JAMES G. MARTIN, GOVERNOR

GEOLOGIC TIME SCALE

Eon	Era	Period	Epoch (Present day, 1985)	Estimated age of boundaries in millions of years
Phanerozoic	Cenozoic Era (Cz)	Quaternary Period (Q)	Holocene Epoch	0.010
			Pleistocene Epoch	2
		Tertiary Period (T)	Pliocene Epoch (Tpy)	5
			Miocene Epoch (Tm)	24
			Oligocene Epoch (To)	38
			Eocene Epoch (Te)	55
			Paleocene Epoch (Tpa)	63
	Mesozoic Era (Mz)	Cretaceous Period (K)	Late Cretaceous Epoch	
			Early Cretaceous Epoch	138
		Jurassic Period (J)		205
		Triassic Period (₮)		~240
	Paleozoic Era (Pz)	Permian Period (P)		290
		Carboniferous Periods (C)	Pennsylvanian Period (IP)	~330
			Mississippian Period (M)	360
		Devonian Period (D)		410
		Silurian Period (S)		435
		Ordovician Period (O)		500
		Cambrian Period (Є)		~570
Proterozoic	Late Proterozoic Era (Z)	Precambrian (pЄ)		900
	Middle Proterozoic Era (Y)			1600
	Early Proterozoic Era (X)			2500
Archeozoic			Oldest known rocks in U.S.	3600[1]
			Oldest known rocks in world	~3850[2]

Adapted from U.S. Geological Survey, 1984, Geologic Time Chart, in Stratigraphic Notes, 1983: U.S. Geological Survey Bulletin 1537-A, p. A-1 to A-4.
[1]Sims, P.K., Peterman, Z.E., Prinz, W.C., and Benedict, F.C., 1984, Geology, geochemistry, and age of Archean and Early Proterozoic rocks in the Marenisco Watersmeet area, northern Michigan: U.S.G.S. Prof. Paper 1292-A, p. A1-A41.
[2]Moorbath, S., Allaart, J.H., Bridgewater, D., McGregor, V.R., 1977, Rb-Sr of Early Archean supercrustal rocks and Amitsoq gneisses at Isua (Greenland): Nature, v. 270, p. 43-45.

MURPHY BELT

METAMORPHIC ROCKS

Zmb — MINERAL BLUFF FORMATION — Quartz-chlorite-sericite schist and phyllite with thin quartzite layers and minor interbedded graphitic schist, garnet-mica schist, staurolite schist, cross-biotite schist, and dark slate

Zmam — MURPHY MARBLE, ANDREWS FORMATION, AND NOTTELY QUARTZITE, UNDIVIDED —
Murphy Marble: calcareous to dolomitic
Andrews Formation: calcareous cross-biotite schist
Nottely Quartzite: meta-orthoquartzite with slate

Zb — BRASSTOWN FORMATION — Cross-biotite schist; includes micaceous quartzite in lower part

Znt — NANTAHALA FORMATION AND TUSQUITEE QUARTZITE, UNDIVIDED
Nantahala Formation: slate and metasiltstone, dark gray, laminated to thin bedded, sulfidic
Tusquitee Quartzite: white to light yellowish gray, numerous, thin slate layers

INTRUSIVE ROCKS

ЄZam — AMPHIBOLITE — Equigranular, massive to well foliated, dioritic to basaltic dikes and sills; variably metamorphosed

BLUE RIDGE BELT

SEDIMENTARY AND METAMORPHIC ROCKS

Єr — ROME FORMATION — Shale and siltstone, variegated red to brown; interbedded fine-grained sandstone and shaly dolomite

Єs — SHADY DOLOMITE — Light gray, fine grained, massive, locally thin bedded or ribboned

CHILHOWEE GROUP

Єcu — UPPER CHILHOWEE — Vitreous quartz arenite, white to light gray; interbedded sandy siltstone and shale. Erwin and Hampton formations of Hot Springs window

Єcl — LOWER CHILHOWEE — Feldspathic arenite, white to yellowish gray. Minor silty shale, feldspathic siltstone, and conglomerate in lower part. Includes Unicoi Formation of Hot Springs window

OCOEE SUPERGROUP

Zwc — WALDEN CREEK GROUP, UNDIVIDED — Slate to metasiltstone, local limy beds and pods; interbedded with quartz-pebble metaconglomerate and metasandstone

Zss — SANDSUCK FORMATION — Slate and metasiltstone, dark green to black. Metaconglomerate lentils in upper part; calcareous metasandstone, sandy metalimestone, and quartzite in lower part

