Pamphlet to accompany:

NCGS Open File Report 2025-07

Compiled Bedrock Geologic Map of the Asheville 30' x 60' Quadrangle (Asheville 100K), North Carolina (Version 6/30/2025)

Compiled by: Bart L. Cattanach, Ashley S. Lynn, Brennan T. Trantham, Jesse S. Hill, and Thomas J. Douglas.

Cartographic representation by Brennan T. Trantham, Ashley S. Lynn, and Bart L. Cattanach

Reference: Cattanach, B.L., Lynn, A.S., Trantham, B.T., Hill, J.S., and Douglas, T.J., 2024, Compiled Bedrock Geologic Map of the Asheville 30' x 60' Quadrangle (Asheville 100K), North Carolina, North Carolina Geological Survey Open-File Report 2025-07, scale 1:100,000, in color, with accompanying pamphlet.

Background: 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 scales more detailed the 1:100,000-scale were used in compilation efforts (i.e. previously published 1:24,000-scale maps, thesis, and dissertation data). From July 2023 to August 2024, NCGS staff conducted targeted foot and vehicle traverses to validate contacts from the legacy sources and to collect new field data. Close attention was paid to rectifying edge-match issues between legacy data and recent 24K-scale mapping to allow accurate transitions of map units from areas with detailed data to areas of legacy data collected at smaller scales (e.g. 250K). More detailed and closer spaced traverses targeted areas of structural or stratigraphic complexity. Less detailed and wider spaced traverses were used in areas of less complex structure or rock types (e.g. areas underlain by homogenous plutons received less attention). LiDAR data displayed as hillshade was used to help identify lineaments and possible faults and dikes that may be groundwater sources or preferred pathways for groundwater contaminants.

Past workers: Specific data sources are listed in the DataSources table in the geodatabase. Individual open-file reports include additional references. Major data sources are provided in the index of workers figure on the map layout.

DESCRIPTION OF MAP UNITS

WESTERN BLUE RIDGE

q	**quartz vein—**	A map-scale quartz vein, more than one mile long and nearly 200 feet thick in places. Transparent to semi-opaque quartz is white to bluish white; medium- to coarse-grained; inequigranular to equigranular. Smaller quartz veins are present throughout but are too small to depict at map scale.

u	**ultramylonite—**	Dark-gray to black; fine-grained; inequigranular; well foliated locally with intrafolial folds; dense homogeneous rock produced by intense mylonitization. Map pattern exaggerated.
Pzc	**cataclasite—**	Granitoid breccia and brecciated mylonite; angular fragments consist of feldspar and quartz, with a matrix of epidote group minerals, biotite, chlorite, sericite, and locally, specular hematite.
Pzcf	**ferruginous cataclasite—**	Granitoid breccia and brecciated mylonite; angular fragments consist of feldspar and quartz, with a matrix of epidote group minerals, biotite, chlorite, sericite, and locally, specular hematite.
Mmy	**sericitic mylonite—**	Mylonite characterized by greenschist facies minerals sericite, epidote group minerals, and chlorite; occurs in linear northeast striking shear zones. This unit includes locally unmylonitized to progressively mylonitized rock.
DSt	**trondhjemite—**	Very-light-gray; fine- to medium-grained; equigranular to inequigranular; granoblastic to megacrystic; typically non-foliated; occur as thin dikes and sills; potassium-poor.
Zd	**dunite—**	Grayish-yellow-green; fine- to medium-grained forsterite, with minor enstatite and bronzite, and disseminated chromite; when altered, serpentine minerals, anthophyllite, talc, and vermiculite replace olivine as disseminated grains, and in interior veins and peripheral areas.
	KNOX GROUP	
O€k	**Undivided carbonates—**	Massive to medium-bedded, medium-bluish-gray limestone and sandstone with local beds of ribboned dolomite, flat pebble conglomerate and chert.
	CONASAUGA GROUP	
	NOLICHUCKY SHALE	
€n	**Undivided—**	Gray to medium-bluish-gray calcareous shale and shaley limestone.
	HONAKER DOLOMITE	
€hk	**undivided—**	Light-gray to dark-gray; laminated to massive; chert-rich in lower part.
	ROME FORMATION	
€r	**undivided—**	Maroon siltstone, silty shale, and argillaceous shale, with subordinate fine-grained sandstone and minor thin dolomitic interbeds.
	SHADY DOLOMITE	
€s	**undivided—**	Light-bluish-gray to medium-bluish-gray; fine- to medium-grained; laminated to massive; dolostone, locally ribboned. Jasperoid occurs locally in outcrop and residuum.
	CHILHOWEE GROUP	
	ERWIN FORMATION	

Ꞓceh	**Helenmode Member—**	This unit is characterized by beds of calcareous shale, siltstone, and minor sandstone. Weathers to orange clay and arkosic sand, rich with manganese and iron oxides
Ꞓce	**quartzite—**	Vitreous quartz arenite to feldspathic sandstone with interbeds of siltstone, shale, and silty sandstone. Quartzite – white; very quartz-rich and resistant. locally conglomeratic. Locally ferruginous. Scolithus are locally present.
	HAMPTON FORMATION	
Ꞓchu	**upper siltstone member—**	Gray, massive to laminated siltstone to sandy siltstone interbedded with minor thick-bedded, poorly sorted feldspathic sandstone.
Ꞓchq	**middle quartzite member—**	Quartzite to feldspathic quartzite; well sorted; locally conglomeratic; locally graded and cross-bedded; vitreous; sulfidic; with slaty lithic fragments and rare scolithus.
Ꞓchi	**lower siltstone member—**	Siltstone and shaly siltstone locally interbedded with feldspathic sandstone. Siltstone is fine-grained; well sorted; laminated to thin-bedded, locally rhythmically banded.
	UNICOI FORMATION	
Ꞓcu	**undivided—**	An interbedded succession of locally graded quartz pebble conglomerate, quartz arenite, feldspathic sandstone, and minor siltstone. Conglomerate clasts consist of rounded quartz pebbles, angular feldspar granules, and fragments of slate. The matrix is feldspathic and locally sulfidic.
Ꞓcum	**Moccasin Gap Member—**	Quartzite to poorly sorted, locally cross-bedded feldspathic quartzite interlayer within the Unicoi Formation; extensive localized barite mineralization.
	WALDEN CREEK GROUP	
	SANDSUCK FORMATION	
ꞒZwsu	**undivided—**	Interbedded sequence of laminated to massive metasiltstone, brown slate, and gray phyllite with beds and lenses of lower Unicoi-like metagraywacke.
ꞒZwsc	**coarse-grained unit—**	Granule to pebble metaconglomerate and quartzite with interbedded metasiltstone, and slate similar to fine-grained unit. Granule metaconglomerate – locally graded; consists of angular quartz and feldspar granules to pebbles and lithic fragments (dominantly slate and metasiltstone). Quartzite - locally conglomeratic; crossbedding and graded bedding are common.
ꞒZwsf	**fine-grained unit—**	Locally laminated or cross-bedded; typically incompetent; grayish-olive-green metasiltstone to metashale with minor interlayers of feldspathic sandstone, metaconglomerate and metagraywacke. Metasiltstone to metashale weathers light to moderate brown.

