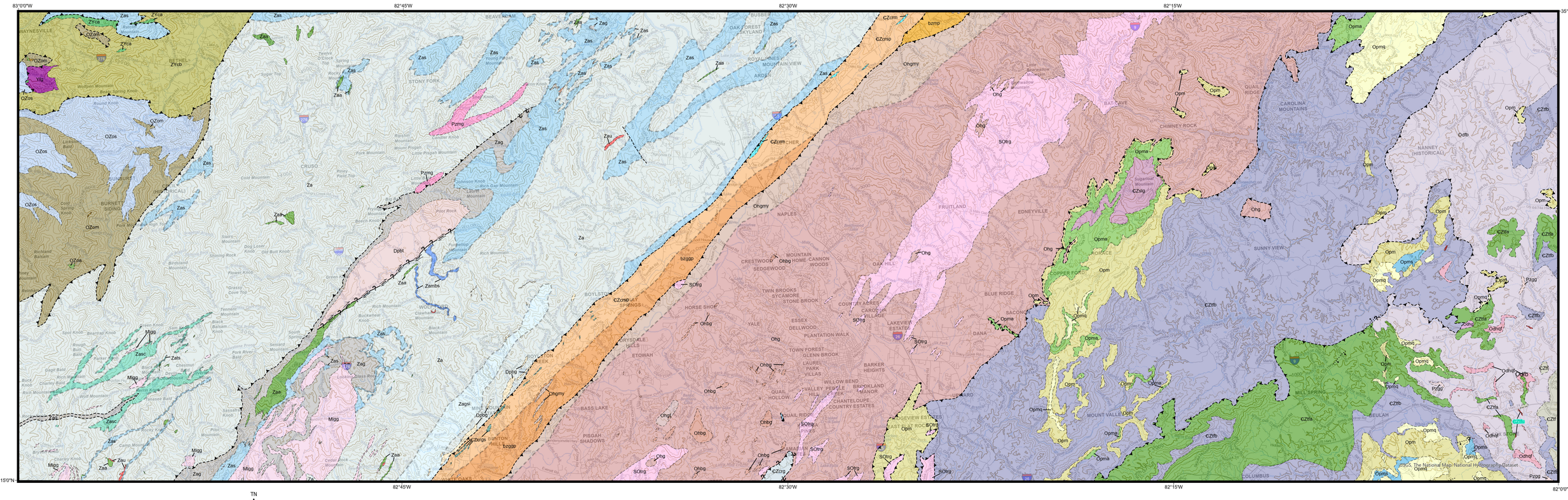
North Carolina Department of Environmental Quality
Division of Energy, Mineral, and Land Resources
William E. Toby Vinson, Jr., Division Director
Dwain Michael Veach, State Geologist

North Carolina Geological Survey
OFR 2025-03

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

NCGS Open File Report 2025-03: Compiled bedrock geologic map of the northern half of Hendersonville 30' x 60' Quadrangle



BEDROCK GEOLOGIC COMPILATION MAP OF THE NORTHERN HALF OF THE HENDERSONVILLE 1:100,000 QUADRANGLE, NORTH CAROLINA

By Bart Cattanach, Ashley Lynn, Brennan Trantham, Jesse Hill, and Thomas Douglas

Bedrock mapping from 1972 to 2024. Map preparation, digital cartography, and editing done by Ashley Lynn, Bart Cattanach, Brennan Trantham, and Jesse Hill.

Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200
Projection: Lambert Conformal Conic
Datum: North American 1983

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

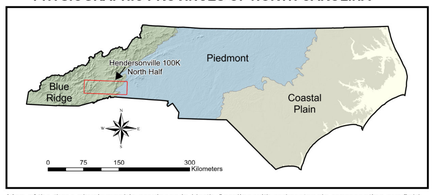
Imagery	NAIP, September 2020 - September 2020
Roads	U.S. Census Bureau, 2016
Roads within US Forest Service Lands	FSTopo Data with limited Forest Service updates, 2016
Names	GNIS, 1980 - 2022
Hydrography	National Hydrography Dataset, 2004 - 2021
Contours	National Elevation Dataset, 2022
Boundaries	Multiple sources; see metadata file 2017 - 2021
Wetlands	FWS National Wetlands Inventory Not Available

TN
MN
UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
LV
Grid Zone Designation
17S

ROAD CLASSIFICATION
Interstate — Major Road
Highway — Local Road

PHYSIOGRAPHIC PROVINCES OF NORTH CAROLINA



Map of the three physiographic provinces in North Carolina with red rectangle representing our field area.

SCALE 1:100,000

0 1.25 2.5 5 7.5 10 Kilometers
0 1.25 2.5 5 7.5 10 Miles

CONTOUR INTERVAL 200 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This product was produced to conform with the National Geospatial Program US Topo Product Standard.

