



1 Nov 2015

*New Horizons O&G Conference field trip, Black Hills, SD, 2014*

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

Geological Society of America  
Baltimore, Maryland



the **ENERGY** lab

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# Project Overview

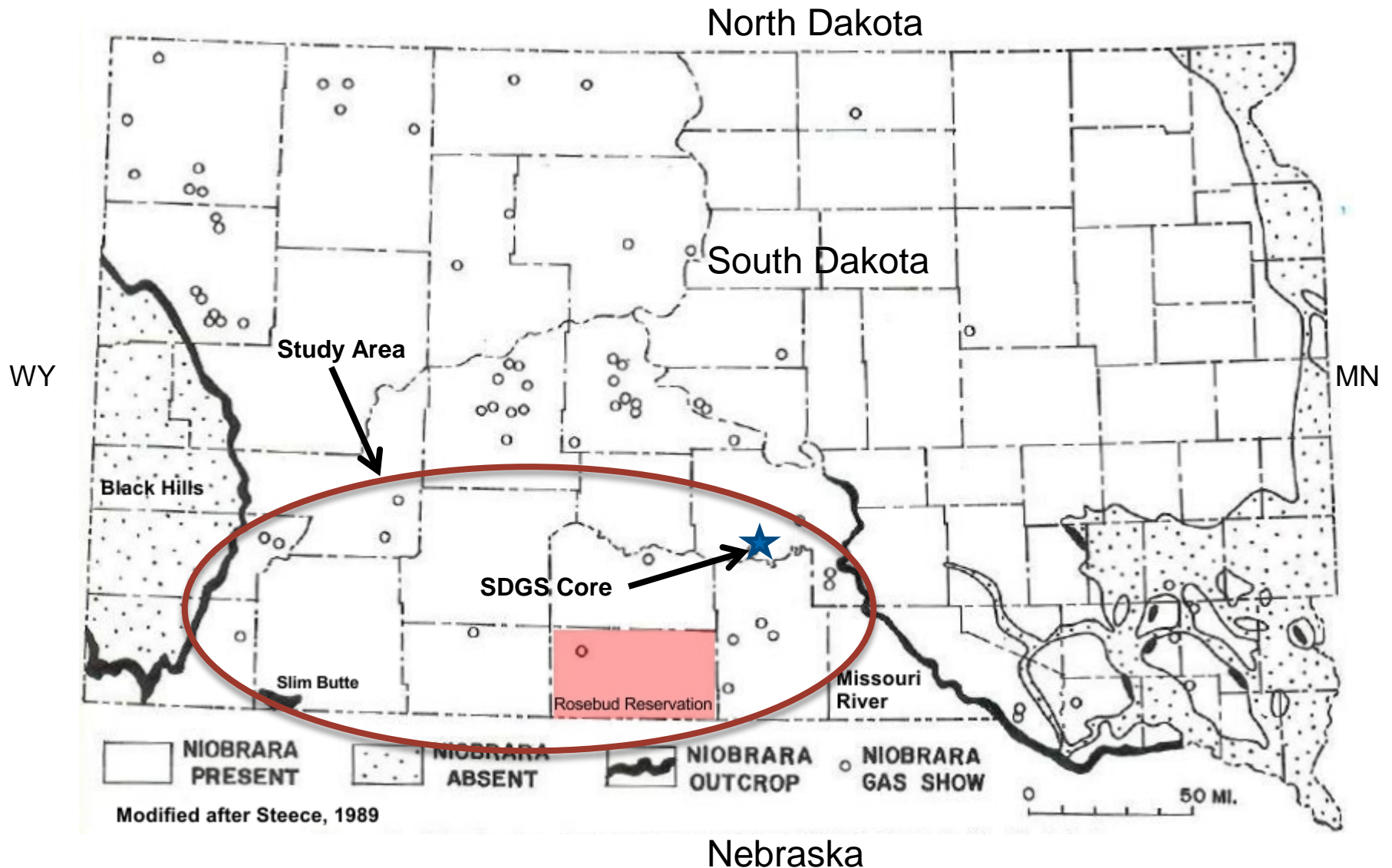
- **Objective:** assess hydrocarbon potential in Niobrara Formation on the Rosebud Reservation in south central South Dakota.
- **Vision:** Use research and evaluation of fossil energy resources to provide STEM education to American Indian students, and introduce oil and gas as a possible career option.
- **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)