€Zwslms	**limestone—**	Quartz-rich metalimestone, grading into calcareous quartzite. Locally brecciated. Quartz grains in micritic matrix are distinctive.
	WILHITE FORMATION	
Zww	**undivided—**	Olive-gray metasiltstone, locally rhythmically banded, calcareous and sulfidic; interbedded with feldspathic silty sandstone, phyllite, and limestone.
Zwwu	**upper unit—**	Metasiltstone is dominant, but interbedded slate, metawacke, quartzite, and feldspathic granule metaconglomerate occur throughout. Metasiltstone is olive-gray; laminated to well-bedded, rhythmically banded; locally calcareous and sulfidic.
Zwwm	**middle unit—**	Mostly feldspathic and locally conglomeratic metawacke, with some quartz granule metaconglomerate, meta-subwacke, and calcareous metasubwacke. Laminated calcareous slate is rare. Quartz granule metaconglomerate contains rare slaty lithic fragments.
Zwwlms	**middle unit limestone —**	Light-gray; coarse crystalline metalimestone and micritic metalimestone. Locally brecciated with limestone clasts in calcareous quartzite matrix.
Zwwl	**lower unit—**	A heterogeneous sequence of interbedded rhythmically banded metasiltstone, locally dolomitic metawacke, and dark-gray, sulfidic slate.
	GREAT SMOKY GROUP	
Zgs	**undivided—**	An interbedded sequence of dominantly metawacke and quartz pebble to granule metaconglomerate, with minor amounts of metasiltstone and slate.
	COPPERHILL FORMATION	
Zchg	**metawacke—**	Light-gray to medium-gray; coarse- and medium-grained: granoblastic to lepidoblastic; massive to well bedded, commonly graded; sulfidic; interlayered with garnet-mica schist and kyanite-garnet-mica-schist.
Zchs	**garnet-mica schist—**	Dark-gray to light-gray, and lustrous; locally coarse-grained; lepidoblastic to porphyroblastic; inequigranular; sulfidic and graphitic; interbedded with metawacke, kyanite-garnet-mica schist, and minor calc-silicate granofels.
Zchk	**kyanite-garnet-mica schist—**	Light-gray and lustrous; coarse-grained; lepidoblastic to porphyroblastic; inequigranular; sulfidic; interbedded with metawacke, garnet-mica schist, and minor calc-silicate granofels.
	SNOWBIRD GROUP	
Zsmy	**mylonitic undivided—**	Snowbird Group metasedimentary rocks that have undergone extensive Mississippian mylonitization. Commonly phyllonite and mylonitic meta-arkose.

PIGEON SILTSTONE

Zsp	**siltstone—**	Interbedded sequence of laminated, sulfidic slate, rhythmically banded metasiltstone, metagraywacke, and metasubwacke. Slate is more abundant higher in the sequence.

ROARING FORK SANDSTONE

Zsrf	**sandstone—**	Variably interbedded sequence of metasiltstone, metawacke to meta-arkose, and slate. Locally current bedded. Intercalated with overlying and underlying units.

LONGARM QUARTZITE

Zsl	**quartzite—**	Dominantly pinkish-gray meta-arkose and metasubwacke, with subordinate dark-greenish-gray metawacke, grayish-olive, rhythmically banded metasiltstone and brownish black slate interbedded throughout the sequence. Locally current bedded.

WADING BRANCH FORMATION

Zswbu	**undivided—**	Dominantly metasiltstone, which is locally interbedded with metagraywacke. Metasiltstone is dusky yellow green to dark greenish gray and thinly laminated to thickly banded; consists of quartz, sericite, biotite (as detrital grains), chlorite, epidote, ilmenite and other black opaque minerals, and zircon. Metagraywacke is pinkish gray to grayish-pink: coarse-grained; feldspathic.
Zswbp	**phyllite member—**	Olive-gray, laminated phyllite interbedded and gradational with poorly sorted, locally graded feldspathic metagraywacke and granule to pebble metaconglomerate. Locally phyllonitic.
Zswbw	**feldspathic metagraywacke—**	Feldspathic metagraywacke interbedded with granule conglomerate with minor schistose metagraywacke and muscovite schist. Feldspathic metagraywacke is moderate-reddish-orange to pinkish-gray to tan; medium- to coarse-grained; well foliated; commonly mylonitic; poorly to moderately-well sorted; subrounded fragments; medium- to thick-bedded; consists of quartz, potassium feldspar, plagioclase, sericite and minor accessory minerals.

CROSSNORE PLUTONIC VOLCANIC SUITE

Zbg	**Bakersville metagabbro—**	Brownish-black to greenish-black; fine- to coarse-grained; subophitic to blastophitic to locally porphyritic; massive to slightly foliated; locally altered to amphibolite; dikes and sills to mappable bodies of gabbro. Secondary nematoblastic texture and alteration minerals developed where altered. Weathers spheroidally. Small dikes are locally abundant.
Zcg	**hornblende metagranite—**	Grayish-pink; weathers very light gray; medium- to coarse-grained; equigranular; granoblastic; locally mylonitic; poorly foliated to massive. Similar to parts of the Beech Granite of Keith (1903).

