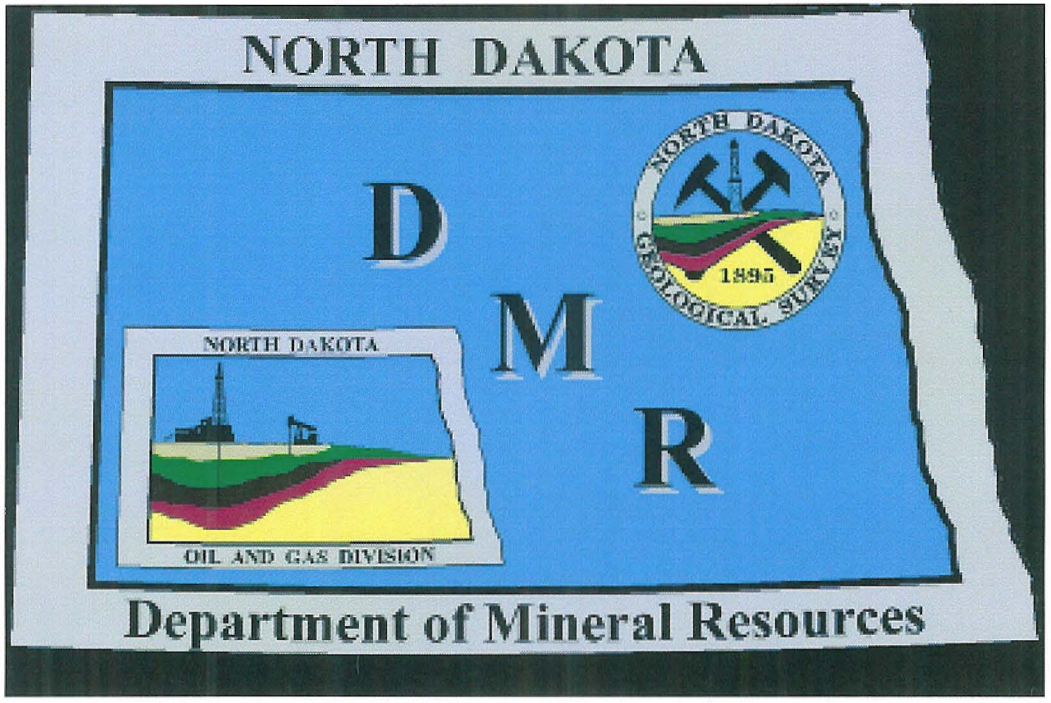
North Dakota Department of Mineral Resources

