

Current map projection:
Maryland State Plane Coordinate System 1987
(Projection: Lambert Conformal Conic, 1980 geodetic reference system)
(Horizontal Datum: North American Datum 1983)

MD State Plane 2000-meter grid tic and coordinates shown in black
Geographic coordinates (latitude-longitude)
shown near corners and 2.5' intervals (in black)

Karst features shown over a modified version of the digital compilation of the
Geologic Map of Funkstown Quadrangle, Washington and Frederick Counties, Maryland (Brezinski and Bell, 2009)
Published by the Maryland Geological Survey (digital version FUNKSGEO2009.1)

Topographic and cultural components of geologic map compiled and extracted from:
U.S. Geological Survey (USGS) 7.5-minute Series (Topographic)
Funkstown quadrangle 1953 (photorevised 1985)
Digital line graphs (DLG) for hydrography, topography, select transportation and boundaries (1:24,000)
(Topography by photogrammetric methods from aerial photographs taken 1941; culture revised 1953)
Photorevisions from aerial photographs taken 1982 and other sources; this information not field checked.
Map dated in 1985.

Reported 1985 magnetic north declination (center of Funkstown quadrangle): 9 degrees west
Estimated 2009 magnetic north declination (center of Funkstown quadrangle): 10 degrees, 28 minutes west
(To determine current magnetic declination see: <http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp>)

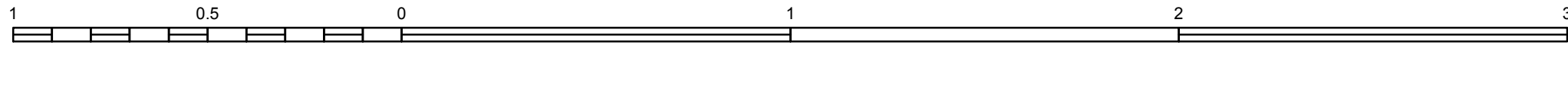
Cultural features shown from USGS Geographic Names Information System (GNIS) database
Maryland State Highway Administration (MD SHA)
MD Cooperative Centerline Program, select quadrangle excerpt (2007) for roads
Original dataset developed at 1:12,000 scale.
Cultural features shown from USGS Geographic Names Information System (GNIS) database

Estimated 2009 magnetic north declination (center of Funkstown quadrangle): 10 degrees, 28 minutes west
(To determine current magnetic declination see: <http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp>)

Karst Features of the Funkstown Quadrangle, Washington County, Maryland

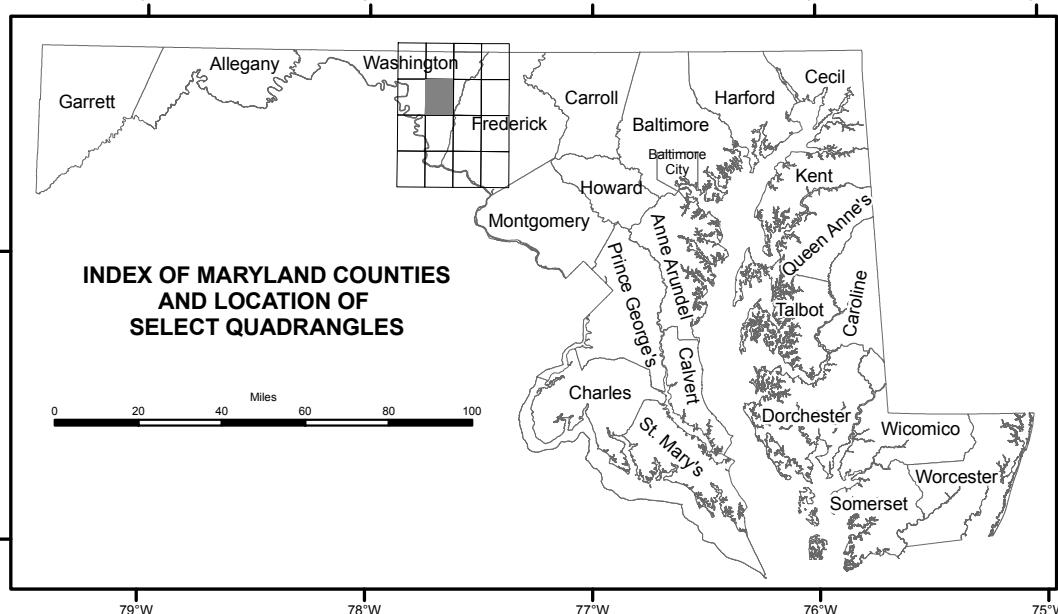
By
David K. Brezinski
2009

Scale 1:24,000



Contour Interval 20 Feet
National Geodetic Vertical Datum of 1929
(To convert elevations to the North American Vertical Datum of 1988, subtract 1 foot)
(To convert from feet to meters, multiply by 0.3048)

