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Trinidad & Tobago's Ultra-deepwater Prospectivity: Extension of the Guyana Play?

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Summary

Summary is not available

Introduction

Combining datasets from 2D seismic surveys throughout the Caribbean and equatorial margin provides a refreshed, merged perspective, allowing explorers the opportunity to unify their understanding and link eastern Trinidad and Tobago's ultra-deepwater territory to the growing production in its neighboring country of Guyana.

There are no significant offshore discoveries in over 76,000 km2 of offshore territory between Ranger, Calypso, and the Manatee trend, however government incentives in drill-friendly Trinidad invite energy companies to explore the interconnected area now. Previous drilling campaigns in deepwater T&T have been unsuccessful because they have not fully tested the petroleum system within the complex structures of the accretionary prism or eastern abyssal plain. Although complex geology and water depths present exploration challenges, the island's mature oil and gas industry is eager to overcome, in favor of a new era of exploration success in its upcoming Deepwater License Round.

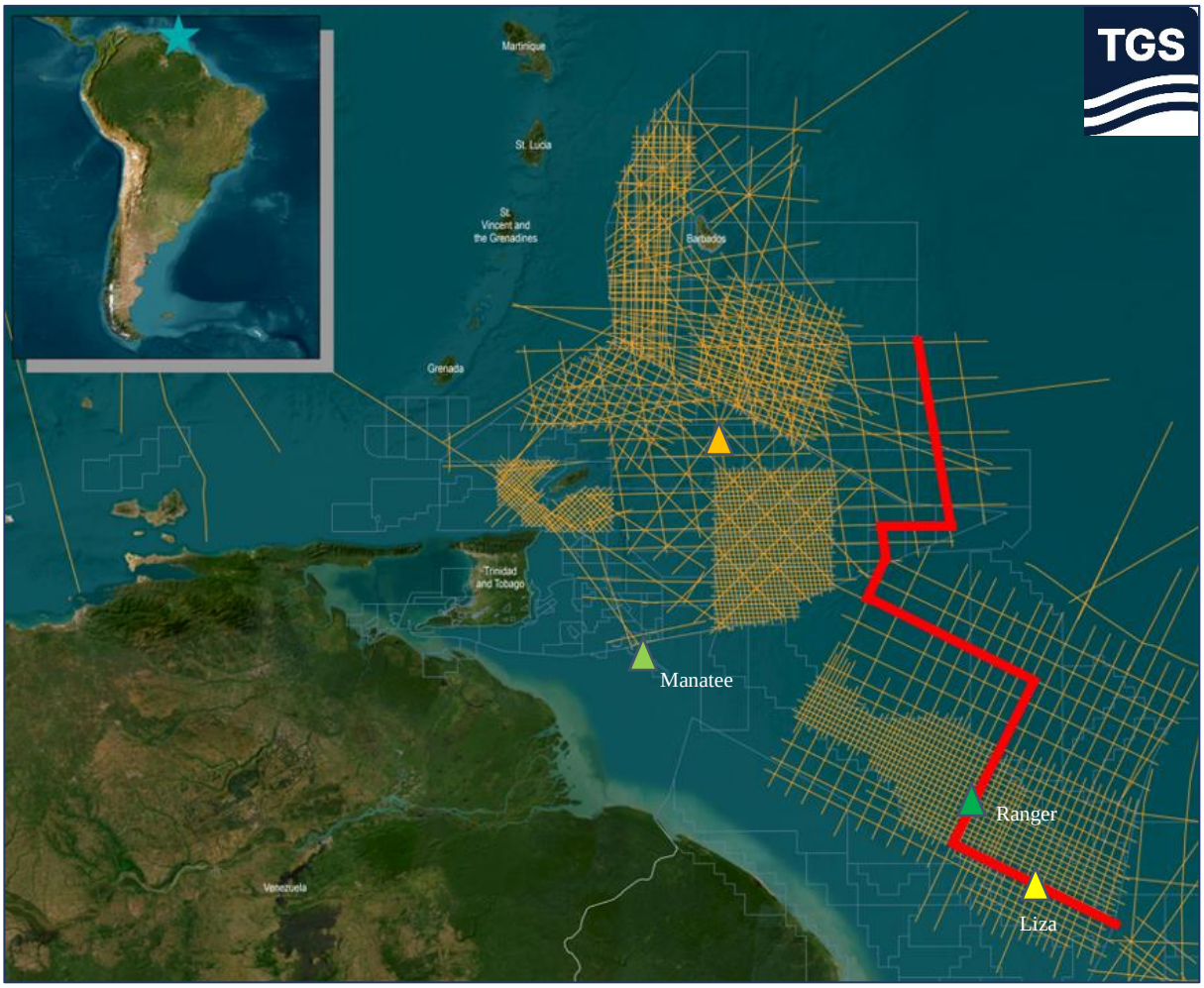

Figure 1 TGS *2D datasets and Arbitrary Line location for Trinidad and Tobago-Guyana source rock analog and significant fields.*

