DIGITAL MAPPING TECHNIQUES 2021

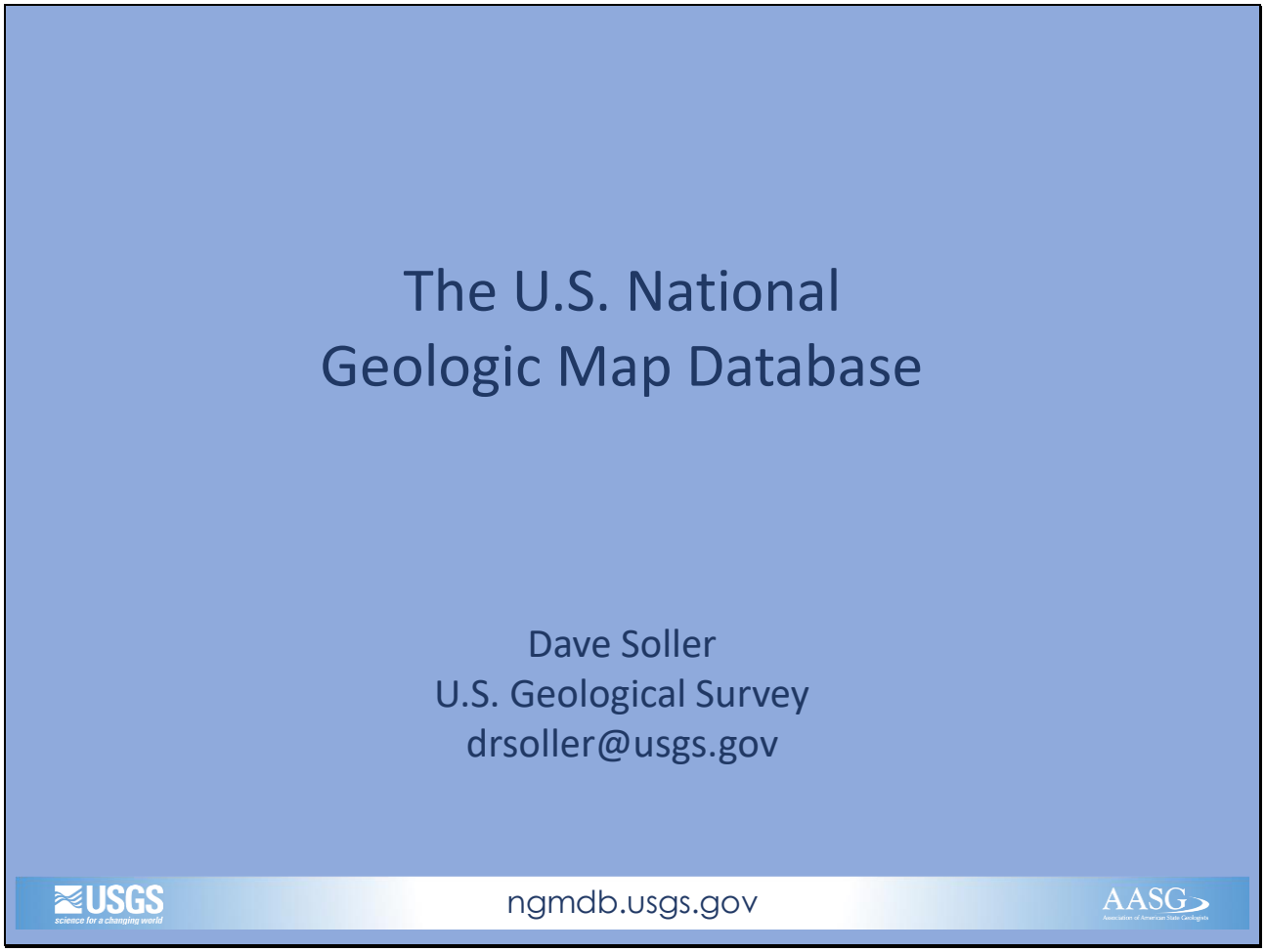
The following was presented at DMT'21
(June 7 - 10, 2021 - A Virtual Event)

The contents of this document are provisional

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

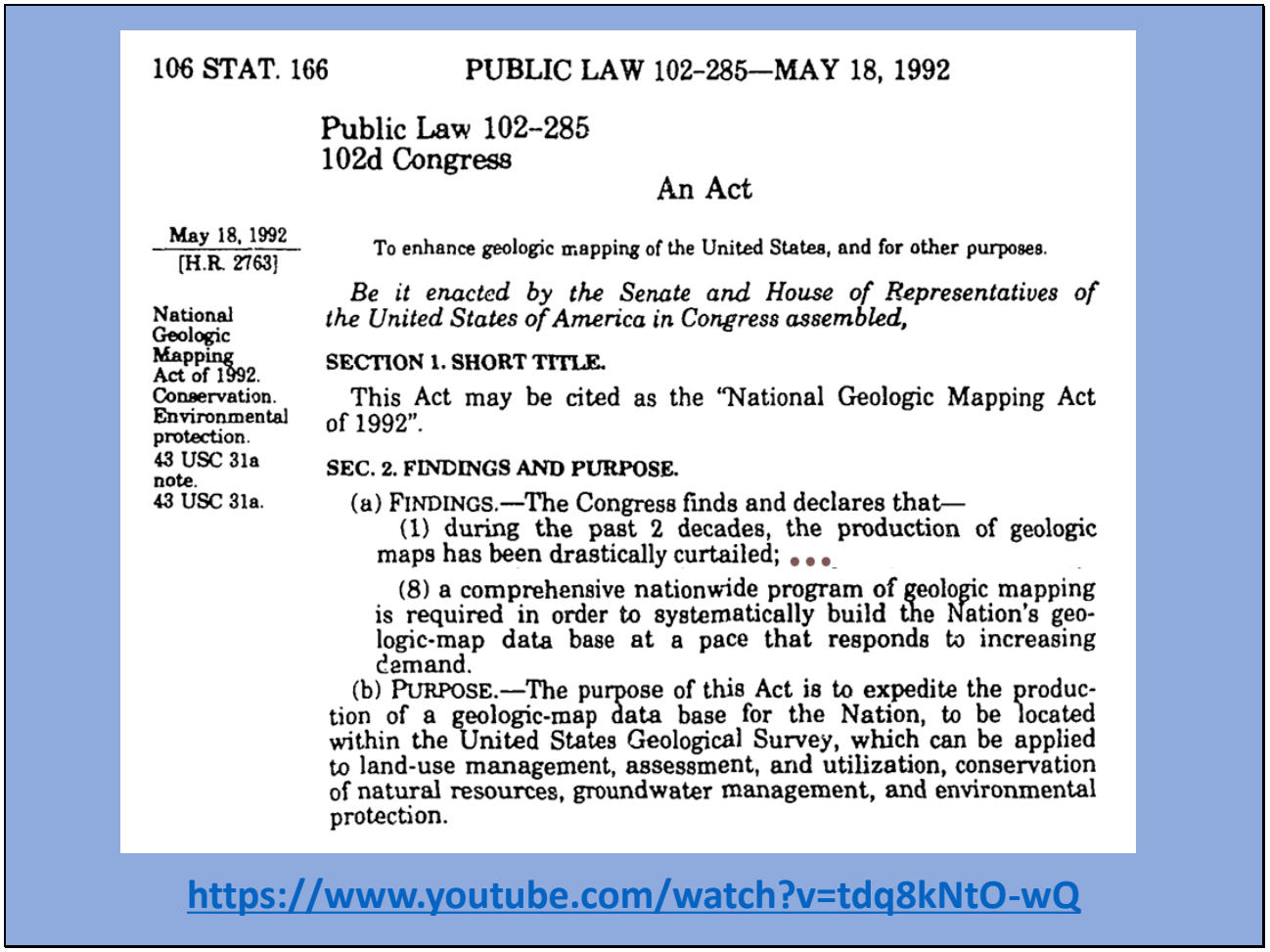
http://ngmdb.usgs.gov/info/dmt/

SLIDE 1



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.

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

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

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; . . .

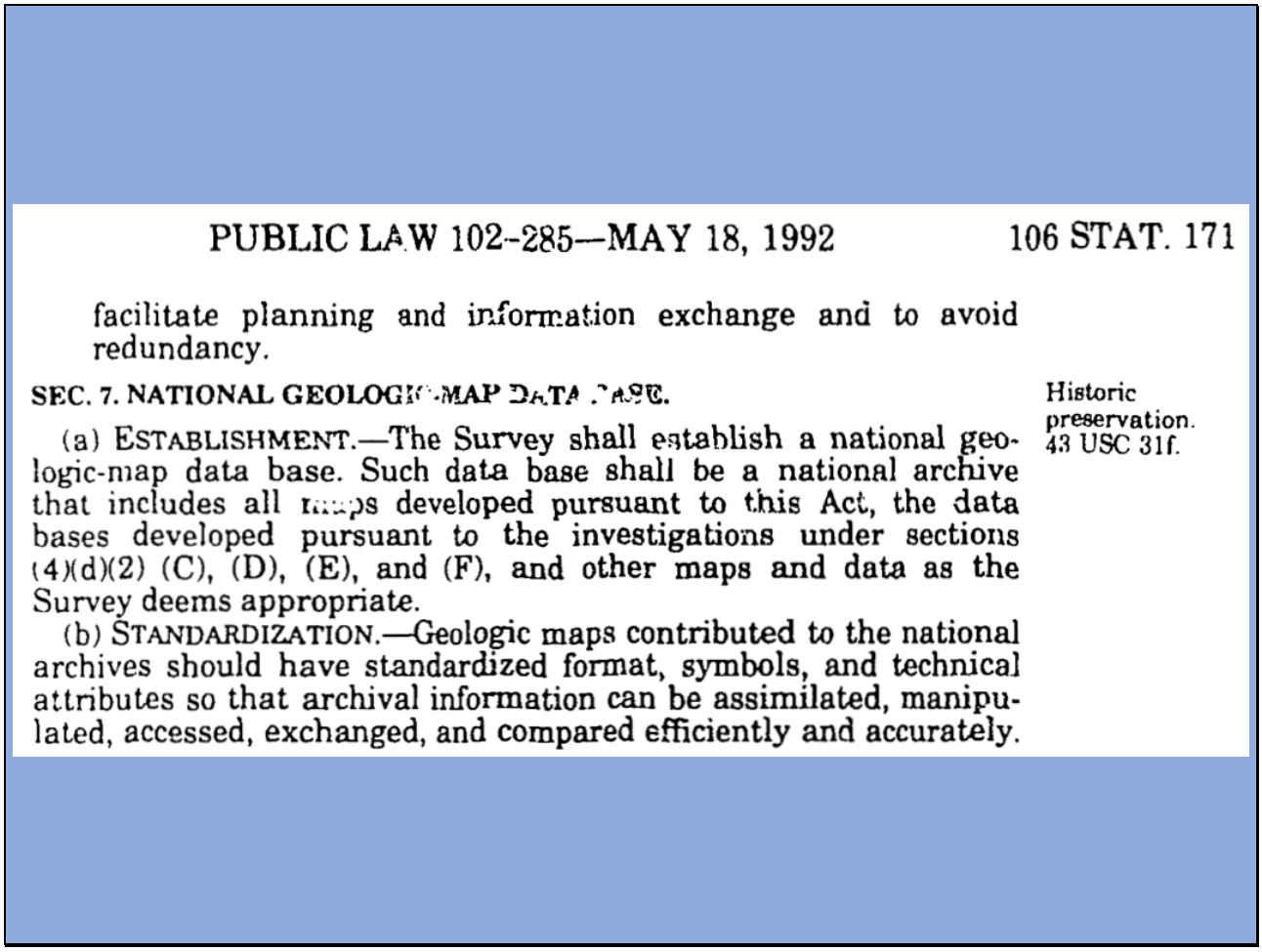
(8) a comprehensive nationwide program of geologic mapping is required in order to systematically build the Nation's geologic-map data base at a pace that responds to increasing demand.

