DIGITAL MAPPING TECHNIQUES 2021

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SEAMLESS STATEWIDE GEOLOGIC COMPILATIONS:

NEW STRATEGIES TO MEET NEW OBJECTIVES

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In earlier statewide geologic map compilations, a standard approach has been to simplify geology, generalize contacts, and exaggerate small but important features to achieve a harmonious and consistent map that displays well on a single base map at a desired scale. Future statewide geologic map compilations will be displayed on accurate base maps in a GIS environment. Consistency is less important than accuracy to users in this environment and contacts should match well with published mapping at larger scales. Simplification is still important, but the level of simplification should be based on the scale of the map product and not the availability of data, as more detail can be added when additional mapping is completed. GeMS is a powerful tool that allows users to understand accuracy and certainty of map features and locate higher resolution source maps, and we should take advantage of these capabilities.

HOW ARE STATE GEOLOGIC MAPS AND SEAMLESS COMPILATIONS DIFFERENT?

STATE GEOLOGIC MAPS

- Designed to be viewed in entirety at a single scale
- Mostly portray geology as a single layer
- Matched to a single basemap
- Are primarily used to understand regional geologic setting
- Users will value consistency and legibility over accuracy at larger scales
- A static product that is replaced every generation or two.

STATEWIDE GEOLOGIC COMPILATIONS

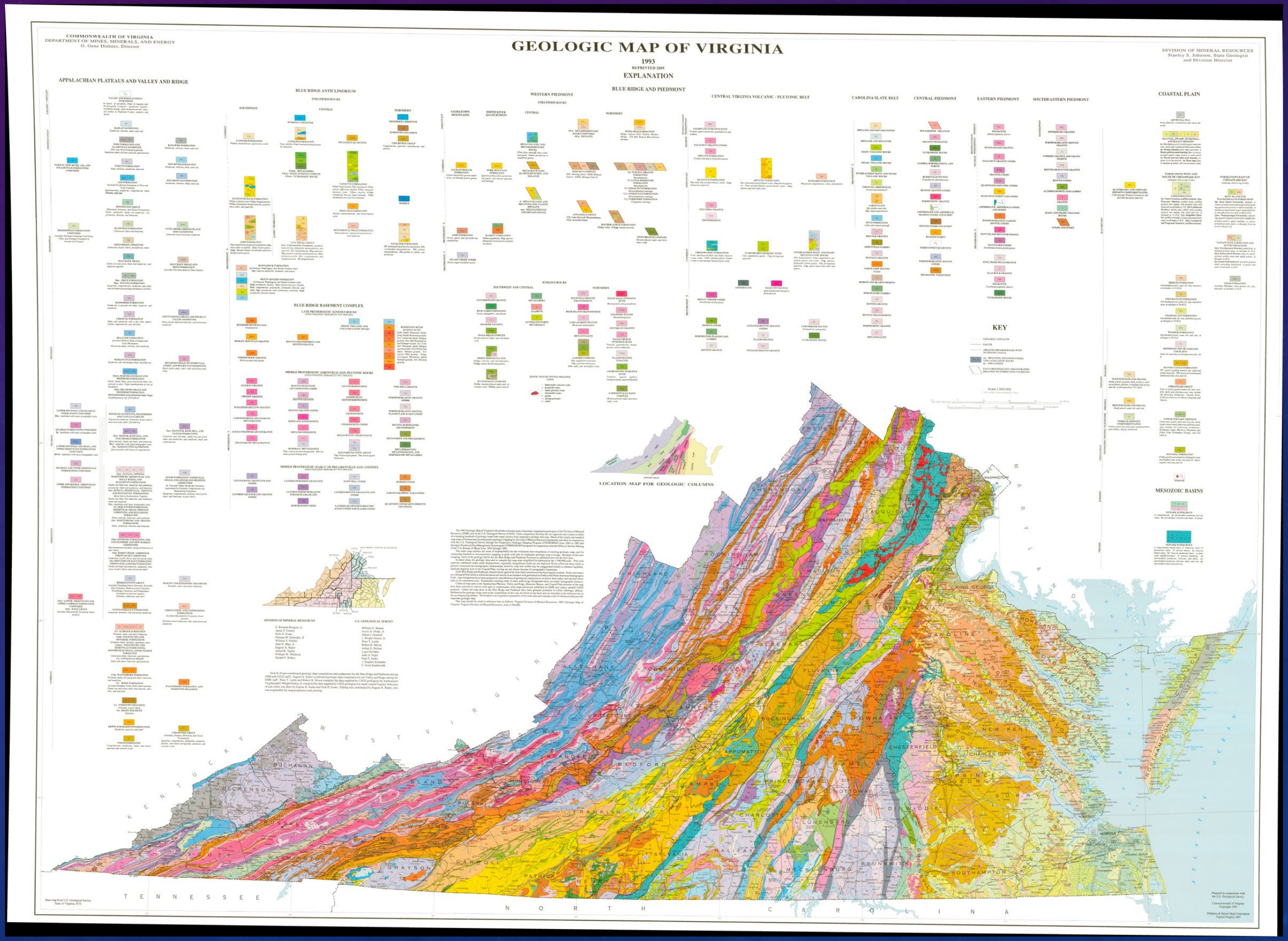
- Best viewed partially at a range of scales
- Can show the geology as multiple layers
- Hopefully match well with multiple base maps
- Have multiple uses, including GIS analysis
- Users will value accuracy over consistency and legibility at smaller scales
- Updatable as new data become available

