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2024 Lease Round and Prospectivity of a Cretaceous play in the West Orphan Basin

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Objective:

A robust offshore 3D seismic database accompanied by quantitative interpretation data volumes and complemented by regional 2D seismic provide a unique perspective to the subsurface prospectivity of the 2024 Orphan Basin Lease bock territory. This combination of datasets reveals reliable regional maps of major sequence boundaries and cross sections of clastic channel and fan complexes throughout the Tertiary and Late-Cretaceous. Early-Cretaceous and Jurassic rift grabens provide one potential source rock to charge the clastic systems but also Tertiary well logs indicate potential for secondary source as maturity increases in the thermal generation window down-dip (Reuber et al 2023). Comprehensive regional seismic interpretation helps determine the potential of the secondary source while also identifying dozens of AVO (Amplitude versus offset) leads for a prospect portfolio. The identification of these leads and the presence of Cretaceous -tertiary source invites explorers to the region for a renewed multidisciplinary perspective.

Method:

Approximately 325,000 km of 2D seismic and 61,500 km^2 of 3D seismic have been acquired and interpreted over the past decade to develop a thorough understanding of the Eastern Canadian offshore subsurface. Post stack time (PSTM), depth (PSDM) seismic stacks and velocity models from eleven 3D seismic surveys and a dense, regional 2D grid, complemented with angle-stacks and attribute volumes. These complementary data are used to illuminate structural traps, stratigraphic pinch-outs, and amplitude related hydrocarbon indicators. Arbitrary seismic lines tying Bay du Nord, Cambriol and the latest block areas, highlight correlative similarities in the exploration targets while also importantly, exploring these relationships to the results at Ephesus in 2023.

Tying the regional 2D interpretation into 3D seismic data is paramount to understanding the seismic responses and their relationships to the accompanying petroleum system (Figure 1). The 2D lines image down to 40km, revealing the Moho unconformity, while the local 3D data images to 10km but provides the density and quality necessary for creating relative inversion volumes such as Vp/Vs ratio and Impedance for lithology and fluid characterization, beyond this study.

Results:

This study confirms regional observations of seafloor spreading between Labrador and Greenland. Rifting in the Orphan Basin rifting represents the “northern arm” of seafloor spreading related to the opening of the Atlantic Ocean. Interpretation on the regional 2D seismic data within

the 2023 Lease Round Area of Interest highlight the complex, horst and graben basement framework with accommodation space for up to 5km of syn-rift Jurassic and Lower Cretaceous age source rocks and contemporary clastic reservoirs between 2,000 m and 6,000 m total vertical depth. Fluctuating thickness of overlying Tertiary sediment packages imply the existence of consistent clastic sedimentation and intermittent sea level changes throughout the Cenozoic and Mesozoic, allowing the accumulation of Tertiary sediments up to 3km thick. This is evidenced by the reservoir quality Lower Cretaceous sandstones encountered in Blue H-28 (Koning, 2015)and the thick Tertiary fairway at Bonavista C-99 well site (Thomas, 1991). Moreover, the shallow water Sheridan J-87 well in Western Orphan documented an immature, 1-7% total organic content Tertiary unit. Combining elements from each of the seismic volumes exposes where this source material is most likely being generated and subsequently migrating.

Discussion:

The large-scale database provides a measurable advantage when evaluating prospectivity for the 2024 bid round and beyond. The regional basin framework provides the foundation for exploration campaigns in the developing territory which aims to rebound and build momentum in a post-Ephesus world.

As industry awaits the public release of the well log data in 2025, Orphan Basin requires a more in-depth evaluation to better define the risk factors in the basin however many data points from a regional synthesis indicate that the petroleum system elements and setting are present for prospective frontier exploration.

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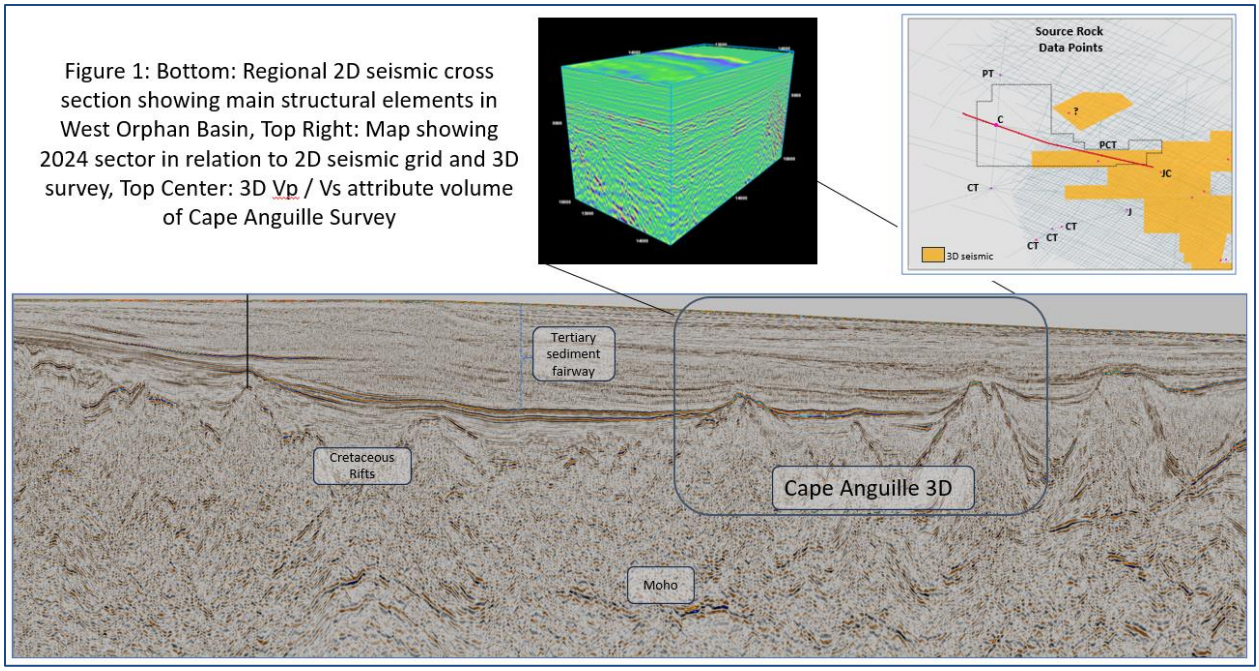

Figure 1: Bottom: Regional 2D seismic cross section showing main structural elements in West Orphan Basin, Top Right: Map showing 2024 sector in relation to 2D seismic grid and 3D survey, Top Center: 3D Vp / Vs attribute volume of Cape Anguille Survey

References

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