(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



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,
3RD IGC (Berlin, 1885)

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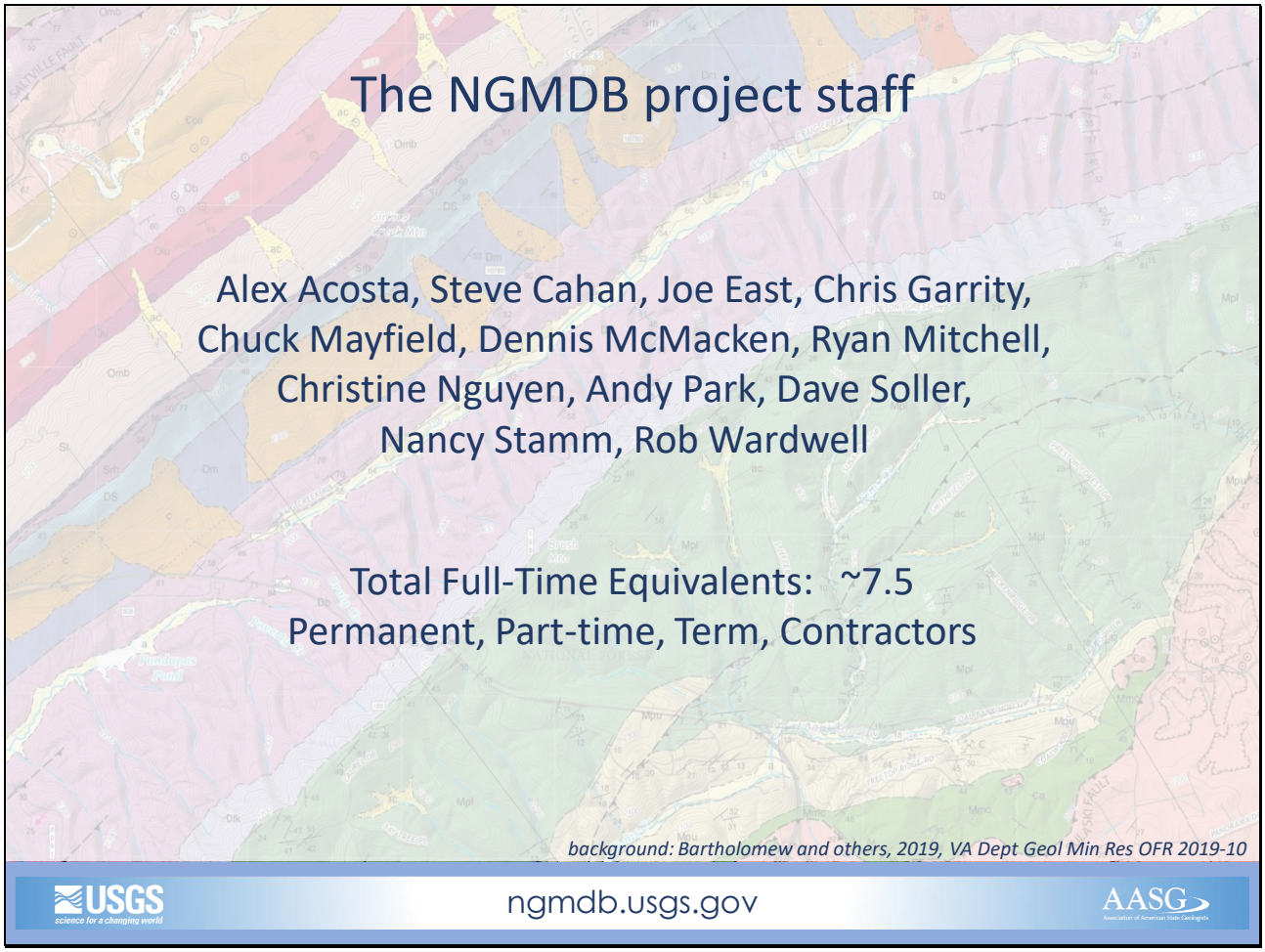
AASG Association of American State Geologists

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.

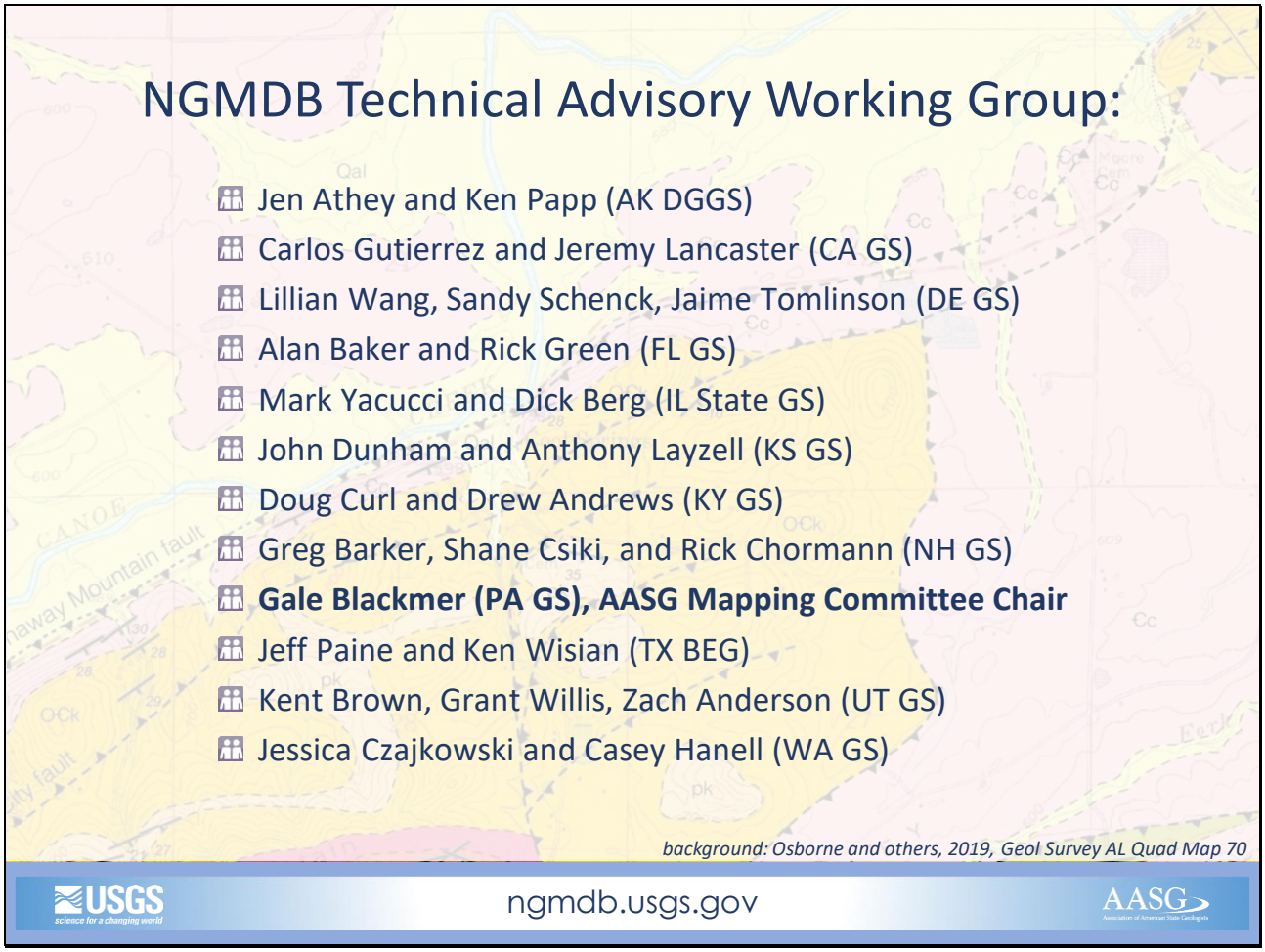
SLIDE 5



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).]

SLIDE 6



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).]

SLIDE 7

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).]

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.

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

SLIDE 9

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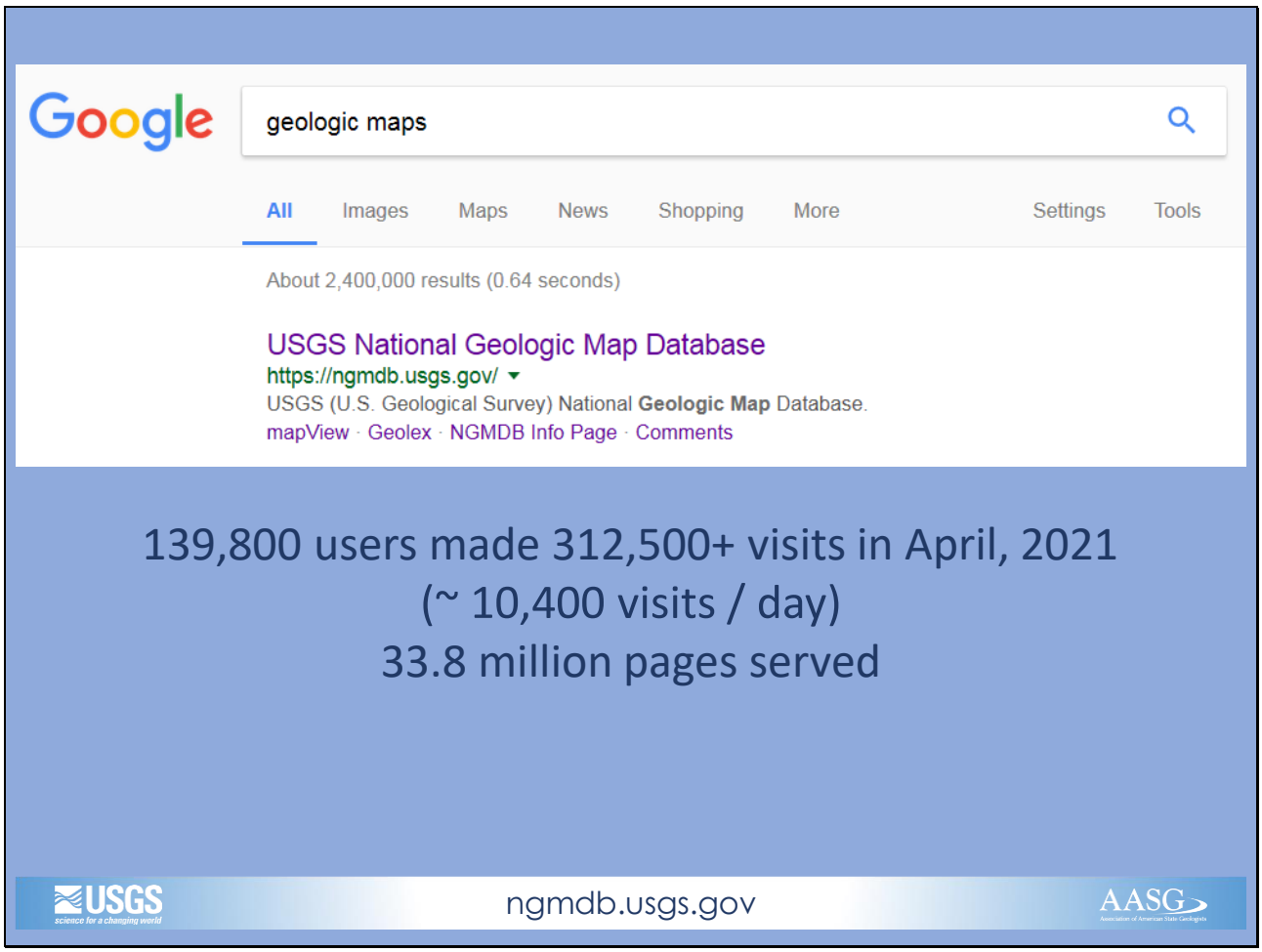
SLIDE 10


Google
geologic maps
All
Images
Maps
News
Shopping
More
Settings
Tools
About 2,400,000 results (0.64 seconds)
USGS National Geologic Map Database
https://ngmdb.usgs.gov/
USGS (U.S. Geological Survey) National Geologic Map Database.
mapView · Geolex · NGMDB Info Page · Comments
139,800 users made 312,500+ visits in April, 2021
(~ 10,400 visits / day)
33.8 million pages served
USGS
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SLIDE 11

