

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



Florissant Fossil Beds National Monument

GRI Ancillary Map Information Document

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

flfo_geology.pdf

Version: 8/16/2017

Geologic Resources Inventory Ancillary Map Information Document for Florissant Fossil Beds National Monument

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Geologic Resources Inventory Map Document



Florissant Fossil Beds National Monument, Colorado

Document to Accompany Digital Geologic-GIS Data

[flfo_geology.pdf](#)

Version: 8/16/2017

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

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.
- 3) **Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado (GRI MapCode FLFO)** - Chapter containing information for the Evanoff, 1992 geologic map.
 - A) **Map Unit Listing** – A listing of all geologic map units present on the Evanoff, 1992 geologic map, generally listed from youngest to oldest.
 - B) **Map Unit Descriptions** – Descriptions for all geologic map units on the Evanoff, 1992 geologic map.
 - C) **Ancillary Source Map Information** – Additional source map information presented on the Evanoff, 1992 geologic map including a correlation of map units, figures, and references.
- 4) **Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado, (Root,**

1981) (GRI MapCode ROOT) - Chapter containing information for the Root, 1981 geologic map.

A) **Map Unit Listing** – A listing of all geologic map units present on the Root, 1981 geologic map, generally listed from youngest to oldest.

5) **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

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.

GRI Digital Maps and Source Map Citations

The GRI digital geologic-GIS maps for Florissant Fossil Beds National Monument, Colorado (FLFO):

Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado (*GRI MapCode FLFO*)

Evanoff, E., Brill, R., de Toledo, P., Murphy, P., and Cushman, R., 1992, Surficial Geologic Map of Florissant Fossil Beds National Monument, Colorado: University of Colorado, unpublished map, scale 1:10,000. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

The GRI used the full extent of the source map, and incorporated prominent components of the provided source maps and reports (e.g., unit descriptions, references) into the GRI digital geologic-GIS dataset and product.

Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado, (Root, 1981) (*GRI MapCode ROOT*)

Root, R., 1981, Geologic Map of Florissant Fossil Beds National Monument, Colorado: National Park Service, unpublished map, scale 1:7,000. (Root, 1981). (*GRI Source Map ID 933*).

The GRI used the full extent of the source map, however no additional source map components were available so they were not included in the GRI digital geologic-GIS dataset and product.

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

Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado (GRI MapCode FLFO)

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Florissant Fossil Beds National Monument, Colorado (FLFO) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Holocene alluvium). 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 (FLFOUNIT) table included with the GRI geology-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. This was done if a unit was considered to be the same unit as one or more units on other source maps used for this project, and these unit symbols, names and/or ages differed. In this case a single unit symbol and name, and the unit's now recognized age, was adopted. Unit symbols, names and/or ages in a unit descriptions, or on a correlation of map units or other source map figure were not edited. If a unit symbol, name or age was changed by the GRI the unit's source map symbol, name and/or age appears with the unit's source map description.

Cenozoic Era

Quaternary Period

[Qal](#) - Holocene alluvium

[Qc](#) - Quaternary colluvium

[Qg](#) - Pleistocene gravels

Paleogene Period

[Tf5](#) - Florissant Formation, unit 5

[Tf4](#) - Florissant Formation, unit 4

[Tf3](#) - Florissant Formation, unit 3

[Tf2](#) - Florissant Formation, unit 2

[Tf1](#) - Florissant Formation, unit 1

[Tb](#) - Eocene boulder conglomerate

[Twm](#) - Wall Mountain Tuff

Precambrian Era

[PCg](#) - Pikes Peak Granite

Map Unit Descriptions

Descriptions of all geologic map units present on the Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, generally listed from youngest to oldest, are presented below.

