

Request for Proposals

Paleogeographic reconstruction and source rock de-risking, offshore Nova Scotia

RFP Release Date: Tuesday 26 November, 2019

RFP Due Date: Monday 13 January, 2020

4 pm (Eastern Standard Time)

Contract Manager

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1. Context and Purpose

The Offshore Energy Research Association of Nova Scotia (OERA) is an independent, not-for-profit research organization that funds geoscience and renewable energy research aimed at reducing risk and encouraging the sustainable development of Nova Scotia's energy resources.

As part of this broad mandate, OERA with funding from the Nova Scotia Department of Energy and Mines (NSDEM) is undertaking a multi-year geoscience research program intended to fill knowledge gaps and reduce uncertainty with respect to the province's offshore conventional oil and gas resources. This Request for Proposals (RFP) addresses two related components of that research program: paleogeographic reconstruction and source rock de-risking.

The Play Fairway Analysis Project completed by Nova Scotia in 2011 developed a model that allows the potential for a lower Jurassic oil prone (Type II) source rock that extends beyond the Sable sub-basin and underlies the whole margin. In the eastern part of the margin the source rock passed through the hydrocarbon generation zone earlier and is over mature at present day. Isotopes of molecular oils discovered in piston cores taken along the length of the margin support the hypothesis of a distinct separate regional source rock (PFA, 2011).

Recent deep water exploration programs led by Shell and BP have not discovered commercial deposits of hydrocarbons and have cast doubt on the assumption of ubiquity for a regional source rock. Analysis of the new exploration seismic and well results indicate that the Lower Jurassic source rock may be compartmentalized, rather than being ubiquitous as originally hypothesized. This could be due to being confined locally to syn-rift sub-basins, due to source rock deposition being bounded in areal extent by vertical salt features that were in place or upwardly mobile during, or due to subsequent erosion and removal. Whereas considerable hydrocarbon potential remains for the under-explored Atlantic margin, the uncertainty about presence of a Jurassic source rock remains a significant risk.

In order to better address the source-rock risk, OERA and Nova Scotia have targeted three main initiatives: (1) an expanded effort to detect hydrocarbon seeps at the ocean floor, (2) a review and survey of the distribution and types of source rocks observed around the Atlantic margins, both offshore Nova Scotia and from neighboring regions, and (3) an up-to-date model of the tectonic evolution of the northern central Atlantic to improve basin models and to provide context for the potential deposition and preservation of syn-rift and early post-rift source rocks. This RFP has been created to solicit proposals to address the third initiative (i.e., an up-to-date paleogeographic reconstruction) that integrates and provides context for the results of the second initiative (i.e., a regional summary of northern Central Atlantic source rock data). The primary Area of Interest is offshore Nova Scotia (Figure 1), although for paleogeographic analysis the consideration, interpretation and reconstruction of the conjugate Moroccan margin as well as other neighboring regions to the north and south will also be necessary.

