

**Unpublished Digital Geologic-GIS Map of Jewel Cave National Monument and Vicinity, South Dakota (NPS, GRD, GRI, JECA, JECA digital map) adapted from a South Dakota Geological Survey Geologic Quadrangle Map by Fagnan (2009)**

Metadata also available as

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## What does this data set describe?

### *Title:*

Unpublished Digital Geologic-GIS Map of Jewel Cave National Monument and Vicinity, South Dakota (NPS, GRD, GRI, JECA, JECA digital map) adapted from a South Dakota Geological Survey Geologic Quadrangle Map by Fagnan (2009)

### *Abstract:*

The Unpublished Digital Geologic-GIS Map of Jewel Cave National Monument and Vicinity, South Dakota is composed of GIS data layers and GIS tables, and is available in the following GRI-supported GIS data formats: 1.) a 10.1 file geodatabase (jeca\_geology.gdb), a 2.) Open Geospatial Consortium (OGC) geopackage, and 3.) 2.2 KMZ/KML file for use in Google Earth, however, this format version of the map is limited in data layers presented and in access to GRI ancillary table information. The file geodatabase format is supported with a 1.) ArcGIS Pro map file (.mapx) file and individual Pro layer (.lyrx) files (for each GIS data layer), as well as with a 2.) 10.1 ArcMap (.mxd) map document (jeca\_geology.mxd) and individual 10.1 layer (.lyr) files (for each GIS data layer). The OGC geopackage is supported with a QGIS project (.qgz) file. Upon request, the GIS data is also available in ESRI 10.1 shapefile format. Contact Stephanie O'Meara (see contact information below) to acquire the GIS data in these GIS data formats. In addition to the GIS data and supporting GIS files, three additional files comprise a GRI digital geologic-GIS dataset or map: 1.) this file (jeca\_geology.gis\_readme.pdf), 2.) the GRI ancillary map information document (.pdf) file (jeca\_geology.pdf) which contains geologic unit descriptions, as well as other ancillary map information and graphics from the source map(s) used by the GRI in the production of the GRI digital geologic-GIS data for the park, and 3.) a user-friendly FAQ PDF version of the metadata (jeca\_geology\_metadata\_faq.pdf). Please read the jeca\_geology\_gis\_readme.pdf for information pertaining to the proper extraction of the GIS data and other map files. Google Earth software is available for free at: <http://www.google.com/earth/index.html>. QGIS software is available for free at: <https://www.qgis.org/en/site/>. Users are encouraged to only use the Google Earth data for basic visualization, and to use the GIS data for any type of data analysis or investigation. The data were completed as a component of the Geologic Resources Inventory (GRI) program, a National Park Service (NPS) Inventory and Monitoring (I&M) Division funded program that is administered by the NPS Geologic Resources Division (GRD). For a complete listing of GRI products visit the GRI publications webpage: <https://www.nps.gov/subjects/geology/geologic-resources-inventory-products.htm>. For more information about the Geologic Resources Inventory Program visit the GRI webpage: <https://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, Jason Kenworthy (jason\_kenworthy@nps.gov). Source geologic maps and data used to complete this GRI digital dataset were provided by the following: South Dakota Geological Survey. Detailed information concerning the sources used and their contribution the GRI product are listed in the Source Citation section(s) of this metadata record (jeca\_geology\_metadata.txt or jeca\_geology\_metadata\_faq.pdf). Users of this data are cautioned about the locational accuracy of features within this dataset. Based on the source map scale of 1:24,000 and United States National Map

Accuracy Standards features are within (horizontally) 12.2 meters or 40 feet of their actual location as presented by this dataset. Users of this data should thus not assume the location of features is exactly where they are portrayed in Google Earth, ArcGIS, QGIS or other software used to display this dataset. All GIS and ancillary tables were produced as per the NPS GRI Geology-GIS Geodatabase Data Model v. 2.3. (available at: <https://www.nps.gov/articles/gri-geodatabase-model.htm>). The GIS data projection is NAD83, UTM Zone 13N, however, for the KML/KMZ format the data is projected upon export to WGS84 Geographic, the native coordinate system used by Google Earth.