# Program Participants

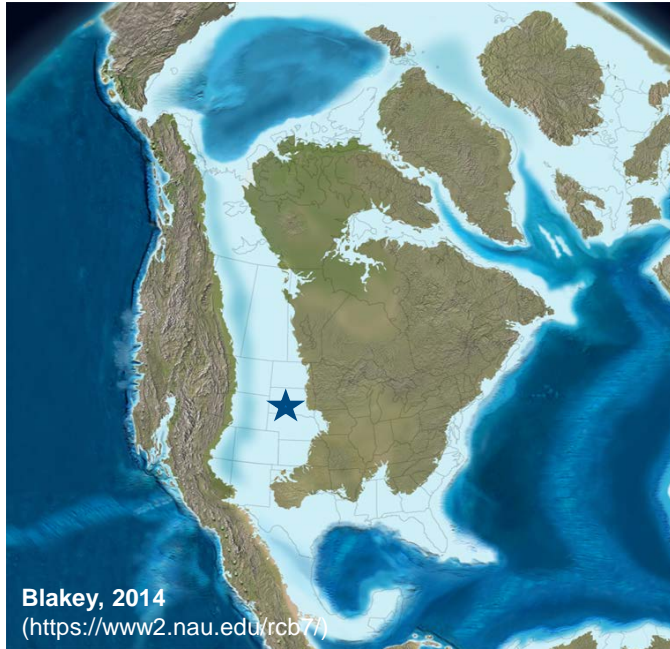


**Cooperative education program between Sinte Gleska University and the South Dakota School of Mines & Technology with technical assistance from DOE National Energy Technology Laboratory and South Dakota Geological Survey**

# Niobrara study area in South Dakota



# Niobrara Formation



Montana	Pierre Shale	Upper unnamed shale
		Kara Bentonitic
		Monument Hill Bentonitic
		Lower unnamed shale
		Red Bird Silty
		Mitten Black Shale
		Sharon Springs
Colorado	Niobrara	80-90 Ma
		Sage Breaks Shale
	Carlile Shale	Turner Sandy
		Pool Creek Shale
Graneros	Greenhorn Limestone	Aquifer
	Belle Fourche Shale	
	Mowry Shale	
	Newcastle Sandstone	
	Dakota Sandstone	
Inyan Kara	Skull Creek Shale	
	Fall River Sandstone	
	Lakota	Fusion Shale
		Chilson

