

# DIGITAL MAPPING TECHNIQUES 2021

The following was presented at DMT'21  
(June 7 - 10, 2021 - A Virtual Event)

The contents of this document are provisional

See Presentations and Proceedings  
from the DMT Meetings (1997-2021)

<http://ngmdb.usgs.gov/info/dmt/>

## SLIDE 1

# The U.S. National Geologic Map Database

Dave Soller  
U.S. Geological Survey  
drsoller@usgs.gov



ngmdb.usgs.gov



### PRESENTER NOTES:

For some in the audience, you've heard me speak on this subject many times in the past 25 years. To you, I apologize for covering what seems like the same ground in this presentation, but indeed the National Geologic Map Database (NGMDB) project doesn't stand still; we evolve and add content on an almost daily basis. Regarding evolution and expansion of the NGMDB's scope and responsibilities, that has been accelerated owing to the Congressional appropriations for NGMDB's Phase Three (e.g., <https://www.congress.gov/congressional-report/116th-congress/house-report/100/1>). Renamed the US GeoFramework initiative, you'll be hearing about that on Wednesday.

Today, I'll overview the main elements that are accessible to you and the public and highlight some of the new developments. If you've seen me present on the NGMDB, you know that I generally lead off with three slides. These are:

SLIDE 2

106 STAT. 166 PUBLIC LAW 102-285—MAY 18, 1992

Public Law 102-285  
102d Congress

An Act

May 18, 1992  
[H.R. 2763]

To enhance geologic mapping of the United States, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

National  
Geologic  
Mapping  
Act of 1992.  
Conservation.  
Environmental  
protection.  
43 USC 31a  
note.  
43 USC 31a.

**SECTION 1. SHORT TITLE.**  
This Act may be cited as the “National Geologic Mapping Act of 1992”.

**SEC. 2. FINDINGS AND PURPOSE.**

(a) **FINDINGS.**—The Congress finds and declares that—

(1) during the past 2 decades, the production of geologic maps has been drastically curtailed; . . .

(8) a comprehensive nationwide program of geologic mapping is required in order to systematically build the Nation’s geologic-map data base at a pace that responds to increasing demand.

(b) **PURPOSE.**—The purpose of this Act is to expedite the production of a geologic-map data base for the Nation, to be located within the United States Geological Survey, which can be applied to land-use management, assessment, and utilization, conservation of natural resources, groundwater management, and environmental protection.

<https://www.youtube.com/watch?v=tdq8kNtO-wQ>

PRESENTER NOTES:

The National Geologic Mapping Act of 1992, which established the National Cooperative Geologic Mapping Program (NCGMP) and called for creation of the NGMDB, as a National Archive that would be accessible for a wide variety of purposes. The Act indicates that the NGMDB is a joint effort, between the USGS and the Association of American State Geologists (AASG). It’s our responsibility, in the Nation’s geological surveys, to ensure that this Archive remains viable and useful —as you see, it’s the sole stated Purpose of the Act. That point is well noted in the Association of American State Geologists’ (AASG) YouTube video on the Act (<https://www.youtube.com/watch?v=tdq8kNtO-wQ>). I applaud the decision of the President of AASG, John Yellich (State Geologist, Michigan Geological Survey) to develop this instructional video, and thank Dick Berg (State Geologist, Illinois State Geological Survey) for putting it together.

SLIDE 3

PUBLIC LAW 102-285—MAY 18, 1992

106 STAT. 171

facilitate planning and information exchange and to avoid redundancy.

**SEC. 7. NATIONAL GEOLOGIC-MAP DATA BASE.**

Historic  
preservation.  
43 USC 31f.

(a) **ESTABLISHMENT.**—The Survey shall establish a national geologic-map data base. Such data base shall be a national archive that includes all maps developed pursuant to this Act, the data bases developed pursuant to the investigations under sections (4)(d)(2) (C), (D), (E), and (F), and other maps and data as the Survey deems appropriate.

(b) **STANDARDIZATION.**—Geologic maps contributed to the national archives should have standardized format, symbols, and technical attributes so that archival information can be assimilated, manipulated, accessed, exchanged, and compared efficiently and accurately.

PRESENTER NOTES:

In the Act, the importance of standardization is emphasized. Further, the Act stipulates that the NGMDB, as the national archive, shall include not just maps developed pursuant to the Act, but also certain ancillary databases, as well as other maps and data as the Survey deems appropriate. That last clause has been vital to the NGMDB Catalog's development into the authoritative, comprehensive collection of many types of geoscience reports and maps.

SLIDE 4

## We stand on the shoulders of giants



*“...the maps are designed not so much for the specialist as for the people, who justly look to the official geologist for a classification, nomenclature, and system of convention so simple and expressive as to render his work immediately [understandable]...”*

– USGS Director J.W. Powell,  
3<sup>RD</sup> IGC (Berlin, 1885)



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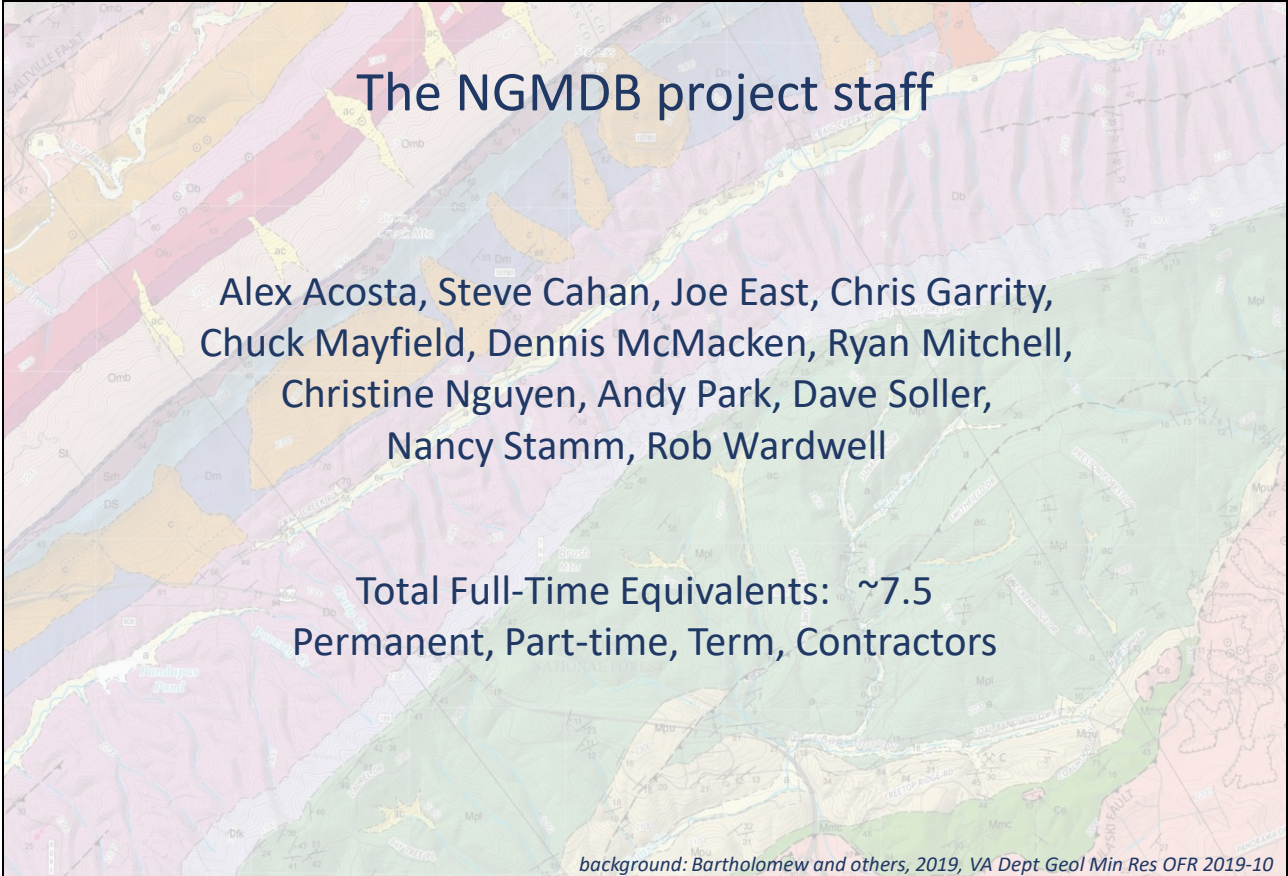
**PRESENTER NOTES:**

I always like to include this quote from our former Director (Powell, J.W., 1888, Methods of geologic cartography in use by the United States Geological Survey, in Congrès Géologique International, Compte Rendu de la 3me Session, Berlin, 1885: Berlin, Germany, A.W. Schade's Buchdruckerei, p. 221–240).

