Request for Proposals

Paleogeography-to-Petroleum Systems: Research Innovations for Offshore Nova Scotia (PaGeo2)

RFP Release Date: Thursday 21 May 2020
RFP Due Date: Friday 28 August 2020, 4 pm (Atlantic Daylight Time)

Contract Manager

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1.0 Introduction

1.1 Context

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 new, 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 proposal (RFP) is tendered following a decade of industry exploration in offshore Nova Scotia focused on the deep water. Deep water tenure and exploration has targeted zones off southwestern Nova Scotia where the 2011 Play Fairway Analysis (PFA) indicated probable oil resources generated from a proposed early Jurassic source rock. Results from new seismic data have encouraged explorers to focus further exploration on areas of southwest and central Nova Scotia that support the presence of a proposed early Jurassic source rock, but also where reservoir presence appears most favorable. However, initial drilling off southwestern Nova Scotia has not yet confirmed the presence of commercial hydrocarbons in the deep water.

Past Play Fairway-type projects funded by the province targeted a regional understanding to link general geological knowledge of offshore Nova Scotia to the factors responsible for hydrocarbon formation, preservation, and discovery. These projects are available here. A recent RFP ('PaGeo1' which closed in January, 2020) takes a paleogeographic approach, targeting specific areas and techniques that de-risk critical source rock factors directly.

The current RFP ('PaGeo2') seeks fundamental advances and insights on the general geological factors that impact Nova Scotia's offshore petroleum resources through a reassessment of basic basin-forming and petroleum system-forming constraints and processes. Ultimately, this work is intended to contribute to the development an academic-led, research-first, International Ocean Discovery Program (IODP) submission, targeted for 2023.

1.2 Objectives

The recently closed paleogeographic RFP (called PaGeo1) sought a state-of-the-art update of the paleogeographic boundary conditions applicable to the syn-rift and early post-rift formation of the northern Central Atlantic, with applications to de-risking the presence and preservation of syn-rift and early post-rift source rocks in offshore Nova Scotia and conjugate regions. PaGeo1 timelines are aggressive, targeting completion within the 2020 calendar year.

In contrast, this RFP (called PaGeo2) seeks proposals that will revisit the basic basin-forming and petroleum system-forming evolution of offshore Nova Scotia from first principles, while keeping in mind and benefiting from all that has been learned over the past decade in deep water exploration. PaGeo2 timelines are longer (up to 30 months) in order to advance knowledge on topics impactful for industry's re-evaluation of Nova Scotia's offshore potential in the mid-term to long term. Projects targeted in this RFP will inform a new integrated view of the petroleum potential of offshore Nova Scotia to be synthesized upon completion of the separately funded projects in several years time.

PaGeo2 projects will also be used to support fundamental geoscience arguments for an IODP application, both through the new understandings that are achieved and, equally, by identifying remaining knowledge gaps that can be addressed using potential, future deep sea drilling-based studies**. Given this latter**

objective, respondents to this RFP are requested to describe components of their research proposals that would later benefit from or support the goal(s) of an IODP proposal.

PaGeo2 projects will address the basic boundary conditions for basin formation and petroleum system evolution in offshore Nova Scotia. Proposals should emphasize how increased rigour, increased breadth, increased focus, or increased innovation have the potential to significantly advance the analysis of Nova Scotia's offshore hydrocarbon potential beyond that available in present models.

The PaGeo2 RFP is intended to support multiple teams and projects that each address distinct parts of paleogeography-to-petroleum systematics in the context of offshore Nova Scotia. **Key for successful proposals will be to explain which part of the relevant geological systems or regions will be targeted and what deliverable(s) will be produced that will be of use for concurrent and later integration.** If useful, single respondents or teams may consider proposing projects which know about one another and which would benefit from mutual funding and an advance integration plan. PaGeo2 is designed to match better with academic or academic-consultant collaborations that may involve the use of 1-2 year graduate or post-graduate research appointments, although this is not a requirement for a successful proposal.

2.0 Study Themes

Six themes are suggested as subject categories for proposals that would be of interest to the NSDEM and OERA. Each theme is described, and candidate projects are suggested.

2.1 Crustal Architecture

Projects in the Crustal Architecture theme are targeted at building a best-in-class model of crustal architecture (and upper mantle architecture) for offshore Nova Scotia and potentially for its northern Moroccan conjugate margin and neighbouring margins to the north and south. The purpose of improving crustal architecture models is because these models provide a key basic input for subsequent models of deformable plates and syn-rift/post-rift thermal evolution and maturation.

