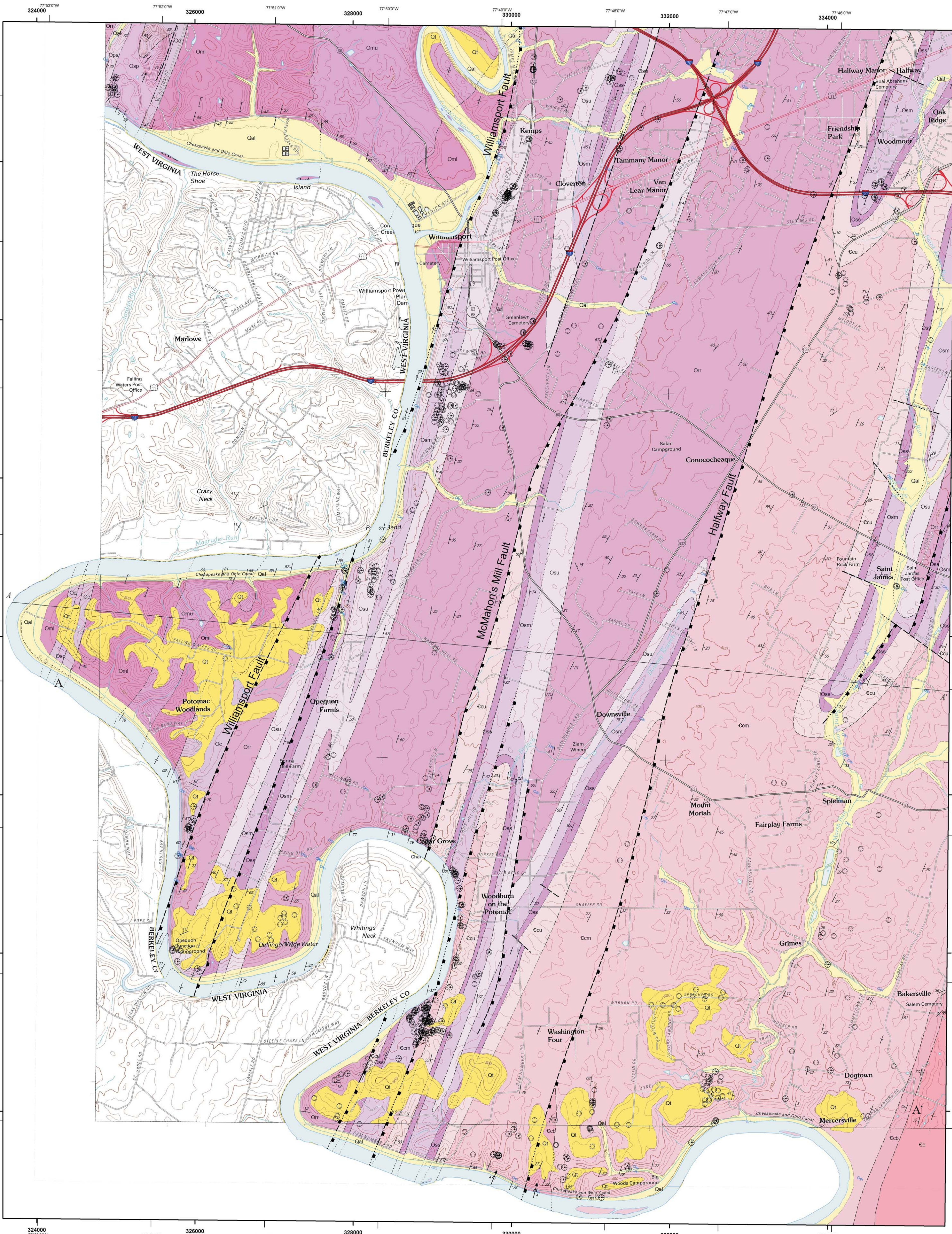


DESCRIPTION OF MAP UNITS

- Qal**  
Alluvium  
Poorly sorted, unconsolidated, tan, reddish brown, to dark-gray mud, silt, sand, and pebbles deposited along active streams. This unit also includes thick reddish, clay-rich soils preserved within karst valleys that contain no active stream channel. Thickness estimated at 3 to 10 feet (1 to 3 m).
- Qt**  
Terrace deposits  
Reddish brown to brown, sandy and clayey mixture of rounded pebbles to cobbles of sandstone, vein quartz, and quartzite. Present along elevated areas above Conococheague Creek. Thickness ranges from 3 to 10 feet (1 to 3 m).
- Omu**  
Martinsburg Formation  
Medium to dark gray silty shale at the base of the formation grading upwards into interbedded grayish green to greenish gray siltstone, tan sandstone, and gray to dark gray shale. Subdivided in the Williamsport quadrangle into two informal units.  
**Upper member**  
Interbedded medium gray shale and thin (0.5 feet) light gray to tan silty, graded sandstone at the base grading upward into interbedded greenish gray to medium gray siltstone and silty shale with medium to thick bedded medium to coarse-grained sandstone. Thickness estimated at 2000 to 3000 feet (610 - 915 m).  
**Lower member**  
Predominantly medium to dark gray, silty, fissile shale with thin (<0.5 inches) siltstone interbeds. Dark gray to black shale at base equivalent to the Utica Shale. Thickness is estimated at 1,500 to 2000 feet (457 - 610 m).
- Ocm**  
Chambersburg Formation  
Medium to dark gray, nodular- to medium-bedded, fossiliferous limestone. Nodular-bedded, shaly, highly fossiliferous limestone bearing the echinoderm, *Echinochaerites* occurs near the base of the formation. Top of the Chambersburg Formation marked by sharp contact with the black shales of the overlying Martinsburg. Thickness is 250 feet (76 m).
- Ocp**  
St. Paul Group (undivided)  
Massive, light gray lime mudstone containing fenestral fabric (calcite filled voids) at the base (Row Park Limestone) overlain by interbedded, medium to light gray, medium-bedded limestone and laminated dolomite. Limestone at the top (New Market Limestone). The thickness of the St. Paul Group 300 feet (91 m).
- Ops**  
Pinesburg Station Dolomite  
Light gray, medium-bedded, highly fractured dolomite interbedded with light gray to tan laminated dolomite. Weathers to a very light gray to buff. Thickness is 350 feet (107 m).
- Orr**  
Rockdale Run Formation  
Interbedded cyclical limestone and dolomite, cherty in the lower 400 feet (120 m). Limestone intervals consist of medium to light gray, ribbon and thrombolitic to stromatolitic lime mudstone to boundstone. Locally, limestone layers are light gray oolitic and/or oolitic grainstone. Dolomite parts of cycles varies from tan laminated to light gray to tan massive fractured with wispy dolomitic laminae. The relative proportion of the limestone to dolomite varies up section. In the lower 600 feet, limestone is typically thicker than dolomite. The progressively changes up section so that the upper 700 feet (215 m) is dominantly dolomite with little limestone within individual cycles. Forms very little topographic expression; many horizons are very poorly exposed. Thickness up to 2500 feet (762m).
- Oou**  
Stonehenge Formation  
The Stonehenge Formation was subdivided in to three separate members. Only the lowest, the Staufferstown Member, is named, the other two are informal.  