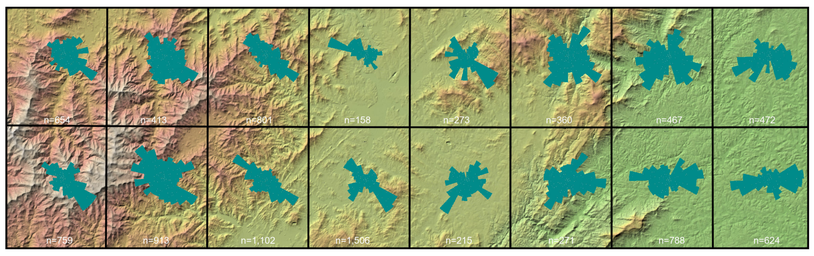
SYMBOLOGY

CONTACTS
Zone of Confidence: 300m

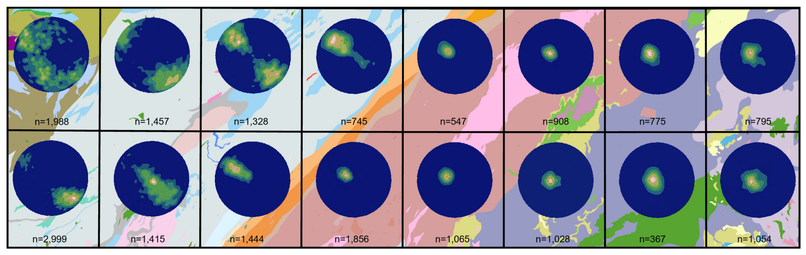
- Contact—Identity and existence certain, location inferred
- Contact—Identity and existence questionable, location inferred
- Gradational contact—Identity and existence certain, location inferred
- Fault (generic: vertical, subvertical, or high-angle: or unknown or unspecified orientation or sense of slip)—Identity and existence certain, location inferred
- Normal fault—Identity or existence questionable, location concealed. Ball and bar on downthrown block
- Thrust fault (1st option)—Identity and existence certain, location inferred. Saw teeth on upper (tectonically higher) plate
- Thrust fault (1st option)—Identity and existence questionable, location inferred. Saw teeth on upper (tectonically higher) plate
- Strike-slip fault, right-lateral offset—Identity and existence certain, location inferred. Arrows show relative motion
- Strike-slip fault, right-lateral offset—Identity and existence questionable, location approximate. Arrows show relative motion
- Strike-slip fault, left-lateral offset—Identity and existence certain, location inferred. Arrows show relative motion

1:24,000-SCALE QUADRANGLE REFERENCE MAP

Numbers correspond with certain references below and the base map polygons correspond with the physiographic province map above.



Rose diagrams of joints for each 7.5-minute quadrangle in the map area. Figure created using a python code developed by Jesse Hill and Brennan Trantham.



Density contours representing foliation poles for each 7.5-minute quadrangle. Contours created using the Kamb Method with exponential smoothing. Figure created using a python code developed by Jesse Hill and Brennan Trantham.

DESCRIPTION OF MAP UNITS

DAHLONEGA GOLD BELT TERRANE

OTTO FORMATION

OZom **Metasandstone-** Light to medium gray, fine- to medium-grained muscovite-garnet-biotite-plagioclase-quartz gneiss with interlayers and lenses of medium-grained calc-silicate. Metamorphic layering ranges from 1 cm to greater than 2 m, is generally parallel to foliation, and locally migmatitic. May be Ashe or Tallulah Falls Formation in the Ratcliff Mountain and Raccoon Creek windows. Adapted from Merschat (2009).

OZoa **Amphibolite-** Dark gray to black, medium-grained plagioclase-hornblende gneiss to hornblende schist. Adapted from Merschat (2009).

OZos **Schist and metasandstone-** Silvery gray to light gray, fine- to medium-grained, porphyroblastic, lepidoblastic quartz-plagioclase-garnet-biotite-muscovite-sillimanite schist interlayered with lesser amounts of medium gray, migmatitic, fine- to medium-grained muscovite-sillimanite schist, and garnet-bearing biotite-plagioclase-quartz gneiss. Schist may be variably migmatitic and/or sulfidic with bright yellow to orange–yellow stains. Subordinate metasandstone layers range from a few centimeters to several meters thick. Layers and lenses of medium-grained calc-silicate occur in both schist and metasandstone, but are more common in the latter. Adapted from Merschat (2009).

OZou **Metadunite-** Light to medium grayish green, fine- to medium-grained, granoblastic to weakly foliated metadunite. Contains minor chromite and talc. Adapted from Merschat (2009).

CARTOOGECHAYE TERRANE

ZYcb **Biotite gneiss-** Light-gray to medium-gray; medium- to coarse-grained; equigranular to inequigranular; lepidoblastic to granoblastic; well-foliated and commonly a straight gneiss; migmatitic; coarse biotite is characteristic.

ZYca **Amphibolite-** Dark-greenish-gray to black; fine- to coarse-grained; nematoblastic to granoblastic; massive to well-foliated, locally biotite and garnet rich; commonly migmatitic.