Zcgp	**protomylonitic hornblende metagranite—**	Protomylonitic and mylonitic equivalent of hornblende-bearing metagranite. Medium-gray to pinkish-gray; granoblastic to lepidoblastic; variably megacrystic. Mylonitic alteration minerals include sericite and epidote group minerals.
	WESTERN BLUE RIDGE NEOPROTEROZOIC INTRUSIVES	
Zlq	**leucocratic quartzo-feldspathic rock—**	Thin bodies of "sugary"-textured rock that crosscut or parallel foliations. Leucocratic, equigranular; aphanitic; granoblastic; locally mylonitic; massive to foliated; granite to tonalite with accessory magnetite.
ZYgg	**red feldspar granitoid gneiss—**	Grayish-pink to moderate-red; equigranular; granoblastic; locally mylonitic; poorly foliated to massive. Epidotization is widespread; epidote and specular hematite commonly fill fractures.
ZYfcs	**ferriferous calc-silicate granofels—**	Very dusky red; granoblastic to megacrystic; massive to thinly foliated, locally mylonitized. Consists of magnetite, garnet, epidote, hornblende, and quartz.
	BROWN MOUNTAIN GRANITE	
Ybm	**granite—**	Semi-massive variety is coarse grained and equigranular with little chlorite and muscovite; mylonitic variety is fine- to medium-grained and equigranular with alternating pink potassium feldspar layers with silver-green chlorite-muscovite layers; both varieties consist of potassium feldspar, quartz, plagioclase feldspar, muscovite, chlorite, and sericite; may contain small mafic/chloritic pods.
Zbmb	**granite-biotite phase—**	Fine- to medium-grained; mylonitic to protomylonitic; locally porphyroclastic; similar to Brown Mountain granitic orthogneiss but with more biotite.
	CRANBERRY GNEISS	
Ycu	**undivided—**	Heterogeneous unit consisting of granitic orthogneiss with minor amounts of biotite gneiss and amphibolite; white to light pink; medium- to coarse-grained; equigranular to inequigranular; mylonitic to protomylonitic; consists of potassium feldspar, quartz, plagioclase feldspar, biotite, and minor amounts of sericite/muscovite, opaque minerals, epidote, chlorite, garnet, and zircon.
	WILSON CREEK	
Ywc	**undivided—**	Heterogeneous unit with dioritic to granitic lithologies that have been variously sheared. Granitoid - Light-to medium-gray to light pink, fine- to coarse-grained; weakly- to well-foliated; mylonitic to protomylonitic; granoblastic to lepidoblastic; locally strongly layered; locally porphyroclastic; consists of potassium feldspar, plagioclase feldspar, quartz, biotite and minor amounts of sericite, chlorite, epidote group minerals, amphibole, and opaque minerals.
Yua	**altered ultramafic—**	Small discontinuous lenses and pods of soapstone throughout, talc-bearing amphibolite, altered pyroxenite, and altered dunite.

DOGGETT GAP PROTOMYLONITIC GRANITOID GNEISS

Ydg	**protomylonitic granitoid gneiss—**	Medium light gray; biotite tonalite to biotite granite feldspar porphyroclasts in a biotite-rich matrix; inequigranular; lepidoblastic; megacrystic; foliated to weakly foliated; protomylonitic to mylonitic. Age of mylonitization is uncertain.
Ydgc	**coarse-grained granitoid gneiss—**	Light gray; biotite granitic gneiss with abundant large (> 3 cm) feldspar porphyroclasts within a biotite-rich matrix; inequigranular; lepidoblastic; megacrystic; weakly foliated to foliated; protomylonitic to mylonitic. Age of mylonitization is Mississippian.
Ydglg	**leucocratic granitoid gneiss—**	Light gray; leucocratic, feldspathic, massive to foliated.
Ydga	**amphibolite—**	Fine- to coarse-grained; nematoblastic to lepidoblastic; well-foliated; interlayered with amphibolite and thin layers of biotite-rich gneiss and schist.

SPRING CREEK GRANITOID GNEISS

Ysc	**granitoid gneiss—**	Heterogeneous metamorphosed orthogneiss dominated by biotite granitic gneiss; interlayered with biotite granodioritic gneiss, biotite tonalitic gneiss, amphibolite, biotite gneiss, and biotite schist. Granitoid rock types are light-gray, mottled with pinkish-gray to pale-reddish-brown; medium- to coarse-grained; equigranular to inequigranular; granoblastic to lepidoblastic, massive to foliated; locally mylonitic.
Yscp	**protomylonitic granitoid gneiss—**	Spring Creek Granitoid Gneiss that has undergone Mississippian (Kunk et al., 2006) protomylonitization; granoblastic to lepidoblastic; megacrystic; protomylonitic foliation is defined by greenschist facies minerals.
Yscmy	**mylonitic granitoid gneiss—**	Spring Creek Granitoid Gneiss that has undergone Mississippian (Kunk et al., 2006) mylonitization. Common mylonitic alteration minerals are sericite, epidote group minerals, and chlorite. Locally interlayered with amphibolite and unmylonitized granitoid gneiss.
Ysclg	**leucocratic granitoid gneiss—**	Leucocratic, feldspathic, massive to foliated granitoid; locally mylonitic.
Yscmb	**marble—**	Light-gray to pinkish-gray; fine- to coarse-grained; equigranular; granoblastic; massive; consists of calcite, diopside, epidote group minerals, and quartz.
Ysca	**amphibolite—**	Dark-greenish-gray; fine- to coarse-grained; nematoblastic to lepidoblastic; well-foliated to mylonitic; hornblende, biotite, and plagioclase content vary.
Ysccs	**calc-silicate granofels—**	Very light gray with diagnostic dark-yellowish-orange splotches on weathered surfaces; granoblastic, weakly foliated; epidosite locally present.

FELDSPATHIC GRANITOID GNEISS

Yfgg	**feldspathic granitoid gneiss—**	Medium light gray, mottled with pink to light-greenish gray; characterized by the lack of accessory minerals and brittle deformation, but distinguished in the field by its tectonically derived alteration to red potassic feldspars and green saussuritized plagioclase. Interlayered with and intruded by mafic rocks.

