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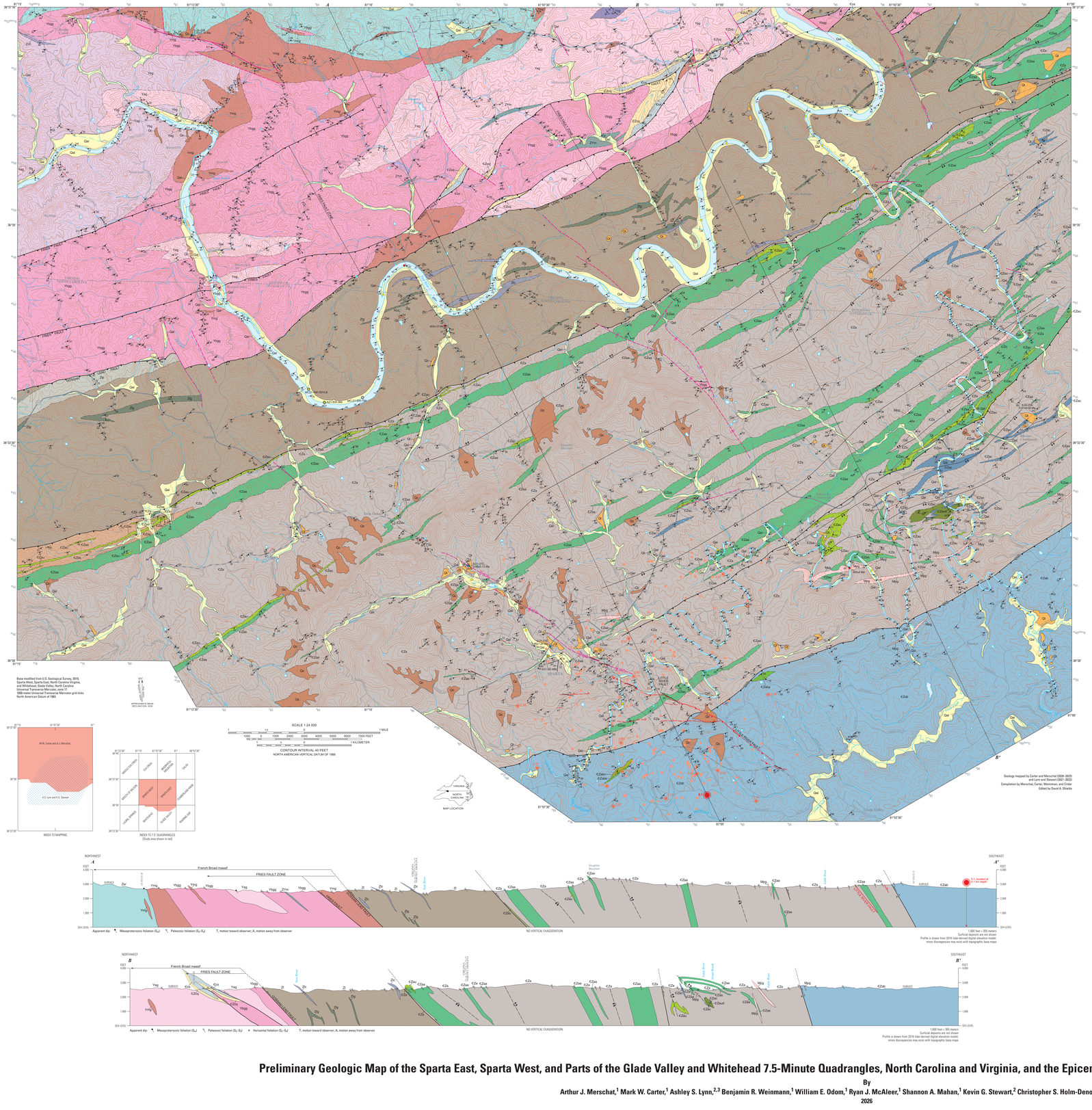

CORRELATION OF MAP UNITS

DESCRIPTION OF MAP UNITS

[Mineral modifiers are described in order of increasing abundance for both igneous and metamorphic rocks]