BOTH PRODUCTS REQUIRE

- Consistency in design
- Simplification of geology
- Adequate explanation

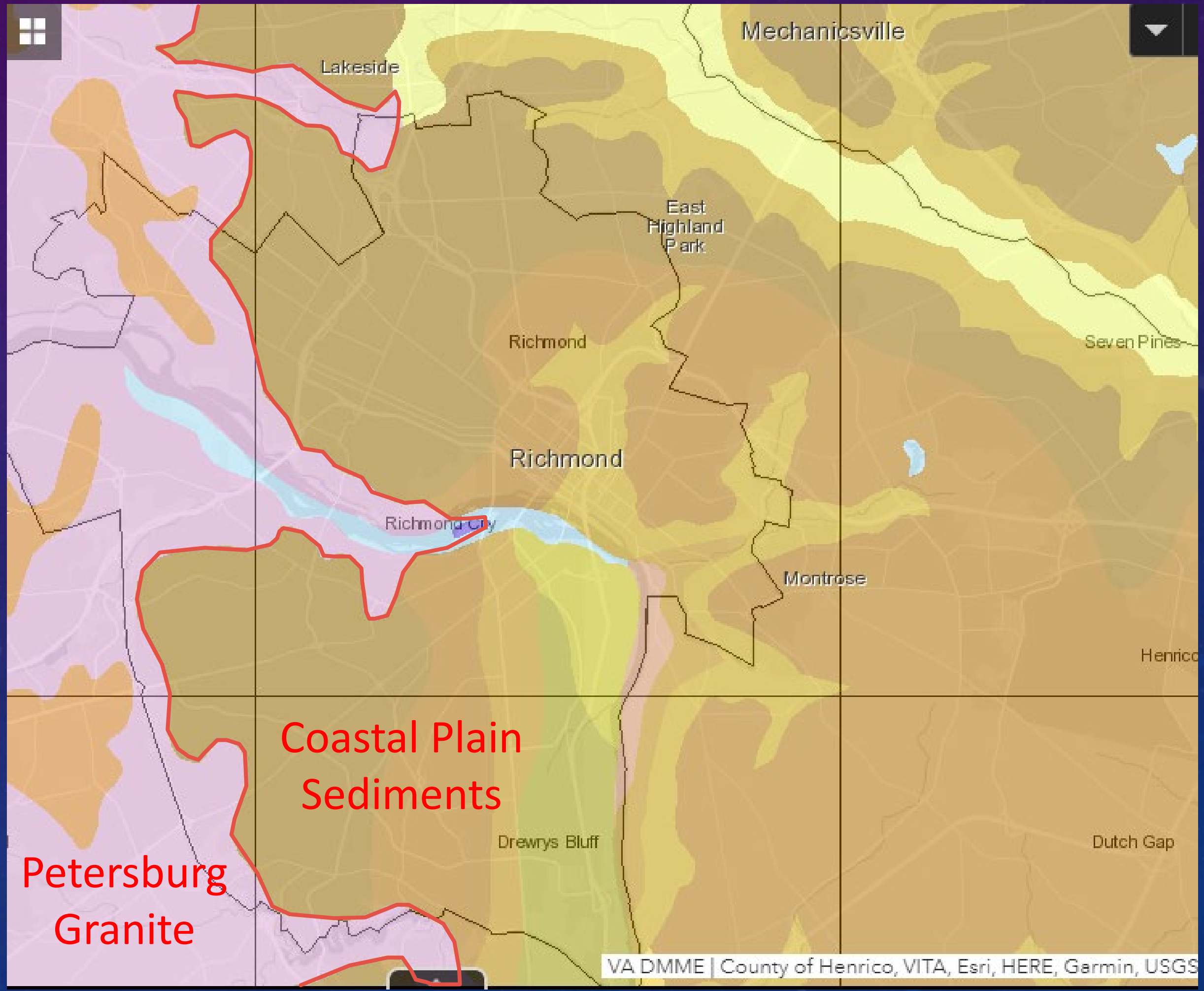
VIRGINIA'S 1993 STATE GEOLOGIC MAP

- 1:500,000-scale paper map
- Paper map was converted to GIS in 2003
- Originally available as shapefiles and now also as a layer in our online map viewer