**Upper member**  
Medium to medium dark gray, medium-bedded, ribbon and oolitic lime mudstone to packstone. Near the base of the member ribbon lime mudstone predominate. Upsection medium gray, ribbon lime mudstone becomes interbedded with intervals of flat-pebble lime grainstone, and hummocky, thickly-laminated lime packstone and oolitic lime packstone to grainstone. Locally thin, (< 1.0 m) algal thrombolites are present. This member commonly forms a persistent and mappable ridge and is frequently well-exposed. Thickness: 500 to 750 feet (150 to 215 m).  
**Middle member**  
The lower part of the member is composed of massive, medium gray, algal lime boundstone with some layers up to 7 m thick. Grading upsection into interbedded medium to dark gray algal thrombolites 1.5 to 2.0 m thick and medium gray, thinly bedded to ribbon, locally fossiliferous, lime wackestone to lime packstone. Several thin tan dolomite beds occur near the middle of the unit. Thickness: 300 to 400 feet (90 to 100m).  
**Staufferstown Member**  
Dark gray, argillaceous, thinly bedded to ribbon, lime mudstone with thin beds of flat-pebble lime grainstone conglomerate and hummocky, discontinuous thin beds of laminated limestone. A single 10 foot (3 m) interval of massive, dark gray, thrombolitic, algal boundstone occurs approximately 30 feet (10 m) above the base of the member. This member weathers into thin, brown and orange chips, which litter overlying soil. Forms a low, discontinuous, ridge. Thickness: 230 to 295 feet (70 to 90m).
- Ocu**  
Conococheague Formation  
Interbedded gray limestone and tan dolomite cycles. Subdivided and mapped as three members, two of which are informal. Total thickness is from 2,000 to 2,500 feet (610 to 762 m).  
**Upper member**  
Interbedded, medium to light gray ribbon lime mudstone that weathers to flaggy to platy beds, and arenaceous grainstones exhibiting edgewise and flat-marble conglomerates. Locally, thin pastel blue and pink marl strata are developed. Black or gray chert fragments and brown weathering quartz sandstone cobbles are frequently abundant in overlying soil. Thickness: 650 to 750 feet (200 to 230m).  
**Middle member**  
Predominantly cyclically bedded, medium- to dark-gray, thrombolitic limestone and gray, ribbon and laminated limestone and tan laminated dolomite. Thrombolites range in thickness from 3 to 6 feet (1 to 2 m) within thrombolitic intervals to less than 1 foot (0.3 m) within the ribbon intervals. Several dark-gray, oolitic intervals present in the upper part of this member. Thickness ranges from 1,500 to 1,800 feet (460 to 550 m).  
**Big Spring Station Member**  
Tan massive dolomite interbedded with tan to light-gray laminated dolomite; unit characterized by dark-brown weathering. At the type section on the western side of the Hagerstown Valley, this member is characterized by interbeds of light-gray, cross-bedded, calcareous, intraclastic, quartzarenitic sandstone approximately 3 feet (1 m) in thickness. Member becomes interbedded with gray dolomitic thrombolitic beds near the top. Thickness ranges from 200 to 300 feet (60 to 90 m).
- Oe**  
Elbrook Formation  
Only the upper strata of the Elbrook Formation are exposed in the Williamsport Quadrangle. These beds consist of cyclically bedded, gray thrombolitic limestone and ribbon to laminated limestone and tan dolomite. Thickness of the entire formation ranges from 2,200 to 2,500 feet (670 to 760 m), but only the upper 500 to 750 feet (150 to 215 m) are exposed in the Williamsport Quadrangle.