It's the guiding principle for this project, and a reminder to us all that the information we publish isn't just for the professional geologist.



**SLIDE 5**





**The NGMDB project staff**

Alex Acosta, Steve Cahan, Joe East, Chris Garrity,  
Chuck Mayfield, Dennis McMacken, Ryan Mitchell,  
Christine Nguyen, Andy Park, Dave Soller,  
Nancy Stamm, Rob Wardwell

Total Full-Time Equivalents: ~7.5  
Permanent, Part-time, Term, Contractors

*background: Bartholomew and others, 2019, VA Dept Geol Min Res OFR 2019-10*

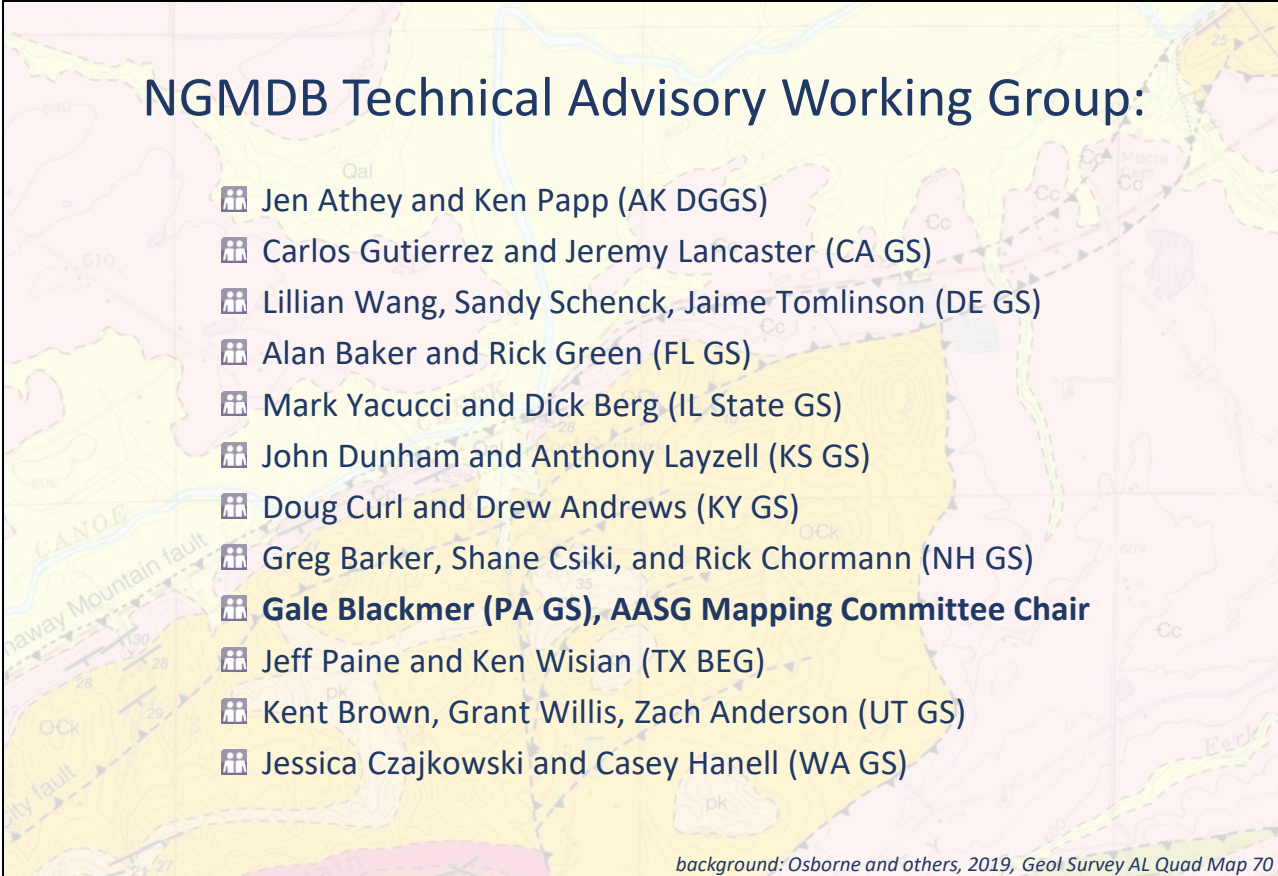
 [ngmdb.usgs.gov](https://ngmdb.usgs.gov) 

**PRESENTER NOTES:**

I'd now like to acknowledge the project's highly dedicated staff, some of whom have been with us throughout the project's 26 years.

[Slide background: portion of Bartholomew, M.J., and others, 2019, Geologic map of the Newport quadrangle, Virginia: Virginia Division of Geology and Mineral Resources, Open-File Report 2019-10, scale 1:24,000. Funded in part by NCGMP STATEMAP. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_109472.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_109472.htm)).]



## SLIDE 6



### NGMDB Technical Advisory Working Group:

- 👤 Jen Athey and Ken Papp (AK DGGS)
- 👤 Carlos Gutierrez and Jeremy Lancaster (CA GS)
- 👤 Lillian Wang, Sandy Schenck, Jaime Tomlinson (DE GS)
- 👤 Alan Baker and Rick Green (FL GS)
- 👤 Mark Yacucci and Dick Berg (IL State GS)
- 👤 John Dunham and Anthony Layzell (KS GS)
- 👤 Doug Curl and Drew Andrews (KY GS)
- 👤 Greg Barker, Shane Csiki, and Rick Chormann (NH GS)
- 👤 **Gale Blackmer (PA GS), AASG Mapping Committee Chair**
- 👤 Jeff Paine and Ken Wisian (TX BEG)
- 👤 Kent Brown, Grant Willis, Zach Anderson (UT GS)
- 👤 Jessica Czajkowski and Casey Hanell (WA GS)

background: Osborne and others, 2019, Geol Survey AL Quad Map 70

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### PRESENTER NOTES:

In 2018 I formed a Technical Advisory Working Group, composed of 26 members from 12 State geological surveys --the membership includes both a technical expert and member of upper management from each Survey. Because the NGMDB is a joint effort between the USGS and AASG, it's important to seek State Geological Survey guidance, to more fully engage the States in the NGMDB and to ensure the NGMDB's relevance to State "business plans." The Working Group has assisted the NGMDB and the geoscience community in many ways, for example: evaluating the proposed approach for certifying compliance with the GeMS schema, testing the GeMS validation scripts, testing the NGMDB's new Catalog input Form, suggesting strategies for improving efficiencies in collecting and managing content, guiding the NGMDB in its outreach activities, and writing a set of recommendations for increasing AASG's role in advising and managing the NGMDB.

[Slide background: portion of Osborne, W.E., and others, 2019, Geology of the Ashville 7.5-minute quadrangle, St. Clair and Blount Counties, Alabama: Geological Survey of Alabama, Quadrangle Map Series 70, scale 1:24,000. Funded in part by NCGMP STATEMAP. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_108995.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_108995.htm)).]

## SLIDE 7

### The NGMDB project serves our community

- ✕ Fulfills the Geologic Mapping Act's purpose, to develop a National Archive of standardized geoscience information, manifested in the NGMDB's Trusted Digital Repository and the Web interfaces that provide access to it.
- ✕ Provides a national, comprehensive, and authoritative resource for professionals and citizens, supported by a strong tradition of customer service.
- ✕ Maintains the national geologic names lexicon and associated resources, to assist mappers and stratigraphers in their work, and in support of more consistent nomenclature across map boundaries.
- ✕ Facilitates the geoscience community's development of standards and guidelines for geologic maps and related reports, supported by various resources maintained by the NGMDB.
- ✕ Supports emerging needs such as those required under the US GeoFramework initiative.

