DIGITAL MAPPING TECHNIQUES 2024

The following was presented at DMT '24
May 13 - 16, 2024

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2024)
http://ngmdb.usgs.gov/info/dmt/

An Update on Virginia's Large-Scale Compilation Mapping with GeMS

By Katie Lang (Virginia Geology and Mineral Resources Program)

The Virginia Energy Geology and Mineral Resources Program has been focused on large-scale compilations since the GeMS format was introduced for the state in 2020. An updated statewide compilation of Virginia was delivered as a GeMS-compliant database and has served as the foundation for all subsequent compilation efforts within the commonwealth. We developed a series of GeMS standards that guide the VA geologists and GIS staff for a variety of map scales. A statewide master DataSources Table ensures every GeMS product from the Virginia Survey will have matching numerical citation values, regardless of scale, project, or year, for ease of customer use. With over 985 DataSources and counting, all maps and citations are easily searchable and available for geologists to directly import into their non-spatial tables. Similarly, we created a standardized glossary for all terms used in the "Type" field throughout the geodatabase such that the terms are also directly importable into the GeMS product. Two new review tools were created in python to check individual projects against the master lists to further review the Glossary and DataSource values at the end of the project cycle. These tools have sped up the internal review time of the GeMS products significantly. For any new and existing staff working on a GeMS related task, the Virginia Survey developed an internal "GeMS Guide" document. This spreadsheet contains current links to important GeMS-related websites, includes Virginia's standards for each feature class, and identifies a point person for specific tasks to facilitate implementation of the GeMS standards into daily workflows. This internal GeMS documentation developed for all VA GeMS products has helped ensure a more accurate and efficient application of standards for all large-scale compilation products produced at the VA survey.

An Update on Virginia's large-scale Compilation Mapping with GeMS

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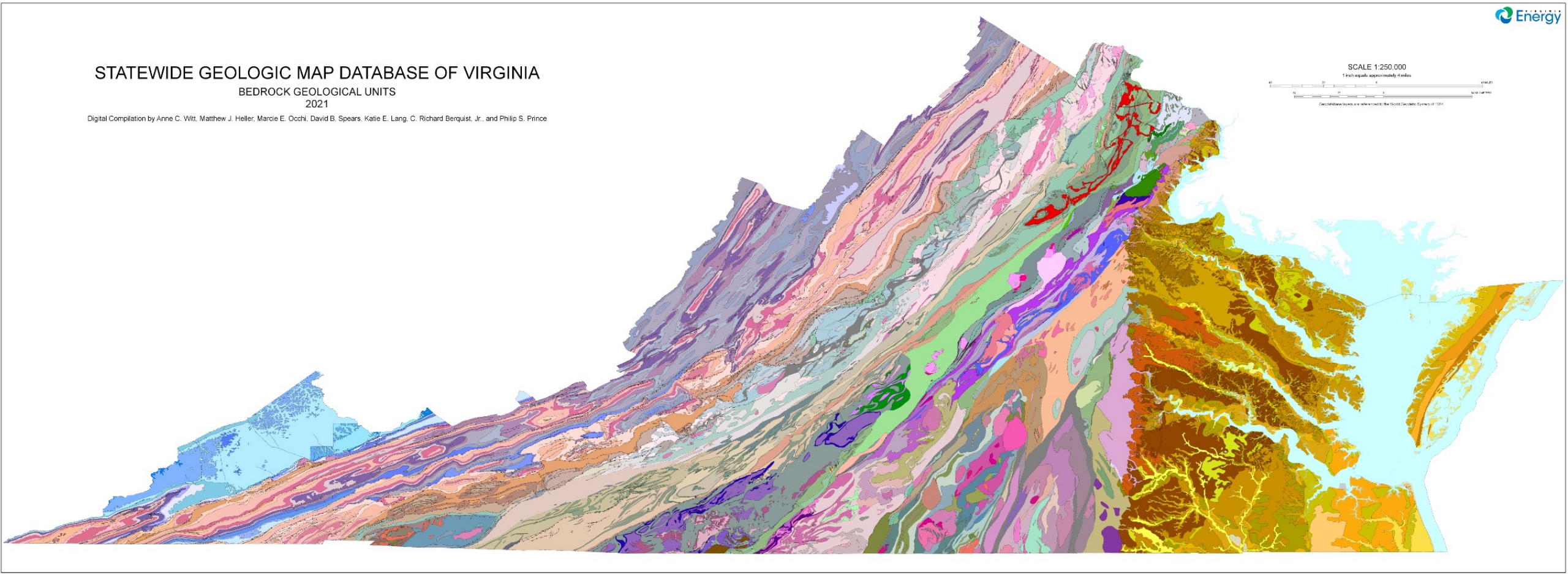
Virginia's System to GeMS compliant mapping