HOW THE 2003 DATA ARE BEING USED TODAY

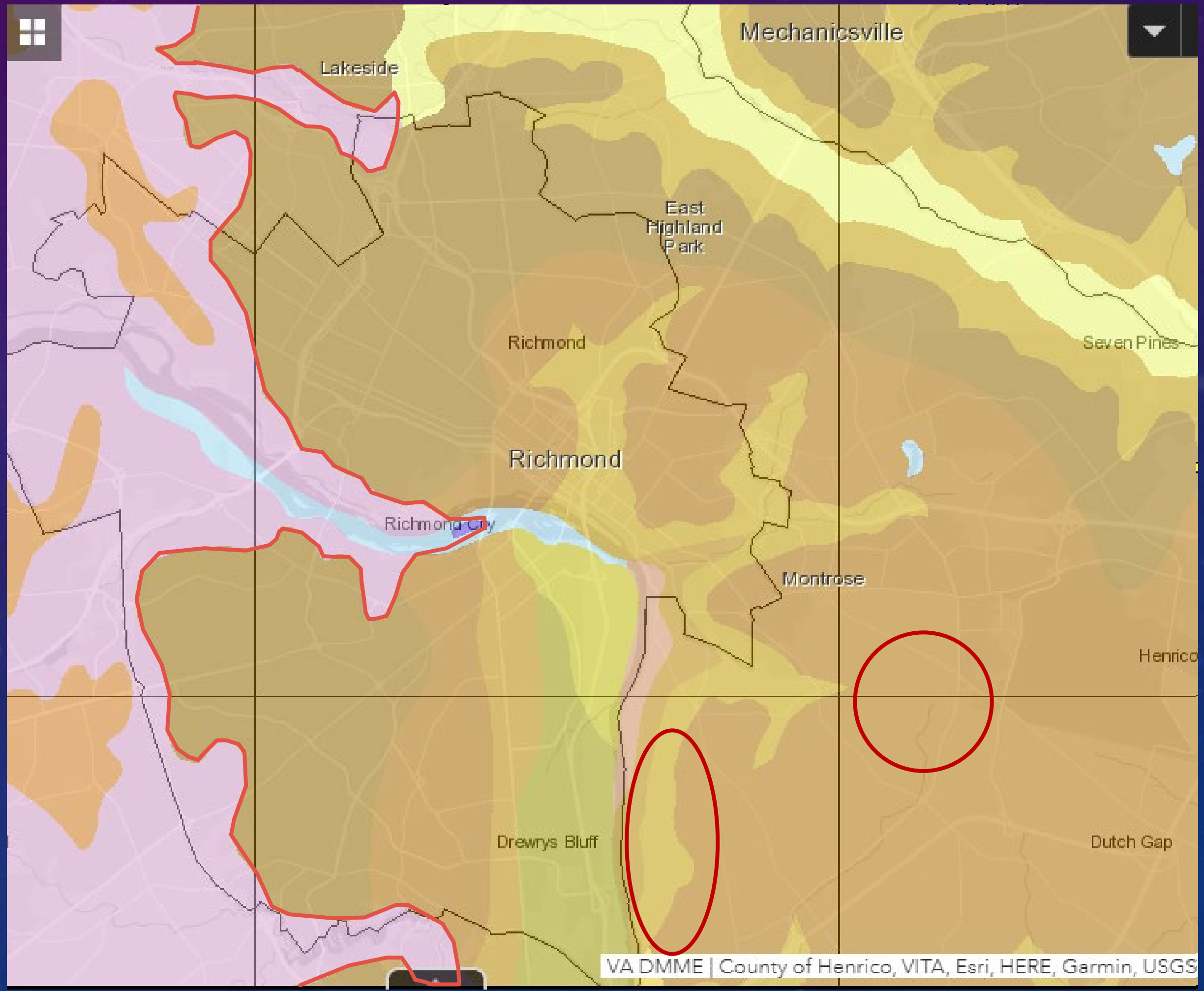
- Providing regional geologic context



DMME DGMR ESRI Map Viewer showing 500K Geology in the vicinity of Richmond

HOW THE 2003 DATA ARE BEING USED TODAY

- Providing regional geologic context
- Relating other datasets to geology

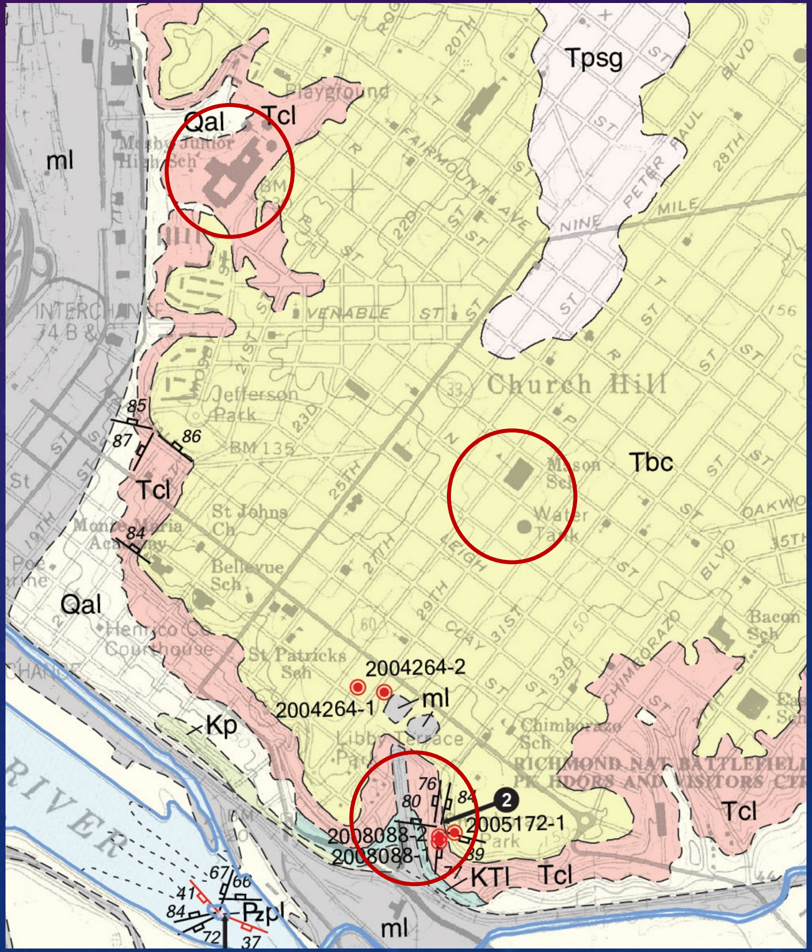


DMME DGMR ESRI Map Viewer showing 500K Geology in the vicinity of Richmond

HOW THE 2003 DATA ARE BEING USED TODAY

- Providing regional geologic context
- Relating other datasets to geology
- Determining the bedrock under a specific property