Specific projects encouraged under this theme include (but are not limited to):

(1) New controlled source refraction seismic line acquisitions for basic crustal and upper mantle calibration;

(2) Calibration and testing of a regional Moho pick from reflection seismic against Moho interpretations derived from potential field inversions;

(3) Calibration and testing of a high-resolution Moho pick from recently acquired 3D-seismic surveys (e.g., Shelburne and Central slope areas) against Moho interpretations derived from targeted potential field data sets acquired in tandem with the 3D seismic surveys;

(4) Development of a crustal architecture model for offshore northern Morocco for the purposes of comparison with offshore Nova Scotia and the shared syn-rift evolution of these conjugate margins.

2.2 Deformable Plates and Thermal History

Projects in the Deformable Plates and Thermal History theme are targeted at building a best-in-class model for the timing, amounts, and distribution of crustal stretching for offshore Nova Scotia and potentially for its northern Moroccan conjugate margin and neighbouring margins to the north and south. As well, projects in this category would look to constrain and unravel the relationship of crustal stretching with the thermal evolution of the overlying basin sediments (in terms of a basal upper mantle thermal boundary condition), the role of radiogenic-derived heat, and other factors. The purpose of improving crustal stretching models is because these models provide a key basic input for subsequent models of oceanic infiltration, maturation of organic-rich sediments, and other petroleum system elements.

Specific projects encouraged under this theme include (but are not limited to):

(1) A classification of crustal architecture in terms of Mesozoic rift-related stretching versus inherited Paleozoic geometry;

(2) An interpretation of links between the evolution of the winning deep water central Atlantic rift versus localized failed rift segments preserved in shelf and onshore settings; an examination of these links could extend to related basins in Newfoundland & Iberia to the north, northern Morocco as the conjugate margin, and southern Morocco and the eastern United States to the south;

(3) A tectonic, biostratigraphic, or other type of analysis to deduce the timing of restricted or open marine conditions offshore Nova Scotia and their relationship to oceanic connections formed between the central Atlantic and western Tethyan (or northern Atlantic) domains, or similarly, their relationships to oceanic connections forming between the central Atlantic and the Caribbean and South Atlantic domains.

(4) A sensitivity analysis for the thermal evolution of offshore Nova Scotia to test end-member models of crustal architecture and stretching histories against the thermal constraints provided from well-based maturation data.

2.3 Paleo-Oceans and Paleo-Climates

Projects in the Paleo-Oceans and Paleo-Climates theme are targeted at building best-in-class models for the timing and style of ocean circulation patterns and climatic boundary conditions in the central Atlantic primarily during its syn-rift and early post-rift evolution. The purpose of improving paleo-oceanic and paleo-climate models is to test end-member models of oceanic circulation with the observational database for source rock formation and preservation in the central Atlantic conjugate margins.

Specific projects encouraged under this theme include (but are not limited to):

(1) Testing the sensitivity of ocean circulation to the timing and style of Tethys-Atlantic and Atlantic-Pacific connections in the Jurassic and early Cretaceous periods.

(2) Producing favourability maps for source rock deposition based on predictions from ocean circulation modeling.

2.4 Paleo-Biogeography

Projects in the Paleo-Biogeography theme are targeted at building best-in-class databases that facilitate testing paleo-elevation and paleo-environment maps derived from tectonic and geomechanical considerations against the observational record of these same parameters that can be deduced from paleo-biogeographical sample analyses. As well, paleo-biogeographical studies could target the relative isolation and/or timing of mixing of different species from the Atlantic, Tethyan, and Pacific geographic domains.

Specific projects encouraged under this theme include (but are not limited to):

(1) Producing a sample-based paleo-elevation database and/or a paleo-environment databased based on a synthesis of existing (and possibly new) biogeographical analyses;

(2) A spatio-temporal analysis of biogeographic data to constrain the timing of oceanic connections between Atlantic, Tethyan, and Pacific domains.

2.5 Tectono-Sedimentary Evolution

Projects in the Tectono-Sedimentary Evolution theme are targeted at building best-in-class databases that constrain paleo-elevation, sediment supply, and sediment distribution networks for offshore Nova Scotia primarily. Projects in this theme could include classic source-to-sink studies, but also could include seismic interpretation and sediment-salt modeling to better understand the interaction between sedimentation rates and loads and induced salt motions.