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Large-scale compilation goals in VA

- Streamlined process for every geologist at the VA survey
- Balance geologist preference and GeMS requirements
- Create standards for all feature classes to increase efficiency
- Intention of customer use

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Scale Dependent Digitization Guides in Virginia

If Mapping at this scale:	1:24k Maps	1:100K Maps	1:250K Maps (Statewide Compilation)
Map features that are clearly visible at this scale	10K-12K	50K	100-125K
Digitize features while zoomed to this scale	4K-6K	10K-15K	24K
Minimum fault and dike length	500 ft	2000 ft	5000 ft
Minimum fold axis length	2000 ft	8000 ft	Only major fold axes
Minimum map thickness for polygon map unit	150 ft	600 ft	1200 ft
Minimum polygon size for overlay polys	200 x 200 ft	400 x 400 ft	1000 x 1000 ft
Show the following mineral resource sites	All known sites	All sites visible on basemap at 24K	All sites visible on basemap at 100K
Show the following karst features	>100ft^2 as points >30,000 ft^2 as lines	>400ft^2 as points >120,000 ft^2 as lines	Not shown
Show the following coal beds	All coal beds	Major coal beds	Not shown

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Statewide Master DataSources Table

DAS ID	Source/Citation
DAS009	Andrews, L.E., Jr., 1952, Structure of the area north of Roanoke, Virginia [Ph.D. dissertation]: Johns Hopkins University, Baltimore, Maryland, 126 p.
DAS010	Averitt, P., 1941, The Early Grove gas field, Scott and Washington counties, Virginia: Virginia Geological Survey Bulletin 56, 50 p.
DAS011	Badger, R.L. and Sinha, A.K., 1988, Age and Sr isotopic signature of the Catoctin volcanic province: Implications for subcrustal mantle evolution: Geology, v. 16, p. 692-695.
DAS719	Lang, K.E., geologic data collection and interpretation
DAS986	Biggs, T.H., unpublished partial geologic field map of the Charlottesville West quadrangle (174D), Virginia: Virginia Department of Energy, Geology and Mineral Resources Program, 1:24,000-scale map.

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Ensures every VA GeMS product will have matching DAS values and gives credit to map and *mapper*

Standardized Glossary for All Terms

	A	B	C	D
1	Term	Definition	DefinitionSourceID	Exact AGI def? (Y/N)
33	DMUUnit3	Paragraph style for description of a third-order map unit within the Description of Map Units table. Such map units are subsidiary to (commonly subdivisions of) second-order map units.	DAS767	GeMS
34	dredging	The process of sucking, scooping up, or excavating earth material from the bottom of a body of water, raising it to the surface, and discharging it to the bank through a floating pipeline or conveyor, into a scow for removal, or, in the case of certain mining dredges, into the same body of water after removal of the ore mineral.	DAS766|DAS857	N
35	fault	A discrete surface or zone of discrete surfaces separating two rock masses across which one mass has slid past the other.	DAS766|DAS857	N
36	float	A general term for isolated, displaced fragments of a rock, esp. on a hillside below an outcropping ledge or vein.	DAS766	Y
37	fold	A curve or bend of a planar structure such as rock strata, bedding planes, foliation, or cleavage. A fold is usually a product of deformation.	DAS766	Y
38	fold axis	A line which, when moved parallel to itself, traces out a folded surface. It applies only in the case of cylindrical folds.	DAS766	Y

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Glossary System in Review Stage

	A	B	C	D	E
1	Added to Complete Glossary? (Y/N)	Term	Definition	DefinitionSourceID	Exact AGI def? (Y/N)
2		rodding [suggest the term being "rodding lineation" as all other types (crenulation, etc) have lineation in their name] - pcf	In metamorphic rocks, a linear structure in which the stronger parts, such as vein quartz or quartz pebbles, have been shaped into parallel rods.	DAS766	Y
3		zone	A belt, band, or strip of earth materials, however disposed, characterized as distinct from surrounding parts by some particular property or content; e.g., the zone of saturation, the zone of fracture or a fault zone.	DAS766	Y
4		point of geologic interest	~~Any~~ A geolocated point on a map indicating ~~sight~~ observation of some point of geologic interest. ~~yet generalized.~~	DAS970|DAS566	N