Geologic Setting

Trinidad and Tobago's location at the frontal edge of the Caribbean plate's eastward advance, overriding the Atlantic plate, creates uniquely complex geology and seismic imaging challenges (Gomez et al. 2021). Shallow water extensional faulting on a lower Tertiary shale detachment, transfers into down-dip compression, complicated further by ~50 km of shortening (Pindell et al., 2007) related to the tectonic scalping of the paleo-Atlantic margin during its eastward migration. Associated, mobilized shale-cored back-thrusting and transpressional folds also contribute to an abundance of potential trapping formations, with seals enhanced through burial by younger, thrusted sediments (Pindell et al., 2012), however the intense compartmentalization of these features increases the probability of complex development strategies (Figure 2).

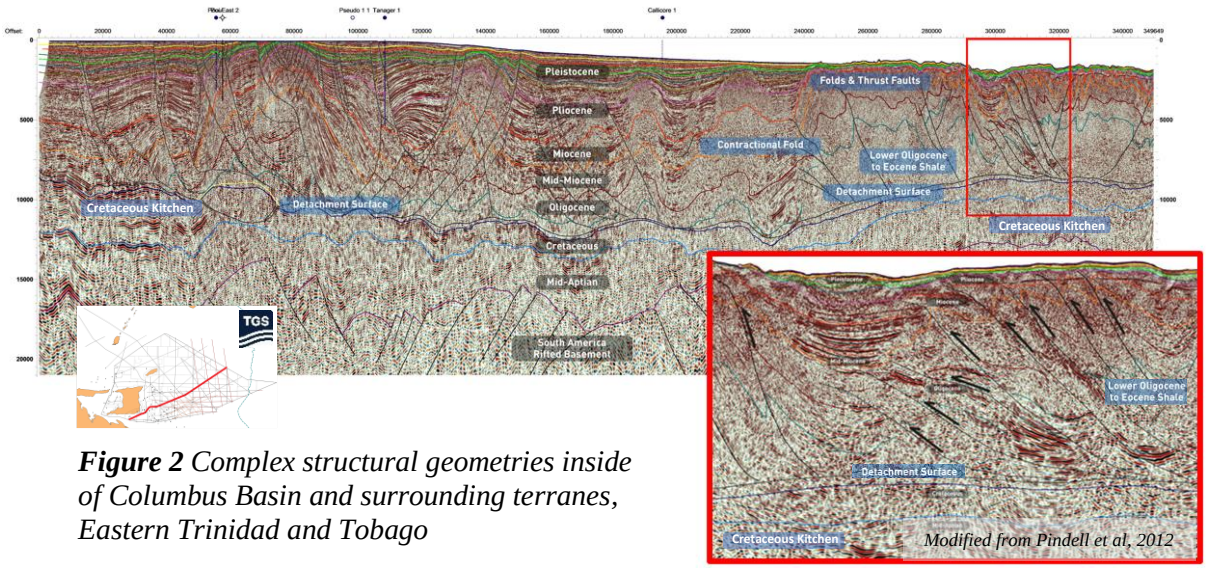

Figure 2 *Complex structural geometries inside of Columbus Basin and surrounding terranes, Eastern Trinidad and Tobago*

Source Rock Interpretation

Consequently, due to shortage of modern 3D data, thorough investigation of source rock presence is made on existing 2D seismic to evaluate ultra-deepwater exploration potential. Merging and applying seismic attributes to an arbitrary line built with six 2D lines from shallow water Guyana to ultra-deepwater T&T, Cretaceous source can be interpreted to the south and east of most of the complex features of Columbus Basin, potentially connected to the prolific Guyana trend. If successful analog can be made, ultra-deep T&T could unlock potential similar to Exxon's Stabroek block, home of Ranger, Liza, and associated discoveries.

Extending the tectonics and paleo-crustal trends of the equatorial margin, before arrival of the Caribbean plate, assumes the northwestward extension of Cretaceous source deposition with clear seismic evidence of subduction under the Caribbean Plate (Gomez et al. 2021). In Trinidad's most distal blocks, outside of the Barbados Prism, less imbricate faulting and a more confident imaging of the Mesozoic section display promising and more simplified potential, analogous to offshore Guyana.

Guyana's Upper Cretaceous Canje formation and the coeval stratigraphic section of Trinidad, known as the Naparima Hill formation, can be seen, represented by the Top Cretaceous

horizon in Figure 3. The Top Cretaceous sits at a depth around 4.5 km TVD at the Liza field, with a Mesozoic thickness over 5 km, and shallows over the Waini Arch to the west, then predictably deepens basinward and underneath the Barbados prism and thinning to ~3 km, underneath an Eocene to Oligocene depocenter in ultra-deep eastern Trinidad.