*background: Wells and others, 2020, USGS SIM-3443*

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### PRESENTER NOTES:

In the 26 years since the NGMDB began with the collaboration of many in our community, we've come to serve in many ways:

- Fulfills the Geologic Mapping Act's purpose, to develop a National Archive of standardized geoscience information, manifested in the NGMDB's Trusted Digital Repository and the Web interfaces that provide access to it.
- Provides a national, comprehensive, and authoritative resource for professionals and citizens, supported by a strong tradition of customer service.
- Maintains the U.S. Geologic Names Lexicon (Geolex) and associated resources, to assist mappers and stratigraphers in their work, and in support of more consistent nomenclature across map boundaries.
- Facilitates the geoscience community's development of standards and guidelines for geologic maps and related reports, supported by various resources maintained by the NGMDB.
- Supports emerging needs such as those required under the Congressional appropriations for the NGMDB's Phase Three (US GeoFramework initiative).

[Slide background: portion of Wells, R.E., and others, 2020, Geologic map of the greater Portland metropolitan area and surrounding region, Oregon and Washington: U.S. Geological Survey, Scientific Investigations Map SIM-3443, scale 1:63,360. Prepared in cooperation with the Oregon Department of Geology and Mineral Industries and the Washington Geological Survey. Funded by NCGMP FEDMAP. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_110666.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_110666.htm)).]



## SLIDE 8

### Our development strategy

- ✿ Focus on content. That's why users come to the Website.
- ✿ Keep the technology simple to use. This isn't a research project. Don't build a site that's beyond the interest, skill, and technologies of our users. Focus on clarity of presentation and navigation, and speed of delivery.
- ✿ Customer Service. Listen to the user. Interact with them. Ensure they get the answers and data they need. As a result, we learn how to improve the system.
- ✿ Plan for the long term. Focus on preserving information. Work with the Library community, to ensure NGMDB content is compatible and addresses generally-accepted, long-term objectives.



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#### PRESENTER NOTES:

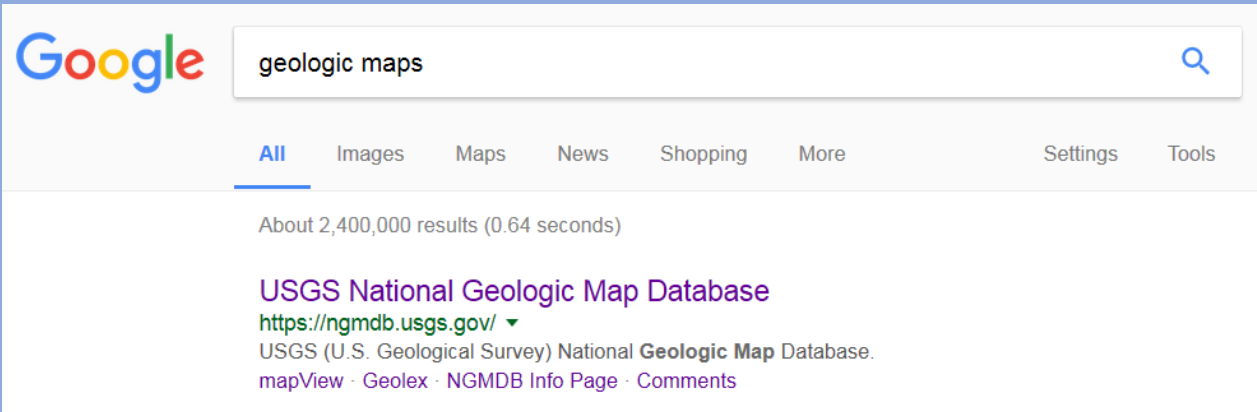
Those accomplishments and responsibilities are the result of our consistent development strategy, over these 26 years...

## SLIDE 9

### Our development strategy

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SLIDE 10



The screenshot shows a Google search interface with the query "geologic maps". The search results page displays "About 2,400,000 results (0.64 seconds)". The top result is titled "USGS National Geologic Map Database" with the URL <https://ngmdb.usgs.gov/>. Below the title, it says "USGS (U.S. Geological Survey) National Geologic Map Database." and provides links for "mapView", "Geolex", "NGMDB Info Page", and "Comments".

139,800 users made 312,500+ visits in April, 2021  
(~ 10,400 visits / day)  
33.8 million pages served

USGS science for a changing world | [ngmdb.usgs.gov](https://ngmdb.usgs.gov) | AASG Association of American State Geologists

## SLIDE 11

### Our development strategy

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## SLIDE 13

### “I need information on...”

Historic USGS topo maps of southwest Oregon. Spatial extent of formations that may have been sources for prehistoric tool stone. Definitions for USGS formation codes Plz, Qu, Yms, Ybgn, Tbgd. Verification there was a hail storm in Orlando in mid-March-FAA doesn't keep track of this anymore. Buckingham slate vs. Vermont slate-which is better for roof shingles. USGS formation code TRL. The altitude of where I live. US Federal policy on collection, allocation, and cost recovery of geoscientific data. Answers to my homework assignment. Which aquifer is my well in. Source of Long Valley caldera map shown on Berkeley website. Brass survey marker labeled sealock 2 1931 on my land. Difference between till and diamicton. How faults are named. USGS standards for map legends. Mercury concentrations in the US. Names of the Wolfcamp to Atoka formations in northernmost Texas-had to come out here in a rush and could use some back-up. Vitrinite reflectance data on Floyd Shale. Depth and type of alluvium for study in southern California. I hear the USGS is photographing Utah at a 1 foot, true color resolution-when will you be finished, I need this for the design of an Air Force training range. USGS bookstore wants a productID, how am I supposed to know that...



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#### PRESENTER NOTES:

Examples of the wide range of user's questions.

## Our development strategy

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## SLIDE 15



- ↻ Maps
- ↻ Reports
- ↻ Unpublished notes, data
- ↻ GIS files
- ↻ Metadata
- ↻ Images

### PRESENTER NOTES:

That last point is a critical one for every agency. In my experience, with the emergence of digital technology and the waning of the Library's presence at most agencies, the management and stewardship of our publications and data, by those of us also tasked with mapping, GIS, and computer technology, has become problematic.



SLIDE 16

## Managing publications and data – getting our houses in order!



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**PRESENTER NOTES:**

For the NGMDB to succeed, as well as the US GeoFramework initiative (Congressional appropriations for NGMDB's Phase Three), a large body of standardized, well organized geoscience data, created and managed by many agencies, must be built and maintained.

SLIDE 17

**USGS** **AASG**  
*science for a changing world* Association of American State Geologists

USGS HOME CONTACT USGS SEARCH USGS

Home Catalog Lexicon MapView New Mapping Standards Comments

# The National Geologic Map Database

Developing a distributed archive of standardized geoscience information for the nation.

**Map Catalog**  
Find over 90,000 products from over 600 publishers

**Stratigraphy**  
Find geologic names, charts, and guidelines

**MapView**  
Discover geologic maps through our map interface

**TopoView**  
Access the Historical Topographic Map Collection

PRESENTER NOTES:

We opened the Website in January, 1996, just a couple of years after the Web was licensed for public use. It's been a 24/7 activity ever since, that's 25 years now. The NGMDB is a foremost, authoritative source for geoscience information for the Nation.

## SLIDE 18

# NGMDB



- 🔗 Geoscience Map Catalog
- 🔗 US Geologic Names Lexicon GEOLEX
- 🔗 MapView
- 🔗 MapExplorer (in prep.)
- 🔗 NCGMP New Mapping In Progress
- 🔗 Earth Mapping Resource Initiative (EarthMRI) Acquisitions Viewer
- 🔗 TopoView (topographic maps)
- 🔗 Standards



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### PRESENTER NOTES:

Here's a list of the principal functions accessed by the public.

**SLIDE 19**

Including the NGMDB Trusted Digital Repository,  
USGS has only four:



\* Certification according to ICSU (International Council for Science) Program for  
Trusted Data Services for Global Science

**PRESENTER NOTES:**

Central to the NGMDB's mission as a National Archive, the NGMDB is one of four USGS certified Trusted Digital Repositories.



## SLIDE 20

# GeMS-related files to be repositied and managed



- ☞ Map database files, incl. Shapefile versions
- ☞ FGDC-compliant metadata
- ☞ Style or stylex files
- ☞ Non-standard fonts
- ☞ Hi-Res graphics
- ☞ Basemap data (if not publ. elsewhere)
- ☞ If applicable: figures, tables, CMUs, DMUs, map pamphlets; files for viewing data with free software (e.g., ArcReader, KML, QGIS)

### PRESENTER NOTES:

In addition to the existing content from the Geoscience Map Catalog, Geolex, and geologic and topographic map images in the Trusted Digital Repository, here are some of the GeMS-related files to be repositied and managed. Regarding how to get this information into the Repository, and get it out, I'll give some indication of our plans tomorrow, in the GeMS session.

