



Energy & Geoscience Institute

AT THE UNIVERSITY OF UTAH



## In Development

# Source Rocks of the North & Central American Basins An ArcGIS Atlas

### Principal Investigator:

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Research Professor

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### Investment per Sponsor

\$40k (USD) non CA members

\$32k (USD) CA members

### Duration

18 months

Project I 01411

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### VALUE

- By better understanding the source rock characteristics of sedimentary basins in North & Central Americas based on a user-friendly database, explorationists can mitigate the risk of charge potential and hydrocarbon generation as part of the overall petroleum system.
- A quick assessment tool for conventional and unconventional play analysis based on source rocks and for assessing data-poor and/or by-passed plays based on basin-scale correlatable source rocks.

### KEY DELIVERABLES

- An ArcGIS database of source rocks of North & Central American basins (USA, Canada, Mexico and Cuba and certain relevant countries) including basinal, stratigraphic, sedimentological, and geochemical attributes (e.g. TOC, Ro, kerogen type, pyrolysis, HC type, etc.) compiled from EGI's proprietary data archive, DSDP-ODP sites as well as from other technical publications.
- ArcGIS maps highlighting distribution of source rocks in space and through geologic history.

## PROJECT RATIONALE & SIGNIFICANCE

North and Central Americas contain world-class petroleum provinces and have historically been prominent producers of oil and gas. USA alone is a pivotal market for oil and gas globally.

An appraisal of organic-rich and thermally mature sedimentary rocks lies at the base of the petroleum system analysis for both conventional (migrated) and unconventional (self-sourced) hydrocarbon plays. A quantitative knowledge of the distribution of source rocks in space and through time has important implications not only for the inventory of rich source-rock formations but also evaluating the geologic conditions favorable for source-rock sweet-spots and the generation of oil and gas in a basin.

The present study aims to assemble and digitize geospatial, geologic, and geochemical data on source-rock formations of various basins in North and Central Americas in a user-friendly and query searchable ArcGIS platform enhanced with geological, geophysical, and paleofacies maps.

EGL, with its 46 years of research work in various basins and regions around the world, holds an impressive archive of >850 reports plus thousands of non-EGL reports and papers. The main objective of this study is to assemble and standardize a source-rock database primarily from EGL sources supplemented by newer, public sources.

The significance of this project is summarized in the following key points:

- (1) The geospatial and temporal distribution of source rocks analyzed statistically, stratigraphically and spatially in this database has practical implications for the risk/success evaluation of petroleum basins and identifying frontier or bypassed plays.
- (2) Sponsoring companies can augment their internal database on source rocks with the EGL database provided for in this project.

