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

Fort Scott National Historic Site

GRI Ancillary Map Information Document

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

fosc_geology.pdf

Version: 10/22/2012

Geologic Resources Inventory Map Document for Fort Scott National Historic Site

Table of Contents

Geologic Resources Inventory Map Document

Fort Scott National Historic Site, Kansas

Document to Accompany Digital Geologic-GIS Data

fosc_geology.pdf

Version: 10/22/2012

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Fort Scott National Historic Site, Kansas (FOSC).

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 Data Store 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.

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Fort Scott National Historic Site, Kansas (FOSC) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium and stream-terrace deposits). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the Geologic Unit Information (FOSCUNIT) table included with the GRI geology-GIS data.

Geologic Map Units

Cenozoic Era

Quaternary Period

Qal - Alluvium and stream-terrace deposits (Qal)

Mesozoic Era

Pennsylvanian Period

PNg - Galesburg Shale (PNg)
PNsw - Swope Limestone (PNsw)
PNeb - Elm Branch Shale (PNeb)
PNmdu - Rocks of Desmoinesian series and/or Missourian series age, undivided (PNmdu)
    PNhcr - Hertha Limestone, Critzer Limestone Member (PNhcr)
    PNck - Checkerboard Limestone (PNck)
    PNlno - Lenapah Limestone, Norfleet Limestone Member (PNlno)
PNa - Altamont Limestone (PNa)
PNb - Bandera Shale (PNb)
PNp - Pawnee Limestone (PNp)
PNl - Labette Shale (PNl)
PNfs - Fort Scott Limestone (PNfs)
PNc - Cabaniss Formation (PNc)
    PNcv - Cabaniss Formation, Verdigris Limestone Member and V-shale (PNcv)
    PNcmc - Cabaniss Formation, mineral coal (PNcmc)

Map Unit Descriptions

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

Qal - Alluvium and stream-terrace deposits (Quaternary)

Alluvial deposits, quarries, and strip pits were mapped using the Soil Survey of Bourbon County, Kansas (Bell and Fortner, 1981). Alluvium and stream- terrace deposits 5 feet or greater in thickness were mapped as Qal. These deposits include sand, gravel, silt, and clay that were deposited on floodplains by streams, creeks, and rivers. (*GRI Source Map ID 55537)* (M-97).

PNg - Galesburg Shale (Upper Pennsylvanian)

Separating the Swope Limestone from the Dennis Limestone is the Galesburg Shale, a medium- to dark-gray to yellowish-brown, platy to blocky mudrock that may be silty and/or sandy. Like the Elm Branch Shale below, the Galesburg is commonly covered, rarely seen, and ranges from 2 to 15 feet thick. (*GRI Source Map ID 55537)* (M-97).

PNsw - Swope Limestone (Upper Pennsylvanian)

At the base of the Swope Limestone, the Middle Creek Limestone Member is a hard, dense, bluish-gray, sparsely fossiliferous limestone between 1 and 2 feet thick. It is easily identified because of its position just below the dark-gray to black, platy to fissile shale of the Hushpuckney Shale Member. The lower part of the Hushpuckney is a black shale and the upper part is a yellowish-gray mudrock. In northeastern Bourbon County, the Hushpuckney is up to 8 feet thick, but commonly it is thinner. Overlying the Hushpuckney Shale Member is the Bethany Falls Limestone Member, consisting of 15 to 35 feet of thin, wavy-bedded, light-gray, fossiliferous limestone. The upper 10 to 12 feet of the Bethany Falls is more thickly bedded and is whitish-gray with darker-gray mottling. Oolitic beds may also be present. (*GRI Source Map ID 55537)* (M-97).

PNeb - Elm Branch Shale (Upper Pennsylvanian)

The Elm Branch Shale ranges from 5 to 15 feet thick. Most often this unit is covered and its position and thickness determined by the top of the underlying Sniabar Limestone Member and the base of the overlying Middle Creek Limestone Member of the Swope Limestone. Where seen, the Elm Branch is a medium- to dark-gray to yellowish-brown, platy to blocky mudrock in places it may be slightly silty and sandy. (*GRI Source Map ID 55537)* (M-97).

PNmdu - Rocks of Desmoinesian series and/or Missourian series age, undivided (Upper Pennsylvanian and Middle Pennsylvanian)

** Unit consists of the following formations of Desmoinesian series and/or Missourian series age (in descending order): Hertha Limestone, Tacket Formation, Checkerboard Limestone, Seminole Formation, Lost Branch Formation, Memorial Shale, Lenapah Limestone and Nowata Shale. Three units, PNhcr, PNck and PNlno, are described below but are present as independent units in the GRI geologic-GIS data.