Zgs — GREAT SMOKY GROUP, UNDIVIDED — Thick metasedimentary sequence of massive to graded beds of metagraywacke and metasiltstone with interbedded graphitic and sulfidic slate and schist

Zd — DEAN FORMATION — Sericite schist with cross-biotite, staurolite, and garnet porphyroblasts; interbedded metagraywacke and quartz-pebble metaconglomerate

Zhha — METASANDSTONE, METAGRAYWACKE, METASILTSTONE, AND MICA SCHIST — Beds and lenses of calc-silicate rock locally abundant; garnet, staurolite, and cross-biotite porphyroblasts common in fine-grained layers. Includes Hughes Gap and Hothouse formations in southern area; Horse Branch Member of Ammons Formation and Grassy Branch Formation in northern area

Zwe — WEHUTTY FORMATION — Slate to schist, dark gray, graphitic and sulfidic; includes mica schist, metagraywacke, and metaconglomerate

Zch — COPPERHILL FORMATION — Metagraywacke, massive, graded bedding common; includes dark-gray slate, mica schist, and nodular calc-silicate rock

Zchs — SLATE OF COPPERHILL FORMATION — Slate to phyllite, dark gray, graphitic, sulfidic; includes metagraywacke with local graded bedding

Zl — PHYLLITE — Dark olive gray, graphitic and sulfidic

Za — ANAKEESTA FORMATION — Slate to schist, dark gray, graphitic and sulfidic; includes interbedded argillaceous, feldspathic metagraywacke

Zbg — BOYD GAP FORMATION — Dark gray, highly-sulfidic slate and metasiltstone interbedded and gradational with metagraywacke. Stratigraphic position uncertain. In Cherokee County includes upper part of Buck Bald Formation

Zrb — RICH BUTT SANDSTONE — Feldspathic; interbedded with dark argillaceous layers and laminae. Stratigraphic position uncertain

Zs — SNOWBIRD GROUP, UNDIVIDED — Feldspathic metasiltstone, metasandstone, and phyllite. Basal schist contains lenses of quartz-pebble conglomerate

Zsp — PIGEON SILTSTONE — Thin bedded to laminated, commonly cross-bedded, metamorphosed; locally includes argillite and calcareous and ankeritic metasiltstone grading to silty metalimestone

Zsr — ROARING FORK SANDSTONE — Greenish gray, fine to medium grained, locally cross-bedded, metamorphosed; interbedded metasiltstone and phyllite

Zsl — LONGARM QUARTZITE — Cross-bedded, feldspathic, locally conglomeratic; includes dark slate and metasiltstone

Zsw — WADING BRANCH FORMATION — Sandy slate to coarse-grained pebbly metagraywacke with local graded bedding. Basal quartz-sericite schist or phyllite

MOUNT ROGERS FORMATION

Zmf — Metafelsite (Late Proterozoic, 820 my; 26) — Light-colored porphyritic extrusive rock

Zml — Metagraywacke — Interlayered with metaconglomerate, laminated metasiltstone, and slate; minor calcareous metasandstone, greenstone, and metarhyolite

ALLIGATOR BACK FORMATION

Zabs — Mica schist and phyllite — Laminated to thin layered; interlayered with minor biotite-muscovite gneiss and amphibolite

Zabg — Gneiss — Finely laminated to thin layered; locally contains massive gneiss and micaceous granule conglomerate; includes schist, phyllite, and amphibolite

Zaba — Amphibolite — Equigranular, massive to well foliated, interlayered, rarely discordant, metamorphosed intrusive and extrusive mafic rock; may include metasedimentary rock

ASHE METAMORPHIC SUITE AND TALLULAH FALLS FORMATION

Zatw — Metagraywacke — Foliated to massive, locally conglomeratic; interlayered and gradational with mica schist, muscovite-biotite gneiss, and rare graphitic schist

Zatm — Muscovite-biotite gneiss — Locally sulfidic; interlayered and gradational with mica schist, minor amphibolite, and hornblende gneiss

Zats — Mica schist — Locally sulfidic and graphitic; minor interlayered mica gneiss and amphibolite

Zatb — Biotite gneiss — Interlayered with biotite-garnet gneiss, biotite-muscovite schist, garnet-mica schist, and amphibolite

Zata — Amphibolite — Equigranular, massive to well foliated, interlayered, rarely discordant, metamorphosed intrusive and extrusive mafic rock; may include metasedimentary rock

Zco — COWEETA GROUP — Quartz dioritic gneiss, feldspar-quartz-biotite gneiss, metasandstone and quartzite, alumino-silicate schist, garnetiferous biotite gneiss, and minor amphibolite. Quartz dioritic gneiss predominant