Yfggp	**protomylonitic feldspathic granitoid gneiss—**	Medium-light-gray, mottled with pale-pink to light-greenish-gray; coarse-grained megacrysts (>2 to 3 cm); weakly foliated to foliated; inequigranular; protomylonitic to locally mylonitic. Age of mylonitization is Mississippian.
Yfggmy	**mylonitic feldspathic granitoid gneiss—**	Medium-gray, mottled, pink to yellow-green; equigranular to inequigranular; granoblastic to lepidoblastic; finely megacrystic; foliated; mylonitic to protomylonitic, locally strongly mylonitic. Age of mylonitization is Mississippian.
	SANDYMUSH FELSIC GNEISS	
Ys	**felsic gneiss—**	Thick, monotonous, layered sequence dominated by biotite granitic gneiss to quartz dioritic gneiss. Includes interlayers of biotite schist and amphibolite. Pinkish gray; granoblastic to lepidoblastic, locally protomylonitic; well-foliated and commonly a straight gneiss (s-tectonite).
Ysp	**protomylonitic felsic gneiss—**	Mississippian (Kunk et al., 2006) protomylonitization; granoblastic to lepidoblastic; megacrystic. Protomylonitic foliation is defined by greenschist facies minerals.
Ysmy	**mylonitic felsic gneiss—**	Inequigranular; granoblastic to lepidoblastic; mylonitic; foliated. Felsic layers range from granitic to tonalitic. Mississippian (Kunk et al., 2006) mylonitic alteration minerals include sericite and epidote group minerals.
Yslg	**leucocratic granitoid gneiss—**	Leucocratic, feldspathic, massive to foliated granitoid; locally mylonitic.
Ysmu	**muscovite gneiss—**	Pale-reddish-brown to dusky-red in saprolite; fine-grained; lepidoblastic; well-foliated; very thinly layered.
Ysa	**amphibolite—**	Dark-green; fine- to coarse-grained; equigranular; nematoblastic to granoblastic; well-foliated and commonly a straight gneiss (s-tectonite). Interlayered with other rock types of the Sandymush Felsic Gneiss.
Yscs	**calc-silicate granofels—**	Very light gray to greenish-gray; medium- to coarse-grained; granoblastic; equigranular; massive to poorly foliated; thin-to medium-layered to podiform; commonly diopside and epidote bearing; characterized by yellowish-brown limonite spots resulting from rapid weathering of diopside.
Ysma	**marble—**	Very light gray; medium- to coarse-grained; calcareous to dolomitic marble. Accessory pale-green rounded diopside, epidote, and opaques. Occurs as small lenses.
Ysm	**mafic gneiss—**	Heterogeneous unit dominated by layered rocks rich in hornblende and biotite interlayered with layered biotite granitic gneiss. Mafic rocks vary from schistose to gneissic and are locally straight gneisses (s-tectonites) to schistose; interlayered on all scales; locally migmatitic.
Ysmacs	**marble and calc-silicate—**	This map unit contains both the marble and calc-silicate rocks described above. The two rocks appear to be gradational from calcite dominated to quartz-feldspar dominated.

EARLIES GAP BIOTITE GNEISS

Ye	**biotite gneiss—**	Heterogeneous unit of biotite gneiss, biotite granitic gneiss, and layered biotite granitic gneiss, interlayered with amphibolite, calc-silicate granofels, altered ultramafic, granulites, rare marble, and other less common rock types. Ranges in composition from biotite granitic gneiss to quartz diorite gneiss. Very similar to portions of the Sandymush Felsic Gneiss and the Earlies Gap Granulitic Gneiss. Distinctive "wavy" to anastamosing appearance of some layers. The gneisses are lepidoblastic to equigranular granoblastic; locally mylonitic, protomylonitic and migmatitic; well-foliated and commonly a straight gneiss.
Yep	**protomylonitic biotite gneiss—**	Medium-light-gray; granoblastic to lepidoblastic; megacrystic; heterogeneous granitoid protomylonite. Locally biotite rich. Age of mylonitization is uncertain.
Yemy	**mylonitic biotite gneiss—**	Medium-gray; inequigranular; granoblastic to lepidoblastic, mylonitic; megacrystic; granitic to tonalitic. Age of mylonitization is Mesoproterozoic.
Yee	**epidote-veined granitic gneiss—**	Mottled, pink and white; massive to poorly foliated granodiorite with no accessory minerals. Epidote occurs as thin veins or fracture fillings.
Yehbg	**hornblende-biotite-garnet gneiss—**	Medium- to dark-gray; poorly foliated to well-foliated; consists of quartz, feldspar, garnet, biotite, and hornblende.
Yehma	**hornblende-magnetite gneiss—**	Light-gray to moderate-pink; massive to poorly foliated; quartzo-feldspathic gneiss; accessory magnetite and minor hornblende.
Yelg	**leucocratic granitoid gneiss—**	Leucocratic, feldspathic, massive to foliated granitoid.
Yemg	**mafic granulite—**	Dark-greenish-gray; mafic rock of variable composition and appearance, from amphibolite to biotite-hornblende. Layers and bodies range in thickness from centimeters to meters to mappable units.
Yepg	**pyroxene granulite—**	Consists of mafic and felsic phases. Color varies with protolith; coarse-grained; granoblastic with clots of hornblende, hypersthene, and diopside throughout the matrix; massive to well-foliated and commonly a straight gneiss (s-tectonite).
Yea	**amphibolite—**	Dark-greenish-gray; fine- to coarse-grained; nematoblastic to granoblastic to lepidoblastic and commonly a straight gneiss (s-tectonite), variable thickness; locally diopsidic. Interlayered with other rock types of the Earlies Gap Biotite Gneiss; derived from metamorphosed mafic igneous rock or retrograded mafic metamorphic rock.
Yecs	**calc-silicate granofels—**	Leucocratic; equigranular; granoblastic; weakly foliated, thin layered to podiform bodies; interlayered with amphibolite and other rock types. Characterized by yellowish brown limonite spots resulting from preferential weathering of diopside.