	F	G	H	I	J
	Notes	Added by	Project Used In	Reviewer #1 initials	Reviewer #2 initials
	Symbol 9.61 in FGDC for reference...suggested modification: "In metamorphic rocks, a linear feature in which more competent material, such as vein quartz or quartz pebbles or phenocrysts, have been stretched or otherwise shaped into parallel rods." a rodding lineation is also a subset of a stretching lineation, so maybe worth mentioning that? - pcf	KEL	Dabneys Map	PCF	HEM
	Introducing this to handle the term 'garnet bearing zone', which appears as a thin band of garnets stretched around a contact on the Linden map. This band looks not quite like an isograd, nor like the broad 'metamorphic zone' between two isograds. This generic zone term would also be useful for other types of zones we encounter, especially in conversions.	VML	Linden Conversion	HEM	
	This is for a specific map feature that has a symbol that does not have an FGDC equivalent. The definition is used to describe how the symbolized feature was used in the original map. This is related to Data Preservation.	AJL	Fluvanna County 62	HEM	

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Internal GeMS Guide for VA Geologists

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**GeMS Cheatsheet**														
2															
3	**GeMS**: **Ge**ologic **M**ap **S**chema														
4	A schema for putting together a geologic map geodatabase so it can eventually be combined for the National Geologic Map Database														
5	Makes smaller geodatabases easier to combine														
6	Provides a framework for consistency														
7															
8	**Resources**														
9	GeMS page:		https://ngmdb.usgs.gov/Info/standards/GeMS/												
10		Toolbox download													
11		ArcGIS Pro style implementation of FGDC standard download													
12		Fonts- geoage and geosymbol- installed through fonts in your computer settings													
13															
14	FGDC Geologic symbols:			https://ngmdb.usgs.gov/fgdc_gds/geolsymstd/download.php											
15		We use 0 padded symbology to match with codes in the ArcPro style file. Example: 01.01.01 is a contact with identity and existance certain, location													
16															
17															
18	GeMS Publication (tabbed print recommended):				https://pubs.usgs.gov/publication/tm11B10										
19															
20	Old STATEMAP Deliverables folder: \\energyfiles\DGMR\PROJECTS\MAPPING\STATEMAP\Deliverables														
21		Useful for examples. If something is questionable, look to see how it was done previously.													

Overview | Toolbox | gdb build | Points | Lines | Polygons | CrossSections | Topology Rules | Non-Spatial Tables | Metadata | LocationConfidence | GeoMaterials | Geologic Names Check | Delivera

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Internal GeMS Guide for every step

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Generic Points**												
2	Includes boreholes, pits, quarries, rock repository samples, etc												
3	Formatting of this has varied over time. Holly Mangum is the best person to ask if help is needed for labeling/StationsID												
4	Type- must match an item in the GMR glossary, some are generalized, all lower case												
5	LocationConfidenceMeters is typically 5 for boreholes (and maybe samples) and 25 for everything else												
6	LocationSourceID and DataSourceID are usually the same DASID												
7	May have to add Azimuth field to turn spring symbology												
8	MapUnit is done at the end of the project with a spatial join. Must match a map unit in the DMU nonspatial table.												
9													
10	**Orientation Points**												
11	Type- must match an item in the GMR glossary, some are generalized, all lower case												
12	Aziumth- strike (turn symbols according to this)												
13	Inclination- dip (no decimals)												
14	Symbol- FGDC 0 padded Ex: 04.03.02												
15	Label-inclination unless it is horizontal (90) or vertical (0)												
16	LocationConfidenceMeters- 5 if from GPS, 25 from topo.												
17	IdentityConfidence is "certain" (all lower case)												
18	OrientationConfidenceDegreees is 5												
19	PlotAtScale is 0 (we may change this in the future)												
20	MapUnit is done at the end of the project with a spatial join. Must match a map unit in the DMU nonspatial table.												
21	LocationSourceID and OrientationSourceID are usually the same DASID												
22													
23	**Stations (not required)**												
24	Typically used for spots in new mapping projects. NOT required for GeMS but if you include it, it needs to be properly formatted.												
25	Since spots are taken with GPS LocationConfidenceMeters is 5												
26	MapUnit is done at the end of the project with a spatial join. Must match a map unit in the DMU nonspatial table.												
27	Double check that in the attributes table for this feature, the column "StationsID" has the "s" at the end of station. Some versions of the t												

Overview | Toolbox | gdb build | **Points** | Lines | Polygons | CrossSections | Topology Rules | Non-Spatial Tables | Metadata | LocationConfidence

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Reviews: Scientific, Database, & Metadata

Reviewer:	Click or tap here to enter text.
Date:	Click or tap to enter a date.
Quadrangle/Project Map:	Click or tap here to enter text.
Review Stage:	Choose an item.

NON-SPATIAL TABLES

Glossary

Do terms match definitions in GMR glossary? Choose an item.
If no, which one(s) do not match? Click to enter text.

Are all terms included in the GMR glossary? Choose an item.
If no, which one(s) are not? Click to enter text.