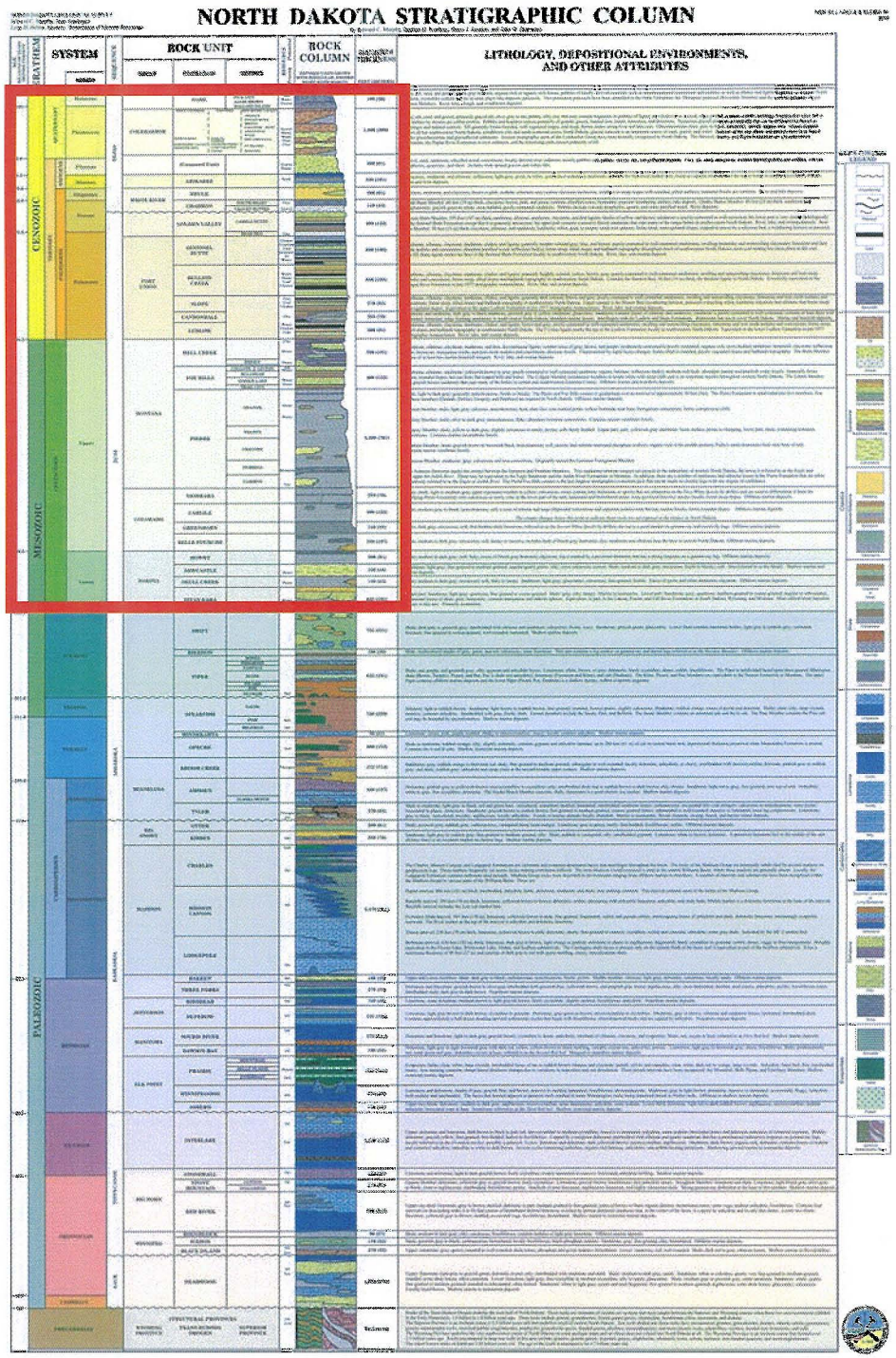


http://www.oilgas.nd.gov ***http://www.state.nd.us/ndgs***

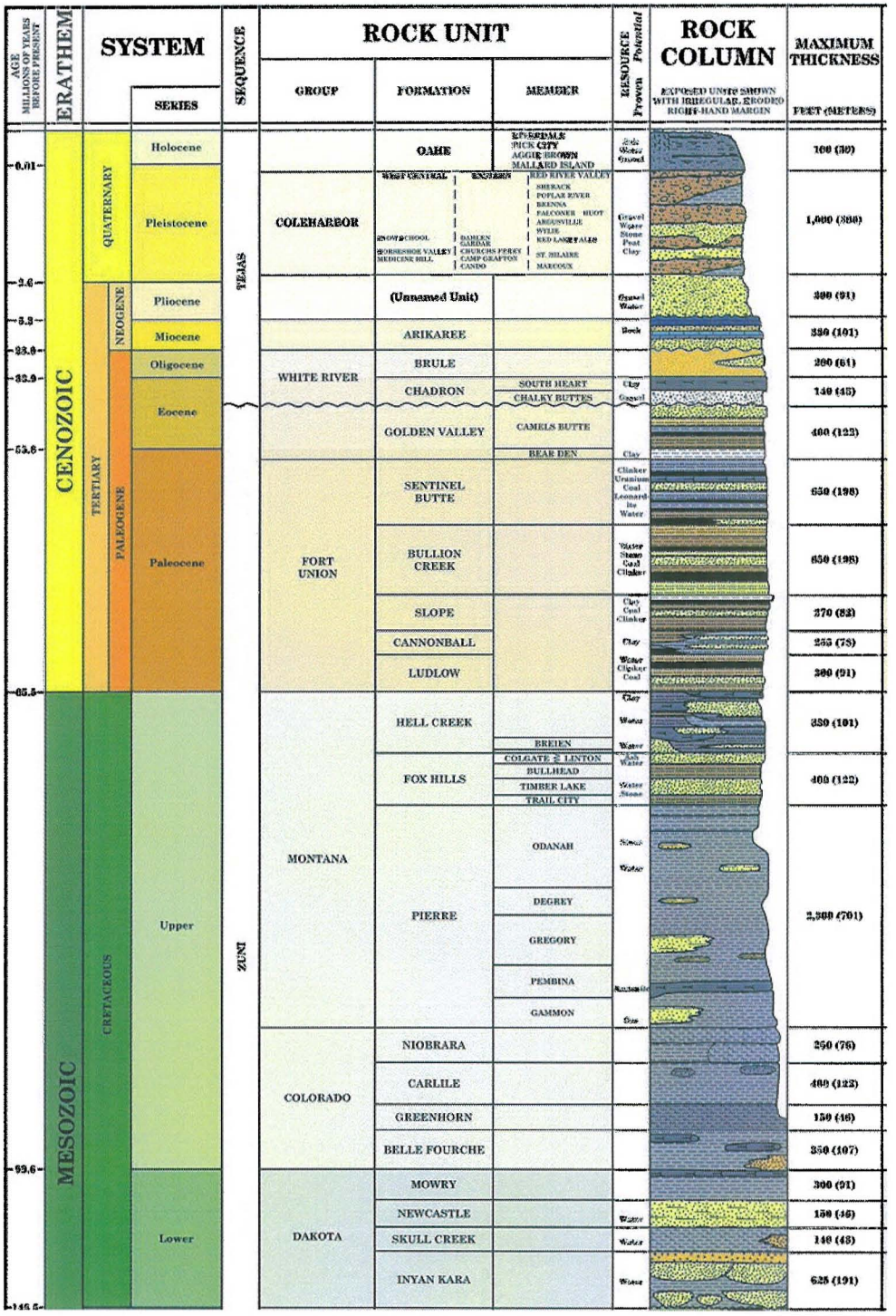
600 East Boulevard Ave. - Dept 405
Bismarck, ND 58505-0840
(701) 328-8020 (701) 328-8000

APPENDIX F

Shallow Gas Interval



Glacial


AGE MILLIONS OF YEARS BEFORE PRESENT
ERATHEM
SYSTEM
SERIES
SEQUENCE
ROCK UNIT
GROUP
FORMATION
MEMBER
RESOURCE Potential
ROCK COLUMN
EXPOSED UNITS SHOWN WITH IRREGULAR, ERODED RIGHT-HAND MARGIN
MAXIMUM THICKNESS
FEET (METERS)
CENOZOIC
MESOZOIC
QUATERNARY
TERTIARY
NEOGENE
PALEOGENE
CRETACEOUS
Holocene
Pleistocene
Pliocene
Miocene
Oligocene
Eocene
Paleocene
Upper
Lower
TEXAS
ZUNI
0.01
2.6
5.3
23.8
33.9
55.8
65.5
99.6
146.5
OAHE
EDGELEY
PICK CITY
AGGIE BROWN
MALLARD ISLAND
COLEHARBOR
WESTCENTRAL
EASTERN
RED RIVER VALLEY
SHEYENNE
POPLAR RIVER
BRENNA
