Digital Geologic-GIS Map of Cape Cod National Seashore and Vicinity, Massachusetts (NPS, GRD, GRI, CACO, CACO digital map) adapted from a U.S. Geological Survey Open-File Report by Stone and DiGiacomo (2010), and Geologic Quadrangle Maps by Oldale, Koteff and Hartshorn (1971), Oldale (1970), Oldale (1968), and Koteff, Oldale and Hartshorn (1967)

Metadata also available as

Frequently-anticipated questions:

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    1. From what previous works were the data drawn?
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- How can someone get a copy of the data set?
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What does this data set describe?

Title:
Digital Geologic-GIS Map of Cape Cod National Seashore and Vicinity, Massachusetts (NPS, GRD, GRI, CACO, CACO digital map) adapted from a U.S. Geological Survey Open-File Report by Stone and DiGiacomo (2010), and Geologic Quadrangle Maps by Oldale, Koteff and Hartshorn (1971), Oldale (1970), Oldale (1968), and Koteff, Oldale and Hartshorn (1967)

Abstract:
The Digital Geologic-GIS Map of Cape Cod National Seashore and Vicinity, Massachusetts is composed of GIS data layers and GIS tables, and is available in the following GRI-supported GIS data formats: 1.) an ESRI file geodatabase (caco_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 3.X map file (.mapx) file (caco_geology.mapx) and individual Pro 3.X layer (.lyrx) 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 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.) a readme file (caco_geology_gis_readme.pdf), 2.) the GRI ancillary map information document (.pdf) file (caco_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 (caco_geology_metadata_faq.pdf). Please read the caco_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: https://www.google.com/earth/versions/. 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: U.S. 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 (caco_geology_metadata.txt or caco_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 Pro, 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).
Supplemental_Information:
The data layers (feature classes) that comprise the Digital Geologic-GIS Map of Cape Cod National Seashore and Vicinity, Massachusetts include: Geologic Attitude Observation Localities (CACOATD), Geologic Measurement Localities (CACOGML), Geologic Observation Localities (CACOGOL), Geologic Sample Localities (CACOGSL), Glacial Feature Lines (CACOGFL), Geologic Line Features (CACOGLF), Paleoshorelines (CACOLIN), Glacial Feature Points (CACOGFP), Geologic Point Features (CACOGPF), Geologic Cross Section Lines (CACOSEC), Surficial Units (CACOSUR) and Surficial Contacts (CACOSURA). In addition to the data layers, there are three GIS tables, the Geologic Unit Information Table (cacounit) Table, the short-version of the Geologic Unit Information Table (cacounit_short) Table, and the Source Map Information Table (cacomap) 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. The GIS data projection is NAD83, UTM Zone 19N, however, for the KML/KMZ format the data is projected upon export to WGS84 Geographic, the native coordinate system used by Google Earth.

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

   National Park Service (NPS) Geologic Resources Inventory (GRI) program, 20240819, Digital Geologic-GIS Map of Cape Cod National Seashore and Vicinity, Massachusetts (NPS, GRD, GRI, CACO, CACO digital map) adapted from a U.S. Geological Survey Open-File Report by Stone and DiGiacomo (2010), and Geologic Quadrangle Maps by Oldale, Koteff and Hartshorn (1971), Oldale (1970), Oldale (1968), and Koteff, Oldale and Hartshorn (1967).

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

   West_Bounding_Coordinate: -70.24947285042862
   East_Bounding_Coordinate: -69.87445767499493
   North_Bounding_Coordinate: 42.1251020895815
   South_Bounding_Coordinate: 41.625113670275695

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: 19-Aug-2024
   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: 19
   Transverse_Mercator:
   Scale_Factor_at_Central_Meridian: 0.999600
   Longitude_of_Central_Meridian: -69.0
   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)

Who produced the data set?

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

    Georgia Hybels, Stephanie O'Meara and Dave Green (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
    1201 Oak Ridge Drive, Suite 200
    Fort Collins, Colorado 80525
    USA

    (970) (303) 969-2090 (voice)
    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 Cape Cod National Seashore.

How was the data set created?

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

    USGS Geologic Quadrangle Map GQ-931 (source 1 of 5)

    Oldale, R.N., Koteff, C., and Hartshorn, J.H., 1971, Geologic Map of the Orleans Quadrangle, Barnstable County, Cape Cod, Massachusetts: Geologic Quadrangle Map GQ-931, U.S. Geological Survey (USGS), Reston, Virginia.

Type_of_Source_Media: paper
Source_Scale_Denominator: 24000
Source_Contribution:
Geologic features present on the source map were digitized using a .TIF image of the paper/mylar map that was scanned at 300dpi and georeferenced in NAD83 UTM. The source map scan was also used to attribute features, as well as to check (QC) line quality, both positionally and spatially, and feature attribution. 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.