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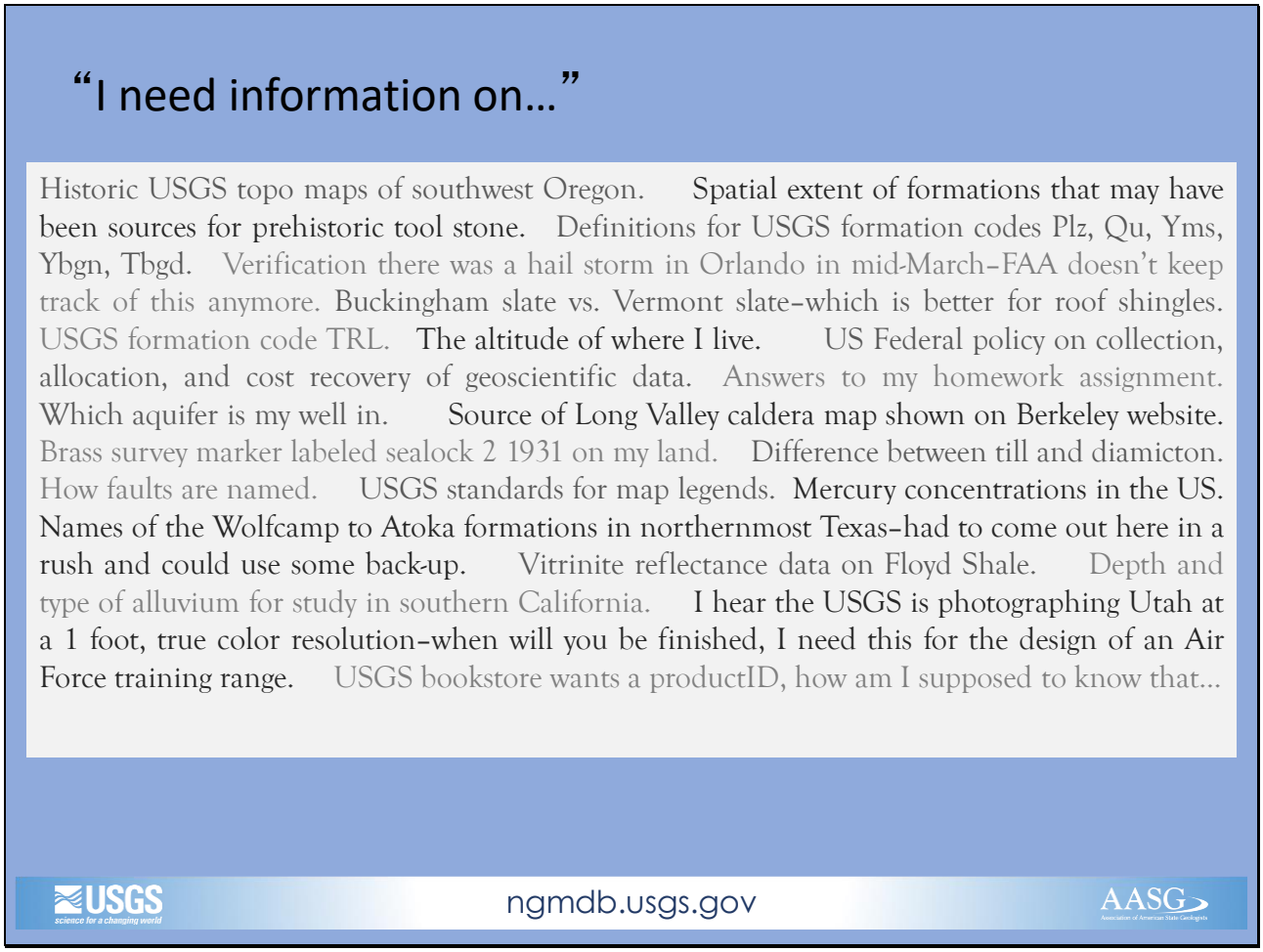
SLIDE 13



PRESENTER NOTES:
Examples of the wide range of user's questions.

SLIDE 14

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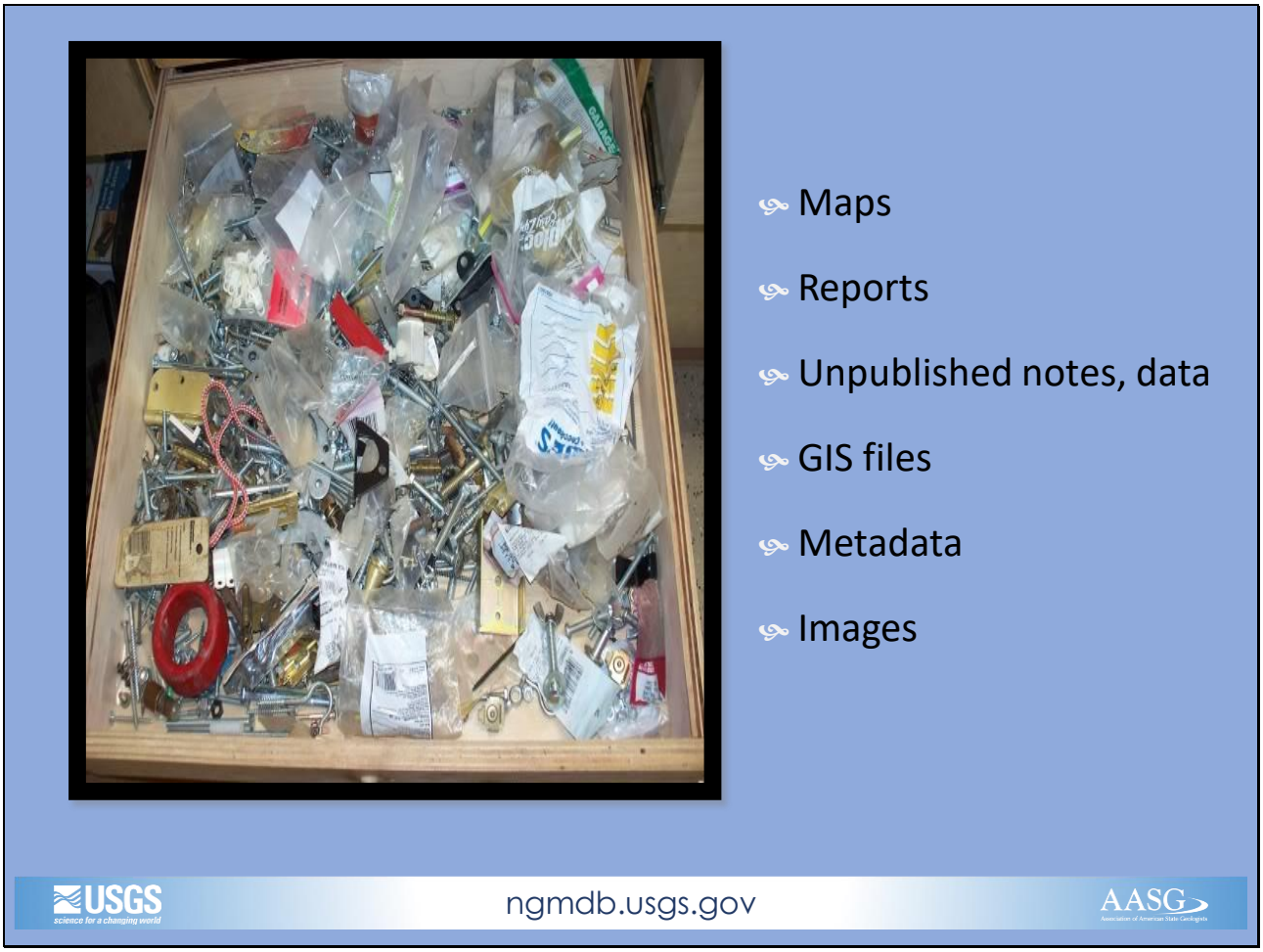
SLIDE 15

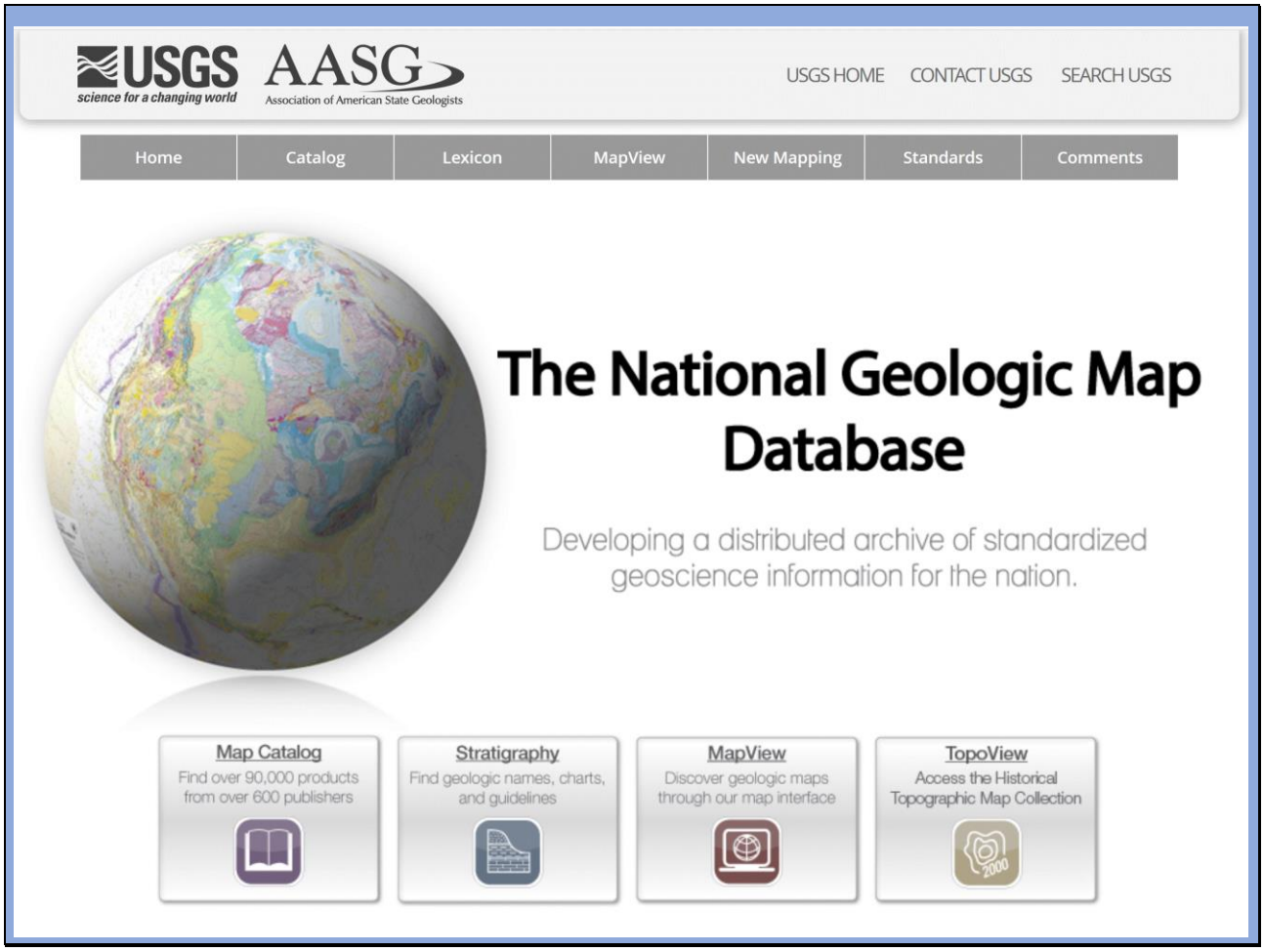


PRESENTER NOTES:
That last point is a critical one for every agency. In my experience, with the emergence of digital technology and the waning of the Library's presence at most agencies, the management and stewardship of our publications and data, by those of us also tasked with mapping, GIS, and computer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

SLIDE 16

PRESENTER NOTES:
For the NGMDB to succeed, as well as the US GeoFramework intiative (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.