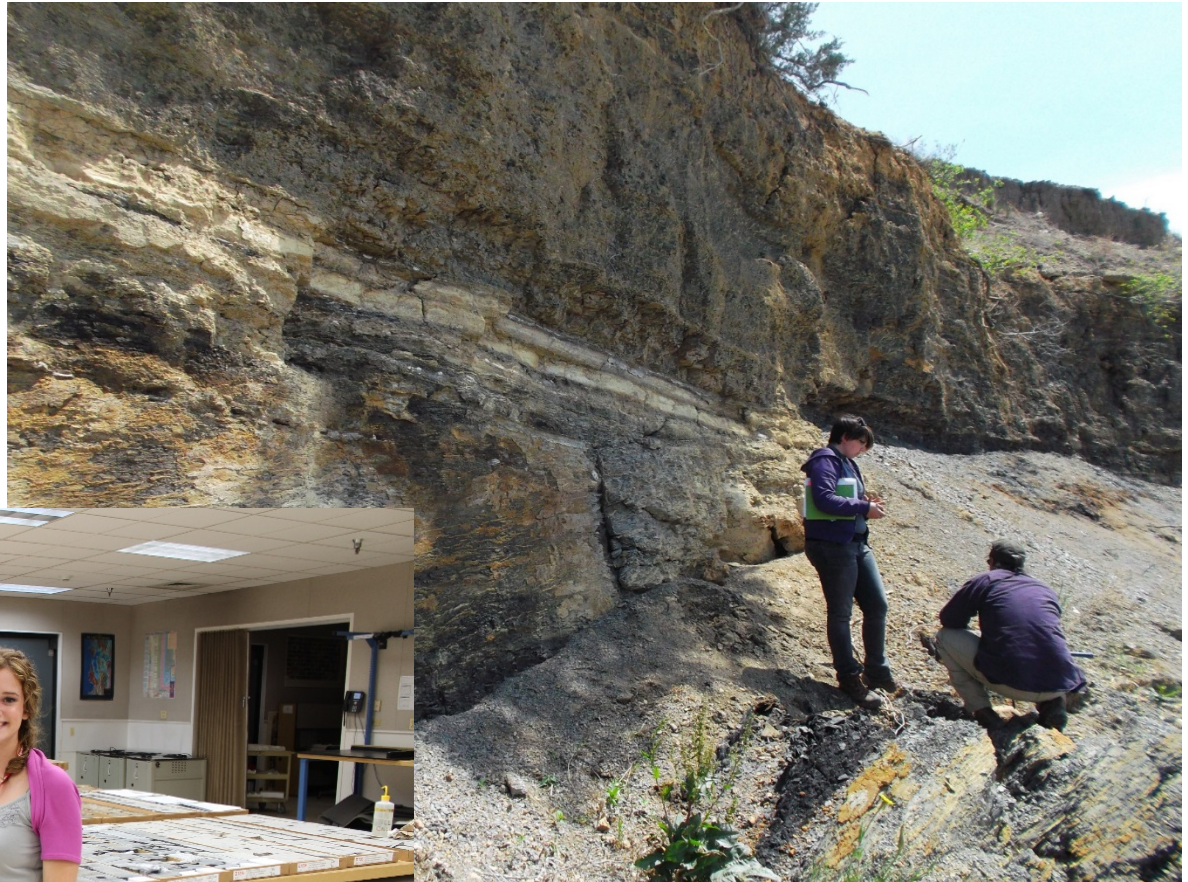


**Niobrara Fm., Slim Butte Area, Oglala Lakota County, SD**

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

