This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program under STATEMAP.

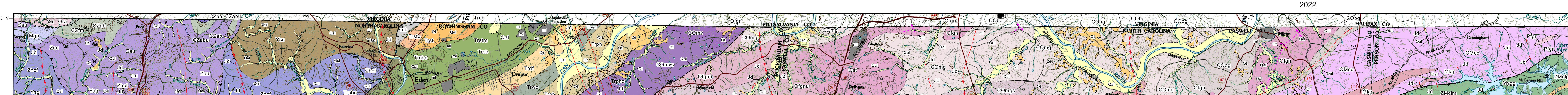
North Carolina Department of Environmental Quality
Division of Energy, Mineral and Land Resources
Brian L. Wrenn, Division Director
Kenneth B. Taylor, State Geologist

North Carolina Geological Survey
Open File Report 2022-05

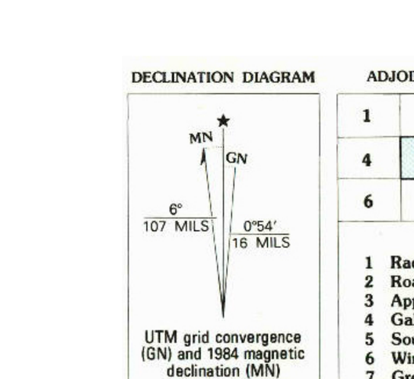
Geologic Map of the North Carolina Portion of the Danville 30 x 60 Minute Quadrangle

Compiled by Philip J. Bradley and Emily K. Michael
Cartographic representation by Emily K. Michael and Michael A. Medina

2022



Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under STATEMAP (Award 2021, G21AC10805).
New Geologic data collected in January 2022 to May 2022 as part of this compilation work.
Base map, Declination Diagram and map of adjoining quadrangles is from USGS 1984 GeoTiff of the Danville 30 x 60 minute quadrangle.



4 2 0 4 8 Miles
4 2 0 4 8 Kilometers

Scale 1:100 000

Contour Interval 10 meters

GENERALIZED ORDER OF MAJOR GEOLOGIC ELEMENTS

Cenozoic
- Surficial Units Quaternary to Present

Mesozoic
- Triassic Rocks of the Dan River Basin ca. 220 Ma

Paleozoic
- Late Paleozoic Intrusive Rocks ca. 330 - 300 Ma
- Milton Terrane ca. 474 - 465 Ma
- Smith River Allochthon Cambrian to Ordovician

Proterozoic
- Blue Ridge Cover Neoproterozoic to Cambrian
- Carolina Terrane - Hyco Arc ca. 630 - 610 Ma
- Mesoproterozoic Basement Rocks ~1 Ba

INTRODUCTION

This compiled geologic map, partially supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under STATEMAP, is a collaborative project with the Virginia Geological Survey to assist with the compilation of the Danville 100K sheet. Virginia Publication 166, Geologic map of the Virginia portion of the Danville 30 X 60 minute quadrangle (Henika, 2002), compiled the VA region of the Danville 100K; this compilation effort in NC completes the entire 100K and attempts to rectify state line edge match issues. The North Carolina project area includes the lower 1/3 of eight 24K-scale quadrangles in NC. From west to east, the map area includes the Blue Ridge Cover Sequence, Smith River Allochthon, Proterozoic Basement Rocks, Sauratown Mountains Anticlinorium, Dan River Basin, Milton terrane, and the Hyco arc portion of the Carolina terrane.