500K Map – web viewer



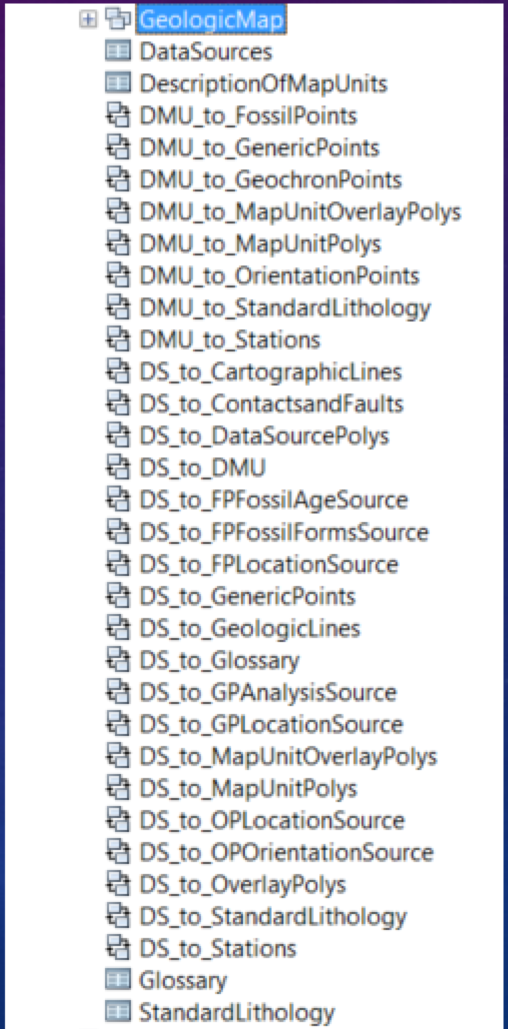
24K Geologic Map

OBJECTIVES OF A SEAMLESS STATEWIDE GEOLOGIC COMPILATION

- Provide users with an up-to-date, simplified, gapless, and seamless (but not necessarily consistent) understanding of geologic conditions in the state.
- Show geologic features appropriate for the range of scale.
- Establish boundaries between geologic units that are precise within the appropriate scale range and accurate at larger scales.

VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- **2-layer GeMS level 2 geodatabase**



VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layer GeMS level 2 geodatabase
- **Useful scale of final product will range from 1:250,000 to 1:500,000.**