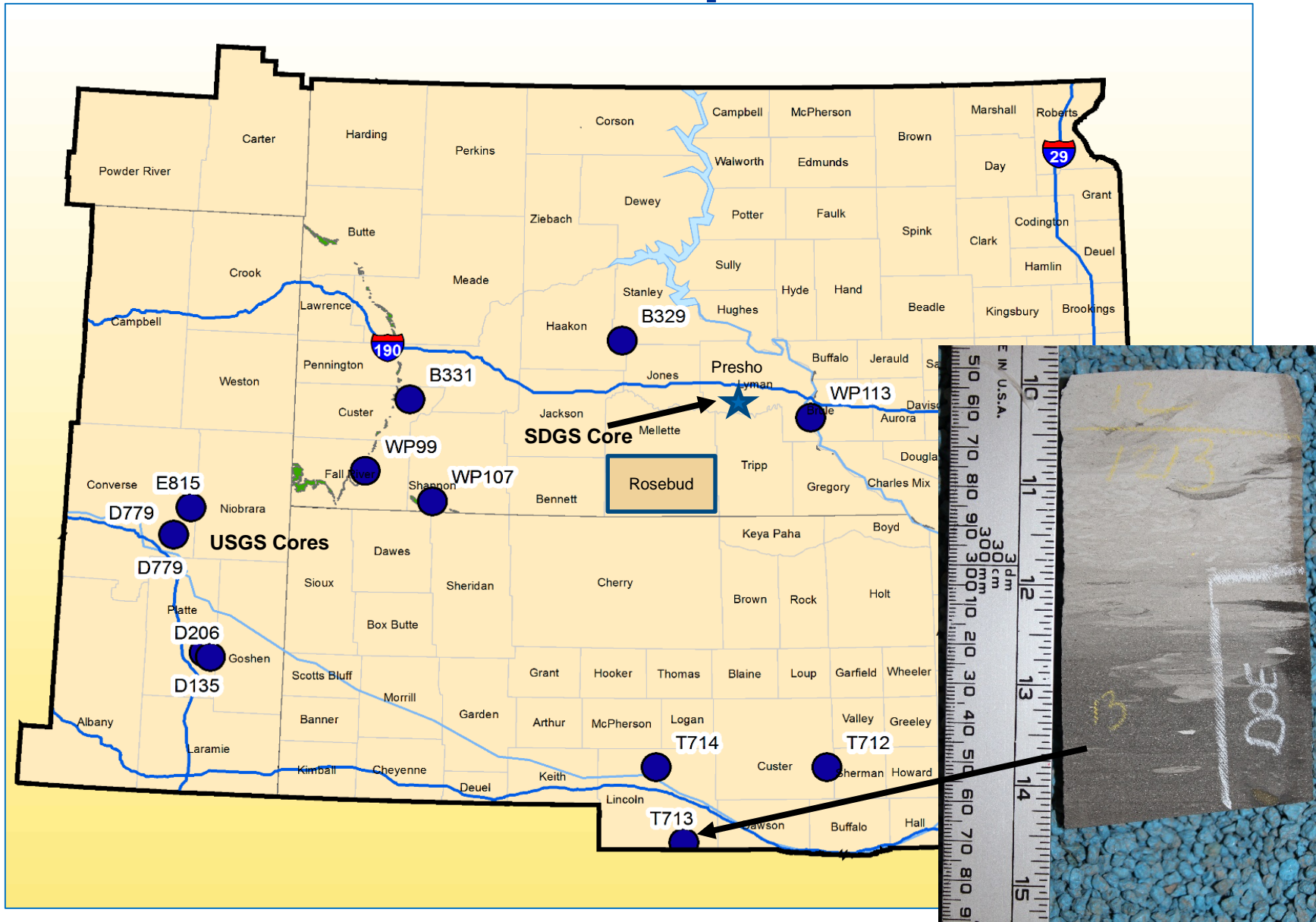
# Sampling and Characterization

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