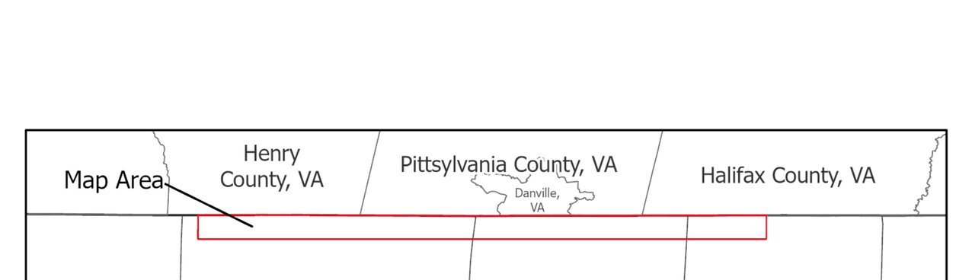
Past Workers
Published geologic maps include the 1:125K-scale North Carolina Geological Survey (NCGS) Region G map (Carpenter, 1982) and portions of 2 24k-scale geologic maps published as NCGS Open-file Maps by Dr. Jim Hibbard (Hibbard, 2017; Wilkins and Hibbard, 2017) along the Hyco shear zone. The work in the Hyco shear zone was part of a larger research effort summarized in Hibbard et al. (1998) and Hibbard et al. (2017). Olsen et al. (2015) is an important work that revised the stratigraphy of the Dan River basin by adding a new formation and significantly revising previous contacts from past workers.

This compilation effort
This collaborative effort referenced the primary sources for Virginia Publication 166 at the most detailed scale available to edge-match linework along the NC-VA state line. NCGS staff directly utilized the works from Hibbard (1998, 2017) and adjusted the linework from Carpenter's Region G Map (1982) to edge-match with Hibbard's work. For discrepancies in the Dan River Triassic Basin, the linework from Olsen et al.'s (2015) revised stratigraphy was used. From January 2022 to May 2022, NCGS staff conducted targeted foot and vehicle traverses to rectify edge-match issues with past workers' maps, validate contacts from Carpenter's Region G Map (1982), and correct edge-match issues with the Winston-Salem East 250K (Espenshade et al., 1975).