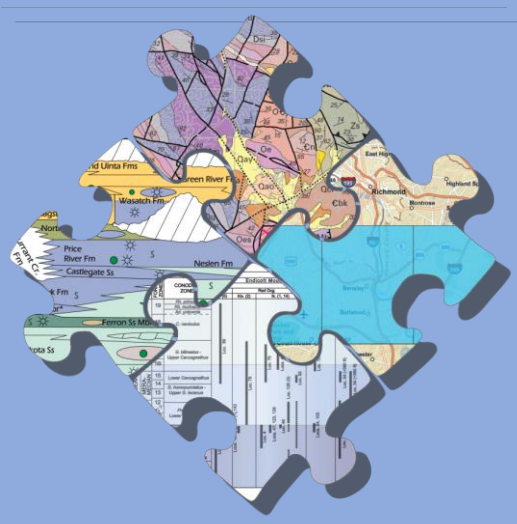
SLIDE 17



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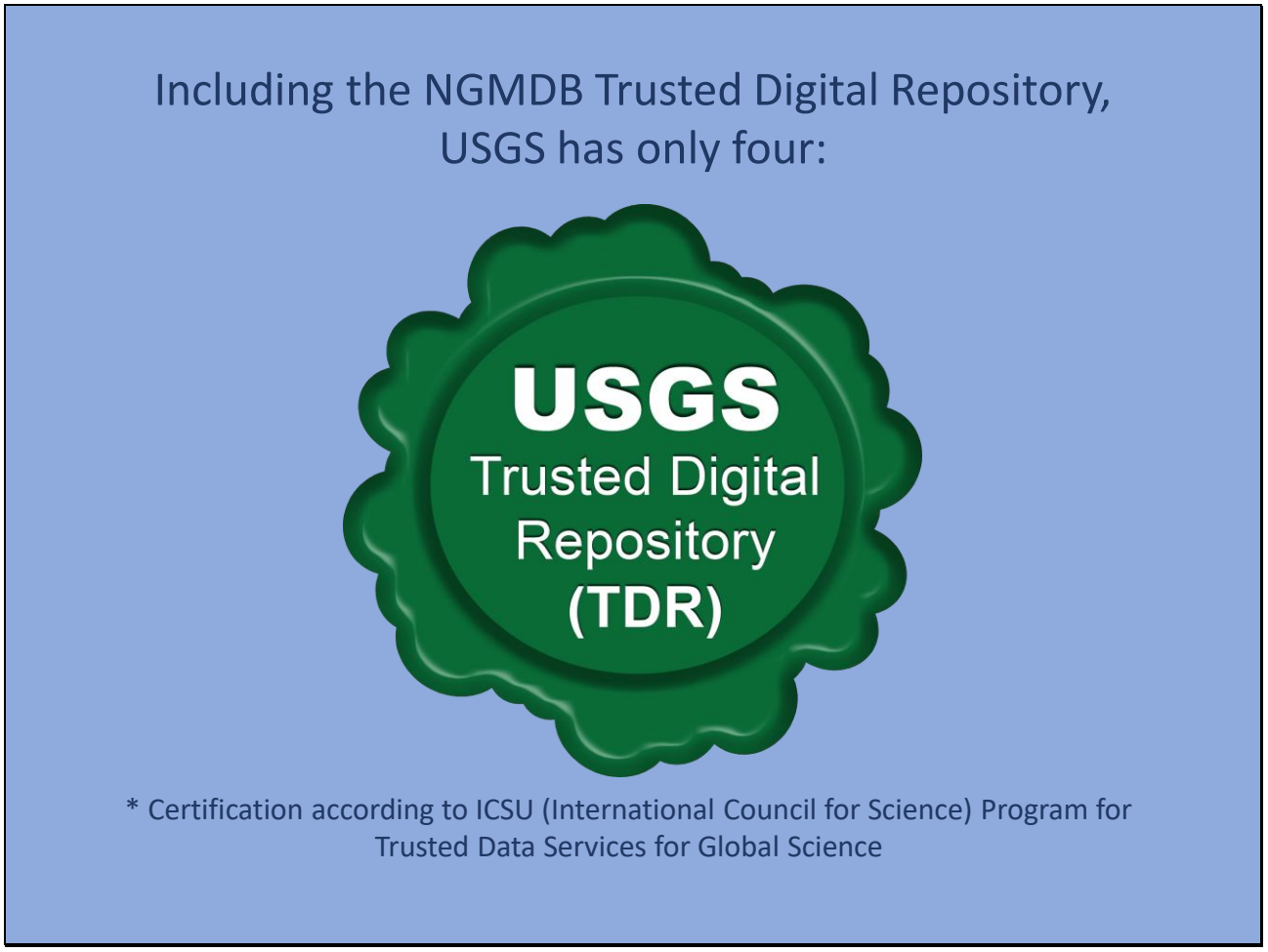
PRESENTER NOTES:
Here's a list of the principal functions accessed by the public.

SLIDE 19



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 reposited 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 reposited 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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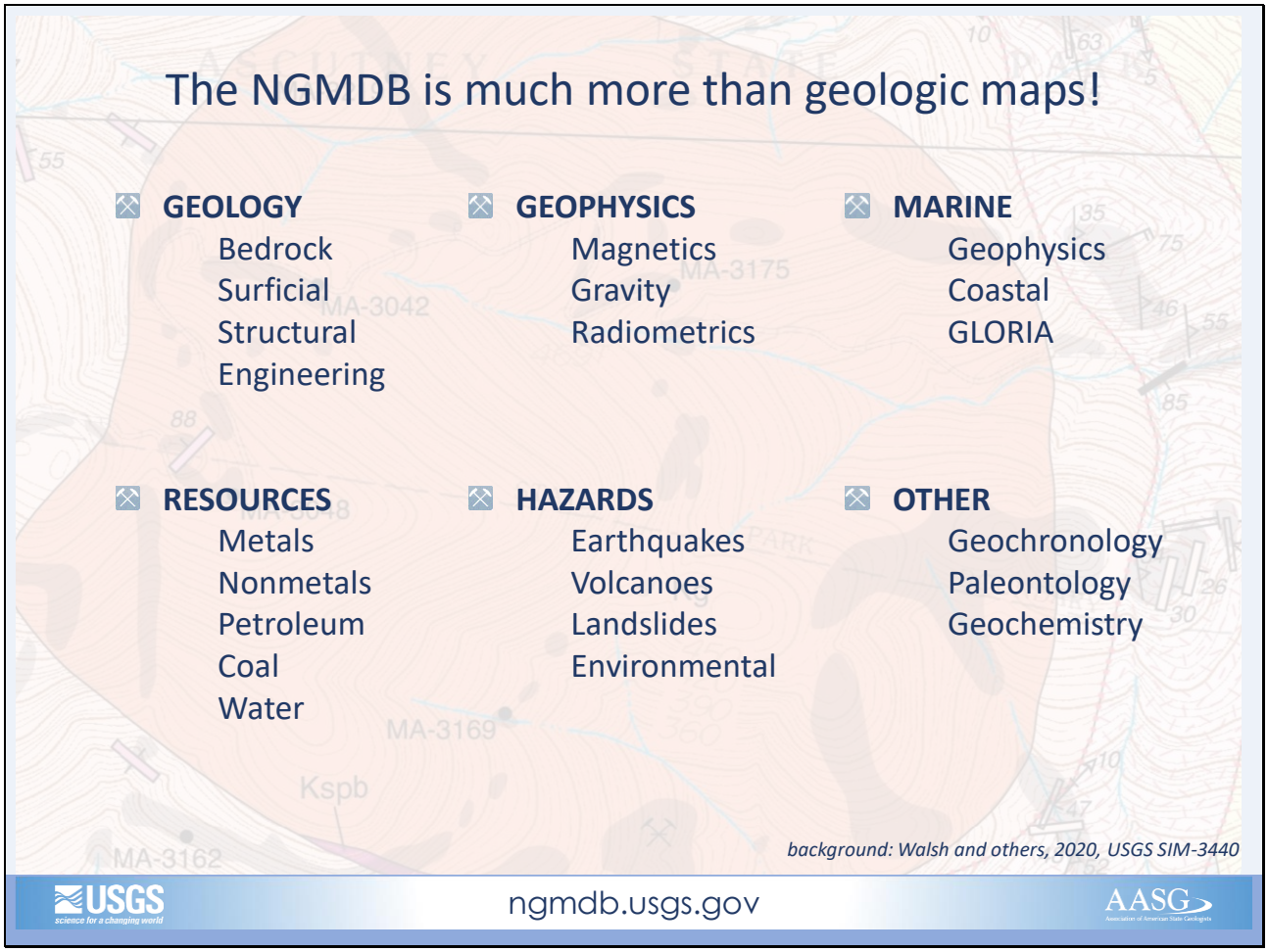
AASG Association of American State Geologists

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.

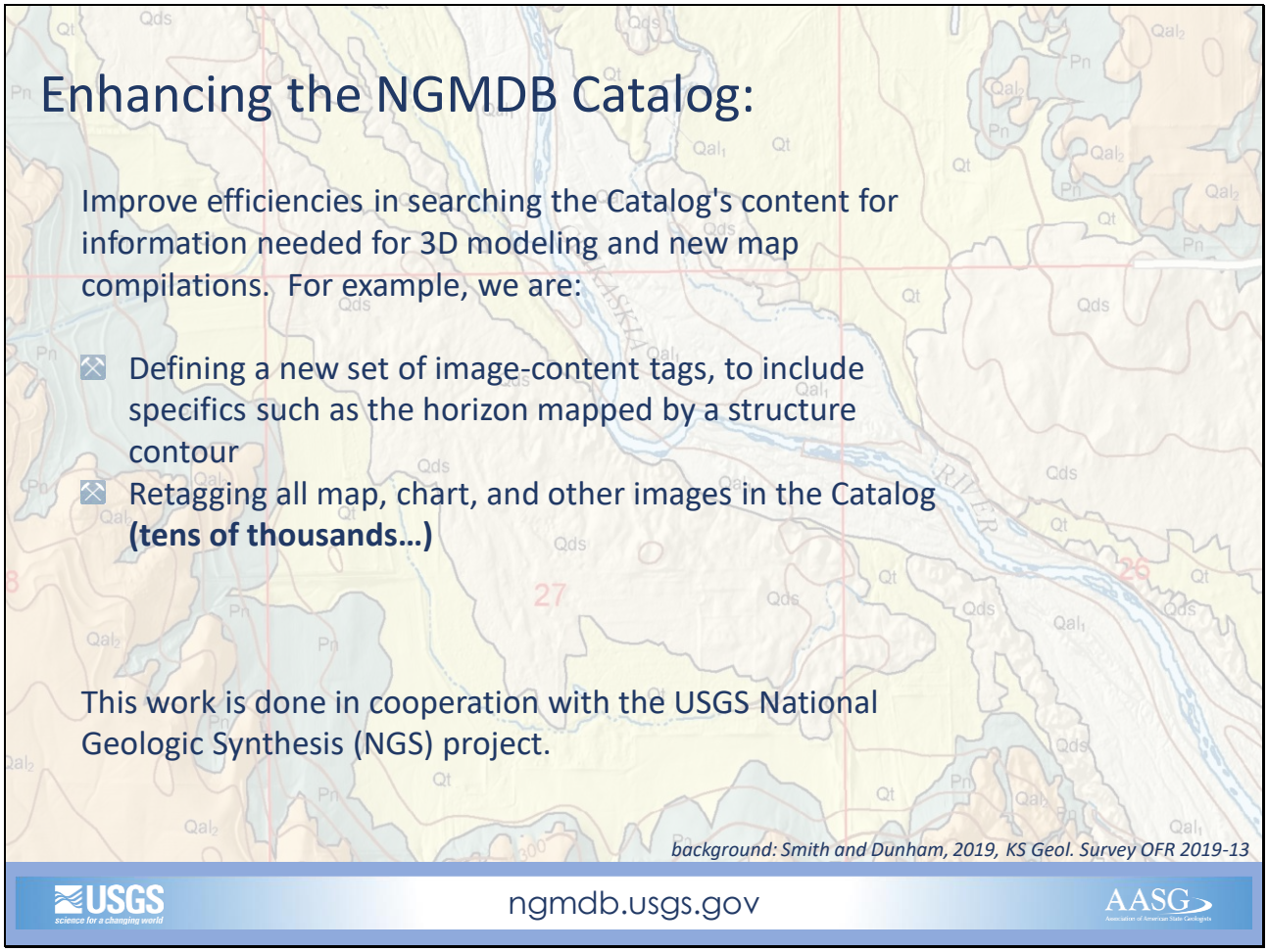
SLIDE 22



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).]

SLIDE 23



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.

