July 2005 magnetic north declination at center of quadrangle is estimated to be 10.5 degrees west.
(To determine current magnetic declination see: http://www.ngdc.noaa.gov/seg/geomag/jsp/Declination.jsp)

GN
(State Plane Grid North)

Geologic Map of the Middletown Quadrangle, Frederick and Washington Counties, Maryland

By
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2005

Adjoining 7.5' Quadrangle Names
Middletown Quadrangle, shaded

1	2	3
4		5
6	7	8

1. Funkstown
2. Myersville
3. Catoctin Furnace
4. Keedysville
5. Frederick
6. Harpers Ferry
7. Point of Rocks
8. Buckeystown

Quadrangle Location

Scale 1:24,000

1 0.5 0 1 Miles
1,000 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 Feet
1 0.5 0 1 Kilometers

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)

On cross sections, surficial (Quaternary) deposits not shown. Relative motion of faults shown by arrows.

Explanation of Map Symbols

Geologic Symbols

Contacts
- Geologic contact; approximately located
- dotted where concealed

Faults
- U Upthrown side
- D Downthrown side
- Fault; concealed
- Fault; inferred

Folds
- Minor folds
  bearing and degree of plunge shown

Lineations
- Lineation at intersection of bedding and cleavage
  bearing and plunge shown
- Lineation at intersection of foliation (gneissic banding) and (flow) cleavage;
  bearing and plunge shown
- Lineation at intersection of flow cleavage and slip (crenulation) cleavage;
  bearing and plunge shown
- Mineral lineation or elongation
  bearing and plunge shown (if known)

A–A' Cross section line

Planar Features
For a single measurement, the point of observation is at the midpoint of the symbol. For multiple measurements (combined symbols), the point of observation is at the tail-end junction point common to all symbols.
- Inclincd bedding
  strike and degree of dip shown
- Overturned bedding
  strike and degree of dip shown
- Inclined cleavage
  strike and degree of dip shown
- Inclined crenulation (slip) cleavage
  strike and dip shown
- Inclined foliation in metamorphic rock
  strike and dip shown
- Inclined flow foliation or layering in igneous rock
  strike and dip shown

Base Map Symbols

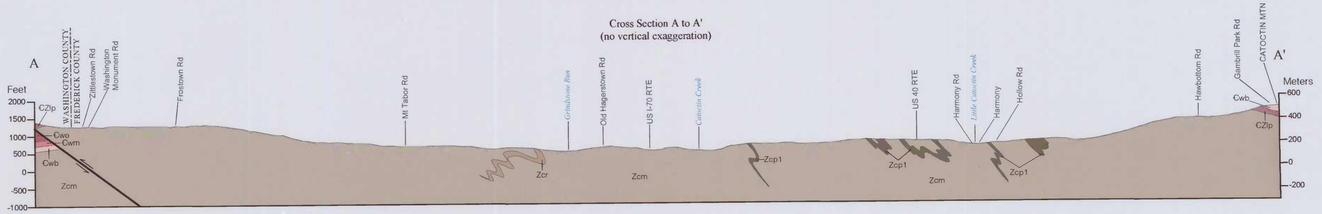
Culture
- Boundary of incorporated city, village, town, or borough
- County boundary
- Small park boundary
- State park boundary
- Powcr transmission line
- Cemctery
- Church
- Gaging Station
- School
- Tower

Hydrography
- Stream
- Water body (e.g. lakes, ponds, rivers)

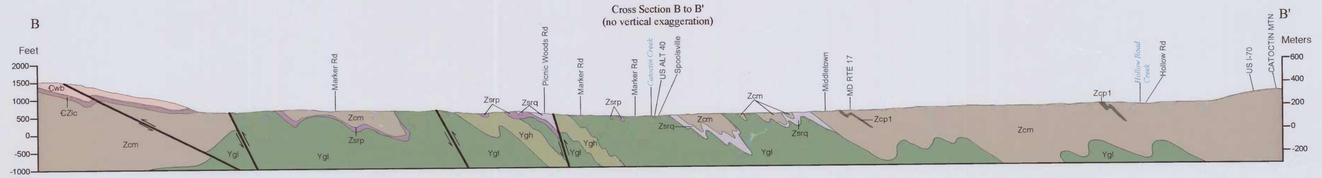
Topography
- Topographic index contour (100- ft interval)
- Topographic intermediate contour (20- ft interval)