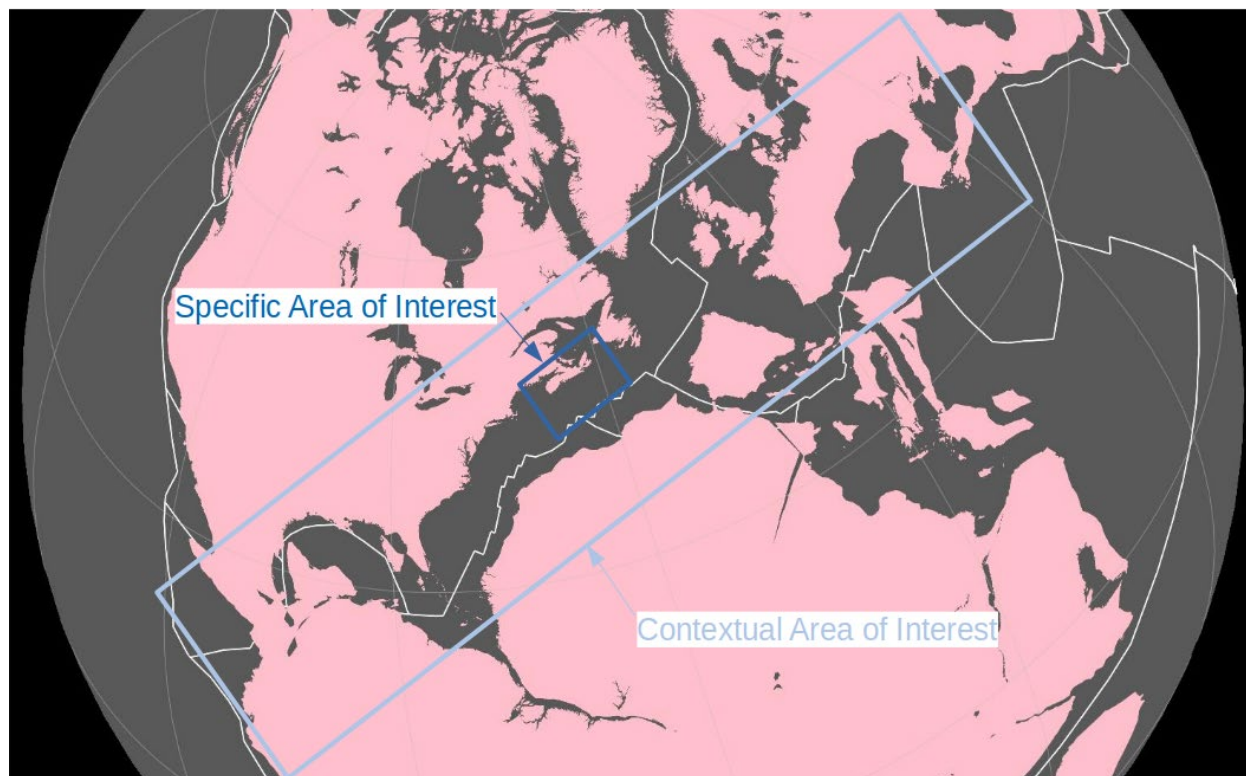


Figure 1: Area(s) of Interest (AOIs) for this RFP. The specific AOI (dark blue) is the area of Mesozoic extension and basins in onshore and offshore Nova Scotia with a focus on the presence and preservation of syn-rift and early post-rift source rocks in the offshore domain. The contextual AOI (light blue) spans broadly the entire Hispanic Corridor linking the Pacific domain to the western Tethys domain in the Jurassic period with a specific focus on the Moroccan conjugate margin and neighboring regions. Areas of interest are shown on a 165 Ma reconstruction (after Earthbyte, 2018).

OERA is seeking proposals from service companies, academic groups, or collaborative combinations thereof to provide an up-to-date model of the tectonic evolution of the northern Central Atlantic with the specific focus of de-risking syn-rift and early post-rift source rocks.

Targeted outcomes include an improved model of present-day basin and crustal architecture combined with the reconstruction of this architecture back to an early Mesozoic pre-rift initial condition. Coupled or parallel models of paleo-climate, paleo-topography, paleo-environment or depositional setting through time and paleo-ocean circulation and upwelling zones through time may provide key insights for de-risking source rock presence and preservation. These components are optional for the purposes of this RFP, but proposals able to include or address any or all of these supporting pieces will be considered to have added competitive technical value.

The overarching purpose of this work is to re-evaluate the syn-rift and early post-rift geological context of northern Central Atlantic basin formation in order to:

(1) de-risk the formation, distribution (whether ubiquitous versus compartmentalized), preservation, and maturation of syn-rift and early post-rift source rocks; and

(2) create an up-to-date set of tectonic boundary conditions for more regional or local petroleum system assessments.

2. Inputs and Objectives

Respondents are expected to be experts in the field of paleogeography and to have existing in-house views, models, or products regarding the paleogeographic reconstruction and basin formation for the Areas of Interest (AOIs). In order to provide an up-to-date reconstruction of northern Central Atlantic evolution for this RFP, proposals are expected to leverage their existing knowledge base and to integrate the following inputs supplied by the client OERA:

(1) a review and survey of the distribution and types of source rocks observed in and around the NS-Morocco conjugate Atlantic margins, both offshore Nova Scotia and from neighboring regions, as prepared by Dr. Andy Bishop (consultant geochemist working for OERA),

(2) a 2D structural reconstruction study of four cross-sections linking the NS-Morocco conjugate margins through time, as prepared by Beicip-Franlab (2019), and

(3) a high resolution Moho pick from reflection seismic data for portions of offshore Nova Scotia.

The goal of integrating existing state-of-the-art tectonic models with the above inputs is to produce a higher resolution and better constrained model of the tectonic and oceanic boundary conditions in the northern Central Atlantic to help the OERA and NS further de-risk the formation, presence, and preservation of syn-rift and early post-rift source rocks. As noted, one priority is to assess the potential for a Lower Jurassic source rock, but it is also targeted to review the upper Jurassic Tithonian sequence which provides the main source rocks for the Sable sub-basin, as well as, any other candidate source rock interval from the syn-rift and early post-rift sections for which credible evidence is available.

3. Outcomes

Required deliverables for this project include:

1. A **technical report** explaining methodology and conclusions regarding paleogeographic reconstructions and the identification of potential source kitchens with accompanying maps in print and digital format.
2. **Source rock presence risk maps** that use paleo-geographic, -geologic and -oceanic boundary conditions to quantify the likelihood of source rock formation and preservation, based on factors such as the connectivity of syn-rift basins, patterns of ocean circulation and upwelling, and the creation, filling, and preservation of required accommodation space in relevant depositional environments.
3. An up-to-date **model of paleo-geographic, -geologic, and -oceanic boundary conditions** for the formation and evolution of the northern Central Atlantic including, but not limited to:
 - i. a present-day crustal architecture map and the kinematic parameters required to retro-deform and retro-position different crustal elements (oceanic, continental, or transitional) from present day time to a pre-rift configuration;

- ii. a model of the Hispanic Corridor (connecting the Pacific and Tethyan oceans via the central Atlantic) in terms of the connectivity of basins as well as oceanic circulation and predictions of upwelling zones during the key syn-rift and early post-rift periods; and
- iii. a package of useful overlays of relevant data or predictions, such as depositional environment constraints as it relates to basin fill and source rock observations.

