

#### Abstract

A new 1:63,500 scale geologic map of greater Page County is being compiled from recent 1:24,000 scale geologic maps of quadrangles in the Page Valley region of northwestern Virginia. This new map updates previous geologic maps of the area, including Allen (1967) and parts of Southworth et al. (2009), Rader and Gathright (2001), King (1950), and Butts (1940). The preliminary version on display was assembled and digitized using ArcGIS 10, accompanied by field mapping in several locations to resolve discrepancies among the source maps.

Page County, Virginia encompasses an area of 316 square miles and extends from the crest of the Blue Ridge Mountains in the east to the eastern ridge of Massanutten Mountain in the west. Page County incorporates all or part of twelve 7.5 minute quadrangles: Bentonville, Big Meadows, Elkton East, Elkton West, Fletcher, Hamburg, Luray, Old Rag Mountain, Rileyville, Stanley, Tenth Legion, and Thornton Gap. The region consists of Precambrian metamorphic rocks to Devonian clastic rocks. The oldest rocks are found in the Blue Ridge province along the eastern margin of the valley, and consists of Precambrian gneisses overlain by Cambrian Chilhowee Group clastic sedimentary rocks. To the west, Ordovician carbonates in the valley floor transition to Silurian and Devonian clastic rocks that comprise the Massanutten Mountain sequence along the western edge of Page Valley.

Page Valley is bounded by prominent structural features: in the east by the western limb of the Blue Ridge anticlinorium, and in the west by the eastern limb of the Massanutten synclinorium. By primarily using detailed 1:24,000 scale maps, the updated 1:63,500 scale Page County map illustrates improved constraints on the geometry of the Blue Ridge thrust system and fold patterns associated with the Alleghanian orogeny. The valley is dominated by cryptic west directed thrust faults and upright and overturned folds that have together resulted in several kilometers of east-to-west crustal shortening. The new Page County geologic map has led to a greater understanding of lithologic patterns, deformation, and relative timing of tectonics events associated with the Alleghanian orogeny in northwestern Virginia.

