U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Fort Union Trading Post National Historic Site

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Fort Union Trading Post National Historic Site

fous_geology.pdf

Version: Sept 2011

Geologic Resources Inventory Map Document for Fort Union Trading Post National Historic Site

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Geologic Resources Inventory Map Document

Fort Union Trading Post National Historic Site, Montana and North Dakota

Document to Accompany Digital Geologic-GIS Data

fous_geology.pdf

Version: Sept 2011

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Fort Union Trading Post National Historic Site, Montana and North Dakota (FOUS).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

For information about the status of GRI digital geologic-GIS data for a park contact:

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About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage http://www.nature.nps.gov/geology/inventory/gre_publications.cfm

GRI geologic-GIS data is also available online at the NPS Natural Resource Information Reference Search Application: http://irma.nps.gov/App/Reference/Search. To find GRI data for a specific park or

parks select the appropriate park(s), enter “GRI” as a Search Text term, and then select the Search Button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: http://www.nature.nps.gov/geology/inventory, or contact:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division.

GRI Digital Map and Source Map Citations

The GRI digital geologic-GIS map for Fort Union Trading Post National Historic Site, Montana and North Dakota (FOUS):

GRI Digital Geologic Map of Fort Union National Historic Site, Montana and North Dakota (*GRI MapCode FOUS*)

Source maps,

Bergantino, R.N., Wilde, E.M., 1998, Geologic Map of the Culbertson 30' x 60' Quadrangle (bedrock emphasis), Northeastern Montana (revised 2007), Montana Bureau of Mines and Geology, Open-File Report 359, 5 p., 1 sheet(s), 1:100,000 scale. (Culbertson 30 x 60). (*GRI Source Map ID 34732*).

***Only data for the Bainville SE 7.5' quadrangle was used in the GRI digital geologic map.*

The data is available through the Montana Bureau of Mines and Geology on-line publication catalog; http://www.mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=11208&

Vuke, S.M., Wilde, E.M., Smith, L.N., 2003, Geologic and Structure Contour Map of the Sidney 30' x 60' Quadrangle, Eastern Montana and Adjacent North Dakota (map revised 2011), Montana Bureau of Mines and Geology, Open-File Report OFR MBMG-478, 1:100,000 scale. (Sidney 30 x 60). (*GRI Source Map ID 60183*).

***Only data for the Dore 7.5' quadrangle was used in the GRI digital geologic map.*

Map revised September 2011 by Susan Vuke, Montana Bureau of Mines and Geology. The revisions occurred in the area of the Fort Union Trading Post and the Culbertson-Sidney quadrangle boundary.

The data is available through the Montana Bureau of Mines and Geology on-line publication catalog; *http://www.mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=11349&*

Additional information pertaining to each source map is also presented in the Source Map Information (FOUSMAP) table included with the GRI geology-GIS data.

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Fort Union Trading Post National Historic Site, Montana and North Dakota (FOUS) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium), and listed from youngest to oldest. Information about each geologic unit is also presented in the Geologic Unit Information (UNIT) table included with the GRI geology-GIS data.

Cenozoic Era

Quaternary Period
Qal - Alluvium (Qal)
Qac - Alluvium and colluvium (Qac)
Qat - Alluvial terrace deposit (Qat)
Qgt - Glacial till (Qgt)

Tertiary Period
Tfsb - Fort Union Formation, Sentinel Butte Member (Tfsb)
Tftr - Fort Union Formation, Tongue River Member (Tftr)

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below.

Qal - Alluvium (Holocene)

Qal - Alluvium (Holocene)
Deposits of gravel, sand, silt or clay on flood plains. *GRI Source Map ID 34732* (Culbertson 30 x 60).

Qal - Alluvium (Holocene)
Light-brown, yellowish-brown, grayish-brown, brown, olive, gray, and light-gray gravel, sand, silt, and clay deposited in stream and river channels and on flood plains. Gravel clasts poorly to well sorted and as much as 2 ft in diameter. Deposits poorly to well stratified. Thickness generally less than 20 ft, but locally as much as 40 ft. *GRI Source Map ID 60183* (Sidney 30 x 60).