Mesoproterozoic Felsic Gneisses

Yfg **Felsic and biotite gneiss-** Light- to medium-gray; well-foliated; layered; migmatitic; fine- to medium-grained; consists of plagioclase, quartz, biotite, garnet, and minor accessory minerals. Commonly contains thin layers of porphyroblastic garnet, quartz, plagioclase, biotite schist and rare lenses of medium- to coarse-grained, migmatitic garnet amphibolite. Description adapted from Merschat (2009).

WESTERN TUGALOO TERRANE

Pzmg **Migmatite-** White to very-light-gray; non-foliated to weakly foliated; medium- to coarse-grained; equigranular; granoblastic; occurs commonly as thin layers and lenses (thickness of layering ranges from centimeters to meters) within other rock types and mappable bodies; locally gradational with pegmatite; consists of plagioclase feldspar, potassium feldspar, quartz, muscovite, sericite, and biotite. Migmatite (neosome) was most likely derived from local melting during regional high-grade metamorphism.

Looking Glass Pluton

Mlgg **Granitic gneiss-** Light gray; non-foliated to foliated; medium- to coarse-grained, granoblastic to lepidoblastic; quartz diorite to granodiorite; consists of plagioclase (oligoclase-andesine), potassium feldspar, quartz, minor biotite and muscovite, and traces of zircon and opaque minerals. Description adapted from Acker (1982).

Pink Beds Pluton

Dpbg **Granitoid gneiss-** White to very light-gray, non-foliated to mylonitic; medium- to coarse-grained; equigranular; granoblastic; occurs commonly as thin layers and lenses (thickness of layering ranges from centimeters to meters) within and cross-cutting Ashe Metamorphic Suite/Tallulah Falls Formation rock types and as mappable bodies; typically trondhjemitic to granitic in composition and consists of 1-60% potassium feldspar, 5-55% plagioclase feldspar, 15-30% quartz, 5-15% muscovite and sericite, and minor biotite and opaques. Granitoid gneiss is possibly related to Pink Beds trondhjemite (Dpbt).

Dpbt **Trondhjemite-** Light gray to very light-gray; non-foliated to weakly foliated; medium- to coarse-grained; equigranular; occurs as massive outcrops. Consists of 45-55% plagioclase, 30-40% quartz, 0-10% potassium feldspar, 0-3% biotite, and 1% opaques. Locally migmatitic and foliated to mylonitic near the contact with Ashe Metamorphic Suite/Tallulah Falls Formation rock types.

ASHE METAMORPHIC SUITE

Za **Undivided-** Heterogeneous unit consisting of interlayered layers and lenses of laterally and vertically grading sedimentary and mafic volcanic rocks metamorphosed to kyanite and sillimanite grade. Rock types include schist, schistose metagraywacke, metagraywacke, conglomeratic metagraywacke, metaconglomerate, metasandstone, amphibolite, and minor calc-silicate. Thickness of layering ranges from centimeters to meters. Where possible Za was mapped and subdivided based on dominant rock type into the following lithologic map units:

Zasc **Chloritoid schist-** Mottled, silvery-white to silvery-medium-gray; fine- to medium-grained; lepidoblastic to porphyroblastic; inequigranular; strongly foliated; in meter-thick layers.

Zats **Tourmaline schist-** Dark greenish black to black, fine- to medium-grained massive quartz-plagioclase-tourmaline schist. Adapted from Merschat (2009).

Zac **Metaconglomerate-** Medium-light-gray to medium-dark-gray; coarse-grained (most commonly granule size, but with some pebble size); inequigranular; granoblastic; non-foliated to weakly foliated; variable thickness; granules are dominantly quartz; commonly interlayered with metagraywacke, schistose metagraywacke, and mica-schist.

Zag **Metagraywacke-** Medium-light-gray to medium-dark-gray; non-foliated to foliated; medium- to coarse-grained; equigranular to inequigranular; granoblastic to lepidoblastic; locally migmatitic; locally porphyroclastic; consists of quartz, sodium and potassium feldspars, biotite, muscovite, and garnet. Interlayered at all scales with mica schist, schistose metagraywacke, and minor conglomeratic metagraywacke and calc-silicate granofels.

Zas **Aluminous schist-** Very-light-gray to greenish-gray to medium-gray; strongly foliated; fine- to medium-grained; equigranular to inequigranular; lepidoblastic to porphyroblastic; consists of muscovite, biotite, quartz, feldspar, garnet, kyanite, and sillimanite; thickness of layering varies; commonly interlayered with schistose metagraywacke.

Zagsi **Sillimanite/kyanite schistose metagraywacke-** Medium-gray to dark-gray; foliated to non-foliated; fine- to medium-grained; equigranular to inequigranular; lepidoblastic to weakly granoblastic; locally migmatitic; consists of quartz, feldspar, biotite, muscovite, and garnet; thickness of layering varies; commonly interlayered with metagraywacke, mica schist, conglomeratic metagraywacke, and minor calc-silicate.

Zambs **Muscovite-biotite schist-** Light-gray to medium-dark-gray; medium- to coarse-grained; foliated; consists of muscovite, biotite, quartz, garnet, and chlorite, with accessory staurolite, kyanite, and pyrite.