SLIDE 21

## Geoscience Map Catalog



- ~106,500 products
- 650+ publishers
- ~71,000 are “digital”
- ~43,000 are geologic maps
- ~40,200 are resource-related
- ~12,700 are hazards-related

We provide bibliographies and links to where you can buy, borrow, or download these products.

*We are enhancing the catalog to enable scientists to quickly find a comprehensive listing of published data relevant to their specific studies –notably subsurface data*



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**PRESENTER NOTES:**

The Geoscience Map Catalog is a foundational piece of the plan. In response to details stipulated in the Mapping Act, this catalog contains far more than just geologic maps.

**SLIDE 22**

**The NGMDB is much more than geologic maps!**

- GEOLOGY**
  - Bedrock
  - Surficial
  - Structural
  - Engineering
- GEOPHYSICS**
  - Magnetics
  - Gravity
  - Radiometrics
- MARINE**
  - Geophysics
  - Coastal
  - GLORIA
- RESOURCES**
  - Metals
  - Nonmetals
  - Petroleum
  - Coal
  - Water
- HAZARDS**
  - Earthquakes
  - Volcanoes
  - Landslides
  - Environmental
- OTHER**
  - Geochronology
  - Paleontology
  - Geochemistry

background: Walsh and others, 2020, USGS SIM-3440

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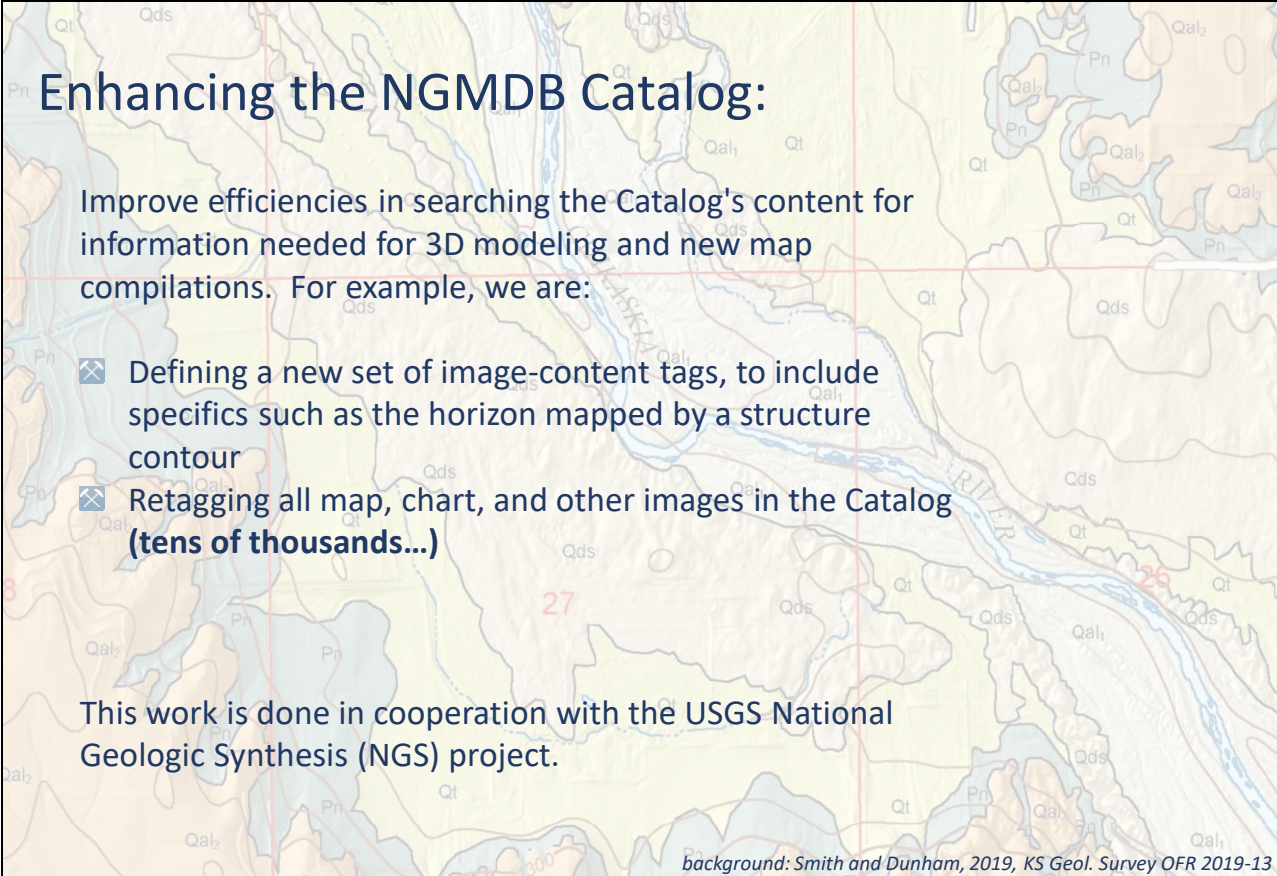
**AASG** Association of American State Geologists

**PRESENTER NOTES:**

For example, many thousands of maps and reports about minerals, energy, water, and environmental resources and hazards.

[Slide background: portion of Walsh, G.J., and others, 2020, Bedrock geologic map of the Mount Ascutney 7.5- x 15-minute quadrangle, Windsor County, Vermont, and Sullivan County, New Hampshire: U.S. Geological Survey, Scientific Investigations Map SIM-3440, scale 1:24,000. Prepared in cooperation with the Vermont Geological Survey, New Hampshire Geological Survey, and the National Park Service. Funded by NCGMP FEDMAP. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_110059.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_110059.htm)).]

## SLIDE 23





### Enhancing the NGMDB Catalog:

Improve efficiencies in searching the Catalog's content for information needed for 3D modeling and new map compilations. For example, we are:

- ✘ Defining a new set of image-content tags, to include specifics such as the horizon mapped by a structure contour
- ✘ Retagging all map, chart, and other images in the Catalog **(tens of thousands...)**

This work is done in cooperation with the USGS National Geologic Synthesis (NGS) project.

*background: Smith and Dunham, 2019, KS Geol. Survey OFR 2019-13*

 [ngmdb.usgs.gov](https://ngmdb.usgs.gov) 

### PRESENTER NOTES:

An urgent need is for some aspects of the Geoscience Map Catalog's publication and image content to be tagged for quick access by those charged with creating new 3D models and map compilations. This we're doing in cooperation with Don Sweetkind's (USGS) task within the US GeoFramework initiative, USGS National Geologic Synthesis (NGS) project.

[Slide background: portion of Smith, J.J., and Dunham, J.W., 2019, Preliminary surficial geology of the Argonia quadrangle, Harper and Sumner counties, Kansas: Kansas Geological Survey, Open-File Report OFR 2019-13, scale 1:24,000. Funded in part by NCGMP STATEMAP. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_108833.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_108833.htm)).]



SLIDE 24

# New Input Form

To use the form, contact  
ngmdb@usgs.gov

Webinar this Summer!

**General Information**

Title\*  
Enter the title of a geologic map publication, or scientific publication containing geologic mapping information.

Year\*  
1850 - present

Author(s)\*  
Enter a list of semi-colon delimited names e.g., Smith, J.R.; Doe, John; Wilson, B.R.

Map Scale\*  
e.g., 24000 (0 if none)

Themes\*  
Geology  
Bedrock  
Surficial  
Structure Contours  
Engineering  
Other  
Geophysics  
Magnetics  
Gravity  
Bathymetry

Larger Work  
Enter the title of a larger compilation which contains this publication

Publication homepage URL  
URL to a Web page where users can learn more about this publication (include http(s)://)

Comments or additional notes  
Please let us know if this publication supersedes or replaces another record in the NGMDB Map Catalog. We will contact you if we have with further questions.