SURFICIAL DEPOSITS

Qal **Alluvium (Quaternary)**—Poorly to well-sorted, massive to well-bedded, unconsolidated sediments ranging from silt to boulders along rivers, streams, and creeks. Generally, consists of well-stratified beds of micaceous silt, sand, and pebbles to boulders ranging from 1 centimeter (cm) to 2 meters (m). Pebbles, cobbles, and boulders are subrounded to rounded. Deposits were mapped using a combination of field observations, topographic maps and hillshade raster images derived from 1-meter (m) lidar data; minor discrepancies may exist between the mapped alluvium and features on the topographic base map. Includes modern river and stream floodplains and terraces adjacent to the modern floodplain; internal contacts demarcating terraces or abandoned stream channels may be mapped locally. Thickness ranges from centimeters to less than 1 m in tributary streams and creeks to 1 to 3 m along the Little River and New River. Only optically stimulated luminescence ages suggest sediment was deposited 10,000 to 200 years before present (Carter and others, 2023).

Qc **Colluvium (Quaternary)**—Poorly sorted, unconsolidated sediments deposited on lower slopes and valleys, includes debris fans, debris flows, and talus or boulder field deposits. Deposits are matrix to clast supported diamicton of angular to subrounded boulders, cobbles and pebbles of local rocks in a matrix of unstratified clay, silt, and sand. Thickness of deposits is not well constrained and may range from 3 to 30 m.

Qt **Terrace deposits (Quaternary)**—Poorly sorted, unconsolidated sediments ranging from clay to sand with common quartz pebble and cobble cobbles. Deposits are located above the current level of the river, creek, or stream valley and recognized by gentle topography and the presence of well-rounded quartz gravels and weathered cobbles. Terraces may be composite and are modified by subsequent erosion. Thickness varies from 10 cm to over 50 cm. Cosmogenic radionuclide burial ages were determined for four deposits, and yielded mean burial ages of 470 to 430 kilo-annum (ka) (Odom and others, 2022; 2023; 2024)

IGNEOUS INTRUSIVE ROCKS

Mzg **Pegmatitic granite (Mesoproterozoic)**—Light gray to tan weathering, white to light gray, coarse-grained to pegmatitic, massive to weakly foliated, biotite-muscovite granite to granodiorite. Contains xenoliths of biotite gneiss, mica schist, and amphibolite; locally, crosscut by aplite dikes and quartz veins, some of which are parallel to and concordant with the foliation. Occurs as dikes 1 to 24 m wide that are weakly discordant to the regional foliation. A SHRIMP U-Pb zircon crystallization age of 345±5 Ma was obtained for a sample from an outcrop on the Little River (Merschat and others, 2024).

METAMORPHOSED SEDIMENTARY AND IGNEOUS ROCKS

CHILLHOWIE GROUP

Ccs **Sericite schist (Cambrian)**—Gray to light gray, locally sulfidic to rusty weathering, gray to dark-gray quartz sericite schist to phyllonite. Correlated with metasiltstones and slates of the Chilhowie Group

CZabj **Quartzite and metaconglomerate (Cambrian to Neoproterozoic)**—White to light tan and slightly rusty weathering, white, protomylonitic to mylonitic sericitic quartzite to metaconglomerate containing granules to pebble-sized clasts. Graded beds are preserved locally. Correlated with sandstones, quartzites, and conglomerate of the Unicoi Formation of the Chilhowee Group

ALLIGATOR BACK METAMORPHIC SUITE

[Stratigraphic order is unknown]

CZab **Pinistriped mica gneiss and schist (Cambrian to Neoproterozoic)**—Light-gray to light-greenish-gray weathering and locally rusty, finely laminated or "pin-striped," magnetite-bearing muscovite-biotite-plagioclase-quartz gneiss to thinly layered metagraywacke with interlayered finely-laminated garnet-biotite-muscovite schist, garnet-muscovite schist, and thinly layered laminated biotite gneiss; locally, mylonitic along fault contact with Ashe Metamorphic Suite. May contain minor quartzite, metaconglomerate, and amphibolite. Interfolial isoclinal folds are common in the pin-striped gneiss, biotite-muscovite schist interlayers, and some finely laminated metagraywacke. Garnet porphyroblasts up to 1 cm may occur; garnet varies from syn- to post-kinematic and appears to truncate pin-striped folia. Locally, may contain abundant folded and (or) boudinaged quartz lenses. Rocks are locally sulfidic. Magnetite is present as millimeter (mm)-sized grains in mafic mineral aggregates in the pin-striped gneiss/metagraywacke and is a diagnostic characteristic of the unit near the contact with the Ashe Metamorphic Suite and other more highly strained horizons