EARLIES GAP GRANULITES AND GRANULITIC GNEISSES

Yeg	**granulitic gneisses—**	Mafic and felsic rock types interlayered and gradational at all scales. Low in quartz and contains almost no muscovite or aluminum silicates. Mafic layers are equigranular; nematoblastic to granoblastic; well-foliated and commonly a straight gneiss (s-tectonite); vary in composition between gabbro and diorite. Felsic layers are equigranular; granoblastic to lepidoblastic; well-foliated to massive; vary from granite to granodiorite; commonly contain clinopyroxene-orthopyroxene. Locally, protomylonitic and mylonitic.
Yegp	**protomylontic granulitic gneiss—**	Dark-gray; megacrystic to weakly megacrystic. Protomylonitic quartz monzonite. Mylonitization is Mesoproterozoic in age.
Yega	**amphibolite—**	Dark-greenish-gray to black; fine- to coarse-grained; nematoblastic to granoblastic to lepidoblastic and commonly a straight gneiss (s-tectonite); variable thickness; locally diopsidic. Interlayered with other rock types of the Earlies Gap granulitic gneisses; derived from retrograded igneous or metamorphic mafic rock.
Yegb	**biotite gneiss—**	Medium-gray; equigranular; lepidoblastic to granoblastic; well-foliated to straight gneiss (s-tectonite); biotite gneiss to layered biotite granitic gneiss with interlayers of amphibolite. Occurs throughout the Earlies Gap granulitic gneiss.
Yeghg	**garnet-hornblende granofels—**	Grayish-black to black with dusky-red garnets; granoblastic, coarse- to very coarse-grained; massive to weakly foliated.
Yegm	**magnetite granitic gneiss—**	Medium-gray; poorly foliated to foliated; quartz monzonite. Magnetite occurs as euhedral grains in the quartzo-feldspathic layers.
Yege	**epidote-veined granitic gneiss—**	Mottled pink and white; massive to poorly foliated granodiorite. Epidote occurs as thin veins or fracture fillings.
Yegpg	**pyroxene granulite—**	Grayish-orange-pink to pale-brown; weakly foliated to massive; granoblastic to nematoblastic; diagnostic hypersthene and diopside; interlayered and gradational with amphibolite and mafic granulite.
Yegmg	**mafic granulite—**	Includes the following rock types: amphibolite, diopside-bearing calc-silicate granofels, and clinopyroxene-orthopyroxene bearing biotite-hornblende gneiss. Larger bodies may show a progression from massive granoblastic mafic granulite at the center to nematoblastic amphibolite at their margins.
Yegcs	**calc-silicate granofels—**	Very light gray; granoblastic; weakly foliated; typically consists of quartz, diopside, epidote group minerals, plagioclase, and garnet. Yellowish brown limonite formed during weathering of diopside is characteristic and diagnostic.

GRANULITE AND GRANULITIC GNEISSES

Ymg	**mafic granulite—**	Medium-gray; medium- to coarse-grained; granoblastic; massive to weakly layered; diorite to quartz diorite to tonalite; hypersthene bearing. Commonly retrogressed to nematoblastic, foliated amphibolite.
Ygbg	**granoblastic biotite granitic gneiss—**	Light-gray; granoblastic, massive; locally mylonitic. Characterized by biotite and amphibole aggregates within the more felsic groundmass.
Ygf	**aluminous granofels—**	Medium-light-gray, mottled, moderate-brown when weathered; inequigranular; granoblastic to lepidoblastic; weakly foliated; massive; garnet-bearing and sillimanite-bearing.
Yggg	**garnet-rich granulite gneiss—**	Light-gray; equigranular; granoblastic, locally mylonitic; weakly foliated to foliated; garnet, up to 20 percent is characteristically present in most folia.
Ygqm	**quartz monzodioritic granulite gneiss—**	Pale-brown with grayish-orange-pink mottling; equigranular; granoblastic; weakly foliated to foliated; medium layered to massive.
Ygt	**tonalitic granulite—**	Light-gray to dark-greenish-gray; equigranular; granoblastic, locally mylonitic; weakly foliated to foliated; medium layered to massive.

CENTRAL BLUE RIDGE

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.
ZYcbmy	**mylonitic biotite gneiss—**	Light-gray to medium-gray; fine- to medium-grained; lepidoblastic to nematoblastic; foliated; mylonitic to protomylonitic; biotite straight gneiss and amphibolite.
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.

EASTERN BLUE RIDGE

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.

WESTERN TUGALOO INTRUSIVES

SPRUCE PINE PLUTONIC SUITE

Dspg **granodiorite—** White to very light-gray, mottled; non-foliated to weakly foliated; coarse-grained; equigranular to inequigranular; granoblastic. Bodies are lenticular to tabular. Thickness of bodies ranges from decimeters to kilometers. Consists of plagioclase feldspar, quartz, potassium feldspar, and muscovite. Accessory minerals include biotite, garnet, apatite, epidote group minerals, thulite, pyrite, chalcopyrite, and pyrrhotite.

Dspp **pegmatite—** White to very light-gray, mottled; non-foliated to weakly foliated; very coarse-grained; equigranular to inequigranular; granoblastic. Bodies are lenticular to tabular. Thickness of bodies ranges from decimeters to tens of meters. Pegmatite occurs as sill-like or cross-cutting bodies within the Ashe Metamorphic Suite. Mineralogically similar to Spruce Pine granodiorite (Swanson and Veal, 2010). Consists of plagioclase feldspar, quartz, potassium feldspar, and muscovite. Accessory minerals vary greatly upon locality and include biotite, garnet, apatite, epidote group minerals, pyrite, chalcopyrite, pyrrhotite, beryl, samarskite, columbite, autunite, and torbernite. A zircon crystallization age of ca. 367.6 +/- 3.5 Ma (pending further refinement) was obtained for NCGS sample NB70 on the Celo quadrangle, a pegmatite body within the Zapm unit.

Dpg **porphyroblastic gneiss—** Heterogeneous mix of porphyroclastic and porphyroblastic mylonitic biotite gneiss, quartzo-feldspathic gneiss, phyllonite, metagraywacke, metasandstone, mica schist, granitic orthogneiss, and amphibolite. Parent unit unknown but believed to be Alligator Back Metamorphic Suite metasediments. Biotite gneiss is typically light-gray to grayish-black; well foliated; locally protomylonitic; medium- to coarse-grained; inequigranular; porphyroblastic to porphyroclastic to lepidoblastic; locally migmatitic; consists of 30 to 40% quartz, 30 to 40% plagioclase, 5 to 20% biotite, 3 to10% muscovite, 3 to 5% potassium feldspar, 0 to 2% epidote and accessory pyrite and/or pyrrhotite occur locally. Interlayered amphibolite characterized by dark-colored, fine-grained matrix with feldspar porphyroblasts, and magnetite sericite chlorite schist.