Transportation
- Primary route, class 1 (divided, lancs separated)
- Primary route, class 1 (undivided)
- Secondary route, class 2 undivided
- Light duty road or street, class 3
- Unimproved road or street, class 4
- Trail, other than 4WD

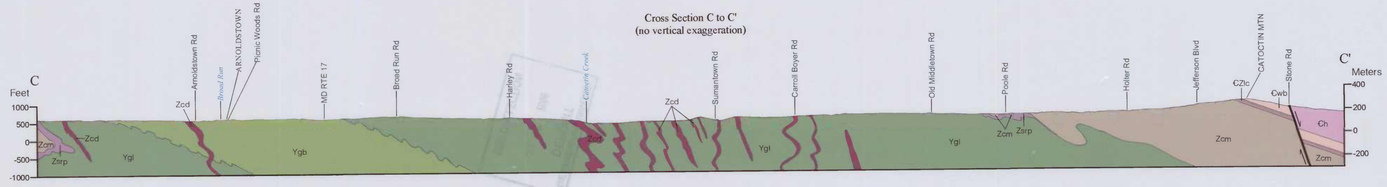
Cross Section A to A'
(no vertical exaggeration)



Cross Section B to B'
(no vertical exaggeration)



Cross Section C to C'
(no vertical exaggeration)



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Supplemental Information
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Geologic field mapping was conducted by Fauth in 1967–1968 and 1973–1975 and by Brezinski in 1991–1992 and 2004-2005. The geologic map was compiled in digital form by Heather Quinn of the Maryland Geological Survey and by Brent Anderson and Catherine Luckhardt of Towson University, Center for Geographic Information Sciences.

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Base layers derived from U.S. Geological Survey (USGS)
7.5-minute Series (Topographic)
Middletown Quadrangle 1953 (photorevised 1979)
Digital line graphs for hydrography, topography, transportation and boundaries (1:24,000)
(Topography by stereophotogrammetric methods from aerial photographs taken 1943.
Culture revised by USGS 1953. Map edited in 1979 by USGS based on aerial photographs taken 1977 and other sources; this information not field checked; boundary line revisions compiled from latest information available from controlling authority.)

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 tics and coordinates shown in black
Geographic coordinates (latitude-longitude) shown near corners and 2.5' intervals (in black)

Description of Map Units

Quaternary

Alluvium (Qal)
Reddish brown, poorly sorted mixture of rounded pebbles to boulders with sand, silt, and clay as interbeds and interstitial matrix. Layers of modcrately well-sorted, rounded cobbles or sandstone pebbles are also present. Thickness estimated at 1.0 foot to more than 10 feet (0.3 to more than 3.5 m) along Catoctin Creek.

Colluvium (Qc)
Unsorted, grayish red to reddish gray, angular to subangular pebbles, cobbles, and boulders of quartzite and vein quartz with a reddish, silty clay matrix. Present near base of the western foot of Catoctin Mountain and eastern foot of South Mountain. Produced by the physical fragmentation of bedrock and slow downslope movement of that material. Originates primarily from the Weverton and Loudoun Formations that underlie Catoctin and South Mountains. Thickness ranges from a thin veneer to more than 100 feet (30 m).

Weathering residuum (Qr)
Mixture of moderate reddish brown clayey soil containing pebbles, cobbles, and locally blocks of grayish pink to white angular, locally euhedral quartz and gneissic fragments. Appears to be an earlier soil horizon that is now dissected by present drainage. Thickness ranges from a thin veneer to 10 feet (3 m).