Are definitions cut off? Choose an item.
If yes, which one(s) are cut off? Click to enter text.

Do the terms have citations that match the GMR glossary? Choose an item.
If no, which one(s) do not match? Click to enter text.

Any other notes: Click or tap here to enter text.

Data Sources

Does the citation in Source field match the DASID number from the master DASID table? Choose an item.
If no, which one(s) do not match? Click to enter text.

Does the citation match the citation in the master GMR Data Sources table? Choose an item.
If no, which one(s) do not match? Click to enter text.

Has an NGMDB Number column been added with the correct NGMDB numbers? Choose an item.
Which number do not match? Click to enter text.

Any other notes: Click or tap here to enter text.

Description of Map Units

Look at Geolex online for each unit.

Are map unit names spelled correctly in the Name and FullName fields)? Choose an item.

Reviews:

- 2 geologic, scientific reviews
- 2 geodatabase reviews
- Metadata review

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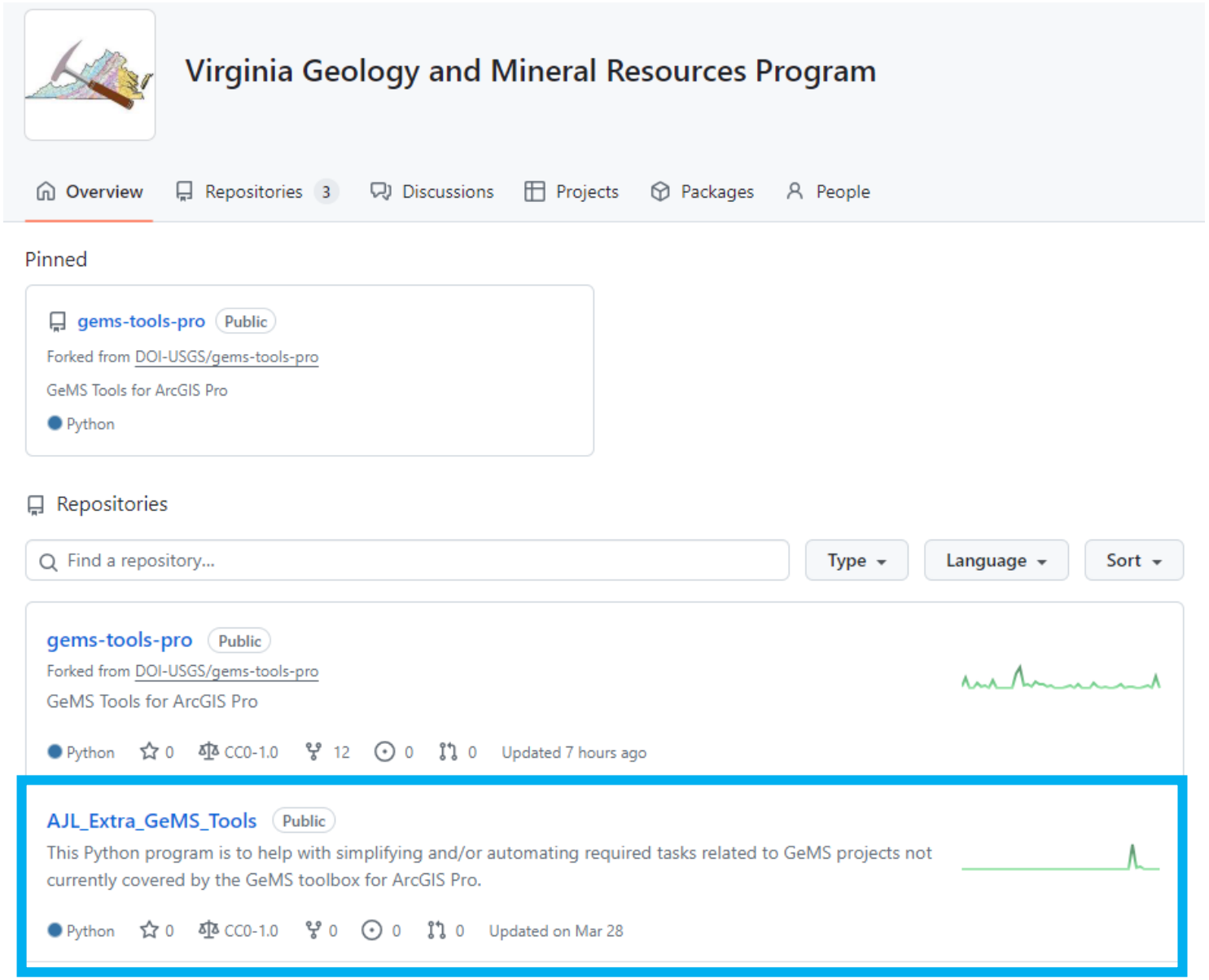
Virginia GitHub tools for GeMS



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New GMR tools to review GeMS tables

Check DataSources Table (GEMS)

Started: Today at 2:03:08 PM

Completed: Today at 2:10:26 PM

Elapsed Time: 7 Minutes 18 Seconds

Parameters Environments **Messages (2)**

Start Time: Friday, May 3, 2024 2:03:08 PM

Successfully connected to Master Data Sources table

Source(s) not matching the GMR Master DAS table:

	DataSources_ID	Source
3	DAS802	U.S. Geological Survey, 2020, USA USGS 24k Qua...