Has GIS data  Has X-section  Online only  Paper only  Subscription only

STATEMAP Funded? No STATEMAP Award Number(s) e.g. G20AC00249 GeMS Format? Not GeMS format

**Publisher and Series**

Publisher\*  
-- Choose Publisher --

Order Contact\*  
None: No contact information available

Order Number

Series Name\*  
-- Choose Series Name --

Series Number

Add More Series Info

**Map Location**

Click on one of the option buttons below to help you enter the map extent and identify States and Counties to associate with this record. Please note that changing options after you have entered data will reset all fields in this section:

Coordinates Quadrangle State / County

Coordinate format:  DMS  DD

North\*\*  
e.g., -45 e.g., -30 e.g., 15.25

South\*\*  
e.g., -44 e.g., -30 e.g., 0

East\*\*  
e.g., -116 e.g., -45 e.g., 30

West\*\*  
e.g., -118 e.g., -15 e.g., 30.25

Map Location Summary  
The following coordinates, States, and Counties will be submitted with this record. You may choose to remove States and/or Counties from the list below. Please refer to the Map Location Field reference in our Help Documentation for more information.  
Coordinates: NW: [0,0] SE: [0,0]  
Included States: None  
Intersecting Counties: None

Preview Record

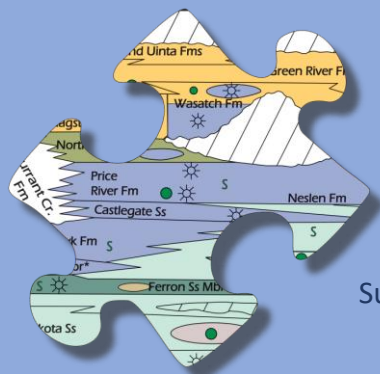
PRESENTER NOTES:

Regarding the Geoscience Map Catalog's content, here's the new Input Form. We'll be holding a Webinar this Summer, to explain its nuances to everyone responsible for entering content. We'll be contacting all STATEMAP Principal Investigators and everyone who's already registered to use it. If you'd like to use it but aren't in our system yet, please contact us at ngmdb@usgs.gov.

## SLIDE 25

# US Geologic Names Lexicon GEOLEX

A compilation of the definitions -and redefinitions- of geologic names applied to the rocks and sediments of the US, its possessions and territories, 1823-Present.



- ∞ 16,600+ geologic names
- ∞ 10,500+ references
- ∞ 39,700+ synopses
- ∞ 4,600,000+ words

Supplemented by: scanned U.S. Geologic Names Committee (GNC) index card catalogs, links to State lexicons, correlation charts, guidelines

**References are stored in the Geoscience Map Catalog. Includes spatial information and images (e.g., maps, cross sections, correlation charts), and links to the publications.**



[ngmdb.usgs.gov](http://ngmdb.usgs.gov)



### PRESENTER NOTES:

The U.S. Geologic Names Lexicon (Geolex) also is a foundational element of the NGMDB and is fully integrated with the Geoscience Map Catalog. As I'm sure you can imagine, it's the most challenging science aspect of the project.

SLIDE 26

[USGS HOME](#)   [CONTACT USGS](#)   [SEARCH USGS](#)

Home
Catalog
Lexicon
MapView
New Mapping
Standards
Comments

## National Geologic Map Database

### Geolex — Correlation Charts

**Statewide and regional correlation charts, lexicons, and other stratigraphic resources (1890-present)**

Correlation charts and stratigraphic sections provide essential two- and three-dimensional context for the geologic names described in Geolex and in statewide and regional lexicons. Our objective is to provide access to a set of charts, sections, and lexicons that reflect the current state of the science, supplemented by older, historically significant publications that have lasting value, both for the science, and also for evaluating changes to stratigraphic terminology.

This page is a work in progress. We welcome your suggestions, especially regarding publications that should be included here. | [About this site](#)

State	Description	Stratigraphic Range	Date	Citation	↻
Delaware	Coastal Plain stratigraphic chart	Mesozoic - Quaternary	2013		
Delaware	Piedmont stratigraphic chart	Precambrian - Mesozoic	2013		
Delaware	Geology of Delaware website	Precambrian - Quaternary	2013		
Delaware	Sheet 1 of 1	Precambrian - Quaternary	1937	Wilmarth, USGS Bull. 896	
Delaware	Hydrologic stratigraphic chart	Jurassic - Quaternary	2013		
Delaware	RASA Atlantic Coastal Plain --NC,VA,MD,DE,NJ,NY	Cretaceous - Quaternary	1992	Trapp, USGS Prof. Paper 1404-G	
Delaware	RASA Atlantic Coastal Plain --DC, MD, DE	Cretaceous - Quaternary	1991	Vroblesky and Fleck, USGS Prof. Paper 1404-E	

Showing 1 to 7 of 7 entries (filtered from 520 total entries)

**PRESENTER NOTES:**

As part of the Geolex task, we provide a strong focus on correlation charts and other aspects of stratigraphy.

SLIDE 27

**National Geologic Map Database**  
Preview

Wilmarth, M.G., compiler, 1938, *Lexicon of geologic names of the United States (including Alaska)*; U.S. Geological Survey, Bulletin B-896, scale  
*Delaware: 1 of 1: The named geologic units of Delaware*

**THE NAMED GEOLOGIC UNITS OF DELAWARE**  
Compiled by M. Grace Wilmarth, Secretary of Committee on Geologic Names  
United States Geological Survey, January 1937.

System	Series	Group	Formation.		Classification	Remarks
Quaternary	Pleistocene	Columbia group	Alluvium		C.W. 1937	Delaware River gravels and clay ear
			Ranlico fm. 0- (terrace with shore line at 25 ft.). (loam, sand, and gravel). (Type, Ranlico Sound, River, and County, N.C.)			
			Talbot fm. 0-50± (terrace with shore line at 42 ft.). (loam, sand, gravel, and clay lenses). (Type, Talbot Co., Md.)			
			Penholoway fm. 0- (terrace with shore line at 70 ft.). (loam, sand, and gravel). (Type, Penholoway Bay and Creek, Ga.)			
			Wicomico fm. 0-50± (terrace with shore line at 100 ft.). (loam, sand, gravel and ice-borne boulders). (Type, Wicomico River, Charles and St. Marys Counties, Md.)			
			Sunderland fm. 0-40± (terrace with shore line at 170 ft.). (loam, sand, and gravel). (Type, Sunderland, Calvert Co., Md.)			
Pliocene	Absent	Absent				
		Chesapeake group				
Tertiary	Miocene	Choptank group	St. Marys fm. not known to be present. (Type, County and River in Md.)			
			Choptank fm. not known to be present. (Type, Choptank River in Talbot Co., Md.)			
			Calvert fm. 150-200± (blue clay, light-colored sand, and diatomaceous earth). (Type, Calvert Cliffs, on Chesapeake Bay, Calvert Co., Md.)			
Eocene	Pamunkey group	(Nanjemoy fm. absent)				
		Aquia fm. to west. 0-35 (light and dark colored sand, largely glauconitic, occasionally finely indurated by iron oxide). (Type, Aquia Creek, Stafford Co., Va.)		Pamunkey fm. of some early beds.	Ranocas fm. to east. 0-50± (dark green sand marl). (Type, Ranocas Creek, Burlington Co., N.J.)	
Upper			Monmouth fm. 0-100± (green to brown sand, with numerous ferruginous plates). (Type, Monmouth Co., N.J.)			

PRESENTER NOTES:

Here's one of the rarer charts, USGS gray literature (Wilmarth, M.G., compiler, The named geologic units of Delaware, dated January 1937), which was developed during preparation of the USGS's first comprehensive national lexicon (Wilmarth, M.G., compiler, 1938, *Lexicon of geologic names of the United States [including Alaska]*: U.S. Geological Survey Bulletin 896, 2 Parts, 2396 p.). A lexicon such as Geolex can't be just a list of names, but must be an historical record of a name's usage and relation to other units, adjacent and distant.

