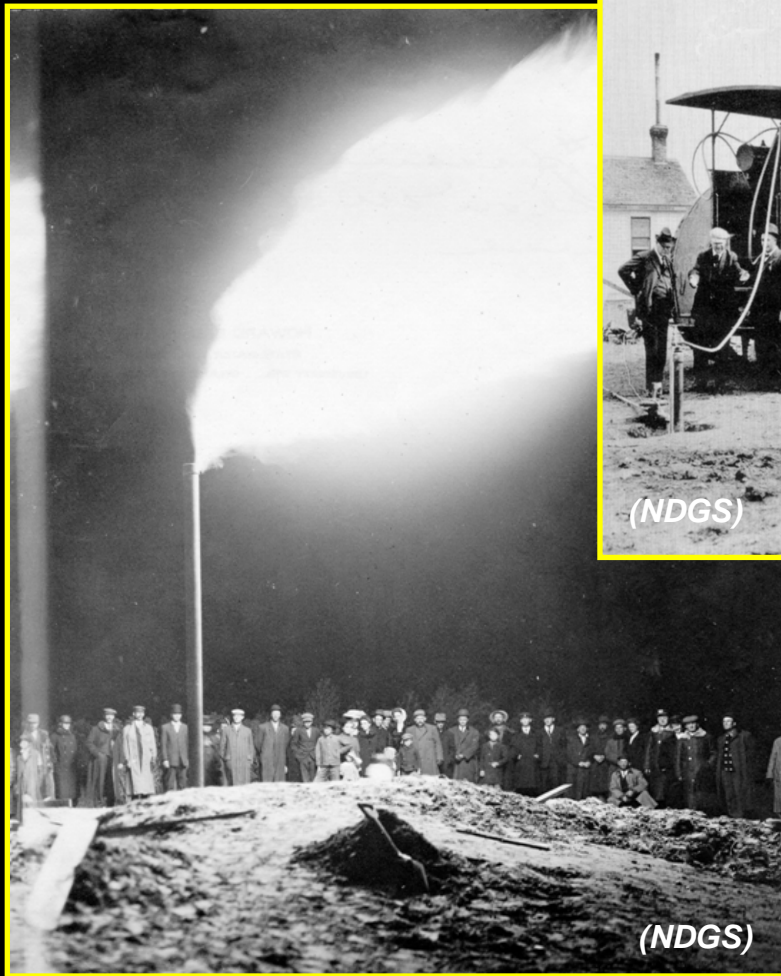


# Assessment of the Shallow Natural Gas Resource Potential of North Dakota

Fred J. Anderson

Geologist

NDGS



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of Mineral Resources

North Dakota Geological Survey  
Geological Investigations No. 32

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# Introduction to Shallow Gas in North Dakota

- Definition of Shallow Gas
- Historical Occurrence and Production
- Geological Factors of Occurrence
- Anthropogenic (Landfill) Gas
- Current Investigations
- Recent Investigative Highlights



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# A Definition of Shallow Gas in North Dakota

- *Natural gas that is generated and accumulates within the near surface geology of the state typically sourced and contained within permeable organic laden glacial sediments or within fractured shale reservoirs of Cretaceous age or combinations of each.*
- Gas Properties (Barry, 1908)
  - 886 BTU
  - 82.7 % Methane
  - 0.2 % Ethane
  - 12.4 % Nitrogen
  - 0.5 % Hydrogen
  - 1.2 % Carbon Monoxide (CO<sub>2</sub>?)



*Gas flare on the Mohall Dome in the early 1920's.*



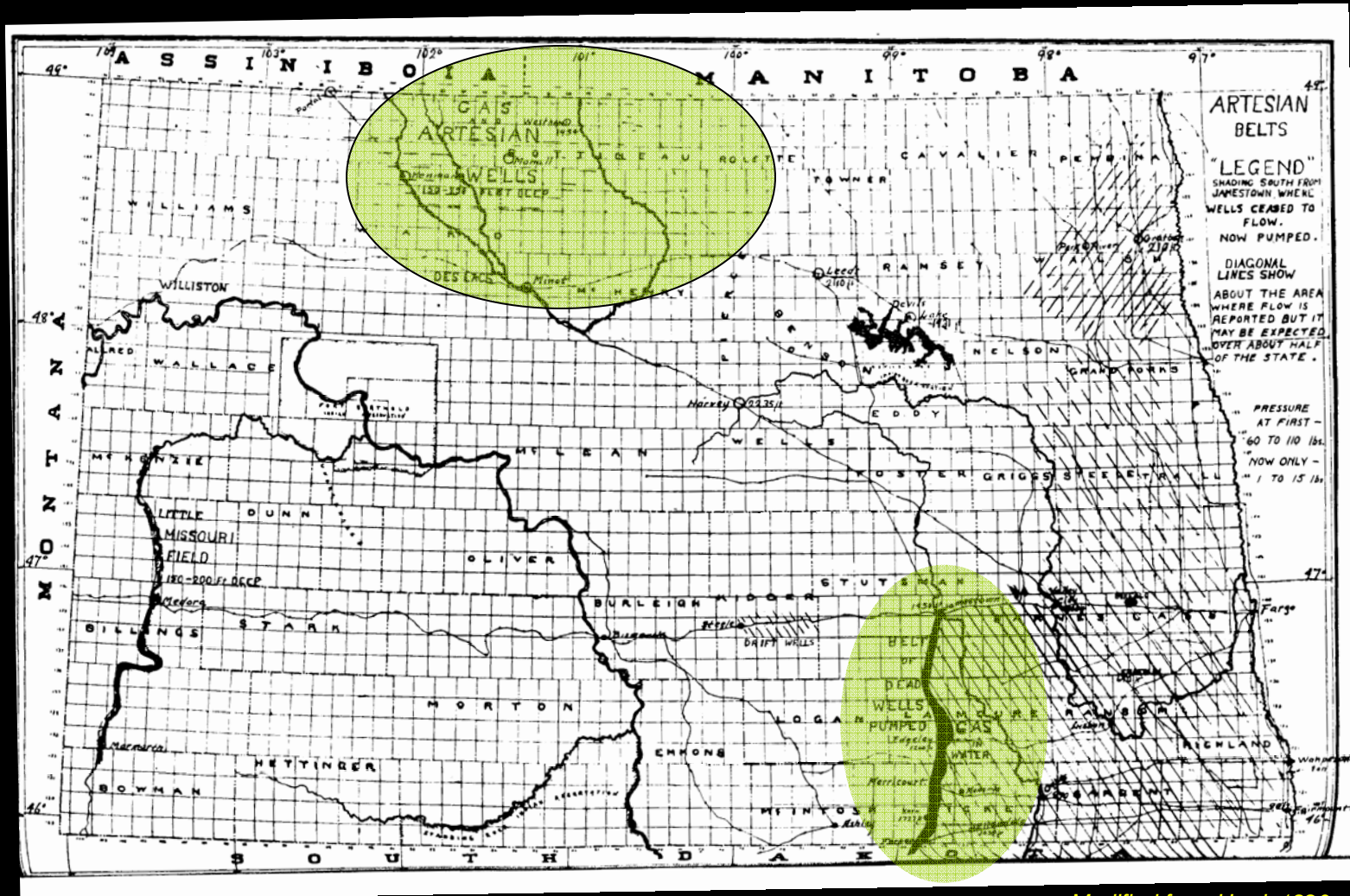
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# Areas of Historical Shallow Natural Gas Occurrence



Modified from Hard, 1920



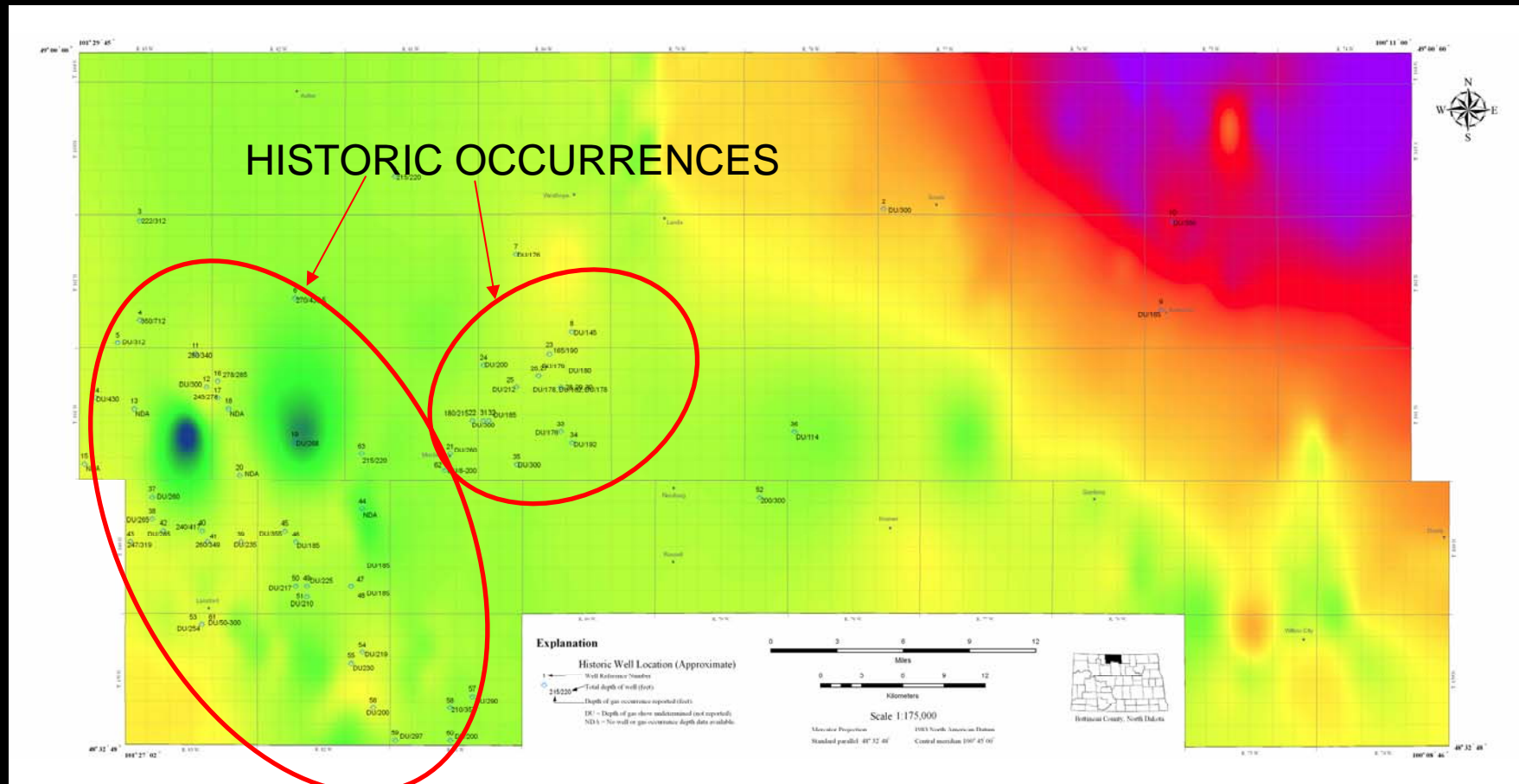
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# Bottineau County Historic Shallow Gas Occurrences



(Modified from Anderson, 2006)



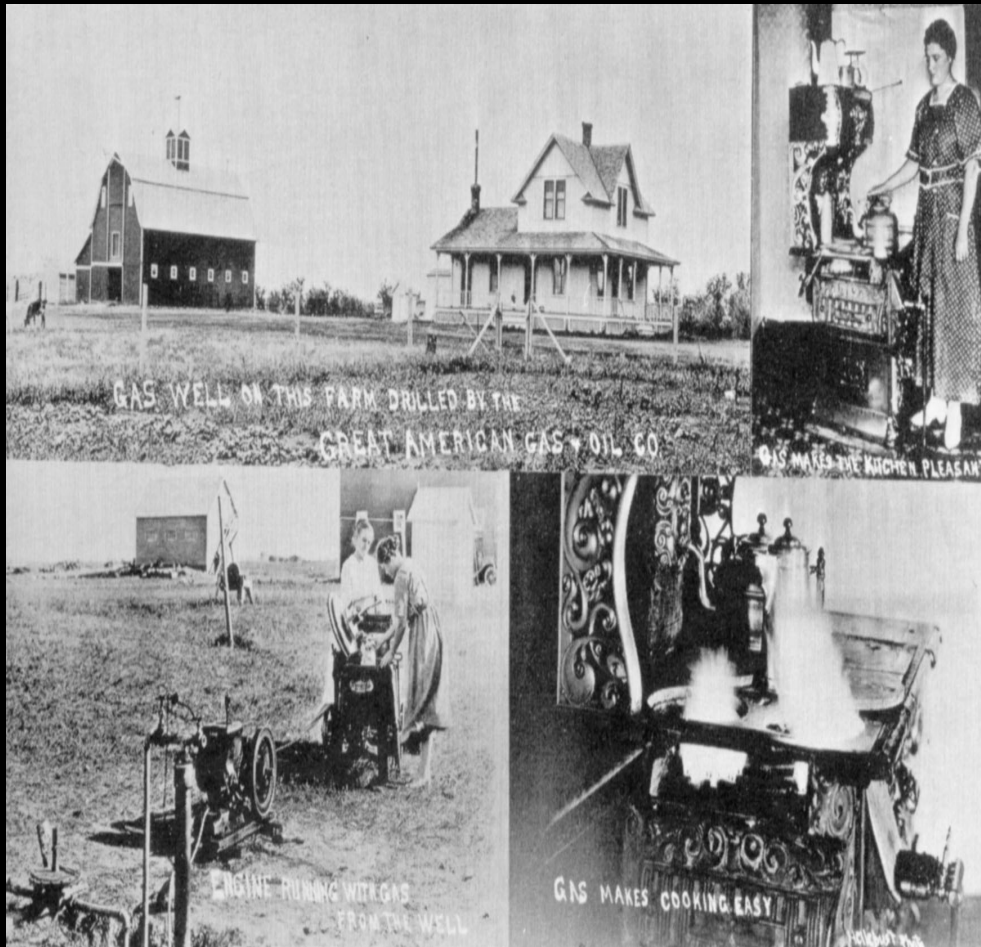
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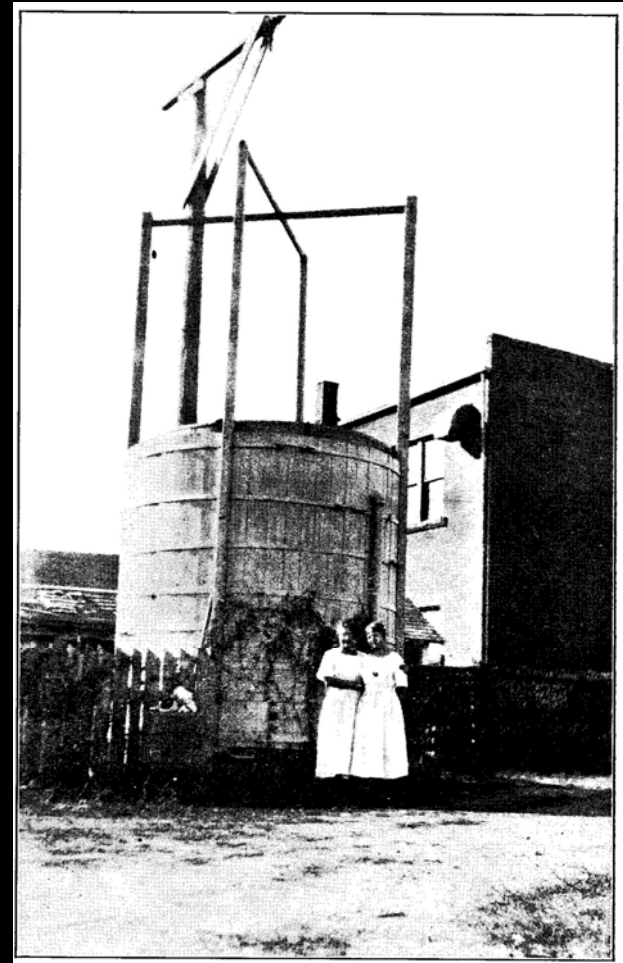
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# Historical Shallow Gas Use in North Dakota



*Examples of historic shallow natural gas use by North Dakotans likely near Mohall, in Renville Co. around 1919.*



*Gas storage tank at the Northern Hotel, Edgeley, LaMoure Co., around 1920*



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# Types of Gas Occurrence in North Dakota

- Thermogenic (Deep Gas)
  - Producing zones within the Williston Basin
- Biogenic (Shallow Gas)
  - Quaternary (Drift) Gas
  - Migrated Gas
    - (Fox Hills/Hell Creek)
  - Cretaceous Gas
    - (Pierre/Niobrara Shale)
- Anthropogenic (Landfills)
  - Fargo Municipal Landfill (Active)
  - Grand Forks (Potential)



Gas producing well in the Mohall, ND area around 1920



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# Shallow Gas Conceptual Models

- Shale Gas (Niobrara Eastern WB Flank)
- Quaternary (Drift Gas)
- Upper Cretaceous Shallow Bedrock



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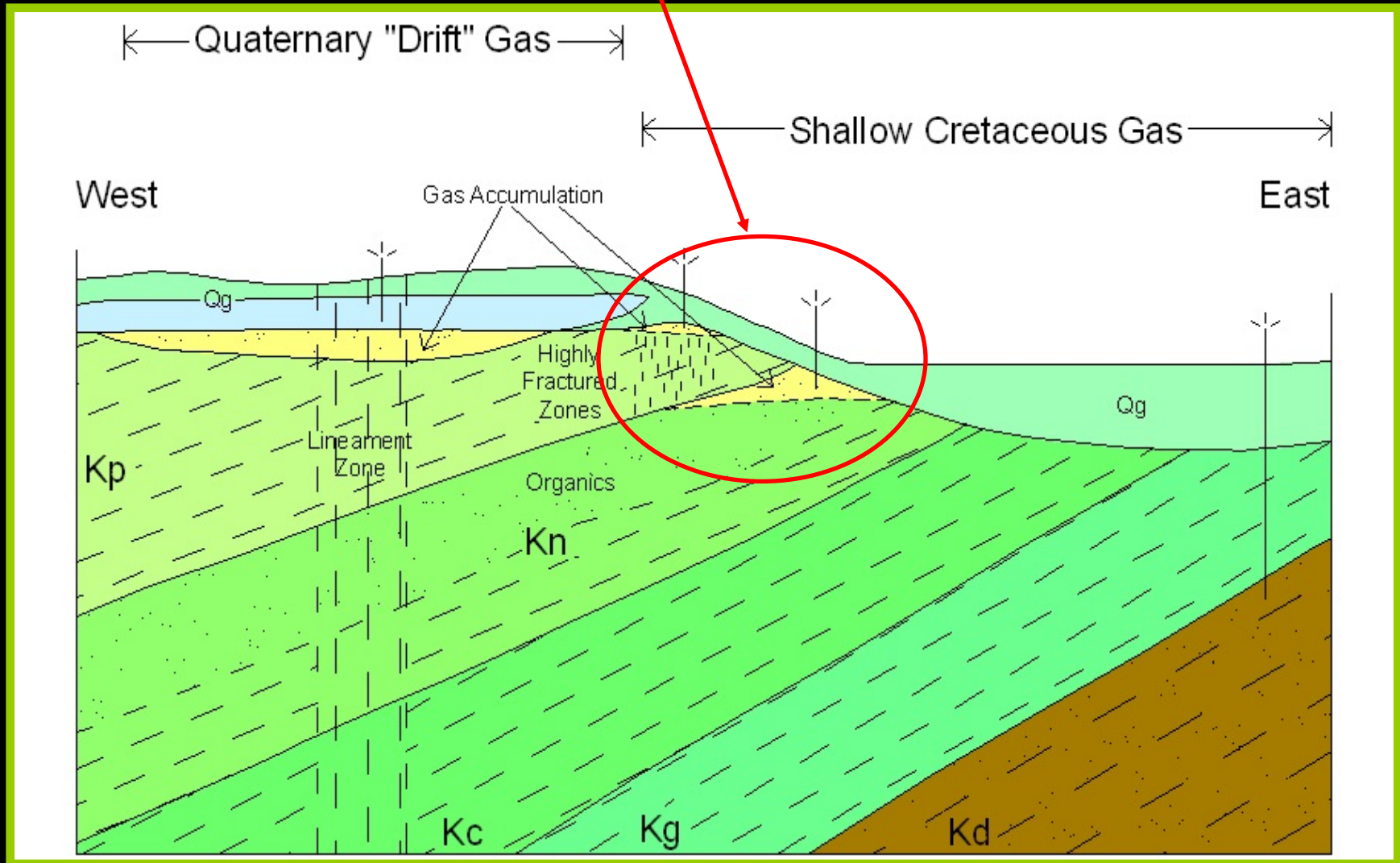
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# Potential Niobrara Gas



