Stratigraphic analysis of the Jurassic and Cretaceous sequence of the Scotia Basin, Atlantic Canada

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Summary

The Nova Scotia margin of Atlantic Canada has been explored for hydrocarbons for more than 50 years. The exploration of the deeper Scotia Basin has not been successful (OETR, 2011), especially in slope and deep-water settings, resulting in only one non-commercial gas discovery (Hogg, 2002). The lack of exploration success in the frontier Scotia Basin has provoked questions about the distribution, quality, extension, and thickness of source rocks, seals, and reservoirs.
This study addresses these questions by building a stratigraphic framework of depositional sequences and system tracts through the integration of subsurface (well and seismic) data. Additionally, numerical stratigraphic modeling will be carried out to simulate the observed stratigraphy and understand the controls on its architecture.

Method / Workflow

A sequence stratigraphic analysis and regional correlation were performed on the Scotia Basin, integrating a total of 10000 km of 2D lines and 87 km² of 3D seismic cube (Fig. 1), data acquired and processed during the last forty years of exploration. Additionally, wireline logs data were used in conjunction with lithology, biostratigraphy, and geochemical data. DionisosFlow™ software will be used to build the stratigraphic model. This model predictions will be tested against field data to validate the accuracy of results. Lateral transport of sediment by ocean currents and intrabasinal generation of biogenic sediment (e.g., carbonate, silica, organic matter) will be considered within sediment input and erosion estimations.

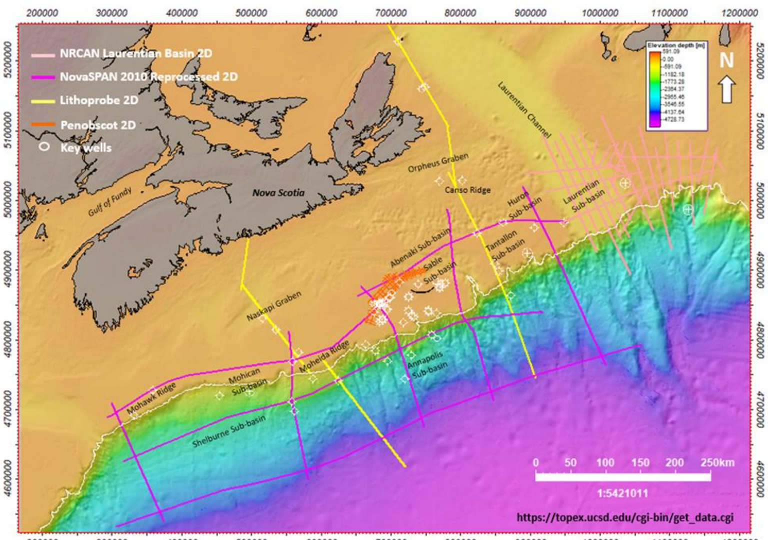

Figure 1: Well and seismic data coverage used against present-day topography.

Results

Preliminary analysis using seismic, well-log, and biostratigraphic data recognizes key stratigraphic surfaces including unconformities and maximum flooding surfaces (MFS). On seismic sections, unconformities are characterized by truncated reflectors below the surface, and onlap or downlap terminations above. Each MFS marks the end of a transgression (i.e., maximum expansion of the sea), and it is followed by a renewed regression. The break-up unconformity was identified in our analysis, which separates the syn-rift Triassic (and older sediments) from the overlying post-rift sequence and the development of the passive margin.

Thick packages of Jurassic and Cretaceous strata have been identified within the Tantallon, Annapolis, Laurentian, Huron and Sable Sub-basins (Fig. 2).

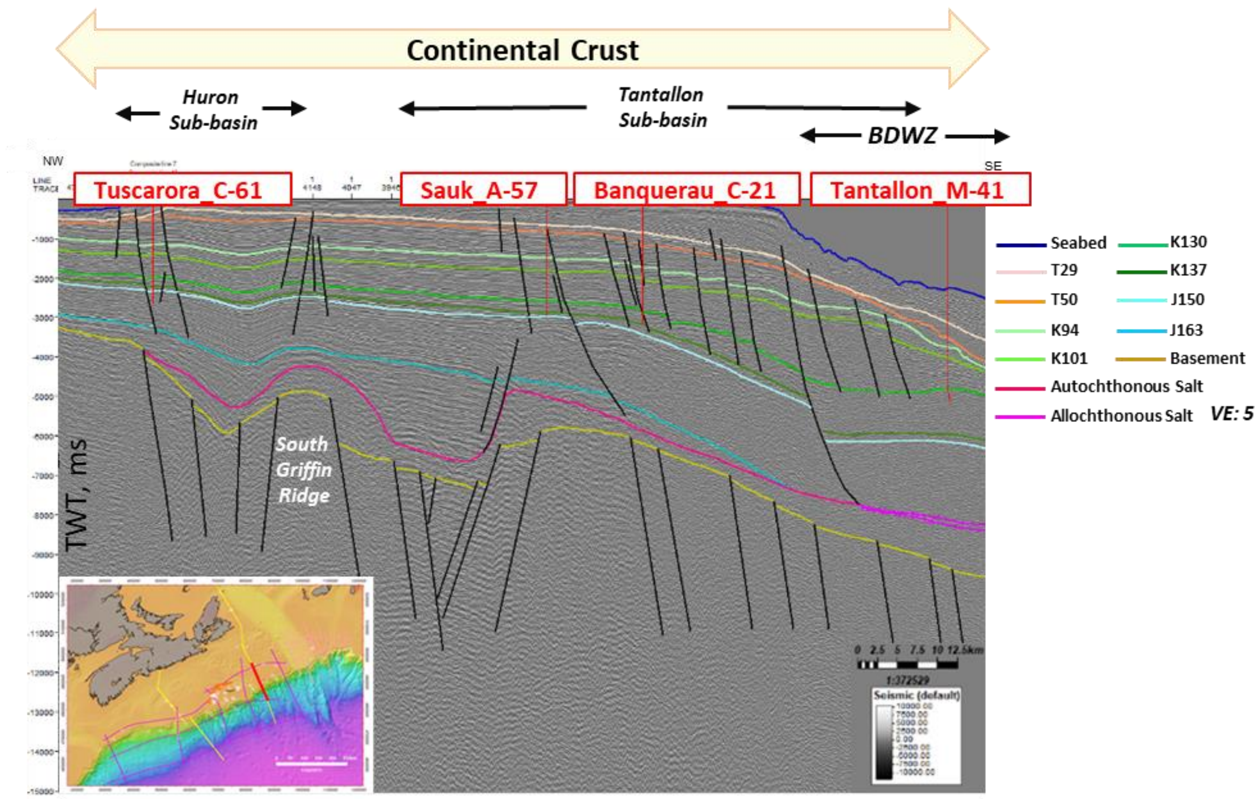

Figure 2: Seismic section for the line "Lithoprobe 891 mrg_s", showing thicker succession of Cretaceous and Jurassic sediments (T29: Mid-Oligocene Unconformity, T50: Base Ypresian Chalk Unconformity, K94: Turonian-Cenomanian Unconformity, K101: Albian Unconformity, K130: Hauterivian MFS, K137: Berriasian-Valanginian Unconformity, J150: Near Tithonian MFS, J163: Near Callovian MFS, BDWZ: Banquereau Detachment Wedge Zone).

Erosional areas had been interpreted throughout the margin, related to (but not limited to) channel incisions, slope failure and unconformities.

Acknowledgements

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