CZmm **Amphibolite (Cambrian to Neoproterozoic)**—Dark-greenish-black to black, medium- to coarse-grained, strongly foliated, amphibolite-to-granulite facies metagabbro and other more highly strained hornblende gneiss to schist. Locally, may contain garnet

CZabu **Meta-ultramafic rock (Cambrian to Neoproterozoic)**—Light-tan to ochre weathering, light-greenish-gray to white, fine- to coarse-grained, metamorphosed ultramafic rock consisting of chlorite-magnesiocarpholite-magnesiocummingtonite-hornblende schist to ilmenite-magnetite-chlorite-talc-tremolite schist. Tremolite porphyroblasts may be 1 to 3 cm long and blocky. Locally, may be strongly magnetic

ASHE METAMORPHIC SUITE

[Stratigraphic order is unknown]

CZa **Metagraywacke and schist (Cambrian to Neoproterozoic)**—Medium- to light-gray, locally rusty and sulfidic, medium- to coarse-grained, strongly foliated to porphyroclastic to mylonitic, locally garnetiferous, muscovite-biotite-plagioclase-quartz gneiss with interlayered muscovite-biotite schist, biotite schist, and muscovite schist; interpreted as metamorphosed graywacke and pelite. Contains subordinate metaconglomerate layers, quartzite, and sub-calcsilicate; locally, migmatitic or intruded by felsic to pegmatitic dikes. Locally, may contain abundant folded and (or) boudinaged quartz lenses, which are up to several cm thick. Bedding is locally preserved and minor metaconglomerate (**CZac**) beds or layers occur; these are mapped as separate units in locations around the meta-ultramafic body at Clark Hop Road and south of the NC-18 bridge over the Little River

CZae **Muscovite schist and metagraywacke (Cambrian to Neoproterozoic)**—Dark-gray to medium-gray weathering, locally sulfidic, silvery gray, strongly foliated, locally carbonaceous, porphyroblastic, lepidoblastic garnet-kyanite-staurolite-plagioclase-quartz-biotite-muscovite schist and interlayered thinly-layered metagraywacke-biotite gneiss

CZac **Metaconglomerate and metagraywacke (Cambrian to Neoproterozoic)**—Light-gray to medium-gray, strongly foliated, porphyroclastic to mylonitic, matrix- to clast-supported metaconglomerate and mica schist. Metaconglomerate beds and layers contain granules to pebbles of quartz, feldspar, and minor recrystallized muscovite-biotite granitic lithic clasts; bedding and graded beds are preserved locally; the best exposures of metaconglomerate are in or along the Little River from Riverside Drive road to the river bend south and west before the bridge over the Little River on NC-18, and in a roadcut on NC-18 near Blevins Crossroads in the eastern part of the Sparta East 7.5-minute quadrangle

CZaa **Amphibolite (Cambrian to Neoproterozoic)**—Black, medium- to coarse-grained, strongly foliated, nematoblastic, magnetite-biotite-quartz-hornblende schist to garnet-quartz-plagioclase-hornblende gneiss; quartz-hornblende schist contains 1- to 5-mm thick quartz±epidote bands parallel to foliation; locally, isoclinally folded. Amphibolite schist contains plagioclase, quartz, and hornblende, with trace amounts of apatite, Fe-sulfides, clinozoisite, epidote, and ilmenite. Hornblende gneiss is medium- to coarse-grained, granoblastic, foliated to layered amphibolite with nearly equal amounts of plagioclase and hornblende, and minor amounts of garnet, clinozoisite, epidote, and quartz; contains trace amounts of apatite, Fe-sulfide, and ilmenite. Garnets are often a few millimeters across and may occur as porphyroblasts with internal quartz trails (snowball garnets), coronas around plagioclase, or rarely approximately 1-cm porphyroblasts. Hornblende aggregates with quartz and plagioclase define a mineral lineation. Small ultramafic bodies (**CZabu**) are often closely associated with the amphibolite; thin layers of metagraywacke and muscovite schist (**CZa**) may occur within the unit