(Modified from Anderson, 2006)



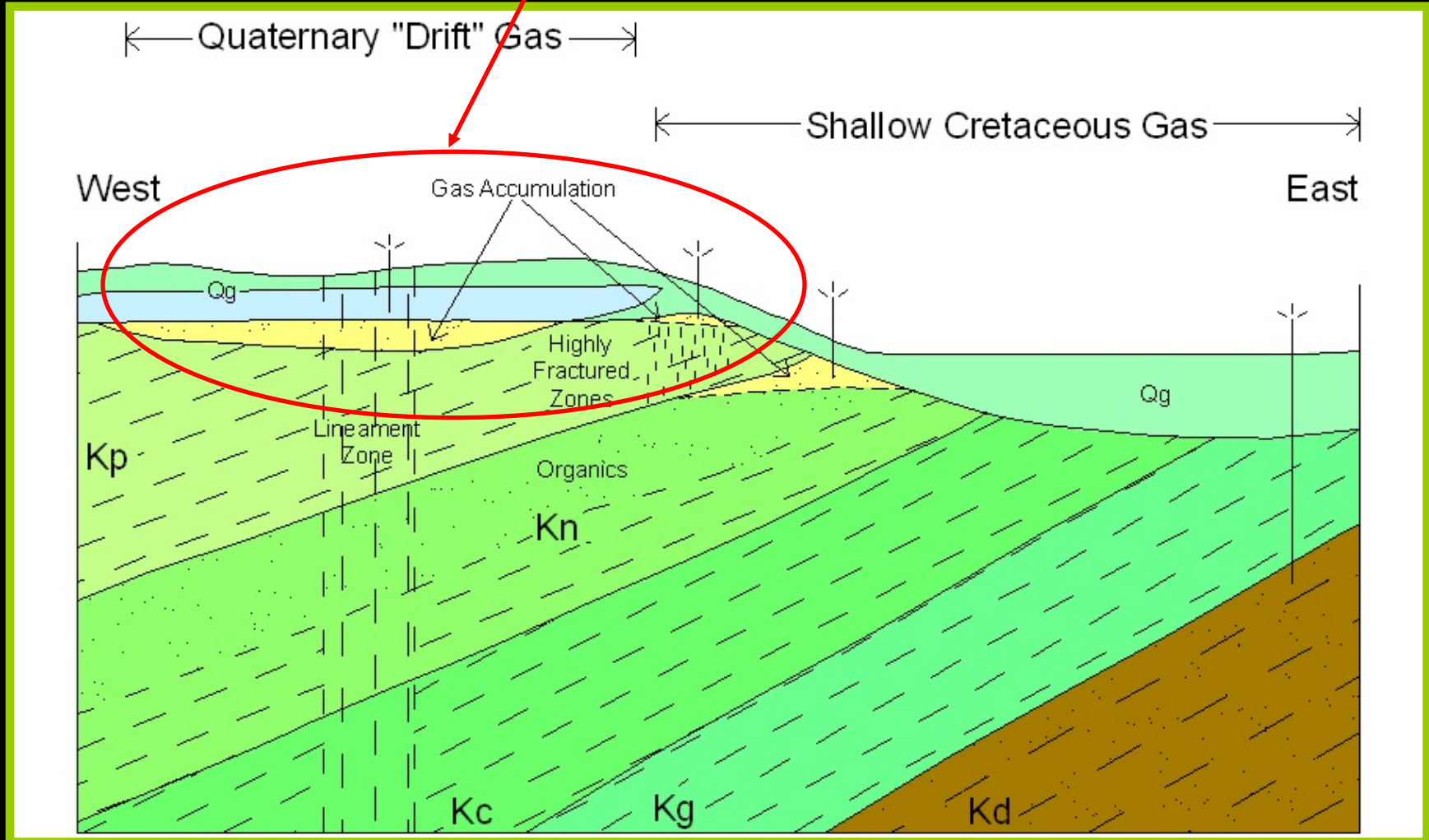
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# Quaternary "Drift Gas"



(Modified from Anderson, 2006)



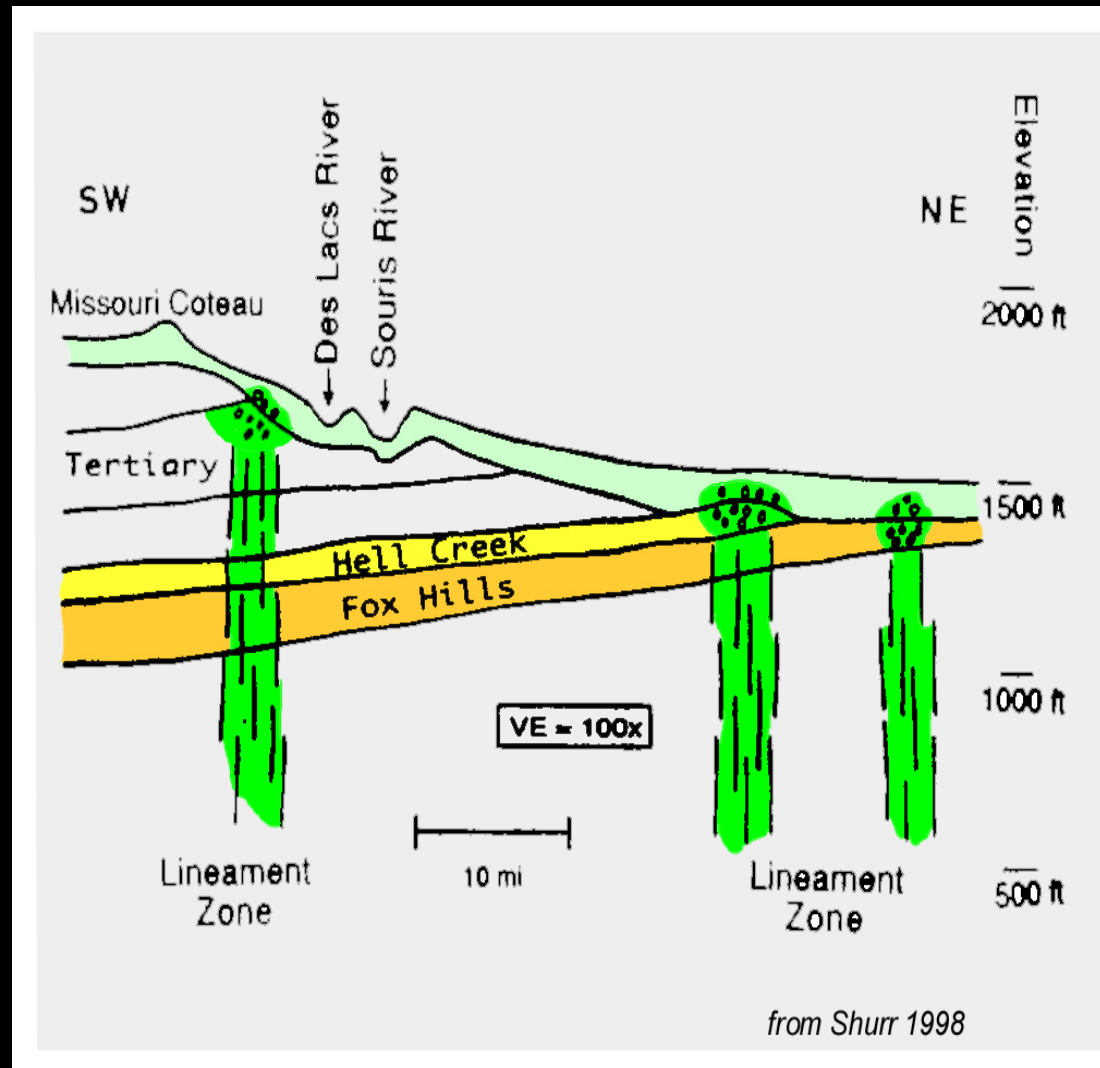
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# Upper Cretaceous Shallow Bedrock



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# Shallow Gas in Quaternary Deposits

- Playa Lake Setting in Northwest North Dakota
- Drift Gas in Pleistocene sediments in North Central North Dakota
- Influence of Glaciotectonic Ice-Thrusts
- Anthropogenic Methane (Landfill Gas)



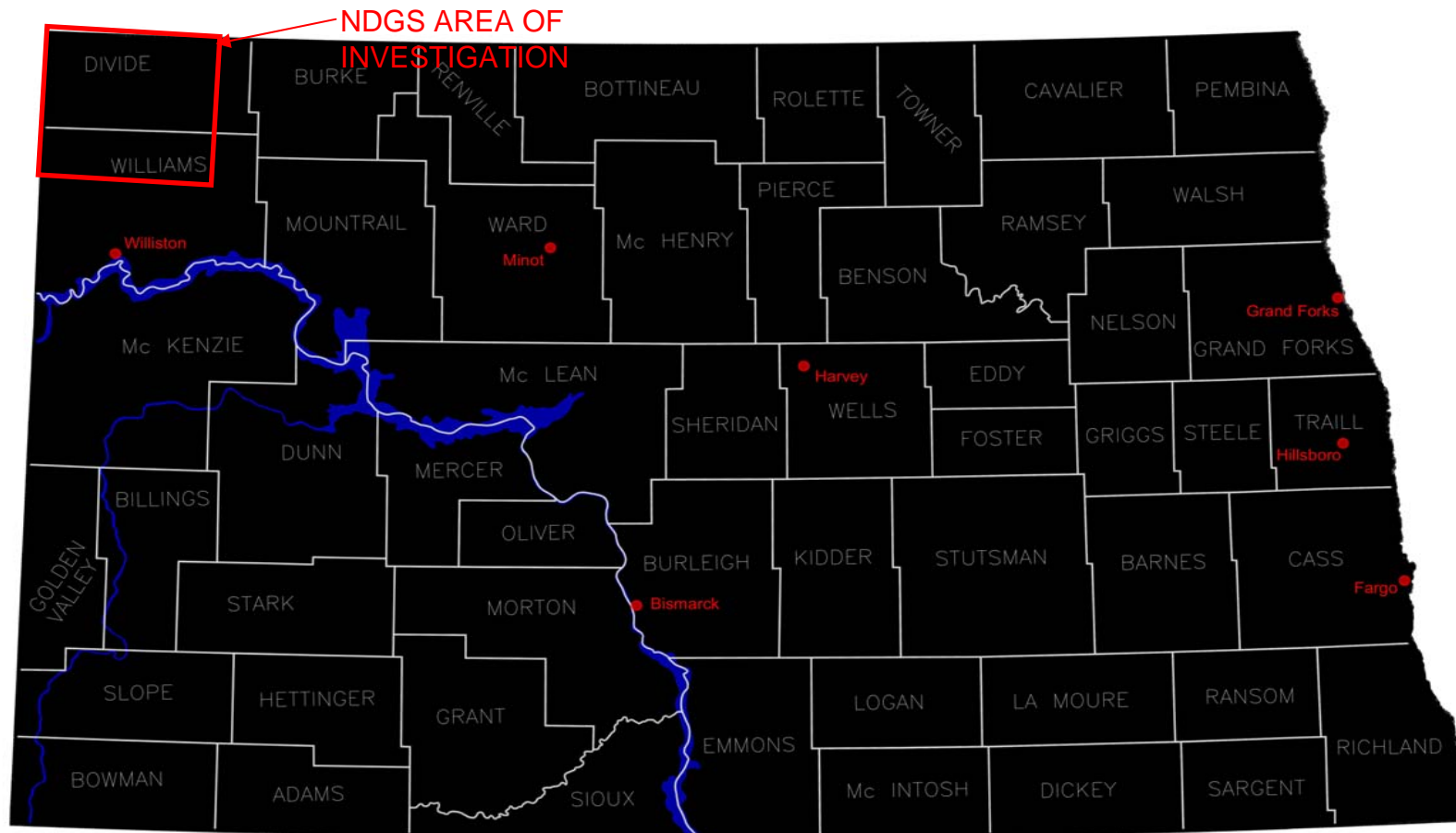
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# North Dakota Playa Lake Setting



(Modified from Anderson and Murphy, 2005)



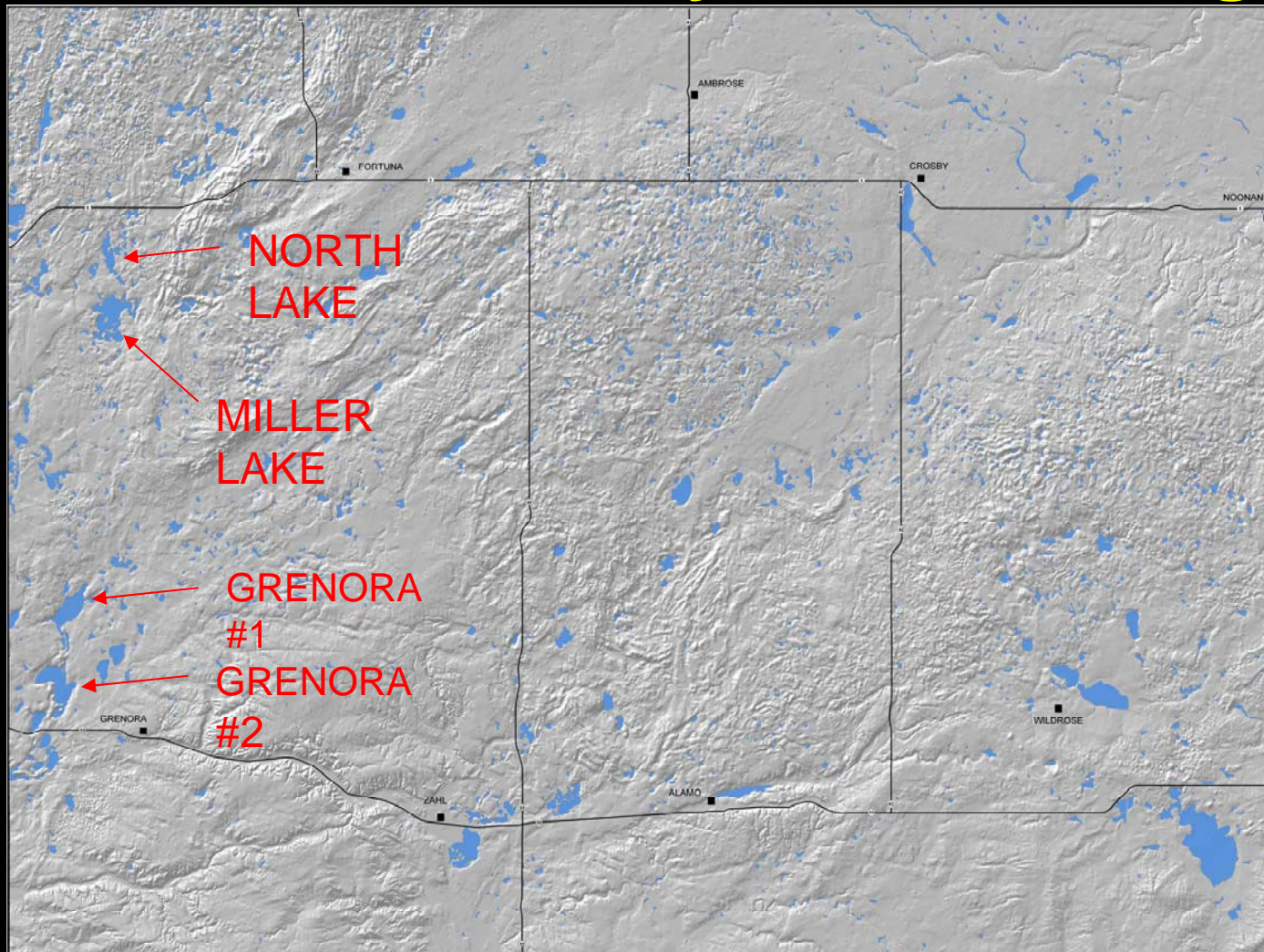
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# North Dakota Playa Lake Setting



*(Modified from Anderson and Murphy, 2005)*



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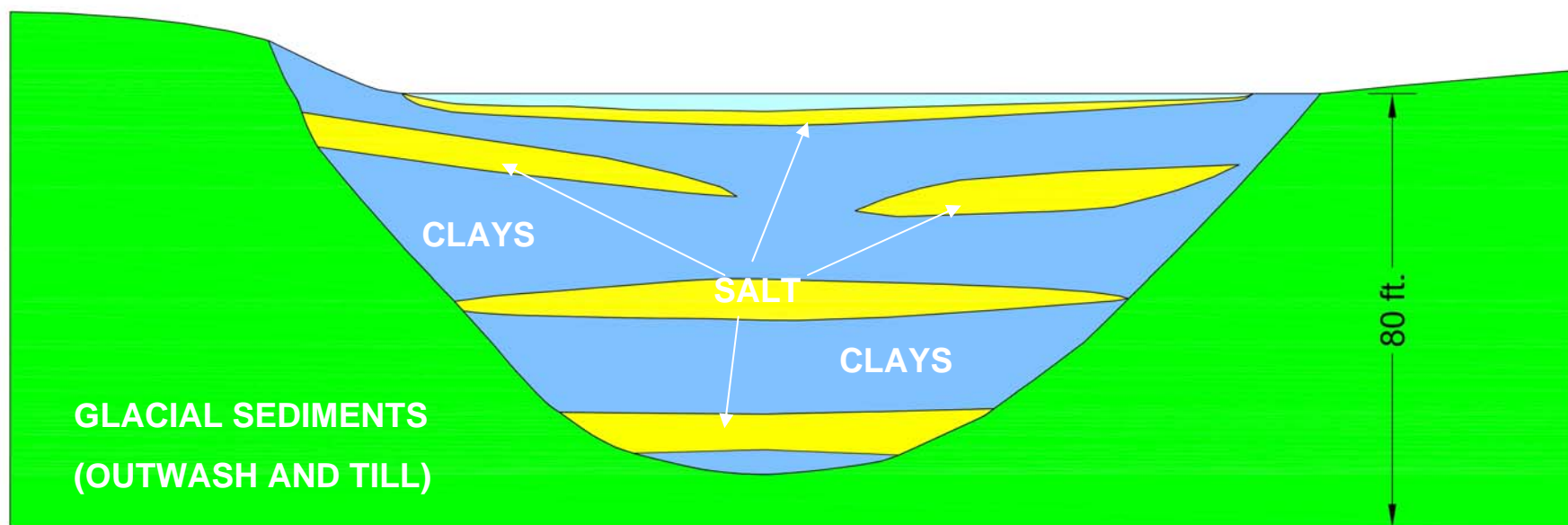
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# North Dakota Playa Lake Setting

