

Play Fairway Evaluation of the Eastern Nova Scotia Passive Margin – New Data, New Insights*

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Abstract

In 2011 OETR (Offshore Energy technology Research Association) and the Department of Energy of Nova Scotia published a comprehensive analysis of the hydrocarbon systems and resource potential offshore Nova Scotia. This applied a detailed and rigorous sequence stratigraphic based play fairway analysis methodology as well as integration of a thorough study of the relevant conjugate margins. This play fairway analysis is in the public domain (2011 PFA).

Since then, exploration offshore Nova Scotia has been re-energised with new seismic activity and drilling expected over the next few years. The eastern part of the margin (commonly referred to as the Banquereau Syn-kinematic wedge - BSW) has a particularly complex Upper Jurassic history. New well data has recently been released to the east of this area within the jurisdiction of the Province of Newfoundland and Labrador. These wells (Bandol-1 and East Wolverine G-37) both penetrated the Upper Jurassic section and provide key calibration data for understanding the BSW. The new study area is shown in [Figure 1](#).

The eastern part of the Scotian passive margin has a particularly complicated tectonic history because of the interaction of a major Jurassic delta system with a syn/post-rift autochthonous salt basin. The Late Jurassic delta displaces salt basin-wards, leading to an anomalously thick Upper Jurassic section with a very complex structural style. Integration of new data accessed from the adjacent Newfoundland part of the Laurentian Basin suggests a revised interpretation of this geological interval. The tectonostratigraphic history of this area is described by Deptuck et al. (2014), who present a revised interpretation of the syn-kinematic wedge, which has a profound effect on the petroleum systems history of the area.

This article focuses on the integrated interpretation of the area shown in [Figure 1](#), including updates to biostratigraphy, sequence ([Figure 2](#)) and seismic stratigraphy ([Figure 3](#)), geochemistry and petroleum systems modeling. The study includes a thorough re-assessment of the biostratigraphy and geochemistry of a number of key wells. This, together with the revised tectono-stratigraphic interpretation, leads to a new view of the charge history in the area of the BSW with impact on the expected gas/liquid ratios predicted from the Upper Jurassic source rocks ([Figure 4](#)).

The key conclusions are that the area of the syn-kinematic wedge has a number of possible reservoir and trapping possibilities (with some trap sizes having a closure areas of up to ~200 sq km). The risk on hydrocarbon charge is low, with the main uncertainty being on fluid phase. The depth of the most effective source rock in the area (Tithonian age, Type II/II source rock), which is highly variable, and the distribution of salt bodies, lead to a wide variation in liquid/gas ratio. Detailed understanding of the fluid phase distribution requires 3D analysis as the salt morphology is highly complex and thermal refraction has a strong influence on temperature and maturation history.

References Cited

Seismic stratigraphic framework and structural evolution of the eastern Scotian Slope: geological context for the NS14-1 Call for Bids area, offshore Nova Scotia.

Mark E. Deptuck, Kris Kendell, David E. Brown, and Brenton M. Smith, 2014, Canada-Nova Scotia Offshore Petroleum Board, Halifax, Nova Scotia, Canada.

Hydrocarbon observations

- Calibration well
- Well with oil or shows
- Grand Banks wells
- Sea bed core - oil
- Sea bed core - gas