Mason and Dixon	Hagerstown	Smithsburg
Williamsport	Funkstown	Myersville
Shepherdstown	Keedysville	Midletown
Charles Town	Harpers Ferry	Point of Rocks



GN
(State Plane Grid North)

Supplemental Information
Use Constraints: These data represent the results of data collection/processing 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 their intended purpose. The Maryland Geological Survey makes no warranty, expressed or implied, as to the use or appropriateness of the licensed data, and there are no warranties of merchantability or fitness for a particular purpose of use. The Maryland Geological Survey makes no representation 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.

Acknowledgments: This map was funded in part by the Maryland State Highway Administration.

Field mapping of karst features was conducted in 2007 through 2009. Field mapping of the geology was conducted in 1990, 1991, and 2007 through 2008. This karst map was compiled in digital form by Heather Quinn and Robert Cookwright of the, Maryland Geological Survey.

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Version: FUNKSST2009.1
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Description of Map Units

Quaternary	Albuvium Qal Poorly sorted, unconsolidated, tan, reddish brown, to dark-gray mud, silt, sand, and pebbles, deposited within the channel of streams and on the flood plain adjacent to the streams. Thickness estimated at 1 to 3 m (3 to 10 feet).	Chesville Member Cwac Reddish brown to chocolate-brown, silty shale, siltstone, and silty fine-grained sandstone, interbedded with white, calcareous, <i>Staliothos</i> -burrowed sandstone beds (2 to 6 cm thick) and tan to buff, medium-bedded, sandy dolomite. This unit usually is the most diagnostic of the Waynesboro lithologies and typically forms a ridge, which makes it easily traceable. Thickness estimated at 100 to 150 feet (30 to 45 m).
	Colluvium Qc Unconsolidated and unsorted sand, cobbles, and boulders that accumulate on the slopes below outcrops of the sandstone and quartzite units, and move slowly downslope under the influence of gravity. Two types were recognized in the Funkstown quadrangle. The first type is composed predominantly of angular boulders that overlie outcroppings of quartzites of the Weverton Formation on the flanks of South Mountain. This type of colluvium appears to be the direct result of the mechanical breakdown of the quartzite ledges. The thickness was not determined. The second type of colluvium is composed of reddish brown, rounded pebbles and cobbles of sandstone, quartzite, and vein quartz. This type of colluvium is present both at the western base of South Mountain, and as isolated patches overlying limestone bedrock in the Hagerstown Valley. The latter is far removed from the slopes of South Mountain and tends to be much more heavily weathered. The thickness of this type of colluvium ranges from a thin veneer less 3 feet to more than 300 feet (1 to 100 m).	Cavetown Member Cwak Medium- to thick-bedded, medium- to coarse-grained, intraclastic grainstone; tan, laminated dolomite and dolomitic limestone; and medium-gray, oolitic, lime grainstone, ribbony carbonates, and burrow-mottled dolomitic limestone. This unit is typically poorly exposed, but makes up the greatest thickness of the formation. Thickness estimated at 600 to 750 feet (180 to 240 m).
	Terrace deposits Qt Reddish brown to brown, sandy and clayey mixture of rounded pebbles to cobbles of sandstone, vein quartz and quartzite. Present along elevated areas above Antietam Creek. Thickness ranges from a thin veneer to more than 10 feet thick (0 to 3 m).	Red Run Member Cwar Interbedded, tan-weathering, punky, fine-grained sandstones; green-gray shale; gray sandy limestone; and laminated dolomite. Locally thin (0.25-2.0 inches; 0.6 to 5 cm) layers of red siltstone and sandstone are present. Typically, this unit forms a low ridge somewhat lower in height than the Chesville Member. Thickness estimated at 150 to 200 feet (45 to 60 m).
Jurassic	Dike/dike(s) Jd Dark gray, medium- to fine-grained diabase. Typically weathers to large, spheroidal boulders that exhibit a reddish brown patina. Diabase dike(s) range in thickness from 3 to 10 feet (1 to 3 m).	Tomstown Formation Jtm Predominantly buff-weathering, medium- to dark-gray, dolomite, dolomitic limestone, and limestone. The Tomstown Formation was divided into four members by Brezinski (1992). These are, in ascending order, the Bolivar Heights, Fort Duncan, Benevola, and Dargan Members. The total thickness of the formation is 1,200 to 1,300 feet (360 to 400 m).
Ordnovician	Rockdale Run Formation Orrr Interbedded and cyclic limestone and dolomite, cherty in the lower 400 feet (120 m). Limestone intervals consist of medium to light gray, ribbony and thrombotic to stromatolitic lime mudstone to boundstone. Locally, limestone layers are light gray oolitic and oolitic grainstone. Dolomite parts of cycles varies from tan laminated to light gray to tan massive fractured with wispy dolomite 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 upsection 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 2,500 feet (762 m).	Dargan Member Ctd Interbedded and cyclic dolomite and limestone. Cycles consist of alternations of dark-gray, bicratered dolomite and medium- to dark-gray, laminated dolomite, or dark-gray dolomite or limestone and tan, laminated, silty dolomite. Thickness is approximately 700 feet (215 m).
	Stonehouse Formation Osu The Stonehouse Formation was mapped as three separate members. Two of these members have not been formally named. Upper member Medium to medium dark gray, medium-bedded, ribbony and oolitic lime mudstone to packstone. Near the base of the member ribbony lime mudstone predominate. Upsection medium gray, ribbony 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).	Benevola Member Ctb Light-gray to white, massive to poorly bedded, highly fractured, sugary dolomite. The Benevola Member varies from white to very light gray, both on fresh and weathered surfaces and has a sugary appearance. Bedding is rarely evident within the Benevola Member, except within polished slabs where faint gray of cross-bedding are common. Thickness is 100 to 150 feet (30 to 45 m).