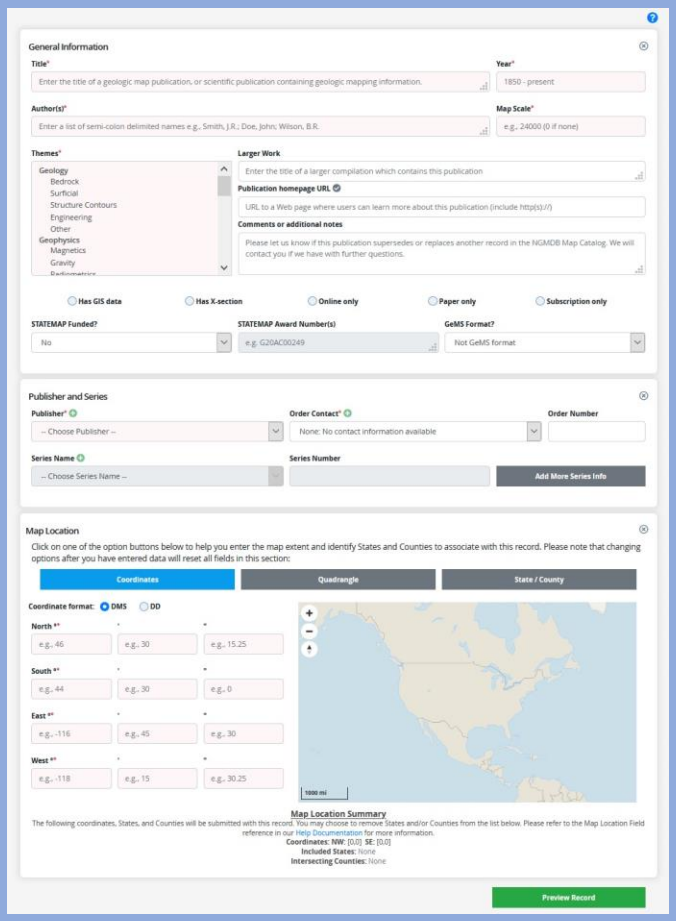
[Slide background: portion of Smith, J.J., and Dunham, J.W., 2019, Preliminary surficial geology of the Argonia quadrangle, Harper and Sumner counties, Kansas: Kansas Geological Survey, Open-File Report OFR 2019-13, scale 1:24,000. Funded in part by NCGMP STATEMAP. Image downloaded from the National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

SLIDE 24

New Input Form

To use the form, contact ngmdb@usgs.gov

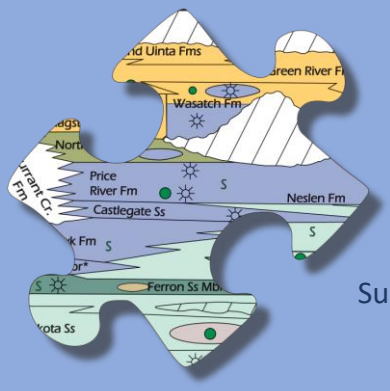
Webinar this Summer!



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.

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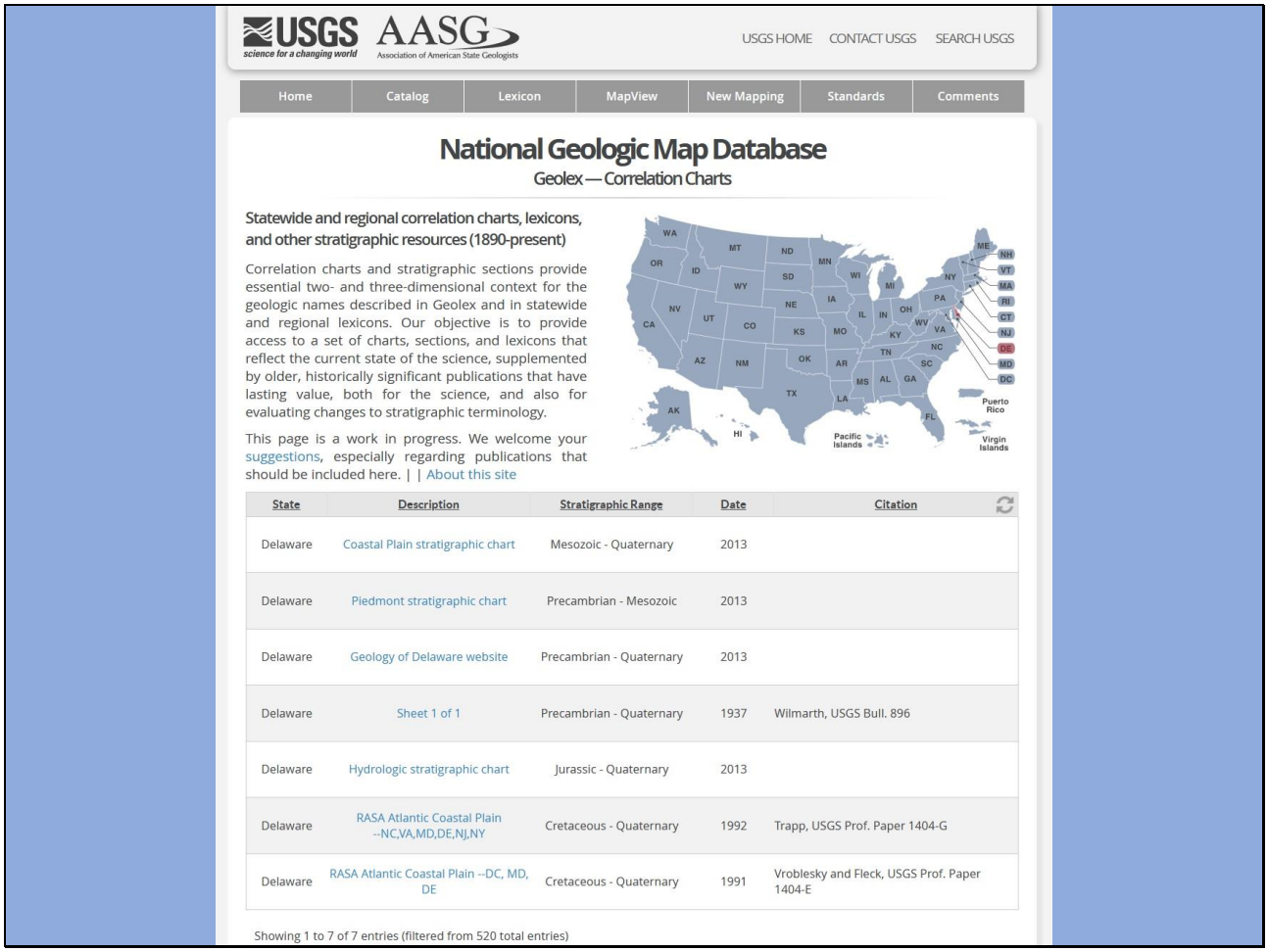
AASG

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

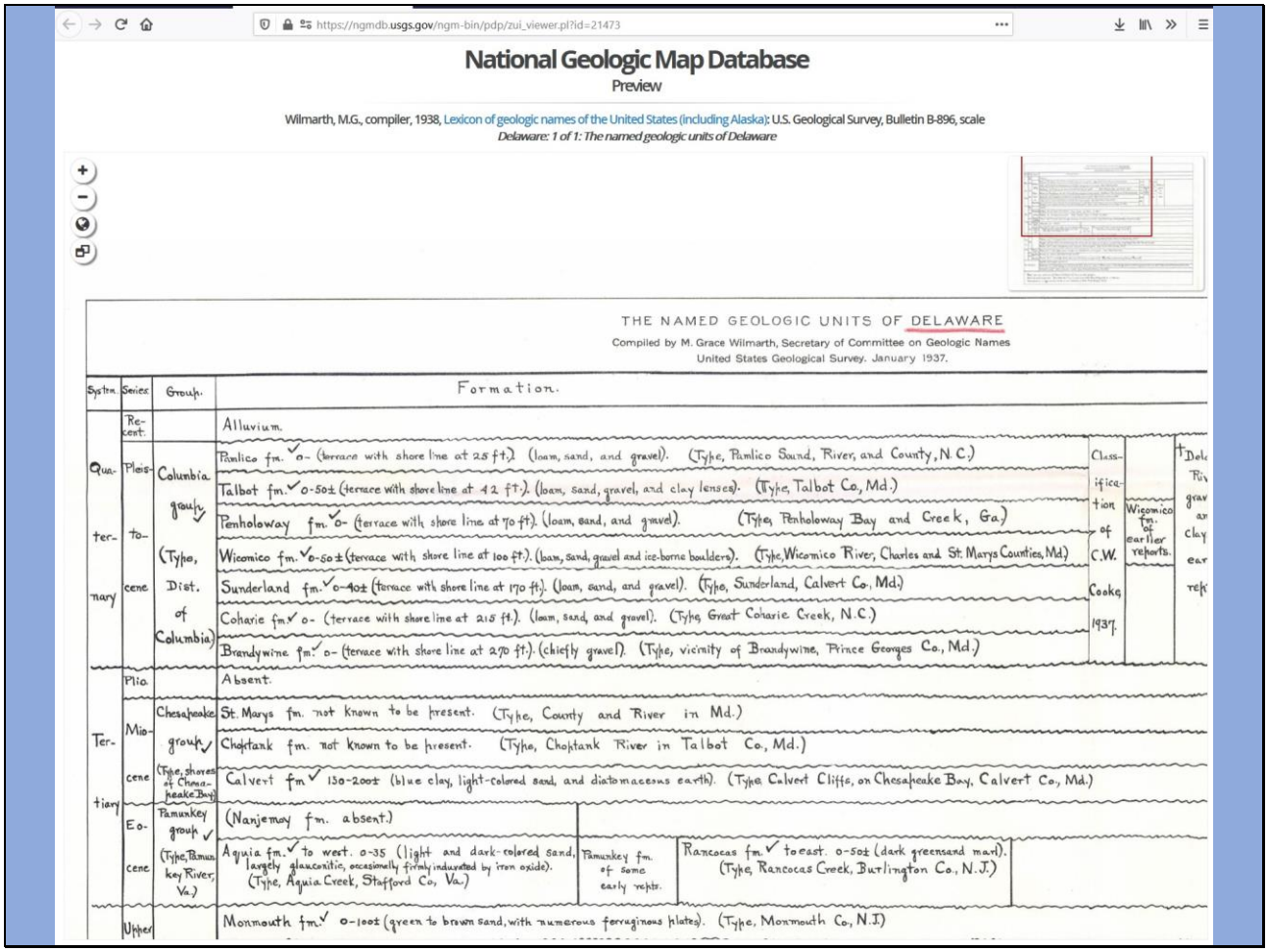


State	Description	Stratigraphic Range	Date	Citation
Delaware	Coastal Plain stratigraphic chart	Mesozoic - Quaternary	2013	
Delaware	Piedmont stratigraphic chart	Precambrian - Mesozoic	2013	
Delaware	Geology of Delaware website	Precambrian - Quaternary	2013	
Delaware	Sheet 1 of 1	Precambrian - Quaternary	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)

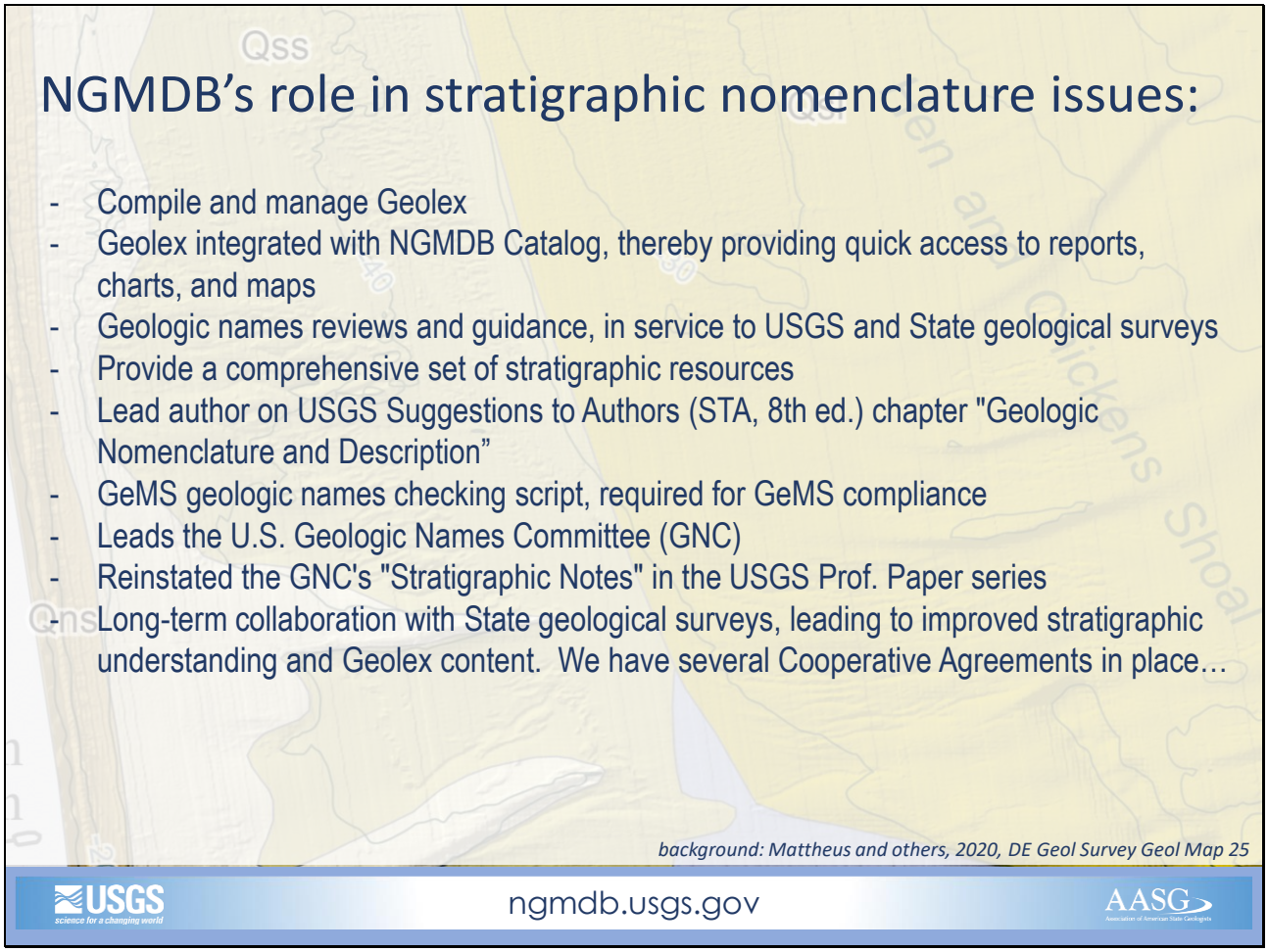
PRESENTER NOTES:
As part of the Geolex task, we provide a strong focus on correlation charts and other aspects of stratigraphy.