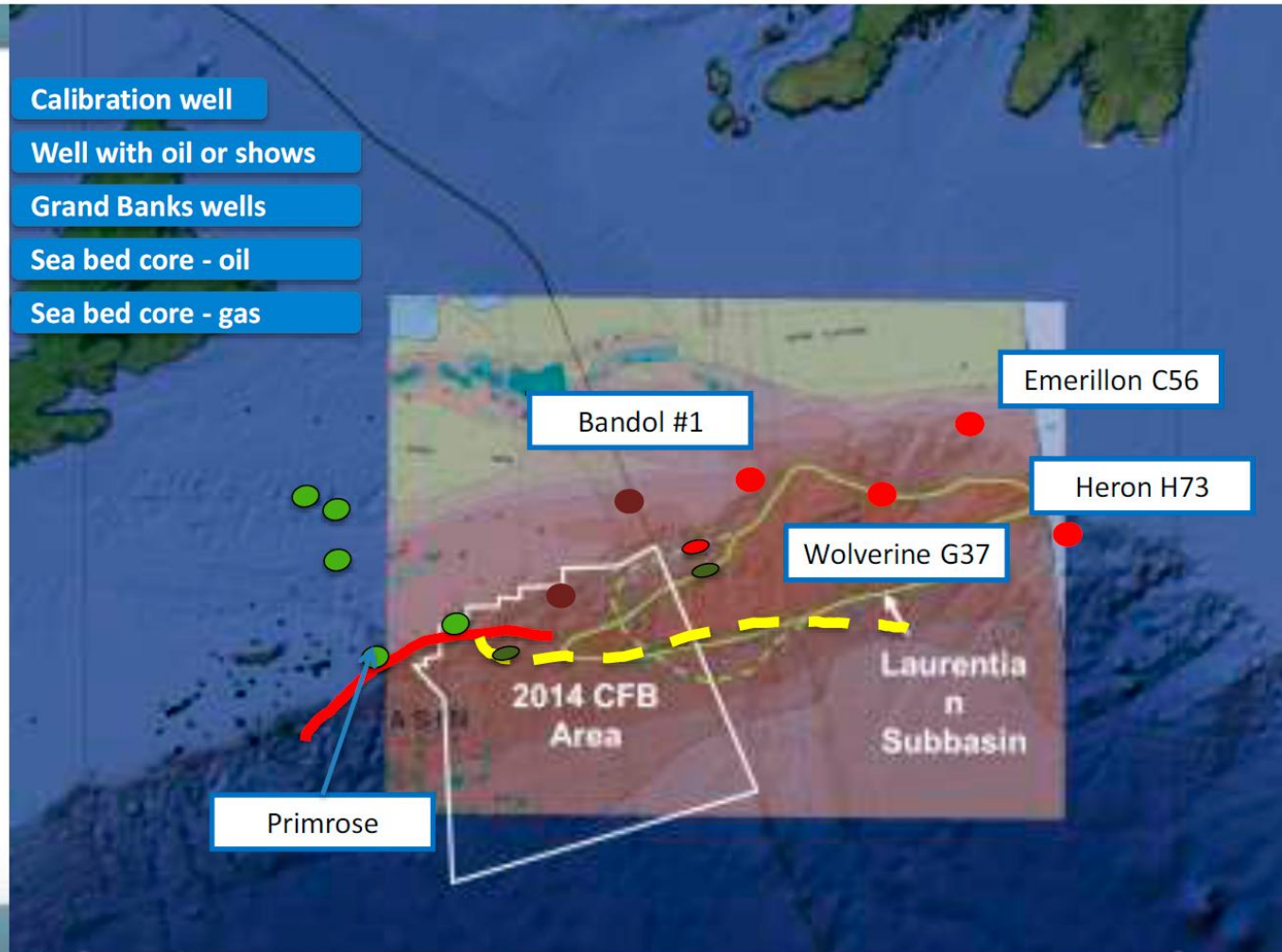


Figure 1. Laurentian sub-basin study area map.