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 four lithologic map units:

Zad	**dunite—**	Grayish-yellow-green; fine- to medium-grained, forsterite, with minor enstatite and bronzite, and disseminated chromite; when altered, serpentine minerals, anthophyllite, talc, and vermiculite replace olivine as disseminated grains, and in interior veins and peripheral areas.
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.
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.
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; 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.
Zakg	**kyanite gneiss—**	Highly altered and heterogeneous unit characterized by an abundance of kyanite and/or muscovite porphyroblasts. Typical rock is mottled light-gray to brown; coarse-grained; foliated; inequigranular to equigranular; porphyroblastic; locally migmatitic; consists of biotite, plagioclase, quartz, muscovite, kyanite and/or sillimanite, garnet, and minor accessory and trace minerals; kyanite porphyroblasts up to 15 cm; felsic interlayers may be due to metasomatism or migmatization; interlayered with other Za lithologies.

Zapm	**pegmatite and metasomatic schist—**	Heterogeneous mix of pegmatite, granodiorite, metasomatic schist, and other Ashe Metamorphic Suite lithologies. Pegmatite bodies range in size from sub-meter to decameter and are typically concordant with surrounding metasediments. Pegmatite is white to light gray to light pink; coarse-grained; granoblastic; consists of plagioclase feldspar, quartz, potassium feldspar, muscovite, biotite, and minor amounts of opaque minerals, and garnet. Metasomatic schist is dark gray; medium- to coarse-grained; well foliated; inequigranular; lepidoblastic; consists of muscovite, biotite, quartz, plagioclase feldspar, potassium feldspar, garnet, and minor accessory minerals.
Zasc	**chloritoid schist—**	Mottled, silvery-white to silvery-medium-gray; fine- to medium-grained; lepidoblastic to porphyroblastic; inequigranular; strongly foliated; in meter-thick layers.
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.
Zah	**hornblende-biotite gneiss—**	Dark gray; medium- to coarse-grained; well foliated; non-layered to well-layered; granoblastic to nematoblastic to lepidoblastic; consists of quartz, plagioclase, biotite, hornblende, potassium feldspar, and minor accessory minerals. Interlayered with amphibolite, calc-silicate, and felsic gneiss.
Zam	**Bandana marble—**	White crystalline marble, composed of over 99 percent dolomite as grains *4 to y2 inch across, crops out in two beds about 10 and 40 feet thick. The dolomite marble is cut by pegmatite and is only slightly altered. Actinolite and diopside have formed in the marble near the contacts with the pegmatite.
Zg	**hornblende metagabbro—**	Dark-green to grayish-green; non-foliated to strongly foliated; fine- to medium-grained; equigranular; nematoblastic to lepidoblastic; consists chiefly of hornblende and chlorite with variable amounts of talc, tremolite/actinolite, serpentine, and relict olivine.

Zacs **chloritic schist—** Heterolithic unit characterized by chlorite and/or actinolite. Chlorite and actinolite are found filling anastomosing shear zones and dilatant fractures. Chlorite is also retrogressed from biotite and garnet. Massive garnet-chlorite schist and garnet-chlorite-actinolite schist is dark-green; medium- to coarse-grained; foliated chlorite-bearing biotite schist and gneiss is Dark-gray, Dark-green, medium- to coarse grained, foliated actinolite schist. Felsic, medium- to coarse-grained, massive chlorite quartzofeldspathic, commonly sheared; interlayered with other Za lithologies. Description adapted from Borella (2000).

ALLIGATOR BACK METAMORPHIC SUITE

Zab **undivided—** Heterogeneous unit consisting of interlayered layers and lenses of laterally and vertically grading sedimentary and mafic volcanic rocks metamorphosed to kyanite grade. Rock types include metagraywacke, metawacke, metasandstone, schistose metagraywacke, and schist with minor amounts of metasiltstone, quartzite, and calc-silicate. Thickness of layering ranges from centimeters to meters.

Metagraywacke — medium-light-gray to medium-dark-gray; fine- to medium-grained; foliated; granoblastic; consists of quartz, plagioclase feldspar, biotite > muscovite, with minor amounts of garnet, potassium feldspar, chlorite, titanite, epidote group minerals, tourmaline, rare staurolite, other accessory minerals, and trace amounts of zircon and apatite.

Metawacke — light-tan to light-gray; fine- to medium-grained; foliated to mylonitic; granoblastic to lepidoblastic; consists of quartz, plagioclase feldspar, muscovite > biotite, sericite, chlorite with minor amounts of garnet, potassium feldspar, titanite, apatite, and other accessory minerals; locally has millimeter scale “pin-striped” fabric.

Schistose Metagraywacke — medium-gray to dark-gray; fine- to medium-grained; well foliated to mylonitic; equigranular to inequigranular; granoblastic to lepidoblastic to porphyroblastic; locally migmatitic; consists of quartz, plagioclase feldspar, 40-60% muscovite and/or biotite with minor amounts of garnet, kyanite, and accessory minerals.