FALCONER HUOT
ARGUSVILLE
WYLIE
RED LAKE FALLS
SNOW SCHOOL
HORSESHOE VALLEY
MEDICINE HILL
BADLEN GARDAR
CHURCHS FERRY
CAMP GRAFTON
CANDO
ST. HILAIRE
MARCOUX
(Unnamed Unit)
ARIKAREE
WHITE RIVER
BRULE
CHADRON
SOUTH HEART
CHALKY BUTTES
GOLDEN VALLEY
CAMELS BUTTE
BEAR DEN
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BULLION CREEK
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CANNONBALL
LUDLOW
MONTANA
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BREIEN
COLGATE & LINTON
FOX HILLS
BULLHEAD
TIMBER LAKE
TRAIL CITY
PIERRE
ODANAH
DEGREY
GREGORY
PEMBINA
GAMMON
COLORADO
NIOBRARA
CARLILE
GREENHORN
BELLE FOURCHE
DAKOTA
MOWRY
NEWCASTLE
SKULL CREEK
INYAN KARA
100 (30)
1,000 (305)
300 (91)
350 (107)
200 (61)
140 (43)
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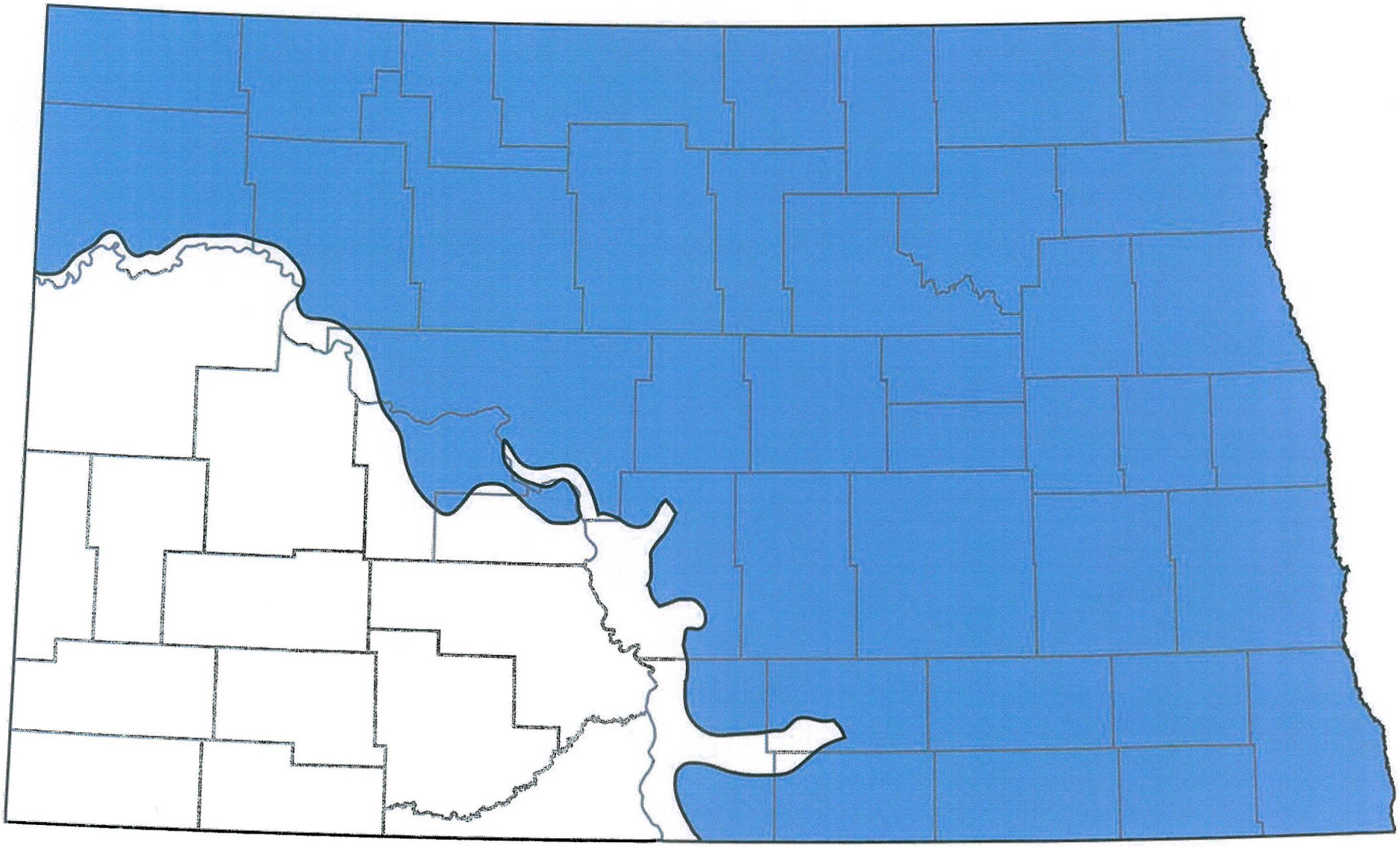
140 (43)
625 (191)