CZau **Meta-ultramafic schist (Cambrian to Neoproterozoic)**—Light-orangish-gray to tan weathering, greenish-blue-gray to greenish-gray to white, fine- to coarse-grained, nematoblastic to porphyroclastic, ilmenite-magnetite-chlorite-talc-tremolite schist. Locally, contains minor amounts of talc and includes m-scale boudins and layers of amphibolite and metadunite. Amphiboles, tremolite-actinolite, and magnesiohornblende, define a mineral lineation (L_M or L_E). Rocks of this unit often weather in relief and occur as spines or fins 1 to 2 m tall and wide, and extends along strike from 10 m to over 100 m

CZbab **Meta-ultramafic rocks at Clark Hop Road (Cambrian to Neoproterozoic)**—Light-orangish-gray to dark-gray weathering, greenish-blue-gray to greenish-gray to brownish-green, fine- to coarse-grained, nematoblastic to diablastic, ilmenite-magnetite-chromite-chlorite-magnesiocastelnite-talc-tremolite schist to ilmenite-magnetite-chromite-ilmenite-dolomite, and metadunite. Locally, contains metachromite layers and includes m-scale boudins and layers of amphibolite schist. Informally named the meta-ultramafic body at Clark Hop Road for exposures on hillslopes around Brush Creek on Clark Hop Road

LYNCHBURG GROUP

Metaigneous Intrusive Rocks

Zg **Metagabbro (Neoproterozoic)**—Dark-gray to black, medium- to coarse-grained, moderately foliated, nematoblastic, quartz-biotite-plagioclase-hornblende gneiss to metagabbro. Occurs as 10-cm to 1-m-thick layers spaced 3 to 5 m apart, or as several m-thick layers that are subparallel to, and locally, may cut the regional foliation in the Lynchburg Group metagraywacke (**Zp**); these are interpreted as possible mafic dikes. A zeolcat on NC-21, 1.5 kilometers (km) south of the bridge over the New River, contains several 10-cm- to 1-m-thick metagabbro dikes. A dike was sampled for SHRIMP U-Pb zircon geochronology and yielded an age of 455±12 Ma (Merschat and others, 2024), interpreted as the time of intrusion and crystallization of the dike; however, this Ordovician age does not agree with previous interpreted ages of mafic rocks in the Lynchburg Group as Late Proterozoic and (or) Cambrian, but we have included it in this report in unit **Zg**.

Metasedimentary Rocks

Zp **Graphitic schist (Neoproterozoic)**—Dark-gray to medium-gray weathering, locally sulfidic, silvery gray, porphyroclastic, lepidoblastic, graphitic garnet-plagioclase-quartz-biotite-muscovite schist with minor interlayered metagraywacke; graphite may be locally abundant. Garnet porphyroblasts to porphyroclasts are typically 1 to 3 mm in diameter. Interlayered metagraywacke varies from thinly layered to thin layers with quartz and feldspar granules. Mapped in the western part of Sparta West 7.5-minute quadrangle

Zr **Metagraywacke and graphitic schist (Neoproterozoic)**—Dark-gray to medium-gray weathering, locally sulfidic, medium- to coarse-grained, strongly foliated, porphyroclastic to conglomeratic muscovite-biotite-K-feldspar-plagioclase-quartz gneiss interlayered with silvery gray to dark-gray, porphyroclastic graphitic muscovite-garnet-plagioclase-quartz-biotite-muscovite schist to phyllonite; graphite in schist and some gneiss layers may be locally abundant. Layering varies in thickness from decimeters to meters and transposed relict bedding may be preserved; quartz and K-feldspar granules to pebbles define conglomeratic beds and some are mapped separately (**Zc**). Siliceous calcite-marble and calc-silicate layers are 10- to 20-cm thick and occur locally. Amphibolite layers 10- to 70-cm thick occur subparallel to foliation and layering; these may represent transposed mafic dikes and sills (**Zg**). Garnet porphyroblasts to porphyroclasts are usually 5 to 10 mm across; garnets are rotated with asymmetric foliation tails with top-to-the-northwest kinematics. Staurolite porphyroblasts, where present, are 1 to 4 cm long and randomly oriented. S-C foliations form folia "buttons" with top-to-northwest kinematics. Phyllonitic to porphyroclastic textures are more strongly developed within approximately 1,000 m of the Gossan Lead thrust; kinematic indicators are top-to-northwest. Cross biotite that is 2 to 4 mm long defines an intersection lineation in some metagraywacke and schist; aggregate mineral stretching lineations are defined by quartz, muscovite, biotite, and feldspar. Well-exposed in roadcuts along Highway 58 and US 221 west of the bridge over the New River; the northwest and southeast contacts of the Lynchburg Formation are faults; the base and top of the formation, as well as the thickness, are unknown