Zabc	**coarse-grained unit—**	Heterogeneous unit consisting primarily of interlayered medium- to coarse-grained metagraywacke, metasandstone, and schistose metagraywacke; foliated to mylonitic. Metagraywacke is medium-light-gray to medium-dark-gray; foliated; granoblastic; consists of quartz, plagioclase, biotite, muscovite, with minor amounts of garnet, potassium feldspar, and other accessory minerals. Metasandstone is tan to medium-light-gray to gray; foliated; granoblastic; consists of quartz, potassium feldspar, plagioclase, with minor amounts of muscovite, biotite and other accessory minerals. Schistose metagraywacke is medium-gray to dark-gray; well foliated; granoblastic to lepidoblastic; consists of quartz, plagioclase, muscovite, biotite, garnet, and minor accessory minerals. Primary rock types are interlayered with lesser amounts of meta-arkose, phyllite, phyllonite, and amphibolite.
Zabgs	**graphitic schist and sandstone—**	Graphitic schist is dark-gray to greenish-gray to medium-gray; fine- to medium-grained; well foliated to mylonitic; equigranular to inequigranular; lepidoblastic to porphyroblastic; locally with kyanite porphyroblasts; consists of sericite, quartz, graphite, feldspar, chlorite, kyanite, pyrite, and accessory minerals. Interlayered with lesser amounts of metasandstone, metasiltstone, schistose metagraywacke, schist, and phyllite.
Zabs	**schist—**	Garnet-mica-schist, muscovite schist, muscovite-biotite schist, locally graphitic. Very light-gray to greenish-gray to medium-gray; medium- to coarse-grained; well foliated; locally mylonitic; inequigranular; lepidoblastic to porphyroblastic.0 Interlayered with lesser amounts of schistose metagraywacke, metasandstone, and phyllonite. Includes rare occurrences of garnet-tourmaline schist consisting of 45 to 50% muscovite, 30 to 45% nematoblastic, prismatic black tourmaline, 5 to 7% quartz, 3 to 5% garnet, 1 to 2% opaque minerals including magnetite. Tourmaline schists are typically associated with tourmaline quartz veins that contain massive and prismatic tourmaline, up to 25mm in length.
Zaba	**amphibolite—**	Dark-green to black; fine- to medium-grained; equigranular; granoblastic to nematoblastic; foliated to mylonitic; consists of hornblende, actinolite, plagioclase, chlorite, epidote group minerals, with trace amounts of garnet, titanite, magnetite and other opaque minerals. Interlayered with phyllonite and meta-arkose.
Zabss	**sandstone—**	Tan to light-gray to medium-gray to light-green, fine- to medium-grained, equigranular to inequigranular, foliated to locally mylonitic; consists of quartz, feldspar, muscovite, and accessory minerals; interlayered with lesser amounts of meta-arkose, metasiltstone, phyllonite, metagraywacke, and schistose metagraywacke; locally has a thin “pin-striped” fabric.

EASTERN TUGALOO TERRANE

BREVARD ZONE

bzgs **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.

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, porphyroblastic biotite gneiss and felsic gneiss.

HENDERSON GNEISS LITHODEME

TABLE ROCK PLUTONIC SUITE

SOtrg **Table Rock Gneiss—** 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.

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).

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.

POOR MOUNTAIN FORMATION

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.

TALLULAH FALLS FORMATION

€Ztf **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.

€Ztfa **amphibolite—**

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. Commonly interlayered with other TFF lithologies.

€Ztfs **garnet-mica schist—**

Very light-gray to greenish-gray to medium-gray; fine- to coarse-grained; strongly foliated; inequigranular; lepidoblastic to porphyroblastic; locally migmatitic; consists of approximately muscovite, quartz, biotite, garnet, plagioclase feldspar, and trace opaque minerals; interlayered with other TFF lithologies

€Ztfm **marble—**

Medium to dark gray; fine- to medium-grained; non- to weakly foliated; equigranular, granoblastic; consists of approximately 70% calcite and/or dolomite, 13% plagioclase, 12% quartz, 4% potassium feldspar and 1% muscovite.

€Ztfu	**altered mafic/ultramafic—**	Altered ultramafic rocks (metaperidotite) are 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, 7-10% 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.
€Ztfb	**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.

REFERENCES

Adams, M.G., 1995, The tectonothermal evolution of part of the Blue Ridge thrust complex, Northwestern North Carolina: Ph.D. dissertation, University of North Carolina, 193 p.

Adams, M.G., Cattanach, B.L., Benton, J.R., Trantham, B.T., Lynn, A.S., 2024, Bedrock Geologic Map of the Burnsville 7.5-minute Quadrangle, Yancey and Mitchell Counties, North Carolina: North Carolina Geological Survey Draft Manuscript Map, in color.

Berquist, P.J., 2003, Geologic map of the northern half of the Marshall quadrangle, North Carolina: Unpublished manuscript map and report in files of North Carolina Geological Survey, scale 1:24,000.

Borella, J. W., 2000, The Crabtree-Penland Fault zone: Investigating a new control on the macroscopic brittle-ductile transformation through mapping and related structural studies: M.S. thesis, University of North Carolina Chapel Hill, scale 1:24,000. Georeferenced and digitized by NCGS.

Brobst, D.A., 1962, Geology of the Spruce Pine district, Avery, Mitchell, and Yancey Counties, North Carolina, (No. 1122A) U.S. Geological Survey

Burr, J.L., 2000, Geologic map of the Enka quadrangle, North Carolina: Unpublished manuscript map and report in files of North Carolina Geological Survey, scale 1:24,000.

Burr, J.L., 2000, Geologic map of the east half of the Enka quadrangle, North Carolina: Unpublished manuscript map and report in files of North Carolina Geological Survey, scale 1:24,000.

Carter, M.W., 1996, Bedrock Geologic Map of the Hot Springs 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 1996-05, scale 1:24,000.

Carter, M.W., and Wiener, L.S., 1999, Bedrock geologic map and mineral resources summary of the Fines Creek 7.5-minute quadrangle, North Carolina: North Carolina Geological Survey, Geologic Map Series 8, scale 1:24,000.

Carter, M.W., Williams, S.T., and Merschat, C.E., 2001, Bedrock Geologic Map of the White Rock 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2001-04, scale 1:24,000.

Cattanach, B.L., and Merschat, C.E., 2008, Bedrock Geologic Map of the Oteen 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2008-02, scale 1:24,000.

Cattanach, B.L., Bozdog, G.N., and Wooten, R.M., 2014, Bedrock Geologic Map of the Black Mountain 7.5-minute quadrangle, Buncombe, McDowell and Henderson Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2014-03, scale 1:24,

Cattanach, B.L., Bozdog, G.N., and Isard, S.J., 2020, Bedrock Geologic Map of the Marion West 7.5-minute Quadrangle, McDowell County, North Carolina: North Carolina Geological Survey, Open-File Report 2020-07, scale 1:24,000.

Cattanach, B.L., Bozdog, G.N., Isard, S.J., and Tibbits, M., 2022, Bedrock Geologic Map of the Celo 7.5-minute Quadrangle, Yancey, McDowell, and Mitchell Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2022-06, scale 1:24,000.