GLACIAL DEPOSITS IN NORTH DAKOTA



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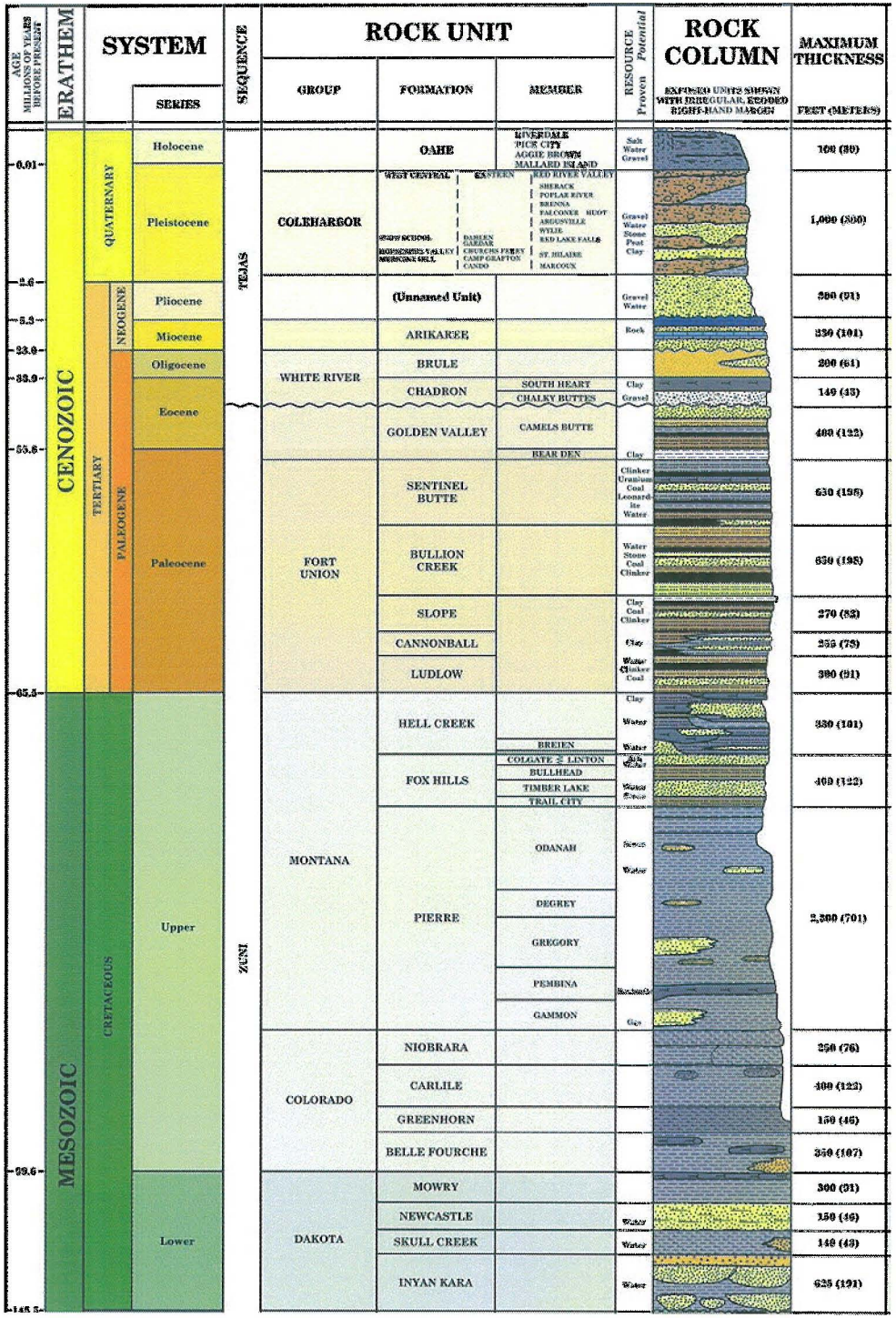
AGE MILLIONS OF YEARS BEFORE PRESENT
ERATHEM
SYSTEM
SERIES
SEQUENCE
ROCK UNIT
GROUP
FORMATION
MEMBER
RESOURCE Proven Potential
ROCK COLUMN
EXPOSED UNITS SHOWN WITH IRREGULAR, ECODED RIGHT-HAND MARGIN
MAXIMUM THICKNESS
FEET (METERS)
0.01
2.6
5.3
23.0
33.9
55.8
65.5
99.6
145.5
CENOZOIC
MESOZOIC
QUATERNARY
TERTIARY
NEOGENE
PALEOGENE
CRETACEOUS
Holocene
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Upper
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TEJAS