SLIDE 27



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.

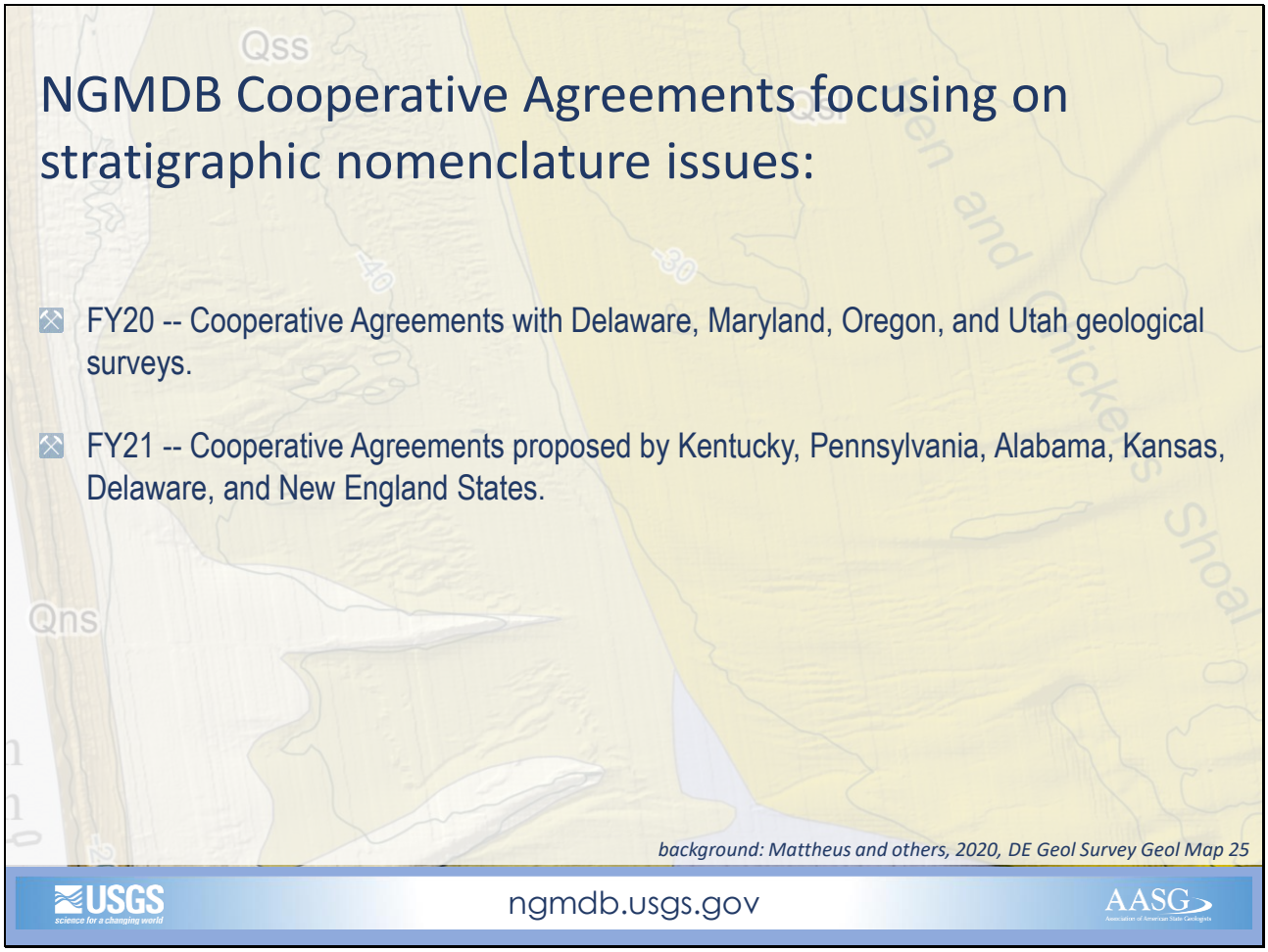
SLIDE 28



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).]

SLIDE 29



[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).]

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:

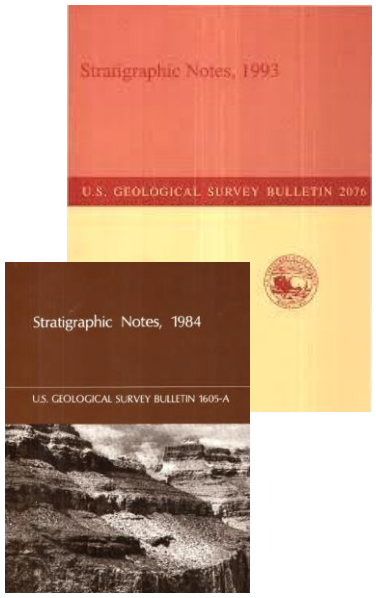
Stratigraphic notes: An Outlet For Stratigraphic Studies

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



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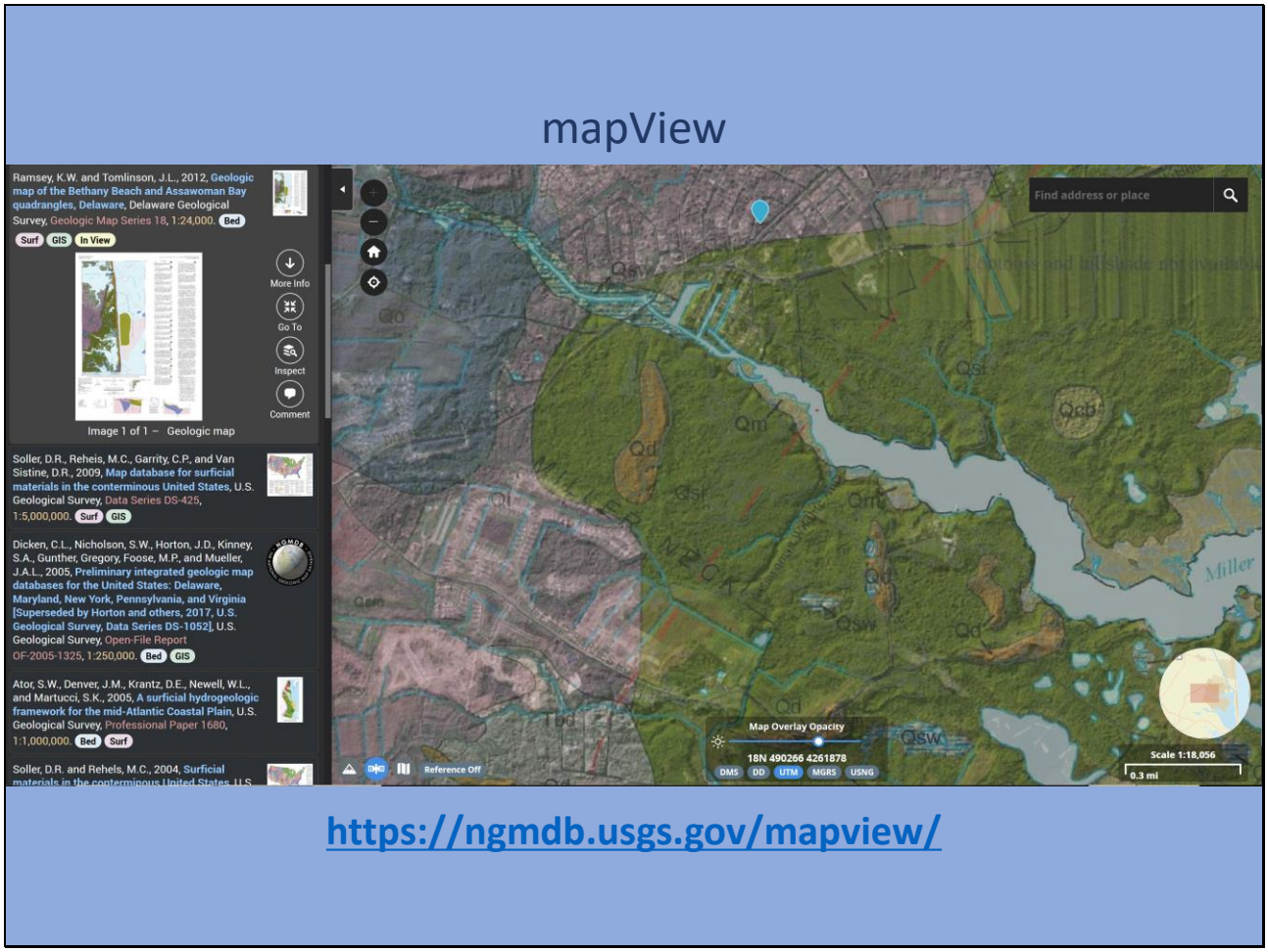
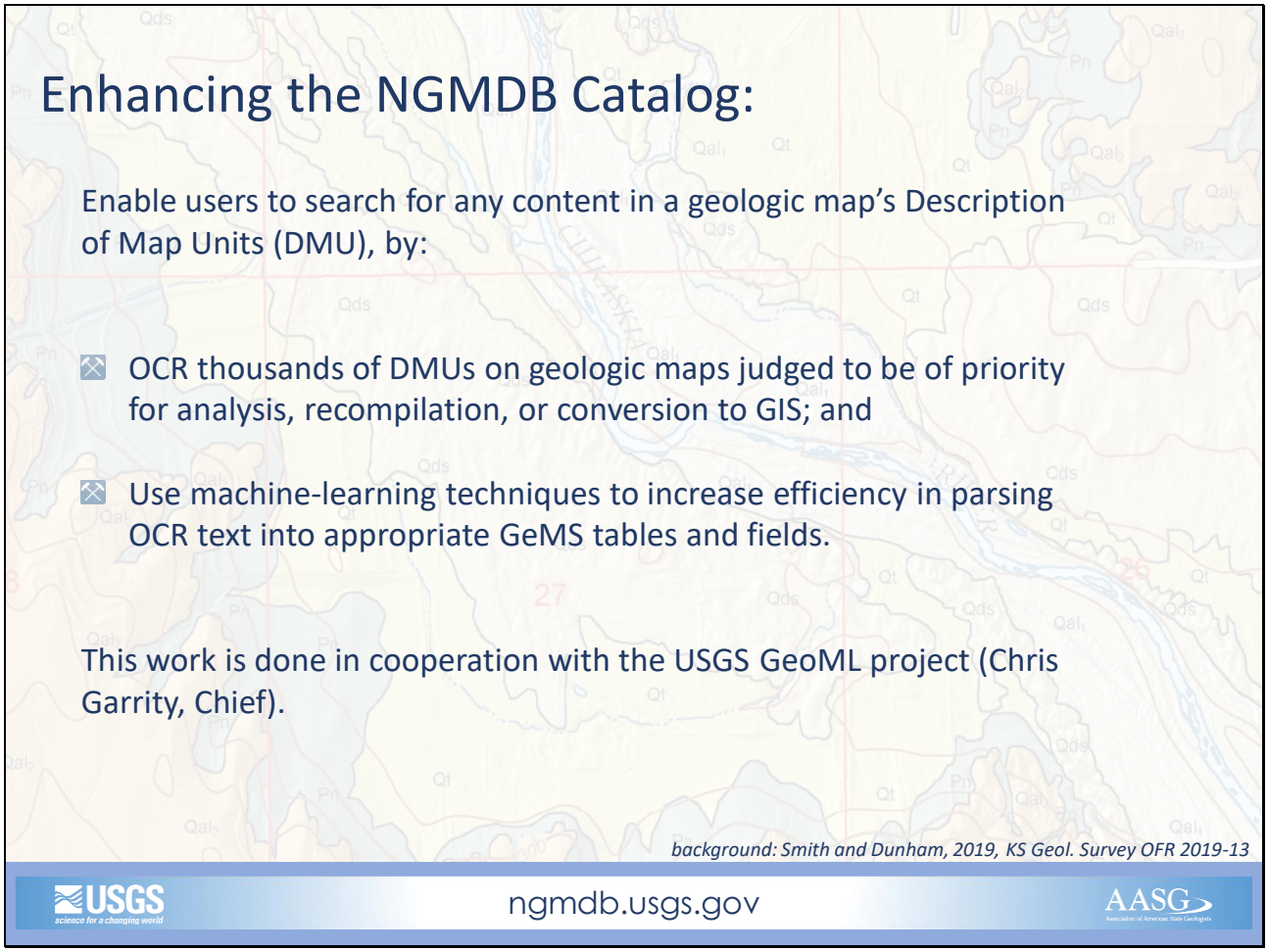
PRESENTER NOTES:
Although it'll be described in a lightning talk on Thursday, I wanted to just note that we're resurrecting the USGS Stratigraphic Notes (published between 1982 and 1995; USGS Bulletins 1529-H, 1537-A, 1605-A, 2060, and 2153). Due to the discontinuation of the USGS Bulletin series, these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