The Hertha Limestone is composed of three members which are, in ascending order, Critzer Limestone Member, the Mound City Shale Member, and the Sniabar Limestone Member. The Critzer Limestone

Member is thin or absent in Bourbon County, and the Mound City Shale Member is often indistinguishable from the underlying Tacket Formation. The Sniabar Limestone Member is a gray, medium- to thick-bedded, fossiliferous limestone that ranges from 5 to 10 feet. The Sniabar is commonly an algal limestone with numerous vugs. Abundant iron oxide gives it a dark-reddish-brown weathered color.
Between the base of the Sniabar Limestone Member of the Hertha Limestone and the top of the Altamont Limestone, several thin, discontinuous limestones occur within this dominantly siliciclastic interval. The thickness ranges from 100 to over 180 feet. Some of these limestones (the Norfleet Limestone Member of the Lenapah Limestone, the Checkerboard Limestone, and the Critzer Limestone Member of the Hertha Limestone) are locally mappable but are not continuous throughout the county. The boundary between the Desmoinesian and Missourian series occurs within this interval, but lithostratigraphic evidence for separating them was not found.

The Tacket Formation is a gray, thin-bedded micaceous siltstone (Seevers, 1969). Because the Checkerboard Limestone is thin or absent, it is difficult to separate the Tacket from the underlying Seminole Formation. Sequences of interbedded thin, hard, dense, dark-gray, unfossiliferous limestones and medium-gray mudrocks, referred to in the literature as the Bourbon flags, occur in the upper part of the Tacket. The stratigraphic position of the Bourbon flags is unclear, and may be, in part, equivalent to the Critzer Limestone Member of the Hertha Limestone. The occurrence of the Bourbon flags is not consistent.

The Checkerboard Limestone is thin, discontinuous, and poorly exposed in Bourbon County.

The Seminole Formation contains two members, the Hepler Sandstone Member and the South Mound Shale Member. The Hepler Sandstone Member is sometimes recognized in outcrop.

The Memorial Shale and Lost Branch Formation are not well exposed in Bourbon County. Jewett (1945) suggested the combined thickness of these gray, bedded, slightly blocky clay mudrock units is generally less than 30 feet.

The Lenapah Limestone consists of two limestones and an intervening mudrock. They are, in ascending order, the Norfleet Limestone Member, the Perry Farm Shale Member, and Idenbro Limestone Member. In Bourbon. County, both limestones vary in lithology and are thin (less than 2 feet) or absent. Overlying the Altamont Limestone is the Nowata Shale, which is lithologically similar to the Labette and Bandera Shales, and like these units, varies in thickness from several feet to several tens of feet. An incised valley-fill sandstone, the Walter Johnson Sandstone Member, occurs in the lower part of the Nowata and in places appears to cut out part, or all, of the Altamont. (*GRI Source Map ID 55537)* (M-97).

PNhcr - Hertha Limestone, Critzer Limestone Member (Middle Pennsylvanian)

No additional information is provided for this unit. See PNmdu (above) for a description of this member unit. (*GRI Source Map ID 55537)* (M-97).

PNck - Checkerboard Limestone (Middle Pennsylvanian)

The Checkerboard Limestone is thin, discontinuous, and poorly exposed in Bourbon County. (*GRI Source Map ID 55537)* (M-97).

PNlno - Lenapah Limestone, Norfleet Limestone Member (Middle Pennsylvanian)

No additional information is provided for this unit. See PNmdu (above) for a description of this member unit. (*GRI Source Map ID 55537)* (M-97).

PNa - Altamont Limestone (Middle Pennsylvanian)

In general, the Altamont Limestone thins in Bourbon County, ranging from 10 to 15 feet thick (Jewett, 1945). In ascending order, the Altamont Limestone is composed of the Amoret Limestone Member, the Lake Neosho Shale Member, and the Worland Limestone Member. The Amoret Limestone Member is absent or represented by a poorly developed nodular limestone. In the northwestern part of the county, it is a thin conglomeratic to brecciated carbonate; in southeast Bourbon County, the Amoret is better developed and the three members of the Altamont are clearly recognized. The prominent Worland Limestone Member is a hard, medium-gray, slightly fossiliferous, medium-bedded limestone. Between the Worland and Amoret limestones, the Lake Neosho Shale Member is a yellow-brown to light-gray mudrock that contains dark phosphatic nodules. (*GRI Source Map ID 55537)* (M-97).