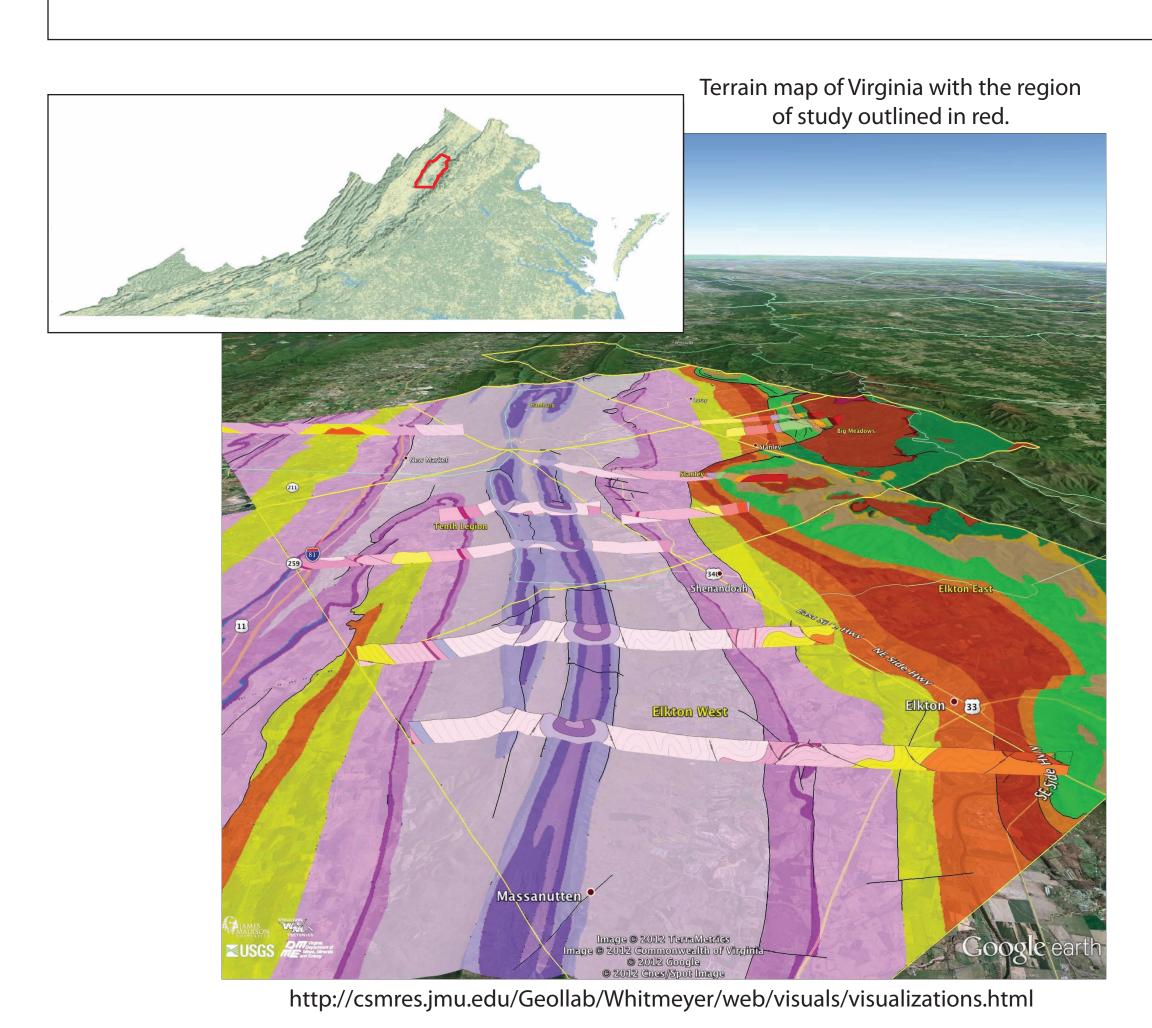
### **Geologic Setting**

Page Valley is situated between the Massanutten synclinorium to the west and the Blue Ridge anticlinorium to the east. Bedrock in Page Valley ranges from Mesoproterozoic gneisses to Devonian clastic rocks. Stratigraphically, the units young towards the west. Lithologies in Page Valley document multiple orogenic events including Grenville, Taconic, Acadian and Alleghanian orogenies. Most of the deformation seen in this region is a result of the Alleghenian orogeny that culminated in the assembly of Pangaea. During this orogeny, approximately 310 - 230 million years ago, the Blue Ridge thrust system transported large amounts of older material from depth along west directed faults. Younger erosional processes