Generalized Lacustrine Stratigraphy



*(Modified from Anderson and Murphy, 2005)*



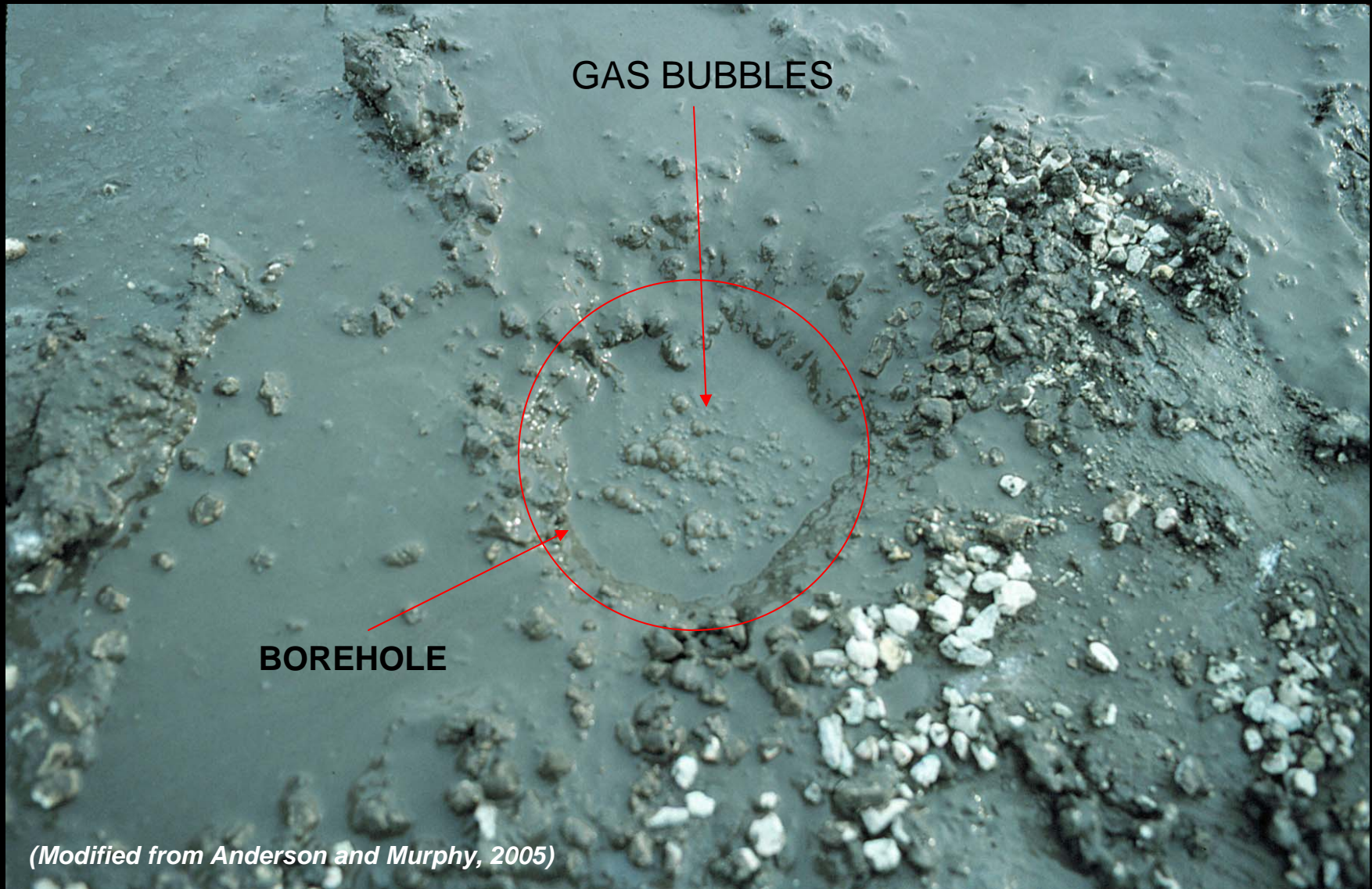
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## Borehole No. 2, Miller Lake, Divide County, ND



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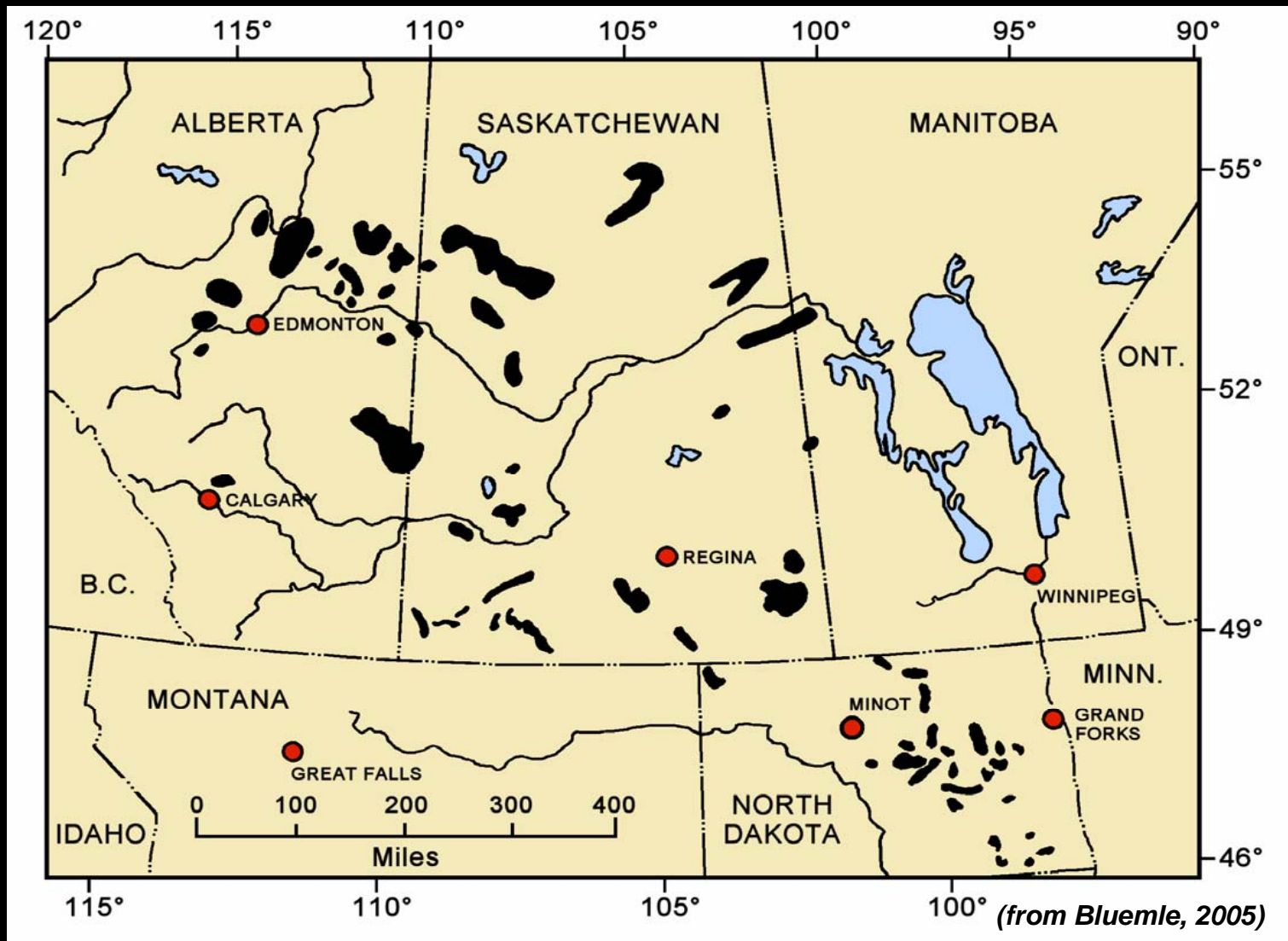
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# Glaciotectonic Ice-Thrusts



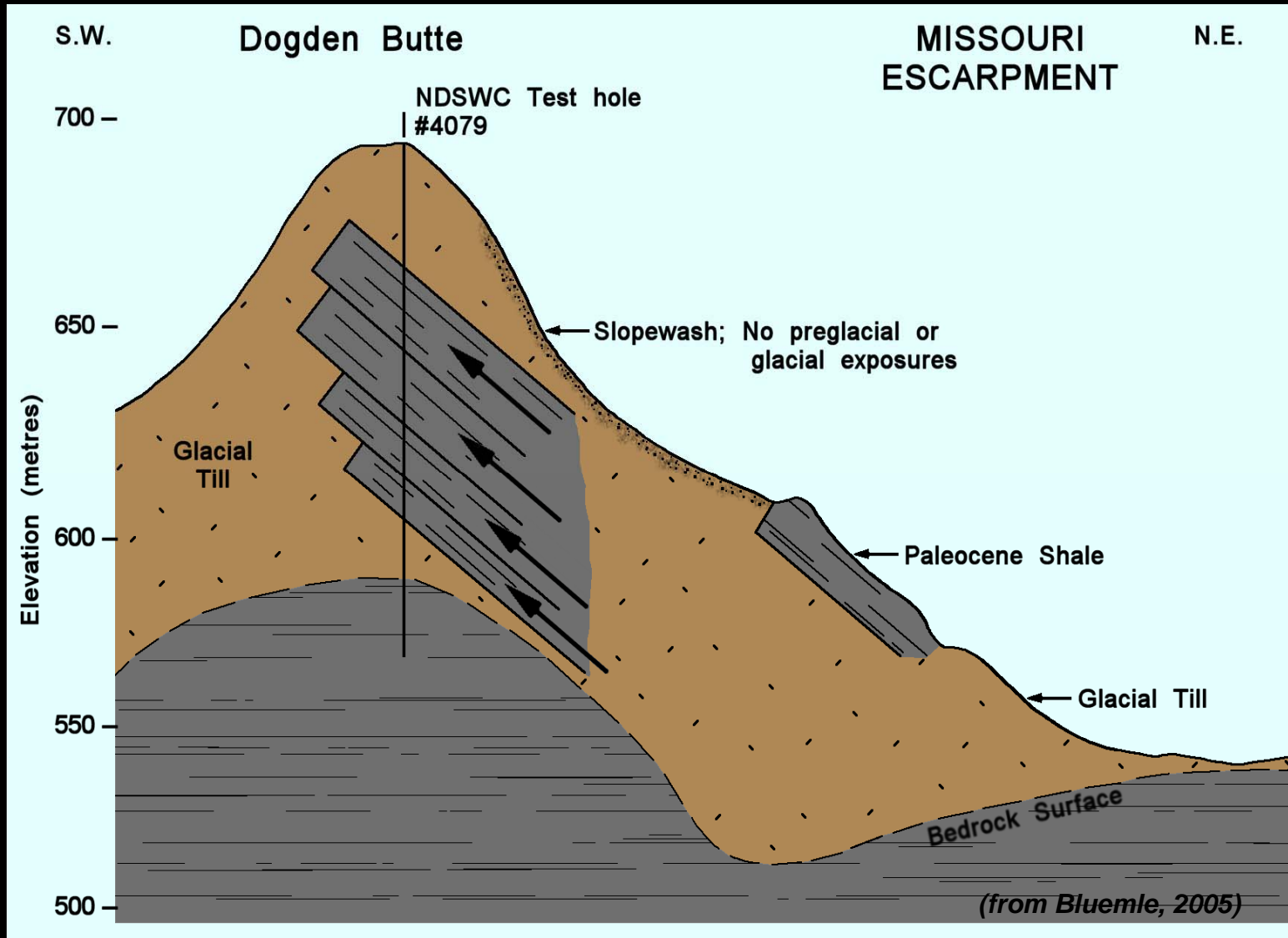
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# Glaciotectonic Ice-Thrusts



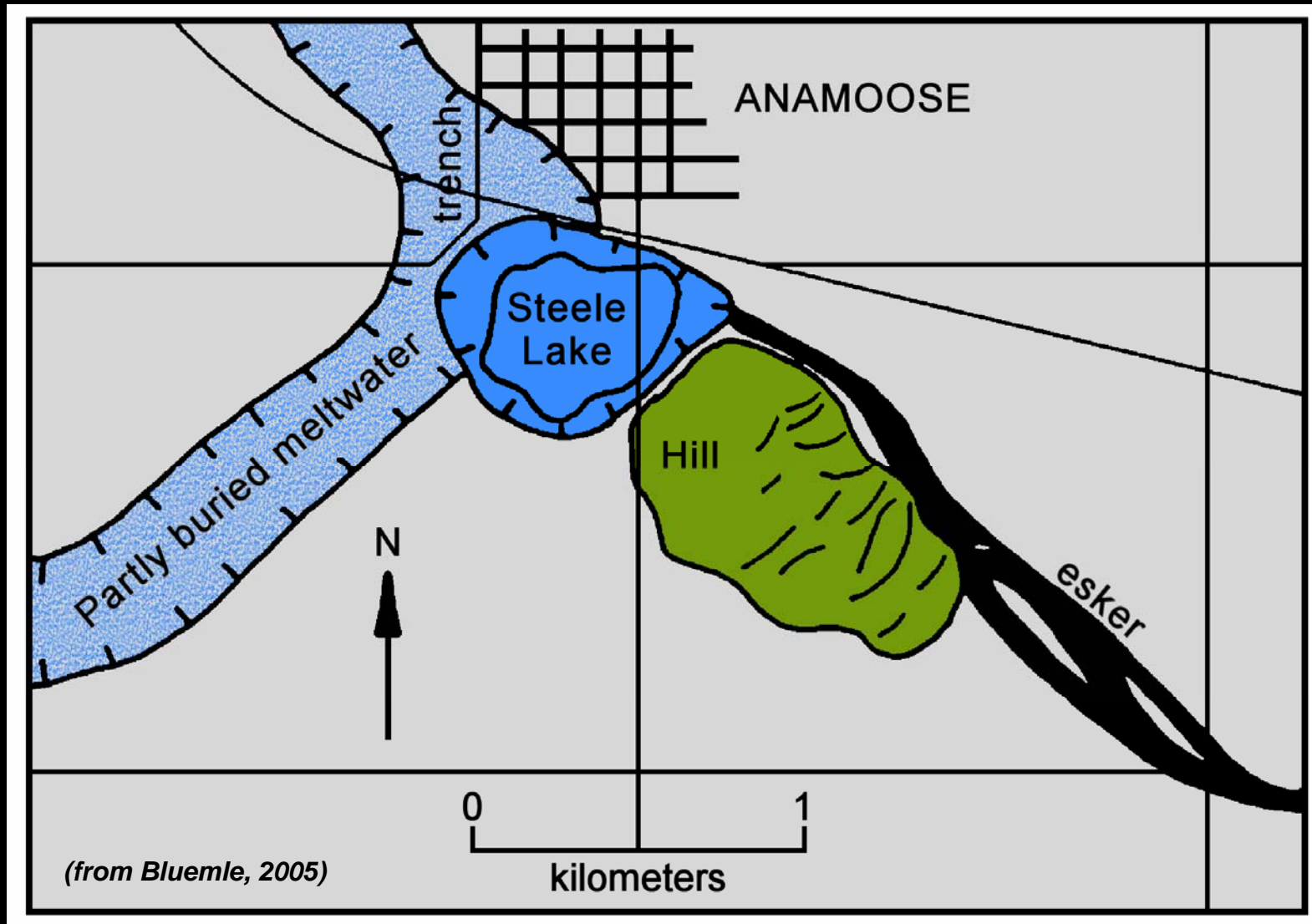
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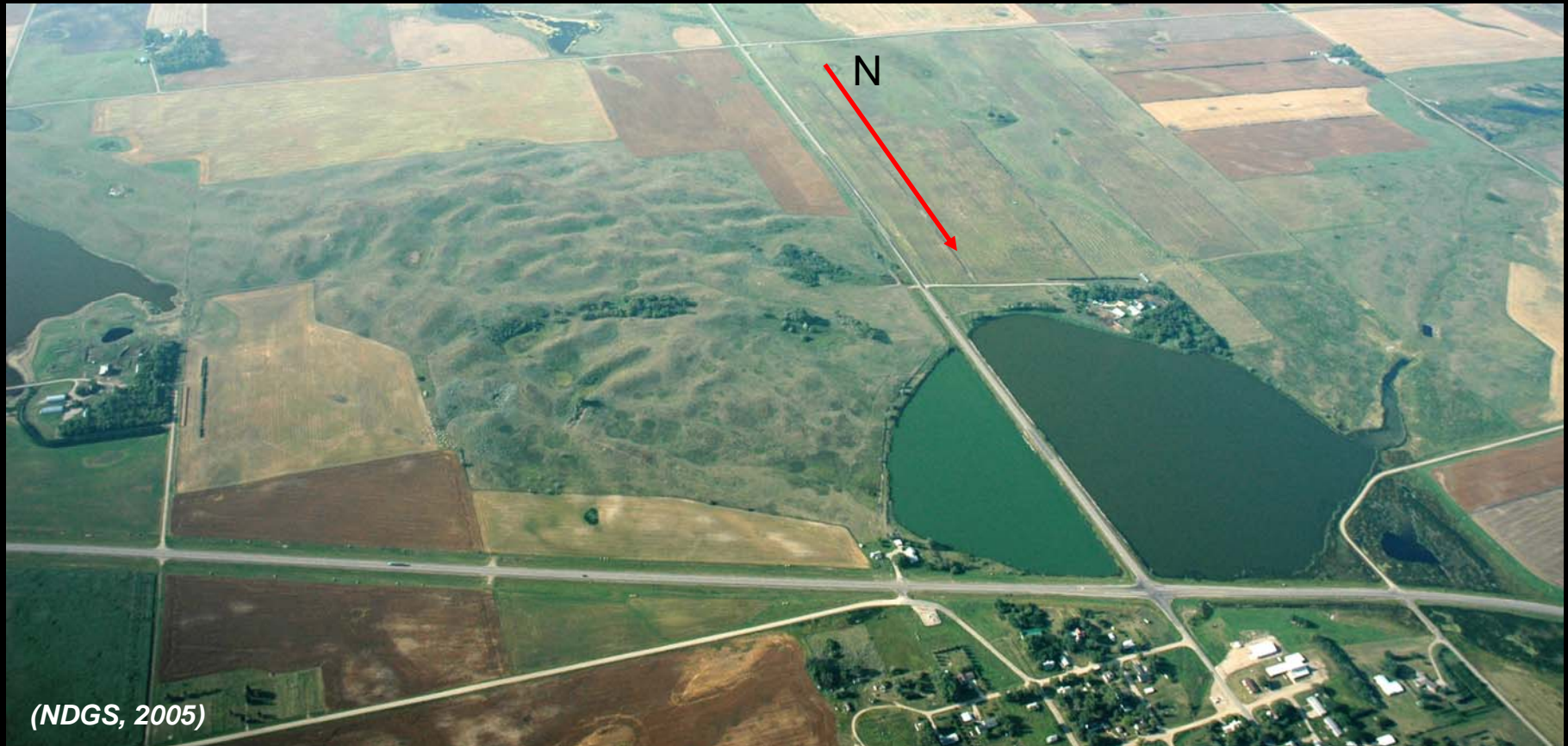
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# Glaciotectonic Ice-Thrusts