Qac - Alluvium and colluvium (Holocene)

Qac - Alluvium-colluvium (Quaternary)
Deposits in alluvial fans, on alluvial terraces, also may include glacial outwash. *GRI Source Map ID 34732* (Culbertson 30 x 60).

Qac - Alluvium and colluvium, undivided (Holocene)
Dominantly sand, silt, and clay in glacial meltwater channels. Color reflects that of older Quaternary and Tertiary units from which it was derived. May locally overlie glacial outwash deposits. Thickness not determined. *GRI Source Map ID 60183* (Sidney 30 x 60).

Qat - Alluvial terrace deposit (Holocene and Pleistocene)

Light-brown, grayish-brown, and light-gray gravel, sand, and silt in terrace remnants at elevations ranging from 5 to 360 ft above modern rivers and streams. Gravel clasts generally well sorted and dominantly well rounded. Deposits poorly to well stratified. Thickness generally less than 20 ft. *GRI Source Map ID 60183* (Sidney 30 x 60).

Qgt - Glacial till (Pleistocene)

Heterogeneous mixture of light-brown, grayish-brown, and light-gray clay, silt, sand, and gravel with rare to abundant cobbles and boulders. Locally contains lenses and stringers of moderately well sorted clay, silt, sand, or gravel. Thickness generally less than 30 ft, but as much as 100 ft. *GRI Source Map ID 60183* (Sidney 30 x 60).

Tfsb - Fort Union Formation, Sentinel Butte Member (Paleocene)

Tfsb - Fort Union Formation, Sentinel Butte Member (Paleocene)
The contact between the Tongue River Member and Sentinel Butte Member is exposed for a few miles on either side of the Montana-North Dakota border on both sides of the Missouri River. Test wells drilled in Divide and Williams Counties, North Dakota (see Hanson, 1967), however, provide enough control

points to draw this contract as approximate in that area. Between the area of outcrop and these control points the contact was derived by use of structure contours. The contact is shown as approximate except near the Missouri River. *GRI Source Map ID 34732* (Culbertson 30 x 60).

Tfsb - Fort Union Formation, Sentinel Butte Member (Paleocene)
Dark-gray shale locally underlain by orangish brown or brown, iron oxide-stained, cross-bedded channel sandstone with medium- to coarse-grained, angular to subangular, poorly sorted clasts. Channel bases display scour features including abundant rip-up clasts. Gray or grayish-brown, poorly resistant mudstone about 20 ft thick underlies the sandstone locally. Prominent coal beds are present near the base of the member in most areas. Upper part of member removed by erosion. Thickness of about 300 ft exposed in map area. *GRI Source Map ID 60183* (Sidney 30 x 60).

Tftr - Fort Union Formation, Tongue River Member (Paleocene)

Tftr - Fort Union Formation, Tongue River Member (Palocene)
The Tongue River Member has been extensively evaluated for coal resources especially on the Fort Peck Indian Reservation; consequently its contact with the Lebo Member is better delimited than that between the Lebo and Tullock members. Nevertheless, the Tongue River-Lebo contact is shown on this map as approximate only. Maximum thickness is about 250 meters (800 ft). *GRI Source Map ID 34732* (Culbertson 30 x 60).

Tftr - Fort Union Formation, Tongue River Member (Paleocene)
Yellow, orange, or tan, fine- to medium-grained sandstone and thinner interbeds of yellowish-brown, orange, or tan siltstone and light-colored mudstone and clay. Clay dominantly nonswelling. Contains several prominent lignite beds (Mathews, 1989a, b, c, and d). Member generally poorly cemented and weathers to badland topography, but some relatively resistant sandstone beds form caprocks. Locally contains silicified wood, freshwater mollusks, and plant molds. Thickness 850 ft. *GRI Source Map ID 60183* (Sidney 30 x 60)

Additional Source Map Information

Culbertson 30 x 60 (OFR-359)

Bergantino, R.N., Wilde, E.M., 1998, Geologic Map of the Culbertson 30' x 60' Quadrangle (bedrock emphasis), Northeastern Montana (revised 2007), Montana Bureau of Mines and Geology, Open-File Report 359, 5 p., 1 sheet(s), 1:100,000 scale. (*GRI Source Map ID 34732*)

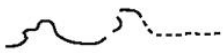
The data is available through the Montana Bureau of Mines and Geology on-line publication catalog; http://www.mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=11208&