have deposited large amounts of colluvium along the edges of the valley from the associated mountains and alluvial cover along the valley bottom from the South Fork of the Shenandoah River and associated tributaries.

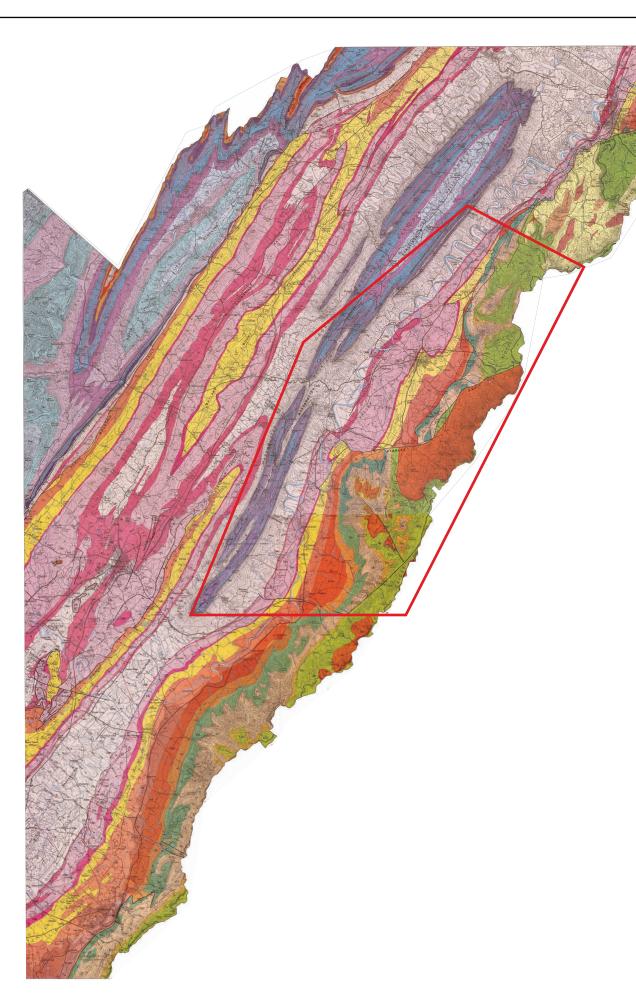
#### **Previous Work**

Several regional maps have been published for Page County beginning with King's 1950 Elkton area map, as seen to the low right. King's map was later followed by Allen's 1966 Page County map, both of Rader and Gathright's 2001 30 x 60 minute maps, and many others. This area has also been the subject of two master's thesis: Thornton (1953), "The geology of the Mount Jackson quadrangle", and Sarros (1995), "A geologic interpretation of the Stanley fault and other thrust faults in Page County".

