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Demonstrating the Value of Full Azimuth Broadband Data from an Inversion Perspective

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SUMMARY

Many case studies around the world have demonstrated that broadband data has contributed to improved imaging results as well as an enhanced inversion to predict reservoir rock properties. Most broadband acquisition and processing strategies aim at extending the temporal bandwidth of the seismic image. However, spatial and azimuthal bandwidth also needs to be addressed to achieve true full-bandwidth data. We present a case study that demonstrates the value of extending the bandwidth of the seismic data in two aspects; temporally and azimuthally through a full azimuth broadband acquisition, applying multi-azimuth processing and inversion approach. We will show results from both an imaging standpoint and also the inversion perspective.

In this case study, the seismic data was acquired in the Luconia province in a carbonate setting with the main objective of characterizing pre-carbonate targets. An extensive survey evaluation and design was previously performed, which demonstrated that both broadband and full azimuth acquisition and processing technologies were required to bring a step change in imaging pre-carbonates. In the acquired full azimuth seismic data, it not only delivers an improved image, but was also crucial in resolving the complexities of the derived earth model, providing a geologically plausible and stable tomographic inversion result to further enhance the final image.

The full azimuth data was sectored into three azimuth groups and each sector was individually pre-stack depth migrated. The multi-azimuth sectors were then optimally summed to take full advantage of simultaneously extending the temporal bandwidth provided by broadband data and improving the illumination of complex targets by extending the source-receiver azimuths acquired. This case study will demonstrate quantitative and qualitative inversion based comparisons of broadband narrow-azimuth (NAZ) data and the improvements achieved from full-azimuth (FAZ) broadband data through consistent simultaneous pre-stack inversion workflows.