Qal - Holocene alluvium (Holocene)

No unit description provided. ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Qc - Quaternary colluvium (Holocene to Pleistocene)

Thin gravels mantling slopes, composed of granular grus derived from the Pikes Peak Granite, rhyolitic gravel derived from the Wall Mountain Tuff, and shale, mudstone, sandstone, and silicified wood

fragments derived from the Florissant Formation. Unconformity at the unit's base. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Qg - Pleistocene gravels (Pleistocene)

Thick gravels mainly composed of granular grus derived from the Pikes Peak Granite. Also includes scattered fragments of Wall Mountain Tuff and silicified wood. Vertebrate fossils rare, including a mammoth from the SW ¼, sec. 12, T. 13 S., R 71 W. ([Cockerell, 1907](#)). Unconformity at the unit's base. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Tf5 - Florissant Formation, unit 5 (Eocene)

Pumice-rich white sandstones and conglomerates, structureless to locally trough crossbedded. Numerous pink pumice clasts near top. Near south entrance includes poorly sorted brown pumiceous sandstones interbedded with scattered lenticular mudstones and shales. Contains locally abundant fingernail clams, rare plant and lymnaeid snail fossils. Maximum measured thickness 22.8 m. Lacustrine at base, fluvial at top. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Tf4 - Florissant Formation, unit 4 (Eocene)

Gray to greenish brown paper shales and blocky mudstones; interbedded with planar, thin yellow to white pumiceous sandstone beds. Near the south entrance this unit is represented by fossiliferous gray to yellowish brown sandstones interbedded with cherty stromatolites. Fossils include leaves, insects, ostracodes, fish scales, and fingernail clams. Maximum measured thickness 5.6 m in the northwest corner of the monument; unit thins to the south. Lacustrine. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Tf3 - Florissant Formation, unit 3 (Eocene)

Yellowish-gray conglomerate with subangular to rounded clasts of tuff, quartz, and andesite. Locally contains blocks of andesite, pumiceous sandstones and blocky mudstone. Unit typically graded, otherwise structureless to crudely horizontally bedded. Fossils include scattered fingernail clams near top. Maximum thickness 7.9 m measured near Lodge stump (E of Scudder pit). Unit thins to the north and is not present in the northwest corner of the monument. Represents a volcanigenic debris-flow deposit. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Tf2 - Florissant Formation, unit 2 (Eocene)

Interbedded brown paper shales, grayish brown blocky mudstones, thin yellowish pumiceous sandstones, and thin granular pumice conglomerates. Contains abundant plant fossils with less abundant insects and planorbid snails. Most of the fossil quarries in the monument occur in the this unit. Maximum thickness 9 m. Lacustrine. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Tf1 - Florissant Formation, unit 1 (Eocene)

Tan to gray blocky tuffaceous mudstones interbedded with yellowish gray pumiceous sandstones and rare arkosic sandstone ribbons. The arkosic sandstones typically have abundant trough crossbedding. Fossil include stumps and logs of gymnosperms and angiosperms, scattered leaves and rare mammal bones. Bottom contact poorly exposed, with a maximum measured thickness of 10.4 m. Fluvial with a volcanigenic mudflow deposit at the top. ([Evanoff, 1992 Map](#)). (*GRI Source Map ID 932*).

Tb - Eocene boulder conglomerate (Eocene)

Lenticular boulder conglomerate composed primarily of large rounded blocks of Pikes Peak Granite, and secondarily of gneiss and rhyolite cobbles and boulders. Rhyolite clasts are rounded to subangular and were derived from the Wall Mountain Tuff. Contains scattered silicified wood fragments. Unit is interbedded with Tf1, and rests on surface cut into the Wall Mountain Tuff and the Pikes Peak Granite. Probable equivalent of the Tallahassee Creek Conglomerate exposed south of Wrights Reservoir (Wobus and Epis, 1978) secondary ref. Maximum thickness about 15 m. Fluvial and debris-flow deposit. ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Twm - Wall Mountain Tuff (Eocene)

Rhyolitic welded tuff, brownish gray to dark gray. Contains abundant sanidine and less abundant biotite, argillized plagioclase, and magnetite. Weathers to large angular to subangular blocks. Mantles sides of the Florissant paleovalley, and is as thick as 15 m in lower exposures. Age of this tuff is 36.6 +/- 0.06 Ma based on 40Ar/39Ar dating (McIntosh and others, 1992). ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