***Only data for the Bainville SE 7.5' quadrangle was used in the GRI digital geologic map.*

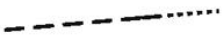
Map Symbols

CULBERTSON 30' x 60' QUADRANGLE

MAP SYMBOLS



Contact; dashed where approximate, dotted where concealed



Fault; approximate location, dotted where concealed

Approximate trace of northeast-trending Weldon-Brockton-Froid zone; relative movement of faults(?) within the zone is unknown

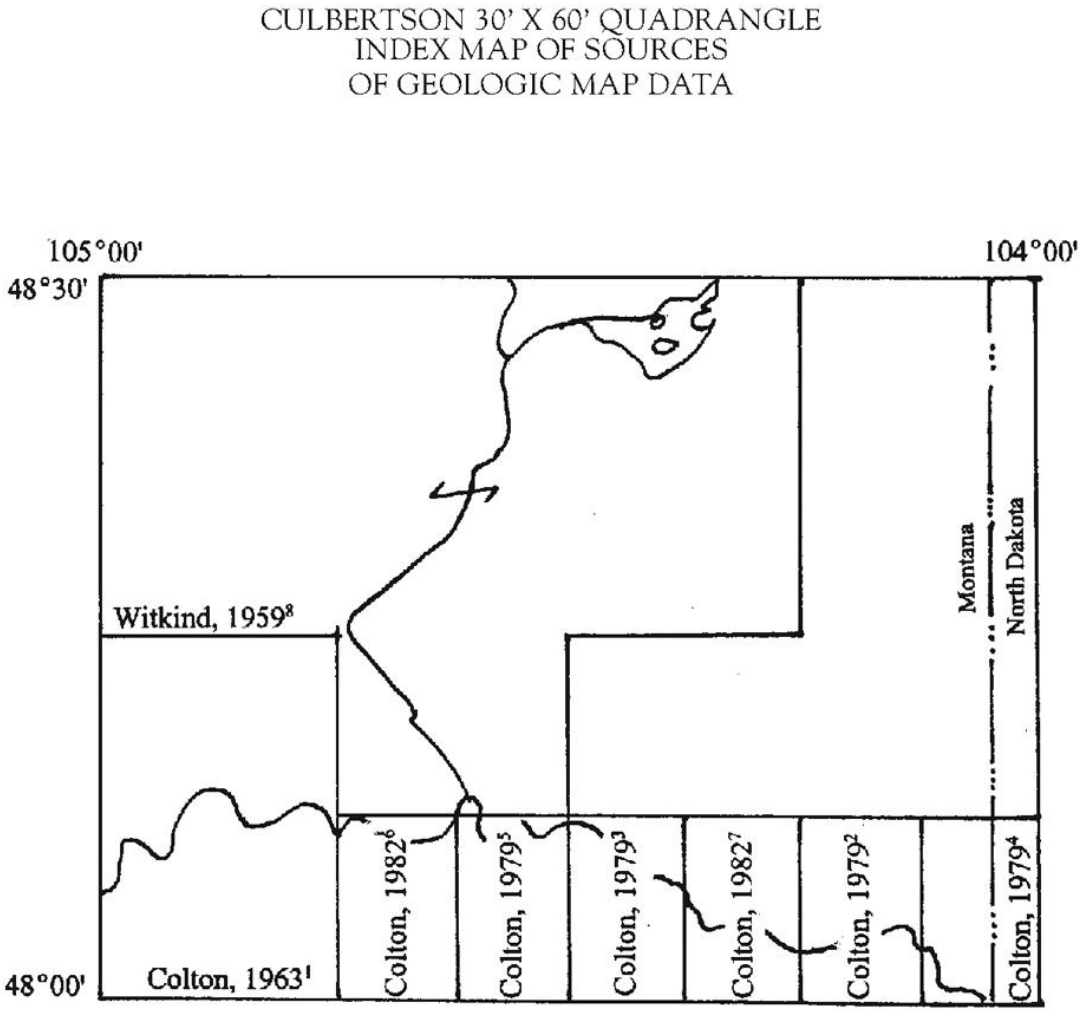
Possible northeast extention of the Weldon-Brockton-Froid zone

Approximate axis of latest pre-diversion (pre-glacial) Missouri River

Significant break between two levels of alluvium-colluvium

Extracted from: (Culbertson 30 x 60).