WESTERN TUGALOO TERRANE continued

Zaa **Amphibolite-** Dark-green to black; equigranular; fine- to medium-grained; nematoblastic to lepidoblastic; well foliated; occurs as a very minor rock type throughout the Ashe metamorphic suite/Tallulah Falls Formation where it may represent metamorphosed basalt. Locally occurs as a metamorphic alteration of an ultramafic or mafic rock.

Zau **Altered ultramafics-** Dark-green to silvery-grayish-green; fine- to medium-grained; non-foliated to strongly foliated; equigranular; granoblastic to nematoblastic to lepidoblastic; consists of tremolite/actinolite, pyroxene, hornblende, chlorite, talc, serpentine, relict olivine, opaques, plagioclase feldspar, magnetite, and other accessory minerals. These mineralogical variations could not be mapped at a 1:24,000 scale. Amphibolite within and adjacent to this unit occurs as a metamorphic alteration of the ultramafic or mafic rock. Thickness of amphibolitic alteration is variable. Contains inclusions of other variations of altered mafic and ultramafic rock.

EASTERN TUGALOO TERRANE

UNNAMED PALEOZOIC INTRUSIVES

Pzgg Granitoid gneiss- White to pinkish-gray to light-gray; fine- to medium-grained; massive to weakly foliated; equigranular to locally inequigranular; consists of plagioclase feldspar, potassium-feldspar, quartz, biotite, and muscovite. Locally observed to cross-cut and intrude foliated and migmatitic gneisses. Many small bodies are not mappable at this scale.

BREVARD ZONE

bzggp **Mylonitic granitic gneiss/phyllonite-** Medium light gray to yellowish gray; fine- to medium-grained; inequigranular; locally porphyroclastic; strongly foliated; mylonitic, locally protomylonitic. Consists of plagioclase, quartz, potassium feldspar, sericite, muscovite, epidote, biotite, and trace accessory minerals. Rounded to elongated feldspar porphyroclasts are common. Interpreted to be a fault slice of mylonitic Henderson Gneiss interlayered with sericite phyllite by Brevard Zone deformation.

bzmp **Mylonite/phyllonite** - Tan to light-gray to dark-gray to light-olive-gray to greenish-gray; fine- to coarse-grained; lepidoblastic to porphyroblastic; strongly foliated; mylonitic, locally ultramylonitic; consists of sericite, quartz, feldspar, biotite, chlorite, and accessory graphite, garnet, sulfides, magnetite, and opaque minerals. Lenticular muscovite-aggregate porphyroblasts flattened in the mylonitic foliation planes impart a distinctive "fish scale" or "button" appearance to phyllonites. Locally interlayered with mylonitic phyllite, metasandstone, metasiltstone, quartzite, meta-arkose, metagraywacke, muscovite schist, schistose metagraywacke.

TABLE ROCK PLUTONIC SUITE

SOtrgg **Granitic Orthogneiss-** White to medium-gray to light-gray; medium- to coarse-grained; equigranular; granoblastic; mylonitic to protomylonitic; consists of quartz, plagioclase, potassium feldspar, muscovite, biotite, and minor amounts of opaques, epidote, chlorite, and garnet. Differs from Henderson Gneiss in general lack of augen, increased muscovite content, and more felsic composition. Correlative with the 438 Ma intrusives into the Henderson Gneiss of Lemmon (1973). Includes local bodies of metagraywacke not mappable at this scale.

HENDERSON GNEISS LITHODEME

Ohg **Granitic augen gneiss-** Medium-gray to medium-bluish-gray to mottled black and white; inequigranular; medium- to coarse-grained matrix with distinctive megacrysts (augen) of microcline variable in size and abundance; typically protomylonitic to mylonitic; granoblastic to lepidoblastic; massive to well foliated. Protolith is dominantly biotite granite that ranges to tonalite; consists of potassium feldspar, plagioclase, quartz, biotite, muscovite and sericite, epidote group minerals, opaques and trace amounts of titanite, zircon and apatite; locally pegmatitic and migmatitic. Locally microcline augen exceed 3 cm in length. The augen structures are produced by a high temperature protomylonitic overprint. Radiometric age date of approximately 447 Ma (Moecher et al., 2011).

Ohbg **Biotite granodioritic gneiss-** Medium gray to dark gray; fine to medium-grained; equigranular; granoblastic to lepidoblastic; weakly foliated; consists of approximately 43% plagioclase, 32% quartz, 10% potassium feldspar, 5% biotite, 2% muscovite, 2% epidote, 1% opaques, and the alteration minerals sericite (3%) and epidote (2%); locally pegmatitic and migmatitic. Interpreted to be a compositional variation of the Henderson Gneiss. Locally interlayered with typical Henderson Gneiss, layered biotite granitoid gneiss, and granite. Mapped with rare calc-silicate granofels on a ridge east of Bowman Bluff and with a rare amphibolite lens. Locally mylonitic.