ZYbn — BIOTITE GNEISS — Migmatitic; interlayered and gradational with biotite-garnet gneiss and amphibolite; locally abundant quartz and alumino-silicates. Stratigraphic position uncertain

ZYba — Amphibolite — Equigranular, massive to well foliated, interlayered, rarely discordant, metamorphosed intrusive and extrusive mafic rock; may include metasedimentary rock

UNCONFORMITY

Ygg — GRANODIORITIC GNEISS (Middle Proterozoic, 1175 my; 2) — Greenish gray to pinkish gray, porphyroclastic to mylonitic; epidote, sericite, and chlorite common

Ytg — TOXAWAY GNEISS (Middle Proterozoic, 1203 my; 12) — Poorly foliated to well foliated, equigranular to inequigranular, granitic

Ybgg — BIOTITE GRANITIC GNEISS (Late to Middle Proterozoic, 950-1250 my, 14) — Pinkish gray to light gray, massive to well foliated, granitic to quartz monzonitic; includes variably mylonitized orthogneiss and paragneiss, interlayered amphibolite, calc-silicate rock, and marble. Includes granites of the Bryson City area, Straight Fork window, and Elk Park Plutonic Suite

Ybam — Amphibolite — Equigranular, massive to well foliated, interlayered, rarely discordant, metamorphosed intrusive and extrusive mafic rock; may include metasedimenary rock

Ymg — MIGMATITIC BIOTITE-HORNBLENDE GNEISSES (Middle Proterozoic, 1214 my; 12) — Layered biotite-granite gneiss, biotite-hornblende gneiss, amphibolite, calc-silicate rock; locally contains relict granulite facies rock

Ymam — Amphibolite — Equigranular, massive to well foliated, interlayered, rarely discordant, metamorphosed intrusive and extrusive mafic rock; may include metasedimentary rock

INTRUSIVE ROCKS

PEGMATITES (Devonian to Silurian, 390-435 my; 21) — Lenticular to tabular dikes and sills, unfoliated, granitic to granodioritic. Too small to show separately; areas of abundance and economic importance shown by pattern

TRONDHJEMITES — Postmetamorphic dikes and sills, fine-grained, locally porphyritic, weakly foliated to massive granodiorite to tonalite. Too small to show separately; areas of abundance shown by pattern

Dqd — QUARTZ DIORITE TO GRANODIORITE (Devonian, 390 my; 4) — Contains biotite, muscovite, and xenocrysts. Includes Whiteside Mountain, Stone Mountain, Mount Airy, Spruce Pine, and other smaller plutons

Org — RABUN GNEISS (Ordovician, 450-500 my; 13) — Weakly to well foliated, granitic to quartz monzonitic

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite, local peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

ЄZam — AMPHIBOLITE — Equigranular, massive to well foliated, dioritic to basaltic dikes and sills; variably metamorphosed

Zg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic, 680-710 my; 25, 27) — Massive to foliated, locally mylonitic. Beech, Crossnore, Brown Mountain, Lansing, and other granitic rocks

Zm — MAX PATCH GRANITE — Mottled pink and light green, coarse grained to porphyritic, massive; contains biotite

BAKERSVILLE METAGABBRO (Late Proterozoic, 734 my; 16) — Thin dikes and sills. Not shown separately; areas of abundance shown by pattern

GRANDFATHER MOUNTAIN WINDOW

METAMORPHIC ROCKS

Єs — SHADY DOLOMITE — Light gray, fine grained, masive, locally thin bedded or ribboned. Thin beds of phyllite

CHILHOWEE GROUP

Єcu — UPPER CHILHOWEE — Vitreous quartzite, white to light gray; interbedded sandy metasiltstone and slate

Єcl — LOWER CHILHOWEE — Feldspathic quartzite, white to yellowish gray. Minor silty slate, feldspathic metasiltstone, and metaconglomerate in lower part

GRANDFATHER MOUNTAIN FORMATION

Zgma — Meta-arkose — Sericitic, conglomeratic, locally cross-bedded; interlayered metasiltstone and slate

Zgmg — Greenstone — Schistose to massive, amygdaloidal; interlayered with metasedimentary rocks. Includes Montezuma Member (metabasalt) in upper part

Zgmr — Porphyritic felsic volcanic rock (Late Proterozoic, 820 my; 26) — Phyllitic to schistose, contains euhedral to subhedral phenocrysts of gray quartz and pink potassic feldspar. Resembles quartzite and meta-arkose