Cattanach, B.L., Bozdog, G.N., Isard, S.J., and Wooten, R.M., 2018, Bedrock Geologic Map of the Mount Mitchell 7.5-minute Quadrangle, Buncombe and Yancey Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2018-10, scale 1:24,000.

Cattanach, B.L., Bozdog, G.N., Isard, S.J., and Wooten, R.M., 2019, Bedrock Geologic Map of the Old Fort 7.5-minute Quadrangle, McDowell and Yancey Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2019-04, scale 1:24,000.

Cattanach, B.L., Bozdog, G.N., Isard, S.J., and Wooten, R.M., 2020, Bedrock Geologic Map of the Moffitt Hill 7.5-minute Quadrangle, McDowell, Rutherford, and Buncombe Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2020-05, scale 1:24,000.

Cattanach, B.L., Bozdog, G.N., Wooten, R.M., and Isard, S.J., 2016, Bedrock Geologic Map of the Montreat 7.5-minute quadrangle, Buncombe, Yancey, and McDowell Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2016-06, scale 1:24,000.

Cattanach, B.L., Isard, S.J., and Bozdog, G.N., 2021, Bedrock Geologic Map of the Little Switzerland 7.5-minute Quadrangle, McDowell and Mitchell Counties, North Carolina: North Carolina Geological Survey, Open-File Report 2021-03, scale 1:24,000.

Cattanach, B.L., Merschat, C.E., and Carter, M.W., 2007, Bedrock Geologic Map of the Spring Creek 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Geologic Map Series GMS - 12, scale 1:24,000.

Cattanach, B.L., Wooten, R.M., Bozdog, G.N., and Bullard, A.R., 2013, Bedrock Geologic Map of the Craggy Pinnacle 7.5-minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2013-05, scale 1:24,000.

Kunk, M.J., Southworth, S., Aleinikoff, J.N., Naeser, N.D., Naeser, CW., Merschat, C. E., and Cattanach, B.L., 2006, Preliminary U-Pb, $^{40}AR/^{39}AR$ and fission-track ages supports a long complex tectonic history in the Western Blue Ridge in North Carolina and Tennessee: Southeastern Geological Society of America Abstracts with Programs, v. 38, no. 3, p. 66.

Langille, J., Palmer, M., Cattanach, B.L., Benton, J.R., Trantham, B.T., Lynn, A.S., 2024, Bedrock Geologic Map of the Spruce Pine 7.5-minute Quadrangle, Mitchell County, North Carolina: North Carolina Geological Survey Draft Manuscript Map, in color

Langille, J.M., Palmer, M., and Green, C., 2023, Evidence for Cenozoic topographic rejuvenation associated with the Laurel Creek Lineament in the Spruce Pine 7.5-minute quadrangle, western North Carolina, USA, Journal of Maps, 19:1, scale 1:24,000. Georeferenced and digitized by NCGS.

Merschat, C.E., 1977, Geologic map and mineral resources summary of the Mars Hill quadrangle, North Carolina: North Carolina Geological Survey, Geologic Map - 7.5-minute quadrangle maps and mineral resource summary GM 191-SE, scale 1:24,000.

Merschat, C.E., 1993, Geologic Map and Mineral Resources Summary of the Barnardsville Quadrangle, North Carolina: North Carolina Geological Survey.

Merschat, C.E., 1997, Bedrock Geologic Map of the Bald Creek 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 1997-05, scale 1:24,000.

Merschat, C.E., and Cattanach, B.L., 2005, Bedrock Geologic Map of the Leicester 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2005-03, scale 1:24,000.

Merschat, C.E., and Cattanach, B.L., 2008, Bedrock geologic map of the western half of the Asheville 1:100,000-scale quadrangle, North Carolina and Tennessee: North Carolina Geological Survey, Geologic Map Series GMS-13, scale 1:100,000.

Merschat, C.E., and Wiener, L.S., 1988, Geologic map of the Sandymush and Canton quadrangles, North Carolina: North Carolina Geological Survey, Bulletin 90, scale 1:24,000.

Merschat, C.E., Carter, M.W., and Hewitt, L.K., 2000, Bedrock Geologic Map of the Sams Gap 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2000-09, scale 1:24,000.

Merschat, C.E., Cattanach, B.L., and Carter, M.W., 2007, Bedrock Geologic Map of the Lemon Gap 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Geologic Map Series GMS - 11, scale 1:24,000.

Merschat, C.E., Cattanach, B.L., Bearce, D.N., Ferguson, H.W., Jewell, W.B., and Oriel, S.S., 2004, Bedrock Geologic Map of the Paint Rock 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Open-File Report 2004-04, scale 1:24,000.

Miller, J.W., and Fryer, K.H., 2008, Bedrock Geologic Map of the Asheville 7.5-Minute Quadrangle, North Carolina: North Carolina Geological Survey, Geologic Map Series GMS-14, scale 1:24,000.

Neuendorf, K.K.E., Mehl, J.P., Jr., and Jackson, J.A., 2005, Glossary of Geology, 5th Edition, American Geological Institute, Alexandria, VA, 779 p.

Peterson, V.L., 2002, Geologic map of the southern half of the Marshall quadrangle, North Carolina: Unpublished manuscript map and report in files of North Carolina Geological Survey, scale 1:24,000.

Waters, C. L., 1999, Mapping and related studies of pre-Alleghenian tectonic features within the Blue Ridge thrust complex of western North Carolina: Micaville Quadrangle. M.S. thesis with 7.5' geological map, University of North Carolina at Chapel Hill, 87 pp., scale 1:24,000. Georeferenced and digitized by NCGS.

Waters-Tormey, C.L., Cattanach, B.L., Benton, J.R., Trantham, B.T., Lynn, A.S., 2024, Bedrock Geologic Map of the Micaville 7.5-minute Quadrangle, Yancey and Mitchell Counties, North Carolina: North Carolina Geological Survey Draft Manuscript Map, in color.

Whisnant, J.S., 1979, Geologic Map and Mineral Resource Summary of the Southeast 1/4 Marion Quadrangle, North Carolina: North Carolina Geological Survey, GM 210-SE and MRS 210-SE.