REFERENCES

Burt, E.R., Carpenter, P.A., III, McDaniel, R.D., and Wilson, W.F., 1978, Diabase Dikes of the Eastern Piedmont of North Carolina: North Carolina Geological Survey Information Circular 23, 12 p. text plus map compilation.
Butler, J.R., 1980, Review of potential host rocks for radioactive waste disposal in the Piedmont Province of North Carolina: Savanna River Laboratory, E. I. Dupont de Nemours and Company, Report D.P.-1562, 47 p.
Carpenter, P.A., 1982, Geologic map of Region G, North Carolina: North Carolina Geological Survey, Regional Geology Series 2, scale 1:125,000.
Coler, D., Samson, S., and Hibbard, J., 2000, The Chompawomsic and Milton Terranes: Correlative Ordovician arc terranes built on ancient continental crust, Southern Appalachians: Journal of Gology, v. 108, p. 363-380.
Conley, J.F., 1985, Geology of the southwestern Virginia Piedmont: Virginia Division of Mineral Resources Publication 59, 33 p.
Deuser, W.G., and Herzog, L. F., 1962, Rubidium-strontium age determinations of muscovites and biotites from pegmatites of the Blue Ridge and Piedmont. Journal of Geophysical Research, v. 67, no. 5, p. 1997-2004.
Espenshade, G.H., Rankin, D.W., Shaw, K.W., and Neuman, R.B., 1975, Geologic map of the east half of the Winston-Salem quadrangle, North Carolina-Virginia: US Geological Survey, Miscellaneous Investigations Series Map I-709-B, scale 1:250,000
Gates, A.E., 1981, Geology of the western boundary of the Charlotte Belt near Brookneal, Virginia [M.S. thesis]: Virginia Polytechnic Institute and State University, Blacksburg, 88 p.
Griffits, W. R., Jahns, R. H., and Limke, R. W., 1953, Mica Deposits in the Southeast Piedmont; Part 3, Ridgeway-Sandy Ridge District, Virginia and North Carolina, U.S. Geological Survey Professional Paper 248-C, p. 141-170.
Henika, W.S., and Thayer, P.A., 1977, Geology of the Blairs, Mount Hermon, Danville, and Ringgold quadrangles, Virginia: Virginia Division of Mineral Resources, Publication 2, scale 1:24,000.
Henika, W.S., 2002, Geologic map of the Virginia portion of the Danville 30 X 60 minute quadrangle: Virginia Division of Mineral Resources, Publication 166, scale 1:100,000.
Hibbard, J.P., Stewart, K.G., and Henika, W.S., 2001, Framing the Piedmont zone in North Carolina and Southern Virginia: Field Trip Guidebook, 50th Annual Meeting, Southeastern Section of the Geological Society of America, Raleigh, North Carolina, p. 1-26.
Hibbard, J.P., 2017, Compiled geologic map of the Hyco shear zone and adjacent portions of the Alton and Olive Hill 7.5-minute quadrangles, Person County, North Carolina: North Carolina Geological Survey Open-file Report 2017-15, scale 1:24,000.
Hibbard, J.P., Shell, G.S., Bradley, P., Samson, S.D., and Wortman, G., 1998, The Hyco shear zone in North Carolina and southern Virginia: Implications for the Piedmont zone-Carolina zone boundary in the southern Appalachians: American Journal of Science, v. 298, p. 85-107.
Hibbard, J.P. and Bradley, P.J., 2017, Geology of the Hyco Shear Zone in North Carolina and Virginia: North Carolina Geological Survey Open-file Report 2017-06, scale 1:80,000, in color.
Horton, J.W., Jr., Peper, J.D., Burton, W.C., Weems, R.E., and Sacks, P.E., 2022, Geologic map of the South Boston 30' × 60' quadrangle, Virginia and North Carolina: U.S. Geological Survey Scientific Investigations Map 3483, 1 sheet, scale 1:100,000, 46-p. pamphlet, https://doi.org/10.3133/sim3483. [Supersedes USGS Open-File Report 93–244.]
Hund, 1987, U-Pb dating of granites from the Charlotte belt of the Southern Appalachians [M.S. Thesis]: Virginia Polytechnic Institute and State University, Blacksburg, 83 p.
Kish, S.A., 1983, A geochronological study of deformation and metamorphism in the Blue Ridge and Piedmont of the Carolinas [Ph.D. dissertation]: University of North Carolina at Chapel Hill, 220 p.
Olsen, Paul E.; Reid, Jeffrey C.; Taylor, Kenneth B.; Whiteside, Jessica H.; Kent, Dennis V., 2015, Revised Stratigraphy of Late Triassic Age Strata of the Dan River Basin (Virginia and North Carolina, USA) Based on Drill Core and Outcrop Data, Southeastern Geology, V. 51, No. 1, p. 1-31.
Shell, G. S., 1996, Nature of the Carolina slate belt-Milton belt boundary near Yanceyville, North Carolina: M.S. thesis, North Carolina State University, Raleigh, North Carolina, 96 p.
Wilkins, K., Hibbard, J.P., 2017, Compiled geologic map of the Hyco shear zone portions of the Milton and Leasburg 7.5-minute quadrangles, Caswell and Person counties, North Carolina: North Carolina Geological Survey Open-file Report 2017-14, scale 1:24,000.
Wortman, G., Samson, S., and Hibbard, J., 1998, Precise U-Pb timing constraints on the kinematic development of the Hyco shear zone, southern Appalachians: American Journal Science, v. 298, p. 108-130.

Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under STATEMAP (Award 2021, G21AC10805).



Index to Geologic Mapping

EXPLANATION OF MAP SYMBOLS
CONTACTS, FAULTS, AND OTHER FEATURES

- Prospect
- Sand, gravel or clay pit
- Active pit or quarry
- Abandoned pit or quarry
- fold axis of anticline
- Limits of high strain from ductile shear zone (Hyco Shear Zone)
- Jd Inferred diabase dike
- Jd Inferred diabase dike supported by aeromagnetic data (Burt et. al., 1978)
- contact - inferred where dashed, concealed where dotted
- fault - inferred where dashed, concealed where dotted
- normal fault - inferred where dashed, concealed where dotted
- thrust fault - certain where solid, inferred where dashed, concealed where dotted

Description of Map Units

SURFICIAL UNITS

ml — **Modified land** (Holocene): Extensive areas of cut, fill, and excavation related to human activity. Includes coal mine and quarry sites, build pads/parking lots, and other areas of intensive site development. (Description provided by Virginia Geology and Mineral Resources)