Ohgf **Fine-grained granitic augen gneiss-** Medium-gray to medium-bluish-gray; inequigranular; fine- to medium-grained matrix with small megacrysts (augen) of microcline variable in size and abundance; protomylonitic to mylonitic to granoblastic to lepidoblastic; massive to well foliated; dominantly biotite granite that ranges to tonalite; consists of potassium feldspar, plagioclase, quartz, biotite, muscovite, epidote group minerals, opaques, hornblende, titanite, and trace zircon and apatite; locally pegmatitic and migmatitic. The augen structures are produced by a high temperature protomylonitic overprint.

Ohgmy **Mylonitic granitic augen gneiss-** Light-gray to medium-gray, fine-grained, equigranular to inequigranular, mylonitic to protomylonitic, consists of microcline, plagioclase, quartz, biotite, muscovite, epidote group minerals, and sericite. The sericite is a product of mylonitization associated with the Brevard Zone and is derived from feldspars.

DYSARTSVILLE COMPLEX

Odfb **Felsic and biotite gneisses-** Undifferentiated unit composed of complexly interlayered felsic gneiss and biotite gneiss with minor interlayers of amphibolite, pelitic schist, metagraywacke, and metasandstone of the TFF, as well as hornblende gneiss of uncertain affinity. Felsic gneiss — light-tan to light-gray; fine- to coarse-grained; semi-massive to foliated; consists of quartz, plagioclase, potassium feldspar, biotite, white mica, epidote group minerals, hornblende, minor chlorite, and trace opaque minerals. Biotite gneiss — typically gray to grayish-black; medium- to coarse-grained; well foliated; compositionally layered; locally protomylonitic; inequigranular; locally porphyroblastic to lepidoblastic; migmatitic; consists of plagioclase, quartz, biotite, potassium feldspar, muscovite, garnet, epidote group minerals, chlorite, and opaque minerals. Hornblende gneiss — mottled white to greenish-black on fresh surfaces; weathered surfaces are mottled white to dark-reddish-brown; medium- to coarse-grained; foliated; massive to well-layered; equigranular; migmatitic; consists of hornblende, plagioclase, quartz, biotite, epidote group minerals, titanite, actinolite, magnetite, minor muscovite and opaque minerals, and trace apatite, monazite, chlorite, and zircon. Biotite granitic gneiss layers within hornblende gneiss are gray to grayish-black; medium- to coarse-grained; foliated; migmatitic; consists of plagioclase, quartz, biotite, muscovite, hornblende, minor epidote group minerals, sericite, and trace apatite.

Odhg **Hornblende gneiss-** Contains dominantly hornblende gneiss with lesser amounts of biotite gneiss. Hornblende gneiss is mottled white to greenish-black on fresh surfaces; weathered surfaces are mottled white to dark-reddish-brown; medium- to coarse-grained; foliated; massive to well-layered; equigranular; migmatitic; consists of hornblende, plagioclase, quartz, biotite, epidote group minerals, titanite, actinolite, magnetite, minor muscovite and opaque minerals, and trace apatite, monazite, chlorite, and zircon. Biotite granitic gneiss layers within hornblende gneiss are gray to grayish-black; medium- to coarse-grained; foliated; migmatitic; consists of plagioclase, quartz, biotite, muscovite, hornblende, minor epidote group minerals and sericite, and trace apatite.

EASTERN TUGALOO TERRANE continued

Odhqf Hornblende quartzofeldspathic gneiss- Very light-gray to grayish-black, commonly weathers to dark-yellowish-orange; fine- to coarse-grained; foliated; well layered; equigranular; consists of quartz, plagioclase, potassium feldspar, epidote group minerals, biotite, muscovite, hornblende, chlorite, garnet, and trace apatite, rutile, monazite, and opaque minerals; interlayered with amphibolite and hornblende gneiss. Locally contains rotated enclaves (xenoliths?) of layered amphibolite and small pods of altered ultramafic rocks.

POOR MOUNTAIN FORMATION

Opm **Undivided-** Heterogeneous unit of metagraywacke, schist, amphibolite, quartzite, metasandstone, meta-arkose, quartzo-feldspathic gneiss, and calc-silicate. Metagraywacke — medium-light-gray to medium-dark-gray; medium- to coarse-grained; foliated; locally mylonitic; equigranular to inequigranular; granoblastic to lepidoblastic; migmatitic; consists of quartz, plagioclase feldspar, biotite, muscovite, potassium feldspar, garnet, and accessory minerals. Calc-silicate — light-gray; medium- to coarse-grained; weakly foliated; consists of quartz, feldspar, epidote group minerals, garnet, biotite, and trace chlorite.

Opms **Schist-** Silvery-gray to light-reddish-gray; fine- to medium-grained; inequigranular; lepidoblastic and porphyroblastic; typically has a sheared (S-C) fabric; migmatitic; consists of muscovite, sillimanite, biotite, garnet, quartz, feldspar, and trace opaque minerals, tourmaline, and apatite. Interlayered with lesser amounts of metasandstone, meta-arkose, metagraywacke, and amphibolite.