# Glaciotectonic Ice-Thrusts



*Anamoose (Steele Lake) Ice-Thrust in north-central North Dakota*



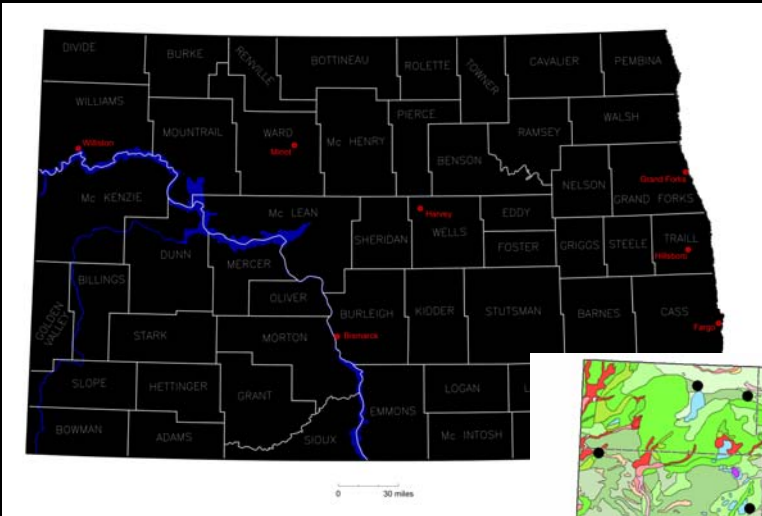
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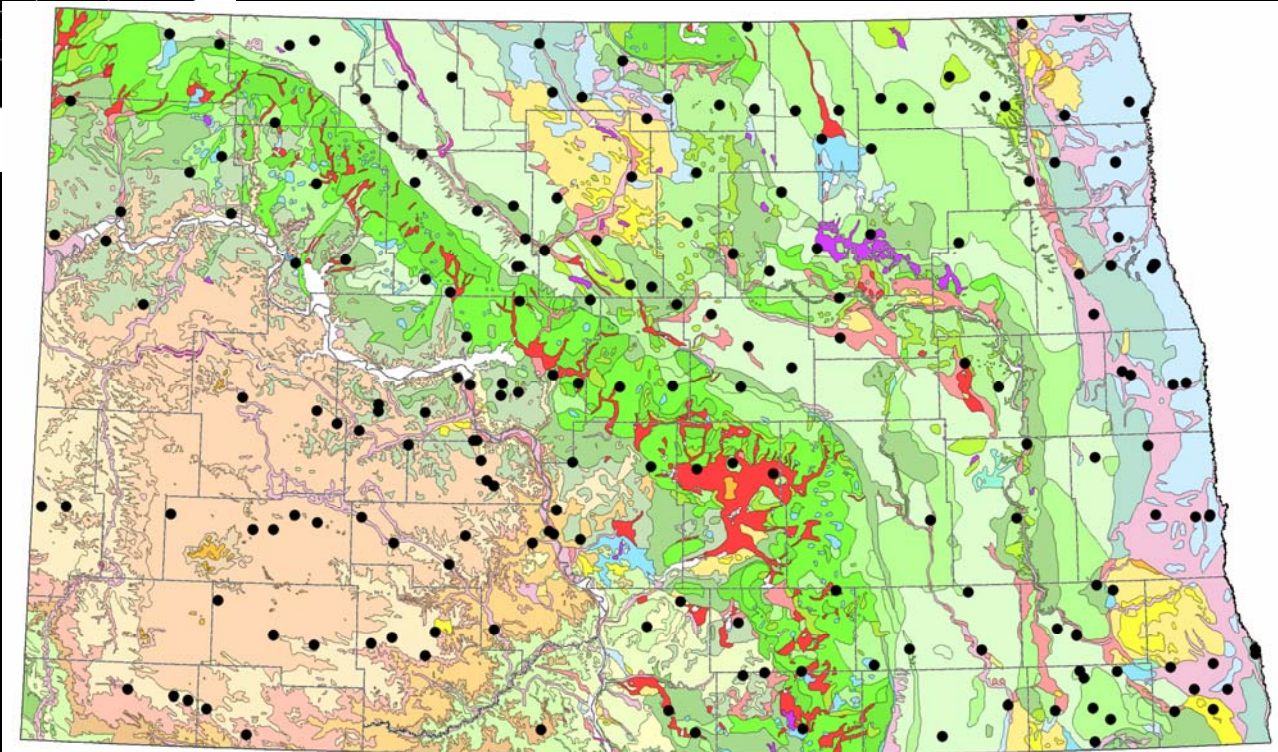
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# Landfill Locations in ND



Location of MSW facilities that are producing gas or have a potential to produce gas (NDDH, 2005).



Facilities depicted here include all current permitted facilities which include: municipal solid waste, special waste, industrial, inert-permit by rule, and inert facilities (NDDH, 2005).

*Geologic map modified from Clayton, et. al., 1980*



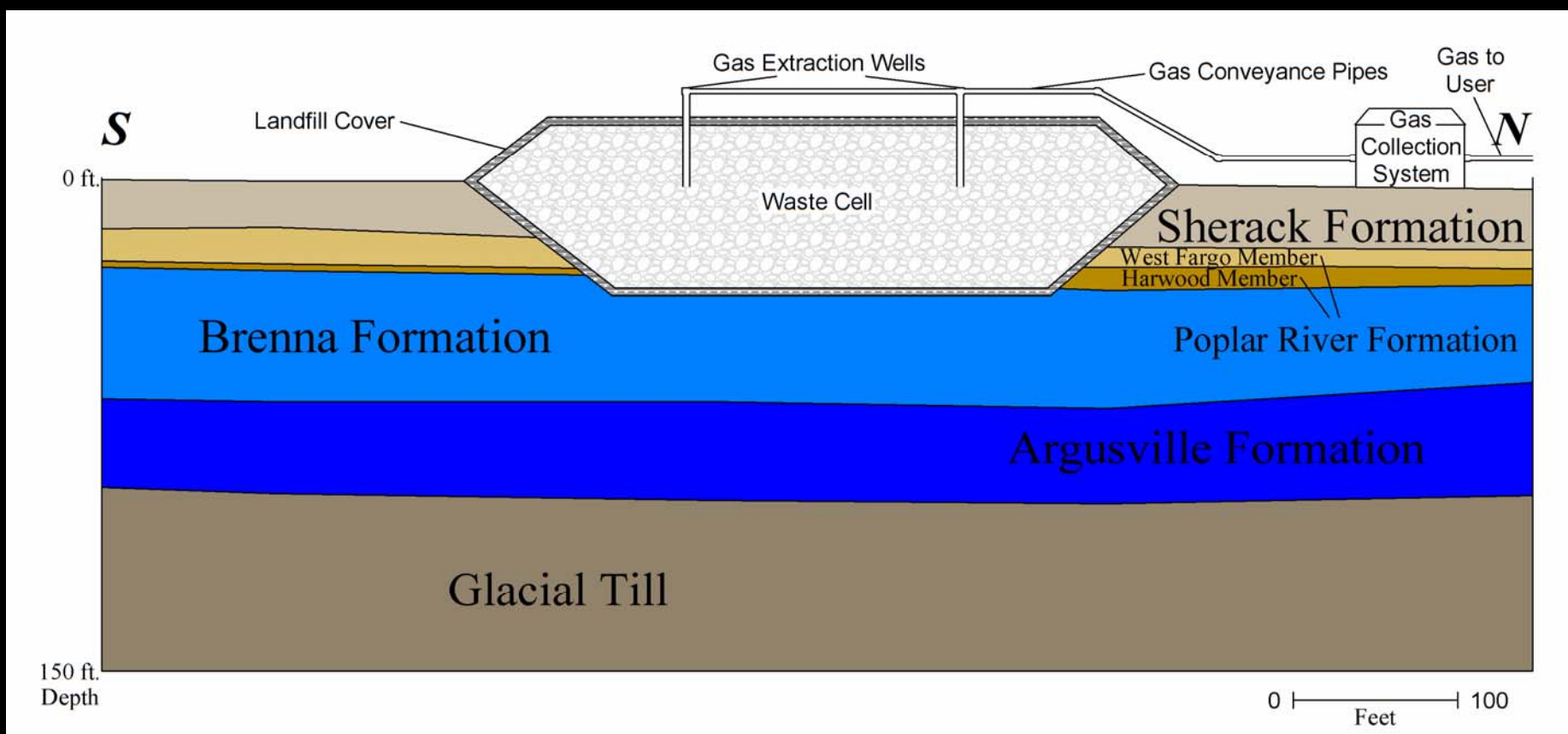
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# Generalized Near Surface Glacial Stratigraphy at Fargo, ND and Conceptual Landfill Construction



(Modified from Anderson and Murphy, 2005)



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## Estimation of Landfill Methane Generation Flow Rate<sup>1</sup>

$$Q_{\text{CH}_4} = L_o R (e^{-kc} - e^{-kt})$$

where,

$Q_{\text{CH}_4}$  = maximum expected methane generation flow rate (cubic meters per year)

$L_o$  = methane generation potential (cubic meters per Megagram solid waste)

$R$  = average annual acceptance rate (Megagrams per year)

$k$  = methane generation rate constant ( $\text{yr}^{-1}$ )

$t$  = age of the landfill (yr)

<sup>1</sup> EPA, AP-42



## City of Fargo Landfill (Active)

- Current Waste Amount: 2,696,775 Mg
- Average Annual Waste Acceptance Rate: 107,871 Mg/yr
- Landfill Age: 25
- Time Since Closure 0
- Methane Generation Potential: 170 m<sup>3</sup>/Mg SW
- Methane Generation rate constant 0.02 yr<sup>-1</sup>
- Estimated Methane Generation: 255M ft<sup>3</sup>/yr
- Current Methane Generation of approx. 210 ft<sup>3</sup>/yr



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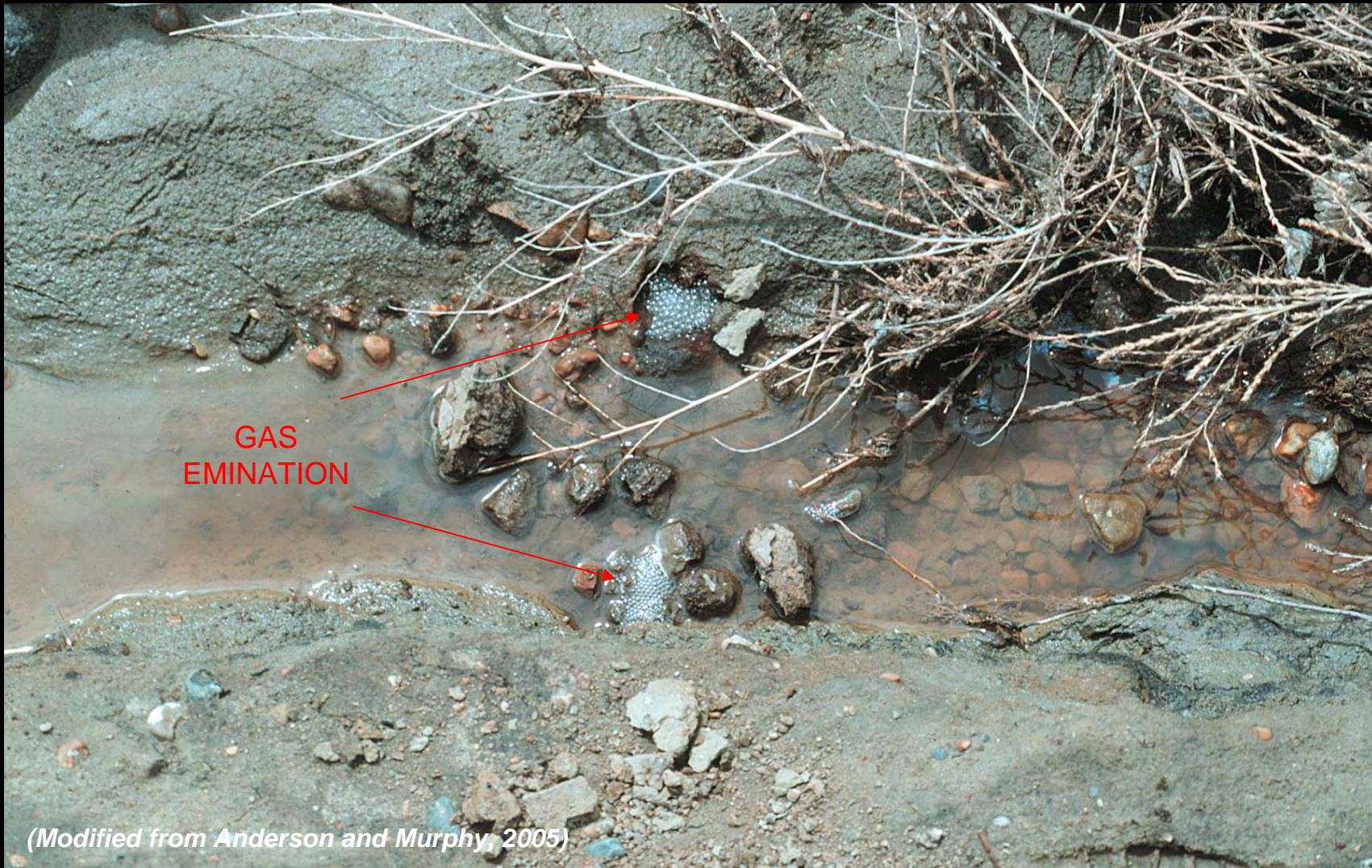
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# Landfill Gas – Old Minot Landfill



# Current NDGS Investigative Activities

- Background Research
  - Online Database of Shallow Natural Gas Occurrences in North Dakota.
  - Online Bibliography of Shallow Natural Gas References in North Dakota.
- Subsurface Geology
  - Preparation of Correlation Cross Sections through the Cretaceous units across North Dakota
  - Preparation of Structure Contour and Isopach maps of selected Cretaceous units in the state.
- Hydrogeologic Data Compilation and Analysis
  - Observation well field screening and sampling
  - Analysis of Ground-Water Geochemistry Data
  - Evaluation of the Influence of Hydraulic Head on Natural Systems



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# Structure on Cretaceous and Jurassic Units

Several Units Being Worked On by the NDGS:

Structure Contour Maps (1:1,000,000)

Greenhorn Formation

Mowry Formation

Inyan Kara Formation

Swift Formation

Isopach Maps (1:1,000,000)

Greenhorn-Mowry

Mowry-Inyan Kara

Inyan Kara-Swift



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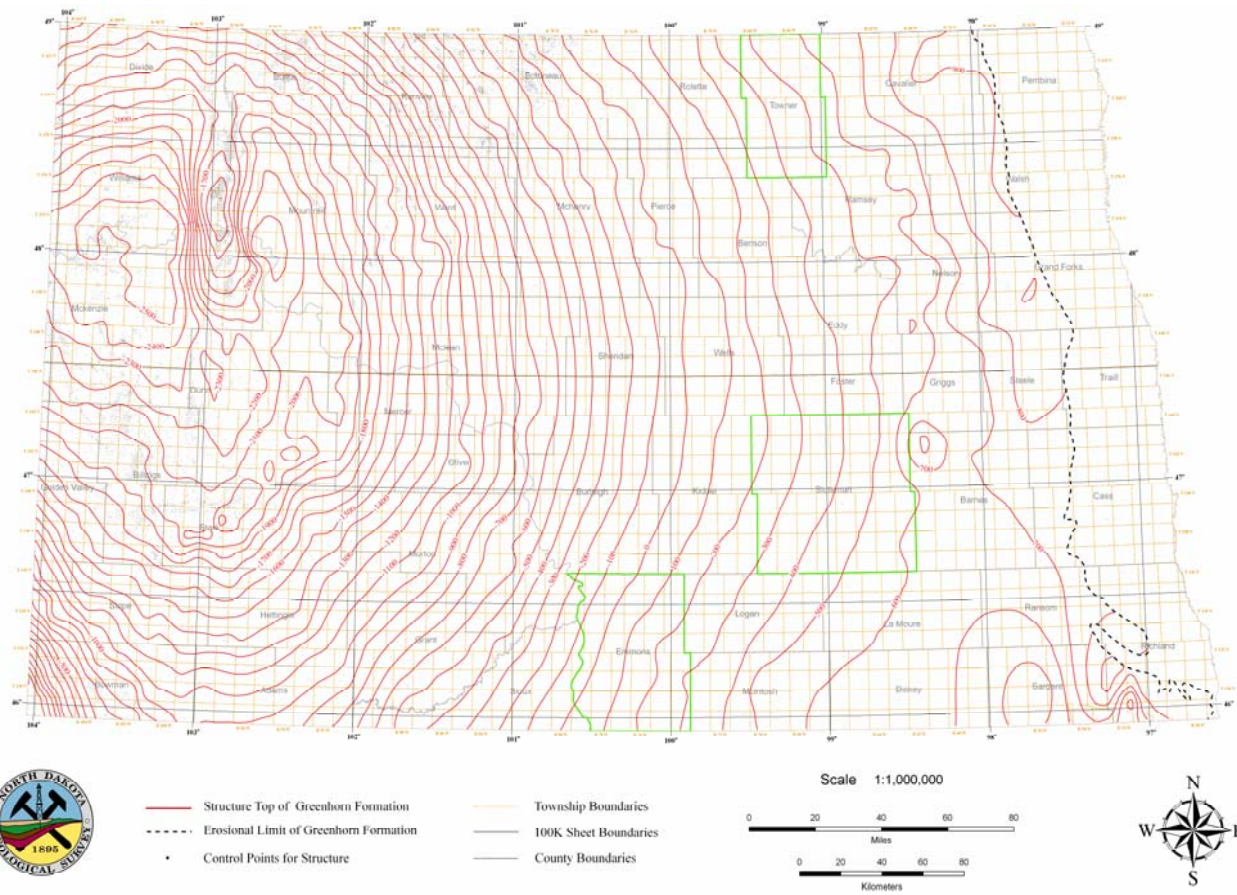
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# Structure Contour Maps