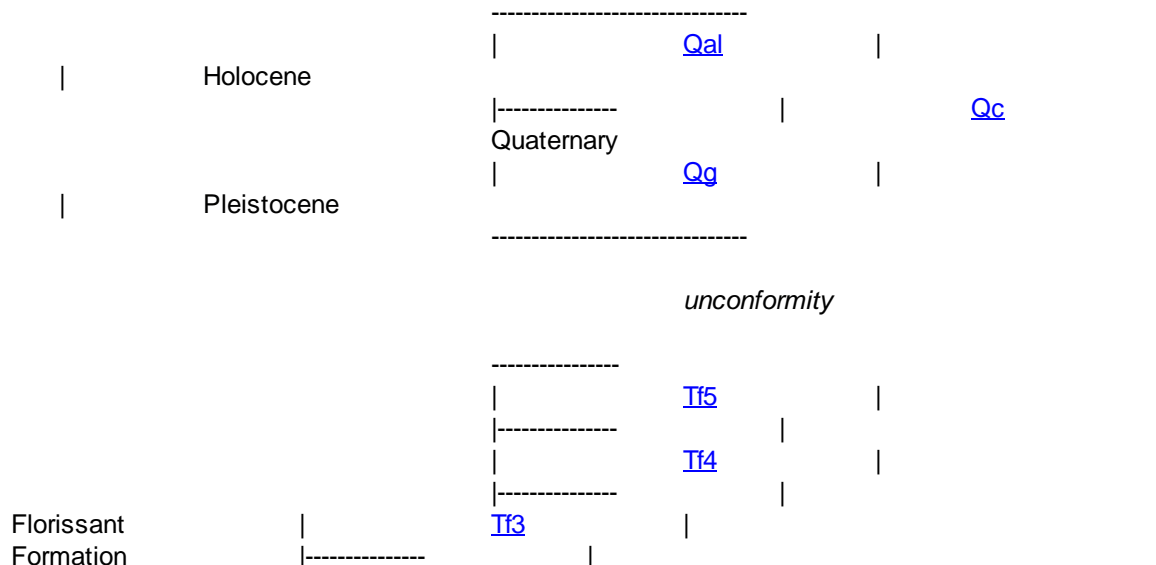
PCg - Pikes Peak Granite (Precambrian)

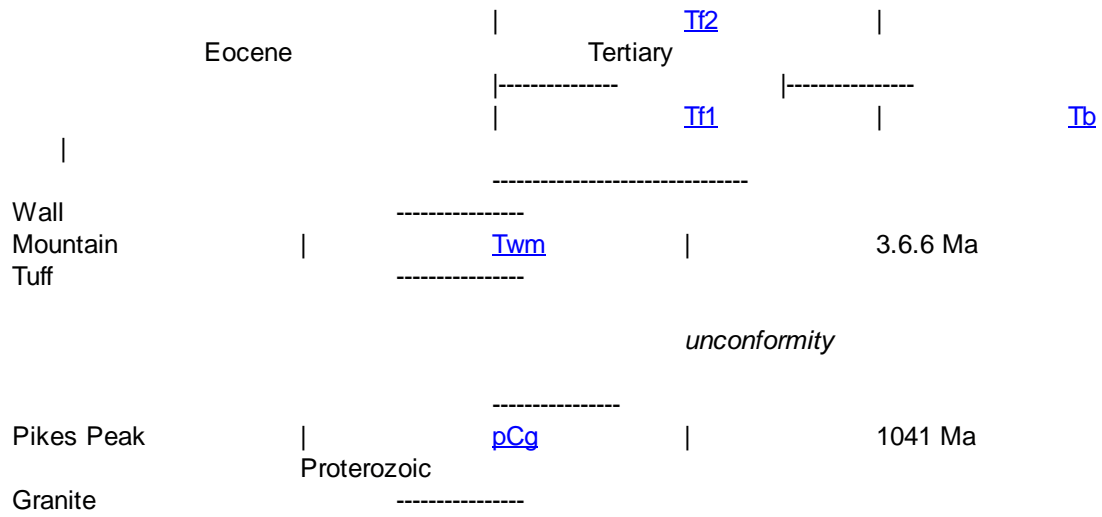
Medium to coarsely crystalline reddish granite and quartz monzonite. Contains abundant perthitic microcline, quartz, and biotite. Weathers into rounded tors and boulders, and into granular grus. Age is 1041 +/- 13 Ma based on Rb/Sr isochron (Hedge, 1970). ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Evanoff, 1992 (Surficial Geologic Map) Source Information