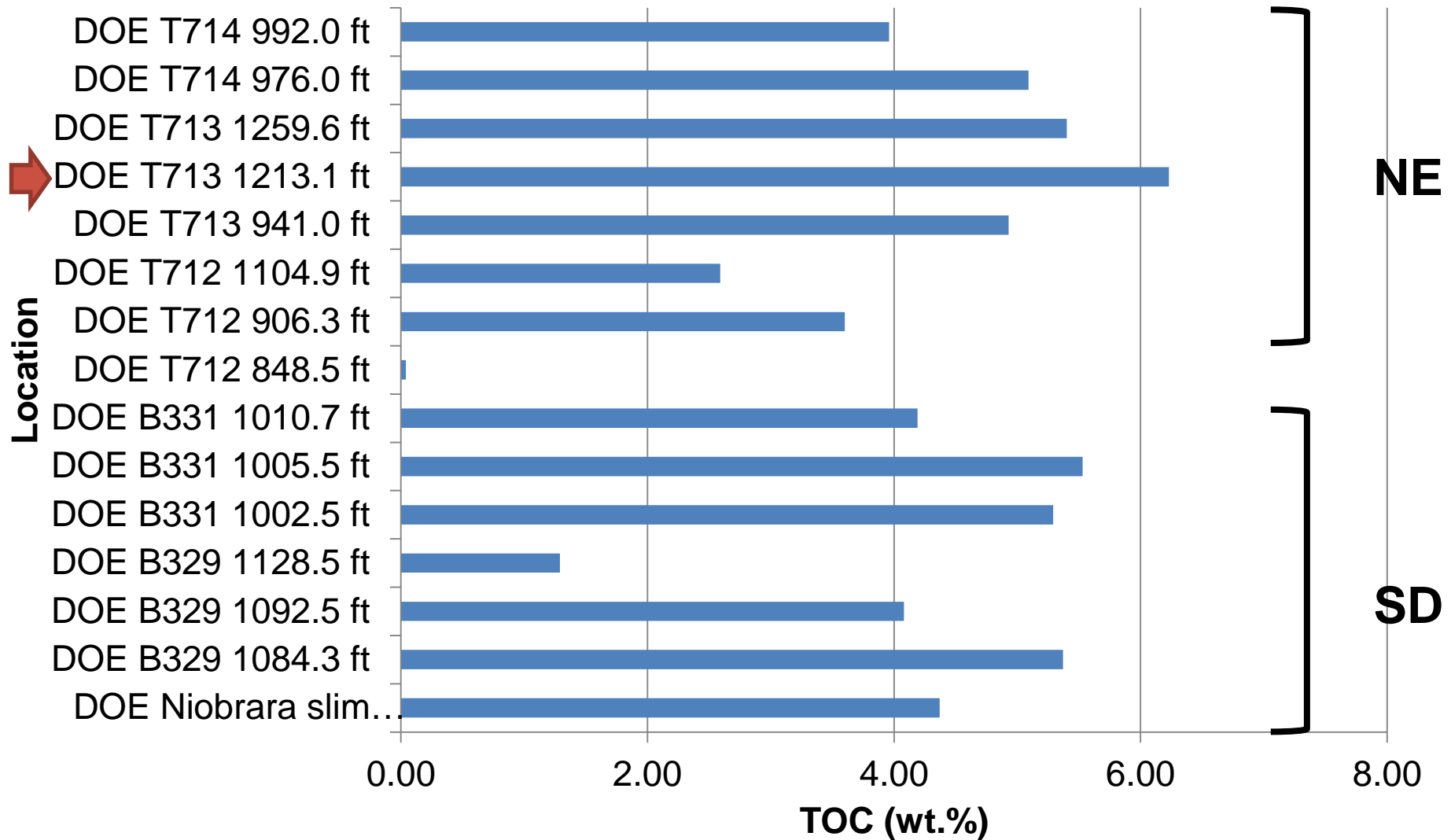


< SDSM&T geology graduate student Kelsey Marzolf at USGS Core Library