PNb - Bandera Shale (Middle Pennsylvanian)

The Bandera Shale overlies the Pawnee Limestone and ranges from 40 to over 60 feet thick. Essentially a siliciclastic sequence, the lower part of the Bandera Shale contains a thin coal, the Mulberry, and in the southern part of the county, a thin, dark-brown, fossiliferous limestone that occurs just above the Mulberry. This limestone may be what has been informally called the Edna limestone in adjacent counties. A thick sandstone, the Bandera Quarry Sandstone Member, is a conspicuous component of this formation, though its occurrence is restricted. West of Redfield, Kansas, it is quarried for building stone. (*GRI Source Map ID 55537)* (M-97).

PNp - Pawnee Limestone (Middle Pennsylvanian)

Units herein mapped as the Pawnee Limestone are, in ascending order, the Myrick Station Limestone Member, Mine Creek Shale Member, and Laberdie Limestone Member. The combined thickness of these three members in Bourbon County ranges from 20 to 30 feet. Although the Anna Shale Member is formally recognized (Zeller, 1968) as the basal member of the Pawnee Limestone, this study does not support the mappability of the base of the Anna Shale Member. The thickness of the Anna is variable and sometimes it is absent. The top of the Labette is often a black to very dark-gray mudrock or shale, making it difficult to distinguish from the overlying Anna. The Myrick Station Limestone Member is a thin-bedded, gray, fossiliferous limestone that weathers into reddish-orange-brown blocks. The Mine Creek Shale Member, a dark-gray fossiliferous mudstone, is sometimes thin or absent. The Laberdie Limestone Member is responsible for most of the thickness of the Pawnee Limestone in Bourbon County. The Pawnee thickens where concentrations of algal debris occur in the light-to medium-gray, hard, thin- to medium- and thick bedded fossiliferous Laberdie. (*GRI Source Map ID 55537)* (M-97).

PNl - Labette Shale (Middle Pennsylvanian)

The Labette Shale is a siliciclastic sequence that ranges from 30 to 75 feet thick. Although it is mostly mudrock, a sandstone (the Englevale Sandstone Member) occurs in the lower part; a thin coal, the Lexington coal, occurs near the middle; and a thin limestone may be present in the upper part. This thin limestone may be the unit that has informally been called the Wimer School limestone in adjacent counties. The Englevale Sandstone Member appears to be an incised valley-fill deposit (formerly referred to in the literature as a channel sandstone) that, in places, cuts out the lower Labette Shale, the Fort Scott Limestone, and the Cabaniss Formation down to the top of the Verdigris Limestone Member (Schoewe, 1959). (*GRI Source Map ID 55537)* (M-97).

PNfs - Fort Scott Limestone (Middle Pennsylvanian)

The Fort Scott Limestone consists of two prominent limestone members and a dark gray to black intervening mudrock and shale. The Fort Scott Limestone is stratigraphically the lowest conspicuous limestone in the county, and ranges from 20 to 30 feet thick. The lowest member, the Blackjack Creek Limestone Member, is thinly bedded in the upper part with the lower part more medium to to thickly bedded. The Blackjack Creek Limestone Member, and the upper member, the Higginsville Limestone Member, are hard, dense, gray, fossiliferous limestones. Between these two limestones is the Little Osage Shale Member, a dark-gray to yellowish-brown mudrock in the upper part and a black, platy to fissile shale in the lower part. A thin coal, the Summit coal, sometimes occurs within this member. (*GRI Source Map ID 55537)* (M-97).

PNc - Cabaniss Formation (Middle Pennsylvanian)

The Cabaniss Formation in Bourbon County is informally separated by the Verdigris Limestone Member, the only reliable marker in the upper part of the formation. Below the Verdigris, the Cabaniss consists of sandstones and mudrocks with three named coal beds. The coals are, in ascending order, the Mineral, Fleming, and Croweburg. Calcareous, pyritic beds often overlie these coals and form caprocks. The Mineral and Croweburg have been extensively mined, and the Fleming is poorly developed in the county. Below the Verdigris, 10 to 45 feet of Cabaniss is exposed in Bourbon County.

The Verdigris Limestone Member is up to 3 feet thick and is easily recognized where it is exposed in the southeastern part of the county. According to Howe (1956), the Verdigris consists of one to three beds of hard, dark-gray to black, fossiliferous limestone that weather a dark orange-brown. This interval is sometimes informally subdivided; the thick limestone is regarded as the Verdigris and the other one or two, thinner, limestone beds and associated black shale are referred to as the V-shale, a unit widely recognized in the subsurface.