No structural data

Minor faults and dikes not shown

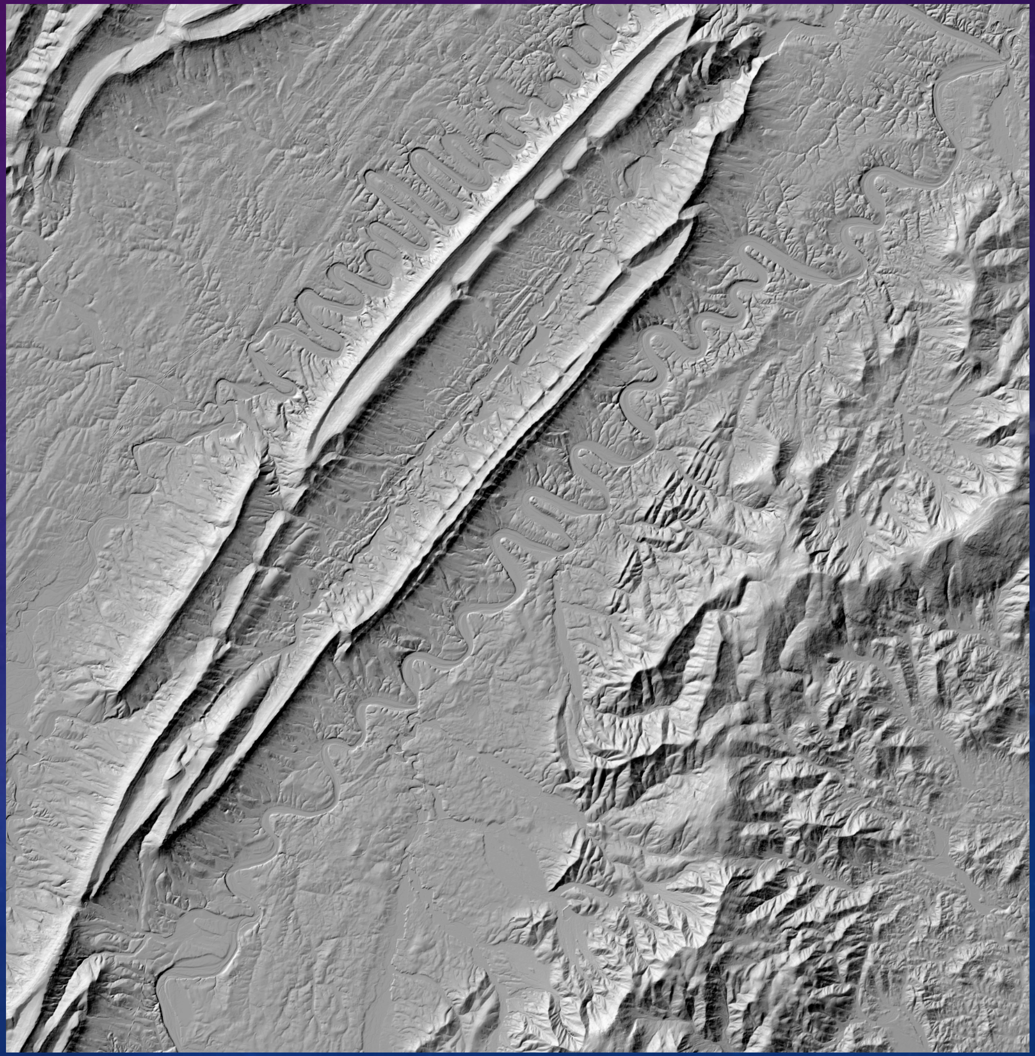
Simplified line symbology

Minimum unit thicknesses

Logical lumping of units

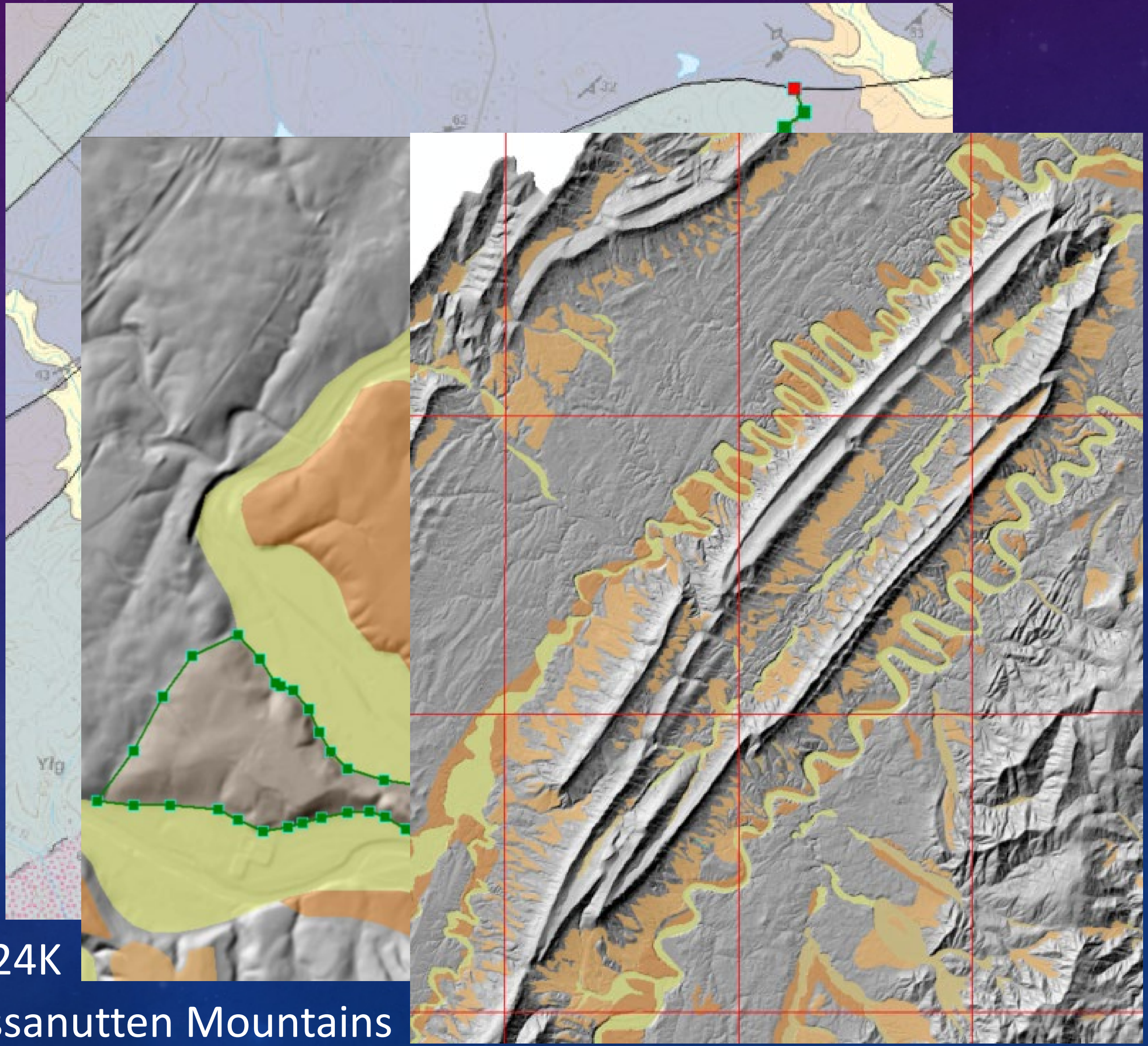
VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layer GeMS level 2 geodatabase
- Useful scale of final product will range from 1:250,000 to 1:500,000.
- **10 meter DEM base map**



VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layer GeMS level 2 geodatabase
- Useful scale of final product will range from 1:250,000 to 1:500,000.
- 10 meter DEM base map
- **Digitizing at 1:24,000-scale**

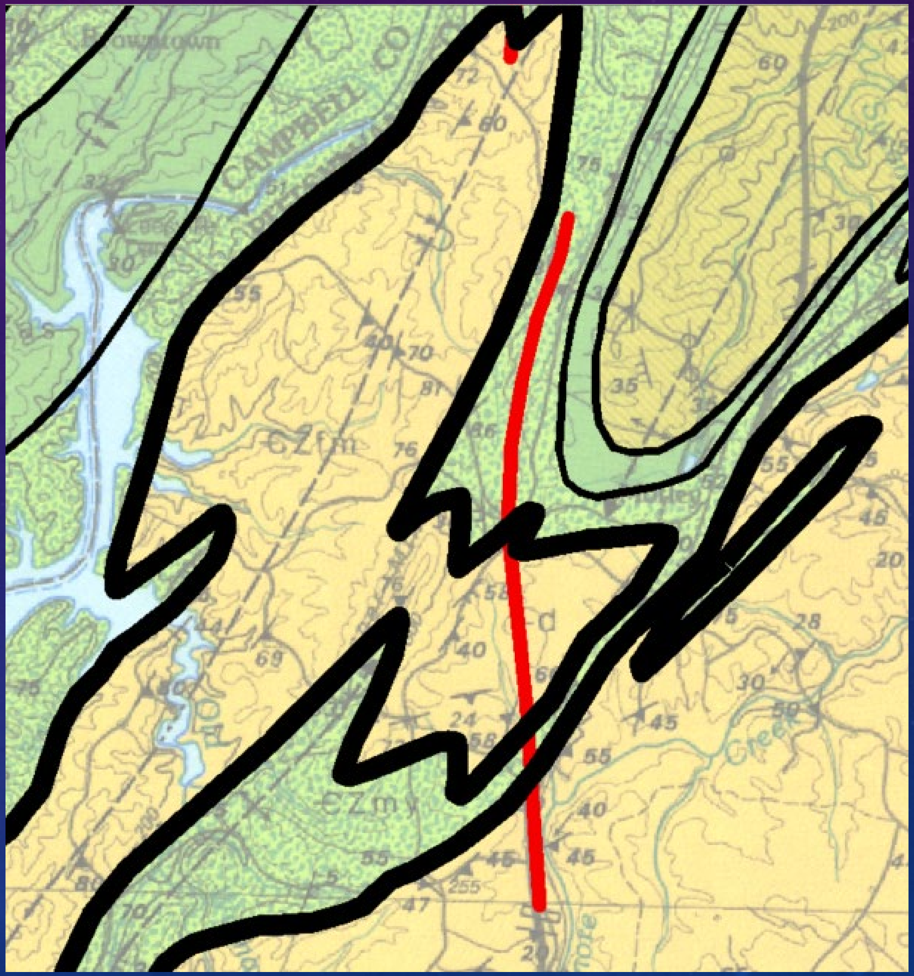


Edinburg 24K

Massanutten Mountains

VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layer GeMS level 2 geodatabase
- Useful scale of final product will range from 1:250,000 to 1:500,000.
- 10 meter DEM base map
- Digitizing at 1:24,000-scale
- **Comparing 2003 line work to georeferenced source maps, and modifying or replacing lines to improve accuracy.**