# Core and Outcrop Locations



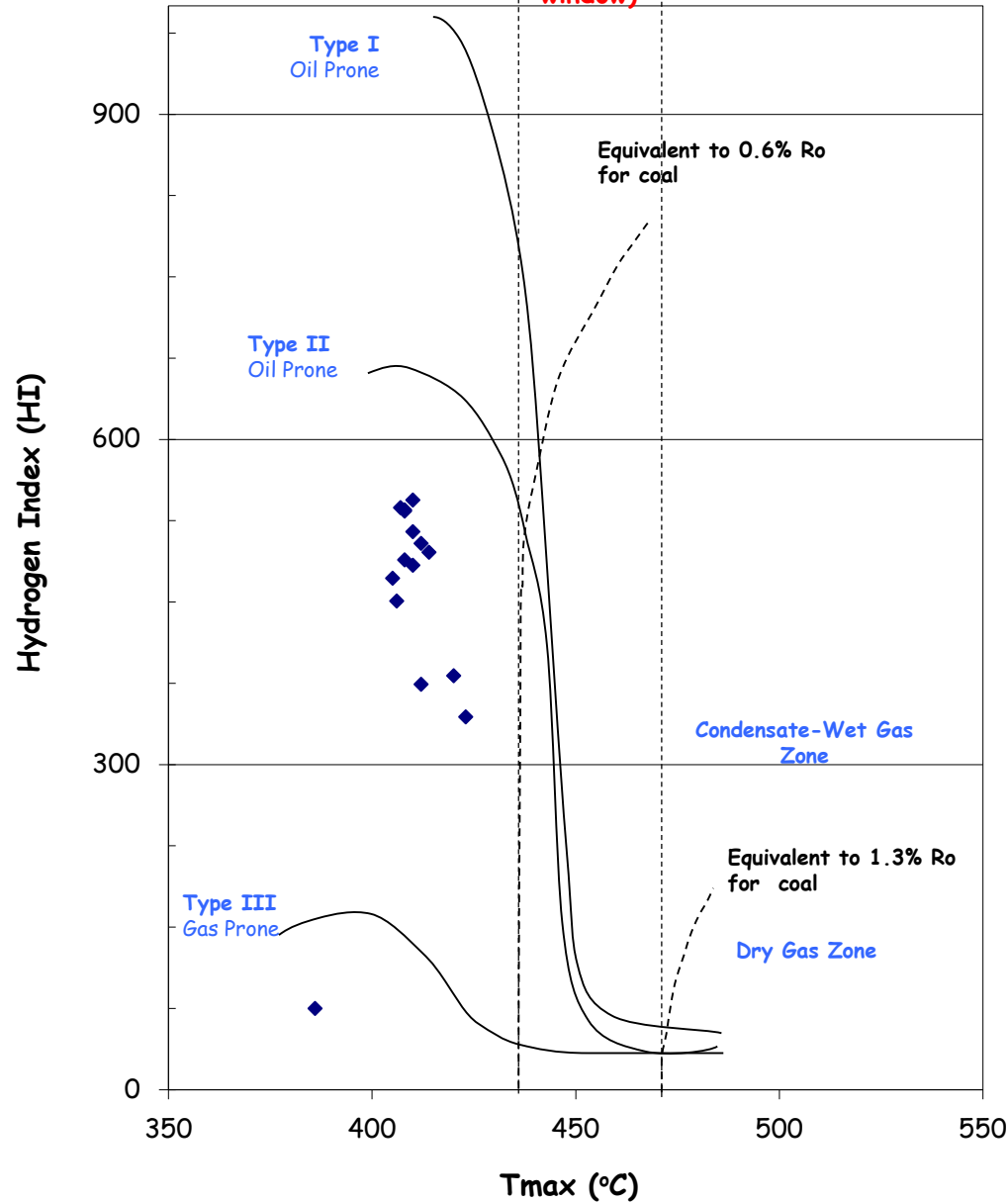
# Total Organic Carbon



Immature

Mature  
(Oil  
window)