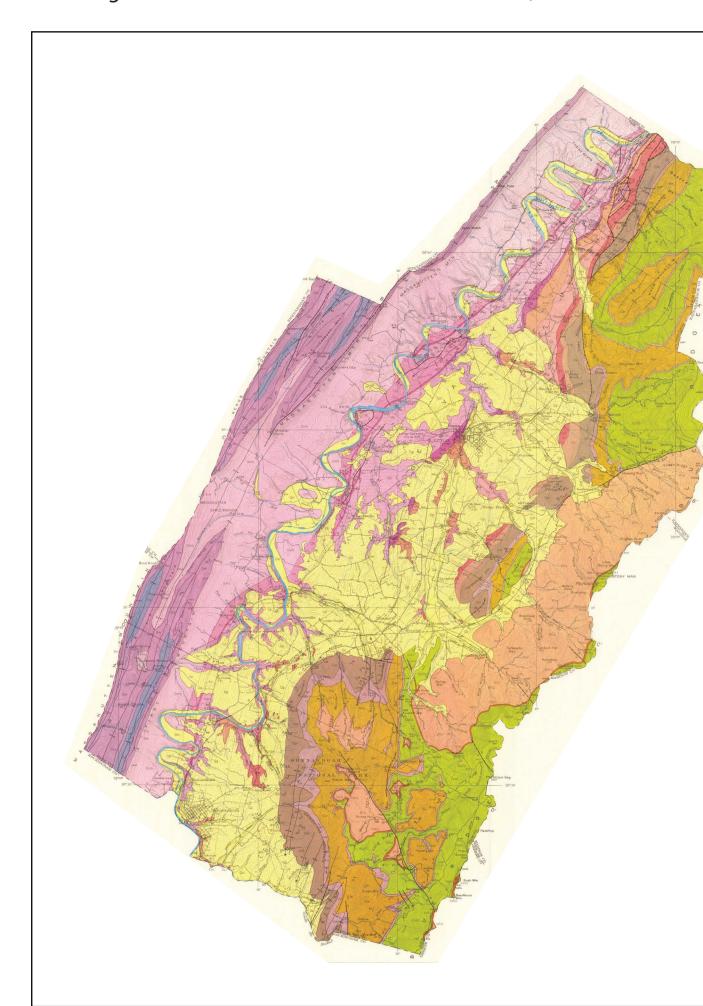
The geologic maps published in this area are at several different scales. The King map is 1:31,250, Allen's is 1;62,500, and Rader and Gathright's are both 1:100,000. These previous maps show different densities of structural data due to their scales. The present 1:63,500 scale map was compiled using mostly 1:24,000 scale maps. And thus has a greater data density than many of the previous maps



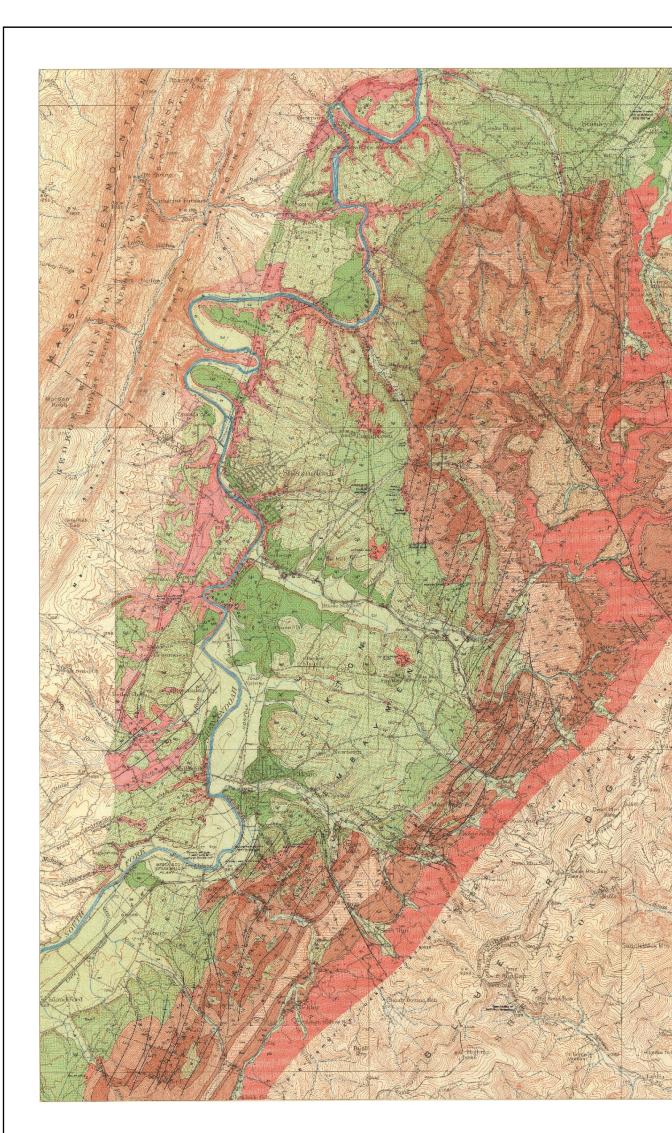
**Selected Previous Geologic** Maps In This Area