Evanoff, E., Brill, R., de Toledo, P., Murphy, P., and Cushman, R., 1992, Surficial geologic map of Florissant Fossil Beds National Monument, Colorado: University of Colorado, unpublished, scale 1:10,000. (GRI Source Map ID 932).

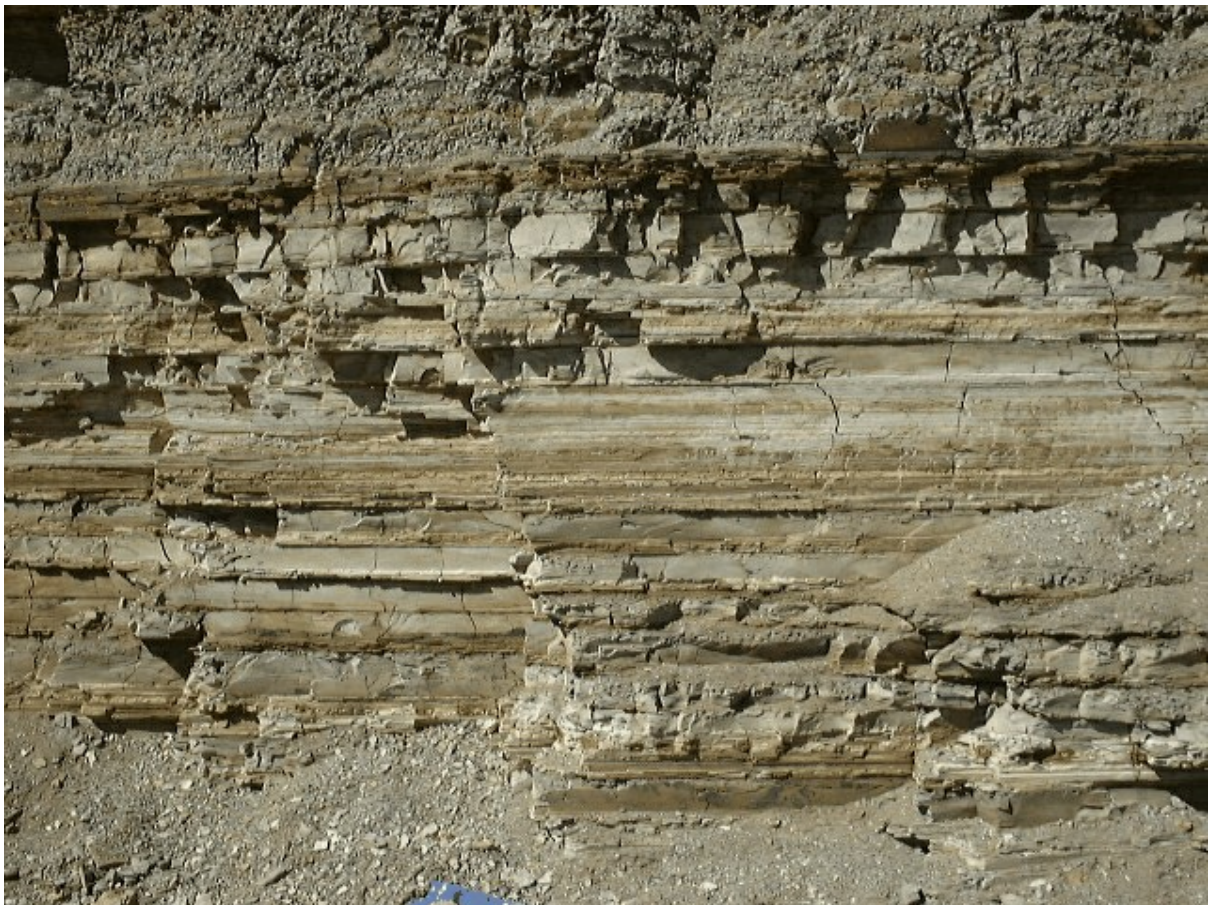
Correlation of Map Units





Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Figure 1



No figure caption was provided

Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Figure 2



No figure caption was provided

Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Figure 3

No figure caption was provided

Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Figure 4

No figure caption was provided

Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

References

Evanoff, E., Brill, R.A., de Toledo, P.M., Murphey, P.C., and Cushman, R.A. Jr., 1992, Surficial geologic map of Florissant Fossil Beds National Monument, Colorado, scale 1:10000. In Doi, K., and Evanoff, E., eds., 1992, The stratigraphy and paleontology of Florissant Fossil Beds National Monument: a progress report: University of Colorado Museum, 169p.

Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Secondary References

Cockerell, T.D.A., 1907, An enumeration of the localities in the Florissant basin from which fossils were obtained in 1906. Bulletin of the American Museum of Natural History, v. 23, p. 127-132.

Hedge, C.E., 1970, Age of the Pikes Peak batholith, Colorado: U.S. Geological Survey Professional

Paper 700B, p. B86-B89.

McIntosh, W.C., Geissman, J.W., Chapin, C.E., Kunk, M.J., and Henry, C.D., 1992, Calibration of the latest Eocene-Oligocene geomagnetic polarity time scale using $^{40}\text{Ar}/^{39}\text{Ar}$ dated ignimbrites: *Geology*, v. 20, p. 459-463.

Wobus, R.A., and Epis, R.C., 1978, Geologic map of the Florissant 15-minute quadrangle, Park and Teller counties, Colorado: U.S. Geological Survey Miscellaneous Investigations Series map I-1044, 1 sheet, scale 62,500.