## SLIDE 28

### NGMDB's role in stratigraphic nomenclature issues:

- Compile and manage Geolex
- Geolex integrated with NGMDB Catalog, thereby providing quick access to reports, charts, and maps
- Geologic names reviews and guidance, in service to USGS and State geological surveys
- Provide a comprehensive set of stratigraphic resources
- Lead author on USGS Suggestions to Authors (STA, 8th ed.) chapter "Geologic Nomenclature and Description"
- GeMS geologic names checking script, required for GeMS compliance
- Leads the U.S. Geologic Names Committee (GNC)
- Reinstated the GNC's "Stratigraphic Notes" in the USGS Prof. Paper series
- Long-term collaboration with State geological surveys, leading to improved stratigraphic understanding and Geolex content. We have several Cooperative Agreements in place...

background: Mattheus and others, 2020, DE Geol Survey Geol Map 25



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#### PRESENTER NOTES:

The NGMDB project is assisting in stratigraphic nomenclature issues by:

(a) Improving awareness, understanding, and use of the North American Stratigraphic Code (North American Commission on Stratigraphic Nomenclature [NASCN], 2005, AAPG Bulletin, vol. 89, no. 11, p. 1547-1591), and its amendments;

(b) Staffing the U.S. Geologic Names Committee (GNC) with regional experts from the AASG and USGS, with the goals of:

(i) facilitating (but not forcing) reconciliation or an "agree to disagree" consensus among geologic mappers; and

(ii) developing documentation through that process that can be used by the GNC Secretary to evaluate content of the U.S. Geologic Names Lexicon (Geolex), through Cooperative Agreements.

[Slide background: portion of Mattheus, C.R., and others, 2020, Geologic Map of Offshore Delaware: Delaware Geological Survey, Geologic Map Series 25, scale 1:40,000. Funded by U.S. Department of Interior, Bureau of Ocean Energy Management. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_109709.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_109709.htm)).]



**SLIDE 29**

## NGMDB Cooperative Agreements focusing on stratigraphic nomenclature issues:

- ✕ FY20 -- Cooperative Agreements with Delaware, Maryland, Oregon, and Utah geological surveys.
- ✕ FY21 -- Cooperative Agreements proposed by Kentucky, Pennsylvania, Alabama, Kansas, Delaware, and New England States.

*background: Mattheus and others, 2020, DE Geol Survey Geol Map 25*



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[Slide background: portion of Mattheus, C.R., and others, 2020, Geologic Map of Offshore Delaware: Delaware Geological Survey, Geologic Map Series 25, scale 1:40,000. Funded by U.S. Department of Interior, Bureau of Ocean Energy Management. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_109709.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_109709.htm)).]



## SLIDE 30

# Stratigraphic Notes (resurrected)

## USGS Professional Paper

“We welcome papers from the USGS, State Geological Surveys funded by the National Cooperative Geologic Mapping Program, and academicians funded by the EDMAP component. “

Volume 1 Table of Contents:

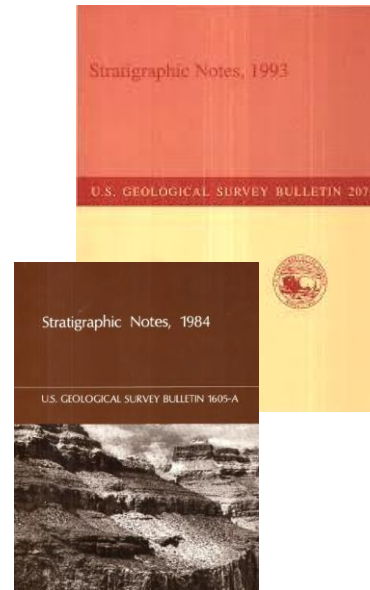
**Stratigraphic notes: An Outlet For Stratigraphic Studies**

**Divisions of Geologic Time—Major Chronostratigraphic and Geochronologic Units**

**Reference Notes on Geologic Names Usage for Authors and Peer Reviewers – A Primer on Stratigraphic Nomenclature**

**Suggestions for Papers Submitted to Stratigraphic Notes**

**Guidelines for Conducting Geologic and Aquifer Names Reviews**



### PRESENTER NOTES:

Although it'll be described in a lightning talk on Thursday, I wanted to just note that we're resurrecting the USGS Stratigraphic Notes (published between 1982 and 1995; USGS Bulletins 1529-H, 1537-A, 1605-A, 2060, and 2153). Due to the discontinuation of the USGS Bulletin series, these will be published in the USGS Professional Paper series. We invite mappers to contribute short articles.



## SLIDE 32

### Enhancing the NGMDB Catalog:

Enable users to search for any content in a geologic map's Description of Map Units (DMU), by:

- ✘ OCR thousands of DMUs on geologic maps judged to be of priority for analysis, recompilation, or conversion to GIS; and
- ✘ Use machine-learning techniques to increase efficiency in parsing OCR text into appropriate GeMS tables and fields.

This work is done in cooperation with the USGS GeoML project (Chris Garrity, Chief).

*background: Smith and Dunham, 2019, KS Geol. Survey OFR 2019-13*



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#### PRESENTER NOTES:

You can readily envision how we could refine the mapView interface to facilitate search, display, and download of maps that contain geologic names, lithologies, ages, and so forth that's recorded in the Description of Map Units (DMU) of a geologic map. But how can we get encode DMU content for the tens of thousands of geologic maps? As noted here, we'll be using machine-learning techniques on thousands of OCR'd DMUs, to parse the content into the appropriate GeMS tables and fields.

[Slide background: portion of Smith, J.J., and Dunham, J.W., 2019, Preliminary surficial geology of the Argonia quadrangle, Harper and Sumner counties, Kansas: Kansas Geological Survey, Open-File Report OFR 2019-13, scale 1:24,000. Funded in part by NCGMP STATEMAP. Image downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_108833.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_108833.htm)).]

SLIDE 33

**Mapping In Progress**

Source: [NGMDB - Progress Reports](#)

Mapping In Progress provides information on current mapping projects, prior to inclusion of their products in the NGMDB map catalog. Click any map or table record for contact information.

ALL  STATEMAP  EDMAP  FEDMAP

Showing **23** projects on screen.

Filter by quad, project, or affiliation name

Project Affiliation Program Scale

- Appalachian Basin Geologic Mapping Project, U.S. Geological Survey  
Scale: Various | Mapping Year: 2019
- Bombay Hook Island (DE-NJ) Quadrangle, Delaware Geological Survey  
Scale: 24000 | Mapping Year: 2019
- Broad Top (part 2) Project, Pennsylvania Bureau of Topographic and Geologic Survey  
Scale: 24000 | Mapping Year: 2019
- Cartersville (VA) Quadrangle, Virginia Division of Mineral Resources  
Scale: 24000 | Mapping Year: 2019
- Gaithersburg (MD) Quadrangle, Maryland Geological Survey  
Scale: 24000 | Mapping Year: 2019  
Contact Name: David K. Brezinski  
Contact Phone: 410-554-5526  
Contact Mail: david.brezinski@maryland.gov
- Gladstone (VA) Quadrangle, College of William and Mary  
Scale: 24000 | Mapping Year: 2019
- Green Bank (NJ) Quadrangle, New Jersey Geological Survey  
Scale: 24000 | Mapping Year: 2019
- Hopewell (VA) Quadrangle, Virginia Division of Mineral Resources  
Scale: 24000 | Mapping Year: 2019
- Jenkins (NJ) Quadrangle, New Jersey Geological Survey  
Scale: 24000 | Mapping Year: 2019

<https://ngmdb.usgs.gov/mip/>

PRESENTER NOTES:

Last year, we restarted the Mapping In Progress database (<https://ngmdb.usgs.gov/mip/>), which shows the footprints and contact information for NCGMP-funded mapping. We're in the process of updating it.



## SLIDE 34

**Earth MRI Acquisitions Viewer**

Source: [Earth Mapping Resources Initiative \(Earth MRI\)](#)  
Metadata & Data Services: [MRData](#), [NGMDB](#)

Earth MRI began in 2019 and is a partnership between the USGS and State Geological Surveys to acquire new geologic maps, geophysical surveys, and LiDAR data to better understand the fundamental geologic framework of areas across the Nation with potential for hosting critical mineral resources. Click any map area or table record to learn more.

All  Geology  Geophysics  LiDAR  Geochemistry

Showing 13 projects on screen.

Filter by project, affiliation, or state name

Project Affiliation Theme Year

Devonian Phosphatic Units, Appalachian and Illinois Basins   Indiana Geological and Water Survey	GC
Year Started: 2020   Year Complete: In Progress	
Devonian Phosphatic Units, Illinois Basin   Illinois State Geological Survey	GC
Year Started: 2020   Year Complete: In Progress	
Eastern St. Francois Mountains, Missouri   Missouri Geological Survey	GE
Year Started: 2020   Year Complete: In Progress	
Fluorspar District, Kentucky   USGS 3D Elevation Program (3DEP)	LI
Year Started: 2019   Year Complete: In Progress	
Gap Survey, MO, IL, KY   USGS Geology, Geophysics, and Geochemistry Science Center	GP
Year Started: 2020   Year Complete: In Progress	
Hicks Dome and Fluorspar District, Illinois   USGS 3D Elevation Program (3DEP)	LI
Year Started: 2019   Year Complete: In Progress	

<https://ngmdb.usgs.gov/emri/>

### PRESENTER NOTES:

Using the code for that new interface, we also began providing the same type of information for EarthMRI data-acquisition projects (<https://ngmdb.usgs.gov/emri/>).