Zc **Metaconglomerate and metagraywacke (Neoproterozoic)**—Light-gray to medium-gray, strongly foliated, porphyroclastic metaconglomerate interlayered with metagraywacke and mica schist. Metaconglomerate beds and layers contain granules to pebbles of quartz and feldspar; bedding and graded beds are preserved locally; metaconglomerate is exposed in the New River below the US 221/NC-21 bridge, 600 m north of the Virginia-North Carolina State line

FRENCH BROAD MASSIF

CROSSNORE COMPLEX

Zrd **Granophyre dike (Neoproterozoic)**—Light-gray to tan weathering, gray, weakly foliated, medium- to coarse-grained, porphyritic granophyre with phenocrysts of quartz and K-feldspar 1 to 7 mm across. Occurs in only one location in a pasture near Bridle Creek Road. Correlated with the Striped Rock Granite (**Zsr**)

Zsr **Striped Rock Granite (Neoproterozoic)**—Light-gray to tan weathering, white to light-gray, medium- to coarse-grained, massive to weakly foliated, equigranular to porphyritic, biotite granite. Contains diagnostic trace amounts of purple to reddish fluorite. Biotite (1 to 2 mm) and possible Na-amphiboles form coarse clots and folia; retrogression to chlorite replaces some biotite. K-feldspar is 1 to 1.5 cm across, blocky, perthitic, and some have Carlsbad twins; alignment of K-feldspar and biotite locally define a magmatic foliation. Contains xenoliths of migmatitic biotite gneiss and schist, and amphibolite (**Ymg**), and locally is cut by aplite and felsic dikes. Often forms rounded exfoliation cliffs, pavement surfaces, and spheroidal boulders. A U-Pb zircon crystallization age of 746±11 Ma was obtained for a sample from an abandoned quarry in the Elk Creek quadrangle (Essex, 1992) north of the map area

Zrm **Mafic-ultramafic intrusive rock (Neoproterozoic to Mesoproterozoic)**—Dark-gray to black to greenish-gray to blue-green, fine- to coarse-grained subophitic metagabbro to epidote-chlorite-actinolite-plagioclase schist; most intrusions are decimeters to a meter thick and transposed into the Paleozoic foliation; several larger bodies are mapped and may be up to 50 m thick. A zircon and a U-Pb age of 737±7 Ma was obtained from a mafic dike in the Park 7.5-minute quadrangle, west of the map area (Tollo and others, 2012). Corresponds to the Catron diorite of Stose and Stose (1957)

METAGNEOUS ROCKS

Yag **Augen gneiss (Mesoproterozoic)**—Medium- to dark-gray, protomylonitic to mylonitic, porphyroclastic to gneissic, garnet- and muscovite-bearing, biotite-quartz-alkali-feldspar-plagioclase gneiss. Consists of 0.5- to 2-cm plagioclase and 1- to 3-cm alkali feldspar porphyroclasts in a medium-grained matrix of biotite, quartz, and plagioclase. Garnets are subhedral to euhedral and 1 to 2 mm in diameter. U-Pb zircon ages, interpreted as crystallization ages, are 1,068 to 1,046 Ma (Odom, 2020)

