

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



Fossil Cycad National Monument

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Fossil Cycad National Monument

focy_geology.pdf

Version: 10/15/2012

Geologic Resources Inventory Map Document for Fossil Cycad National Monument

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Geologic Resources Inventory Map Document



Fossil Cycad National Monument, South Dakota

Document to Accompany Digital Geologic-GIS Data

[focy_geology.pdf](#)

Version: 10/15/2012

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Fossil Cycad National Monument, South Dakota (FOCY).

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 Fossil Cycad National Monument, South Dakota (FOCY) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium). Units are listed from youngest to oldest. Information about each geologic unit is also presented in the Geologic Unit Information (FOCYUNIT) table included with the GRI geologic-GIS data.

Cenozoic Era

Quaternary Period

Qal - Alluvium ([Qal](#))

Qtg - Terrace gravel ([Qtg](#))

Ql - Landslide ([Ql](#))

Mesozoic Era

Cretaceous Period

Kfr - Fall River Sandstone, undifferentiated ([Kfr](#))

Kfrs - Fall River Sandstone, sandstone ([Kfrs](#))

Kfrm - Fall River Sandstone, mudstone ([Kfrm](#))

Kfrss - Fall River Sandstone, interbedded sandstone and siltstone ([Kfrss](#))

Kfrs5 - Fall River Sandstone, Unit No. 5 ([Kfrs5](#))

Kfrsm - Fall River Sandstone, interbedded sandstone and mudstone ([Kfrsm](#))

Kfml - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, undifferentiated ([Kfml](#))

Kfmls - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, sandstone ([Kfmls](#))

Kfmlm - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, mudstone ([Kfmlm](#))

Kfmlsm - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, interbedded sandstone and mudstone ([Kfmlsm](#))

Kfmlss - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, interbedded sandstone and siltstone ([Kfmlss](#))

Kfmls4 - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, Unit No. 4 ([Kfmls4](#))

Kfmls3 - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, Unit No. 3 ([Kfmls3](#))

Kfmls1 - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, Unit No. 1 ([Kfmls1](#))

Jurassic Period

Jm - Morrison Formation ([Jm](#))

Ju - Unkpapa Sandstone ([Ju](#))

Js - Sundance Formation

Jsr - Sundance Formation, Redwater Shale Member ([Jsr](#))

Jsl - Sundance Formation, Lak Member ([Jsl](#))

Jsh - Sundance Formation, Hulett Sandstone Member ([Jsh](#))

Jssb - Sundance Formation, Stockade Beaver Shale Member ([Jssb](#))

Jscs - Sundance Formation, Canyon Springs Sandstone Member ([Jscs](#))

Triassic Period

TRs - Spearfish Formation ([TRs](#))

Map Unit Descriptions

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

Qal - Alluvium (Quaternary)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Qtg - Terrace gravel (Quaternary)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

QI - Landslide (Quaternary)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Kfr - Fall River Sandstone, undifferentiated (Lower Cretaceous)

The unit is divided into several units based on lithology, as well as having several prominent sandstone beds (S4, S3 and S1). *GRI Source Map ID 9586* ([MF 70](#)).

Kfrs - Fall River Sandstone, sandstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

** The source map explanation/correlation of units figure doesn't indicate that this lithologic differentiation appears within the Fall River Sandstone, however, 's', the map's designation for 'sandstone' does appear within the Fall River Sandstone on the source map.

Kfrm - Fall River Sandstone, mudstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

** The source map explanation/correlation of units figure doesn't indicate that this lithologic differentiation appears within the Fall River Sandstone, however, 'm', the map's designation for 'mudstone' does appear within the Fall River Sandstone on the source map.

Kfrss - Fall River Sandstone, interbedded sandstone and siltstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

** The source map explanation/correlation of units figure doesn't indicate that this lithologic differentiation appears within the Fall River Sandstone, however, 'ss', the map's designation for 'interbedded sandstone

and siltstone' does appear within the Fall River Sandstone on the source map.

Kfrs5 - Fall River Sandstone, Unit No. 5 (Lower Cretaceous)

(S5) - No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

** Unit S5 appears on the source map as a mapped unit, however, the unit doesn't actually appear in the map's explanation/correlation of units figure. The unit is within the Fall River Sandstone, above the top marker/contact of the Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, undifferentiated, and thus was placed within the Fall River Sandstone.

Kfrsm - Fall River Sandstone, interbedded sandstone and mudstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

** The source map explanation/correlation of units figure doesn't indicate that this lithologic differentiation appears within the Fall River Sandstone, however, 'sm', the map's designation for 'interbedded sandstone and mudstone' does appear within the Fall River Sandstone on the source map.

Kfml - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, undifferentiated (Lower Cretaceous)

Prominent sandstone beds (S1, S3 and S4) are numbered from oldest to youngest. *GRI Source Map ID 9586* ([MF 70](#)).