Preliminary Structure Map On Top Of The Cretaceous Greenhorn Formation in North Dakota



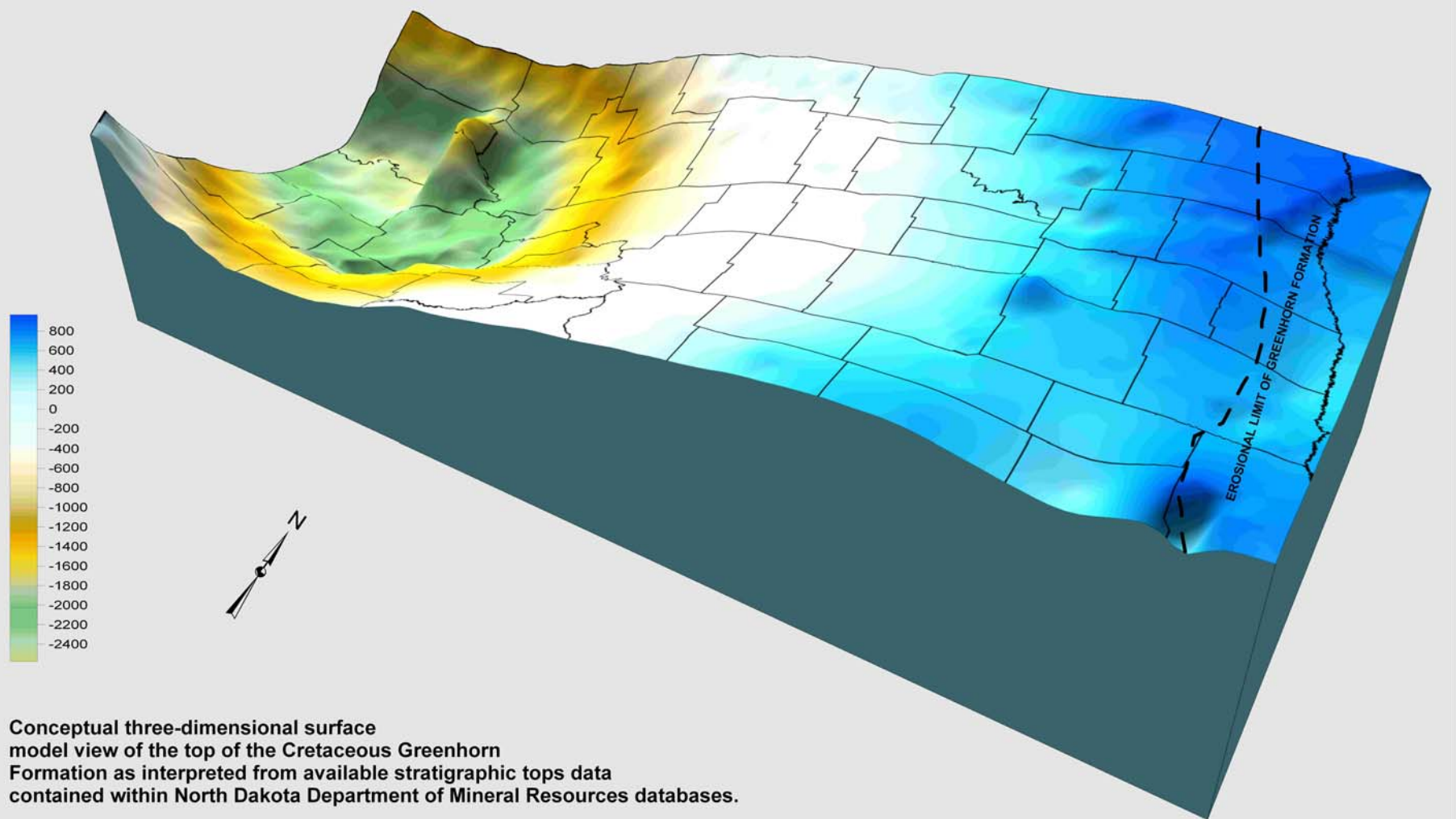
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# 3D Conceptual Structural Surfaces



Conceptual three-dimensional surface model view of the top of the Cretaceous Greenhorn Formation as interpreted from available stratigraphic tops data contained within North Dakota Department of Mineral Resources databases.



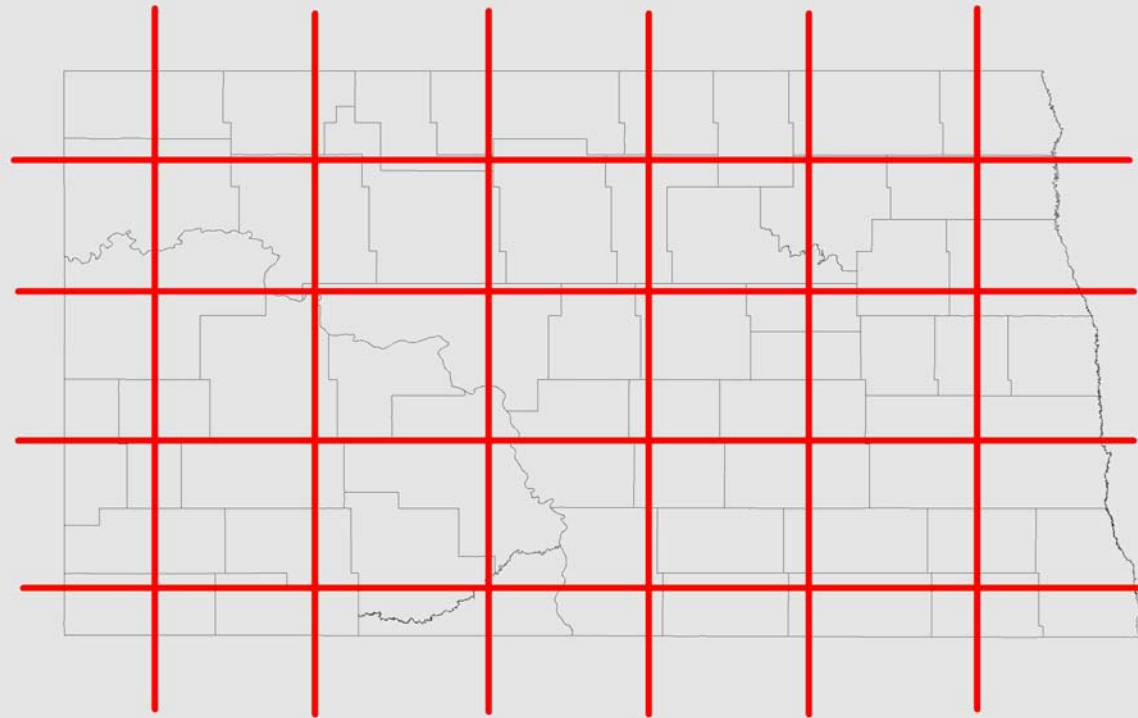
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# Stratigraphic Sections of Cretaceous Units



Proposed lines of stratigraphic and geologic section that will be constructed across Cretaceous stratigraphic units present in North Dakota. Several sections are planned that will interpret the Cretaceous geology across the state from south to north and west to east on a spacing interval of approximately one degree of latitude and longitude.



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# Stratigraphic Cross Sections

## STRATIGRAPHIC UNITS TO BE EVALUATED

- Kg GREENHORN FORMATION (CRETACEOUS)
- Km MOWRY FORMATION (CRETACEOUS)
- Ki INYAN KARA FORMATION (CRETACEOUS)
- Js SWIFT FORMATION (JURASSIC)
- Jr RIERDON FORMATION (JURASSIC)

Several stratigraphic units are planned to be evaluated in North Dakota. These five units consist of three Cretaceous age stratigraphic units (Green-horn, Mowry, and Inyan Kara) and two Jurassic age stratigraphic units (Swift and Rierdon Formations). Structure contour maps drawn on each stratigraphic unit along with corresponding isopach maps at scales of 1:1,000,000 are planned.





# Recent Investigative Highlights

- Steele County  
Niobrara Shale Gas Concept  
Results
- Bottineau County  
Combined “Drift Gas” and Upper Cretaceous  
Shallow Bedrock
- Renville County  
Continuation of Bottineau Area Trend



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# Reconnaissance Field Screening Studies

- Screening of existing monitoring points with portable instrumentation:

Flame Ionization Detectors (FIDs)

Methane

Multi-Gas Meters

Oxygen

Carbon Dioxide

Hydrogen Sulfide



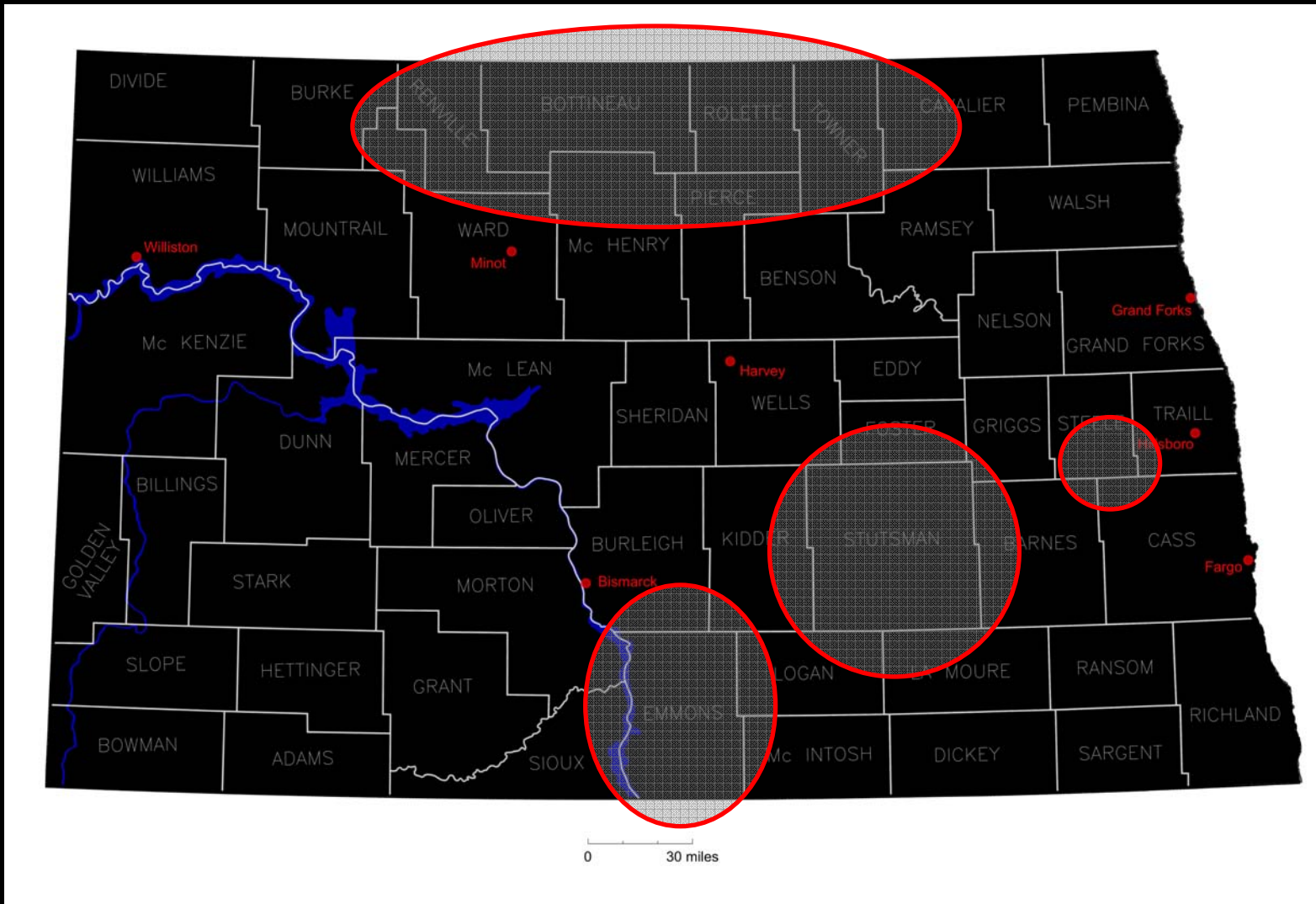
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# NDGS Reconnaissance Observation Well Field Screening Investigations



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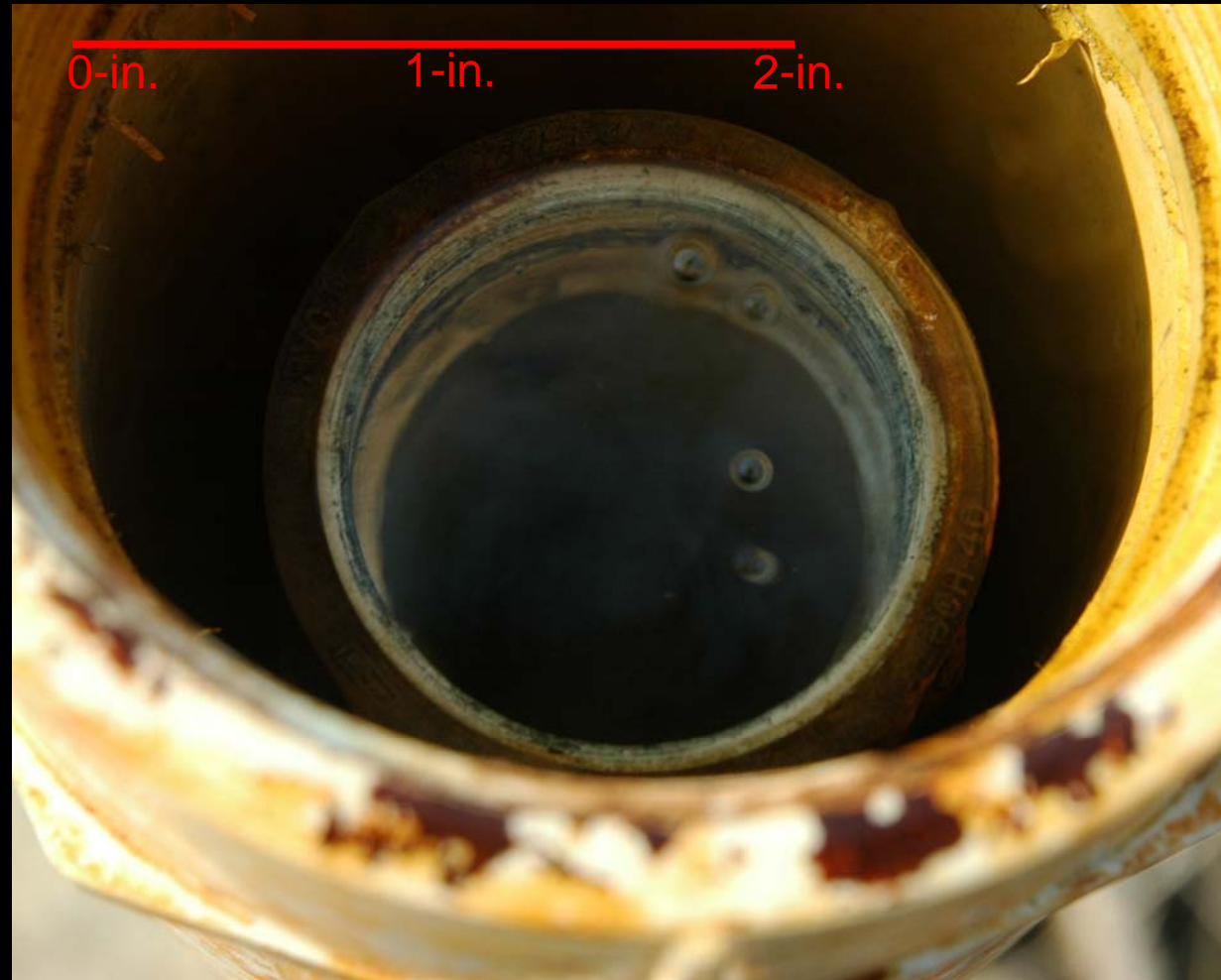
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# Recent Shallow Gas Occurrences

- **Observation Well:**  
162-83-15CCC
- **FID Instrument**  
Response = 236 ppm  
(as methane)
- **Flowing head well**  
( $<1$  gpm)
- **[Methane] in**  
groundwater = 8.3 mg/L
- **Located in area of**  
historic shallow natural  
gas occurrence  
(western Bottineau Co.)
- **Bubbling continuously**  
at top of well  
(approx 2-3 bubbles/5 sec.)