Roanoke 100K Geologic Map

VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layerGeMS level 2 geodatabase
- Useful scale of final product will range from 1:250,000 to 1:500,000.
- 10 meter DEM base map
- Digitizing at 1:24,000-scale
- Comparing 2003 line work to georeferenced source maps, and modifying or replacing lines to improve accuracy.
- **Updating geology in areas of more recent mapping**

Cornwall 24K map

VIRGINIA’S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layer GeMS level 2 geodatabase
- Useful scale of final product will range from 1:250,000 to 1:500,000.
- 10 meter DEM base map
- Digitizing at 1:24,000-scale
- Comparing 2003 line work to georeferenced source maps, and modifying or replacing lines to improve accuracy.
- Updating geology in areas of more recent mapping
- **Data sources are assigned to individual contact segments**

Table

DataSources

OBJECTID *	DataSources_ID	Source
1	DAS001	Aleinikoff, J.N., Walter, M., Lyttle, P.T., Burton, W.C., Leo, G.W., Nelson, A.E., Schindler, J.S., and Southworth, C.S., 1993, U-Pb zircon and monazite ages of Middle Proterozoic rocks, northern Blue Ridge, Virginia [abs.]:Geological Society c
2	DAS002	Aleinikoff, J.N., Zartman, R.E., Rankin, D.W., Lyttle, P.T., Burton, W.C., and McDowell, R.C., 1991, New U-Pb zircon ages for rhyolite of the Catoctin and Mount Rodgers Formations -- more evidence for two pulses of Iapetan rifting: Americar
3	DAS003	Allen, R.M., 1963, Geology and mineral resources of Greene and Madison counties: Virginia Division of Mineral Resources Bulletin 78, 102 p.
4	DAS004	Allen, R.M., 1967, Geology and mineral resources of Page County: Virginia Division of Mineral Resources Bulletin 81, 78 p.
5	DAS005	Alvord, D.C. and Miller R.L., 1972, Geologic map of the Elkhorn City quadrangle, Kentucky-Virginia and part of the Harman quadrangle, Pike County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-951.
6	DAS006	Alvord, D.C., 1971, Geologic map of the Hellier quadrangle, Kentucky-Virginia and part of the Clintwood quadrangle, Pike County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-950.
7	DAS007	Amato, R.V., 1974, Geology of the Salem quadrangle, Virginia: Virginia Division of Mineral Resources, Report of Investigations 37, 40 p.
8	DAS008	Andrews, G.W., 1988, A revised marine diatom zonation for Miocene strata of southeastern United States: U.S. Geological Survey Professional Paper 1481, 29 p.
9	DAS009	Andrews, L.E., Jr., 1952, Structure of the area north of Roanoke, Virginia [Ph.D. dissertation]: Johns Hopkins University, Baltimore, Maryland, 126 p.
10	DAS010	Averitt, P., 1941, The Early Grove gas field, Scott and Washington counties, Virginia: Virginia Geological Survey Bulletin 56, 50 p.
11	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.
12	DAS012	Bailey, C.M. and Simpson, C., 1993, Extensional and contractional deformation in the Blue Ridge Province, Virginia: Geological Society of America Bulletin, v. 105, n. 4, p. 411-422.
13	DAS013	Bailey, C.M., Berquist, P.J., Mager, S.M., Knight, B.D., Shotwell, N.L., and Gilmer, A.K., 2003, Bedrock geologic map of the Madison quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, 1:
14	DAS014	Bailey, C.M., Koteas, G.C., Relyea, J.A., Weikel, E.O., Dubose, J., and Goodman, M.C., 2005, Geologic map of the Columbia 7.5-minute quadrangle, Virginia: Virginia Division of Geology and Mineral Resources Open-File Report 05-02, 1:2
15	DAS015	Bailey, C.M., Lamoreaux, M.H., Olney J., Nicholls, O.G., and Tadlock, J.E., 2009, Geologic Map of the Browns Cove quadrangle, Virginia, 1:24,000 scale map.
16	DAS016	Bailey, C.M., Wooton, K.M., Forte, A.M., Hasty, B.A., Goldenbaum, L.A., and Shirvell, C.R., 2012, Geologic map of the Swift Run Gap quadrangle, Virginia: U.S. Geological Survey EDMAP, 1:24,000-scale geologic map.
17	DAS017	Bailey, W.M., 1983, Geology of the northern half of the Horseshoe Mountain quadrangle, Nelson County, Virginia [M.S. thesis]: University of Georgia, Athens, 100 p.
18	DAS018	Baird, R.A., 1988, Shear zone geometry in previously foliated rocks – An example from the Clover shear zone, south-central VA [abs.]: Geological Society of America Abstracts with Programs, v. 20, no. 4, p. 253.
19	DAS019	Baird, R.A., 1989, Geology of the Charlotte belt, south-central Virginia [Ph.D. dissertation]: Virginia Polytechnic Institute and State University, Blacksburg, 187 p.
20	DAS020	Baird, R.A., 1991, Stratigraphy of the northern Charlotte metamorphic belt: Application to the Charlotte belt/Milton belt problem: Southeastern Geology, v. 32, no. 2, p. 61-82.
21	DAS021	Bambach, R.K., 1987, Ordovician-Silurian unconformity in western Virginia and adjacent West Virginia: Appalachian Basin Industrial Association, v. 13, p. 2-14.
22	DAS022	Barker, W.J. and Bjorken, E.D., 2001, A digital representation of the 1978 geologic map of Norfolk South quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, 1:24,000-scale geologic map
23	DAS023	Bartholomew, M.J. and Brown, K.E., 1992, The Valley coalfield (Mississippian age) in Montgomery and Pulaski counties, Virginia: Virginia Division of Mineral Resources Publication 124, 33 p.
24	DAS024	Bartholomew, M.J. and Lewis, S.E., 1984, Evolution of Grenville massifs in the Blue Ridge Geologic Province, southern and central Appalachians, in Bartholomew, M.J. and others, editors, The Grenville event in the Appalachians and relatec