Specific projects encourage under this theme include (but are not limited to):

(1) Source-to-sink studies for offshore Nova Scotia;

(2) Study of hinterland uplift using thermo-chronometry;

(3) Interactions between clastic sedimentation, faulting and salt tectonics via geological or geodynamic modeling.

2.6 Other

Projects in the Other theme target innovative proposals that do not otherwise fit in the categories above but could nonetheless be of interest. Possible examples of interesting projects under the other theme include (but are not limited to):

(1) Source-rock-from-seismic studies, depending on the ability of OERA to provide necessary access to pre-stack seismic data.

3.0 Inputs

In order to provide focused, innovative uplifts to the current state of analysis in offshore Nova Scotia, proposals are expected to leverage the existing knowledge base and to integrate the following inputs as supplied by OERA:

(1) any off-confidentiality well, seismic, potential-field, biostratigraphic, geochronological, or geochemical analyses submitted to the Canada-Nova Scotia Offshore Petroleum Board;

(2) any previous PFA-type study, report, related database, or interpreted data set (e.g., basin outlines, seismic picks, and so on) produced by the OERA, the Nova Scotia Department of Energy and Mines, or their collaborators that is available for use by dependent projects;

(3) results, once available, from the PaGeo1 paleogeographic update project targeted for completion by the Fall of 2020.

4.0 Outcomes

Required deliverables for the selected project(s) include:

1. Quarterly or bi-annual ***project updates or status presentations*** in PowerPoint form delivered via WebEx. This includes a final project status presentation delivered with the draft technical report.

2. **Bi-annual or annual Interim Reports**, preliminary model or other results and/or presentations that can be integrated with other ongoing projects and used by OERA and NSDEM to promote Nova Scotia's offshore exploration potential.

3. A ***draft Technical Report*** explaining inputs, methods, results, and conclusions for the completed project.

4. Upon receipt of comments following the final project status presentation, a ***final Technical Report*** incorporating the comments and explaining inputs, methods, results, and conclusions for the completed project.

5. ***Digital maps, databases, or models*** that encapsulate the specific original data, synthesized data sets, or resultant 2D or 3D interpretations arising for the completed project. It is necessary that projects provide the specific geological constraints produced in formats suitable for use in subsequent dependent-projects and for integration into an updated regional synthesis.

6. (Optional) Peer-reviewed papers produced as a result of successful projects are an optional outcome that, if proposed, would add value to a proposal, but are considered optional. Peer reviewed papers may require additional time for preparation beyond what is available for funding of PaGeo2 projects; deliverables 1-5 capture what would constitute successful delivery of a completed project to OERA for this RFP. All projects will be required to make results and conclusions available for OERA's further use and for sharing with the public. If proponents prefer that the initial form of public disclosure is in a peer-reviewed paper, this must be stated in the proposal along with a clear statement of when final results will be delivered to OERA.

5.0 Structure

5.1 Project Time Frame

Responses to this RFP are due August 28, 2020 and successful respondents will be notified by September 30, 2020 for start-up no later than January, 2021. This RFP targets proposals that can deliver **project completion over two years, by June 2023 at the latest**. If possible, projects should aim to begin by October, 2020.

5.2 Project Management, Coordination and Integration

Project management is a critical requirement of this RFP. All respondents are expected to demonstrate their project management capabilities to coordinate their team and integrate proposed work commitments. This must include how the respondent will manage in-house expertise, sub-contractors, partners and student researchers, and how the project manager will communicate with OERA.

Academic and other respondents should be aware that OERA expects a high degree of project management professionalism to ensure that that milestone commitments are met, communication is timely and projects are delivered on time and on budget. This is particularly important since all funded research projects will ideally be integrated into an IODP application.

5.3 Ownership, Use and Distribution

The OERA intends to publish the technical reports and accompanying digital products in the public domain upon completion of this project. Certain interim reports, presentations or other deliverables may be made public in whole or in part before project completion, if warranted. Respondents should be aware that interim or preliminary project results may used to promote the longer-term project objectives and Nova Scotia's hydrocarbon prospectivity. Ownership and rights attached to these products must allow for these uses. Interim and final work products including model results, data, analyses and reports must be delivered in a format that can be integrated with other work so that it can be presented by OERA and NSDEM to industry.

Respondents will be expected to deliver interim and final results on specified deliverable dates before publication. If project proponents intend to publish key project results in the peer-reviewed literature, OERA will negotiate with proponents on the timelines and locations for the public release of reports and digital products in order to ensure an optimal order, priority, and location of publication. Ideally, peer-reviewed publications would be at the journal acceptance stage by December 2022, although longer timelines might

be accommodated under compelling circumstances. If this means main project results need to be completed several months prior, this should be targeted in proposed project timelines and milestones.