Qal — **Alluvial deposits** (Quaternary): Channel deposits consisting of unconsolidated clay, silt, and rounded to sub-angular sand, pebbles, cobbles, and boulders. Overbank deposits consisting of clay, silt, and sand granules, pebbles, and cobbles. Deposited by flowing water during recent geologic time. Deposits underlie modern and typically active stream beds and flood plains, and low terraces. (Description provided by Virginia Geology and Mineral Resources)

Qt — **Terrace deposits** (Quaternary - Neogene): Older alluvium within elevated stream valleys above the active flood plain. Deposits consist of unconsolidated, poorly-sorted clay, silt, sand, subangular to subrounded gravels, and sub-rounded to rounded cobbles and boulders. Generally exist on gentle, flat terrain. (Description provided by Virginia Geology and Mineral Resources)

UNMETAMORPHOSED INTRUSIVE BODIES

Jd — **Diabase** (Jurassic): Basalt, diabase, and gabbro, dark-greenish-gray to black, fine- to coarse-grained, aphanitic, subophitic to hypidomorphic granular textures. Chilled margins common. Vertical dikes emplaced in Jurassic fracture systems. Dashed lines indicate inferred diabase dikes, dashed lines with open circles indicate diabase dike location based on aeromagnetic data. (Burt et. al., 1978)

TRIASSIC SEDIMENTARY ROCKS OF THE NEWARK SUPERGROUP
DAN RIVER BASIN
STONEVILLE FORMATION

Trstm — **Mudstones of the Stoneville Formation** (Triassic): Medium - to dark-gray shale and mudrock with lesser amounts of light- to medium-light-gray, medium-grained sandstone and conglomerate.

Trst — **Sandstones of the Stoneville Formation** (Triassic): Arkose and lithic arkose, light-gray and pale-yellowish-orange, thin lenses of poorly sorted lithic pebble and cobble conglomerate.

Trstc — **Conglomerates of the Stoneville Formation** (Triassic): Poorly sorted lithic pebble and cobble conglomerate.

COW BRANCH FORMATION

Trcb — **Siltstones of the Cow Branch Formation** (Triassic): Siltstone, claystone and shale, medium- to dark-gray, carbonaceous, rarely dolomitic. Siltstone well indurated, evenly stratified, laminated, mottled or structureless, with some very-fine- to medium-grained arkose in irregular sandstone channel lenses.

Trcbc — **Conglomerates of the Cow Branch Formation** (Triassic): Conglomerates, lithologically identical to conglomerate facies of Trcg.

DRY FORK FORMATION

Trdf — Sandstone, predominantly gray, brownish-gray, and greenish-gray, lesser amounts of mudstone and sandy conglomerate, interbedded with predominantly poorly sorted, very course sandstone, siltstone and shale. Conglomerate beds along both the southeastern and the northwestern basin margins contain lithic clasts derived from the metamorphosed igneous and volcaniclastic rocks of the Central Virginia Volcanic-Plutonic Belt.

WALNUT COVE FORMATION

Trwc — Cyclical black and gray mudstones, sandstones and coal beds. Black mudstones are massive, thin bedded to laminated, but never microlaminated and tend to have higher levels of total organic carbon than the dark gray to black mudstones of the Cow Branch Formation.

PINE HALL FORMATION

Trph — **Sandstones of the Pine Hall Formation** (Triassic): Sandstone, light-gray and pinkish-gray, medium- to coarse-grained arkose, subarkose, and lithic arkose, locally with lenses of sandy, pebble, and cobble conglomerate and interbeds of reddish-brown siltstone and mudrock, sandy conglomerate, cobble and boulder beds interbedded with subordinate pebbly, coarse- and very-coarse-grained arkose and lithic arkose. Silicified fragments and logs of araucarian conifers are locally abundant in sandstones along western basin margin.

Trphc — **Conglomerates of the Pine Hall Formation** (Triassic): Conglomerates along the eastern basin margin derived from metamorphosed igneous and volcaniclastic rocks of the Central Virginia Volcanic-Plutonic Belt (Milton Belt of Butler, 1980).