Check these records and run again.

Succeeded at Friday, May 3, 2024 2:10:26 PM (Elapsed Time: 7 minutes 17 seconds)

Check Glossary (GEMS)

Started: Today at 11:40:36 AM

Completed: Today at 11:43:21 AM

Elapsed Time: 2 Minutes 45 Seconds

Parameters Environments **Messages (3)**

Start Time: Friday, May 3, 2024 11:40:36 AM

The following term(s) were not found in the GMR glossary:

	Term
0	coal bed
28	kink band

Name: Term, dtype: object

Definition(s) for the following term(s) were not found in the GMR glossary:

	Term	Definition
0	coal bed	A coal seam; a stratum or bed of coal
28	kink band	A type of deformation band occurring microscop...

Data Source(s) for the following term(s) were not found in the GMR glossary:

	Term	Geodatabase	GMR Glossary
0	coal bed	DAS766	NaN
8	inclined dike or vein	DAS766	DAS766|DAS857
28	kink band	DAS766	NaN

Succeeded at Friday, May 3, 2024 11:43:21 AM (Elapsed Time: 2 minutes 45 seconds)

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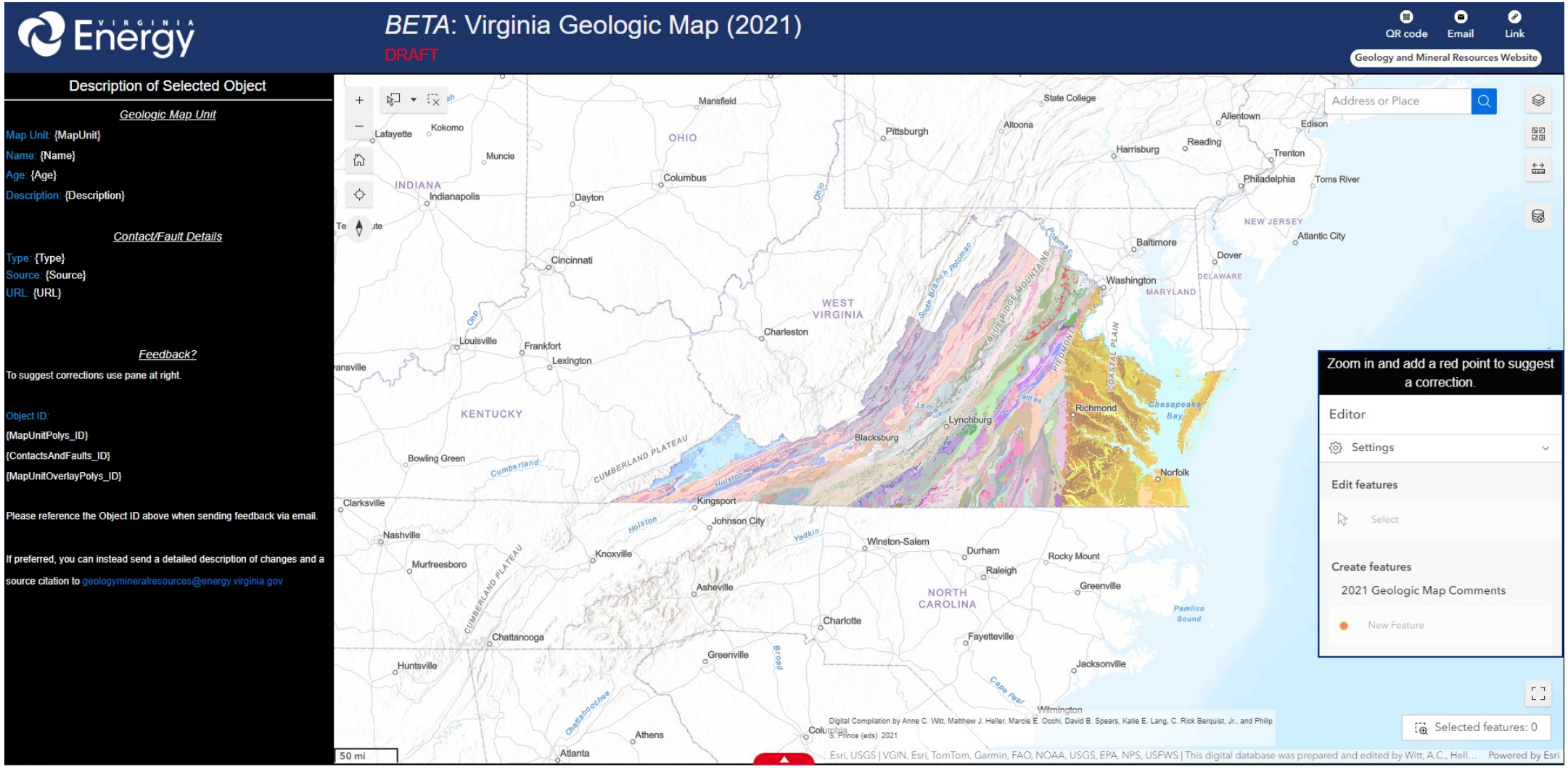
BETA VA Statewide Geologic Map Viewer!