Ybg **Biotite metagranite (Mesoproterozoic)**—Light-tan to white, massive to moderately foliated, coarse-grained, equigranular biotite metagranite; locally, the best exposures of metaconglomerate are in or along the Little River from Riverside Drive road to the river bend south and west before the bridge over the Little River on NC-18, and in a roadcut on NC-18 near Blevins Crossroads in the eastern part of the Sparta East 7.5-minute quadrangle

Ybgg **Biotite granitic gneiss (Mesoproterozoic)**—Light- to medium-gray, strongly foliated to mylonitic, coarse-grained to porphyritic, biotite metagranite, biotite granite gneiss, and leucocratic biotite granite gneiss with biotite schist and gneiss layers; may contain xenoliths of biotite gneiss, granofels, and amphibolite. Mylonitic granitic gneiss is a porphyroclastic schlieric±biotite-white-mica-quartz-feldspar mylonite to phyllonite

Yog **Megacrystic biotite metagranite (Mesoproterozoic)**—Medium-gray, massive to weakly foliated, megacrystic biotite metagranite. K-feldspar megacrysts are blocky and up to 10 cm long

PARAGNEISSIC ROCKS

Yng **Migmatitic paragneiss (Mesoproterozoic)**—Rusty, reddish-brown weathering, slightly sulfidic, strongly foliated, migmatitic, garnet-muscovite-quartz-biotite gneiss to schist, and biotite-quartz-feldspar granofels, with trace to accessory sillimanite, ilmenite, zircon, monazite, and Fe-sulfides. Contains pods and bundles of amphibolitic migmatitic layering is parallel to the gneissic foliation and is locally cut by pegmatitic dikes. The foliation (S_M) is Mesoproterozoic and locally overprinted by a strong Paleozoic foliation defined by muscovite and is locally mylonitic. SHRIMP U-Pb analyses of detrital zircons show abundant 1,400 to 1,300 Ma grains and a few grains as old as 1,700 Ma (Merschat and others, 2024); metamorphic rims on zircon are approximately 1,060 Ma (Merschat and others, 2024). Corresponds with the Saddle gneiss of Stose and Stose (1957)

EXPLANATION OF MAP SYMBOLS

Contact—Solid where location is known, dashed where location is approximate (located to within 25 meters [m], or 82 feet [ft]); dotted where covered by water or surficial material

Internal contact—Distinct surfaces that occur along second order and higher order branch streams within alluvium, and in permanently abandoned stream channels. Internal contacts were constructed from both field observation and hillshade raster images derived from 1-m lidar

FAULTS

[Solid where the location is known, dashed where location is approximate (located to within 25 m, or 82 ft, unless otherwise stated); dotted where covered by water or surficial materials]

High-strain symetamorphic fault—Sawteeth on upper plate; arrows show relative movement, where known

Brittle fault—Steeply dipping fault; displacement and kinematics are indicated where known; U, upthrown side; D, downthrown side; arrows show relative movement

Little River fault—Coseismic surface rupture from the August 9, 2020, Mw 5.1 earthquake. The Little River fault and related splays were mapped on newly acquired high-resolution (QL1) lidar (Merschat and Carter, 2023). Locations along faults associated with the rupture are considered more precise than a standard 1:24,000-scale map. Solid lines show where the location is known and mapped within 1 m; long-dashed lines show where faults are approximate and located within 3 m; and short-dashed lines show where faults are inferred and located within 5 m

Thrust fault—Sawteeth on upper plate

Thrust fault with scarp—Sawteeth on upper plate; hachures point downscarp

Fault—Movement type unknown or unspecified; queried where existence or identity are questionable

FOLDS

[Location is known or approximate; dotted where covered by water or surficial materials. Symbols show trace of axial surface and direction of dip of limbs; where known, arrow at the end of the axial trace indicates direction of plunge]

Overturned antiformal fold axis

Overturned synformal fold axis

PLANAR FEATURES

[Symbols may be combined; point of intersection shows location of measurement. Listed from youngest to oldest

Strike and dip of inclined brittle fault

Strike and dip of inclined quartz and (or) manganese vein

Strike and dip of inclined axial surface of fold

Strike and dip of crenulation cleavage

Strike and dip of inclined Paleozoic foliation (S_E)

Strike and dip of inclined Paleozoic high-strain (mylonitic) foliation (S_F)

