

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



# Agate Fossil Beds National Monument

## *GRI Ancillary Map Information Document*

Produced to accompany the Geologic Resources Inventory (GRI) Digital  
Geologic-GIS Data for Agate Fossil Beds National Monument

agfo\_geology.pdf

Version: 6/9/2020

# Geologic Resources Inventory Map Document for Agate Fossil Beds National Monument

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## Geologic Resources Inventory Map Document



# Agate Fossil Beds National Monument, Nebraska

## Document to Accompany Digital Geologic-GIS Data

[agfo\\_geology.pdf](#)

Version: 6/9/2020

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Agate Fossil Beds National Monument, Nebraska (AGFO).

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.

This document contains the following information:

- 1) **About the NPS Geologic Resources Inventory Program** – A brief summary of the Geologic Resources Inventory (GRI) Program and its products. Included are web links to the GRI GIS data model, and to the GRI products page where digital geologic-GIS datasets, scoping reports and geology reports are available for download. In addition, web links to the NPS Data Store and GRI program home page, as well as contact information for the GRI coordinator, are also present.
- 2) **GRI Digital Maps and Source Citations** – A listing of all GRI digital geologic-GIS maps produced for this project along with sources used in their completion. In addition, a brief explanation of how each source map was used is provided. An index map showing the extent of the GRI digital geologic-GIS maps and park boundary is also presented.
- 3) **Map Unit List** – A listing of all geologic map units present on maps for this project, generally listed from youngest to oldest.
- 4) **Map Unit Descriptions** – Descriptions for all geologic map units. If a unit is present on multiple source maps the unit is listed with its source geologic unit symbol, unit name and unit age followed by the unit's description for each source map.
- 5) **Ancillary Source Map Information** – A report, Paleontological Excavations at Agate Fossil Beds National Monument, related to the Hunt, 1988 source map is mentioned.
- 6) **GRI Digital Data Credits** – GRI digital geologic-GIS data and ancillary map information document production credits.

For information about using GRI digital geologic-GIS data contact:

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## About the NPS Geologic Resources Inventory Program

### Background

The Geologic Resources Inventory (GRI) provides geologic map data and pertinent geologic information to support resource management and science-informed decision making in more than 270 natural resource parks throughout the National Park System. 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 GRI is one of 12 inventories funded by the National Park Service (NPS) Inventory and Monitoring Program. The Geologic Resources Division of the NPS Natural Resource Stewardship and Science Directorate administers the GRI. The NPS Geologic Resources Division partners with the Colorado State University Department of Geosciences to produce GRI products. Many additional partners participate in the GRI process by contributing source maps or reviewing products.

The GRI team undertakes three tasks for each park in the Inventory and Monitoring program: (1) conduct a scoping meeting and provide a summary document, (2) provide digital geologic map data in a geographic information system (GIS) format, and (3) provide a GRI report. These products are designed and written for nongeoscientists.

### 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: <https://www.nps.gov/articles/gri-geodatabase-model.htm>

**Geologic Reports:** GRI reports synthesize discussions from the original scoping meeting, follow up conference call(s), and subsequent research. Chapters of each report discuss the geologic setting of the park, distinctive geologic features and processes within the park, highlight geologic issues facing resource managers, and describe the geologic history leading to the present-day landscape. Each report also includes a poster illustrating these GRI digital geologic-GIS data.

For a complete listing of GRI products visit the GRI publications webpage: <https://go.nps.gov/gripubs>. GRI digital geologic-GIS data is also available online at the NPS Data Store: <https://irma.nps.gov/DataStore/Search/Quick>. 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: <https://>

[www.nps.gov/subjects/geology/gri.htm](http://www.nps.gov/subjects/geology/gri.htm). At the bottom of that webpage is a “Contact Us” link if you need additional information. You may also directly contact the program coordinator:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division. Learn more about I&M and the 12 baseline inventories at the I&M webpage: <https://www.nps.gov/im/inventories.htm>.

## GRI Digital Maps and Source Map Citations

The GRI digital geologic-GIS maps for Agate Fossil Beds National Monument, Nebraska (AGFO). Listed with each map is the source map used to produce the GRI digital geologic-GIS map, as well as a brief explanation of the source map extent used and that all geologic features present on the source map were captured in the GRI digital geologic-GIS data.

### **Digital Geologic-GIS Map of portions of Agate Fossil Beds National Monument, Nebraska (GRI MapCode AGFO)**

Hunt, Robert M., 1988, Geologic Map of the Agate Fossil Beds National Monument: University of Nebraska, unpublished map, scale 1:16,896. (*GRI Source Map ID 1313*).