In the context of the above, please note:

The geographic scope of any work must be large enough to allow an assessment of ocean basin connectivity from the Pacific through to the Tethyan oceans via the Central Atlantic 'writ large'. This may be regarded as a significant and somewhat uncertain task. Responses must clarify therefore how this would best be handled for a project of reasonable time and scope given that the specific area of interest is for the offshore Nova Scotia margin.

The OERA may be able to leverage its existing collaborative relationship with Morocco's Office National of Hydrocarbons and Mines (ONHYM) to facilitate access to technical input and data.

4. Structure

4.1 Project Time Frame

Project initiation is tentatively scheduled for February 2020 although the Moho pick will not be available until mid March. Respondents should describe model or product inputs and outputs including the timing/scheduling of both inputs and outputs (deliverables).

Regarding the specific technical workflows, Respondents must describe the steps required to produce the outcomes along with the timeframe and costs for each step and for the project as a whole. If the technical workflow involves collaboration with third parties or the client, Respondents must describe how the integration of inputs, tools, and methods will be managed to achieve a successful project.

If applicable, groups are encouraged to propose several tiers of work – with different implications for what can be included and for what costs.

4.2 Coordination and Integration

Groups must describe and demonstrate their project management capabilities to coordinate and integrate proposed work commitments including how this could or would involve the use of in-house expertise, sub-contractors, partners, or collaboration with the client.

4.3 Ownership, Use and Distribution

The OERA intends to publish the technical report, accompanying digital surfaces, and the source rock risk maps in the public domain at the completion of this project. Ownership and rights attached to these products must allow for this use.

4.4 Project Initiation

Upon project initiation:

1. A startup meeting (or web meeting) will take place between the client and the successful Respondent;
2. Client-provided data sets and model inputs will be confirmed and supplied to the Respondent by the client. Any information requested or required by the Respondent for the successful completion of this project that is in addition to items specified in this RFP will be identified, agreed upon and provided in a timely fashion by the client to the Respondent.

5. Information Requirements

Respondents are requested to:

1. Describe task objectives, approach(es) to be used, and anticipated outcomes.
2. Describe alternative scenarios or approaches (if appropriate) and provide justification for their consideration.
3. Provide order of magnitude or expected cost ranges of the principal tasks; provide a similar estimate for the total project cost.
4. Provide time estimates per task (weeks or months) as well as an estimate of total project duration.
5. Include a brief description of the Respondent's company and its relevant experience with similar projects.
6. This funding is open to Canadian and non-Canadian entities as well as project teams consisting of Canadian and non-Canadian partners.
7. Costs must be quoted in Canadian dollars. Payments will be made in Canadian dollars.
8. The response should be concisely worded with clearly described objectives, methods, timelines and outcomes. Maximum 15 pages excluding appendices. A single electronic document is sufficient.
9. The cover letter can be addressed as shown below and should be uploaded in WORD and PDF format to the OERA FTP site at <https://oera.sharefile.com/share/getinfo/rcdf90a4e27a42179> no later than **4:00 p.m. EST, Monday January 13, 2020.**

Offshore Energy Research Association of Nova Scotia (OERA)
Joseph Howe Building, Suite 1001
1690 Hollis Street
Halifax, NS B3J 1V7
Attention: Russell Dmytriw, Director of Research
10. Please provide any additional detail that you consider relevant that may help OERA and NSDEM achieve the objectives described above.
11. OERA will require up to three weeks to review the responses (to end January). During this time, OERA and/or NSDEM staff may contact the Respondents directly for additional discussions regarding project

approaches. Project initiation is tentatively scheduled for early February 2020. OERA reserves the decision to proceed or not to the contracting stage.

6. Questions and Clarifications

The OERA will accept questions from interested applicants until **Wednesday December 18, 2019**. A Q&A page will be available on the OERA website: <http://www.oera.ca/news/requests-for-proposals-funding/current-opportunities/>. The names and organizations of those submitting questions will remain anonymous; only the question and OERA response will be posted. Interested parties are encouraged to check the Q&A page for updated information and/or clarifications that may help in completing their proposal.

Please submit your questions by email to Russell Dmytriw, Director of Research (rdmytriw@oera.ca).

References

PFA – Play Fairway Analysis OETR - Offshore Energy Technical Research Association, 2011. Play Fairway Analysis Atlas - Offshore Nova Scotia. Nova Scotia Department of Energy Report, NSDOE Records Storage File No. 88-11-0004-01, 347p. <https://oera.ca/research/play-fairway-analysis-atlas>