NORTH DAKOTA GEOLOGICAL SURVEY

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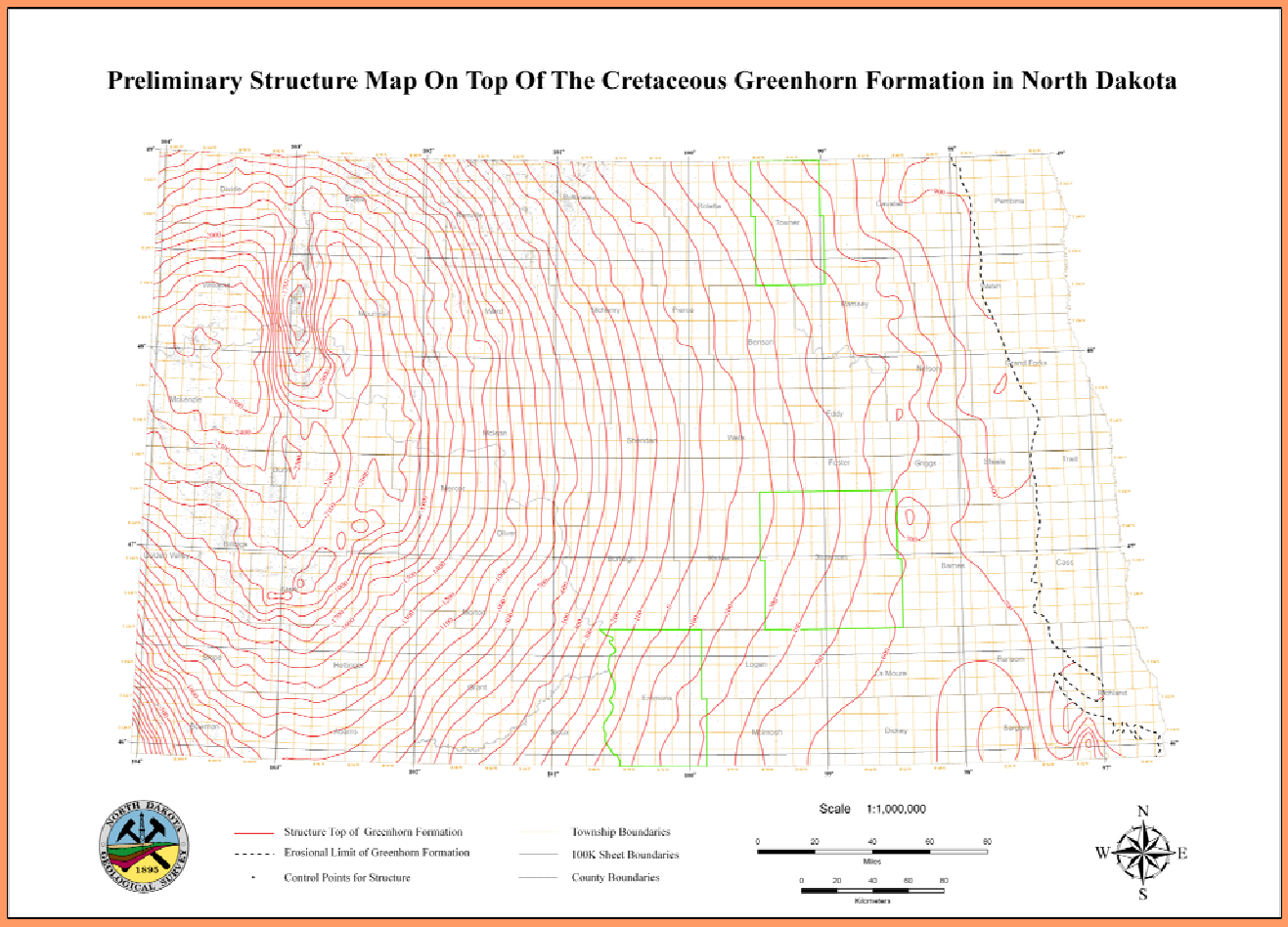
NORTH DAKOTA DMR Department of Mineral Resources

ASSESSMENT OF POTENTIAL SHALLOW GAS RESOURCES IN NORTH DAKOTA



Preliminary Structure Contour Map on the Cretaceous Greenhorn Formation in North Dakota

NDGS GEOLOGICAL INVESTIGATIONS NO. 26 (GI-26)

The North Dakota Geological Survey is conducting an assessment of potential shallow natural gas resources in North Dakota that is currently focused on providing a contemporary interpretation of Cretaceous and upper Jurassic stratigraphy including the Greenhorn, Mowry, Inyan Kara, Swift, and Rierdon Formations. GI-26 desc -cribes the recently completed activites conducted by the NDGS and explains the methodology and additional aspects of investigative and stratigraphic work that is planned. A type log from the Tachenko No. 1-15-4A is included which illustrates several examples of the typical log characteristic used in the picking of stratirgraphic tops in the Williston Basin by ND Oil and Gas Division geologists.

North Dakota Deparment of Mineral Resources
Lynn D. Helms, Director

NDGS Fact Sheet GI-26
June 2006

North Dakota Geological Survey
Edward C. Murphy, State Geologist

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Authors: Anderson, F.J., and Juenker, B.J.