SLIDE 31



PRESENTER NOTES:
Regarding the delivery of geoscience content, in addition to the Geoscience Map Catalog and the U.S. Geologic Names Lexicon (Geolex), let me mention our related interfaces. Here's mapView (https://ngmdb.usgs.gov/mapview/), which began in 2010, as a visual front-end to selected geologic maps in the Catalog. It also served as an effective means for us, and the States, to evaluate the geologic maps, and scans of those maps, in our respective collections. We now have nearly 19,000 georeferenced maps in mapView.

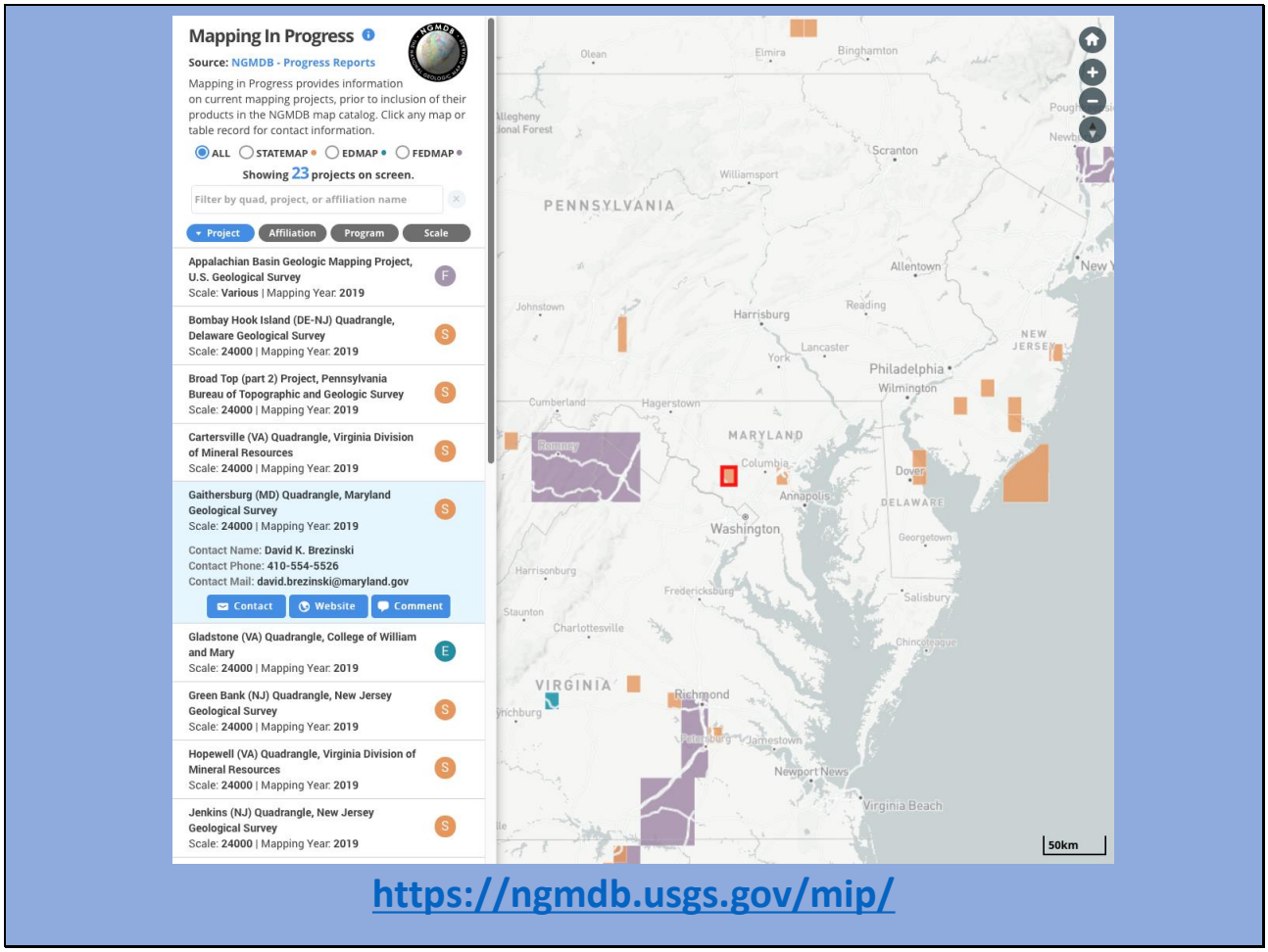
SLIDE 32



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).]

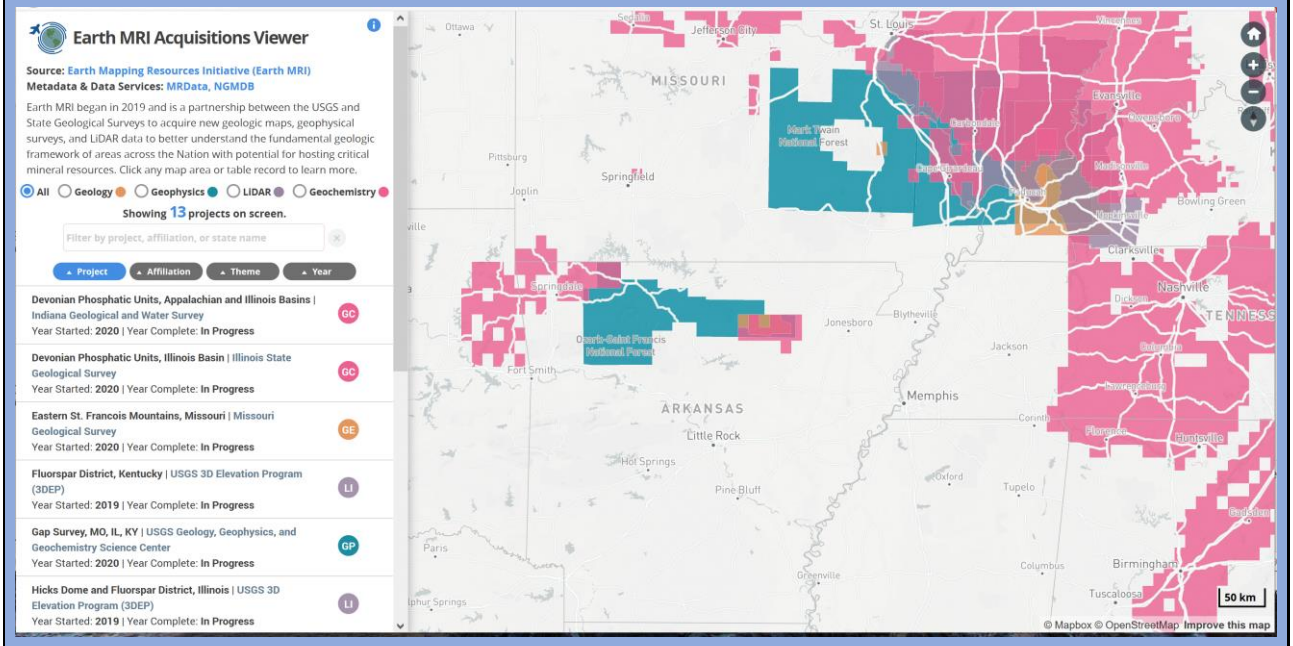
SLIDE 33



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.