*Supplemental Information:*

The data layers (feature classes) that comprise the Unpublished Digital Geologic-GIS Map of Jewel Cave National Monument and Vicinity, South Dakota include: JECAGLG (Geologic Units), JECAGLGA (Geologic Contacts), JECAHZA (Hazard Area Features), JECAHZAA (Hazard Area Feature Boundaries), JECAGLN (Linear Geologic Units), JECAFLD (Folds), JECAFLT (Faults), JECASEC (Geologic Cross Section Lines), JECAATD (Geologic Attitude Observation Localities), JECAGPF (Geologic Point Features), JECAHZP (Hazard Point Features) and JECASYM (Map Symbology). In addition to the data layers, there are three GIS tables, the Geologic Unit Information Table (jecaunit) Table, the short-version of the Geologic Unit Information Table (jecaunit\_short) Table, and the Source Map Information Table (jecamap) Table. Refer to the NPS GRI Geology-GIS Geodatabase Data Model v. 2.3 (available at: <https://www.nps.gov/articles/gri-geodatabase-model.htm>) for detailed data layer (feature class) and table specifications including attribute field parameters, definitions and domains, and implemented topology rules and relationship classes. For the KML/KMZ format all or only some of the data layers are available. The KMZ file also possesses on-line links to the GRI program and its products, and to this readme document, the GRI ancillary map information document and the FAQ metadata pertaining to this dataset/map.

**1. How should this data set be cited?**

National Park Service (NPS) Geologic Resources Inventory (GRI) program, 20200225, Unpublished Digital Geologic-GIS Map of Jewel Cave National Monument and Vicinity, South Dakota (NPS, GRD, GRI, JECA, JECA digital map) adapted from a South Dakota Geological Survey Geologic Quadrangle Map by Fagnan (2009).

**2. What geographic area does the data set cover?**

*West\_Bounding\_Coordinate:* -103.87548

*East\_Bounding\_Coordinate:* -103.75

*North\_Bounding\_Coordinate:* 43.7500019562

*South\_Bounding\_Coordinate:* 43.6249999118

**3. What does it look like?**

Not applicable

No browse graphic provided

4. **Does the data set describe conditions during a particular time period?**

*Calendar\_Date:* 25-Feb-2020

*Currentness\_Reference:* ground condition

5. **What is the general form of this data set?**

*Geospatial\_Data\_Presentation\_Form:* map

6. **How does the data set represent geographic features?**

a. **How are geographic features stored in the data set?**

b. **What coordinate system is used to represent geographic features?**

*Grid\_Coordinate\_System\_Name:* Universal Transverse Mercator

*Universal\_Transverse\_Mercator:*

*UTM\_Zone\_Number:* 13

*Transverse\_Mercator:*

*Scale\_Factor\_at\_Central\_Meridian:* 0.999600

*Longitude\_of\_Central\_Meridian:* -105.0

*Latitude\_of\_Projection\_Origin:* 0.000000

*False\_Easting:* 500000.000000

*False\_Northing:* 0.000000

Planar coordinates are encoded using coordinate pair

Abscissae (x-coordinates) are specified to the nearest 0.000007

Ordinates (y-coordinates) are specified to the nearest 0.000007

Planar coordinates are specified in meters

The horizontal datum used is North American Datum of 1983.

The ellipsoid used is Geodetic Reference System 80.

The semi-major axis of the ellipsoid used is 6378137.000000.

The flattening of the ellipsoid used is 1/298.257222.