OTHER UNITS ASSOCIATED WITH THE DAN RIVER BASIN

mb — **Microbreccia** (Late Paleozoic-Mesozoic): Medium- to light-gray silicified microbreccia and reddish-brown to greenish-gray vitreous cataclasite dikes cutting coarsely-brecciated Triassic sedimentary rocks along the Chatham, Vandola, and Laniers Mills (Triassic) border faults.

MISSISSIPPIAN TO PERMIAN INTRUSIVE ROCKS

Pfgr — **Farmer's Lake granite** (Pennsylvanian): Light grey, weakly to moderately foliated, homogeneous fine - to medium -grained biotite granite. The granite occurs as sporadic stocks and dikes, most of which are too small to be resolved at 1:24,000 scale mapping. It intrudes the Kilgore orthogneiss, the Cunningham complex, and the Country Line complex. A U-Pb zircon age date of 319.6 +/-0.7 Ma on the granite (Yanceyville Quadrangle, NC) is interpreted to reflect the crystallization age of the pluton (Wortman et al. 1998).

Mygg — **Yanceyville orthogneiss** (Mississippian): Foliated, medium- to coarse-grained biotite granite. Overprinted by the same sequence of deformation as the surrounding mafic gneisses in the Country Line complex within the Carolina terrane. Contains xenoliths of the enclosing layered mafic gneisses and locally, dikes of the granite gneiss crosscut layering in the mafic gneisses (Shell, 1996). The Yanceyville granite gneiss has a U-Pb zircon age of 335.4 +/- 2.2 Ma (Wortman et al. 1998).

Mkg — **Kilgore orthogneiss** (Mississippian): Medium grey, medium- to coarse - grained, K-feldspar-plagioclase-quartz-biotite orthogneiss. Locally megacrystic and heterogeneously deformed; feldspar commonly displays a distinct 'clastic' texture. Deformation ranges from a single, weak to moderate foliation to the northwest to an intense, gneissic foliation in the southeast, along the contact between the pluton and adjacent Country Line complex. In most places along the contact, the Kilgore orthogneiss is concordantly interlayered with gneiss of the Country Line complex, although locally, it crosscuts layering in the complex (Shell, 1996). The Kilgore orthogneiss also contains enclaves of amphibolite and diorite lithically identical to immediately adjacent Country Line complex rocks in the hanging wall. These enclaves range from equidimensional pods in the north to elongate narrow lenses and layers in the south. The mafic enclaves contain a gneissic layering and foliation that is generally oblique to the foliation in the surrounding granitoid. A 327 ± 1.5 Ma U-P b zircon age from the Kilgore orthogneiss (on the Leasburg Quadrangle, NC) is interpreted as the crystallization age for the pluton (Wortman et al., 1998)

Mgp — **Granite, pegmatite, and alaskite** (Mississippian): Granite: light- to medium-gray, poorly foliated to gneissic, fine- to medium-grained, composed of microcline, oligoclase, and quartz with accessory hornblende, garnet, sphene, and zircon intrusive into mica gneiss, mica schist, and garnetiferous amphibole of the Ashe Metamorphic Suite along the Ridgeway and Forbrush Fault Zones. Pegmatite and Alaskite: light-gray to white, very course-grained, structureless to rudely foliated, greenish books of muscovite, with accessory garnet, tourmaline and beryl. Dikes and sills emplaced along the Ridgeway Fault Zone southwestward from Henry County, Virginia, westward through Rockingham and Stokes Counties, North Carolina form the Ridgeway-Sandy Ridge Mica District. Griffitts, Jahns, and Lemke (1953, p.191) reported uranite, autinite, and uranophane (?), other secondary uranium minerals, and allanite (?) at the Harry Knight Mine in Rockingham County, North Carolina. Deuser and Herzog (1962) reported a Rb-Sr whole rock date of 321+/- 17 Ma from pegmatite at the Harry Knight Mine.

CAROLINA TERRANE
HYCO ARC
COUNTRY LINE COMPLEX

ZMclg — **Unseparated biotite granite orthogneiss** (Late Proterozoic to Mississippian): Buff weathering, medium grey, weakly to strongly foliated, mainly medium grained biotite gneiss.