The GRI used the full extent of the source map and all geologic features within this extent were captured.

### **Digital Surficial Geologic-GIS Map of the Whistle Creek NW Quadrangle, Nebraska (GRI MapCode WHCR)**

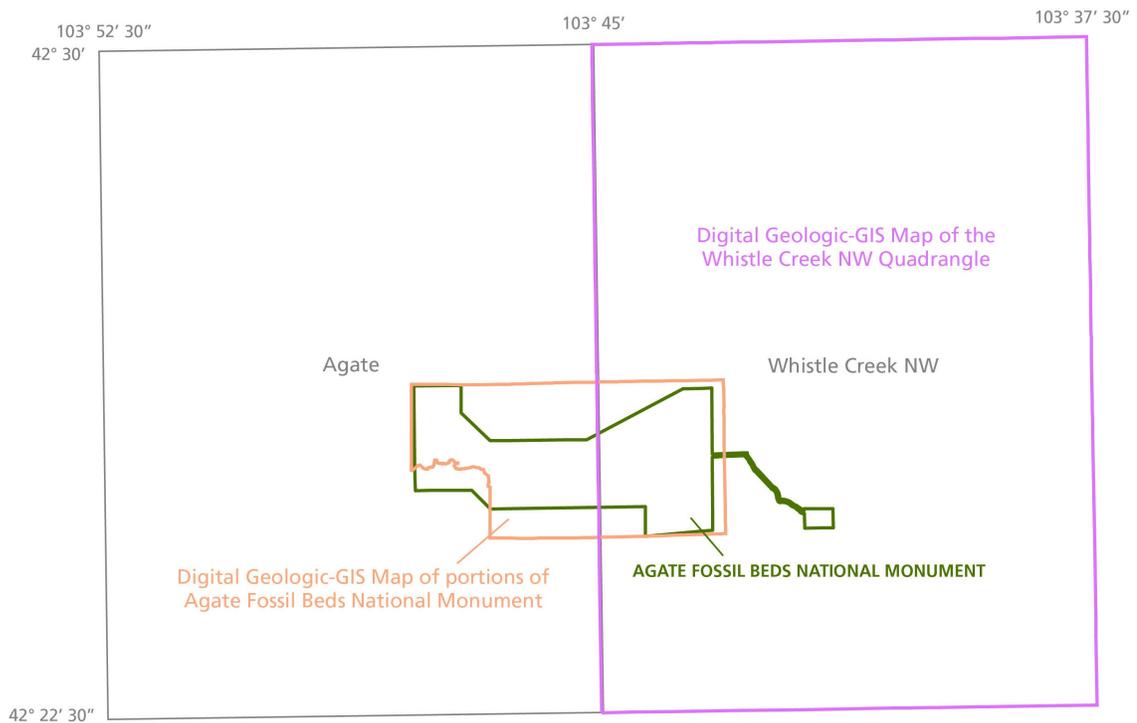
Dillon, J.S., Hanson, P.R., and Howard, L. M., 2013, Surficial Geology of the Whistle Creek NW 7.5-Minute Quadrangle, Nebraska: University of Nebraska Conservation and Survey Division, Geologic Maps and Charts (Whistle Creek NW Quadrangle), scale 1:24,000. (*GRI Source Map ID 75781*).

The GRI used the full extent of the source map and all geologic features within this extent were captured.

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

## Index Map

The following index map displays the extents of the GRI digital geologic-GIS maps produced for Agate Fossil Beds National Monument (AGFO). The extent of the GRI Digital Geologic-GIS Map of portions of Agate Fossil Beds National Monument (*GRI MapCode AGFO*) is outlined in light green, whereas the extent of the GRI Digital Geologic-GIS Map of the Whistle Creek NW Quadrangle (*GRI MapCode WHCR*) is shown in blue. The boundary for Agate Fossil Beds National Monument (as of May, 2020) is outlined in green. The two 7.5' quadrangles that include the monument, Agate and Whistle Creek NW, are also shown. At present, no large-scale geologic map exist for the Agate Quadrangle.



Index map produced by Stephanie O'Meara (Colorado State University).

## Map Unit List

The geologic units present in the digital geologic-GIS data produced for Agate Fossil Beds National Monument, Nebraska (AGFO) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qaf - Artificial fill). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the GRI Geologic Unit Information (AGFOUNIT) table included with the GRI geologic-GIS data. Some source unit symbols, names and/or ages may have been changed in this document and in the GRI digital geologic-GIS data.