Opmq **Quartzite-** Very pale-orange to grayish-orange to grayish-purple; dusky-yellowish-brown on weathered surfaces; fine- to medium-grained; foliated; locally mylonitic/sheared; equigranular; granoblastic; consists of quartz, potassium feldspar, plagioclase feldspar, garnet, biotite, muscovite, epidote, and opaque minerals. Interlayered with lesser amounts of metagraywacke, schist, quartzo-feldspathic gneiss, and amphibolite.

Opma **Amphibolite-** Occurs as a mappable unit structurally beneath metasandstone, quartzite, and meta-arkose layers in places on the quadrangle, and as a minor rock type throughout other map units of the Poor Mountain Formation. Amphibolite is typically mottled white to dark-green to black; fine- to coarse-grained; foliated; equigranular to nematoblastic; consists of hornblende, plagioclase, biotite, epidote group minerals, quartz, and minor garnet, chlorite, pyroxene, titanite, and opaque minerals. Interlayered with lesser amounts of metasandstone, quartzite, meta-arkose, and sillimanite schist.

SUGARLOAF MOUNTAIN GROUP

CZslg **Sugarloaf grainitoid/granitic gneiss-** Dark gray to white; massive to well-foliated; medium- to coarse-grained; granitic to granodioritic; consists of microcline, plagioclase, biotite, muscovite, with minor zircon, titanite, apatite, allanite, chlorite, epidote, and garnet. Description adapted from Lemmon (1973).

CHAGUA RIVER FORMATION

CZcrg **Metagraywacke-** Medium-light-gray to medium-dark-gray; fine-grained; equigranular to inequigranular; lepidoblastic to mylonitic; foliated; consists of approximately 38% quartz, 35% plagioclase, 17% biotite, 9% muscovite, 1% opaques, and trace apatite. Interlayered and gradational into muscovite-biotite schist.

CZcrmq **Muscovite-quartz schist-** Light-gray to olive-gray to dark-gray; medium- to coarse-grained; granular to inequigranular; foliated to mylonitic; consists of quartz, muscovite, and epidote. Occurs in a small lens-like body.

CZcrsp **Sericitic Phyllite-** Dark gray to light olive gray, to greenish gray; fine- to coarse-grained; lepidoblastic to porphyroblastic; strongly foliated; mylonitic. Composed of sericite, quartz, feldspar, and accessory graphite, chlorite, and opaque minerals. Lenticular muscovite-aggregate porphyroblasts are flattened in the mylonitic foliation planes and give rise to a distinctive "fish scale" or "button" appearance. Locally interlayered with mylonitic metagraywacke and schistose metagraywacke, sericite-chlorite phyllonite and sulfidic graphitic schist.

CZcrm **Marble-** White and light-gray, fine- to medium-grained, thick-bedded marble; in part dolomitic. Composed mostly of calcite with minor amounts of quartz, pyrite, and magnetite. Marble encloses a few discontinuous layers of sericitic phyllite as much as 10cm thick. Description adapted from Dabbagh and McDaniel (1981).

CZcrgs **Graphitic schist-** Medium gray to dark gray; fine-grained; inequigranular; lepidoblastic; thinly foliated; consists of quartz, graphite, muscovite, biotite, and opaques. Interlayered with phyllite, mylonite, marble, meta-arkose and sericite schist. Thickness of layering ranges from centimeters to meters.