Strike and dip of inclined penetrative Paleozoic foliation (S_E)—In hillslopes of the eastern Blue Ridge, this may represent a composite (S_E-S_F) foliation

Strike and dip of inclined Paleozoic foliation (S_E) parallel to compositional layering or bedding

Strike and dip of inclined bedding

Strike and dip of inclined overturned bedding

Strike and dip of Neoproterozoic magmatic foliation and (or) compositional layering

Strike and dip of inclined Mesoproterozoic foliation (S_M)

LINEAR FEATURES

[Symbols may be combined; point of intersection shows location of measurement. Listed from youngest to oldest]

Bearing and plunge of slickenline

Bearing and plunge of crenulation axis

Bearing and plunge of late open-fold axis, Paleozoic (F_E)

Bearing and plunge of tight to isoclinal minor fold axis (F_E or F_F)

Bearing and plunge of intersection lineation—Intersection between Mesoproterozoic foliation (S_M) and Paleozoic foliation (S_E), or intersection between Paleozoic foliations (S_E and S_F or S_F and S_F)

Bearing and plunge of Paleozoic mineral lineation (L_E or L_F)

Bearing and plunge of Paleozoic F_E fold axis

Bearing and plunge of Mesoproterozoic fold axis

OTHER SYMBOLS

Earthquake epicenters (U.S. Geological Survey, 2022)

Magnitude less than 2.0

Magnitude 2.0–4.0

Magnitude 5.1 mainshock

Abandoned borrow pit (fill, fill material)

Abandoned quarry (Qa, crushed stone; Ba, barite)

Potential paleoliquefaction site—May be combined with optically stimulated luminescence (OSL) sample location. Sample numbers (for example, MC-21-SW-794) are identified in Mahan and others (2025) and Merschat and others (2026)

Geochronology sample—Location of uranium-lead (U-Pb) zircon age (with uncertainty of 2 sigma) in million years before present (Ma, mega-annum) by sensitive high-resolution ion microprobe (Merschat and others, 2024). Sample age is shown, where known

Cosmogenic nuclide sample—Location of sand and quartz gravels sampled for $^{26}Al/^{10}Be$ isochron burial ages (Odom and others, 2022, 2024; Merschat and others, 2024); sample location numbers (for example, 9-21-21C) from source publications are shown. Ages are in Ma

Optically stimulated luminescence (OSL) sample location (Mahan and others, 2025)

INTRODUCTION

New bedrock and surficial geologic mapping in the Sparta East, Sparta West, and parts of the Glade Valley and Whitehead 7.5-minute quadrangles, North Carolina and Virginia, investigates the geologic framework and causative mechanism of the August 9, 2020, Mw 5.1 earthquake near Sparta, North Carolina. The mapping documents (1) the coseismic surface rupture from the 2020 earthquake and related brittle structures in the bedrock; (2) the fault contact between the western Blue Ridge and eastern Blue Ridge; (3) lithostratigraphy of the Lynchburg Group, Ashe Metamorphic Suite, and Alligator Back Metamorphic Suite; (4) the nature of the contact between the Lynchburg Group, Ashe Metamorphic Suite, and Alligator Back Metamorphic Suite; and (5) surficial deposits.

