Geologic Map of the Gaithersburg Quadrangle, Montgomery County, Maryland

by Rebecca Kavage Adams,
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Description of Map Units

Quaternary

Alluvium (Holocene)

Qal

Poorly to well sorted, stratified mixtures of unconsolidated clay, silt, sand, gravel, and cobbles underlying flood plains of nearly all rivers and tributaries. Channels of tributaries are commonly incised into bedrock with alluvium covering and exposed along the banks. Thickness of alluvium is highly variable, and is a function of bedrock, topography, and land-use practices. Locally, thick deposits of alluvium result from soil erosion due to agricultural practices of the 19th century (Southworth et al, 2008). Abundant deposits of alluvium are present in Great Seneca Creek and Goshen Branch.

Jurassic

Diabase dikes and sills (Early Jurassic)

Jd

Medium-to dark-gray, medium-grained crystalline and equigranular, massive diabase that weathers to characteristic rusty orange-brown surface and rounded boulders. One linear dike from south of Damascus to Germantown mapped on presence of rounded boulders in stream valleys and previous maps (Cloos, 1953; Froelich, 1975).

Ordovician ?

Quartz bodies

Oq

White, massive, and intensely fractured irregular bodies of quartz. Interpreted to result from intrusion as large veins or metamorphic differentiation during the Ordovician (Lyttle, et al., 2017) and now preserved as smaller remnants. Four quartz bodies are mapped in the Mather Gorge Formation based on small outcrops and abundant angular boulders.

Bear Island Granodiorite

Obg

Pinkish-gray, fine to coarse grained muscovite-biotite granodiorite and related pegmatite composed largely of plagioclase feldspar, with lesser quartz and mica. Hornblende crystals 0.1 to 1 inch long (3 mm to 2 cm) in size are seen in pegmatite veins. Forms small- to medium-size, crosscutting sheets and bodies in rocks of the Mather Gorge Formation and appear undeformed. Old quarries are 20 to 100 feet in length and crosscutting bodies are 1 to 5 feet thick. Along Mill and Rock Creeks in the southeastern corner of the quadrangle, dark gray to black schist is found within and adjacent to light granodiorite as residuals and melanosome (Maxeiner et al., 2017). The Bear Island Granodiorite may be a later phase of partial melting during the migmatization of the Mather Gorge Formation. Minimum age is estimated at 469+or-20 Ma based on Rb-Sr dating (Muth et al., 1979).

Lower Cambrian and/or Neoproterozoic

Sykesville Formation (Lower Cambrian)

Cs

Variegated, gray metamorphosed sedimentary mélange consisting of a quartzofeldspathic granofels matrix containing quartz and feldspar grains, and fragments and bodies of metamorphosed sedimentary, volcanic, and intrusive rocks.

Marburg Formation (Lower Cambrian? and Neoproterozoic?)

Metasiltstone

Cmbs

Greenish-gray to light-olive-gray, phyllitic metasiltstone containing thin, light-gray quartz laminae and ribbons; medium-light-gray to very pale-orange muscovite phyllite. Much of the unit is transposed, phyllonitized, and has abundant pods and stringers of white vein quartz with deposits of chlorite and epidote (Southworth, 1999).

Phyllonite (Pleasant Grove shear zone)

Cmbp

Greenish-gray, chlorite phyllonite containing white vein quartz. Many foliation surfaces have abundant magnetite crystals from 0.04 to 0.2 inches (1 to 5 mm) in size. Highly sheared with phacoidal "oyster-shell" fabric that becomes penetrative near the Pleasant Grove Fault (Muller, 1994). The northwestern contact of the unit was also defined based on a linear pattern of magnetic highs from aeromagnetic maps (Fisher et al., 1979) of this region and washboard pattern in hillshade derived from LiDAR.