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SHERACK
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BRENNA
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HIDOT
ARGUSVILLE
WYLIE
RED LAKE FALLS
ST. HILAIRE
MARCOUX
DARIEN
GARDAR
CHURCHS FERRY
CAMP CLIFTON
CANDO
(Unnamed Unit)
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CARLILE
GREENHORN
BELLE FOURCHE
DAKOTA
MOWRY
NEWCASTLE
SKULL CREEK
INYAN KARA
Salt Water Gravel
Gravel Water Stone Peat Clay
Gravel Water
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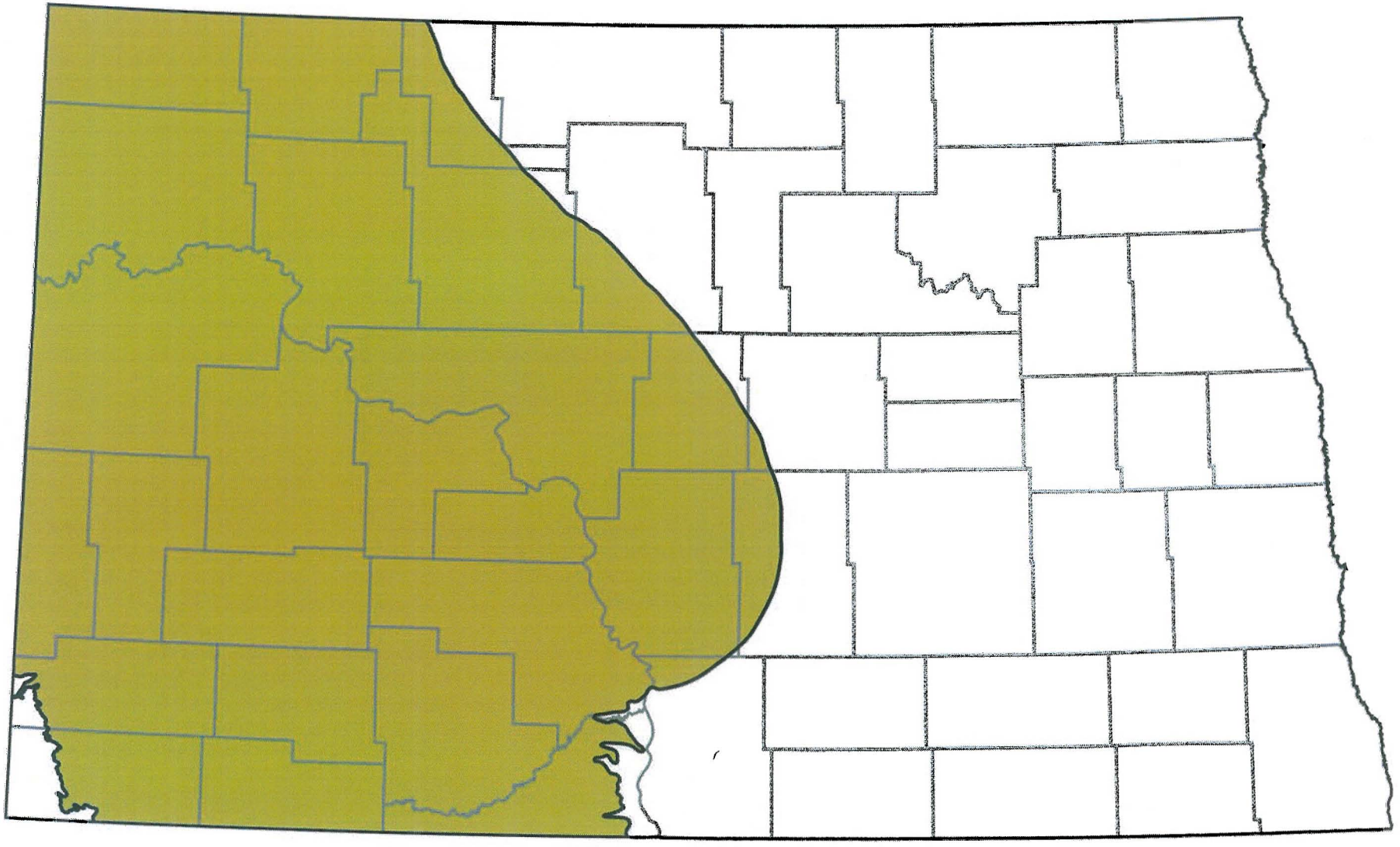
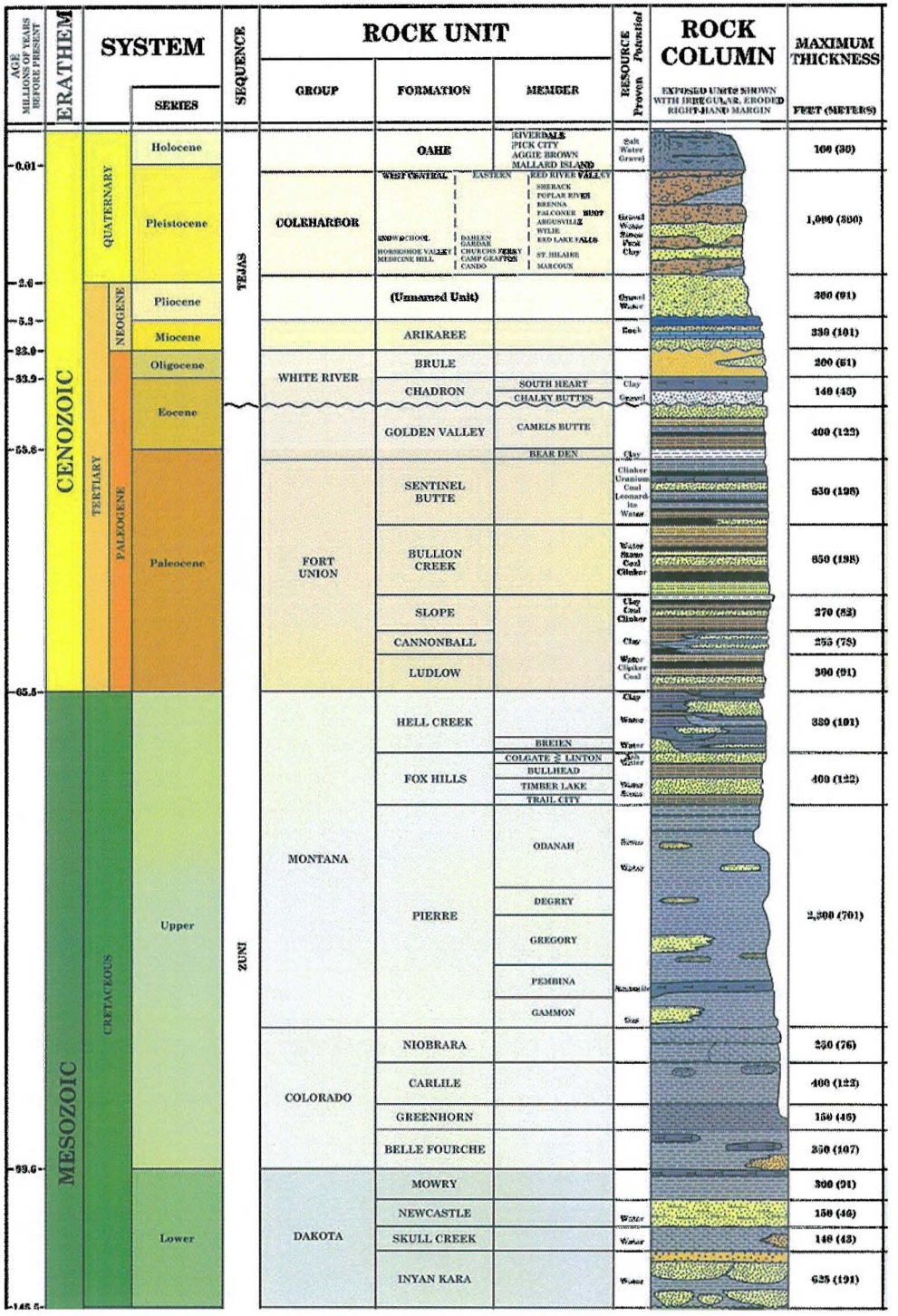
COAL DEPOSITS IN NORTH DAKOTA