5.4 Project Initiation

Upon project initiation:

1. A start-up face-to-face or web meeting will take place between the OERA and the successful Respondents;

2. OERA-held data sets and model inputs will be confirmed and supplied to the Respondent by OERA. 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 to the Respondent.

5.5 Pricing Expectations

1. A total budget of approximately $850,000 has been allocated to the PaGeo2 program. OERA will consider projects at all price points but is generally interested in projects the require funding between $75,000 and $250,000 each.

2. The RFP is open to private sector and academic respondents. Although in-kind contributions will not be considered and should not be included in any proposal, OERA recognizes that academic respondents may be able to leverage additional cash funding through various granting agencies. If applicable, these additional funds should be clearly delineated in the proposal, along with a description of when the funds would be secured, and the effect on the project scope and outcomes should the anticipated extra funding not be secured. Guaranteed or secured leveraged funding from academic respondents will be considered an asset when evaluating the proposals. Unsecured leverage funding will also be considered but at considerably lessor value.

3. This funding is open to Canadian and non-Canadian entities as well as project teams consisting of Canadian and non-Canadian partners. The presence of Canadian expertise will be considered an asset when evaluating the proposals but is not a requirement for submission. Approximately one half of the funding will be Canadian-weighted while one half will be unweighted with respect to Canadian content.

4. Costs must be quoted in Canadian dollars. Payments will be made in Canadian dollars.

5. Please provide a task-cost breakdown or equivalent method of budget description, along with the total project cost. Please provide time estimates per task (days or weeks) as well as an estimate of total project duration.

6. Fixed cost bids are requested however some post-proposal discussions may be required to fix the final scope of work. Given this, final costs may not be identical to those presented in the proposal. The Respondent should endeavour to provide a full fixed cost and clearly identify any items that remain cost-uncertain.

6.0 Information Requirements

Respondents are requested to:

1. Describe required project inputs, task and project objectives, anticipated methods, and project deliverables as well as any other outcomes that may result. Describe how the proposed work will contribute to the IODP application. Respondents must describe a basic timeline with milestones. Maximum 20 pages excluding appendices.

2. Where project funds will be used to employ graduate or post-doctoral staff for the duration of the project, respondents should describe briefly the type of assistant research positions that will be advertised and when they will be filled.

3. Include a description of the Respondent's company or research team and their relevant experience with similar projects. Respondents must describe the team structure and how it will be managed.

4. **An electronic submission is sufficient; no hard copies are required**. 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/r-rf7f33a02c264c01a no later than **4:00 p.m. ADT, August 28, 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

5. OERA will require up to four weeks to review the responses (to end September, 2020). During this time, OERA and/or NSDEM staff may contact the Respondents directly for additional detail regarding project approaches.

6. OERA reserves the decision to proceed or not to the contracting stage.

7.0 Questions and Clarifications

The OERA will accept written questions from interested respondents until Friday, August 14, 2020. A Q&A page will be available on the OERA website: https://oera.ca/opportunities/request-proposals/rfp-paleogeography-petroleum-systems-research-innovations-offshore. The names and organizations of those submitting questions will remain anonymous; only the question and OERA response will be posted. **Respondents are requested to check the Q&A page for updated information and/or clarifications that may help in completing their proposal.** Please do not telephone with questions or contact NSDEM with enquiries.

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

8.0 Proposal Evaluation

This project will be administered through the OERA. As shown below, proposals will be quantitatively evaluated against a set of criteria by representatives from the NSDEM and OERA then further discussed to select the preferred project(s).

Factor	Weight
Experience and Knowledge: Qualifications, experience and capabilities of the company or institution and delivery team; demonstration of local and international knowledge relevant to this study.	25%
Project Plan, Timelines and Methodology: Proponent has outlined a clear and effective work plan leading to concrete and timely outcomes. Proposal describes the objectives, methodology, schedule and deliverables, and a sound approach in undertaking this project. Communication format and frequency between the Respondent and OERA are clearly described. Team member contributions are described and project management abilities are clearly demonstrated. Project uncertainties are acknowledged and likely effects are identified	35%

Cost: The project will offer very good value for the proposed budget. The budget is clear, complete and well described.	30%
Proposal Presentation Includes all RFP requirements, demonstrates attention to clarity, grammar, presentation, comprehensibility, etc.	10%
Total	100%