USGS Geologic Quadrangle Map GQ-911 (source 2 of 5)

> Oldale, R.N., 1970, Geologic Map of the Chatham Quadrangle, Barnstable County, Cape Cod, Massachusetts: Geologic Quadrangle Map GQ-911, U.S. Geological Survey (USGS), Reston, Virginia.

Type_of_Source_Media: paper
Source_Scale_Denominator: 24000
Source_Contribution:
Geologic features present on the source map were digitized using a .TIF image of the paper/mylar map that was scanned at 300dpi and georeferenced in NAD83 UTM. The source map scan was also used to attribute features, as well as to check (QC) line quality, both positionally and spatially, and feature attribution. 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.

USGS Geologic Quadrangle Map GQ-750 (source 3 of 5)

> Oldale, R.N., 1968, Geologic Map of the Wellfleet Quadrangle, Barnstable County, Cape Cod, Massachusetts: Geologic Quadrangle Map GQ-750, U.S. Geological Survey (USGS), Reston, Virginia.

Type_of_Source_Media: paper
Source_Scale_Denominator: 24000
Source_Contribution:
Geologic features present on the source map were digitized using a .TIF image of the paper/mylar map that was scanned at 300dpi and georeferenced in NAD83 UTM. The source map scan was also used to attribute features, as well as to check (QC) line quality, both positionally and spatially, and feature attribution. 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.

USGS Geologic Quadrangle Map GQ-599 (source 4 of 5)

> Koteff, C., Oldale, R.N., and Hartshorn, J., 1967, Geologic Map of the North Truro Quadrangle, Barnstable County, Massachusetts: Geologic Quadrangle Map GQ-599, U.S. Geological Survey (USGS), Reston, Virginia.

Type_of_Source_Media: paper

Source_Scale_Denominator: 24000
Source_Contribution:
Geologic features present on the source map were digitized using a .TIF image of the paper/mylar map that was scanned at 300dpi and georeferenced in NAD83 UTM. The source map scan was also used to attribute features, as well as to check (QC) line quality, both positionally and spatially, and feature attribution. 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.

USGS Open-File Report OF-2006-1260-E (source 5 of 5)

> Stone, B.D., and DiGiacomo, M.L., 2010, Surficial Geologic Map of the Pocasset-Provincetown-Cuttyhunk-Nantucket 24-Quadrangle Area of Cape Cod and Islands, Southeast Massachusetts: Open-File Report OF-2006-1260-E, U.S. Geological Survey (USGS), Reston, Virginia.

Type_of_Source_Media: digital data
Source_Scale_Denominator: 24000
Source_Contribution:
Features and attribution were derived from source digital data. Ancillary map text, including unit descriptions, and graphics, if present on the source map, 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: 19-Aug-2024 (process 1 of 1)
1.) GIS features were produced from source digital data or digitized from a source paper map. 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: https://www.nps.gov/articles/gri-geodatabase-model.htm). GIS features captured from a source paper map were digitized from a TIF image of the map scanned at 300dpi and 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 ArcGis Pro map (.mapx) file, as well as individual layer (.lyrx) files, were produced. 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
Dept. of Geosciences (1482)
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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:

- USGS Geologic Quadrangle Maps GQ-931, GQ-911, GQ-750 and GQ-599, USGS Open-File Report OF-2006-1260-E

3. **What similar or related data should the user be aware of?**

National Park Service Geologic Resources Inventory (GRI) program, 20240819, Metadata for the Digital Geologic-GIS Map of Cape Cod National Seashore and Vicinity, Massachusetts (NPS, GRD, GRI, CACO, CACO digital map).

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 Pro 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 is 1 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 ESRI file geodatabase, OGC geopackage and 2.2 KML/KMZ file formats.

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 Pro, 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
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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 3.0) GIS (file geodatabase format) data package with a Pro map (.mapx) file (caco_geology_gdb_pro.zip) Size: 10.39
Network links:	NPS Data Store, https://irma.nps.gov/DataStore/
Data format:	KML/KMZ (version 2.2) Google Earth (kml/kmz format) data package (caco_geology_kml.zip) Size: 14.69
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 (caco_geology_gpkg.zip) Size: 8.91
Network links:	NPS Data Store, https://irma.nps.gov/DataStore/
Data format:	PDF (version 9) Ancillary Map Information Document Size: 4.99
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/

Who wrote the metadata?

Dates:

Last modified: 19-Aug-2024

Metadata author:

Stephanie O'Meara
Colorado State University
Research Associate, Geologist/GIS Specialist/Data Manager
Dept. of Geosciences (1482)
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USA

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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/>

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