Regional Chronostratigraphic Cross-section

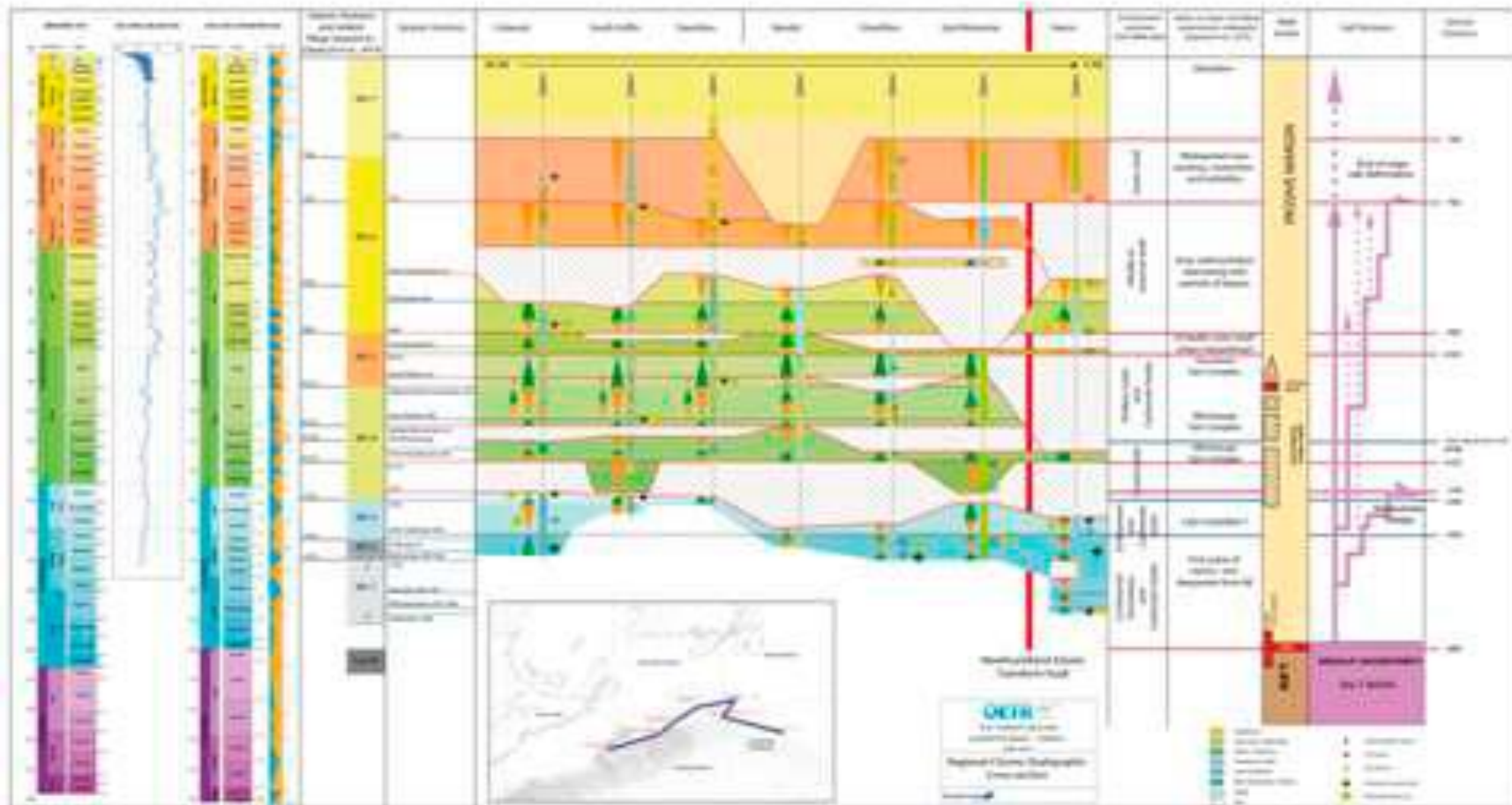


Figure 2. Regional chronostratigraphic section.