Postmature



## RockEval Pyrolysis results

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

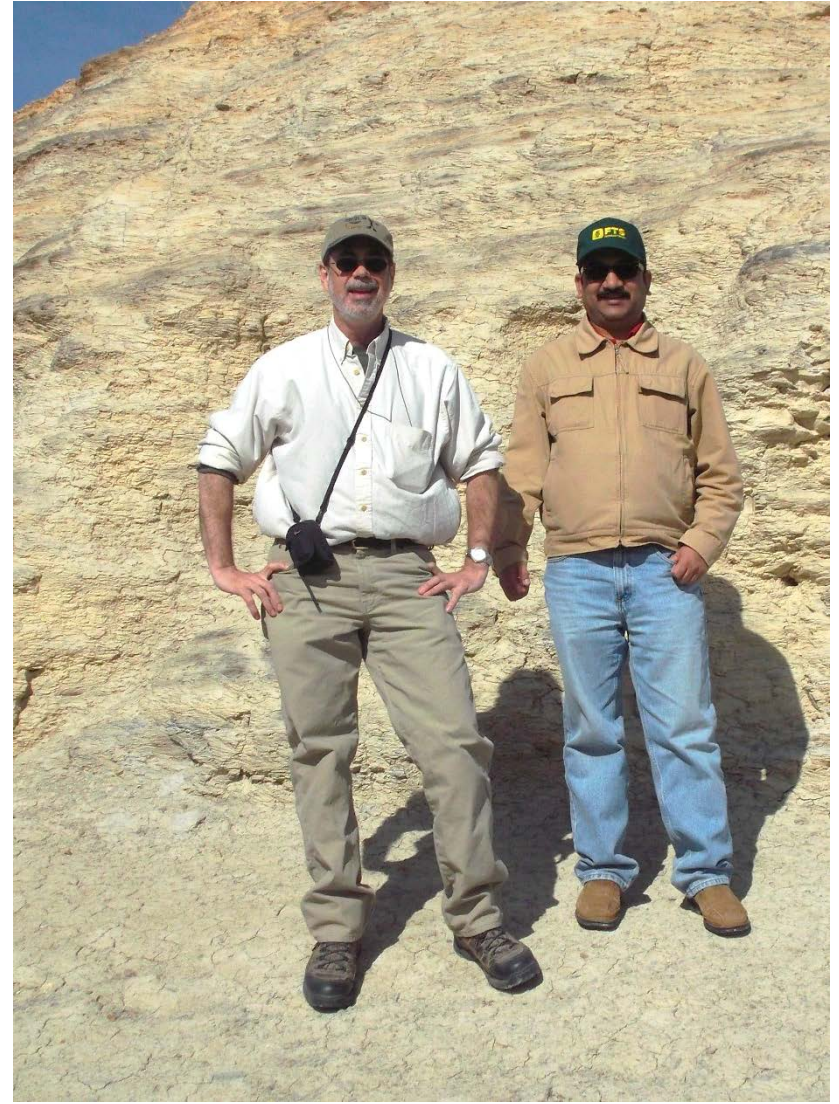
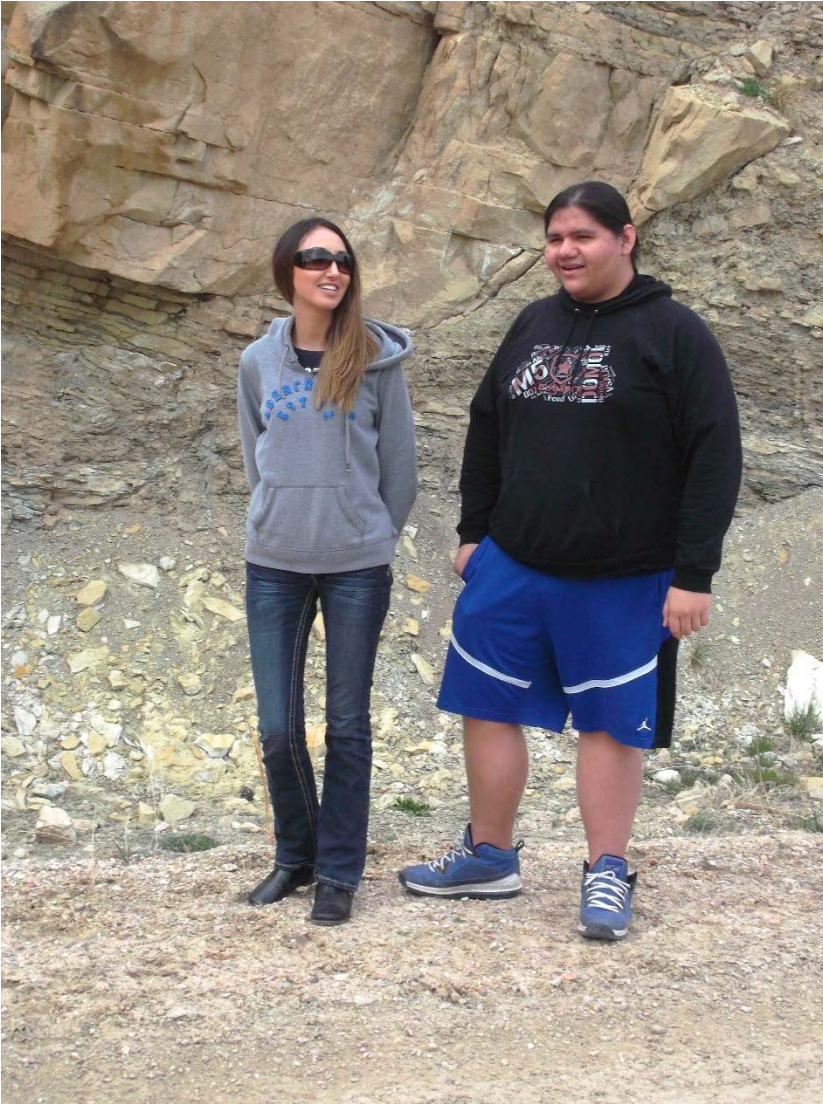
T-max indicates low thermal maturity

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.
  - Intention to start baseline surface water monitoring in 2016.
  - Dakota aquifer beneath the Niobrara is a major regional groundwater resource.
  - Opportunity for environmental geosciences research.

# Black Hills Field Trip



Mikal Bordeaux (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



# 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**



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