Terrace deposits (Qt)
Reddish brown to brown, sandy and clayey mixture of rounded pebbles to cobbles of sandstone, vein quartz and quartzite. Locally present on elevated low areas along Catoctin Creek. Thickness ranges from a thin veneer to more than 10 feet (3 m).

Jurassic

Diabase dike(s) (Jd)
Dark gray to black, fine-grained diabase weathering to rusty, red-brown, spheroidal boulders and cobbles. Dikes do not crop out in the Middletown quadrangle, but are recognized by linear boulder traces indicating their presence. Occurs primarily in the western part of the quadrangle.

Late Proterozoic

Harpers Formation (Ch)
Brownish gray to dark greenish gray, silty phyllitic shale to highly sheared phyllitic siltstone with intervals of brownish gray, medium-grained, silty sandstone. On Catoctin Mountain: light brownish gray to light olive-gray, sheared, muscovite(?)-sericite phyllite weathering to pale red, moderate reddish brown, and yellowish brown. Approximate formation thickness 1,000 to 1,500 feet (300-450 m). On South Mountain: primarily light olive gray and dark greenish gray, highly cleaved phyllitic siltstone. Interbeds of medium-grained, medium-gray sandstone and quartzite occur locally. Estimated formation thickness greater than 2,500 feet (760 m) (Brezinski, 1992).

Weverton Formation
Primarily light gray to medium dark gray quartzite, conglomerate, and metagraywacke. Three members make up the Weverton Formation. These are in ascending order: the Buzzard Knob, Maryland Heights, and Owens Creek Members (Brezinski, 1992). The Buzzard Knob Member is the main ridge-forming quartzite in the Maryland Blue Ridge. Owing to truncation by Triassic faulting, only the Buzzard Knob Member is present south of Braddock Heights on Catoctin Mountain.

Owens Creek Member (Cwo)
Medium to dark gray, medium-bedded, pebbly, ferruginous conglomerate, and conglomeratic, crossbedded, coarse-grained sandstone to quartzite. Member occurs on the dip slope of Catoctin Mountain, and rarely is a ridge-forming unit within the Weverton Formation. Thickness is 150 to 200 feet (45 to 60 m).

Maryland Heights Member (Cwm)
Interbedded, dark greenish gray to medium dark gray, metagraywacke, quartzite, and highly cleaved, sandy, phyllitic siltstone. Metagraywackes are dark gray, silty sandstone, with pebbly conglomerate layers. At least one massive, light gray quartzite is present near top of member, but is not mapped separately in the Middletown quadrangle. Thickness of the member is estimated at 200 to 300 feet (60 to 90 m).

Buzzard Knob Member (Cwb)
Light gray to medium gray, medium-bedded quartzite with dark gray, argillaceous layers up to 4 cm thick, separating the quartzite beds. Crossbedding within individual quartzite strata is pervasive. The Buzzard Knob Member has an estimated thickness of 50 to 150 feet (15 to 45 m).

Late Proterozoic - Cambrian?

Loudoun Formation (undivided) (CZl)
Medium to dark gray, medium-bedded conglomerate and black, tuffaceous phyllite. Lithology is very variable, ranging from a crossbedded quartz-pebble conglomerate to a highly cleaved, polymictic conglomerate with a matrix of flattened phyllite pebbles. The localized distribution of this formation may be the result of the original deposition or omission by faulting; however, owing to the colluvial apron of the Weverton, this relationship remains obscure. The Loudoun Formation (where undivided) ranges in thickness from 50 to 150 feet (15 to 45 m) in the Middletown quadrangle.

Conglomerate (CZlc)
Medium-bedded, medium light gray, grayish yellow-green or dusky blue conglomerate that weathers light gray and greenish gray or dusky blue. Contains oval pebbles of quartz, quartzite, rhyolite, and granite(?), 0.5 to 4.0 cm long, and flattened dark-colored phyllite fragments, 1.5 to 3.0 cm long; matrix is a medium- to coarse-grained graywacke. Conglomerate beds are intercalated with cross-laminated, thin- to medium-bedded, medium- to coarse-grained, pebbly graywacke and thin intervals of very dusky purple, dusky blue, or very dusky red phyllites and quartz phyllites. Unit grades upward into pebbly quartzites. Conglomerate member ranges from 0 to 50 feet (0 to 15 m) in thickness.

