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3-D Seismic Structural Interpretation of the Northern Monagas Giant Producing Trend, Venezuela: Time Versus Depth

The Northern Monagas Giant Producing trend is a 50 km long and 8 km wide anticline structure broken by transverse saddles into three huge producing structures: El Furrrial, Carito, and Santa Barbara/ Bosque. Collectively these fields currently produce 800,000 bbl/d from late Cretaceous to Early Miocene sandstone. Regional integration of 980 km² of 3-D seismic surveys shows a continuous allochthon above a regional thrust with a displacement of 14 km. The crest of the anticline is typically cut by minor backthrusts and backfolds in all areas and by major imbrications in Carito and Santa Bárbara due to a younger tectonic pulse from the Pirital thrust, located more to the North.

Shallow imbrications, out-of-sequence thrusts, and growth unconformities create major velocity pull-ups and seismic imaging problems for the producing structures, which lie at depths of 12,000 to 18,000 feet. These pull-ups generate false plays, indicating the importance of using seismic data in depth. 3-D-post stack depth migration was carried out based on primary seismic time interpretation to avoid these artifacts.

The new 3-D seismic depth cube and more than 400 wells data helped to interpret of these giant structures and facilitated detailed structural mapping of secondary thrusts and transverse faults, essential to map details of reservoir compartmentalization. Transverse extensional saddles with large-displacement growth normal faults segment the hangingwall anticline. The growth faults and growth synclines are contemporaneous with the deposition of the thick overlying shale as well as the emplacement and compressional folding of the thrust sheet.