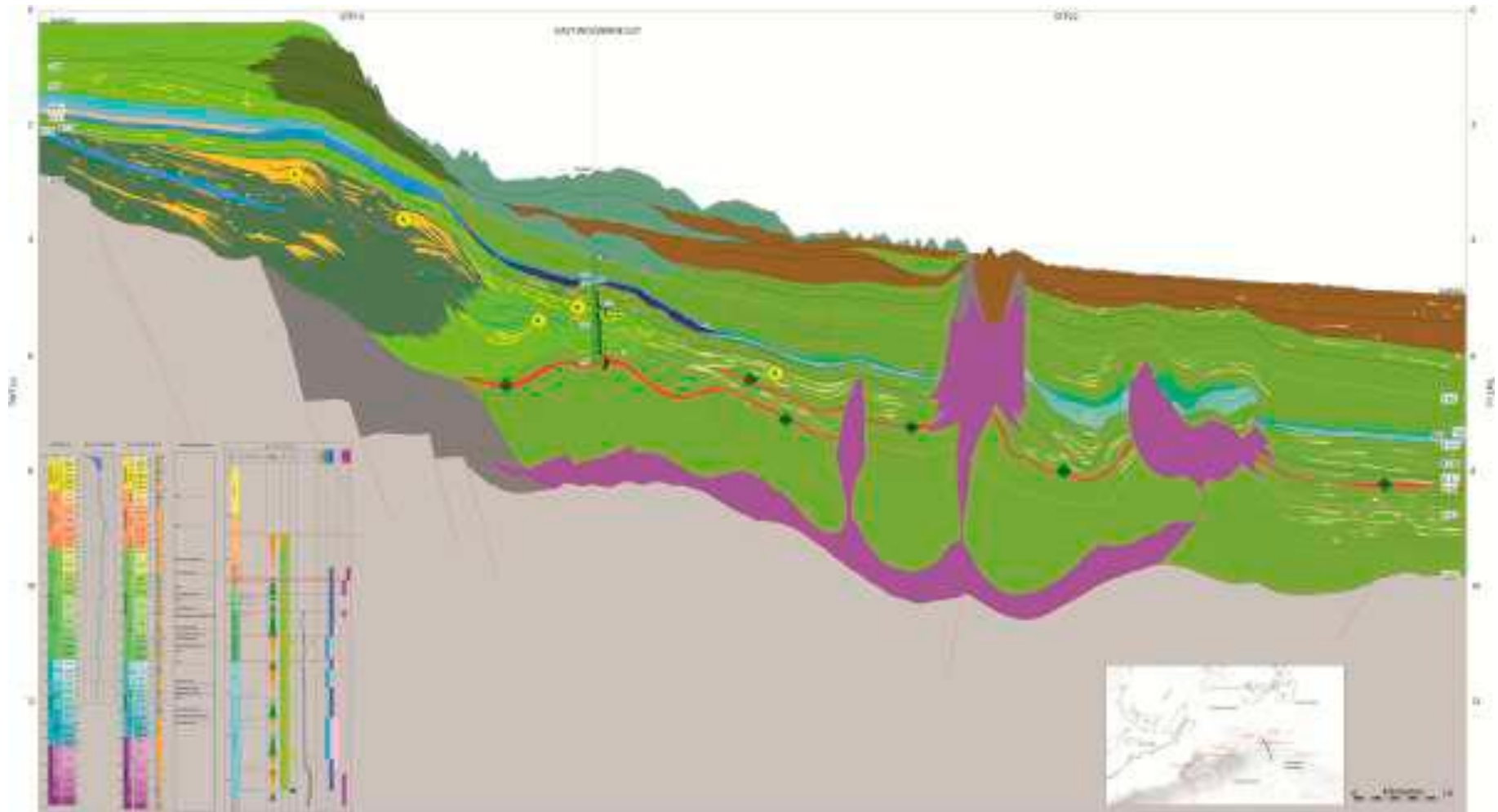
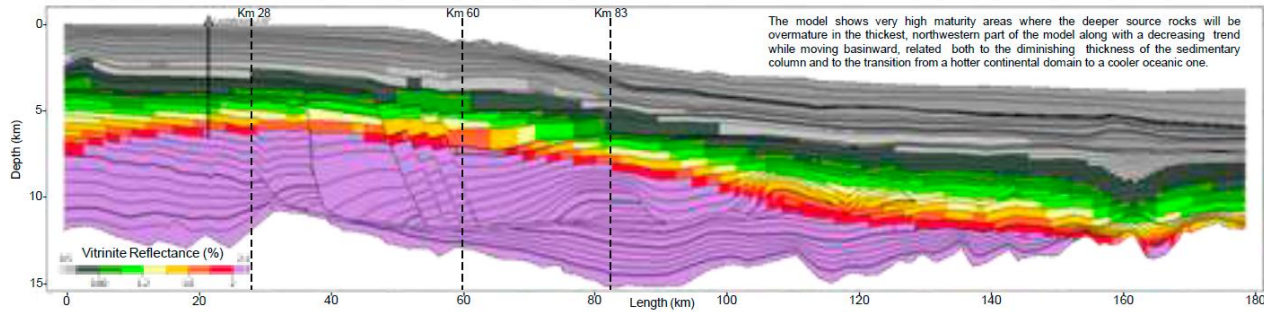


Figure 3. Architectural cross section 2: East-Wolverine G37 seismic lithostratigraphy.