Shale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ROCK COLUMN
EXPOSED UNITS SHOWN WITH IRREGULAR, ERODED RIGHT-HAND MARGIN
MAXIMUM THICKNESS
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MOWRY
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SKULL CREEK
INYAN KARA
Salt Water Gravel
Gravel Water Brown Pick Clay
Gravel Water
Rock
Clay
Gravel
Clinker Uranium Coal Leonard ite Water
Water Stone Coal Clinker
Clay Coal Clinker
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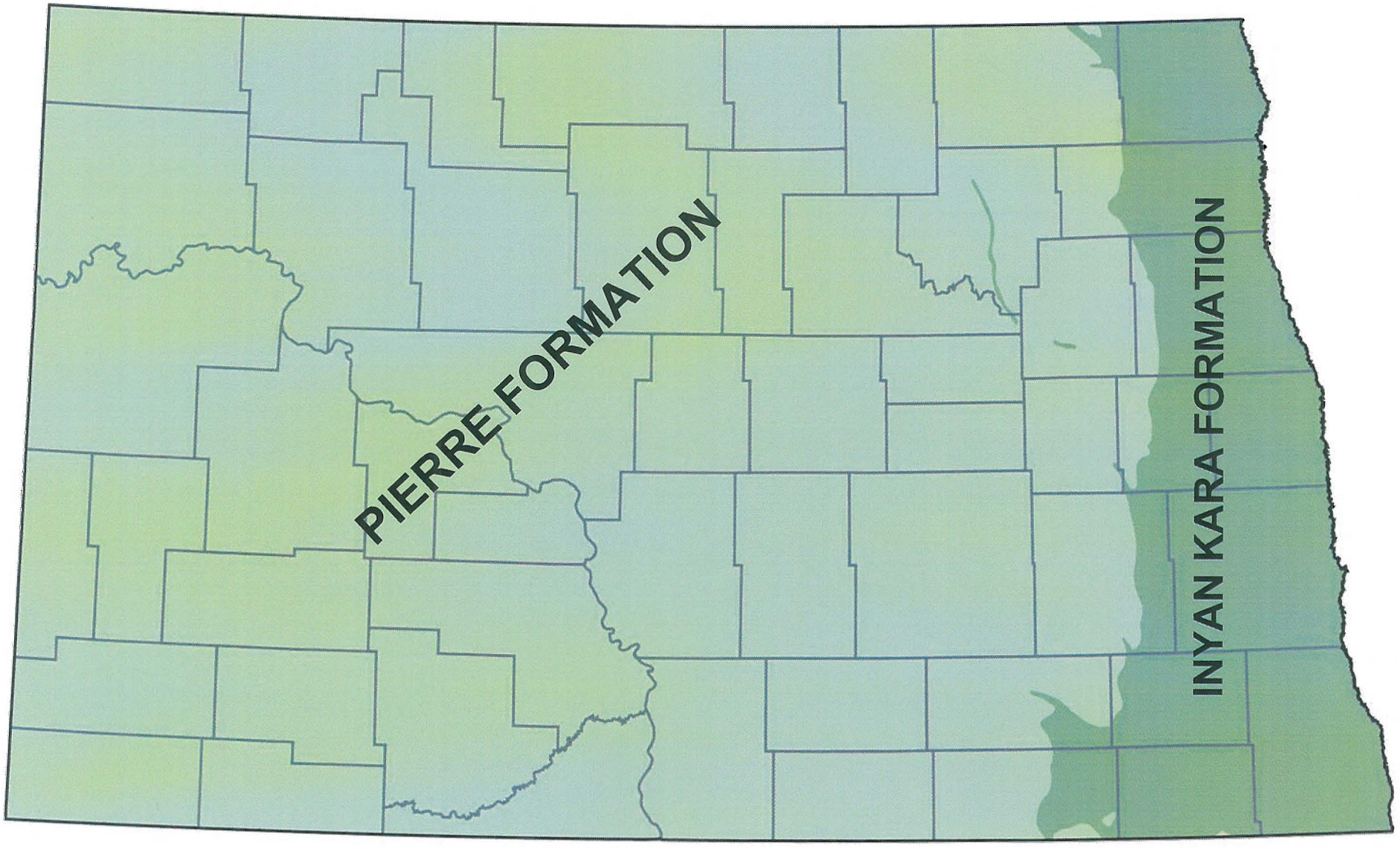
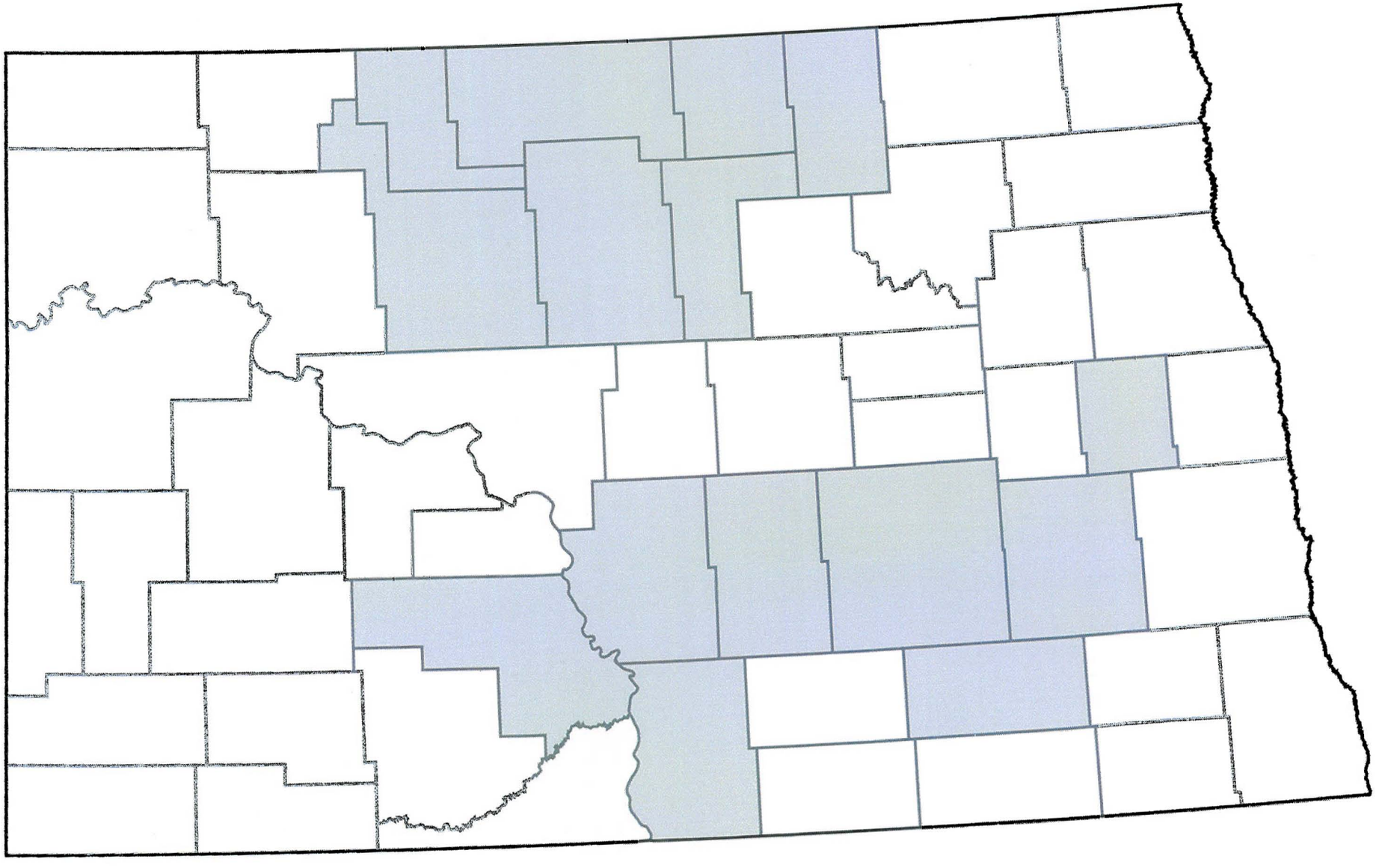
625 (191)