At the eastern-most boundary of the outer deformation front of the prism (Escalona et al.., 2008), we infer the presence of the stratigraphic, "Liza-Like" play, but in a deeper water, and a shallower, Tertiary, clastic reservoir deposited from the Orinoco instead of the Essequibo and Berbice paleo-drainage systems. Although the Cretaceous sequence is much deeper in eastern Trinidad, there is high probability of vertical migration through thrusted fault planes, charging the younger reservoirs in the boundary of the toe-thrust province and abyssal plain as the Caribbean plate acts as a tectonic squeegee, pushing hydrocarbons to the outer limit of the shale-cored thrust belt, behaving similar to allochthonous salt sheets in the Gulf of Mexico Sigsbee Escarpment.

Conclusions

Complex geology and absence of 3D data in ultra-deepwater Trinidad and Tobago presents challenges to exploration, however available 2D data provides insights to the potential linkage of petroleum system elements from the prolific discoveries in offshore Guyana. New, long offset 3D data acquisition and updated imaging workflows employing full waveform inversion will increase the industry's understanding of these complex geologic nuances and decrease risk involved in frontier exploration in the territory.

Acknowledgements

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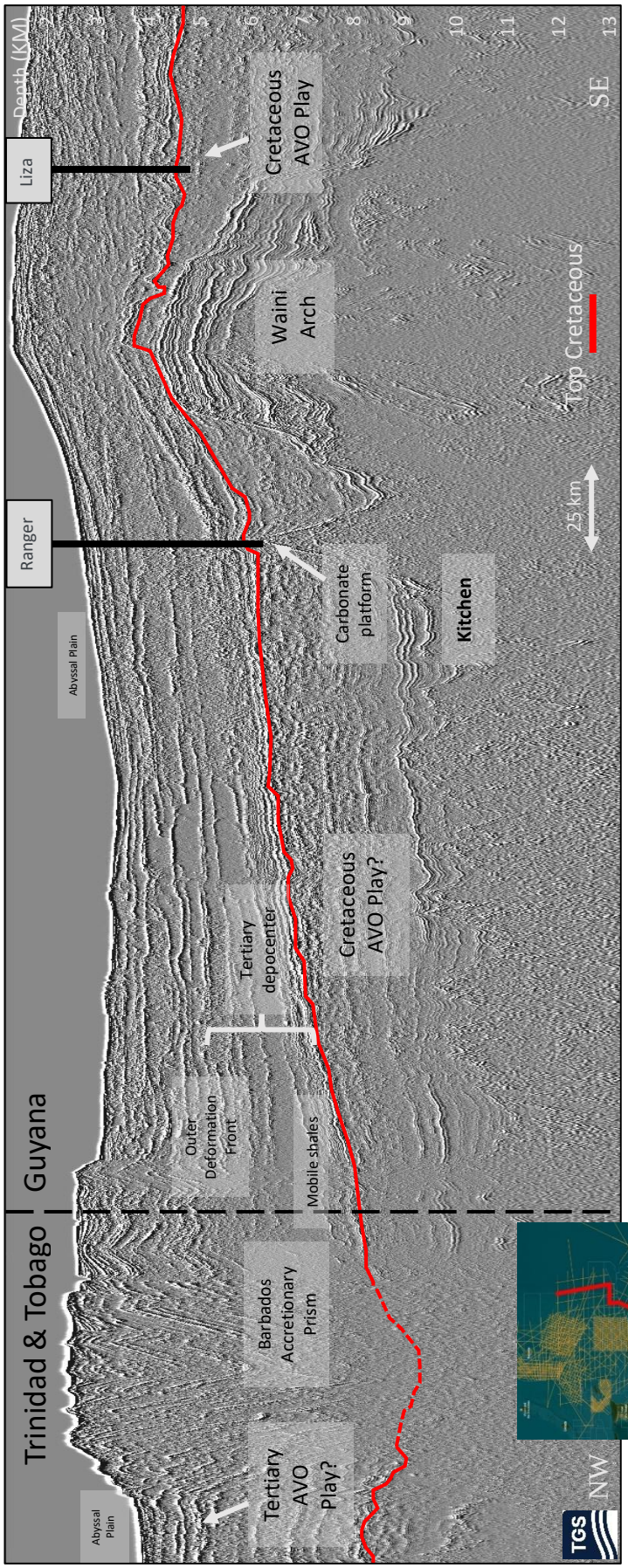

Figure 3 *A ~700 km long 2D arbitrary line (red on map) connecting offshore Guyana discoveries with eastern T&T acreage available in future Deepwater License Rounds. The depth cross section, which ties six 2D seismic lines, allows observations to be made on the northeast side of the Barbados Accretionary Prism where stratigraphic horizons can be mapped to major discoveries in offshore Guyana.*