Quartzite

Cmbq

Light- to medium-olive gray, coarse-grained, blocky to massive quartzite. Pebbly beds are sometimes present, containing white to bluish-gray quartz pebbles 0.04 to 0.1 inches (1 to 3 mm) in size. Euhedral pyrite crystals 0.04 to 0.4 inches (1 to 10 mm) in size are common. A 2 to 20 inch (5 to 50 cm) spaced cleavage, folded into anitforms and synforms on a 15 to 30 foot (5 to 10 m) scale, is present in quartzite beds.

Mather Gorge Formation (Lower Cambrian? and Neoproterozoic?)

Schist with interlayered metagraywacke

Cmg

Quartz-mica schist with subordinate quartzitic metagraywacke interbedded in layers and lenses on a millimeter to meter scale (pelitic and psammitic schist of Cloos et al., 1964). Magnetite-epidote-plagioclase-chlorite-muscovite-quartz schist is fine-grained, lustrous greenish gray to gray (Drake et al., 1999; Muller, 1994). Metagraywacke is light to dark olive gray, fine- to medium-grained, with mm-scale mylonitic foliation folded into small antiforms and synforms. Quartz pebbles and graded bedding occasionally visible. Stringers and pods of isoclinally folded and boudinaged white quartz veins are abundant. Although subordinate, metagraywacke is more frequently seen in outcrop than schist due to its resistance to weathering.

Schist with interlayered metagraywacke (Pleasant Grove shear zone)

Cmgp

Interbedded quartz-mica schist and quartzitic metagraywacke with penetrative S-C metamorphic fabric, formed by the intersection of the dominant foliation (S) and the shear plane (C) near the Pleasant Grove Fault (Krol and Muller, 1995; Muller, 1994). Mapped on distinct phacoidal "oyster-shell" appearance although lithologically is similar to Cmg.

Migmatite 1

Cmm1

Interbedded quartz-mica schist and quartzitic metagraywacke with intermittent zones of in-situ leucosome and melanosome producing stromatic migmatite (Maxeiner et al., 2017) with cm-scale light/dark banding ('lit-par-lit' of Cloos, et al., 1964). Only the schist is migmatitic; metagraywacke remains similar in appearance to Cmg. Weathering form of migmatite outcrops is more massive and rounded than Cmg. The western boundary of this unit is postulated to be the Blockhouse Point Fault of Kunk et al. (2005) and Wintch et al. (2010).

Migmatite 2

Cmm2

Interbedded quartz-mica schist and quartzitic metagraywacke with abundant zones of highly folded stromatic migmatite and cross-cutting leucosome in cm-scale bands and meter-scale bodies sometimes containing residuals of schist and metagraywacke (Maxeiner et al., 2017). Only the schist is migmatitic; metagraywacke remains similar in appearance to Cmg and sometimes occurs as residuals surrounded by migmatite. Leucosome ranges in color from white to very pale orange and is comprised of mm-cm size crystals of plagioclase feldspar, quartz, and muscovite. Occasional bands of leucosome with larger (0.2 to 0.5 inches / 5 mm to1 cm) crystal size also contain black, bladed hornblende crystals. Bodies of leucosome larger than 5 feet (2 meters) are mapped as Obg. Most of these appear to have been quarried.