KfmIs - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, sandstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

KfmIm - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, mudstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

KfmIsm - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, interbedded sandstone and mudstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Kfmlss - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, interbedded sandstone and siltstone (Lower Cretaceous)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Kfmls4 - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, Unit No. 4 (Lower Cretaceous)

(S4) - White, gray and yellow-brown medium- to coarse-grained, conglomeratic, highly cross-bedded channel sandstone. *GRI Source Map ID 9586* ([MF 70](#)).

Kfmls3 - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, Unit No. 3 (Lower Cretaceous)

(S3) - White to red, friable, fine-grained massive sandstone. *GRI Source Map ID 9586* ([MF 70](#)).

Kfmls1 - Fuson Formation, Minnewaste Limestone, and Lakota Sandstone, Unit No. 1 (Lower Cretaceous)

(S1) - Tan to yellow-gray cliff-forming, thin- to thick-bedded, fine-grained sandstone with interbedded mudstone. *GRI Source Map ID 9586* ([MF 70](#)).

Jm - Morrison Formation (Upper Jurassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Ju - Unkpapa Sandstone (Upper Jurassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Sundance Formation**Jsr - Sundance Formation, Redwater Shale Member (Upper Jurassic)**

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Jsl - Sundance Formation, Lak Member (Upper Jurassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Jsh - Sundance Formation, Hulett Sandstone Member (Upper Jurassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Jssb - Sundance Formation, Stockade Beaver Shale Member (Upper Jurassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

Jscs - Sundance Formation, Canyon Springs Sandstone Member (Upper Jurassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

TRs - Spearfish Formation (Triassic)

No additional information was present on the source publication. *GRI Source Map ID 9586* ([MF 70](#)).

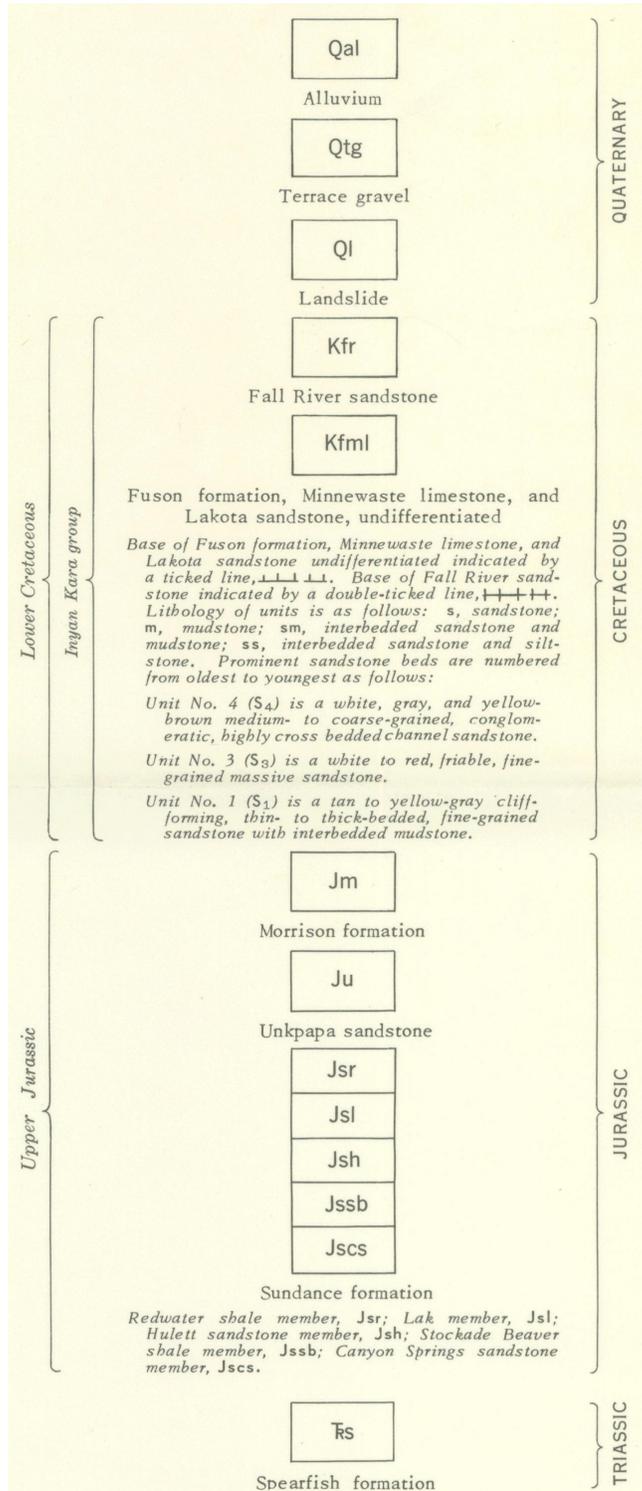
GRI Source Map

The GRI digital geologic-GIS map for Fossil Cycad National Monument, South Dakota (FOCY) was compiled from the following source:

Wilmarth, V.R. and Smith, R.D., 1957, Preliminary Geologic Map of the Southwestern part of the Minnekahta Quadrangle, Fall River County, South Dakota, U.S. Geological Survey (prepared in cooperation with the U.S. Atomic Energy Commission), Mineral Investigations Field Studies Map MF 70, 1:7,200 scale. (*GRI Source Map ID 9586*).