Geologic and Karst Features Map of the Williamsport Quadrangle, Washington County, Maryland

By David K. Brezinski 2014

Current map projection: Maryland State Plane Coordinate System FIPS 1900 (Projection: Lambert Conformal Conic, 1980 geoidetic reference system) (Horizontal Datum: North American Datum 1983)  
MD State Plane 2,000-meter grid ties and coordinates shown in black (Geographic coordinates latitude-longitude) (Shown near corners and 1.0° intervals (in black))  
U.S. Geological Survey (USGS) US Topo digital 7.5-minute Series  
Williamsport, MD-WV quadrangle, 2011  
Hydrography derived from USGS National Hydrography Dataset, 2009  
Topography generated from 1/3 arc-second National Elevation Dataset, 2006  
Transportation from TIGER/Line and National Dataset, 2006-2010  
Map published 2011 as a gePDF document by USGS US TOPO, conforms to US TOPO Product Standard 0.5.10  
Reported magnetic north declination (center of Williamsport quadrangle): 10.45° W  
Estimated magnetic north declination (center of Williamsport quadrangle): 10.52° W changing by 0.02° W per year.  
To determine current magnetic declination see: <http://www.ngdc.noaa.gov/geomag/declination.shtml>  
Cultural features shown from USGS Geographic Names Information System (GNIS) database, 2010

Use Constraint: These data represents results of data collection for a specific Department of Natural Resources, Maryland Geological Survey activity and indicate general existing conditions. As such, they are only valid for the intended use, content, time, and accuracy specifications. The user is responsible for the results of any application of the data for other than the intended purpose. The Maryland Geological Survey makes no warranty, express or implied, as to the use or appropriateness of the data and there are no warranties of merchantability or fitness for particular purpose or use. The Maryland Geological Survey makes no representation as to the accuracy or completeness of the data and may not be held liable for human error or defect. Data are only valid at 1:24,000 scale. Data should not be used at a scale greater than that.  
Acknowledgements: This geologic and karst mapping was partially funded as a research grant in cooperation with the Maryland State Highway Administration Office of Materials, Technology, and the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G13AC00172. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U. S. Government.  
Geologic field mapping conducted in 2013-2014. The geologic map was compiled in digital form by Elizabeth Sylvia and Robert Conkwright of the Maryland Geological Survey.  
The facilities and services of the Maryland Department of Natural Resources are available to all without regard to race, color, religion, sex, sexual orientation, age national origin or physical and mental disability.  
Copies of this map downloadable in digital form from: MARYLAND GEOLOGICAL SURVEY  
<http://www.mgs.md.gov/>  
Version: W11L2014.1  
Released June 2014