Source Index



Extracted from: (Culbertson 30 x 60).

Sources of Geologic Map Data

Colton, R.B. 1963. Geologic map of the Brockton quadrangle, Roosevelt and Richland counties, Montana. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-362. Scale 1:62,500.

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Extracted from: (Culbertson 30 x 60).

Sidney 30 x 60 (OFR MBMG-478)

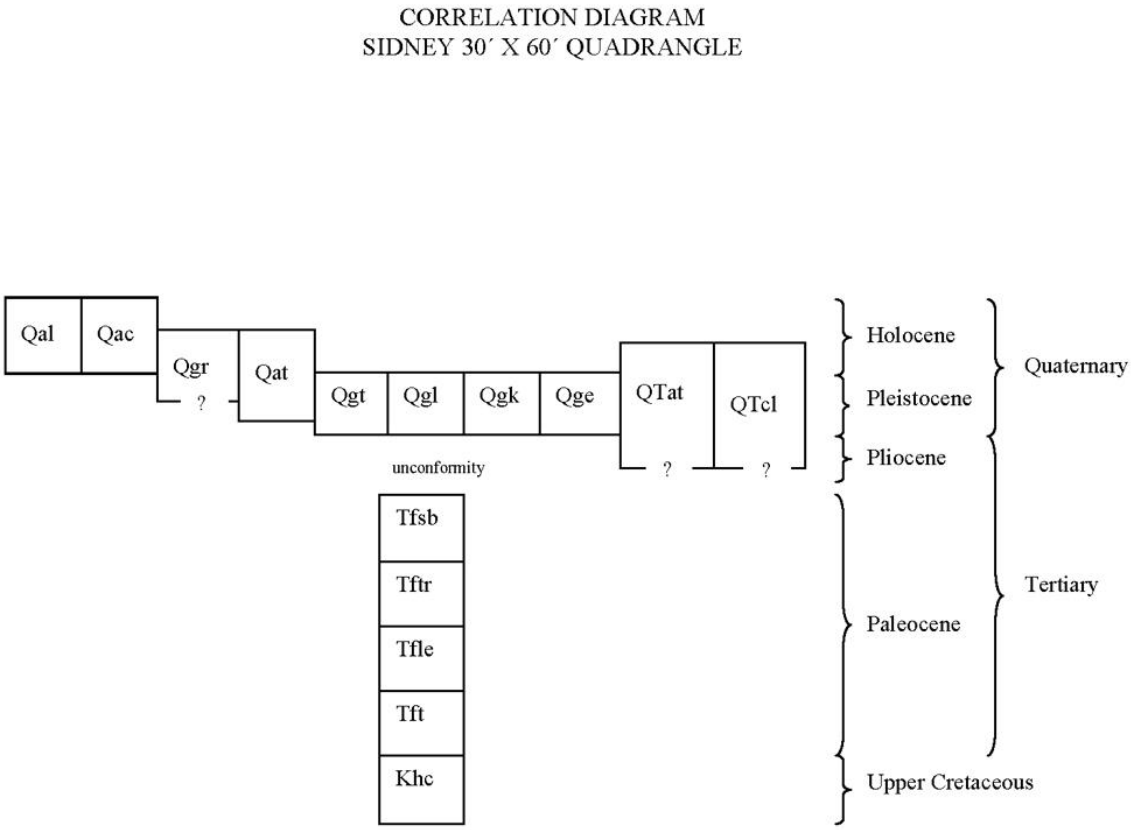
Vuke, S.M., Wilde, E.M., Smith, L.N., 2003, Geologic and Structure Contour Map of the Sidney 30' x 60' Quadrangle, Eastern Montana and Adjacent North Dakota (map revised 2011), Montana Bureau of Mines and Geology, Open-File Report OFR MBMG-478, 1:100,000 scale. (*GRI Source Map ID 60183*)

Map revised September 2011 by Susan Vuke, Montana Bureau of Mines and Geology. The revisions occurred in the area of the Fort Union Trading Post and the Culbertson-Sidney quadrangle boundary.