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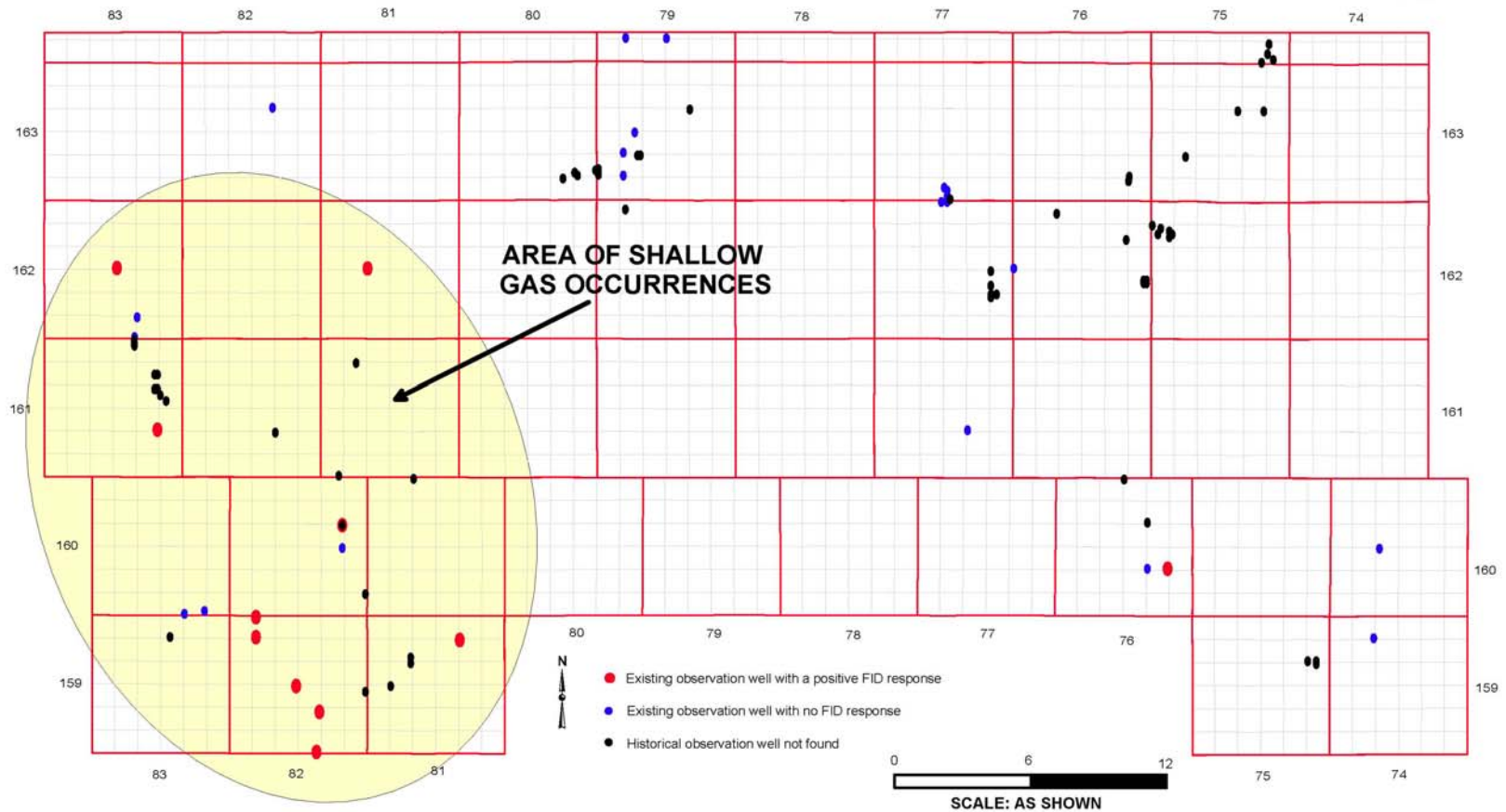
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# Recent FID Field Screening Results



## GROUND-WATER OBSERVATION WELL SHALLOW GAS FID FIELD SCREENING BOTTINEAU COUNTY, NORTH DAKOTA



NDGS, 2006



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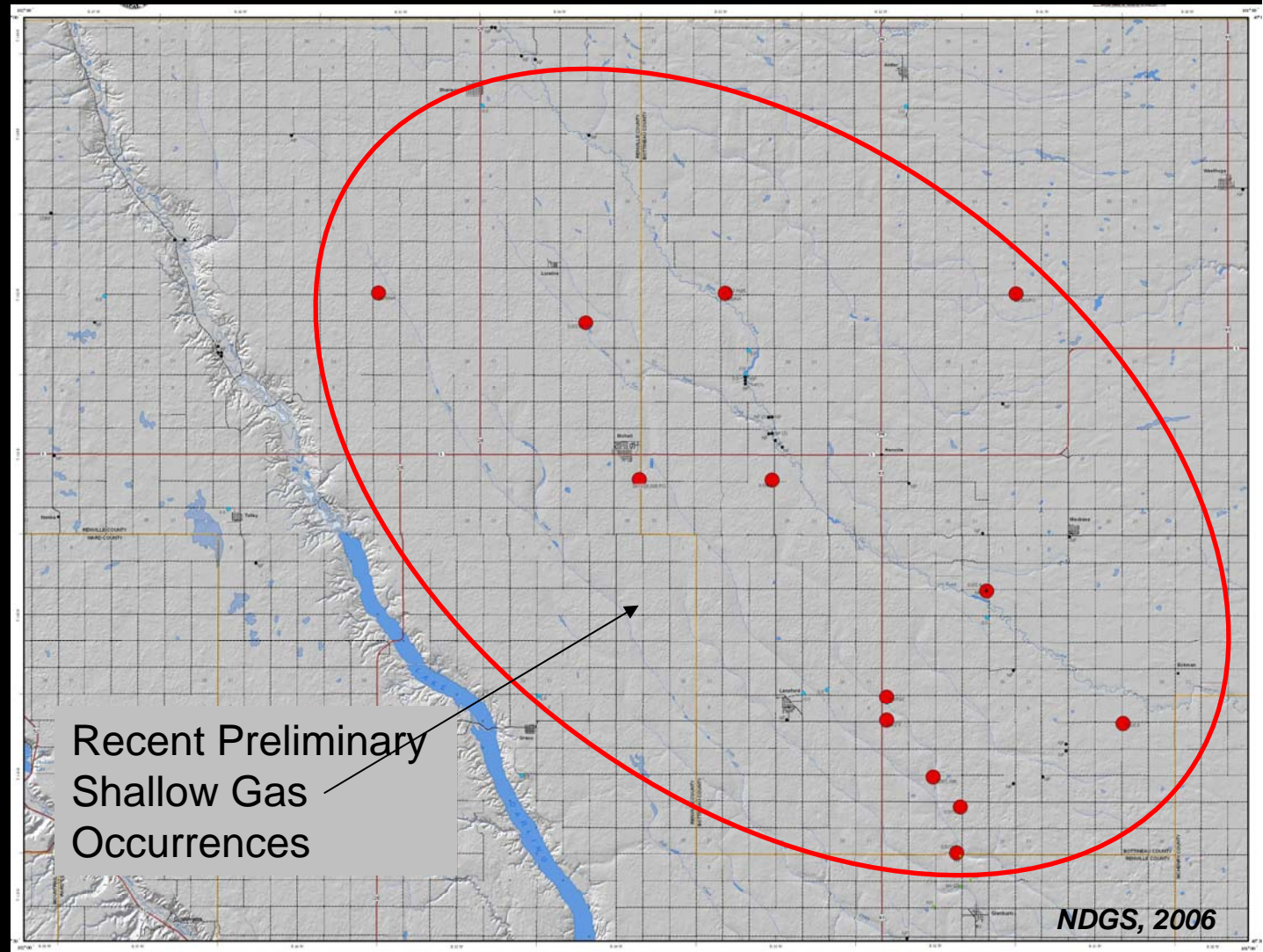
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# Bottineau & Renville County, North Dakota

Continuation of the  
Historical Bottineau  
Area Trend



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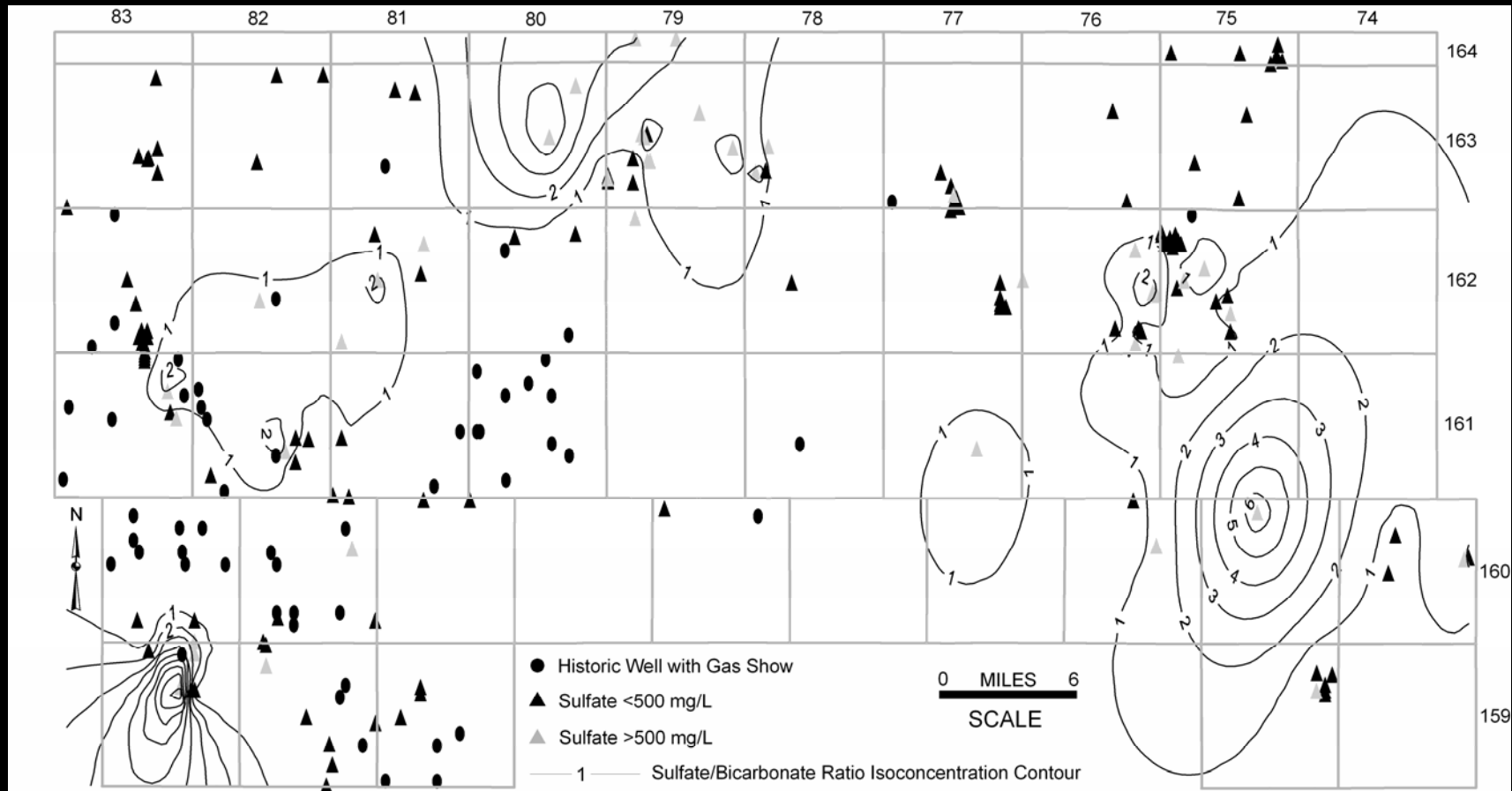
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# Hydrogeologic Data Assessments

## Assessment and Interpretation of Ground-water Geochemistry



(Modified from Anderson, Shurr, and Fischer, 2006)

## Relationship of Historic Wells with Gas Shows to [Sulfate]



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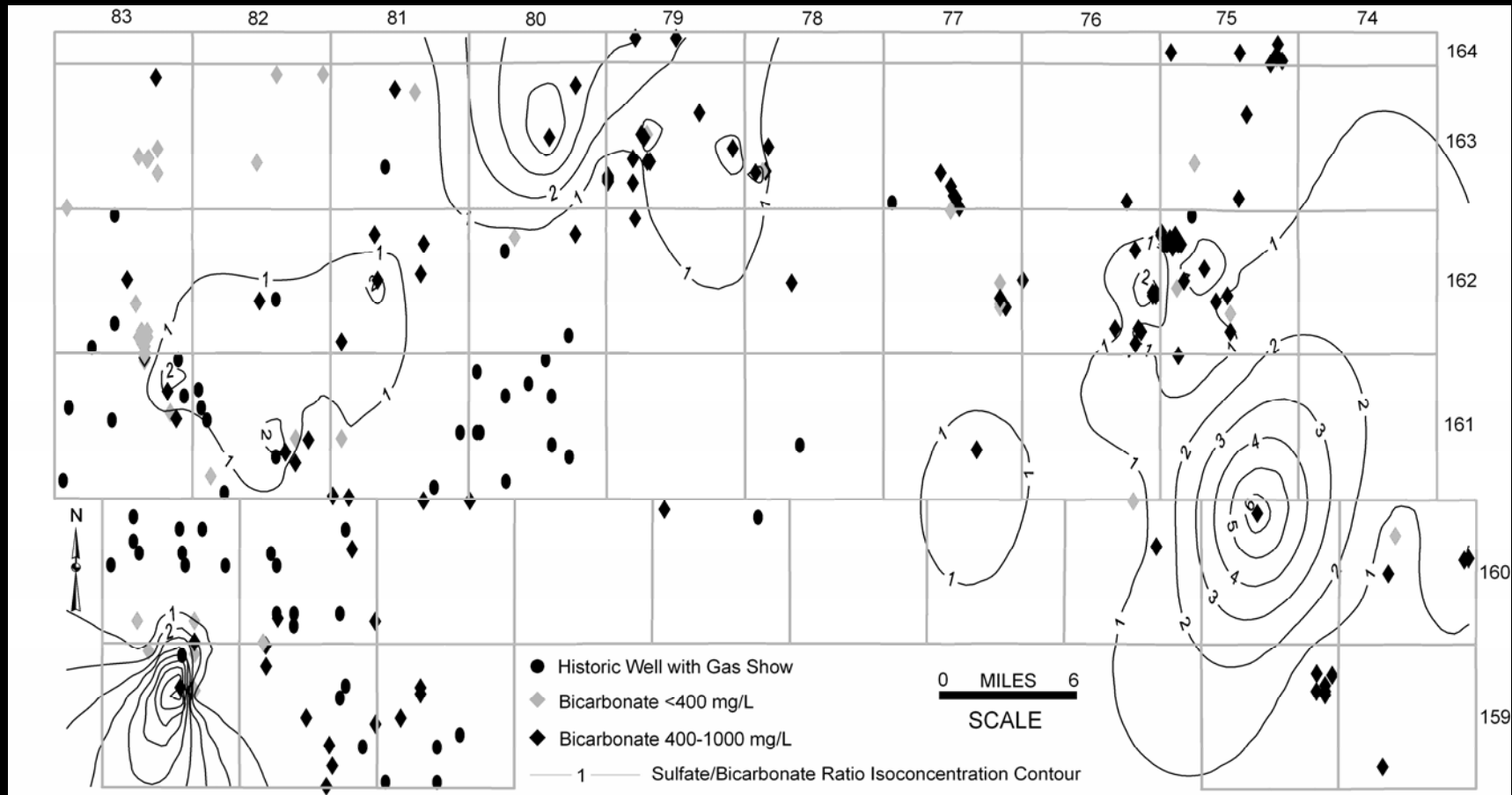
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# Hydrogeologic Data Assessments

## Assessment and Interpretation of Ground-water Geochemistry



(Modified from Anderson, Shurr, and Fischer, 2006)

### Relationship of Historic Wells with Gas Shows to [Bicarbonate]



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# Remote Sensing and Geomorphic Analysis



*LANDSAT Imagery modified from USGS – NASA*



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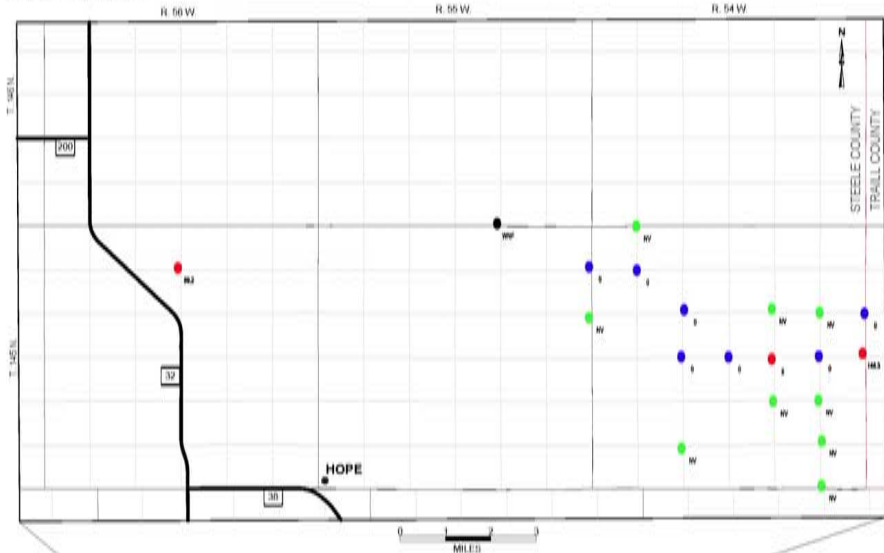
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# Planned Focused Field Investigations

NORTH DAKOTA DEPARTMENT OF MINERAL RESOURCES  
Lynn D. Helms, Director

NORTH DAKOTA GEOLOGICAL SURVEY  
Edward C. Murphy, State Geologist  
Geological Investigations No. 30



## RECONNAISSANCE GROUND-WATER OBSERVATION WELL SHALLOW GAS FIELD SCREENING IN SOUTHEASTERN STEELE COUNTY, NORTH DAKOTA

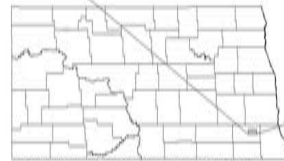
The investigation of shallow natural gas occurrences within selected existing ground-water observation wells in Steele County, North Dakota was conducted on September 11, 2006. A total of 15 observation well sites, consisting of historic and existing observation wells were reviewed prior to the field component of this investigation. Eleven of these observation well sites were selected to be visited in the field to (1) determine the existence of the well, (2) verify its location, and (3) perform shallow gas field screening. Seven observation well sites were not visited during this investigation. Three of the wells were field screened for the presence of combustible gasses using a portable flame-ionization detector (PID) calibrated to methane in air (101 ppm low-span or 10,000 ppm high-span). The PID was used solely for field screening on all wells. Instrument response was collected at the top of well casing (TOC) and just above the groundwater/air interface, after the collection of a depth to water level reading using and electric well tape. Of the existing wells that were field screened, three wells returned positive FID responses, ranging from 2.0 ppm to 146.3 ppm as methane. One well (145-56-4DDD) recently installed by the North Dakota State Water Commission returned responses of 89.3 ppm and 46.3 ppm, shortly after the first reading, from just above the groundwater/atmospheric interface. This shallow well is completed and screened within the Cretaceous Pierre Shale.

### EXPLANATION

- BB2 Ground-water observation well with positive FID response as methane in parts per million (ppm)
- 0 Ground-water observation well with no FID response (0)
- NV Ground-water observation well site not visited during this investigation
- WNF Ground-water observation well not found at prescribed location

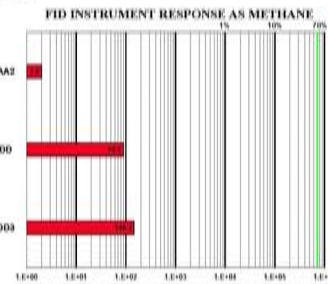


Fred J. Anderson  
2006



### REFERENCES

- Blumie, 1935, Geology of Griggs and Steele Counties, North Dakota Geological Survey Bulletin No. 64 - Part I, 50 p.
- Dowsey, J.B., Hutchinson, R.D., and Sunderland, G.L., 1973, Ground-Water Basic Data for Griggs and Steele Counties, North Dakota, North Dakota Geological Survey Bulletin 64-Part II, 408 p.
- Dowsey, J.B., and Armstrong, C.A., 1977, Ground-Water Resources of Griggs and Steele Counties, North Dakota, North Dakota Geological Survey Bulletin No. 64-Part III, 33 p.
- NDGWC, 2005, North Dakota State Water Commission Online Ground-Water Information Database, <http://www.water.state.nd.us>



Graphical depiction of FID instrument response in parts per million (ppm) for wells in the study area. Logarithmic scale of methane concentration in ppm is shown on the x-axis in addition to the average concentration of methane in commercial natural gas at 70% depicted by the vertical green line.