Rader and Gathright 2001, Geologic Map of the Front Royal 30 x 60 Minute Quadrangle: Portions of Clarke, Page Rockingham, Shenandoah, and Warren Counties, Virginia Rader and Gathright2001, Geologic Map of the Augusta, Page, and Rockingham Counties Portion of the Charlottesville, 30 x 60 Minute Quadrangle



Allen 1966, Geologic Map of Page County Virginia

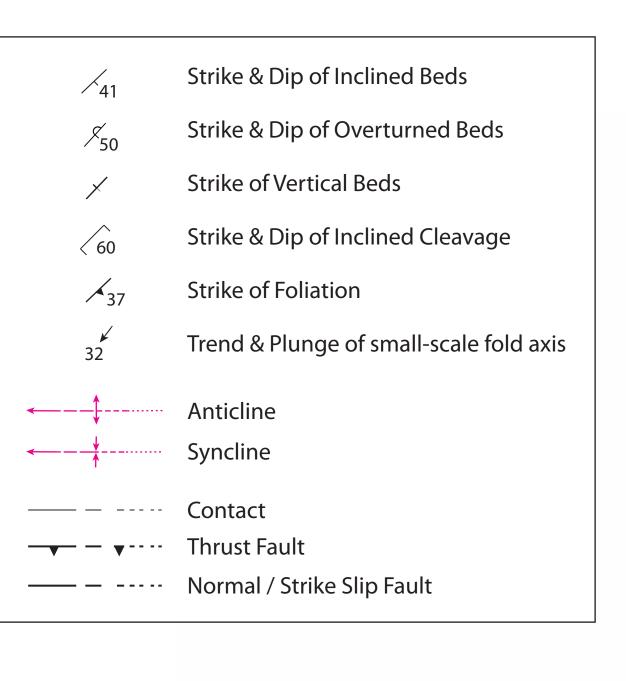


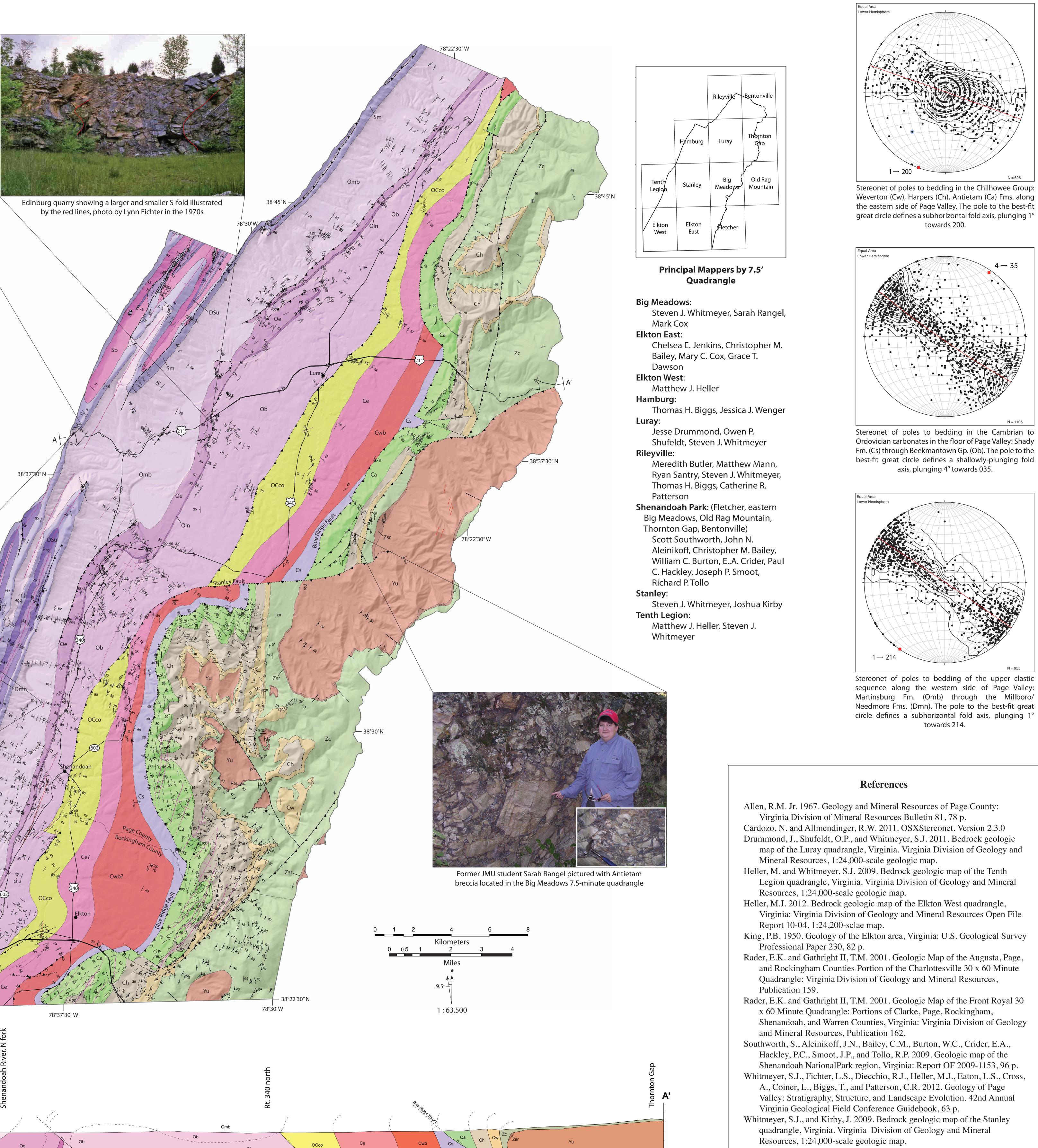
King 1950, Geologic Map of the Elkton Area, Virginia

# A New Geologic Map Of Greater Page County, Virginia: Compiled And Digitized Using ArcGIS Catherine R. Patterson & Steven J. Whitmeyer, James Madison University 22807

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Dmn	Devonian Millboro/ Needmore formations
DSu	Silurian - Devonian undivided
Sb	Silurian Bloomsburg Formation
Sm	Silurian Massanutten Sandstone
Omb	Ordovician Martinsburg Formation
Oe	Ordovician Edinburg Formation
Oln	Ordovician Lincolnshire/ New Market Limestones
Ob	Ordovician Beekmantown Group
<mark>OCco</mark>	Cambrian - Ordovician Conocheague Formation
Ce	Cambrian Elbrook Formation
Cwb	Cambrian Waynesboro Formation
Cs	Cambrian Shady Formation
Са	Cambrian Antietam Formation
Ch	Cambrian Harpers Formation
Cw	Cambrian Weverton Formation
Zc	Neoproterozoic Catoctin Formation
Zsr	Neoproterozoic Swift Run Formation
Yu	Mesoproterozoic basement complex