### Cenozoic Era

#### Quaternary Period

[Qaf](#) - Artificial fill

[Qalc](#) - Unknown Quaternary? unit

[Qa1](#) - Youngest alluvium

[Qac1](#) - Youngest sandy alluvium and colluvium

[Qac2](#) - Sandy alluvium and colluvium

[Qat](#) - Alluvium and terrace

[Qr3](#) - Sandy residuum

[Qa3](#) - Older alluvium

#### Tertiary Period

[Taar](#) - Unknown younger Tertiary? unit

[Trw](#) - Runningwater Formation

[Tar](#) - Anderson Ranch Formation

[Thaa](#) - Agate Ash

[Th](#) - Harrison Formation

[Tor](#) - Unknown older Tertiary? Unit

[Ts](#) - Sharps Formation

[Ukn](#) - Unknown unit

## Map Unit Descriptions

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

### **Qaf - Artificial fill (Recent)**

No additional information present on source map. Unit present on source map: [Agate Fossil Beds National Monument](#).

### **Qalc - Unknown Quaternary? unit (Quaternary?)**

#### **Qalc - Unknown**

No additional information present on source map. Unit present on source map: [Whistle Creek NW Quadrangle](#).

Unit is Quaternary in age based on communication with the University of Nebraska Conservation and Survey Division.

### **Qa1 - Youngest alluvium (Holocene)**

Commonly sand and pebbly gravel, minor thin sandy silt beds: yellowish-gray and yellowish-orange; unit underlies the modern stream channels and floodplain. Sands are trough and planar bedded. Most clasts are derived from local bedrock. Commonly 1-4m thick. Description from source map: [Whistle Creek NW Quadrangle](#).

### **Qac1 - Youngest sandy alluvium and colluvium (Holocene)**

No additional information present on source map. Unit present on source map: [Whistle Creek NW Quadrangle](#).

### **Qac2 - Sandy alluvium and colluvium (Holocene and upper Pleistocene)**

Sand and silt residuum and colluvium derived from the weathering of sandy siltstones and sandstones, primarily of the Arikaree and Ogallala groups; brown to yellowish-gray. Upland occurrences are primarily colluvium (locally derived gravels or conglomerates) and typically grades into alluvium. The unit includes the Tassel-Ashollow-Rock soil association. Commonly 2–15m thick. Description from source map: [Whistle Creek NW Quadrangle](#).

### **Qat - Alluvium and terrace (Holocene and Pleistocene)**

Silt, sand and gravel. Description from source map: [Agate Fossil Beds National Monument](#).

### **Qr3 - Sandy residuum (Pleistocene)**

Residuum and soils derived from the weathering of sandy siltstones and sandstones of the White River and Arikaree groups and minor amounts (10-15%) of alluvial and colluvial silt and sand sediments. Description from source map: [Whistle Creek NW Quadrangle](#).

### **Qa3 - Older alluvium (Pleistocene)**

Clays to cobble sized sediment deposited in modern and ancient stream channels and floodplains. Description from source map: [Whistle Creek NW Quadrangle](#).

### **Taar - Unknown younger Tertiary? unit (Tertiary?)**

#### **Taar - Unknown**

No additional information present on source map. Unit present on source map: [Whistle Creek NW Quadrangle](#).

Unit is Tertiary in age based on communication with the University of Nebraska Conservation and Survey Division.

### **Trw - Runningwater Formation (early Miocene)**

Non-marine light buff to orange sand, massive, often with local zones of carbonate cementation, and occasional lenses of crystalline gravel, sand and silt of fluvial origin. Description from source map: [Agate Fossil Beds National Monument](#).

### **Tar - Anderson Ranch Formation (early Miocene)**

#### **Thu - Upper Harrison Formation (Early Miocene)**

Non-marine light gray to light brown fine sand and silt of pyroclastic origin, massive in its upper part within the monument area, and in its lower part often reworked by fluvial and aeolian processes into horizontally laminated and cross-stratified deposits, with buff to white lenses rich in mammalian fossils filling the base of local channels. Includes local dense freshwater limestones (Agate Limestone), volcanic ash and lithic pebble conglomerate. In the study area the unit contains at or near its top a prominent silica-cemented land surface (Agate paleosurface) extensively burrowed and rich in root casts. Description from source map: [Agate Fossil Beds National Monument](#).

Unit is now recognized to be the Anderson Ranch Formation.