7. **How does the data set describe geographic features?**

*Entity\_and\_Attribute\_Overview:*

Refer to the NPS GRI Geology-GIS Geodatabase Data Model v. 2.3 (available at: <https://www.nps.gov/articles/gri-geodatabase-model.htm>) for detailed feature class and table attribute field parameters, definitions and domains, and implemented relationship classes, as well as for implemented feature class topology rules.

*Entity\_and\_Attribute\_Detail\_Citation:*

NPS GRI Geology-GIS Geodatabase Data Model v. 2.3. (available at: <https://www.nps.gov/articles/gri-geodatabase-model.htm>)

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## Who produced the data set?

1. **Who are the originators of the data set?** (may include formal authors, digital compilers, and editors)
  - o National Park Service (NPS) Geologic Resources Inventory (GRI) program
2. **Who also contributed to the data set?**

Stephanie O'Meara and Jake Suri (Colorado State University)

3. **To whom should users address questions about the data?**

Stephanie O'Meara  
Colorado State University  
Research Associate, Geologist/GIS Specialist/Data Manager  
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USA

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stephanie\_o'meara@partner.nps.gov

*Hours\_of\_Service:* 9:00 a.m. to 5:00 p.m. (MST), Monday - Friday

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## Why was the data set created?

The data are intended to assist NPS personnel in the protection and management of Jewel Cave National Monument.

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## How was the data set created?

1. **From what previous works were the data drawn?**

### **Geologic Quadrangle Map GQ24K-9** (source 1 of 1)

Fagnan, Brian A., 2009, Geologic Map of the Jewel Cave Quadrangle, South Dakota: Geologic Quadrangle Map GQ24K-9, South Dakota Geological Survey, Vermillion, South Dakota.

*Type\_of\_Source\_Media:* digital data and image

*Source\_Scale\_Denominator:* 24000

*Source\_Contribution:*

Geologic features were derived from source digital data, however, numerous line connections, line coincidence and "topologic" issues existed within the source digital data. Where needed, lines were extended or trimmed to an adjacent fault or geologic

contact. ESRI topology was validated to ensure feature coincidence where there should be (e.g., between faults and faulted contacts, geologic contacts and geologic unit boundaries), and to ensure that "no dangles" existed within the geologic contacts feature class. The geologic units feature class was re-built (Feature to Polygon) using the corrected geologic contacts feature class (lines) and label points exported (Feature to Point) from the source "geology" feature class. A map boundary using precisely defined 2.5' latitude-longitude "tics" for the Jewel Cave 7.5' quadrangle was created and inserted into the geologic contacts and related geologic units feature classes as the source digital data map boundary extent was shifted ~40 to the west of where the boundary should be. A few geologic features not present in the source digital data were digitized using a TIF image of the source map georeferenced in NAD83 UTM. The source map image was also used to attribute features, as well as to check (QC) line quality, both positionally and spatially, and feature attribution. Many features in the source digital data had incomplete attribution or attribution that didn't match the published source map. Ancillary source map text, including unit descriptions, and graphics, if present, were captured, formatted and added to the ancillary map information document. See the Process Step section for additional information.

## 2. **How were the data generated, processed, and modified?**

Date: 25-Feb-2020 (process 1 of 1)

1.) GIS features were produced from source digital data or digitized from a source map. In many cases lines were "corrected" to ensure coincidence and snapping. See the Source Information Contribution section(s) for specific source map details. GIS features converted from source digital data were imported into a GRI data model compliant geodatabase. For details on the GRI data model see the NPS GRI Geology-GIS Geodatabase Data Model v. 2.3 (available at: <http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm>). GIS features captured from a source map were digitized from a TIF image of the map georeferenced in NAD83 UTM. 2.) Line quality of digitized features was checked against the source scan to ensure that GIS features were represented accurately, both positionally and spatially. Line quality of digital data was checked and if warranted edited to ensure good quality linework. 3.) Feature attribution was derived for all features using the source data attribution and the source printed/plotted map if available. 4.) Data Model topology rules were validated on all features and any topology errors corrected. 5.) Quality control (QC) consisted of checking features and their attribution against the source digital data, as well as against the source printed/plotted map if available. A GRI developed ArcObjects tool was run to check for GRI data model validation and feature-related consistency. 6.) The UNIT and MAP tables were populated and checked against the source(s). Relationship classes were also added and used to ensure attribution consistency between feature class and table attribution. 7.) Feature symbology was produced for all feature classes. An attempt was made to best match symbology to its source map, however, in some cases features symbology maybe slightly modified, primarily based on the limitations of the ArcGIS geology styles. In some cases, however, symbology may have been modified to reconcile differences from multiple sources. 8.) An ArcMap Document was produced, in part by a GRI finalize mxd tool, and layer (.lyr) files saved