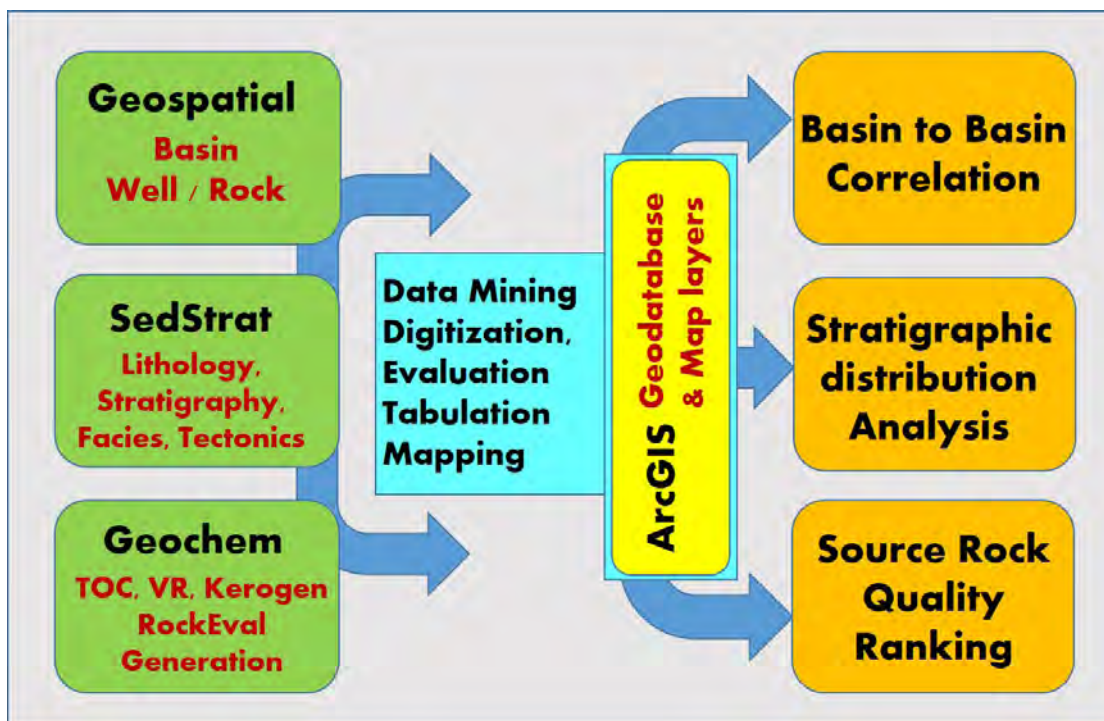


Figure 1. Workflow and uses of the geodatabase on source rock formations constructed in this proposed study. The source-rock data for the North & Central American basins (onshore and offshore) include geospatial, basinal, stratigraphic, sedimentological, and geochemical information (as available in our sources and archives).

## RESEARCH TASKS & KEY DELIVERABLES

The geographic coverage of the project is North & Central American basins in the USA, Canada, Mexico, Cuba, and certain other countries as needed by the sponsoring companies.

The Report will consist of the following:

- (1) Geodatabase of source rock formations (samples from wells and some outcrops) including geospatial, geologic (stratigraphy, lithology, formation name and depositional environment), and geochemical data (TOC, R<sub>0</sub>, pyrolysis, kerogen type, and source rock quality description – whatever is available in our sources). The geodatabase comes from source rock formation of >20,000 wells (and some outcrops). The data are standardized in a scheme so that it can be searchable and can augmented by the sponsoring companies for their own use.
- (2) Rock formation data (stratigraphy, lithology, mineralogy and geochemistry) from DSDP-ODP deepwater wells surrounding the North & Central American countries.
- (3) A summary of source rock formations will be provided in an individual file for each basin.
- (4) Integrated stratigraphic charts across basins for correlation of rock formations
- (5) Distribution maps of source rock formations through stratigraphic periods (21 time horizons from the Ediacarran through the Pliocene)
- (6) Paleofacies maps (for various stratigraphic horizons) from selected regions in Gondwana margins as available in EGI reports and archive.
- (7) Essential geologic and geophysical maps to better constrain the source rock data (including outcrop geology, gravity, aeromag, heat-flow data, etc.).
- (8) Bibliographic references for the source-rock data will be documented for wells and basins.