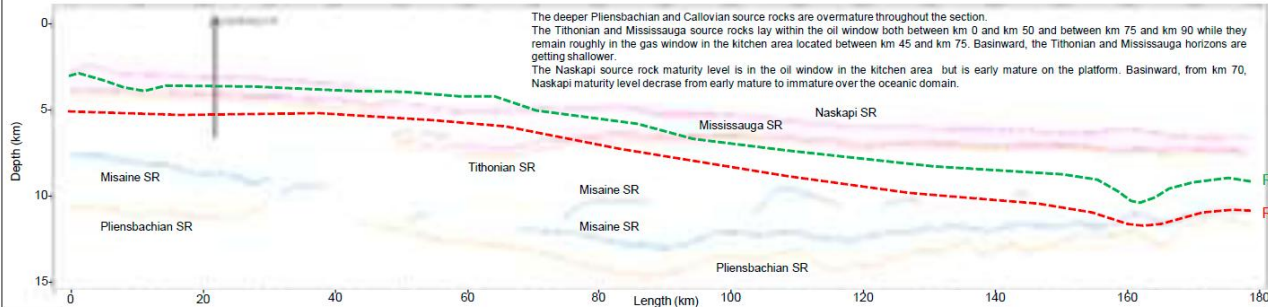
BASIN MODELING – TEMIS 2D

Laurentian Sub-Basin study - CANADA - June 2014

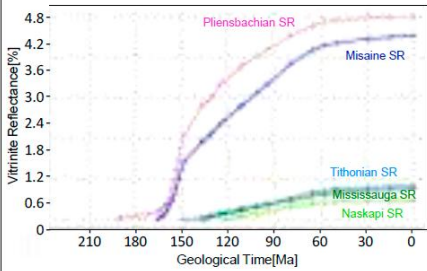
Vitrinite Reflectance(Reference Scenario)



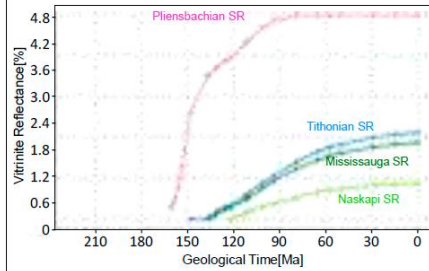
Oil & Gas Windows



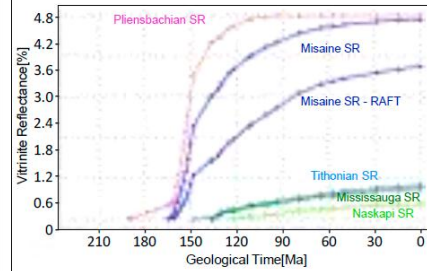
Vitrinite Reflectance through time at Km 28 Location



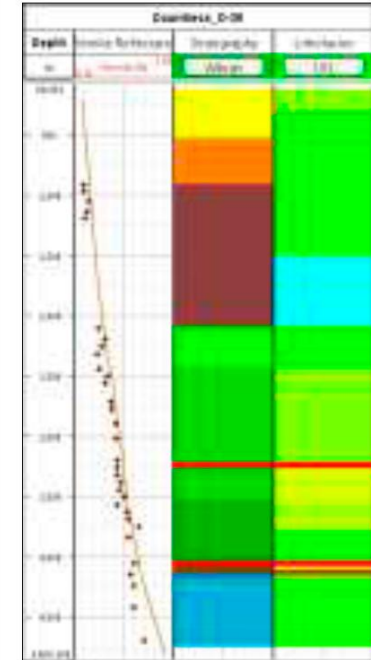
Vitrinite Reflectance through time at Km 60 Location



Vitrinite Reflectance through time at Km 83 Location



Calibration (Reference Scenario)



Vitrinite model is calibrated versus available observed data at Louisbourg J-47 well location:

- Observed data is represented with dots,
- Simulated data is represented with thick line.

Vitrinite calibration at Louisbourg J-47 well location falls under the measurements uncertainty range.

Figure 4. 2D petroleum systems model cross section through the Louisbourg J-47 well.