for all data layers. 9.) The ancillary map information PDF document, see the Supplemental Information section for additional information, was produced from textual information and figures present on the source map(s) and/or in digital data files. If applicable, source map images were produced at 150dpi or greater resolution and optical character recognition (OCR) software was used to produce text from source map text. The text, source map images and other ancillary source map information were added to a Help & Manual (.hmxz) template file. The .hmxz file was then compiled to produce the ancillary map information document. Any compilation errors were then checked and corrected and the document was reviewed for content, usability and grammatical errors. 10.) A Google Earth .kmz/.kml file, as well as a OGC GeoPackage and QGIS project file was produced from the finalized file geodatabase and ArcMap document.

Person who carried out this activity:

Stephanie O'Meara  
Colorado State University  
Research Associate, Geologist/GIS Specialist/Data Manager  
1201 Oak Ridge Drive, Suite 200  
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*Hours\_of\_Service:* 9:00 a.m. to 5:00 p.m. (MST), Monday - Friday

Data sources used in this process:

- Geologic Quadrangle Map GQ24K-9
3. **What similar or related data should the user be aware of?**

National Park Service Geologic Resources Inventory (GRI) program, 20200225, Metadata for the Unpublished Digital Geologic-GIS Map of Jewel Cave National Monument and Vicinity, South Dakota (NPS, GRD, GRI, JECA, JECA digital map).

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## **How reliable are the data; what problems remain in the data set?**

1. **How well have the observations been checked?**

Feature and table attribution was derived and checked with the source map(s). Attribution was checked (QCd) for errors. Users of this data are advised to FULLY and CAREFULLY READ the "DISTRIBUTION LIABILITY" section of this metadata before using the data.

## 2. **How accurate are the geographic locations?**

Data was produced from digital source data and digitized from a georeferenced source map .TIF image(s) (300dpi). Users of this data are cautioned about the locational accuracy of features within this dataset. Based on the source map scale and United States National Map Accuracy Standards features are within (horizontally) 12.2 meters or 40 feet of their actual location as presented by this dataset. Users of this data should thus not assume the location of features is exactly where they portrayed are in ArcGIS or other software used to display this dataset. The PRECISION of any Shapefile (.shp) files is DOUBLE. The maximum root mean square (RMS) horizontal accuracy of the georeferenced image as measured in ArcMap is #PAM# meters. Coordinate tics on the georeferenced (registered and rectified) source map image(s) were checked against control points that had the exact specified coordinates of the tic. The direct distance between the image tic and its control point were measured. All measured distances were less than 50% of the required distance to meet National Map Accuracy Standards (1/50th of an inch for maps at 1:20,000 scale and smaller). Features were checked (QCd) after digitizing for positional accuracy errors using the georeferenced source map image.

## 3. **How accurate are the heights or depths?**

No vertical coordinates are present in this GRI digital dataset.

## 4. **Where are the gaps in the data? What is missing?**

All data is considered complete to the extent of the source map(s).

## 5. **How consistent are the relationships among the observations, including topology?**

GIS data in 10.1 file geodatabase, OGC geopackage and 2.2 KML/KMZ file formats.