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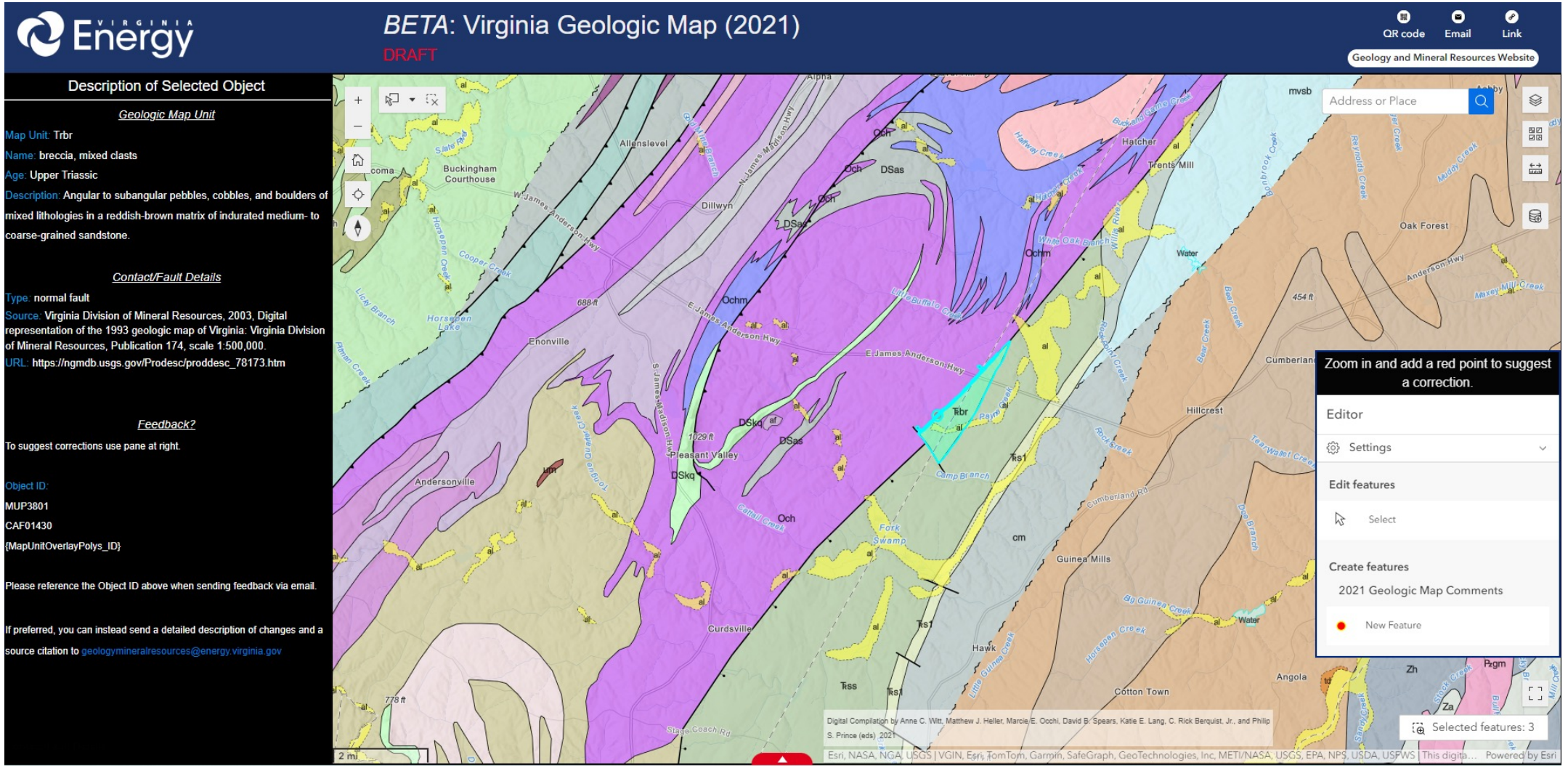
BETA VA Statewide Geologic Map Viewer!