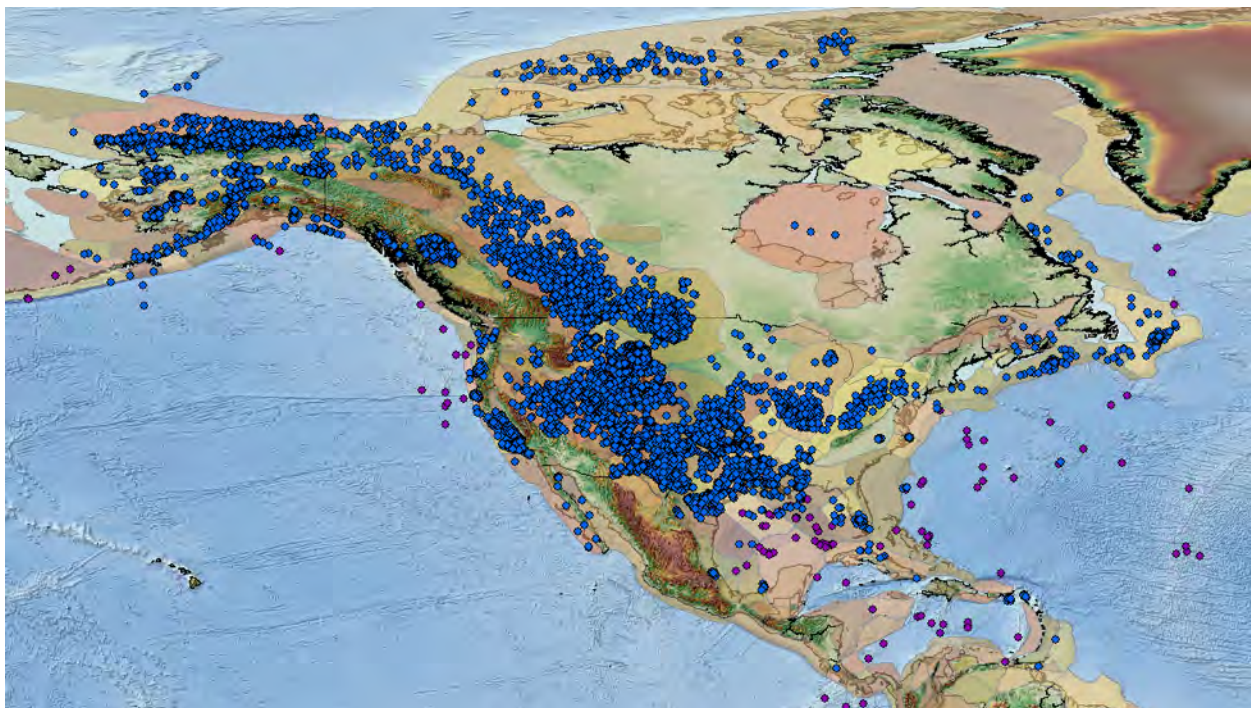


Figure 2. Sedimentary basins of the North and Central America and the location of wells onshore and offshore covered in this study.



Figure 3. EIA map showing the major shale plays in the USA, Canada and Mexico.

## RESEARCH STAFF

Dr. Rasoul Sorkhabi, Research Professor at the University of Utah’s Energy & Geoscience Institute, will act as Principal Investigator for the work. Scientists, students and technical staff from EGI will participate in the Project depending on the areas of expertise as necessary for this Project.

## PROJECT TIMELINE, INVESTMENT & REPORT

The project will be conducted Q3-2018 through Q4-2019. The first version of the ArcGIS database will be delivered to the sponsoring companies within 3 months of joining the consortium. The study will incorporate new data, and updated versions of the database will be delivered to the sponsoring companies periodically in the course of this project.

The investment per sponsor for this study and database is \$42,000 (USD) for the entire project (not annually).

## EGI TECHNICAL CONTACT

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## EGI SPONSORSHIP & CONTRACT INFORMATION

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# Rasoul Sorkhabi, PhD

## RESEARCH PROFESSOR

Rasoul joined EGI as a Research Professor in 2003. Prior to EGI, he worked for Japan National Oil Corporation and Arizona State University. Rasoul holds B.Sc. and M.Sc. degrees in geology from India and a Ph.D. in geology from Japan. A native of Iran, he has lived most of his life in the United States, Japan, and India, and is multi-lingual. Rasoul is a member of AAPG, AGU, GSA, EAGE, etc. He has served as a contributing editor for *GeoExPro* and *Earth*, is a member of editorial board for *Journal of Earth Systems Science*, a member of AAPG History of Petroleum Geology Committee, a member of the GSA Academic & Applied Geoscience Relations Committee, and a member of the Advisory Board on Springer Publisher's Global Energy Program. Rasoul has published and presented hundreds of papers, is co-editor and co-author of *GSA Special Paper 328* (1999), *AAPG Memoir 85* (2005), *Tectonophysics Special Issue Volume 451* (2008), *Geological Excursions Around Miri, Sarawak* (2011), *GSA Special Paper 525* (2017) and *Geological Society London Special Publication 465* (2018).

### Professional Philosophy: Regional Geology & Basin Evolution

Rasoul believes that the need to understand geologic processes and records in their evolutionary contexts calls for a holistic approach to basin analysis. Towards this end, his research focuses on constructing regional databases, integrative tectonostratigraphic records, play fairway maps, and paleofacies maps through time. Moreover, he investigates the impact of basement tectonics and plate settings on the distribution or destruction of plays.

### Structures & Fluid Flow

An important application of structural investigation is to better understand fluid flows in rocks. Fault seals compartmentalize reservoirs, thus dismembering and localizing pools; leaking faults are risk factors in exploration. Fractures play critical roles in fluid flow on basin to prospect scales, and the significance for very low-permeability rocks is amplified in view of a major industry shift toward unconventional resources.

### Back to the Source

After conducting a large number of regional geology projects, Rasoul is currently Principal Investigator for EGI's new research initiative "Source Rocks Consortium: Source Rocks in Space & through Time." This is essentially motivated by the recent convergence of conventional and unconventional hydrocarbon resources at the source-rock level and the question of why rich source rocks are located where they are in time and space.

### Global Experience

Rasoul has over two decades of academic and industry experience, and has worked on projects in various parts of the world, from the fold-and-thrust belts through Tethys and Gondwana to deepwater toe-thrusts. Focus regions include: Asia and the Middle East, Africa, and North America.

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### Research Interests

- Regional Geology
- Tectonics & Structural Geology
- Petroleum Systems & Plays
- Trap and Seal Analysis
- Geochronology & Thermochronology
- Well Logging & Formation Evaluation

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