**Explanation of Map Symbols**

**Contacts**  
Geologic contacts; approximately located dotted where concealed

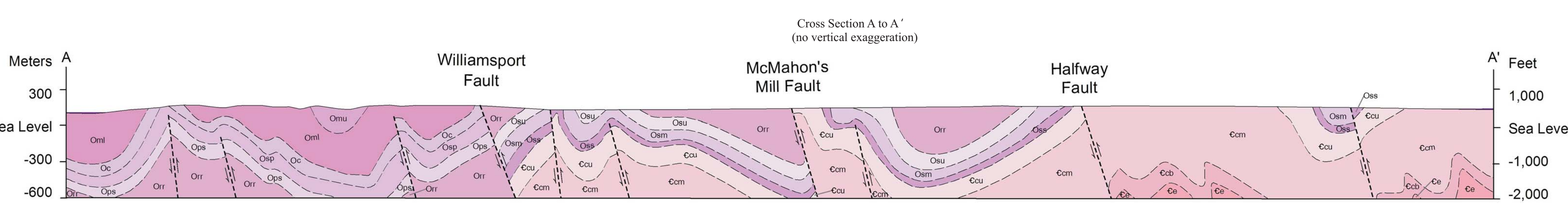
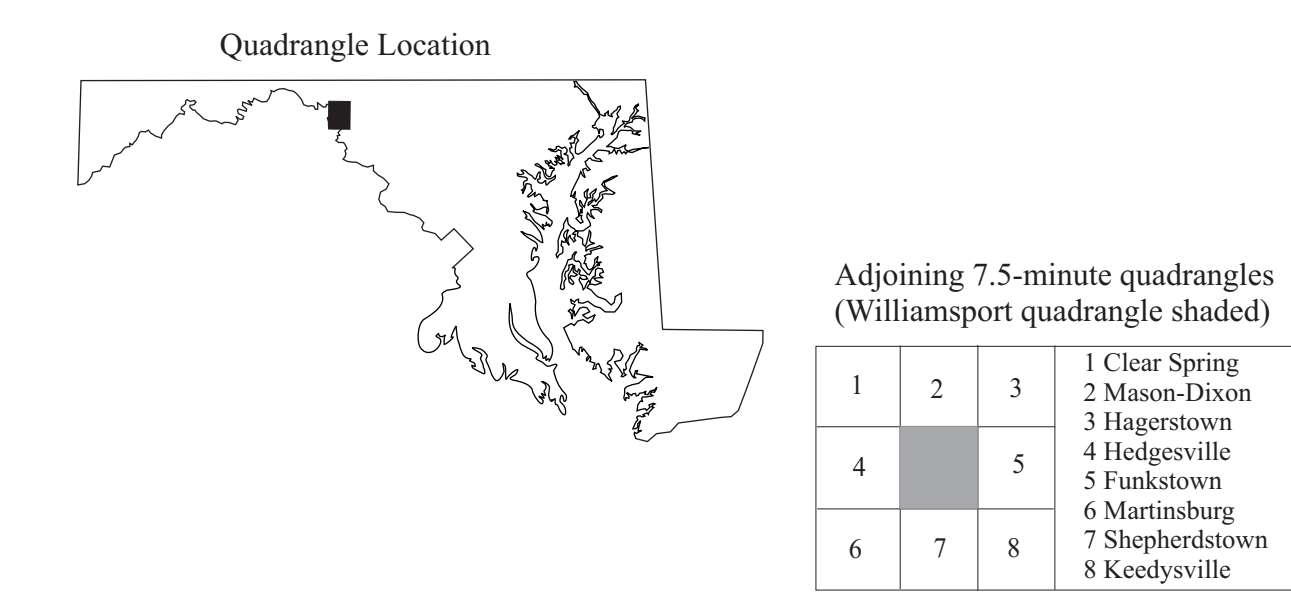
**Faults**  
High angle reverse fault (rectangles on upthrown side)  
Generic high angle fault (D Downthrown side U Uplifted side)  
Fault concealed

**Planar Features**  
Inclined bedding, strike and degree of dip shown  
Vertical bedding, strike shown  
Horizontal bedding  
Overturned bedding, strike and degree of dip shown

**Folds**  
Minor syncline (bearing and degree of plunge shown)  
Minor anticline (bearing and degree of plunge shown)

**Karst Features**  
Spring  
Closed depression  
Sinkhole

**Base Map Symbols**  
**Transportation**  
Primary route, class 1 (divided, lines separated)  
Primary route, class 1 (undivided)  
Secondary route, class 2  
Light duty road or street, class 3  
**Topography**  
Topographic index contour (100-ft interval)  
Topographic intermediate contour (20-ft interval)  
**Hydrography**  
Stream  
Water body (eg. lakes, ponds, rivers)



STATE OF MARYLAND  
Martin O'Malley  
Governor  
Anthony G. Brown  
Lieutenant Governor



DEPARTMENT OF NATURAL RESOURCES  
Joseph P. Gill  
Secretary  
Frank W. Dawson  
Deputy Secretary  
MARYLAND GEOLOGICAL SURVEY  
Richard Orr  
Director