Base Maps from U.S. Geological Survey 7 ½ minute quadrangle maps for Divide (1954, photo-revised 1985) and Lake George (1956, photo-revised 1984), Colorado.

Extracted from: ([Evanoff, 1992 Map](#)). (GRI Source Map ID 932).

Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado, (Root, 1981) (GRI MapCode ROOT)

Map Unit List

The geologic units present in the digital geologic-GIS data produced for the Digital Geologic-GIS Map of Florissant Fossil Beds National Monument, Colorado, (Root, 1981) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qac - Quaternary alluvium and colluvium). Units are listed from youngest to oldest. No unit descriptions or additional information was provided with the source map.

Cenozoic Era

Quaternary Period and Recent Epoch

Qac - Quaternary alluvium and colluvium

Quaternary Period

Qal - Holocene alluvium

Paleogene Period, Eocene Epoch

Tfut - Florissant Formation, upper tuff

Tfuts - Florissant Formation, upper tuff and lake shales, undifferentiated

Tfsh - Florissant Formation, lake shales

Tflts - Florissant Formation, lower tuff and lake shales, undifferentiated

Tflt - Florissant Formation, lower tuff

Tfb - Florissant Formation, basal arkosic breccia

Twm - Wall Mountain Tuff

Tep - Echo Park Alluvium

Precambrian Era

PCg - Pikes Peak Granite

GRI Digital Data Credits

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

The information in this document was compiled from GRI source maps, and intended to accompany the digital geologic-GIS map(s) and other digital data for Florissant Fossil Beds National Monument, Colorado (FLFO) developed by Anne Poole (NPS) and Stephanie O'Meara. Data and file format migration by James Winter (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).

GRI finalization by Stephanie O'Meara.

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