ZMclm — **Neoproterozoic mafic gneiss and amphibolite interlayered with Mississippian pegmatite and orthogneiss** (Late Proterozoic to Mississippian): Greenschist to amphibolite facies mafic gneisses with interlayered granitoids and granitic pegmatites; subordinate biotite gneiss and minor metapyroxenite, semipelitic schist, and felsic schist (Shell, 1996). The mafic gneisses range from amphibolites to biotite - amphibole gneisses. Commonly, they are layered on a centimeter to meter scale, although in some places they are massive, with a medium - to coarse -grained gabbro-like texture. The mafic gneisses are extensively interlayered with granitic pegmatites, locally envelope brownish-grey, fine -grained granitoids, and are intruded by cross-cutting granitic pegmatites. North of the Yanceyville orthogneiss (Yanceyville and Leasburg quadrangles, NC), the complex is characterized by a very regularly layered (centimeter-scale), fine - to medium - grained gray biotite + blackish green amphibole gneiss with interlayered granitic gneiss (Shell, 1996). Locally, over the span of a few meters, the regularly layered gneiss grades into migmatite (sensu lato) with a network of foliated coarse granitoid containing meter scale pods of amphibolite with layering and foliation oblique to that in the granitoid. Biotite gneiss is a minor component of the Country Line complex; typically, it is a fine - to medium -grained equigranular, gray quartz-feldspar-biotite + garnet gneiss. Generally, it forms massive and homogeneous lens-shaped bodies that are too small to be resolved at 1:24,000. Zircon from a layered mafic gneiss sub-unit in the South Boston, VA area has yielded a discordant upper intercept age of 613.9 +/-9.3 Ma that is interpreted to reflect a protolith age for the mafic gneisses. Zircon and sphene from the same sample have yielded a concordant age of ca. 323 Ma (Wortman et al., 1998). Concordantly interlayered pegmatites increase in volume towards the Mississippian Yanceyville orthogneiss (Yanceyville and Leasburg quadrangles, NC), suggesting that the concordant pegmatites are also Mississippian. Thus, the complex is a mixture of Late Proterozoic and Mississippian rocks.

MILTON TERRANE
CUNNINGHAM COMPLEX

OMcc — **Biotite gneiss and schist of the Cunningham complex** (Ordovician to Mississippian): Heterogeneous mixture of medium to dark grey biotite gneiss and biotite schist ranging from massive, equigranular granitic gneiss to layers and lenses of biotite +- garnet +- sillimanite schist. The most common rock type is biotite gneiss that represents a hybrid between these two end-members, although distinct irregular-shaped areas of either end-member can be found. The granitic gneiss is locally K-feldspar megacrystic with crystals up to 50 mm long. Layering, at centimeter to meter scale, is defined by feldspar porphyroclast concentration as well as biotite content; it is generally subtle in most of the unit, but it is accentuated near the contact of the gneisses with the Country Line complex. Locally, meter-scale pods of amphibolite, dioritic gneiss, and calc-silicate gneiss are enveloped in a matrix of biotite gneiss. The granitic gneiss is compositionally similar to and appears to grade into the Kilgore orthogneiss. The biotite schist is similar to, and appears to grade into the Ordovician(?) Milton schist and paragneiss. Thus the complex appears to be a mixture of Ordovician and Mississippian rocks. Portions of unit may correlate to Omc (Horton et. at., 2022).

SHELTON IGNEOUS SUITE

Ost — **Orthogneiss of the Shelton Igneous Suite** (Ordovician): Pinkish-gray to black-and-white, structureless to strongly lineated, coarse-grained to coarsely porphyritic, biotite granite to biotite quartz monzonite orthogneiss. Thick homogeneous sills form broad topographic domes surrounded by layered mafic and felsic metavolcanic rocks. A U-Pb zircon date of 443+/- 2 Ma was obtained from gneiss in the Shelton type locality- the Vulcan Construction quarry just South of Danville (Workman unpublished data reported in Hibbard and others, 2001). Earlier dates include a Rb-Sr whole rock age of 424 +/- 3 Ma (Kish, 1983) and a 463 +/- 14 Ma U-Pb date (Hund, 1987).