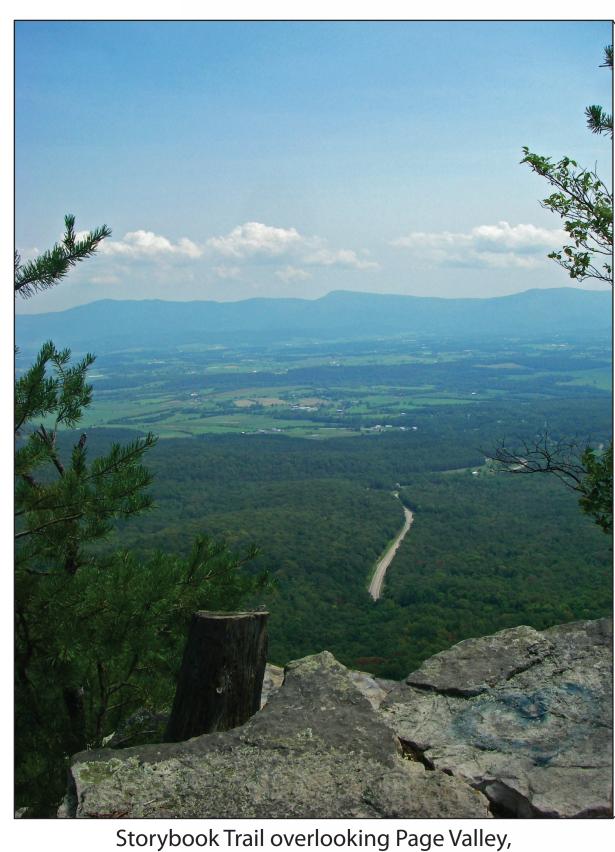


photo by Lorrie Coiner



Matt Heller, Virginia Department of Mines, Minerals, and Energy, standing in the center of a fold in the Martinsburg Fm.

4000 ft 1



## **Individual Map Status and Issues**

-Elkton West, Tenth Legion, Stanley, and Luray 7.5-minute quadrangles are all reviewed and available as open file reports

-Elkton East, Hamburg, Rileyville, and the western half of Big Meadows 7.5-minute quadrangles are either currently under review, waiting review, or nearing field completion

-Fletcher, Old Rag Mountain, Thornton Gap, Bentonville, and the eastern half of Big Meadows 7.5-minute quadrangles have yet to be mapped so Southworth's 1:100,000 Shenandoah Park Map was used to fill in the missing information

-Formation contact discrepancies were found between adjacent quadrangles

-Major fault systems received different interpretations for their placement between or within formations

-Structural complexities, such as fold patterns and faulted offsets, are depicted differently due to the density of data and the interpretation from the principal mapper(s)

# **Methodology for Digital Map Cartography**

-ArcMap 10 was used for laboratory cartography, analysis, and digitization of previously published maps, shown by the 7.5-minute quadrangle principal mappers.

-Discrepancies were field checked between boundaries of previously published 7.5-minute quadrangles

-An Xplore iX104C4 Rugged Mobile Tablet PC with ArcPad 7 to add structural data was used for new digital field mapping along with ArcMap 10 for laboratory analysis and cartography

## Conclusions

-Some quadrangles have not been mapped at 1:24,000 scale therefore the data is not of a uniform density throughout Page County. Quadrangles mapped at a 1:100,000 scale are along the eastern margin of Page Valley.

-In the Elkton East quadrangle there are large deposits of surficial data that obscure the underlying bedrock. Thus there are few constraints on the location of, and contacts between, the Shady, Waynesboro, and Elbrook formations. More structural data needs to be acquired in this area, northeast of Elkton, Va.

-One of the most disputed contacts in the valley is the Edinburg/Martinsburg contact. Each principal mapper has interpreted this contact differently, ie. loss or presence of silt, the varying amount of carbonaceous material, presence of specific stratigraphic features. This has resulted in some quadrangles displaying varying thicknesses of the Edinburg and Martinsburg formations.

-Folds in the Martinsburg formation are only occasionally apparent however they suggest significant but variable contraction which may result in the changing thicknesses across the map pattern.

-The eastern part of the Massanutten synclinorium in the Tenth Legion, Hamburg, and Rileyville quadrangles exhibit many complex structural relationships. The area has apparently duplicated sections bounded by both east and west directed thrusts with associated small scale folds.

-The Stanley promontory, which extends Blue Ridge basement rock to the west and apparently thins carbonate rocks of Page Valley is consistently shown in the many maps of the area. We interpret this as a late Alleghanian thrust that transported older Blue Ridge rock farther west over Ordovician carbonates of the Page Valley region.

-In the most recent publication of the area, Rader and Gathright (2001) have depicted the eastern section near VA Rt. 211 more simplistically compared to the preliminary map presented. The presented map shows many faults either offsetting or truncating formations.

-In comparison to previous maps there is a significant increase in data density for the map presented. This is attributed to the compilation and transfer of data from detailed 1:24,000 scale maps to the new larger 1:63,500 scale map.

#### Acknowledgements

Thank you to all the principal mappers and their contributions to this map. Also, a special thank you to those who provided feedback at the Virginia Geologic Field Conference in September 2012. Thank you to the Virginia Division of Geology and Mineral Resources for use of their ArcGIS digital map template.