Phyllite (CZlp)
Poorly exposed. Primarily medium dark gray phyllite, but also dusky blue and very dusky purple phyllites. Phyllites typically contain oriented and elongated, light-colored blebs up to 20 mm long, or very fine-grained lithic clasts of various colors. Some phyllites possess dark-colored, planar or convoluted laminations. Thickness of member is estimated to be between 0 and 100 feet (0 to 30 m).

Catoctin Formation
The Catoctin Formation is a suite of volcanigenic rocks that consists principally of metabasalt, metarhyolite, and tuffaceous phyllites. Although these major rock types are mappable lithologic units, their stratigraphic relationships are not known.

Massive metabasalt (Zcm)
Characteristically a green, greenish gray, bluish green, or gray, medium-grained, non-porphyritic, massive to highly cleaved rock. Commonly amygdaloidal with quartz, epidote, plagioclase feldspar, or chlorite filling oval-shaped vesicles; or porphyroblastic with flattened and elongated grains or aggregates of chlorite, actinolite(?), or epidote ranging between 10 and 25 mm in length. May exhibit medium to broad bands that differ in color or texture. Locally brecciated. Prominent veins and nodular masses of epidote and quartz are widely distributed throughout the unit. Thickness of the entire metabasalt unit ranges from approximately 200 feet to greater than 1,000 feet (60 to greater than 300 m).

Porphyritic metabasalt (Zcmp)
Greenish gray to bluish green rock that weathers bluish gray to dark greenish gray. Very prominent white to very light gray, randomly oriented lath-shaped feldspar (albite?) phenocrysts. Individual crystals or aggregates may range in length from 1 to 25 mm and make up about 2 to 7 percent of the rock.

Metarhyolite (Zcrf, Zcr, Zcrp)
Predominantly medium dark gray to grayish blue, massive metarhyolite [Zcr], weathering light bluish gray to dark gray. In addition to the dominant (massive) texture, two other textural varieties are recognized – banded and porphyritic. Flow-banded metarhyolite [Zcrf] is finely laminated or banded, slabby weathering, blue, aphanitic metarhyolite containing some small (2 to 4 mm), widely scattered, very light gray feldspar phenocrysts that make up less than 1 to 2 percent of the rock. Laminations 0.3 to 0.5 mm wide, generally weather very pale orange, moderate orange-pink, or yellowish gray. Porphyritic metarhyolite [Zcrp] is a bluish metarhyolite with conspicuous white, pinkish gray, grayish orange or moderate orange-pink, randomly oriented, equant to subequant feldspar phenocrysts about 2 to 6 mm in length. May also contain rounded, medium light gray or dark reddish brown quartz phenocrysts, 1 to 2 mm long, which typically comprise between 2 and 5 percent of the rock. Total thickness of the unit ranges from approximately 50 to 200 feet (15 to 60 m).

Phyllite
For mapping purposes, phyllite units are differentiated on the basis of textural and physical characteristics, including color. These rocks, in part, may be altered metarhyolite tuffs.

Phyllite, unit I (Tssp1)
Poorly exposed, lustrous, light gray to medium dark gray, olive-gray phyllite, or mottled yellowish gray and medium gray phyllite. Commonly contain numerous light-colored, flattened and elongate blebs from 1x10 to 10x20 mm in size. Unit thickness is estimated to be between 50 and 100 feet (15 to 30 m). Unit I is the lithologic correlative of the gray phyllite unit in the Catoctin Furnace and Myersville 7.5-minute quadrangle geologic maps (Fauth, 1977, 1981).