TALLULAH FALLS FORMATION

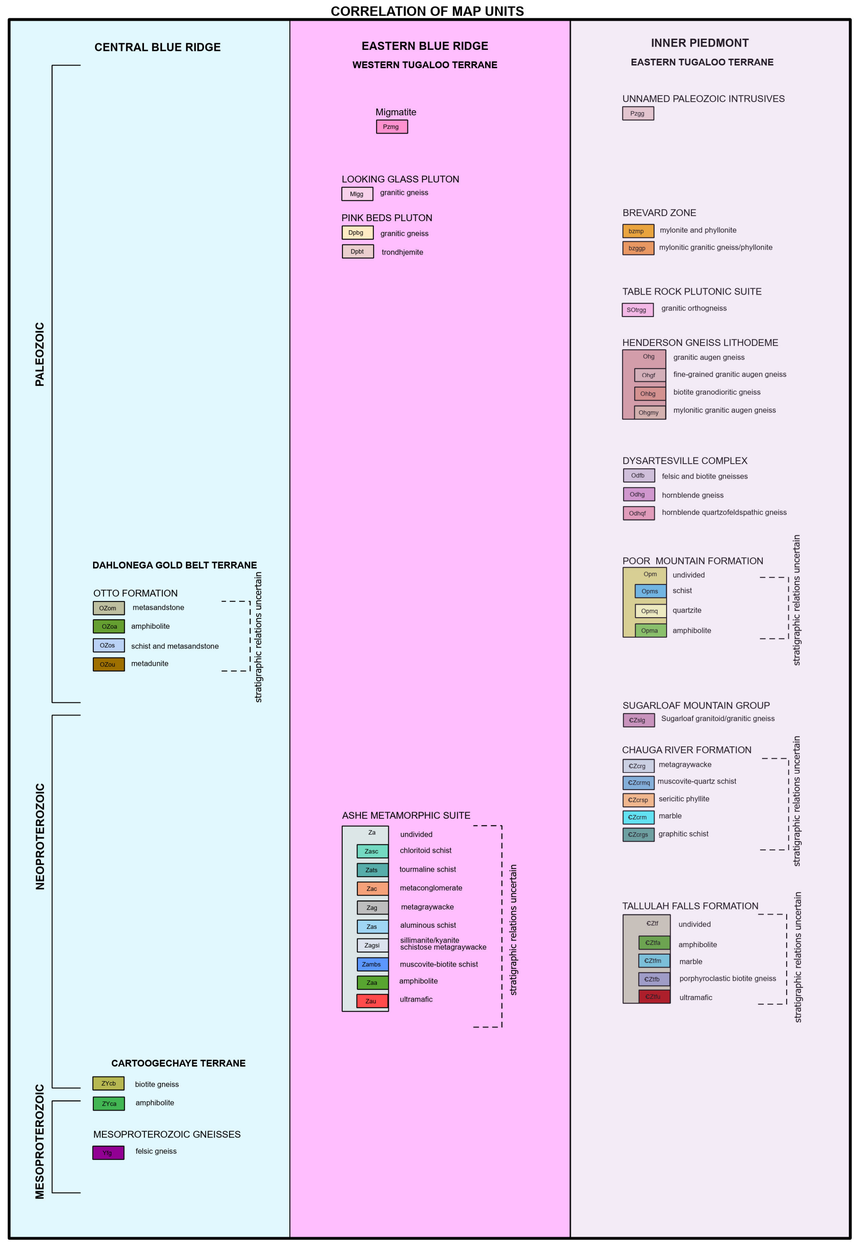
CZtf **Undivided-** The Tallulah Falls Formation is a thick, heterogeneous sequence of metamorphosed sedimentary and volcanic rocks. Sequences of metagraywacke, schistose metagraywacke, mica schist, and amphibolite are interlayered at all scales. Metagraywacke — medium-light-gray to medium-dark-gray; medium- to coarse-grained; foliated (ranges from massive to gneissic); equigranular to inequigranular; granoblastic to lepidoblastic; migmatitic; consists of quartz, plagioclase, biotite, muscovite, potassium feldspar, sillimanite, and minor garnet, opaques, epidote, and apatite; thickness of layering ranges from decimeters to meters. Interlayered at all scales with mica schist, schistose metagraywacke, amphibolite, and minor calc-silicate. Schistose metagraywacke — medium-gray to dark-gray; fine- to medium-grained; foliated; equigranular to inequigranular; lepidoblastic to weakly granoblastic to porphyroblastic; migmatitic; consists of quartz, plagioclase, muscovite, biotite, potassium feldspar, sillimanite, epidote group minerals, chlorite, garnet, and trace opaque minerals; thickness of layering ranges from several millimeters to meters; commonly interlayered with metagraywacke, mica schist, conglomeratic metagraywacke, amphibolite, and minor calc-silicate. Mica schist — silvery-gray to medium-dark-gray; fine- to medium-grained; equigranular; lepidoblastic to porphyroblastic; migmatitic; consists of muscovite, biotite, garnet, quartz, feldspar, and trace epidote group minerals, chlorite, and opaque minerals; interlayered with metagraywacke, schistose metagraywacke, amphibolite, and rare calc-silicate.

CZtfa **Amphibolite-** Mottled white to dark-green to black; fine- to coarse-grained; foliated; equigranular to nematoblastic; consists of hornblende, plagioclase, biotite, epidote group minerals, quartz, and minor garnet, chlorite, pyroxene, titanite, and opaque minerals. Commonly interlayered with other TFF lithologies.

CZtfb **Porphyroclastic biotite gneiss-** Heterogeneous unit consisting of interlayered porphyroblastic biotite gneiss, with lesser amounts of metagraywacke, schist, and hornblende-biotite gneiss. Biotite gneiss is typically gray to grayish-black; medium- to coarse-grained; well foliated; compositionally layered; locally protomylonitic; inequigranular; porphyroblastic to lepidoblastic; migmatitic; consists of plagioclase, quartz, biotite, potassium feldspar, muscovite, garnet, epidote group minerals, chlorite, opaques, and little to no hornblende.

CZtfu **Altered mafic/ultramafic-** Dark-green to silvery-grayish-green; weakly foliated to foliated; fine- to medium-grained; equigranular; granoblastic to lepidoblastic; consists of 0 to 97% hornblende, 55 to 65% chlorite, 0 to 30% magnetite and other opaques, 7 to 10% enstatite, 3 to 5% talc, and trace carbonate. Altered mafic rocks (metagabbro) are dark-green to green-black, weakly foliated to strongly foliated, very fine-to medium-grained, equigranular to mylonitic, consist of 10 to 65% chlorite, 0 to 45% amphibole, 3 to 25% plagioclase, 2 to 25% epidote, 0 to 5% quartz, 0 to 5% magnetite; and 0 to 3% augite.