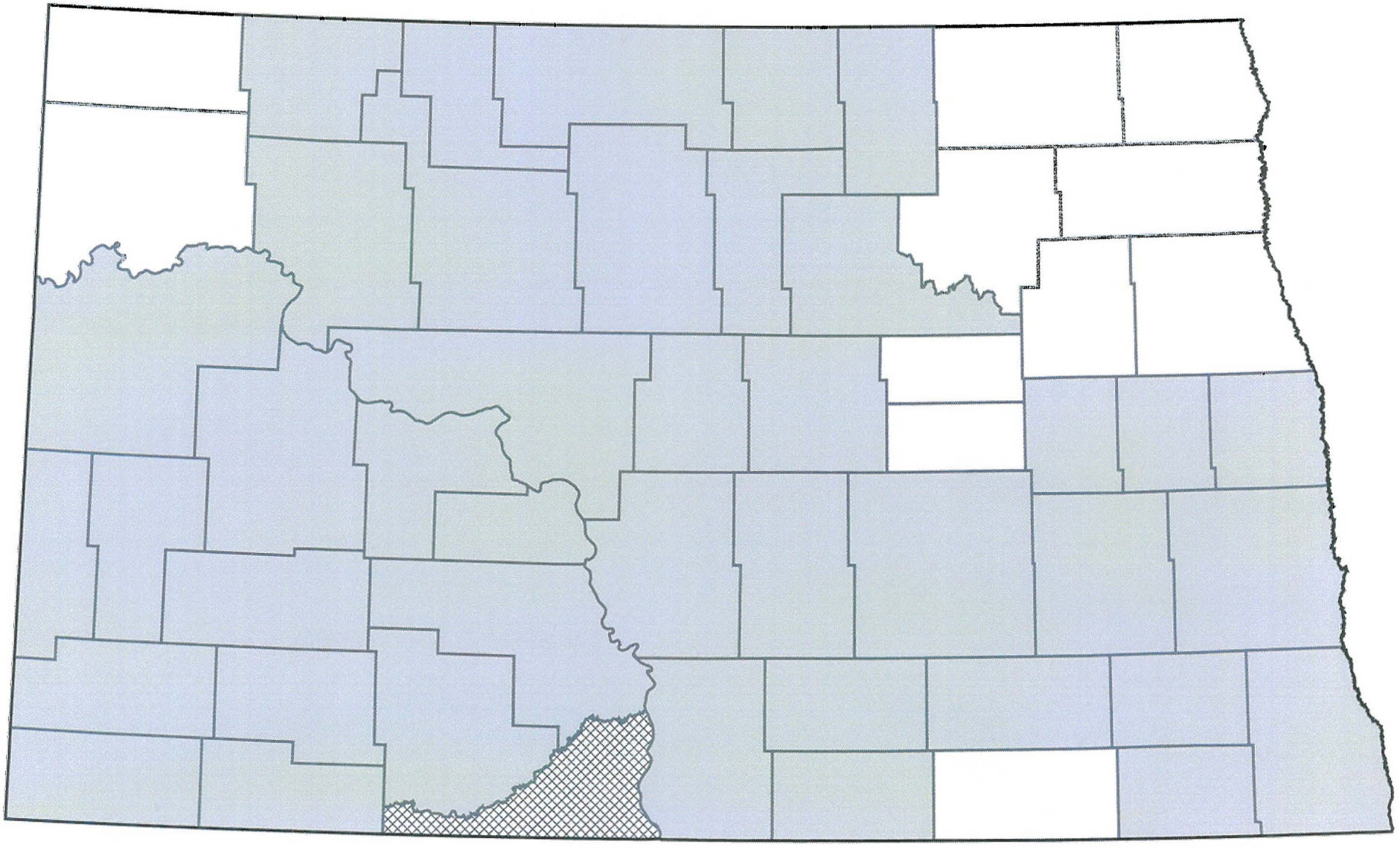
EXTENT OF CRETACEOUS SHALES IN NORTH DAKOTA