### SUMMARY OF OBSERVATION WELL CONSTRUCTION INFORMATION

Date	Well Location		FID Response	Screened Interval	Total Well Depth
	PLSS	Longitude Latitude			
10/20/04	14505613DDO3	-97.47561 47.36018	146.3	75-80	100
06/14/06	14505604DDD	-97.79533 47.39861	89.2	55-60	60
06/29/06	14505422AAA2	-97.51810 47.36740	2.0	74-79	106
11/30/99	14505501DDO2	-97.60320 47.39220	0.0	36-41	50
07/20/04	14505408BBB	-97.58093 47.39710	0.0	55-60	160
07/13/04	14505417DDO	-97.56039 47.36840	0.0	83-98	280
11/30/99	14505409CCC2	-97.55891 47.36300	0.0	45-50	58
07/19/04	14505416CCC2	-97.53830 47.36824	0.0	78-83	100
07/26/04	14505413AAA2	-97.47466 47.36243	0.0	27-32	40
12/01/99	14505410DDO2	-97.51792 47.38403	0.0	15-20	23
01/01/88	14505709BAA	-97.03373 47.48400	NV	0-80	80
11/30/99	14505513AAA2	-97.60337 47.38143	NV	46-51	50
07/20/04	14505405BBB2	-97.58102 47.41163	NV	35-40	60
10/21/04	14505432AAA	-97.56047 47.33809	NV	88-73	147
07/28/04	14505427AAA	-97.51756 47.35353	NV	87-91	200
07/27/04	14505426AAA3	-97.49640 47.35375	NV	58-63	60
07/15/04	14505414DDO2	-97.49608 47.36834	NV	55-60	80
07/19/04	14505413BBB	-97.49561 47.36274	NV	75-80	280
10/21/04	14505436CCC	-97.49517 47.32548	NV	78-83	280
10/20/04	14505425CCC2	-97.49492 47.34027	NV	75-80	100
10/30/70	14505534DDD	-97.64605 47.41276	WNF	48-51	120

Observation well information from NDGWC (2006).

[http://www.state.nd.us/ndgs/Publication\\_List/geoinvest\\_h.htm](http://www.state.nd.us/ndgs/Publication_List/geoinvest_h.htm)

- Shallow Monitoring Wells
- Air and Ground-Water Sampling
- Isotope C Geochemistry
- Ground-Water Geochemistry
- Methanogens



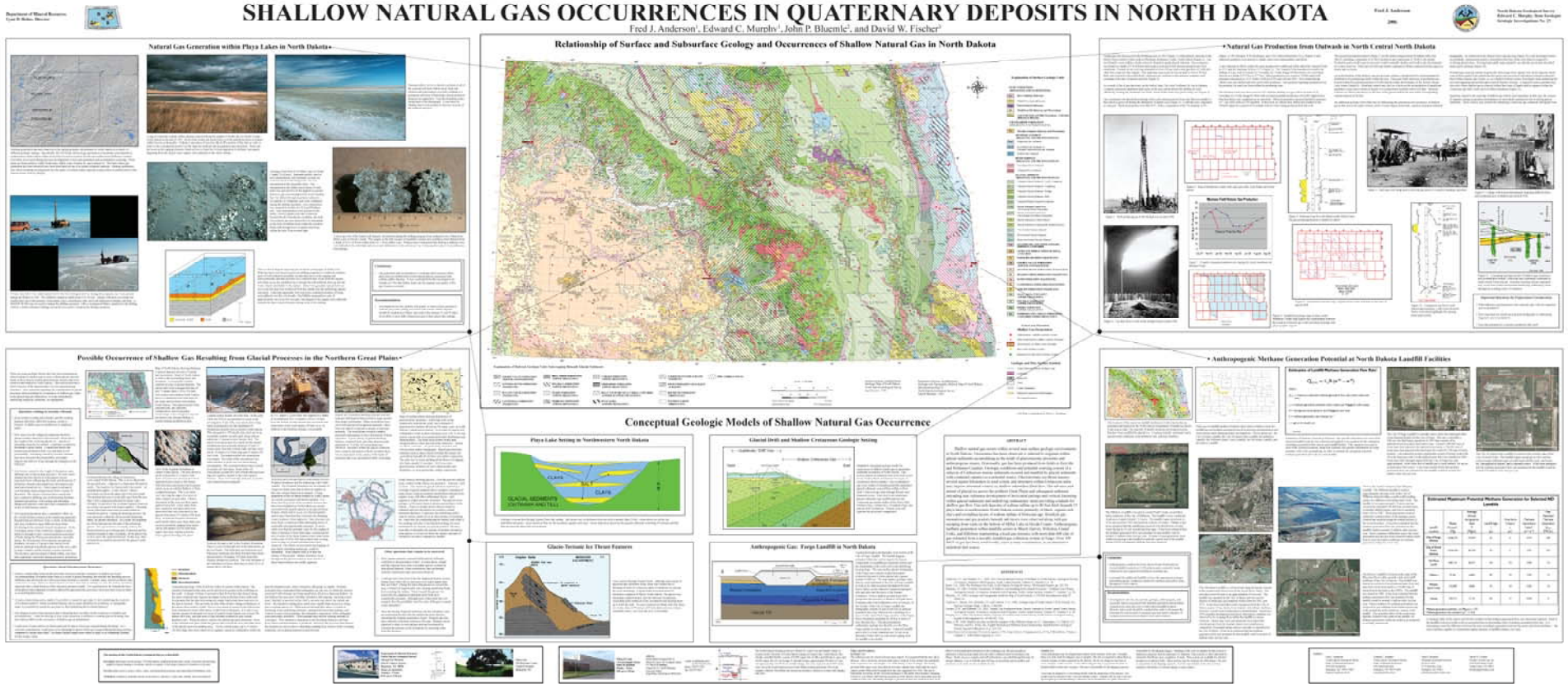
North Dakota Department  
of Mineral Resources

North Dakota Geological Survey  
Geological Investigations No. 32

North Dakota  
Geological Survey



# Recent NDGS Publications of Interest Related To Shallow Gas



- NDGS Geological Investigation No. 25 (GI-25)



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# Recent NDGS Publications of Interest Related To Shallow Gas

North Dakota Department of Mineral Resources  
Lynn D. Rehn, Director

## ASSESSMENT OF POTENTIAL SHALLOW NATURAL GAS RESOURCES IN NORTH DAKOTA

North Dakota Geological Survey  
Edward C. Murphy, State Geologist  
Geological Investigations No. 26

Geologic log showing stratigraphic units and lithology.

### Preliminary Structure Map On Top Of The Cretaceous Greenhorn Formation in North Dakota

Preliminary structure map showing contour lines on the Cretaceous Greenhorn Formation.

### NDGS Shallow Gas Investigations Activities Completed and Planned

- January 2005 - North Dakota Geological Survey conducts investigative research planning and initiates preliminary shallow gas investigative work in North Dakota.
- May 2005 - Survey geologists Fred J. Anderson and Edward C. Murphy present results of studies regarding unconventional sources of methane in North Dakota at the 39th Annual Meeting of the North-Central Section of the Geological Association of America in Minneapolis, Minnesota.
- February 2006 - North Dakota Geological Survey launches shallow gas investigations web page and user interface for the collection of anecdotal information on shallow gas occurrences in North Dakota.
- March, 2006 - Presentation on Historical Shallow Gas Occurrences in North Dakota given to the North Dakota Water Well Drillers Association 2006 convention in Bismarck.
- April, 2006 - Survey completes Shallow Natural Gas Occurrences in Quaternary Deposits NDGS Geological Investigations No. 25 - Presented at the 2006 American Association of Petroleum Geologists (AAPG) Annual Meeting and Exposition in Houston, Texas.
- May, 2006 - Survey completes Preliminary Structure Contour Maps at scales of 1:1,000,000 for the state of North Dakota and 1:100,000 for Emmons, Stutsman, and Towner Counties.
- May, 2006 - Survey presents Shallow Natural Gas Occurrences in Quaternary Deposits - NDGS Geological Investigations No. 25 and Historical Occurrences of Natural Gas in Central North Dakota at the 14th Williston Basin Petroleum Conference & Prospect Expo in Minot.
- QIII 2006 - Survey plans to complete Preliminary Structure Contour Maps, Isopach Maps, and Geologic Log Sections on the Cretaceous Greenhorn, Mowry, and Inyan Kara Formations across North Dakota.
- Q1 2007 - Survey plans to complete several stratigraphic cross-sections and Geologic log sections on the Cretaceous across North Dakota.

Table of stratigraphic units to be evaluated.

NDGS SHALLOW GAS PROJECT WEB PAGE

3D geological model showing subsurface structures.

Errol J. Anderson and Bruce J. Jendryk

2006

## • NDGS Geological Investigation No. 26 (GI-26)



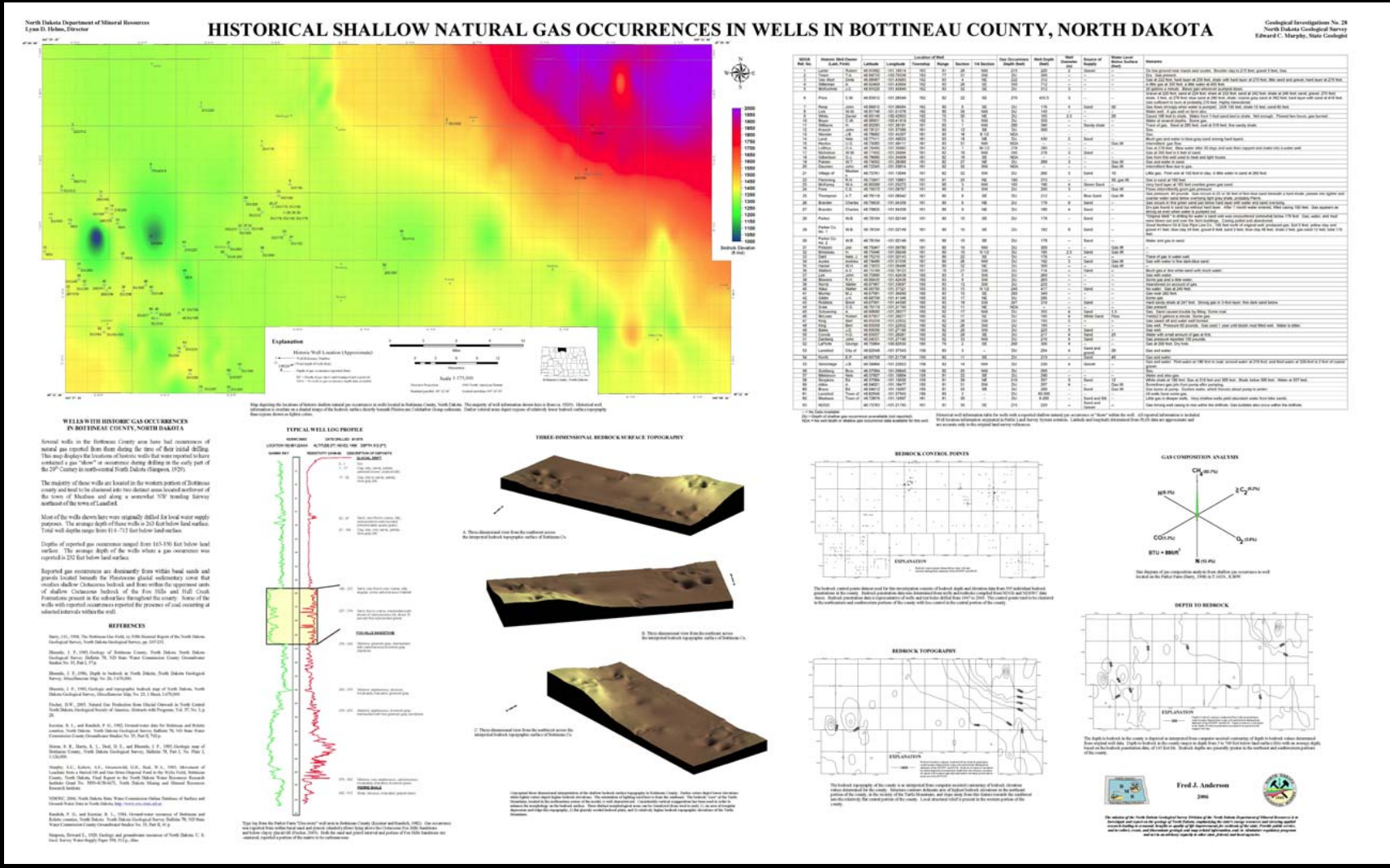
North Dakota Department of Mineral Resources

North Dakota Geological Survey Geological Investigations No. 32

North Dakota Geological Survey



# Recent NDGS Publications of Interest Related To Shallow Gas



## • NDGS Geological Investigation No. 28 (GI-28)



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Geological Investigations No. 32

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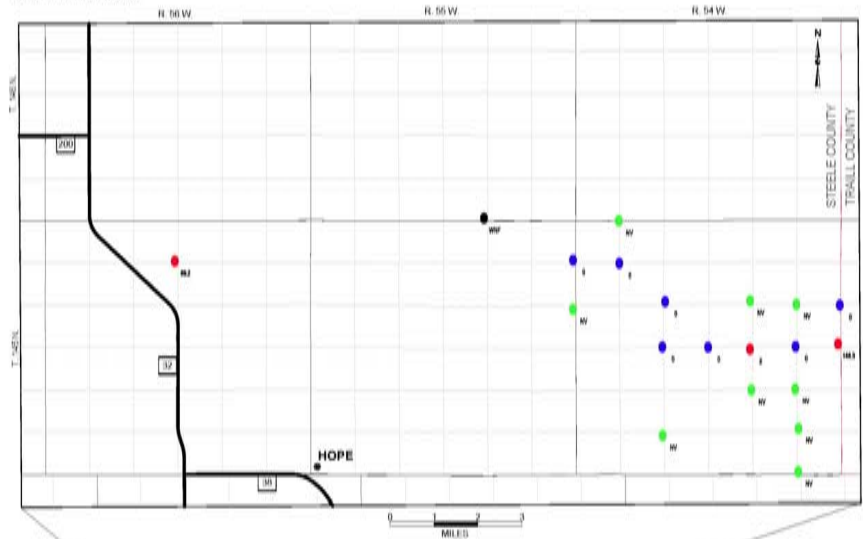




# Recent NDGS Publications of Interest Related To Shallow Gas

NORTH DAKOTA DEPARTMENT OF MINERAL RESOURCES  
Lynn D. Helms, Director

NORTH DAKOTA GEOLOGICAL SURVEY  
Edward C. Murphy, State Geologist  
Geological Investigations No. 30



## RECONNAISSANCE GROUND-WATER OBSERVATION WELL SHALLOW GAS FIELD SCREENING IN SOUTHEASTERN STEELE COUNTY, NORTH DAKOTA

The investigation of shallow natural gas occurrences within selected existing ground-water observation wells in Steele County, North Dakota was conducted on September 11, 2006. A total of 15 observation well sites, consisting of historic and existing observation wells were reviewed prior to the field component of this investigation. Eleven of these observation well sites were selected to be visited in the field to (1) determine the existence of the well, (2) verify its location, and (3) perform shallow gas field screening. Seven observation well sites were not visited during this investigation. Three of the eleven wells visited returned a positive numerical FID response as methane. Each of the wells were field screened for the presence of combustible gases using a portable flame-ionization detector (FID) calibrated to methane in air (101 ppm low-span or 10,000 ppm high-span). The FID was used solely for field screening on all wells. Instrument response was collected at the top of well casing (TOC) and just above the groundwater/air interface, after the collection of a depth to water level reading using and electric well tape. Of the existing wells that were field screened, three wells returned positive FID responses, ranging from 2.0 ppm to 146.3 ppm as methane. One well (145-56-4DDD) recently installed by the North Dakota State Water Commission returned responses of 89.2 ppm and 46.3 ppm, shortly after the first reading, from just above the groundwater/atmospheric interface. This shallow well is completed and screened within the Cretaceous Pierre Shale.

### EXPLANATION

- Ground-water observation well with positive FID response as methane in parts per million (ppm)
- Ground-water observation well with no FID response (0)
- Ground-water observation well site not visited during this investigation
- Ground-water observation well not found at presented location



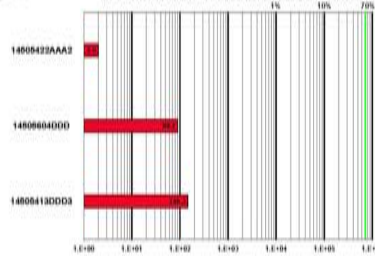
Fred J. Anderson

2006



LOCATION OF INVESTIGATION IN STEELE COUNTY, ND

### FID INSTRUMENT RESPONSE AS METHANE



Graphical depiction of FID instrument response in parts per million (ppm) for wells in the study area. Logarithmic scale of methane concentrations in ppm is shown on the x-axis in addition to the average concentration of methane in commercial natural gas at 70% depicted by the vertical green line.

### SUMMARY OF OBSERVATION WELL CONSTRUCTION INFORMATION

Date	Well Location		FID Response	Screened Interval	Total Well Depth
	PLSS	Longitude Latitude			
10/20/04	14505413DDD3	-97.475611 47.369118	146.3	75-80	100
06/14/06	14505604DDD	-97.795333 47.390611	89.2	50-60	60
06/20/06	14505422AAA2	-97.518110 47.367499	2.0	74-79	106
11/30/09	14505501DDD2	-97.635209 47.399278	0.0	36-41	50
07/20/04	14505408HHB	-97.580923 47.397110	0.0	65-69	100
07/13/04	14505417DDD	-97.560339 47.368400	0.0	93-98	280
11/30/09	14505409CCC2	-97.558891 47.383000	0.0	45-50	58
07/19/04	14505416CCC2	-97.538300 47.368240	0.0	78-83	100
07/26/04	14505413AAA2	-97.474866 47.382433	0.0	27-32	40
12/01/09	14505410DDD2	97.517625 47.364033	0.0	15-20	23
01/01/88	14605700BAA	-97.633733 47.484095	0.0	0-50	80
11/30/09	14505513AAA2	-97.603373 47.381143	0.0	46-51	58
07/20/04	14505405HHB2	-97.581029 47.411633	0.0	35-40	60
09/12/04	14505432AAA	-97.560447 47.338900	0.0	68-73	147
07/28/04	14505427AAA	-97.517766 47.353353	0.0	67-61	200
07/27/04	14505456AAA3	-97.496440 47.353375	0.0	58-63	80
07/15/04	14505414DDD2	-97.496098 47.368374	0.0	55-60	80
07/19/04	14505413BBB	-97.495661 47.382724	0.0	75-80	280
02/21/04	14505436CCC	-97.495417 47.356488	0.0	78-83	280
10/20/04	14505435CCC2	-97.484809 47.340277	0.0	75-80	100
10/30/70	14605534DDD	-97.646095 47.412726	WNF	48-51	120

Observation well information from NDWRG (2006).