	Middle member Osm 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 ribbony, 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 100 m).	Fort Duncan Member Ctf Medium- to dark-gray, thick-bedded, mottled dolomite with white, void-filling, sparry dolomite. Weathered surface characterized by irregular anastomosing network of closted algae. Layers of the white, sparry dolomite, 0.5 to 1.5 inches wide, fill voids that are continuous in beds for up to several yards (several meters). The white, void-filling dolomite contrasts the darker mottled dolomite. Thickness ranges from 200 to 250 feet (60 to 75 m).
	Stoufferstown Member Oss Dark gray, argillaceous, thinly bedded to ribbony, 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, thrombotic, 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 gray. Forms a low, discontinuous, ridge. Thickness: 230 to 295 feet (70 to 90 m).	Bolivar Heights Member Cth The Bolivar Heights Member is characterized by three stratigraphically stacked lithologies. The basal lithology is a tan, vuggy dolomite that is in contact with the underlying Antietam Formation. This dolomite ranges from 10 to 40 feet (9 to 12 m) in thickness, and is rarely exposed. Overlying the tan basal dolomite is an interval 40 to 50 feet (12 to 15 m) thick, comprised of very light gray, sheared, laminated, dolomite marble (Keedysville marble bed). Above the Keedysville marble bed, the Bolivar Heights Member consists of about 200 feet (60 m) of thin- to medium-bedded, dark-gray, ribbony, burrow-mottled, lime mudstone that weathers light gray in color. The number and density of burrows vary among beds, with very little burrowing in some layers and an anastomosing network of burrows in others. Thickness is 200 to 250 feet (60 to 75 m).
	Conococheague Formation Ccu 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 ribbony lime mudstone that weathers to flaggy to platy beds, and arenaceous grainstones exhibiting edgewise and flat-pebble conglomerates. Locally, thin, pastel blue and pink marble 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 230 m).	Antietam Formation Ca Dark green-gray, highly cleaved, silty, phylitic shale and siltstone interbedded with white, <i>Staliothos</i> -burrowed, fine-grained sandstone in the lower part of the formation. These lower strata grade upsection into medium-bedded, white, bioturbated and cross-bedded, fine- to medium-grained sandstone in the middle of the formation. The uppermost strata of the formation consist of light- to medium-gray, cross-bedded, granular conglomerate. Although exposures of the formation are very rare, mapping of the Antietam Formation is facilitated by the upper sandstone-conglomerate interval, which forms a ridge somewhat lower in altitude than the Weverton Formation, but considerably higher than the Waynesboro ridges. Thickness ranges from 500 to 800 feet (150 to 245 m).
Cambrian	Middle member Ccm Predominantly cyclically bedded, medium- to dark-gray, thrombotic limestone and gray, ribbony and laminated limestone and tan laminated dolomite. Thrombolites range in thickness from 3 to 6 feet (1 to 2 m) within thrombotic intervals in less than 1 foot (0.3 m) within the ribbony 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).	Harpers Formation Ch Predominantly dark green-gray, highly cleaved, phylitic shale and siltstone with lesser amounts of metasandstones and impure gray quartzites. Shale and siltstone are dark green-gray, dark brown-gray to medium gray in color and weather tan. Cleavage typically obscures bedding. Locally traceable metasandstones (Chm) are commonly thin (10 to 15 feet or 3 to 5 m), dark green-gray, fine to medium grained, highly argillaceous, and contain <i>Staliothos</i> burrows, especially near top of formation. Quartzites are light to medium gray, coarse grained to conglomeratic, cross-bedded and commonly less than 10 m (30 feet) in thickness. Owing to intense intraformational folding, determining the thickness of the formation was impossible. Estimates range from 1,500 to 3,000 feet (450 to 900 m).
	Big Spring Station Member Cbs 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, quartzarenite sandstone approximately 3 feet (1 m) in thickness. Member becomes interbedded with gray dolomite thrombotic beds near the top. Thickness ranges from 200 to 300 feet (60 to 90 m).	Weverton Formation Cwv Primarily light-gray to gray quartzite, conglomerate, and metagraywacke with interbeds of dark-gray to black phyllite. Three members are recognized and mapped in the Keedysville quadrangle (Brezinski, 1992), however only two are present in the Funkstown quadrangle.
	Elbrook Formation Ce Lower part of the formation is very poorly exposed and contains interbedded tan, thin- to thick-bedded limestone and dolomite, which frequently weather shaly, that are intercalated with medium-bedded, dark-gray limestone. Middle part of the formation contains cyclic, dark-gray limestone and dolomite limestone. The upper part of the formation, and making up its greatest thickness, is cyclically bedded, gray thrombotic limestone and ribbony to laminated limestone and dolomite. Thickness ranges from 2,200 to 2,500 feet (670 to 760 m).	Owens Creek Member Cwo Dark to very dark gray, very coarse grained to conglomeratic, cross-bedded graywacke. Although commonly cross-bedded, the very coarse grained nature of this unit makes recognition of cross-bedding difficult. Large (1 to 3 cm) white and pink quartz pebbles are characteristic of this member, although they are only locally common. Thickness ranges from 150 to 200 feet (45 to 60 m).
	Waynesboro Formation Cwb Interbedded and cyclically bedded carbonates and clastics. Specifically, gray limestone and tan dolomite interbedded with a variety of clastic rocks including: red and green siltstone, shale, and red-brown, green-gray, white, and tan, fine-grained sandstone at the top and bottom. Divided into three members by Brezinski (1992).	Buzzard Knob Member Cwb The lowest member of the formation consists of two ledge-forming quartzites, which are often difficult to discern. The lower ledge consists of light- to medium-gray, medium-bedded quartzite with dark-gray argillaceous layers up to 4 cm thick, separating the quartzite beds. Cross-bedding within individual quartzite strata is pervasive and is commonly accentuated by purplish or yellow-gold bands demarcating the individual cross-bedded forests. The upper ledge-forming quartzite is composed of medium- to thick-bedded, very light green-gray, shaly quartzite. Cross-bedding is much less common than in the lower ledge. This member is the main ledge-forming unit of the Maryland Blue Ridge. Thickness ranges from 125 to 175 feet (40 to 50 m).