25	DAS025	Bartholomew, M.J. and Lowry, W.D., 1979, Geology of the Blacksburg quadrangle, Virginia: Virginia Division of Mineral Resources Publication 14, scale 1:24,000.
26	DAS026	Bartholomew, M.J., 1977, Geology of the Greenfield and Sherando quadrangles, Virginia: Virginia Division of Mineral Resources Publication 4, 43 p.
27	DAS027	Bartholomew, M.J., 1981, Geology of the Roanoke and Stewartsville quadrangles: Virginia Division of Mineral Resources Publication 34, 23 p.
28	DAS028	Bartholomew, M.J., 1987, Structural evolution of the Pulaski thrust system, Southwestern Virginia: Geological Society of America Bulletin, v. 99, p. 491-510.
29	DAS029	Bartholomew, M.J., Gathright, T.M., II, and Henika, W.S., 1981, A tectonic model for the Blue Ridge in central Virginia: American Journal of Science, v. 281, n. 11, p. 1164-1183.
30	DAS030	Bartholomew, M.J., Lowry, W.D., and Henika, W.S., 2012, Interstate 81 Corridor Digital Geologic Compilation: Blacksburg quadrangle, Virginia: Virginia Division of Geology and Mineral Resources Open File Report 12-01, 1:24,000-scale ge
31	DAS031	Bartlett, C.S., Jr. and Biggs, T.H., 1980, Geology of the Abingdon, Wyndale, Holston Valley, and Shady Valley quadrangles: Virginia Division of Mineral Resources Publication 16, 39 p.
32	DAS032	Bartlett, C.S., Jr. and Webb, H.W., 1971, Geology of the Bristol and Wallace quadrangles, Virginia: Virginia Division of Mineral Resources, Report of Investigations 25, 93 p.
33	DAS033	Bartlett, C.S., Jr., 1974, Anatomy of the Lower Mississippian delta in southwestern Virginia [Ph.D. dissertation]: University of Tennessee, Knoxville, 373 p.
34	DAS034	Bauerlein, H.J., 1966, Geology of the Millers Cove area, Roanoke, Craig, and Montgomery counties, Virginia [M.S. thesis]: Virginia Polytechnic Institute and State University, Blacksburg, 77 p.
35	DAS035	Bennett, R.R. and Collins, G.G., 1952, Brightseat Formation, a new name for sediments of Paleocene age in Maryland: Washington Academy of Science Journal, v. 2, n. 4, p.114-116
36	DAS036	Benson, R.N., 1992, Map of exposed and buried early Mesozoic basins/synrift rocks of the U.S. middle Atlantic continental margin: Delaware Geological Survey Miscellaneous Map Series No. 5, 1:1,000,000-scale map with discussion.
37	DAS037	Bently, M.G., 1992, A petrographic study of the peralkaline North View pluton, located in the south-central Virginia Piedmont [M.S. thesis]: Eastern Kentucky University, Richmond, 125p.
38	DAS038	Berquist, C.R., Jr. and Bleick, H.A., 2006, Geologic map of the Ware Neck 7.5-minute quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Geology and Mineral Resources STATEMAP Deliverable, 1:24,000-s
39	DAS039	Berquist, C.R., Jr. and Bleick, H.A., 2007, Geologic map of the Gloucester 7.5-minute quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy 2007 STATEMAP Deliverable, 1:24,000-scale geologic map.
40	DAS040	Berquist, C.R., Jr. and Bleick, H.A., 2009, Geologic map of the Surry 7.5-minute quadrangle, Virginia: Virginia Division of Geology and Mineral Resources, 1:24,000-scale geologic map.
41	DAS041	Berquist, C.R., Jr. and Carter, M.W., 2009, Geologic map of the Dutch Gap quadrangle Virginia: Virginia Division of Geology and Mineral Resources Open File Report 11-12, 1:24,000-scale geologic map.
42	DAS042	Berquist, C.R., Jr. and Goodwin, B.K., 1989, Terrace gravels, heavy mineral deposits, and faulted basement along and near the Fall zone in Southeastern Virginia: Twenty-first Virginia Geological Field Conference, Guidebook, 40 p.
43	DAS043	Berquist, C.R., Jr. and Johnson, G.H., Revision of the 1971 G.H. Johnson geologic map of the Yorktown quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, 1:24,000-scale geologic map.
44	DAS044	Berquist, C.R., Jr. and Occhi, M.E., 2015, Geologic map of the Manquin quadrangle, Virginia: Virginia Division of Geology and Mineral Resources Open File Report 15-02, 1:24,000-scale geologic map.
45	DAS045	Berquist, C.R., Jr. and Russell, T.M., 2001, Geologic map of the New Point Comfort quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, 1:24,000-scale geologic map.
46	DAS046	Berquist, C.R., Jr., 2001, Geologic map of the Achilles quadrangle, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, 1:24,000-scale geologic map.
47	DAS047	Berquist, C.R., Jr., 2011, Geologic map of a portion of the Claremont quadrangle, Virginia: Virginia Division of Geology and Mineral Resources, 1:24,000-scale geologic map.
48	DAS048	Berquist, C.R., Jr., 2014, Geologic map of the Quinton 7.5-minute quadrangle, Virginia: Virginia Division of Geology and Mineral Resources Open File Report 14-05, 1:24,000-scale geologic map.
49	DAS049	Berquist, C.R., Jr., 2010, Geologic map of the East Half of the Dendron 7.5-minute quadrangle, Virginia: Virginia Division of Geology and Mineral Resources, 1:24,000-scale geologic map.
50	DAS050	Occhi, M.E., Berquist, C.R., Latane, V.M., Blanchette, J.M., 2018, Geologic map of the Petersburg National Battlefield and adjacent areas: Virginia Division of Geology and Mineral Resources, Open-File Report 18-09, 1:24,000-scale geolog
51	DAS051	Bice, K.L. and Clement, S.C., 1982, A study of the feldspars of the Montpelier Andesine Anorthosite, Hanover County, Virginia [abs.]: Geological Society of America Abstracts with Programs, v. 14, n. 1-2, p. 5.