[http://www.state.nd.us/ndgs/Publication\\_List/gasinvest\\_h.htm](http://www.state.nd.us/ndgs/Publication_List/gasinvest_h.htm)

## • NDGS Geological Investigation No. 30 (GI-30)



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Geological Investigations No. 32

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Geological Survey



# NDGS Publications Related to Coal Gas

NDGS

Open File Report 98-1

(OF-98-1)

## THE COALBED METHANE POTENTIAL OF NORTH DAKOTA LIGNITES

by  
Edward C. Murphy and Gerard E. Goven



Open File Report 98-1  
North Dakota Geological Survey  
John P. Bluemle, State Geologist  
1998



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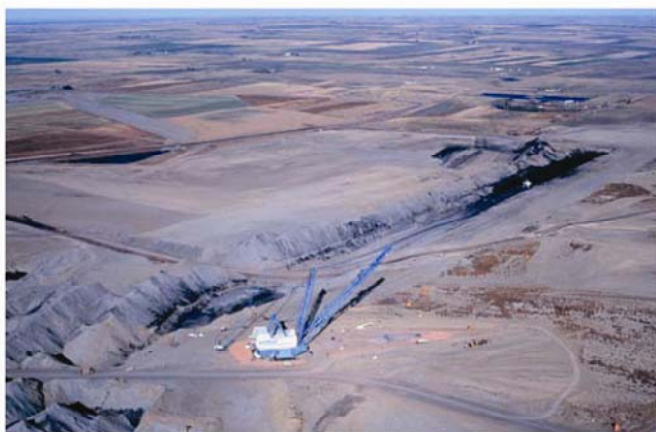


# Report of Investigations No. 104

## THE LIGNITE RESERVES OF NORTH DAKOTA

by

Edward C. Murphy



REPORT OF INVESTIGATION NO. 104  
North Dakota Geological Survey  
Edward C. Murphy, State Geologist  
Lynn D. Helms, Director Dept. of Mineral Resources  
2006

## 25 Billion Tons of Mineable Lignite



**North Dakota Department  
of Mineral Resources**

**North Dakota Geological Survey  
Geological Investigations No. 32**

**North Dakota  
Geological Survey**



# Report of Investigations No. 105

## THE LIGNITE RESOURCES OF NORTH DAKOTA

by

Edward C. Murphy, Ned W. Kruger, Gerard E. Goven,  
Quentin L. Vandal, Kimberly C. Jacobs, and Michele L. Gutenkunst



REPORT OF INVESTIGATION NO. 105  
North Dakota Geological Survey  
Edward C. Murphy, State Geologist  
Lynn D. Helms, Director Dept. of Mineral Resources  
2006

## 1.3 Trillion Tons of Coal in North Dakota



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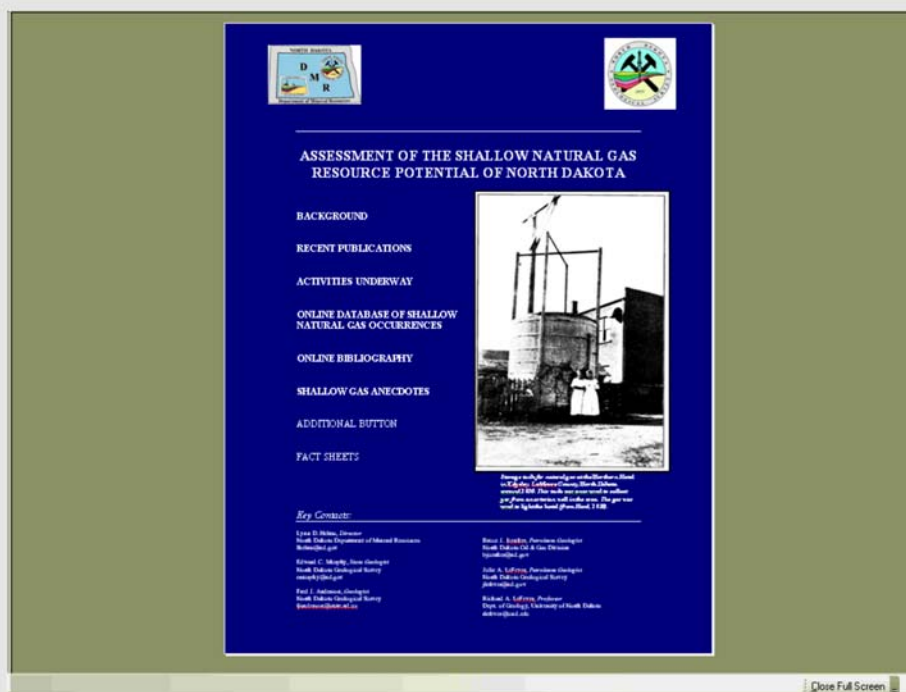


## •Shallow Gas Project Website

-Focal Point for the delivery of all data and shallow gas related information for North Dakota.

# NDGS SHALLOW GAS PROJECT WEB PAGE

[www.state.nd.us/ndgs/Shallowgas/sgas.htm](http://www.state.nd.us/ndgs/Shallowgas/sgas.htm)



The NDGS Shallow Gas Project web page (currently under construction) is the focal point for the access of geologic information on shallow gas occurrences in North Dakota. The web page contains useful historical background information on shallow gas exploration and development, in addition to recent publications and online databases and maps. It is planned to be updated each quarter with new information including data and map additions as they are completed.



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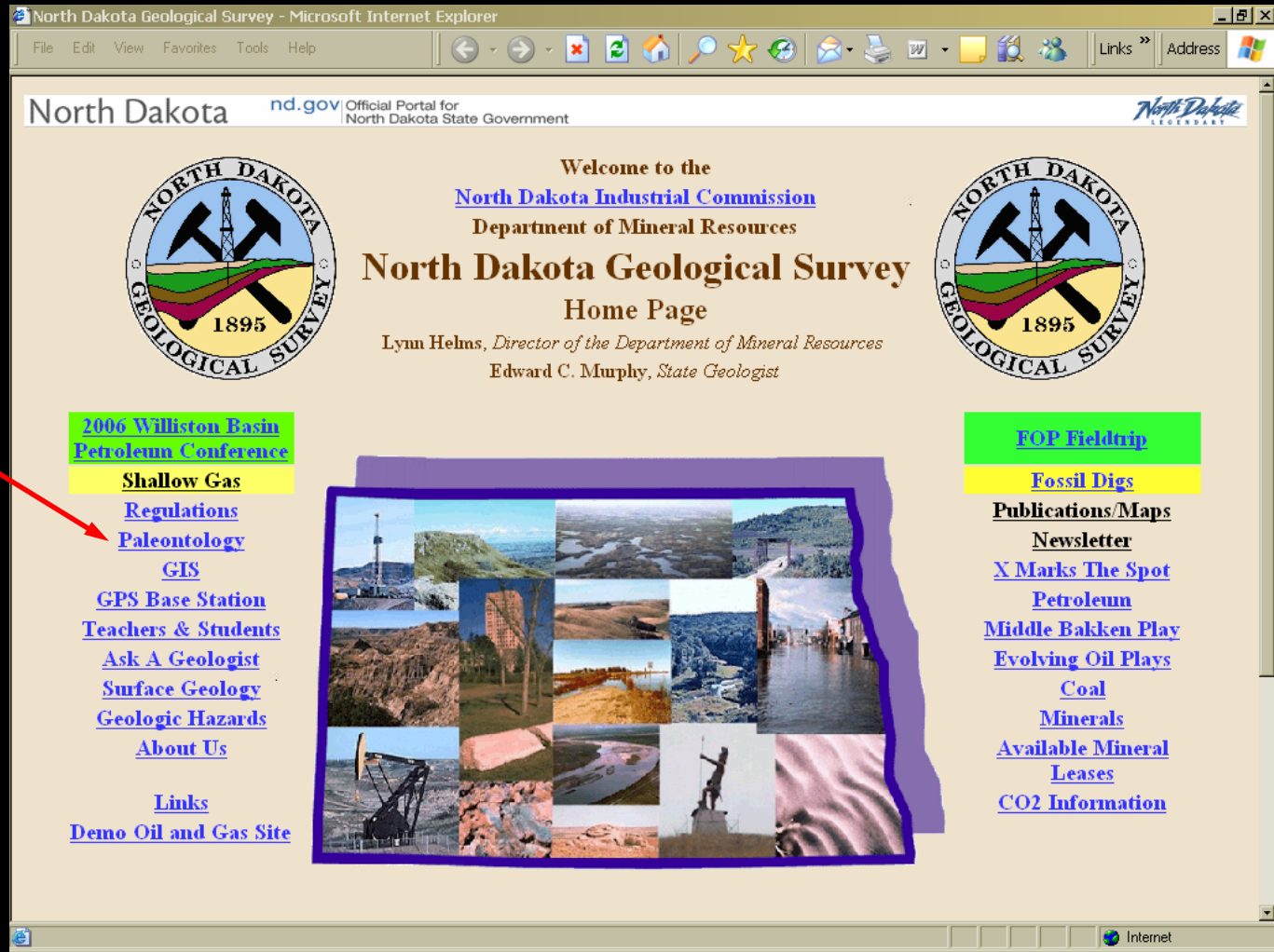
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# NDGS Web Page

- Link to Shallow Gas Project Page



<http://www.state.nd.us/ndgs/>



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# ND Shallow Gas Project Page

SHALLOW NATURAL GAS OCCURRENCES IN NORTH DAKOTA

The North Dakota Geological Survey, a division of the North Dakota Department of Mineral Resources, is conducting an assessment of the Shallow Natural Gas Resource Potential of North Dakota.

A valuable component of the research portion of this investigation is the collection of anecdotal information about occurrences of shallow natural gas across the state. This anecdotal information may be in the form of a story or personal account of gas emanating from a well, or gas encountered while digging or drilling a private residential or farm well, or while conducting general excavation.

Your story may be very significant! We would encourage you to share your story with us by way of this website page and link. Simply click on the submit your story link below and send us an email message with your story or other information. Individual submissions will be reviewed by the geological staff of the Survey for inclusion into the North Dakota Geological Survey Online Database of Shallow Natural Gas Occurrences in North Dakota that will be available soon on this website.

Please include your contact information with your submittals so that our staff can follow-up with you on a one-on-one basis. We look forward to hearing your stories. Perhaps it will be your story that leads to the next great shallow natural gas discovery in our state!

**Please click on the submit your story link to email your information to us.**

Thank you!

[Shallow Natural Gas Stories](#)

Read and Submit  
your Shallow Gas  
Story



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# Further questions to be answered

- In what geologic framework is gas being generated and/or accumulated?
- What is the timing associated with initial gas generation and/or the rates of gas generation?
- What are the underlying and overlying structural conditions influencing generation, migration, and accumulation?



# Some Potential Indicators for Exploration

- Direct Detection of Methane in Shallow Wells

Observation

Stock

Water Supply (private and municipal)

- Ground-water Geochemistry

Sulfate and Bicarbonate

Others?



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# NORTH DAKOTA GEOLOGICAL SURVEY

North Dakota Department of Mineral Resources  
and Geological Survey Division Main Offices

<http://www.state.nd.us/ndgs/>



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Mailing Address: 600 East Boulevard Avenue, Bismarck ND 58505-0840  
Telephone: (701) 328-8000 FAX: (701) 328-8010

## The Wilson M. Laird Core & Sample Library



P.O. Box 8156 University Station  
Grand Forks, ND 58202  
Telephone: (701) 777-2231  
FAX: (701) 777-2857

## North Dakota Geological Survey Paleontology Lab



Street Address: 612 East Boulevard Avenue, Bismarck, ND 58505-0830  
Mailing Address: 600 East Boulevard Avenue, Bismarck ND 58505-0840  
Telephone: (701) 328-8000  
FAX: (701) 328-8010

Email Contact: [fjanderson@nd.gov](mailto:fjanderson@nd.gov)



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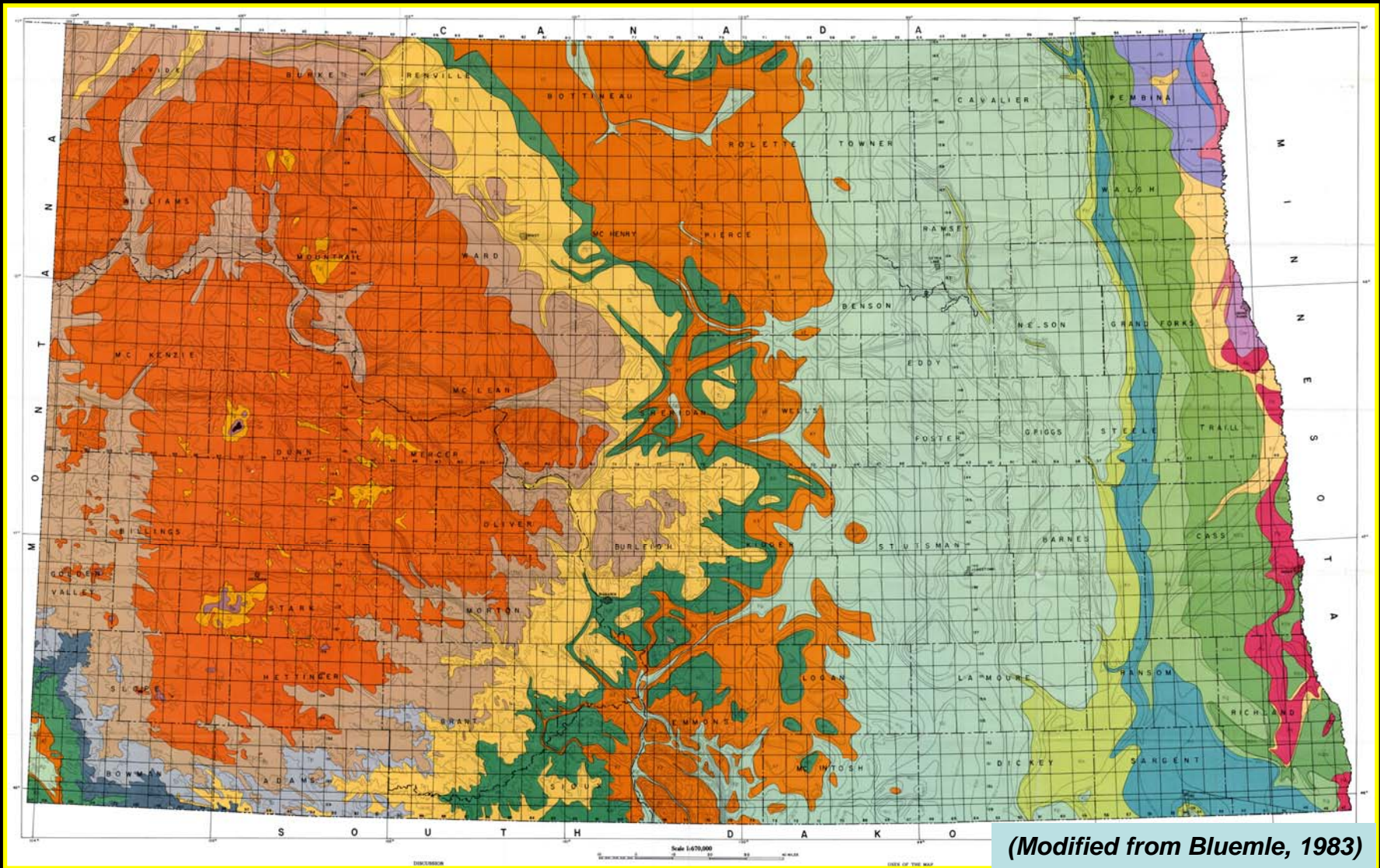
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# Subsurface Geologic Map of North Dakota



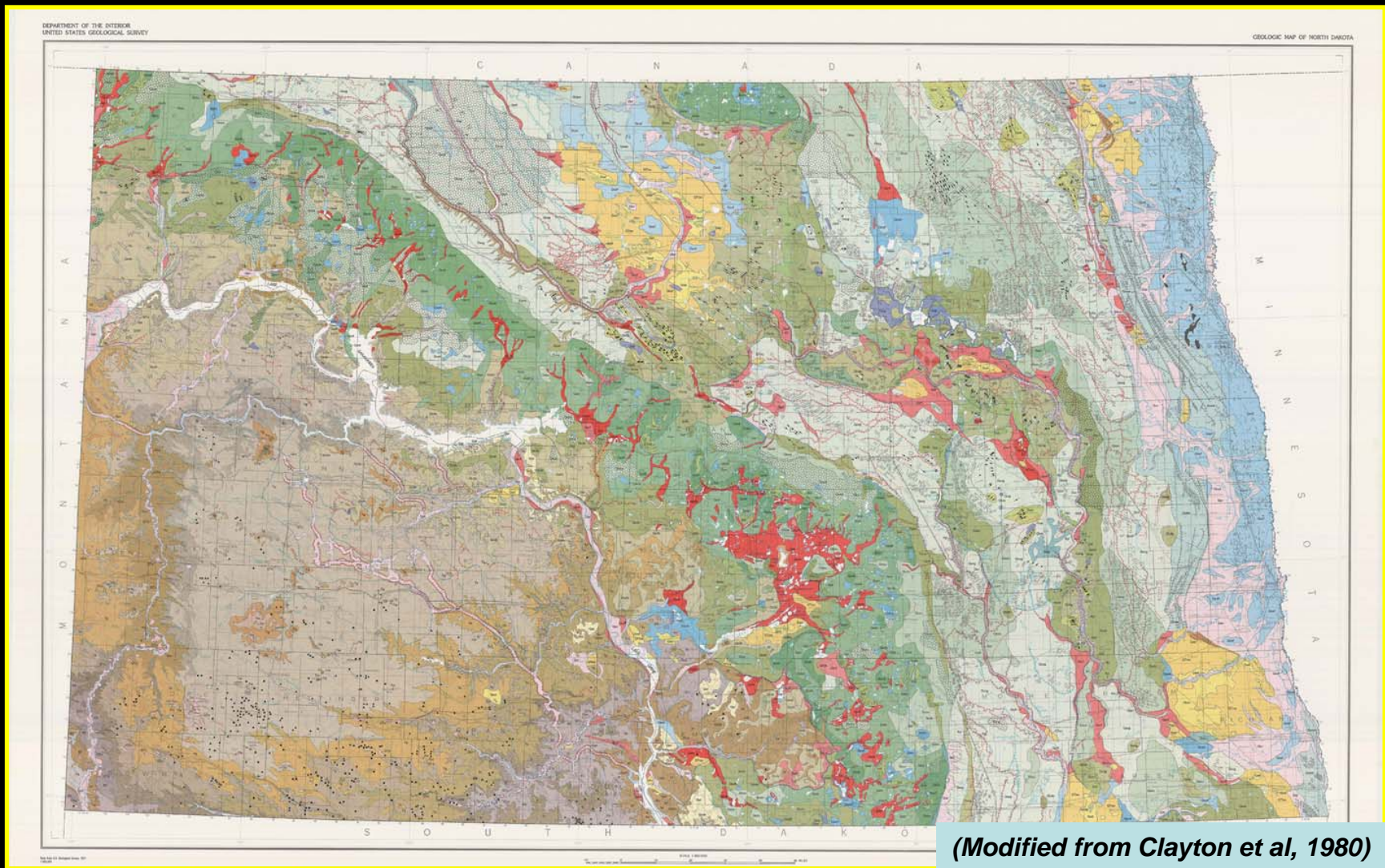
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# Surface Geologic Map of North Dakota



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