Ultramafic Rocks

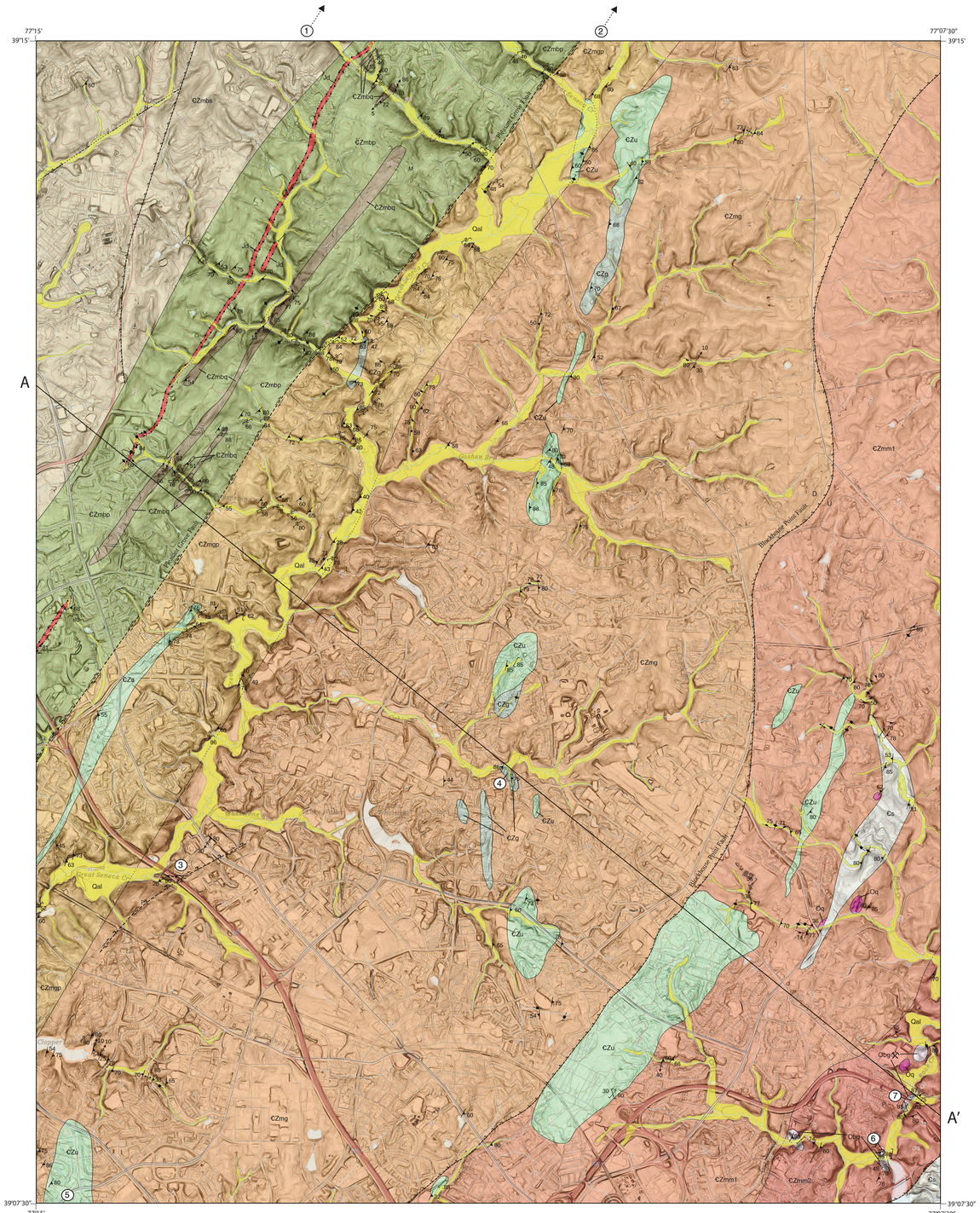
Cu

Undifferentiated serpentine and soapstone that occur within rocks of the Mather Gorge Formation. Serpentinite is hard, massive, dark green to black, and has a cracked, sometimes soft, light-gray weathering surface. Soapstone is light-gray to light-greenish-gray, very soft, and weathers white with rusty pitted spots. Where exposed, the margins of serpentinite bodies are magnesian schist of fine- to coarse-grained tremolite, actinolite, chlorite, and epidote schist. Extent of several ultramafic bodies in heavily developed areas are based on previous maps due to poor exposure (Cloos and Cooke, 1953; Froelich, 1975; Southworth et al., 2008).