The Cabaniss Formation above the Verdigris is lithologically very similar to the Cabaniss below, except that it contains a thick sandstone bed and several thin, dark-gray to black, clayey limestones. it ranges in thickness from 80 to 100 feet, The most conspicuous limestone in this interval is the Breezy Hill Limestone Member and the prominent coal is the Mulky. Another coal, the Bevier, is also present 1 to 2 feet above the Verdigris in some parts of the county. These coals have also been extensively mined. Overlying the Mulky coal is a black, platy to fissile shale, informally called the Excello shale, that is useful in recognizing the position of the base of the Fort Scott Limestone. (*GRI Source Map ID 55537)* (M-97).

PNcv - Cabaniss Formation, Verdigris Limestone Member and V-shale (Middle Pennsylvanian)

The Verdigris Limestone Member is up to 3 feet thick and is easily recognized where it is exposed in the southeastern part of the county. According to Howe (1956), the Verdigris consists of one to three beds of hard, dark-gray to black, fossiliferous limestone that weather a dark orange-brown. This interval is sometimes informally subdivided; the thick limestone is regarded as the Verdigris and the other one or two, thinner, limestone beds and associated black shale are referred to as the V-shale, a unit widely recognized in the subsurface. (*GRI Source Map ID 55537)* (M-97).

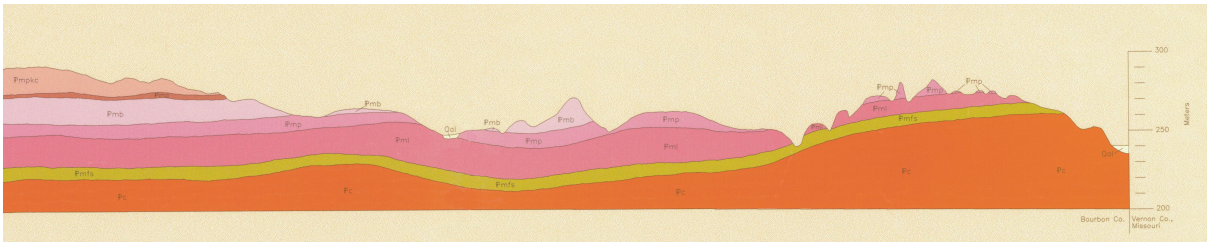
PNcmc - Cabaniss Formation, mineral coal (Middle Pennsylvanian)

Below the Verdigris, the Cabaniss consists of sandstones and mudrocks with three named coal beds. The coals are, in ascending order, the Mineral, Fleming, and Croweburg. Calcareous, pyritic beds often overlie these coals and form caprocks. The Mineral and Croweburg have been extensively mined. (*GRI Source Map ID 55537)* (M-97).

Geologic Cross Section

The geologic cross section present in the GRI digital geologic-GIS data produced for Fort Scott National Historic Site, Kansas (FOSC) is presented below. The cross section graphic was scanned at a high resolution and can be viewed in more detail by zooming in (when viewing the digital format of this document).

Partial A-A'



** The above cross section graphic of A-A' has been cropped to the approximate extent of the cross section line in the GRI digital geologic-GIS data. **
Extracted from: (M-97).

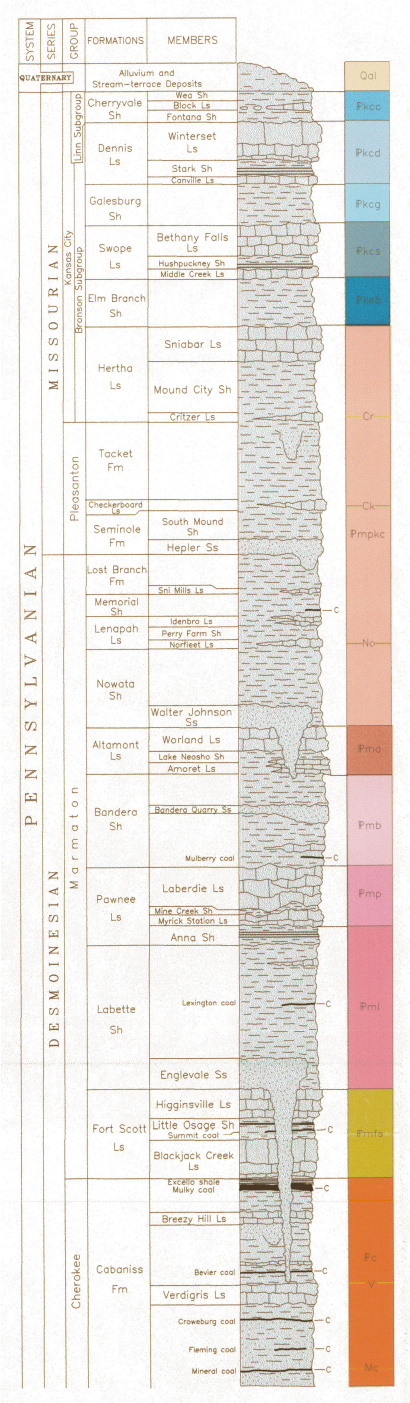
GRI Source Map Citation

The GRI digital geologic-GIS map for Fort Scott National Historic Site, Kansas (FOSC) was compiled from the following source:

West, Ronald R., Sawin, Robert S., 2002, Geologic Map of Bourbon County, Kansas, Kansas Geological Survey and University of Kansas, Map M-97, 1:50000 scale. (*GRI Source Map ID 55537*).