SLIDE 35

topoView

<https://ngmdb.usgs.gov/topoview/>

PRESENTER NOTES:

And because we use topographic maps extensively and needed quick access to them, we built topoView in cooperation with the USGS National Geospatial Program (NGP). This is a very popular interface, and I encourage you to try it out (<https://ngmdb.usgs.gov/topoview/>).



SLIDE 36

The screenshot shows the website for the National Geologic Map Database (NGMDB) Standards and Guidelines. At the top, there are logos for USGS (science for a changing world) and AASG (Association of American State Geologists). Navigation links include USGS HOME, CONTACT USGS, and SEARCH USGS. A secondary navigation bar contains Home, Catalog, Lexicon, MapView, New Mapping, Standards, and Comments. The main heading is "National Geologic Map Database" with the subtitle "Standards and guidelines".

**Background**

**Background**  
To create, manage, and disseminate digital earth-science information, it is increasingly clear to data producers and users that certain widely-accepted standards are essential. In the past, many organizational units (e.g., projects or programs) have of necessity developed their own standard practices for creating and managing digital map data. Because the resources needed to develop widely-accepted standards are difficult for a single organizational unit to justify, many of these standard practices developed in an ad hoc fashion, with scant input from other groups.

**"GeMS"**  
Two notable mechanisms now exist in the United States to promote the coordination of widely-accepted standards: 1) the National Geologic Mapping Act of 1992 stipulates that necessary standards be developed by USGS and the Association of American State Geologists (AASG) to support the National Geologic Map Database (NGMDB); and 2) the Federal Geographic Data Committee (FGDC), through its Geologic Data Subcommittee, is responsible for development of standards to support geologic data management at the Federal level.

**Recommended Database Design**  
The links below contain information pertinent to the development of standards and guidelines for geologic mapping. Many of these works stemmed from discussions held at the annual [Digital Mapping Techniques](#) workshop, sponsored by the NGMDB and the Association of American State Geologists. The beginning stages of this work (ca. 1996-1997) are documented and preserved in an [archival site](#) and in the [earliest NGMDB reports of progress](#).

**Related But Older Database Designs**  
**FGDC Cartography Standards**  
**Geologic Time Scales**  
**Science Terminologies**  
**Base Maps and Projections**  
**Tools and Techniques**  
**Publication Guidelines**

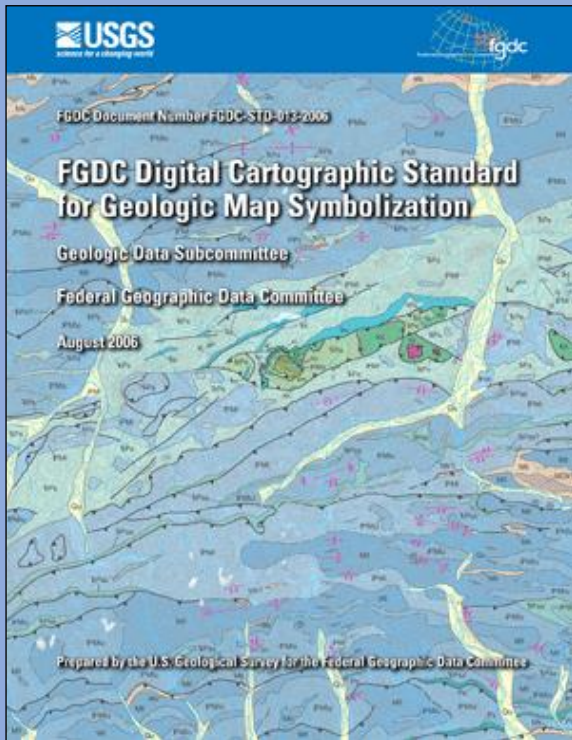
**"GeMS" — standard Geologic Map Schema**  
"GeMS" (formerly named NCGMP09) is the standard schema for geologic maps funded by the USGS National Cooperative Geologic Mapping Program (NCGMP). Its design specifies encoding the content analogous to that contained in a single, traditional geologic map. GeMS is intended to provide a stepping stone toward development of multimap databases, in particular the National Geologic Map Database (NGMDB). Please visit our [GeMS site](#).

<http://ngmdb.usgs.gov/Info/standards>

PRESENTER NOTES:

Regarding our standards development activities (<http://ngmdb.usgs.gov/Info/standards>), in addition to what we all do as the result of DMT workshops, for brevity I'd just like to highlight the following:

SLIDE 37



[https://ngmdb.usgs.gov/fgdc\\_gds/](https://ngmdb.usgs.gov/fgdc_gds/)

**Contacts:**

Taryn Lindquist, USGS, [tlindquist@usgs.gov](mailto:tlindquist@usgs.gov)

Dave Soller, USGS, [drsoller@usgs.gov](mailto:drsoller@usgs.gov)

**ESRI style files:**

Megan James,  
South Carolina Geological Survey,  
[jamesm@dnr.sc.gov](mailto:jamesm@dnr.sc.gov)

Paper Copies Are  
Still Available !




[ngmdb.usgs.gov](https://ngmdb.usgs.gov)



PRESENTER NOTES:

Federal Geographic Data Committee (FGDC) 2006 Digital cartographic standard for geologic map symbolization ( [https://ngmdb.usgs.gov/fgdc\\_gds/](https://ngmdb.usgs.gov/fgdc_gds/) ).

## SLIDE 38




The image shows the cover of a report titled "GeMS (Geologic Map Schema)—A Standard Format for the Digital Publication of Geologic Maps". The cover features a colorful, abstract map-like background. Text on the cover includes the USGS logo, the title, "Chapter 10 of Section B, U.S. Geological Survey Standards, of Book 11, Collection and Delineation of Spatial Data", "Techniques and Methods 11-B10", and "U.S. Department of the Interior U.S. Geological Survey".

[pubs.er.usgs.gov/publication/tm11B10](https://pubs.er.usgs.gov/publication/tm11B10)

This report describes and defines GeMS (Geologic Map Schema), a new standardized database design for the digital publication of geologic maps. It originally was intended for geologic mapping funded by the National Cooperative Geologic Mapping Program of the U.S. Geological Survey, but its use can be extended to other programs and agencies as well. It is intended to bridge the gap between traditional geologic mapping and GIS communities at an operational level.


GeMS provides for the encoding in digital form of the content contained in individual geologic maps published by the U.S. Geological Survey and by state geological surveys. The design is focused on the publication, transfer, and archiving of map data and less on the creation of map data, the visual representation of map data, or the compilation of data from many different map sources.

Although GeMS is designed for a single-map database, it also is intended to provide a stepping stone toward the development of multiple-map databases, in particular the National Geologic Map Database. The database design contained herein will significantly promote that goal. All questions or comments about GeMS should be directed via email to [gems@usgs.gov](mailto:gems@usgs.gov).



USGS  
science for a changing world

[ngmdb.usgs.gov](https://ngmdb.usgs.gov)

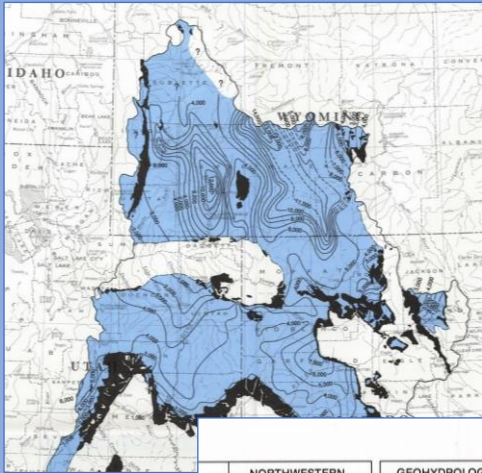


AASG  
Association of American State Geologists

### PRESENTER NOTES:

U.S. Geological Survey National Cooperative Geologic Mapping Program, 2020, GeMS (Geologic Map Schema)—A standard format for the digital publication of geologic maps: U.S. Geological Survey Techniques and Methods, Book 11, Chap. B10, 74 p.;  
<https://doi.org/10.3133/tm11B10>, <https://pubs.usgs.gov/tm/11b10/tm11b10.pdf>.