North Dakota Department of Mineral Resources
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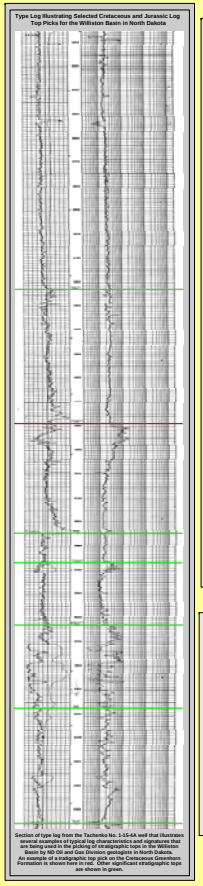
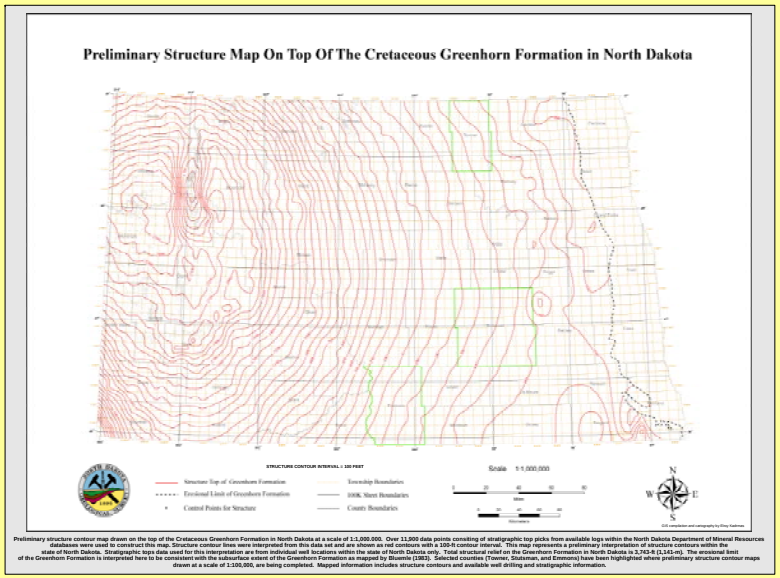
ASSESSMENT OF POTENTIAL SHALLOW NATURAL GAS RESOURCES IN NORTH DAKOTA

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



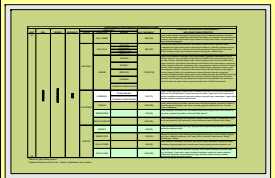
Section of type log from the Tschetka No. 1-01-4A well that illustrates several examples of typical log characteristics and signatures that are being used in the picking of stratigraphic tops in the Williston Basin by ND Oil and Gas Division geologists in North Dakota. An example of a stratigraphic top pick on the Cretaceous Greenhorn Formation is shown here in red. Other significant stratigraphic tops are shown in green.



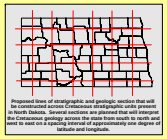
Preliminary structure contour map drawn on the top of the Cretaceous Greenhorn Formation in North Dakota at a scale of 1:1,000,000. Over 11,000 data points consiting of stratigraphic top picks from available logs within the North Dakota Department of Mineral Resources databases were used to construct this map. Structure contour lines were interpreted from this data set and are shown as red contours with a 100-ft contour interval. This map represents a preliminary interpretation of structure contours within the state of North Dakota. Stratigraphic tops data used for this interpretation are from individual well locations within the state of North Dakota only. Total structural relief on the Greenhorn Formation in North Dakota is 3,743-ft (1,141-m). The erosional limit of the Greenhorn Formation is interpreted here to be consistent with the subsurface extent of the Greenhorn Formation as mapped by Bluemle (1983). Selected counties (Towner, Stutsman, and Emmons) have been highlighted where preliminary structure contour maps drawn at a scale of 1:100,000, are being completed. Mapped information includes structure contours and available well drilling and stratigraphic information.

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.
- QI 2007 - Survey plans to complete several stratagraphic cross-sections and Geologic log sections on the Cretaceous across North Dakota.



Cretaceous stratigraphic unit nomenclature of North Dakota as modified from Bluemle et. al. (1986) which incorporates the Cretaceous stratigraphic members as described by Reiskind (1986). The Greenhorn, Mowry, and Inyan Kara Formations are planned to have a contemporary stuctural interpretation completed by the Survey. Structure contour and corresponding isopach maps are planned for completion in 2006. Studies of the shallow gas potential of the Niobrara Formation in North Dakota are also planned.



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 intergret 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.

STRATIGRAPHIC UNITS TO BE EVALUATED

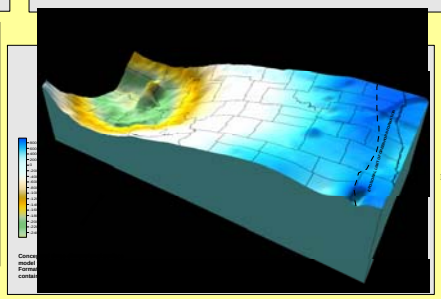
Kg	GREENHORN FORMATION (CRETACEOUS)
Km	MOWRY FORMATION (CRETACEOUS)
Ki	INYAN KARA FORMATION (CRETACEOUS)
Js	SWIFT FORMATION (JURASSIC)
Jr	RIERDON FORMATION (JURASSIC)

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.

NDGS SHALLOW GAS PROJECT WEB PAGE

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.



Fred J. Anderson and Bruce J. Juenker

2006

North Dakota Geological Survey Geological Investigation No. 26 (GI-26) is a large format poster size publication that is available for download and viewing from the NDGS website at: http://www.state.nd.us/ndgs/Shallowgas or as a hardcopy poster from the NDGS publications department.

- Key Contacts: Fred Anderson, Geologist
  North Dakota Geological Survey
  (701) 328-8000
  jfjanderson@nd.gov
- Office Location: North Dakota Geological Survey
  1016 East Calgary Avenue
  Bismarck, ND 58503
- Mailing Address: North Dakota Geological Survey
  600 East Boulevard
  Bismarck, ND 58505-0840