(0 out of 742 Selected)

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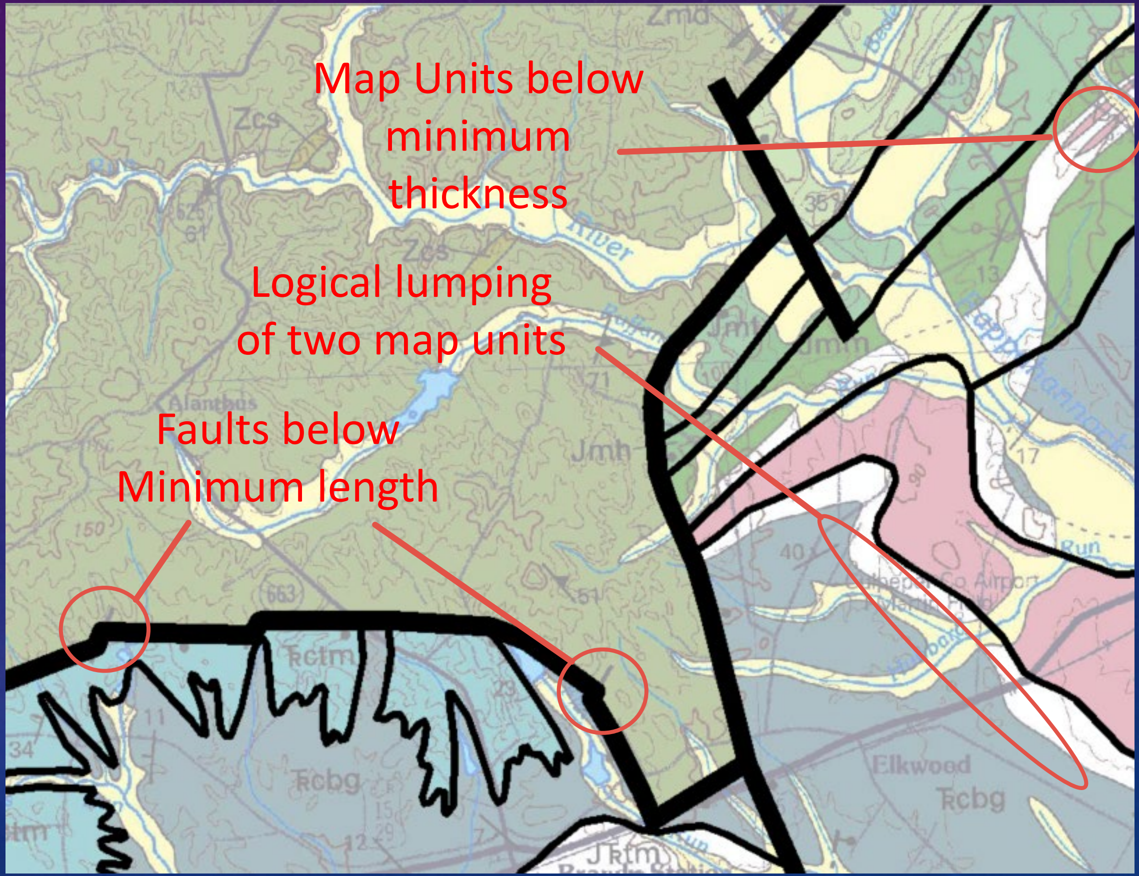
DAS703	<Null>

VIRGINIA'S CURRENT STATE GEOLOGIC MAP COMPILATION

- 2-layer GeMS level 2 geodatabase
- Useful scale of final product will range from 1:250,000 to 1:500,000.
- 10 meter DEM base map
- Digitizing at 1:24,000-scale
- Comparing 2003 line work to georeferenced source maps, and modifying or replacing lines to improve accuracy.
- Updating geology in areas of more recent mapping
- Data sources are assigned to individual contact segments
- **Establishing minimum lengths for faults, width for map units, and area for polygons**



Washington West 100K map

STRATEGIES FOR A SEAMLESS STATEWIDE GEOLOGIC COMPILATION

- Design the compilation with the ultimate end product in mind
- Inconsistency in detail in the meantime is OK.
- Establish minimum thicknesses of units, area of polygons, and length of mappable faults in advance.
- Favor accuracy over consistency when digitizing lines.
- Take advantage of GeMS to convey the source and confidence of each contact and polygon, and make note of alternate interpretations.

ACKNOWLEDGEMENTS

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Dan Doctor (USGS) has provided us with updated geology for the Winchester 30- x 60-mimnute quadrangle.

Philip Prince (VT) is helping with map compilation in a portion of southwestern Virginia.