Phyllite, unit II (Zcp2)
Light greenish gray, moderate greenish gray and very light gray, streaked phyllite; may be silicified. Weathered surfaces commonly soft and soapy. Lithologically similar to parts of the lavender phyllite exposed in adjacent parts of the Myersville 7.5-minute quadrangle (Fauth, 1977). Estimated thickness between 30 and 50 feet (9 and 15 m).

Phyllite, unit III (Zcp3)
Medium dark gray, medium bluish gray, or light gray phyllite containing blebs 2 to 4 mm long. Weathers to light-colored, flat or platy fragments up to 15x40 cm in size. Estimated thickness between 30 and 60 feet (9 and 15 m).

Mafic dikes (Zcd)
Typically dark greenish gray to grayish olive-green, fine- to medium-grained metadiabase or metabasalt. Commonly occurs as dikes and sills(?) intruding rocks of basement gneiss complex. Crosscutting relationship with older, gneissic structure discernible in several outcrops. Dikes range in width from several inches up to 40 feet (12 m). Thicker dikes may show chilled margins; thinner dikes usually have been altered to chlorite phyllite or schist. Individual dikes may be traceable and mappable for distances ranging from a few hundred to thousands of feet (about 100 m to more than 1000 m).

Felsic dikes (Zcdf)
Massive, light gray to medium gray felsite; weathers light orange-brown. Contain very few, small feldspar phenocrysts.

Swift Run Formation

Phyllite (Zsrp)
Very light gray, dusky yellow-green and very light greenish gray, lustrous quartz-sericite(?) phyllite that weathers grayish orange to very light gray. Quartz occurs as medium to coarse detrital grains either uniformly disseminated throughout the rock or concentrated in thin bands or lenses. Estimated thickness ranges from 0 to 75 feet (0 to 23 m).

Quartzite (Zsrq)
Very light gray, thin-bedded, laminated and cross-laminated, sericitic quartzite that weathers light greenish gray to light gray; and medium light gray, thick-bedded, coarse-grained, laminated quartzite, weathering light gray. Locally, a white to very light gray, graded fine- to coarse-grained, friable feldspathic sandstone that weathers yellowish gray and grayish orange. Estimated thickness ranges from 0 to 90 feet (0 to 27 m).

Middle Proterozoic

Basement gneiss complex
The basement gneissic complex is a suite of high-grade metamorphic rocks that form the core of the Blue Ridge Anticlinorium in Maryland. These rocks were created during the Grenville Orogeny (Clark, 1984) approximately 1.1 bya and no stratigraphy is inferred.

Leucocratic gneiss (Ygl)
Fine- to medium-grained, tan to very light gray, massive, finely banded to indistinctly foliated chlorite-quartz-microcline-plagioclase gneiss. Very light gray to yellowish gray granitic rock that weathers very pale orange, grayish pink, and grayish orange to pale brown.

Garnet gneiss (Ygt)
Fine- to medium-grained, very light gray, finely banded to indistinctly foliated quartz-microcline-plagioclase gneiss. Similar to leucocratic gneiss [Ygl], but with scattered garnets. Weathers light gray to yellowish.

Biotite gneiss (Ygb)
Fine- to medium-grained, very light gray to yellowish gray granitic rock that weathers very pale orange, grayish pink, and grayish orange to pale brown. Usually massive, but a faint foliation is commonly discernible. Quartz occurs in prominent grayish blue grains. Biotite, the principal varietal mineral, is brownish black to greenish black. In places, the gneiss is interlayered with thin, irregular bands or zones of biotite schist.

Hornblende gneiss (Ygh)
Medium-grained, granular, massive or poorly foliated, biotite-hornblende-plagioclase gneiss that weathers light olive-gray, pale olive, or greenish gray. May contain prominent greenish black hornblende porphyroblasts 5 to 10 mm long. Hornblende, grayish black biotite, and dusky green to dusky yellow-green chlorite contrast with very light gray to light greenish gray plagioclase feldspar.

Paragneiss (Ygp)
Fine- to medium-grained, tan to rusty red, highly foliated mica-quartz-garnet paragneiss to schist. Weathers to a yellowish brown or very pale orange, schistose rock.