Explanation of Map Symbols

Geologic and Karst Symbols

Contacts
Geologic Contacts
Location certainty is indicated by line pattern:
solid where accurate; long dash where approximate;
short dash where inferred; dotted where concealed.

Karst Features
Active sinkhole
Depression
Spring

Faults
Location certainty is indicated by line pattern:
solid where accurate; long dash where approximate;
short dash where inferred; dotted where concealed.
Queries (?) added where identity or existence may be questionable.

Fault - generic, high-angle, normal or multigenerational
Relative (most recent) motion shown, if known
U Upright side
D Downthrown side

Thrust fault, teeth on upper plate
(sawtooth in direction of dip)

Reverse fault, rectangles on upthrown block

Base Map Symbols

Topographic Symbols	Cultural Symbols	Transportation Symbols
Topographic contour - Index (100-ft interval)	Municipal boundary	Primary highway (Class 1)
Topographic contour - Intermediate (20-interval)	Park/reservation boundaries:	Secondary highway (Class 2)
Stream, perennial	National or state park, forest, wildlife refuge or military reservation boundary	Urban or light duty road (Class 3)
Water body (e.g., lake, pond, river)	Large/regional park boundary	Railroad
Reservoir	Local or small park boundary	Power transmission line
Sewage disposal pond or settling basin	State prison boundary	

STATE OF MARYLAND
Martin O'Malley
Governor

DEPARTMENT OF NATURAL RESOURCES
John R. Griffin
Secretary

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