GEOLOGICAL SURVEY SHALLOW GAS MONITORING PROGRAM
2006-2008



GEOLOGICAL SURVEY SHALLOW GAS MONITORING PROGRAM
2006-2009

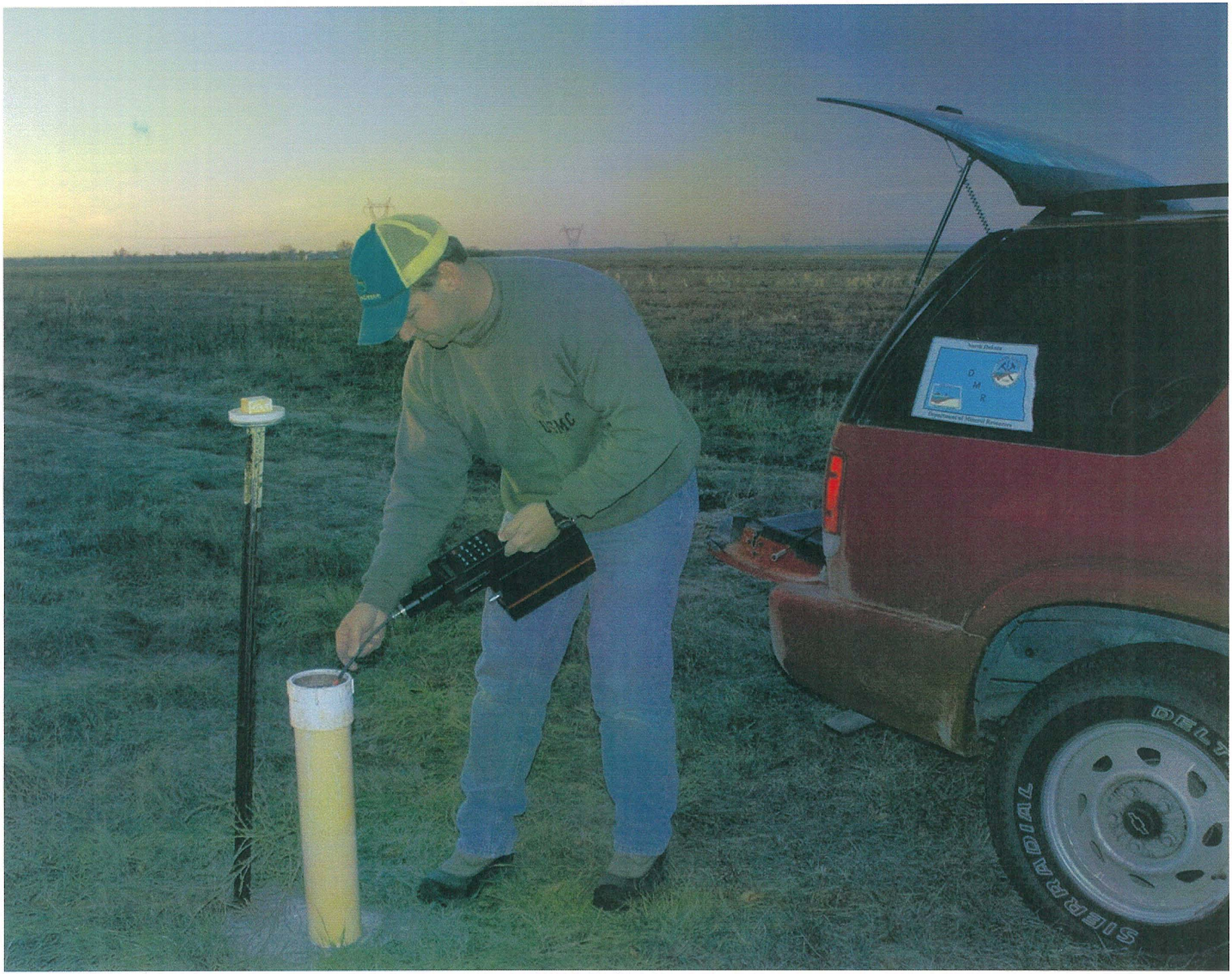


SHALLOW GAS STUDY

- We have investigated 5,238 well sites

- We found 2,628 monitoring wells

  535 of those wells had a positive response for methane.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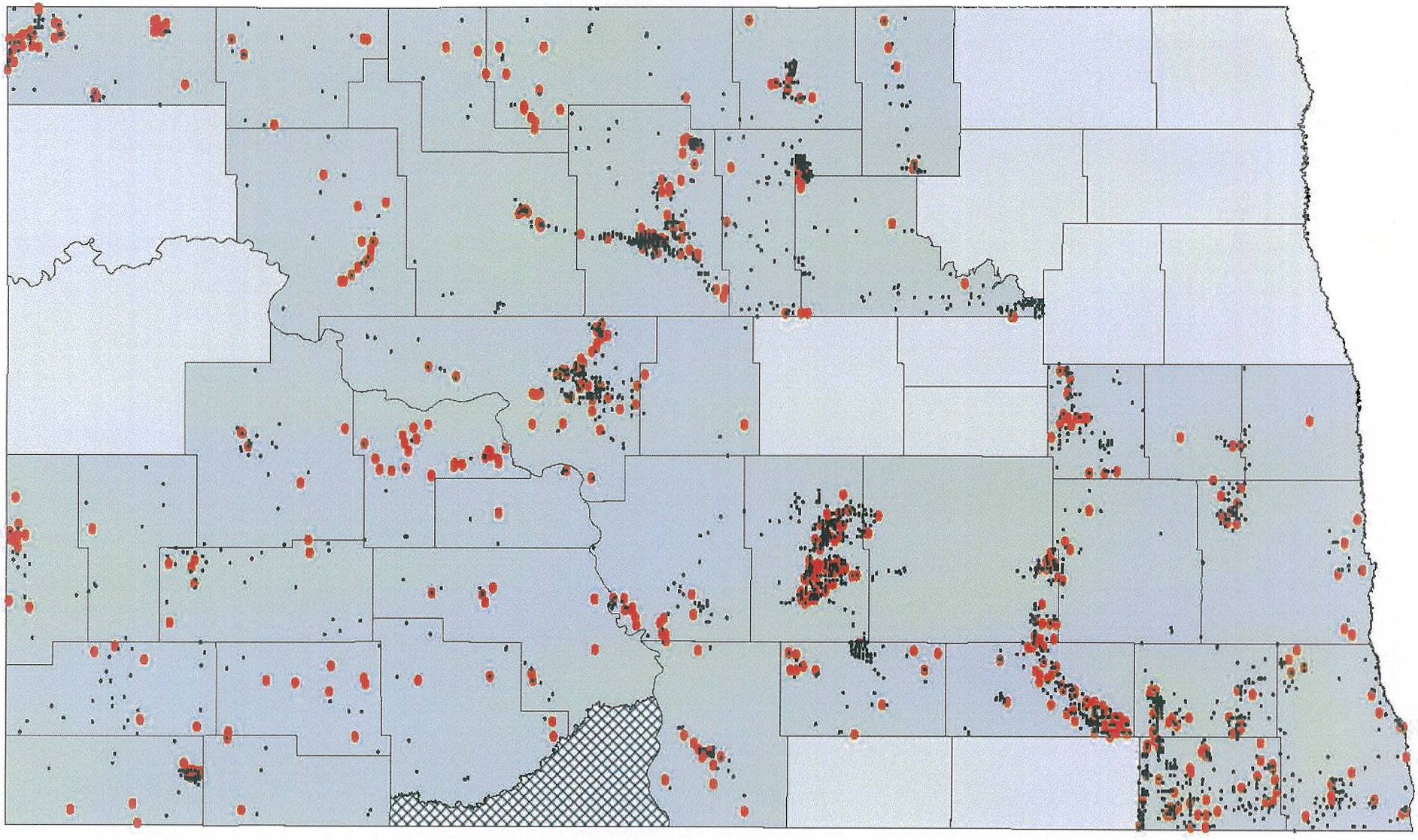
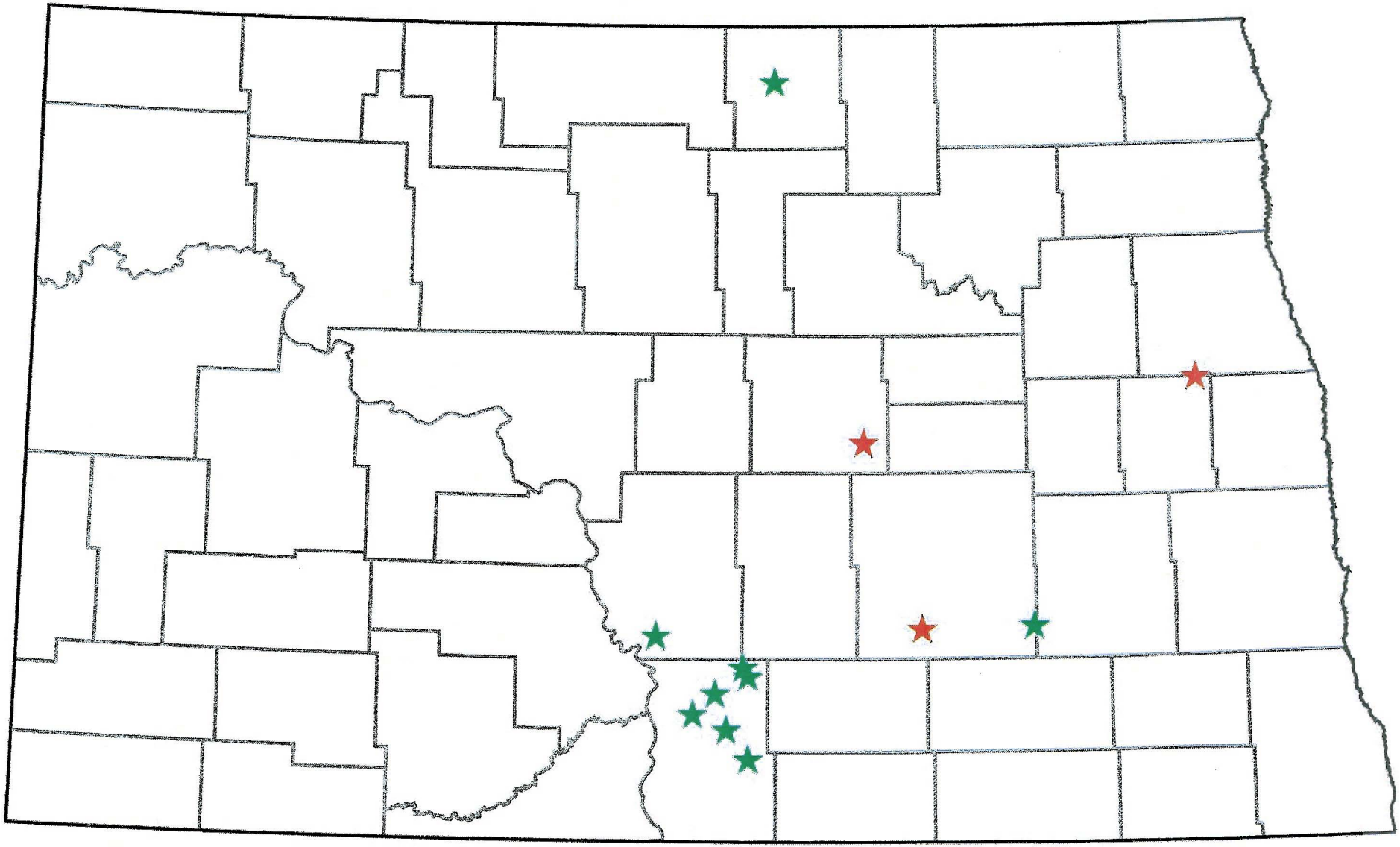
R
SIERRA RADIAL

GEOLOGICAL SURVEY SHALLOW GAS MONITORING PROGRAM
2006-2009



- Monitoring Wells -- no methane
- Monitoring Wells -- methane

SHALLOW GAS WELLS DRILLED IN NORTH DAKOTA EAST OF THE MISSOURI RIVER



Wells drilled prior to July 2003

Wells drilled after July 2003

Gas flair from sandstone at a depth of 250 feet near Mohall in the early 1920s.