Ofgn — **Quartz-feldspar gneiss of the Shelton Igneous Suite** (Ordovician): White to pink fine- to medium-grained, lineated, muscovite-quartz feldspar gneiss. Mafic minerals comprise only 3 to 4%. Contains enclaves or xenoliths of metavolcanic rocks. A U-Pb zircon date of 458 +/- 4 Ma was obtained from outcrops of felsic gneiss concordantly interlayered in the unit on the golf course along Rutledge Creek south of Danville (Coler and others, 2000).

Ofgnu — **Undifferentiated felsic gneiss of the Shelton Igneous Suite** (Ordovician): Leucocratic, fine- to medium-crystalline muscovite-quartz-feldspar gneiss, includes lesser amounts of biotite gneiss, phyllite and metamorphosed felsic volcaniclastic rocks. Includes rocks mapped as felsic gneiss (fg) by Carpenter (1982). May be related to Ofgn (Henika, 2002).

CHOPAWOMSIC FORMATION
CHOPAWOMSIC FORMATION, UPPER UNIT (?)

COmvs — **Metamorposed volcanosedimentary rocks** (Cambrio-Ordovician): Fissile, thinly layered, fine-crystalline leucogneiss and sericite phyllite to fine-crystalline white mica schist. Mafic phyllite locally present. Interpreted as metamorphosed volcanosedimentary lithologies at lower amphibolite facies. Present west of Sandy Creek fault.

COmv — **Metamorphosed mafic volcanics** (Cambrio-Ordovician): Dark-green, fine- to medium-grained, amphibole schist and gneiss derived from mafic volcanic flows and volcaniclastic rocks. Includes interlayered quartzite, quartzose graywacke, schist, and phyllite units west of the Sandy Creek Shear Zone.

COmg — **Mafic and felsic gneiss** (Cambrio-Ordovician): Black to moderate-olive-brown, medium- to coarse grained hornblende biotite gneiss, hornblende gneiss, schist and amphibolite. Highly deformed gneiss layers contain large amphibolite boudins, possibly metamorphosed mafic boulder breccia beds. Interlayered coarse-grained quartz-feldspar granite and pegmatitic granite sills locally abundant. Also includes metamorphosed felsic volcaniclastic rocks similar to Ofv unit (Henika, 1977, p. 3-7; Gates, 1981, p. 7-11; Conley, 1985).

CHOPAWOMSIC FORMATION, LOWER UNIT (?)

CObg — **Biotite gneiss** (Cambrio-Ordovician): Brownish-gray to black-and-white, medium- to coarse grained, garnetiferous biotite gneiss. Layered mylonitic to porphyroclastic textures. Interbeds of light-gray to pinkish-gray, fine- to medium-grained laminated gneiss, kyanite and sillimanite schist, and quartzite. Boudins and pods of calc-silicate gneiss and corundum-hornblende gneiss. Coarse-grained quartz-feldspar granite and pegmatitic granite sills locally abundant, especially towards southeastern contact. Unit correlates with Hibbard's unit Om (NCGS OFR 2017-06 and 2017-14).

CHOPAWOMSIC FORMATION, UNDIVIDED

COmgs — **Chopawomsic Formation, undivided mixed gneiss and schist** (Cambrio-Ordovician): Interlayered, heterogeneous biotite gneiss, biotite +- hornblende gneiss, schist and felsic gneiss. Includes rocks mapped as mica gneiss and schist (mgs) by Carpenter (1982).

SMITH RIVER ALLOCTHON
RICH ACRES IGNEOUS SUITE

Ora — **Metadiorite and metagabbro of the Rich Acres Igneous Suite** (Ordovician): Dark-greenish-gray, medium- to coarse-grained, locally porphyritic, hornblende-biotite metadiorite and metagabbro. Intrudes the Fork Mountain and Bassett Formations in extensive sill(s) near the base of the Smith River allochthon. Norite occurs as small, irregularly shaped masses or possible as dikes cutting the gabbroic and dioritic rocks. Unit correlates to the mafic rocks of the Smith River allochthon (Pzsm) in the east half of the Winston-Salem Quadrangle (Espenshade and others, 1975).