Mafic Rocks

Cg

Undifferentiated metagabbro and magnesian schist that occur within rocks of the Mather Gorge Formation. Metagabbro has a hard, massive, dark grayish-green to pinkish-gray fine-grained matrix surrounding dark greenish-gray, waxy, rhombohedral crystals of antigorite from 0.1 to 1 inch (3 mm - 2 cm) in size. Magnesian schist is soft, colorless (tremolite) to greenish-gray (actinolite), with bladed crystals from 0.1 to 0.5 inch (3 mm to 1 cm) in length. Extent of several mafic bodies in heavily developed areas are based on previous maps due to poor exposure (Cloos and Cooke, 1953; Froelich, 1975; Southworth et al., 2008).



Bare earth digital elevation model (DEM) derived from 2018 Montgomery County LiDAR data

U.S. Geological Survey (USGS) US Topo TNM Gaithersburg, MD quadrangle, 2020

Coordinate System: NAD 1983 UTM Zone 18N
Projection: Transverse Mercator
Horizontal Datum: North American Datum 1983

Geographic coordinates (latitude-longitude) shown near corners

10° 50'
APPROXIMATE MEAN DECLINATION, 2020

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
(To convert elevations to North American Vertical Datum of 1988, subtract 1 foot)
(To convert from feet to meters, multiply by 0.3048)

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1. Urbana
2. Damascus
3. Woodbine
4. Germantown
5. Sandy Spring
6. Seneca
7. Rockville
8. Kensington

Adjoining 7.5' quadrangle names (Gaithersburg quadrangle shaded)

Explanation of Map Symbols

A — A′ Cross section line

Contacts

- Geologic contacts, inferred; dotted where concealed by alluvium, dashed where projected in cross section.
- Contact of dike mapped by presence of cobbles and boulders.

Faults

- Fault, unknown type, location inferred. Dotted where concealed by alluvium.
- Strike-slip fault, location inferred. Arrows show relative motion. Dotted where concealed by alluvium, ? where existence is uncertain.
- Strike-slip movement toward viewer
- Strike-slip movement away from viewer
- Fault, unknown type, in cross section. Arrows showing relative motion

Folds

Showing axial trace and plunge direction

- Minor antiform (1-10 m)
- Inclined small antiform (20-100 cm)

Other Features

- Quarry (historic)
- P Pyrite porphryoblasts, 1-10 mm
- M Magnetite porphryoblasts, 1-5 mm
- G Garnet porphryoblasts, 1-5 mm
- S-C metamorphic fabric, formed by intersection of dominant foliation (S) and the shear plane (C)

Planar Features

Showing strike and dip

- Inclined joint
- Vertical or near-vertical joint
- Inclined spaced cleavage
- Vertical spaced cleavage
- Inclined penetrative foliation
- Vertical penetrative foliation
- Inclined schistosity
- Inclined crenulation or small folds of foliation (1 mm-20 cm)
- Inclined shear band cleavage, dextral sense of shear
- Vertical, shear band cleavage, dextral sense of shear

Linear Features

Showing bearing and plunge

- Inclined aligned deformed/elongate minerals
- Inclined foliation-cleavage intersection
- Inclined cleavage-cleavage intersection

Base Map Symbols

Transportation

- Primary highway, divided by median strip
- Primary route, class 1 (divided, lanes separated)
- Primary route, class 1 (undivided)
- Secondary route, class 2
- Light duty road or street, class 3
- Railroad

Topography

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

Hydrography

- Muddy Creek Stream
- Spring
- Deep Lake Water body (e.g. lakes, ponds, rivers)

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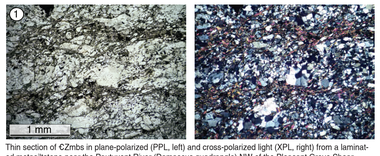
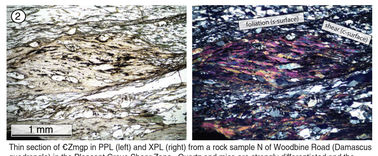
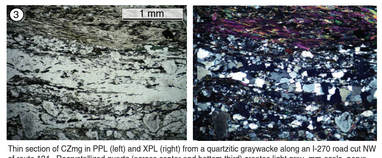