The data is available through the Montana Bureau of Mines and Geology on-line publication catalog; *http://www.mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=11349&*

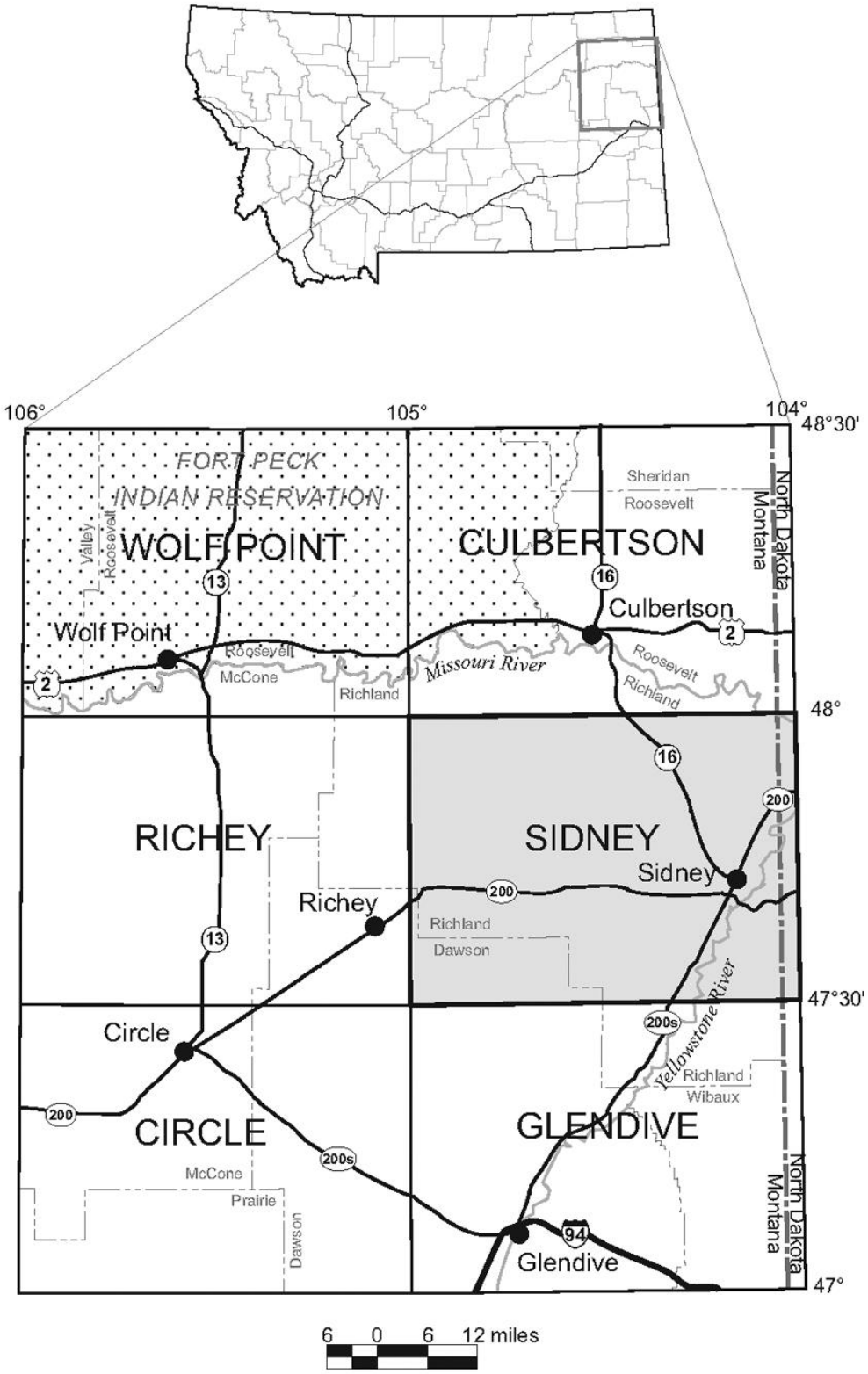
***Only data for the Dore 7.5' quadrangle was used in the GRI digital geologic map.*

Correlation of Units



Extracted from: (Sidney 30 x 60).