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## **How can someone get a copy of the data set?**

### **Are there legal restrictions on access or use of the data?**

*Access\_Constraints:* None

*Use\_Constraints:*

Not for use at scale greater than 1:24,000 (source map scale). Users of this data are cautioned about the locational accuracy of features within this dataset. Based on the source map scale and United States National Map Accuracy Standards features are within (horizontally) 12.2 meters or 40 feet of their actual location as presented by this dataset. Users of this data should thus not assume the location of features is exactly where they are portrayed in Google

Earth, ArcGIS, QGIS or other software used to display this dataset.

1. **Who distributes the data set?** (Distributor 1 of 1)

Stephanie O'Meara  
Colorado State University  
Research Associate, Geologist/GIS Specialist/Data Manager  
1201 Oak Ridge Drive, Suite 200  
Fort Collins, Colorado 80525  
USA

(970) 491-6655 (voice)  
stephanie\_o'meara@partner.nps.gov

*Hours\_of\_Service:* 8:00 a.m. to 4:00 p.m. (MST), Monday - Friday

*Contact\_Instructions:*

GRI data are available at: <http://irma.nps.gov/App/Reference/Search>

2. **What's the catalog number I need to order this data set?**

GIS map data available in several GRI-supported GIS data formats

3. **What legal disclaimers am I supposed to read?**

The National Park Service shall not be held liable for improper or incorrect use of the data described and/or contained herein. These data and related graphics are not legal documents and are not intended to be used as such.

The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived. It is the responsibility of the data user to use the data appropriately and consistent within the limitations of geospatial data in general and these data in particular. The related graphics are intended to aid the data user in acquiring relevant data; it is not appropriate to use the related graphics as data.

The National Park Service gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. It is strongly recommended that these data are directly acquired from an NPS server and not indirectly through other sources which may have changed the data in some way. Although these data have been processed successfully on a computer system at the National Park Service, no warranty, expressed or implied is made regarding the utility of the data on another system or for general scientific purposes, nor shall the act of distribution constitute any

such warranty. This disclaimer applies to both to individual use of the data and aggregate use with other data.

#### 4. How can I download or order the data?

- **Availability in digital form:**

**Data format:** GDB (version ArcGIS Pro 2.4) GIS (file geodatabase format) data package with a Pro map (.mapx) file (jeca\_geology\_gdb\_pro.zip) Size: 2.02

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

**Data format:** GDB (version ArcGIS 10.1) GIS (file geodatabase format) data package with an ArcMap map document (.mxd) file (jeca\_geology\_gdb.zip) Size: 2.33

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

**Data format:** KML/KMZ (version 2.2) Google Earth (kml/kmz format) data package (jeca\_geology\_kml.zip) Size: 2.08

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

**Data format:** GPKG (version OGC geopackage) GIS (geopackage format) data package with a QGIS project (.qgz) file (jeca\_geology\_gpkg.zip) Size: 1.6

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

**Data format:** PDF (version 9) Ancillary Map Information Document Size: 3.54

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

**Data format:** PDF (version 9) GIS Readme Document Size: 0.1

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

**Data format:** PDF (version 9) FAQ Metadata File Size: 0.1

**Network links:** NPS Data Store, <https://irma.nps.gov/DataStore/>

- **Cost to order the data:** None

- **Special instructions:**

Search for the GRI map, then download the GRI data at:  
<https://irma.nps.gov/DataStore/>

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## Who wrote the metadata?

Dates:

Last modified: 25-Feb-2020

Metadata author:

Stephanie O'Meara  
Colorado State University  
Research Associate, Geologist/GIS Specialist/Data Manager  
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stephanie.omeara@colostate.edu

*Hours\_of\_Service:* 9:00 a.m. to 5:00 p.m. (MST), Monday - Friday

Metadata standard:

FGDC Content Standards for Digital Geospatial Metadata (FGDC-STD-001-1998)

Metadata extensions used:

- <http://www.fgdc.gov/standards/>