Interpretation Techniques to Unravel the Oil Trapping System of Area 16, Sinco Oil Field Barinas, Venezuela

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Abstract

Within Barinas-Apure Basin, south of Barinas, oil-bearing sands have been found in Cretaceous and Tertiary deposits. Sinco Area16 is a small oilfield with hydrocarbon accumulation at the upper part of the stratigraphic section. Even though there has been oil production and it is considered a mature field nowadays, the trapping mechanism is not well understood.

The structural and stratigraphic framework previously interpreted in Sinco Area16 does not explain the oil production performance. A drag fold-like trap defines the Eocene reservoir structure in Sinco field; although Sinco Area16 is in the downward part of this structure, commercial oil is produced below the OWC. According to wells log data, hydrocarbon storage in the same oil-bearing sand is erratic, which could indicates lateral facies changes. This represents a significant difference with the established Gobernador Formation sedimentological model. Moreover, recently acquired biostratigraphic data in eastward exploration wells of Área16 reveals that the Cretaceous Burguita Formation is not totally eroded, as had been thought before.

The complex hydrocarbon storage and the new discoveries in exploration wells, led to a seismic stratigraphic reinterpretation of about 192 Km^2 and correlation of 52 well logs to build a detailed geological model. The improvement in the understanding of the stratigraphy and structural arrangement allows us to define the limits of Area 16, to delineate structurally new discoveries in East Silvestre, and to unravel the typical trap layout for similar prospects. A multi-scale data integration technique was performed, starting from biostratigraphic analysis, followed by the old conventional and special well log interpretation and well-seismic calibration to build 1D subsurface models. This was turned into a 2D model by applying seismic-stratigraphic principles to a master section. Finally we produced an integrated stratigraphic-structural 3D model. To understand the stratigraphic framework of Sinco Area16, an adaptation of a proposed method was combined with advance well correlation tools. In a random master section, geological and seismic criteria were established throughout more of the seismic covered zones with better recorded wells. Stratigraphic markers were set, followed by an amplitude correlation according to horizon continuity. To avoid making a confusing interpretation, structural discontinuities were recognized. Afterward, stratigraphic termination such as erosional truncations and onlaps were interpreted and connected for surface delineation of discontinuities.

A Cretaceous-Tertiary regional unconformity previously defined in Barinas is significantly important in reconstructing the strata; however, expressionless seismic data restricts unconformity correlation. Cretaceous strata deposited on a passive margin are relatively continuous until the unconformity, which forms erosionally truncated terminations. Fluvial sediments in-filling the Gobernador Formation were deposited over the eroded-deformed Cretaceous surface to form onlaps. Finally, a geocellular model and structural maps of all horizons were built. As a

result, Sinco Área16 oil trapping is seen to correspond to a paleostruture of the Cretaceous Burguita Formation, vertically sealed by the Tertiary Pagüey Formation; the East Silvestre are principally structural traps, nevertheless, in the zones where Burguita Formation erosion was minor, sealing rock and reservoir rock can be found within the same formation.