DISCUSSION

Bedrock in the map area consists of deformed and metamorphosed Mesoproterozoic to Paleozoic igneous and sedimentary rocks. In the northwestern part of the map area, there are Mesoproterozoic gneisses (Ymg, 1.3 giga-annum [Ga]; Merschat and others, 2024) and granites (Ybg, Ybgg, Yog, 1.2–1.0 Ga; Tollo and others, 2017) of the western Blue Ridge. These are intruded by the Neoproterozoic Striped Rock Granite (**Zsr**; ~746 mega-annum [Ma]; Essex, 1992) and granophyre dikes (**Zrd**), and by Mesoproterozoic to Neoproterozoic mafic dikes (**Zrm**). Mesoproterozoic (S_M) and folds are preserved in the crossmore complex. The rocks are overprinted by a late Paleozoic greenschist-facies foliation that intensifies into several-mesometamorphy high-strain shear zones of the Fries fault zone; rocks within the shear zones are white-mica phyllonites to ultramylonites. Kinematic indicators in the Fries fault zone consistently document top-to-northwest thrust motion. To the southeast, the polydeformed eastern Blue Ridge is juxtaposed over the western Blue Ridge along the Gossan Lead fault, an approximately 1 kilometer (km)-wide amphibolite-facies shear zone. Lithostratigraphy in the northwestern part of the eastern Blue Ridge consists of interlayered graphitic mica schists (**Zp**), metagraywacke and graphitic schist (**Zr**), metaconglomerate and metagraywacke (**Zc**), and metagabbro (**Zg**) assigned to the Lynchburg Group. A sensitive high-resolution ion microprobe (SHRIMP) uranium-lead (U-Pb) zircon age of 455±12 Ma was obtained on an approximately 1 meter (m)-thick metagabbro dike that intruded metagraywacke in the Lynchburg Group (Merschat and others, 2024). Lynchburg Group rocks are separated from meta-ultramafic-bearing rocks of the Ashe Metamorphic Suite by an unnamed amphibolite-facies fault. The Ashe Metamorphic Suite consists of metagraywacke and schist (**CZa**), muscovite schist and metagraywacke (**CZae**), metaconglomerate and metagraywacke (**CZac**), amphibolite (**CZaa**), and meta-ultramafic schist and bottle-bearing granofels (**CZau**). Several weakly discordant muscovite- and biotite-bearing pegmatitic granite dikes (**Mzg**) intruded the Ashe and Alligator Back Metamorphic Suites. A SHRIMP U-Pb age of 345±5 Ma was obtained from the pegmatitic granite unit (Merschat and others, 2024). The structurally higher Alligator Back Metamorphic Suite consists of pinstriped mica gneiss and schist (**CZab**). The contact between the Ashe and Alligator Back Metamorphic Suites is a second shear zone.

Northeast-southwest trending structures dominate the eastern Blue Ridge and include relict S_M bedding, transposed S_E foliations and intrafolial F_E folds, and a penetrative regional Paleozoic foliation (S_E) that locally is a composite of S_E and S_F; the mean strike and dip of the Paleozoic foliation is 063°/52° southeast (right-hand rule). Map-scale isoclinal F_E folds are overprinted by an S_E foliation associated with shear zones and F_F folds. Late F_E open folds and crenulations superpose earlier structures. There are many outcrop- to map-scale brittle faults mapped throughout the map area. The faults are commonly marked with slickenlines, and locally with zones of cataclasite including iron-oxide cemented breccia.

Surficial deposits include alluvium (**Qal**), colluvium (**Qc**), and terrace deposits (**Qt**). Alluvium (**Qal**) is mapped in floodplains of rivers and streams, and includes internal contacts identified in the field and through lidar interpretation. Colluvium (**Qc**) is mapped on lower slopes and may include several different types of deposits. Terrace deposits (**Qt**) are mapped above the New River, Little River, Bledsoe Creek, and major tributaries.

In the upmost area of the earthquake, the Little River fault (strike and dip of approximately 110°/45–60° southwest) is mapped for approximately 4 km, and similarly oriented brittle faults occur in the Bledsoe Creek valley up to 4 km to the northwest. Iron- and manganese-oxide-cemented, strained brittle faults and surfaces are common; manganese oxide-cemented breccias occur locally. In the epicentral area, undeformed terrace deposits above Bledsoe Creek overlie a brittle fault and yield cosmogenic burial ages of approximately 470 to 430 kilo-annum (ka) (Merschat and others, 2024), placing a minimum age of fault motion in that locality. Potential paleoliquefaction structures were identified at three locations along the New River and one location on Bledsoe Creek.

This report includes a surficial and bedrock geologic map with cross sections, description of map units, correlation of map units, explanation of map symbols, and a GeMS level 3 geodatabase (Merschat and others, 2026).

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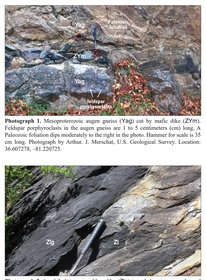

Photograph 1. Mesoproterozoic augen gneiss (**Yag**) cut by mafic dike (**Zrm**).