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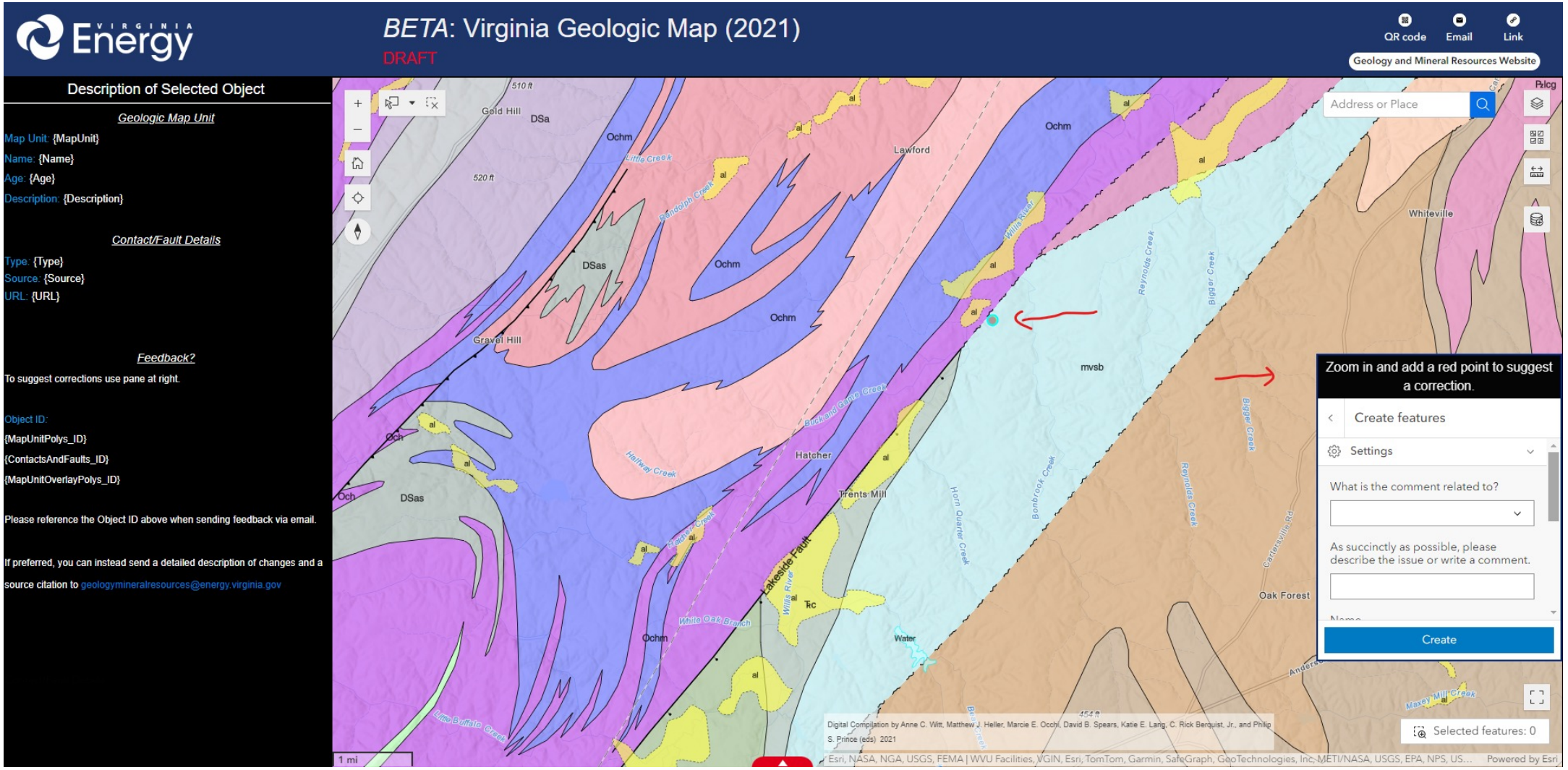
Correction points through Survey123