Index Map


106°
105°
104°
48°30'
48°
47°30'
47°
FORT PECK
INDIAN RESERVATION
WOLF POINT
CULBERTSON
Sheridan
Roosevelt
Valley
Roosevelt
Wolf Point
Culbertson
Roosevelt
McCone
Richland
Missouri River
Roosevelt
Richland
North Dakota
Montana
RICHEY
SIDNEY
Sidney
Richey
Richland
Dawson
Yellowstone River
Richland
Wibaux
Circle
CIRCLE
GLENDIVE
McCone
Prairie
Dawson
Glendive
North Dakota
Montana
6 0 6 12 miles

Extracted from: (Sidney 30 x 60).

Map Symbols

MAP SYMBOLS

Contact—Dotted where concealed.

1000

Structure contour line—Number indicates estimated feet above sea level of top of Pierre (Bearpaw) Shale.

1005

Well-log location—Number indicates altitude of top of Pierre (Bearpaw) Shale.

Extracted from: (Sidney 30 x 60).

Source Index

GEOLOGIC MAP SOURCES AND INDEX OF 7.5′ QUADRANGLES
SIDNEY 30′x 60′ QUADRANGLE

105° 104°

48°

Elmdale NW	Elmdale	Elm Coulee 3	Andes 3	Blue Hill 3	Sioux Pass 3	Fairview NW 3	Dore 3
Elmdale SW 2	Carda Coulee 2	Three Buttes Creek West 2	Three Buttes Creek East 2, 3	Girard 3	Brorson 3	Fairview SW 3, 4	Fairview 3
Kuester Lake 2	Enid 1, 2	Fox Lake 1, 2	Lambert 2, 3	Crane NW 3	Crane NE 3, 4	Sidney 3, 4	Sidney NE 4
Clay Butte 1, 2	Enid SE 1, 2	Butler Table 2	McCone Heights 1, 2, 3	Larson School 1, 3	Crane 3, 4, 5	Piche 4, 5	Sidney SE 4

47°30′

Numbers above correspond with reference list below.

1. Culbertson, W.S., 1954, scale 1:42,240
2. Parker, F.S., 1936, scale 1:190,000
3. Prichard, G.E., and Landis, E.R., 1955, scale 1:62,500.
4. Stebinger, Eugene, 1912, scale 1:125,000.
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Entire quad

Mathews, J.E., 1989a, b, c, and d, scale 1:100,000.
Stoner, J.D., and Lewis, B.D., 1980, scale 1:500,000.
Vuke, S.M., Wilde, E.M., and Bergantino, R.N., 1994, scale 1:100,000.

Extracted from: (Sidney 30 x 60).

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Matson, R.E., and Schell, E.M., 1976, Preliminary report of coal drill-hole data and chemical analyses of coal beds in Campbell, Converse, and Sheridan Counties, Wyoming, and Bighorn, Dawson, and Richland Counties, Montana: Montana Bureau of Mines and Geology Open-File Report MBMG 21 (also U.S. Geological Survey Open-File Report 76-450), 382 p.

Matson, R.E., and Schell, E.M., 1977, Preliminary report of coal drill-hole data of coal beds in Campbell and Sheridan counties, Wyoming, and Bighorn, Dawson, McCone, Richland, Rosebud, Roosevelt, Sheridan and Wibaux Counties, Montana: Montana Bureau of Mines and Geology Open file report MBMG 24 (also U.S. Geological Survey Open-file Report 77-283), 403 p.

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Vuke, S.M., Bergantino, R.N., and Wilde, E.M., 1989 (1994): Montana Bureau of Mines and Geology Open-File Report 281, scale 1:100,000. [superseded by this report]

Extracted from: (Sidney 30 x 60).

GRI Digital Data Credits

This document was developed and completed by Greg Mack (National Park Service, PWR Seattle, Washington) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Document quality control by Stephanie O'Meara (Colorado State University). Format updated in 2014 by Stephanie O'Meara.

The information contained here was compiled to accompany the digital geologic-GIS map(s) and other digital data for Fort Union Trading Post National Historic Site, Montana and North Dakota (FOUS) developed by Greg Mack (National Park Service). Quality control by Stephanie O'Meara.

GRI finalization by Stephanie O'Meara.

GRI program coordination and scoping provided by Bruce Heise and Tim Connors (NPS GRD, Lakewood, Colorado).