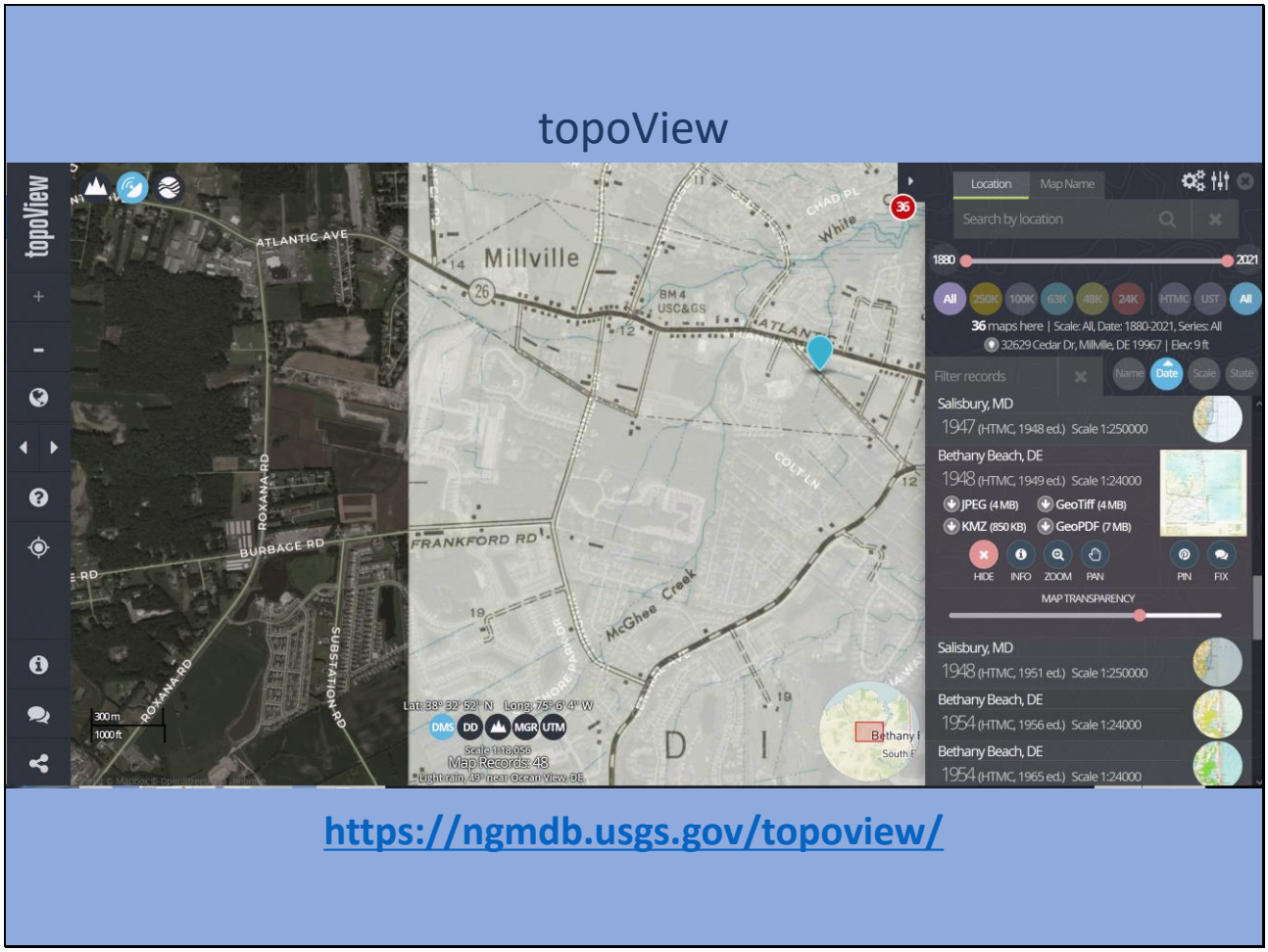
SLIDE 34



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

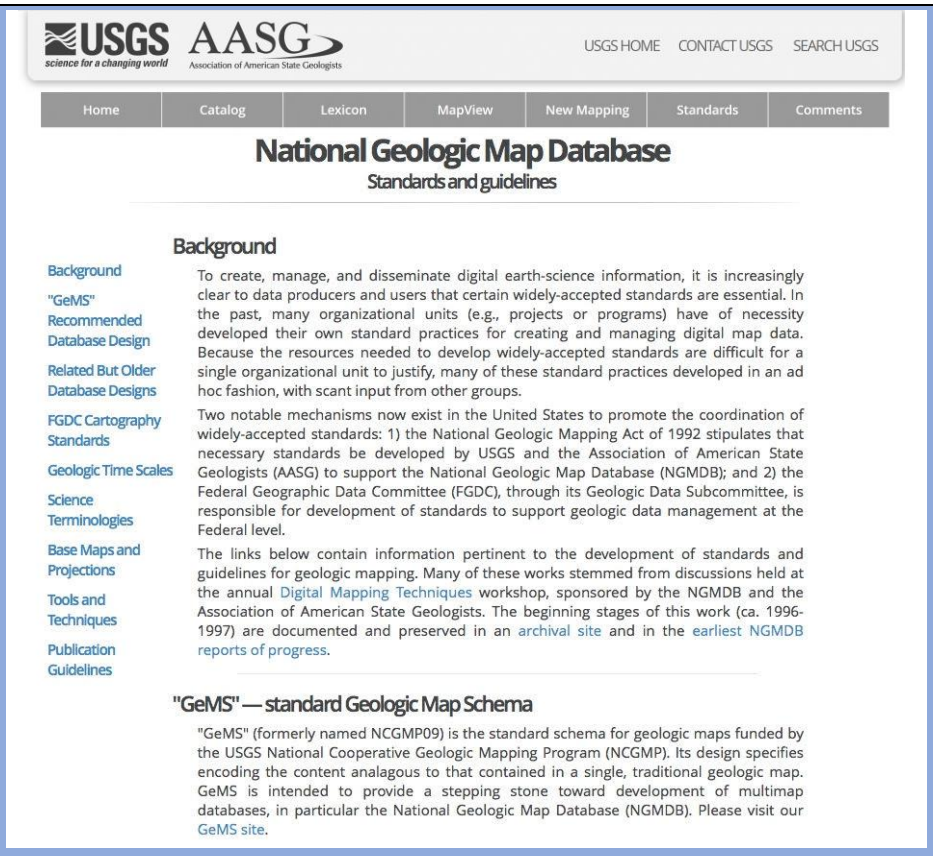
PRESENTER NOTES:
Using the code for that new interface, we also began providing the same type of information for EarthMRI data-acquisition projects (https://ngmdb.usgs.gov/emri/).

SLIDE 35



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/).

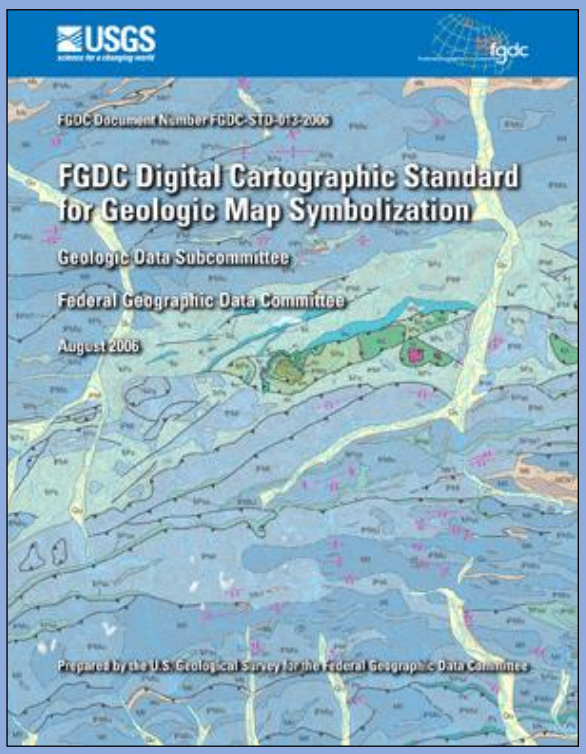
SLIDE 36



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/

Contacts:
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ESRI style files:
Megan James,
South Carolina Geological Survey,
jamesm@dnr.sc.gov

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PRESENTER NOTES:
Federal Geographic Data Committee (FGDC) 2006 Digital cartographic standard for geologic map symbolization (https://ngmdb.usgs.gov/fgdc_gds/).

SLIDE 38

pubs.er.usgs.gov/publication/tm11B10

This report describes and defines GeMS (*G*eologic *M*ap *S*chema), 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.

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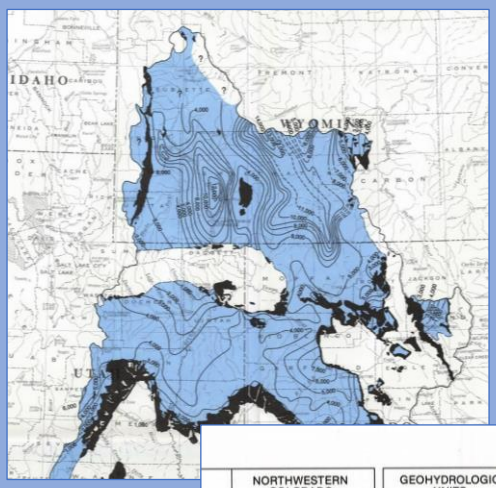
PRESENTER NOTES:
U.S. Geological Survey National Cooperative Geologic Mapping Program, 2020, GeMS (Geologic Map Schema)—A standard format for the digital publication of geologic maps: U.S. Geological Survey Techniques and Methods, Book 11, Chap. B10, 74 p.; https://doi.org/10.3133/tm11B10, https://pubs.usgs.gov/tm/11b10/tm11b10.pdf.

SLIDE 39

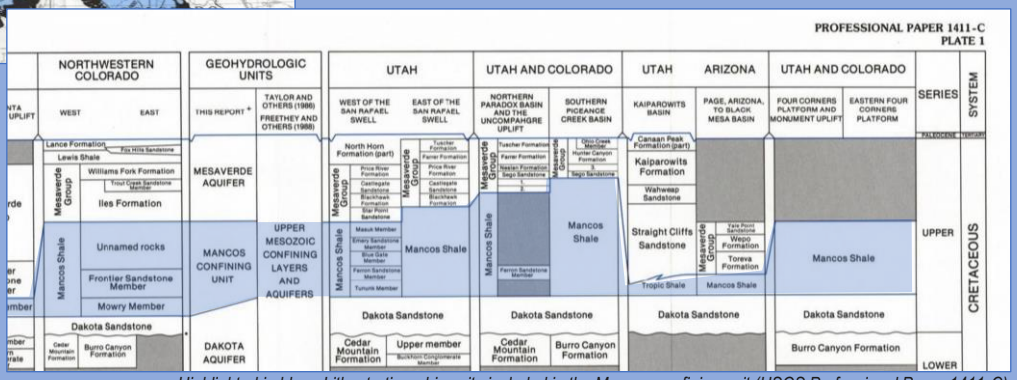


Mancos confining unit (USGS Prof.Paper 1411-C)

Sweetkind, D.S., and Masbruch, M.D., 2020
https://doi.org/10.5066/P9HPE08L,
https://ngmdb.usgs.gov/Prodesc/proddesc_111269.htm

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

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)

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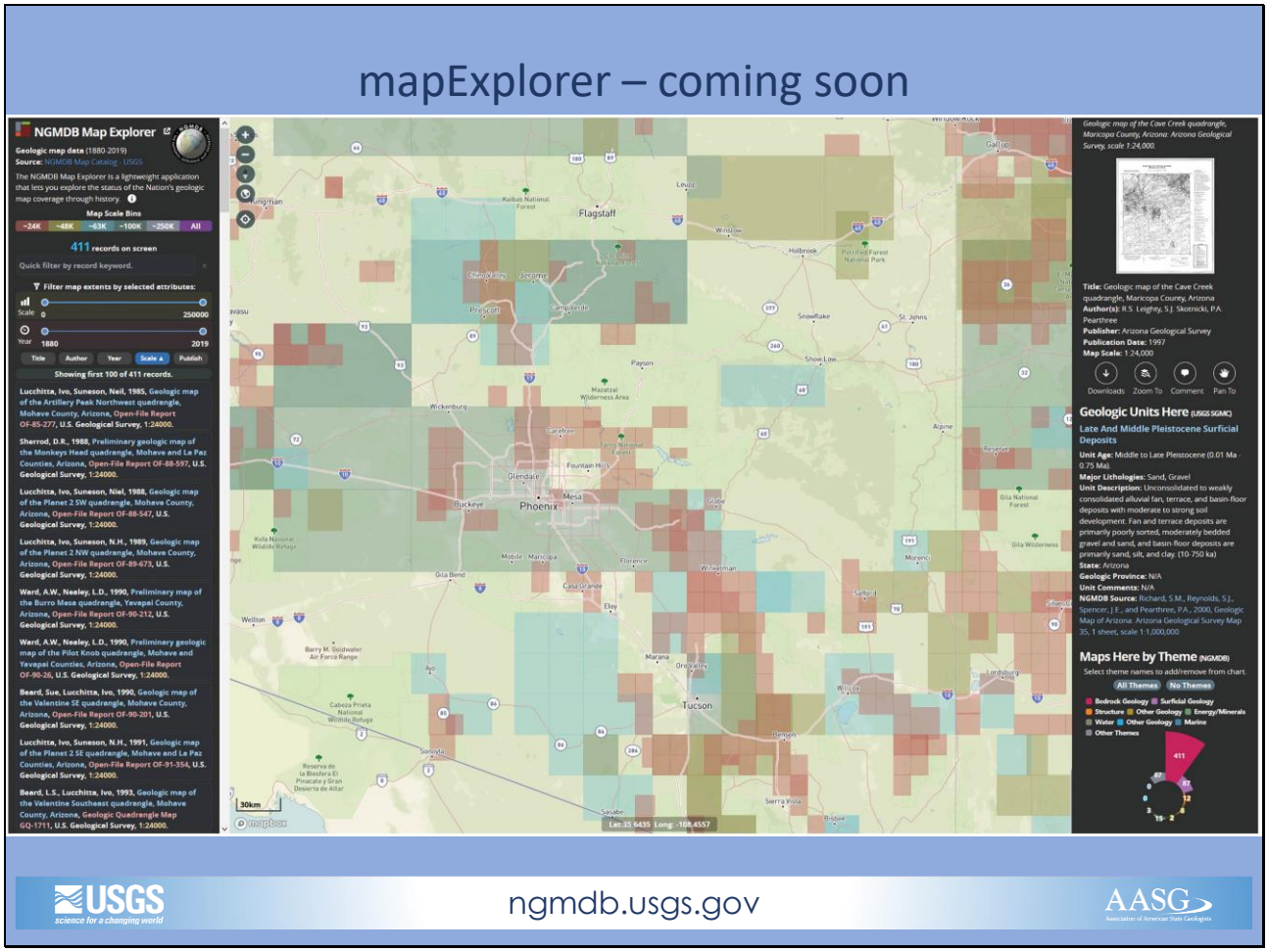
PRESENTER NOTES:
There has been much discussion about the need for 3D standards, a topic that Don Sweetkind has been leading with NCGMP's group in USGS. I'd like to note that one of Don's recent publications (Sweetkind and Masbruch, 2020), which was vector-based structure contours derived from a USGS 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).

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).

SLIDE 40



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

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