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

Correlation of Units Figure

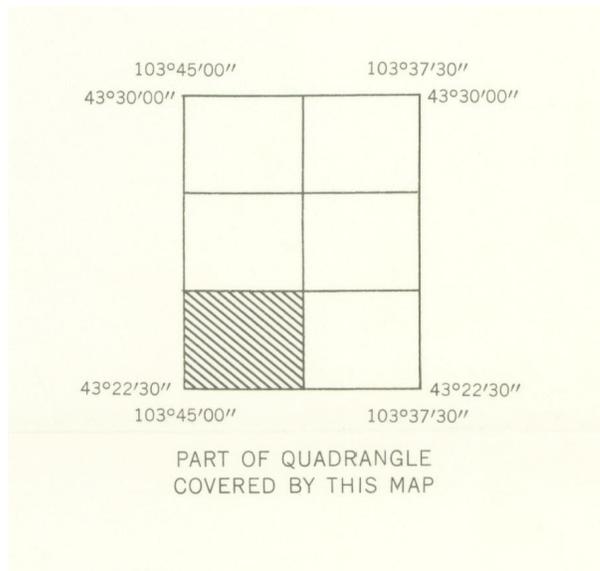


Extracted from: (ME 70).

** The Fall River Sandstone, Fuson Formation, Minnewaste Limestone, Lakota Sandstone, Morrison Formation, Unkpapa Sandstone, Sundance Formation and Spearfish Formation all are now recognized

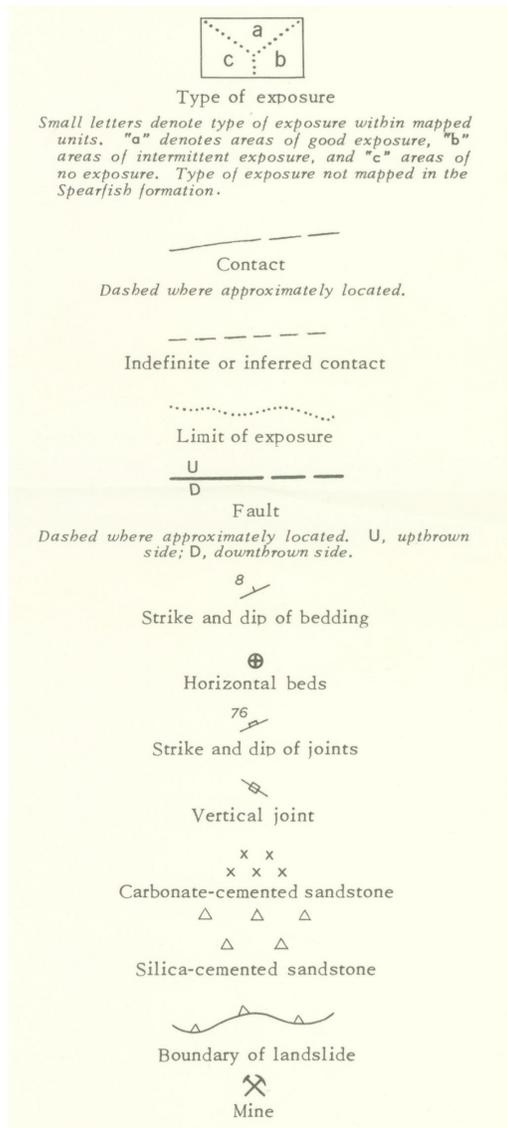
to be formal units (as per the NGMDB Geologic Names Lexicon). Lithology differentiations and prominent sandstone beds within the Fall River Sandstone and Fuson Formation, Minnewaste Limestone and Lakota Sandstone are considered units and assigned unit symbols (e.g., Kfrs) in the GRI digital geologic-GIS map even though the source publication didn't assign unit symbols to these units.

Quadrangle Index



Extracted from: ([MF 70](#)).

Explanation (of source map symbols)



Extracted from: [\(MF 70\)](#).

GRI Digital Data Credits

This document was developed and completed by Stephanie O'Meara (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Quality control of this document by Derek Witt (Colorado State University).

The information contained here was compiled to accompany the digital geologic-GIS map and other digital data for Fossil Cycad National Monument, South Dakota (FOCY) developed by Stephanie O'Meara, Ian Hageman, Rachel Yoder, Derek Witt and Max Jackl (Colorado State University) using a [U.S. Geological Survey 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).