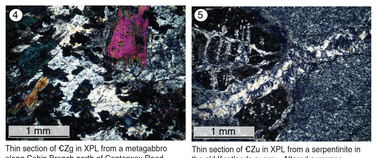
Thin section of Cmbs in plane-polarized (PPL, left) and cross-polarized light (XPL, right) from a laminated metasiltstone near the Pautuxent River (Damascus quadrangle) NW of the Pleasant Grove Shear Zone. Finely banded quartz (white, gray, black) and mica (pink, yellow) give the rock a planar, pinstriped appearance in hand sample and outcrop.



Thin section of Cmgp in PPL (left) and XPL (right) from a rock sample N of Woodbine Road (Damascus quadrangle) in the Pleasant Grove Shear Zone. Quartz and mica are strongly differentiated and the dominant foliation (s-surface) is rotated into "mica fish" by dextral shear band cleavage (c-surface). Note abundant chlorite (green in PPL).

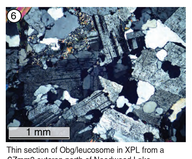


Thin section of CZmg in PPL (left) and XPL (right) from a quartzitic graywacke along an I-270 road cut NW of route 124. Recrystallized quartz (across center and bottom third) creates light gray, mm-scale, pervasive banding commonly seen in outcrop in the CZmg region of the map. Porphryoclasts such as feldspar (large gray grain, bottom right) have not recrystallized.

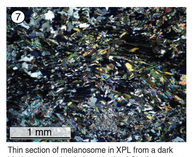


Thin section of CZg in XPL from a metagabbro along Cabin Branch north of Centerway Road. Coarse altered pyroxene (pink, teal, yellow) are surrounded by diopside (blue to black, high relief) and fine blades of tremolite.

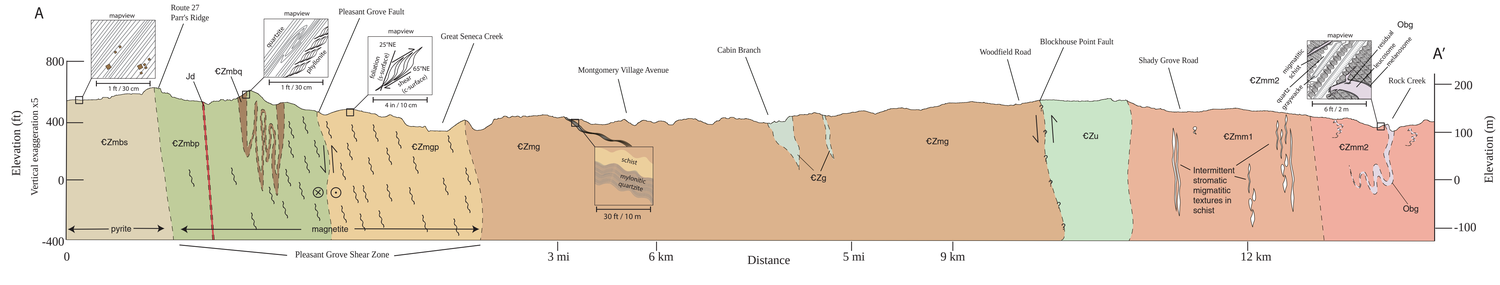
Thin section of CZu in XPL from a serpentinite in the old Kentlands quarry. Altered pyroxene (brown) in a matrix of serpentine (dark gray) and cut by fibrous serpentinite veins (white to yellow).



Thin section of Obg/leucosome in XPL from a CZmm2 outcrop north of Needwood Lake. Plagioclase feldspar (twinned) comprises most of the grains, with lesser quartz and muscovite.



Thin section of melanosome in XPL from a dark blocky outcrop bordering a body of Obg/leucosome along Rock Creek under the MD 200 overpass . Blades of biotite (brown, green, yellow) are abundant.



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