### **Thaa - Agate Ash (early Miocene)**

Non-marine gray to dark gray fine sand of pyroclastic origin, massive, but locally reworked by fluvial and aeolian processes into horizontally laminated and cross-stratified deposits, and including throughout the monument the Agate Ash (KA 48). Description from source map: [Agate Fossil Beds National Monument](#).

### **Th - Harrison Formation (early Miocene)**

#### **Th - Harrison Formation (early Miocene)**

Non-marine gray to dark gray fine sand of pyroclastic origin, massive, but locally reworked by fluvial and aeolian processes into horizontally laminated and cross-stratified deposits, and including throughout the monument the Agate Ash (KA 48). Description from source map: [Agate Fossil Beds National Monument](#).

**Tah – Harrison Formation (early Miocene)** - This unit consists of brown and gray, fine to medium grained, massive or weakly bedded, often poorly indurated volcanoclastic sandstones having

prominent, rhizolithic silcretes 2-10 m thick in its upper 75 m. Fine siliceous and calcareous rhizoliths, root molds, and voids suggesting subterranean insect galleries are common within the upper part. These beds are well exposed along the flank and top of the Pine Ridge Escarpment. The upper boundary is an abrupt contact with overlying yellowish or grayish brown fine-grained sandstones of the Upper Harrison Formation. This contact is a regional unconformity overlying a widespread silcrete that weathers into a prominent, flat bench that can be traced across the region. Hunt's (1985) disconformable contact between this unit and the underlying Monroe Creek Formation was observed within Monroe Canyon [Warbonnet Buttes (Nebraska) 7.5' quadrangle], but no discernable lithologic change occurs at this disconformity and it could not be traced outside the of Monroe Canyon. In most areas no recognizable lithologic contact between this unit and the underlying Monroe Creek Formation was observed, in which case these units were combined (Tah/Tam) following Swinehart and others (1985). Alternately, the contact was placed at the base of the lowest rhizolithic silcrete, giving this unit an overall thickness of 75-95 m. Below this alternate contact the sandstones are gray or buff rather than brown and were assigned to the underlying Monroe Creek Formation. *Daimonelix* are present throughout the uppermost 75 m of this unit, and vertebrate fossils, while present as isolated occurrences or local concentrations (Hunt, 1985), were not observed during this study. Description from source map: [Whistle Creek NW Quadrangle](#).

### **Tor - Unknown older Tertiary? Unit (Tertiary?)**

#### **Tor - Unknown**

No additional information present on source map. Unit present on source map: [Whistle Creek NW Quadrangle](#).

Unit is Tertiary in age based on communication with the University of Nebraska Conservation and Survey Division.

### **Ts- Sharps Formation (early Miocene)**

#### **TI - Unnamed lithic unit**

Non-marine light orange to light brown sand and silt of pyroclastic origin, massive, with frequent small vertically oriented carbonate concretions scattered throughout the unit. Description from source map: [Agate Fossil Beds National Monument](#).

Unit is now recognized to be the early Miocene Sharps Formation.

### **Ukn - Unknown unit**

No additional information present on source map. Unit present on source map: [Whistle Creek NW Quadrangle](#).

## Ancillary Source Map Information

The following section present ancillary source map information related to the Geologic Map of the Agate Fossil Beds National Monument (Hunt, 1998) source map.

No additional information, other than unit descriptions, is presented for either the Geologic Map of the Agate Fossil Beds National Monument (Hunt, 1998) or Whistle Creek NW (Dillon, 2013) source maps.

## Report on Paleontological Excavations

A report related to the Geologic Map of the Agate Fossil Beds National Monument (Hunt, 1988) source map exist.

Hunt, Robert M. Jr., 1988, Report on Paleontological Excavations at Agate Fossil Beds National Monument undertaken by the University of Nebraska State Museum from June 25, 1985 to August 16, 1986: State Museum and Department of Geology, University of Nebraska.

The report, however, is not presently available in digital format. Users interested in the report are encouraged to seek the report from the University of Nebraska State Museum.

## 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 Stephanie O'Meara.

The information in this document was compiled from GRI source maps and intended to accompany the digital geologic-GIS maps and other digital data for Agate Fossil Beds National Monument, Nebraska (AGFO) developed by Stephanie O'Meara (see the [GRI Digital Maps and Source Map Citations](#) section of this document for all sources used by the GRI in the completion of this document and related GRI digital geologic-GIS maps). Initial GRI digital geologic-GIS data for the

GRI finalization by Stephanie O'Meara.

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