SLIDE 39

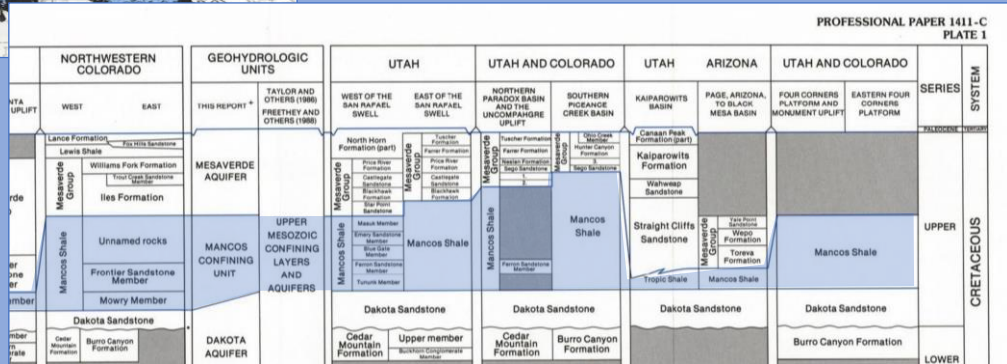


Mancos confining unit (USGS Prof. Paper 1411-C)

Sweetkind, D.S., and Masbruch, M.D., 2020  
<https://doi.org/10.5066/P9HPE08L>,  
[https://ngmdb.usgs.gov/Prodesc/proddesc\\_111269.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_111269.htm)

USGS data release of Freethey and Cordy, 1991, USGS Professional Paper 1411-C (RASA upper Colorado River)  
[https://ngmdb.usgs.gov/Prodesc/proddesc\\_4867.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_4867.htm)

A geodatabase of contour line and polygon data and nonspatial tables describing data provenance, glossary of terms, and description of map units. Feature classes in this dataset follow structure of GeMS feature class "Isolines."



Highlighted in blue: Lithostratigraphic units included in the Mancos confining unit (USGS Professional Paper 1411-C)



ngmdb.usgs.gov



PRESENTER NOTES:

There has been much discussion about the need for 3D standards, a topic that Don Sweetkind has been leading with NCGMP's group in USGS. I'd like to note that one of Don's recent publications (Sweetkind and Masbruch, 2020), which was vector-based structure contours derived from a USGS Prof. Paper (Freethey and Cordy, 1991), delivered the content using the Isolines feature class in the GeMS schema. Here you're looking at the top of the Mancos confining unit.

References:

Freethey, G.W., and Cordy, G.E., 1991, Geohydrology of Mesozoic rocks in the Upper Colorado River basin in Arizona, Colorado, New Mexico, Utah, and Wyoming, excluding the San Juan Basin: USGS Professional Paper 1411-C, 118 p. Images downloaded from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_4867.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_4867.htm)).

Sweetkind, D.S., and Masbruch, M.D., 2020, Digital subsurface data of Mesozoic rocks in the Upper Colorado River Basin in Wyoming, Utah, Colorado, Arizona, and New Mexico from USGS Regional Aquifer System Analysis: USGS Data Release, scale 1:2,500,000. Link to data release available from the National Geologic Map Database ([https://ngmdb.usgs.gov/Prodesc/proddesc\\_111269.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_111269.htm)).



SLIDE 40

# mapExplorer – coming soon

The screenshot displays the NGMDB Map Explorer web application. The main map area shows a geologic map of Arizona with various colored regions representing different geological units. The interface includes a sidebar on the left with search and filter options, and a sidebar on the right with detailed metadata for the selected map.

**NGMDB Map Explorer**  
Geologic map data (1850-2019)  
Source: USGS (last updated: 1/2019)  
The NGMDB Map Explorer is a lightweight application that lets you explore the status of the Nation's geologic map coverage through history.

Map Scale Bins: -24K -48K -96K -192K -384K All  
411 records on screen  
Quick filter by record keyword.

Filter map extents by selected attributes:  
Scale: 0 to 250000  
Year: 1880 to 2019  
Title Author Year Scale Publish

Showing first 100 of 411 records.

Lucchitta, Ivo, Samson, Neil, 1985. Geologic map of the Artillery Peak Northwest quadrangle, Mohave County, Arizona, Open-File Report OF-85-277, U.S. Geological Survey, 1:24000.

Sherrod, D.R., 1988. Preliminary geologic map of the Monkeys Head quadrangle, Mohave and La Paz Counties, Arizona, Open-File Report OF-88-597, U.S. Geological Survey, 1:24000.

Lucchitta, Ivo, Samson, Neil, 1988. Geologic map of the Pineda 2 SW quadrangle, Mohave County, Arizona, Open-File Report OF-88-547, U.S. Geological Survey, 1:24000.

Lucchitta, Ivo, Samson, N.H., 1989. Geologic map of the Pineda 2 NW quadrangle, Mohave County, Arizona, Open-File Report OF-89-473, U.S. Geological Survey, 1:24000.

Ward, A.W., Nealey, L.D., 1990. Preliminary map of the Burro Mesa quadrangle, Yavapai County, Arizona, Open-File Report OF-90-212, U.S. Geological Survey, 1:24000.

Ward, A.W., Nealey, L.D., 1990. Preliminary geologic map of the Pilot Knob quadrangle, Mohave and Yavapai Counties, Arizona, Open-File Report OF-90-201, U.S. Geological Survey, 1:24000.

Beard, Sze, Lucchitta, Ivo, 1990. Geologic map of the Valentine SE quadrangle, Mohave County, Arizona, Open-File Report OF-90-201, U.S. Geological Survey, 1:24000.

Lucchitta, Ivo, Samson, N.H., 1991. Geologic map of the Pineda 2 SE quadrangle, Mohave and La Paz Counties, Arizona, Open-File Report OF-91-354, U.S. Geological Survey, 1:24000.

Beard, S.S., Lucchitta, Ivo, 1993. Geologic map of the Valentine Southeast quadrangle, Mohave County, Arizona, Geologic Quadrangle Map GQ-1711, U.S. Geological Survey, 1:24000.

**Geologic map of the Cave Creek quadrangle, Maricopa County, Arizona**  
Author(s): R.S. Enghy, S.J. Skornicki, P.A. Pearce  
Publisher: Arizona Geological Survey  
Publication Date: 1997  
Map Scale: 1:24,000

**Geologic Units Here (1855-500)**  
Late And Middle Pleistocene Surficial Deposits  
Unit Age: Middle to Late Pleistocene (0.01 Ma to 0.75 Ma)  
Major Lithologies: Sand, Gravel  
Unit Description: Unconsolidated to weakly consolidated alluvial fan, terrace, and basin-floor deposits with moderate to strong soil development. Fan and terrace deposits are primarily poorly sorted, moderately bedded gravel and sand, and basin floor deposits are primarily sand, silt, and clay (10-750 ka) State Arizona  
Geologic Province: N/A  
Unit Comments: N/A  
NGMDB Source: Richard, S.M., Reynolds, S.J., Sancer, J.E., and Pearce, P.A., 2000. Geologic Map of Arizona. Arizona Geological Survey Map 35, 1 sheet, scale 1:1,000,000.

**Maps Here by Theme (10000)**  
Select theme names to add/remove from chart.  
(All Themes) (No Themes)  
Bedrock Geology | Surficial Geology  
Structure | Other Geology | Energy/Minerals  
Water | Other Geology | Marine  
Other Themes



ngmdb.usgs.gov



PRESENTER NOTES:

And finally, we wanted you to be aware that we'll also be releasing a map-based front end to the entire Catalog, tentatively named Map Explorer, which will let the user conduct complex searches as currently done through the text-based search page.

**SLIDE 41**

Would you like to join the NGMDB ?

Contact me, at [drsoller@usgs.gov](mailto:drsoller@usgs.gov)



[ngmdb.usgs.gov](http://ngmdb.usgs.gov)



**PRESENTER NOTES:**

As noted early in this presentation, in terms of staffing, we're a rather lean project. Too lean, actually, especially considering the scope of responsibilities that come with the additional appropriations. And so, if you're interested in working with us, as a volunteer, under an IPA, or as a USGS staff member, please contact me to discuss the various possibilities.

**\*END OF PRESENTATION\***