FORK MOUNTAIN FORMATION

CZfm — **Schist and gneiss of the Fork Mountain Formation** (Late Proterozoic-Cambrian): Light- to medium-gray, fine- to medium-grained, porphyroblastic muscovite-biotite schist and medium-gray, medium- to coarse-grained, garnetiferous biotite gneiss. Quartose and carbonate layers transposed along a mylonitic foliation. Chloritoid, garnet, staurolite, kyanite/sillimanite/andalusite and biotite/chlorite porphyroblasts all show effects of complex prograde and retrograde metamorphism. Calc-silicate granofels, rare white marble, amphibolite, quartzite and polymictic breccia lenses a few hundred meters wide and generally a few meters thick.

BASSETT FORMATION

CZba — **Amphibolite and hornblende gneiss of the Bassett Formation** (Late Proterozoic-Cambrian): Dark-green to black-and-white, medium- to coarse-grained amphibolite and hornblende-plagioclase gneiss. Complexly folded layers and thin feldspar-rich dikes. Epidote-quartz segregations and flattened ovoid quartz-epidote-plagioclase amygdules.

BLUE RIDGE COVER
BLUE RIDGE COVER OF THE SAURATOWN MOUNTAINS ANTICLINORIUM
ALLIGATOR BACK METAMORPHIC SUITE

CZab — **Schist of the Alligator Back** (Late Proterozoic-Cambrian): Light-bluish-gray muscovite-biotite schist containing abundant pink to red garnet porphyroblasts, less abundant bluish-gray kyanite, and black, untwinned, prismatic staurolite porphyroblasts. Thin quartz and plagioclase segregations as well as discontinuous graphite schist layers. Pegmatite locally abundant.

CZabu — **Ultramafics of the Alligator Back** (Late Proterozoic-Cambrian): Dark-green to greenish-black, generally schistose to granular, fine-grained to porphyroclastic altered ultramafic rocks

ASHE METAMORPHIC SUITE

Zau — **Gneiss and schist of the Ashe** (Late Proterozoic): Light-gray, medium grained, salt-and-pepper-textured muscovite-biotite gneiss. Contains many interlayers of muscovite-biotite schist. Pegmatite and alaskite dikes and sills pervasive along the Ridgeway Fault, truncated and mylonitized along the sheared contact with the Stuart Creek Gneiss (Forbush Fault-Brookneal Shear Zone) in the southeastern part of the Sauratown Mountains Anticlinorium.

HOGAN CREEK FORMATION

Zhcf — **Biotite gneiss of the Hogan Creek Formation** (Late Proterozoic): Strongly foliated, medium- to coarse-grained biotite gneiss and schist. Locally interlayered with felsic gneiss, granitic orthogneiss and metaconglomerate with feldspar fragments similar to nearby augen gneisses. Locally intruded by pegmatite. Correlates to pCb unit the Winston Salem East 250k map.

PROTEROZOIC BASEMENT ROCKS
PROTEROZOIC ROCKS OF THE SAURATOWN MOUNTAINS

Yag — **Augen Gneiss** (Middle Proterozoic): Strongly foliated, coarse-grained, augen gneiss composed of microcline augen in biotite-muscovite-quartz-feldspar matrix. Mylonitic near the contact with the overlying Hogan Creek Formation.

Ysc — **Stuart Creek Gneiss** (Middle Proterozoic): Light-gray to black-and-white-banded, coarse-grained, irregularly layered to massive biotite-augen gneiss, biotite protomylonite, and mylonitic biotite gneiss or flaser gneiss. Flaser gneisses are characterized by asymmetric feldspar porphyroclasts in a matrix of biotite gneiss. Augen locally partially destroyed by shearing, some attentuated, flattened, and bent by crinkle folds; locally contains relict microcline phenocrysts. Mylonitic and flaser structure is generally in the sheared, in the upper part of the unit, along the contact with overlying, younger metasedimentary rocks. In North Carolina, these sheared rocks are found near the southern contact with the Hogan Creek Formation. Locally intruded by pegmatite dikes.