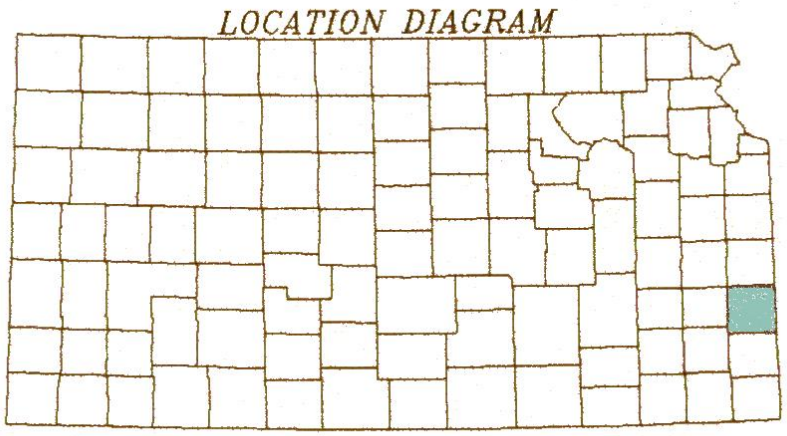
Additional information pertaining to each source map is also presented in the Source Map Information (FOSCMAP) table included with the GRI geologic-GIS data.

Correlation of Map Units



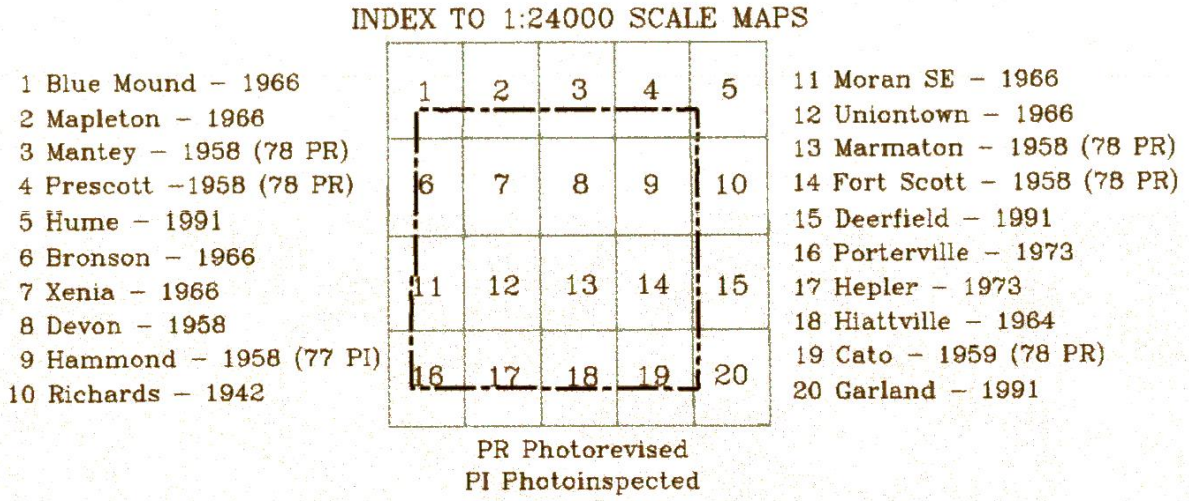
Extracted from: (M-97).

Location Map



Extracted from: (M-97).

Quadrangle Index Map



Extracted from: (M-97).

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Extracted from: (M-97).

GRI Digital Data Credits

This document was developed and completed Rachel Yoder (Colorado State University) with document review/quality control by Stephanie O'Meara (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program.

The information contained here was compiled to accompany the digital geologic-GIS map(s) and other digital data for Fort Scott National Historic Site, Kansas (FOSC) developed by Rachel Yoder, Stephanie O'Meara, Derek Witt and Jim Chappell (Colorado State University) using a Kansas Geological Survey and University of Kansas source map.

GRI finalization by Stephanie O'Meara (Colorado State University).

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