CORRELATION OF MAP UNITS



REFERENCES

10 Acker, L.L., 1982, Geology of the Shining Rock quadrangle, North Carolina [MS thesis]: University of North Carolina at Chapel Hill, 110 p.

8 Cattanach, B.L., Bozdog, G.N., Isard, S.J., and Wooten, R.M., 2018, Bedrock geologic map of the Shingle Hollow 7.5-minute quadrangle, Rutherford and Polk counties, North Carolina: North Carolina Geological Survey, Open-File Report 2018-12, scale 1:24,000.

12 Cattanach, B.L., and Merschat, C. E., 2009, Bedrock geologic map of the Horse Shoe 7.5-minute quadrangle, Henderson and Transylvania counties, North Carolina: North Carolina Geological Survey, Open-File Report 2009-04, scale 1:24,000.

16 Cattanach, B.L., Wooten, R.M., Bozdog, G.N., and Isard, S.J., 2016, Bedrock Geologic Map of the Pea Ridge 7.5-minute quadrangle, Polk and Rutherford Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2016-07, scale 1:24,000.

11 Cattanach, B.L., Wooten, R.M., Bozdog, G.N., and Worley, B.D., 2012, Bedrock geologic map of the Pisgah Forest 7.5-minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2012-05, scale 1:24,000.

3, 4 Dabbagh, A. E., 1975, Geology of the Skyland and Dunsmore Mountain quadrangles, western North Carolina [Ph.D. Dissertation]: University of North Carolina at Chapel Hill, 228 p.

4 Dabbagh, A.E., and McDaniel, R.D., 1981, Geologic map and mineral resources summary of the Skyland quadrangle, NC: North Carolina Geological Survey, Geologic Quadrangle Map GM193-NE and MRS193-NE, scale 1:24,000.

5, 6, 7, 13, 14, 15 Davis, T.L. and Yanagihara, G., 1993, Geologic map of the Columbus Promontory, western Inner Piedmont, North Carolina, In: Hatcher, R.D., Davis, T.L., eds., Studies of Inner Piedmont Geology, with a focus on the Columbus Promontory: Carolina Geological Society Field Trip Guidebook, scale 1:48,000, 1 plate, 144 p.

2, 3, 10, 11 Dockal, J.A., 2007, Cradle-of-Forestry-in-America Fault within the Eastern Blue Ridge, Transylvania County, North Carolina: Southeastern Geology, v. 44, n.4, p.171-189.

13 Lemmon, R.E., 1979, Geologic map of the Hendersonville quadrangle, North Carolina: North Carolina Geological Survey, scale 1:24,000 [unpublished].

5 Lemmon, R.E. and Dunn, D.E., 1973, Geologic map and mineral resources summary of the Fruitland quadrangle, North Carolina: North Carolina Geological Survey, Geologic Quadrangle Map 202-NW and MRS 202-NW, scale 1:24,000.

1, 9 Merschat, A. J., 2009, Assembling the Blue Ridge and Inner Piedmont: Insights into the nature and timing of terrane accretion in the southern Appalachian orogen from geologic mapping, stratigraphy, kinematic analysis, petrology, geochemistry, and modern geochronology [PhD Dissertation]: University of Tennesse at Knoxville, 455 p

3, 4 Merschat, C.E., and Carter, M.W., 2002, Bedrock Geologic Map of the Bent Creek Research and Demonstration Forest, Southern Research Station. USDA Forest service, Including the North Carolina Arboretum and a Portion of the Blue Ridge Parkway: North Carolina Geological Survey, Geologic Map Series GMS-09, scale 1:12,000.

2, 3, 4, 5, 6, 7 Merschat, C.E., and Cattanach, B.L., 2007, Bedrock Geologic Map of Buncombe County, North Carolina: North Carolina Geological Survey, 1:62,500-scale.

2, 3, 4, 9, 10 Merschat, C.E., Wooten, R.M., Cattanach, B.L., Latham, R.S., Bozdog, G.N., Witt, A.C., and Carter, M.W., 2008, Digital geologic and geohazard maps and inventories for the North Carolina segment of the Blue Ridge Parkway and Carl Sandburg Home National Historic Site: unpublished N.C. Geological Survey data and GIS data layers prepared for the National Park Service under study BLRI-00065.

2 Morrow, H.B., 1978, Geologic map of the Cruso quadrangle, North Carolina: North Carolina Geological Survey, scale 1:24,000 [unpublished].

11 Worley, B.D., 2000, Geology across the western boundary of the Brevard fault zone, Transylvania County, North Carolina [M.S. Thesis]: University of North Carolina at Wilmington, 120 p.

Base map was created from a combination of files from USGS and NCDOT.

Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under STATEMAP (Award 2023, G23AC00464).

This map and explanatory information is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for governmental purposes. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed of implied, of the U.S. Government.

The goal of this compilation effort was to produce a new 1:100,000-scale digital geologic map of the study area using the USGS Geologic Mapping Schema (GeMS). When available, geologic data at