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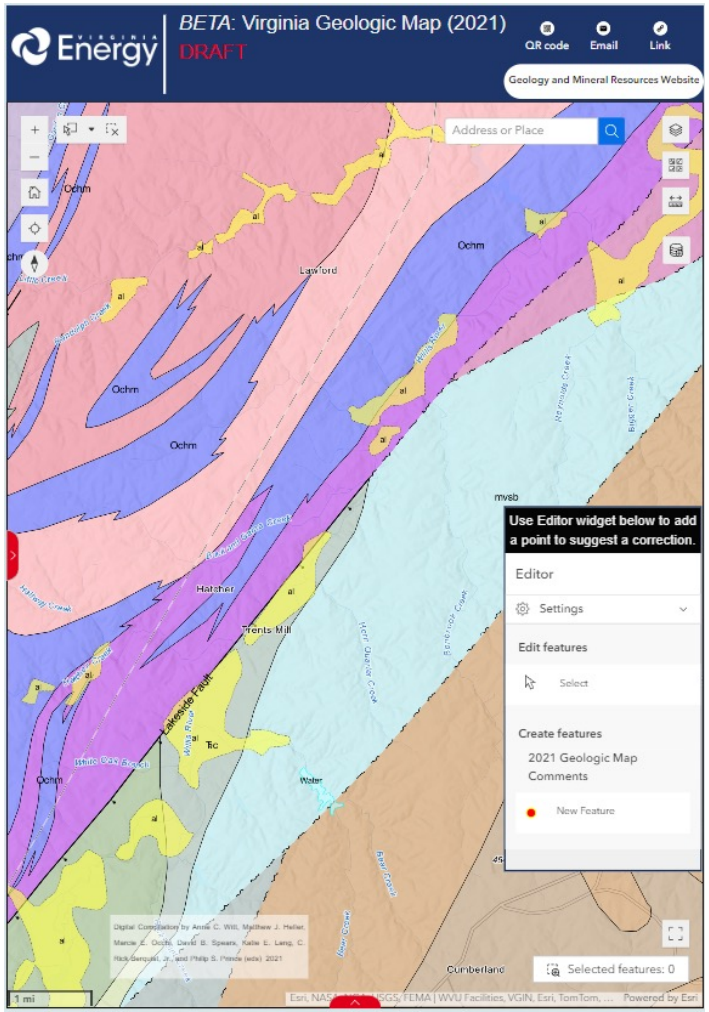
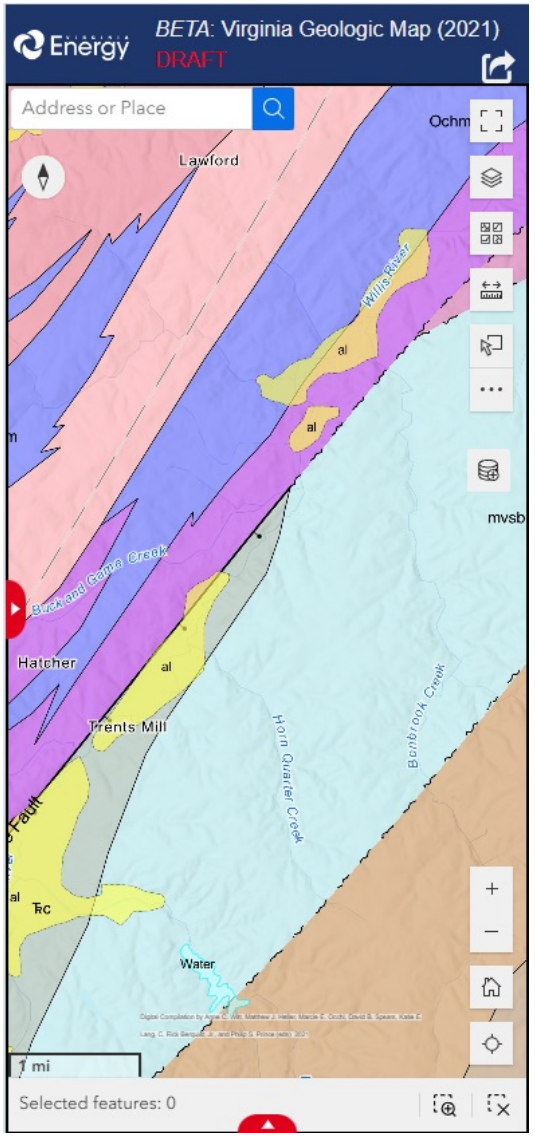
Mobile Views





If you'd like to view, try the map located at the QR code here!

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Conclusions

For the Virginia Survey's effort with GeMS:

- Statewide, standard table values are key
- Internal GeMS documents facilitate more accurate implementation of standards
- Creating tools that help automate reviews increases efficiency

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Thank You!

- Virginia Dept. of Energy colleagues:
  - Holly Mangum, Virginia Latane, Catherine Brown, Anne Witt, and Adam Link
- Illinois Geological Survey: Thanks for hosting a wonderful DMT meeting!
- Contributors to the GeMS GitHub

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