Engaging a Tribal College in the Assessment of Oil and Gas Resources on a Sioux Indian Reservation

Geological Society of America
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Objective: assess hydrocarbon potential in Niobrara Formation on the Rosebud Reservation in south central South Dakota.

Vision: Use research and evaluation of fossil energy resources to provide STEM education to American Indian students, and introduce oil and gas as a possible career option.

Approach: analyze geological samples from public sources
- USGS core library in Lakewood, Colorado, and regional rock outcrops
- Fresh samples from South Dakota DENR (SDGS) core near Presho, SD
- Geologic assessment and computer modeling to determine resource potential, gas in place (GIP) and estimated ultimate recovery (EUR).

Sponsored/supported by the following organizations:
- American Indian Higher Education Consortium (AIHEC)
- American Indian Science and Engineering Society (AISES)
- DOE American Indian Research and Education Initiative (AIREI)*
- DOE National Energy Technology Laboratory (NETL)

* Cooperative Agreement DE-ED0000129
Program Participants

Cooperative education program between Sinte Gleska University and the South Dakota School of Mines & Technology with technical assistance from DOE National Energy Technology Laboratory and South Dakota Geological Survey
Niobrara study area in South Dakota

Niobrara Formation


Niobrara Fm., Slim Butte Area, Oglala Lakota County, SD

80-90 Ma

Aquifer

43° 4'40.30"N, 102°55'28.48"W; Photo by Dan Soeder
Sampling and Characterization

NETL intern Isabella Cross Najafi and SDSM&T geology professor Foster Sawyer at Niobrara/Pierre contact along the Missouri River, near Chamberlain, SD.

< SDSM&T geology graduate student Kelsey Marzolf at USGS Core Library

Outcrop: Elm Creek, SD: 43°34'0.62"N, 99°18'44.10"W; photos by D. Soeder:
Total Organic Carbon

Results vary considerably within the section

- **DOE T714** 992.0 ft
- **DOE T714** 976.0 ft
- **DOE T713** 1259.6 ft
- **DOE T713** 1213.1 ft
- **DOE T713** 941.0 ft
- **DOE T712** 1104.9 ft
- **DOE T712** 906.3 ft
- **DOE T712** 848.5 ft
- **DOE B331** 1010.7 ft
- **DOE B331** 1005.5 ft
- **DOE B331** 1002.5 ft
- **DOE B329** 1128.5 ft
- **DOE B329** 1092.5 ft
- **DOE B329** 1084.3 ft
- **DOE Niobrara slim**
RockEval Pyrolysis results

Hydrogen index (HI) indicates predominantly Type II marine (sapropelic) kerogen

T-max indicates low thermal maturity

Assessment suggests hydrocarbon resources in Niobrara Formation at Rosebud Reservation are probably in immature, biogenic-wet gas zone.
Unique Aspects

• Tribal government supports this project for potential jobs, economic development, and affordable energy
  – Researchers agreed to work with tribal medicine men.
  – Researchers agreed to respect the spirits of the land and water.
  – Communications with the tribal government are through the tribal college.
  – Niobrara is only 1500 - 2000 ft. deep (450 - 600 m), low maturity
  – Drilling costs are less than with deeper targets

• The reservation is not near a natural gas transmission pipeline, so any produced gas would have to be used locally.
  – Options include heating buildings and greenhouses, generating electricity, fueling motor vehicles, etc.
  – Opportunity for utilization engineering research of stranded gas, which is an issue in many places without pipelines.

• Members of the tribe are deeply concerned about environmental degradation from energy development schemes.
  – Environmental monitoring must be part of any development plan on tribal land.
  – Dakota aquifer beneath the Niobrara is a major regional groundwater resource.
  – Opportunity for environmental geosciences research.
Black Hills Field Trip

Mikal Bordeux (SGU) and Taylor Long Crow (SGU); Foster Sawyer (SDSMT) and Subodh Singh (SGU)
Presho Coring

Presho, South Dakota
November 18, 2014
Temperature: 11 deg F
Wind speed: 40 mph

Photos by Dan Soeder and Foster Sawyer
Results to Date

- Rocks contain up to 6% total organic carbon.
- Thermal maturity is low; in “wet biogenic gas” window.
- Resource is probably significant enough to produce and use locally, but NOT significant enough to justify the cost of a pipeline connection.
- Two tribal students have been with the project long term, six others have participated intermittently.
- Three graduate students at SDSM&T did their MS thesis on this assessment.
- The environmental monitoring work appears to be engaging additional students at SGU and SDSM&T.
Next Steps at Rosebud

- Complete the resource assessment and present results to tribal government as a report from Sinte Gleska University
  - Recommend a demonstration well to assess delivery rates and volumes, and provide a better number for estimated ultimate recovery (EUR)
- Begin surface water monitoring program at Rosebud with SGU.
  - Baseline data needed for a year prior to gas well drilling.
  - Groundwater monitoring requires a defined gas well location (at SGU?)
- Utilization research for the gas needed prior to production
- Gas well requires planning and funding
Challenges

• How do we work with other tribal colleges on other reservations?
• Can resource assessments expand to include CO₂ storage, coal, geothermal, possibly others?
• How do we maintain continuity with both students and professors in tribal colleges?
  – Transient students/professors
  – Intermittent students
• How do we get students off the reservation to participate in oil and gas fieldtrips, scientific meetings, workshops, etc.? ($$)
• What can we do on the reservation?
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