Zgms — Metasiltstone — Locally contains thin bedded iron-bearing dolomitic marble; interlayered with phyllite, metagraywacke, and meta-arkose

Zgmw — Metagraywacke — Cross-bedding and graded bedding common, locally conglomeratic; interlayered with metasiltstone and phyllite

Zgmu — Felsic metavolcanic rocks and metasedimentary rocks (Late Proterozoic, 820 my; 26) — Tentatively correlated with Grandfather Mountain Formation

UNCONFORMITY

Ybrg — BLOWING ROCK GNEISS (Middle Proterozoic, 1000 my; 10) — Abundant white potassic feldspar megacrysts in finely banded biotite schist, locally calcareous; interlayered with quartz-feldspar schist, calcareous biotite schist, phyllite, black slate, calcareous quartzite, sulfidic greenstone, and siliceous tuff

Ybgg — BIOTITE GRANITIC GNEISS (Middle Proterozoic, 950-1250 my; 14) — Contains paragneiss and granitic to quartz monzonitic orthogneiss; locally schistose and mylonitic. Locally includes tectonic slices, infolded remnants, or recrystallized equivalents of the Grandfather Mountain Formation. Equivalent to the Wilson Creek Gneiss

INTRUSIVE ROCKS

Zlm — LINVILLE METADIABASE — Metadiabase, greenstone, and amphibolite dikes and sills; massive to schistose

Zg — METAMORPHOSED GRANITE (Late Proterozoic, 680-710 my; 25,27) — Massive to foliated, locally mylonitic. Equivalent to Brown Mountain Granite

KINGS MOUNTAIN BELT

METAMORPHIC ROCKS

ЄZbl — FINE-GRAINED BIOTITE GNEISS — Strongly foliated; minor layers of amphibolite and muscovite schist

ЄZbl — BLACKSBURG FORMATION — Sericite schist, locally with graphite, phyllite with sericite quartzite, banded marble, amphibolite, and minor calc-silicate rock

Zbt — BATTLEGROUND FORMATION — Quartz-sericite schist with metavolcanic rock, quartz-pebble metaconglomerate, kyanite-sillimanite quartzite, and garnet-quartz rock

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

IPPmg — FOLIATED TO MASSIVE GRANITIC ROCK (Pennsylvanian to Permian, 270-230 my; 18,19) — Megacrystic to equigranular. High Shoals Granite

Mc — CHERRYVILLE GRANITE — (Mississippian, 351 my; 20,21) — Massive to weakly foliated; contains pegmatites

PzZq — METAMORPHOSED QUARTZ DIORITE — Foliated to massive

INNER PIEDMONT, CHAUGA BELT, SMITH RIVER ALLOCHTHON, AND SAURATOWN MOUNTAINS ANTICLINORIUM

METAMORPHIC ROCKS

Bf — ROCKS OF BREVARD FAULT ZONE — "Fish scale" schist and phyllonite, graphitic; interlayered with feldspathic metasandstone, marble lenses

ЄZbg — BIOTITE GNEISS AND SCHIST — Inequigranular, locally abundant potassic feldspar and garnet; interlayered and gradational with calc-silicate rock, sillimanite-mica schist, mica schist, and amphibolite. Contains small masses of granitic rock

ЄZbf — FINE-GRAINED BIOTITE GNEISS — Strongly foliated; minor layers of amphibolite and muscovite schist

ЄZms — MICA SCHIST — Garnet, staurolite, kyanite, or sillimanite occur locally; lenses and layers of quartz schist, micaceous quartzite, calc-silicate rock, biotite gneiss, amphibolite, and phyllite

ЄZab — AMPHIBOLITE AND BIOTITE GNEISS — Interlayered; minor layers and lenses of hornblende gneiss, metagabbro, mica schist, and granitic rock

ЄZam — AMPHIBOLITE — Metamorphosed mafic extrusive and intrusive rock; includes hornblende gneiss, thin layers of mica schist, calc-silicate rock, and, rarely, marble. Also includes small masses of metadiorite and metagabbro

ЄZmb — MEGACRYSTIC BIOTITE GNEISS — Poorly layered to massive; megacrysts of microcline and quartz; local mica schist, amphibolite, and biotite gneiss

ЄZq — QUARTZITE — Interlayered with quartz-muscovite schist, contains muscovite, andalusite, kyanite, or sillimanite

ЄZmg — METAGRAYWACKE AND MUSCOVITE-BIOTITE SCHIST — Metagraywacke (biotite gneiss) interlayered and gradational with muscovite-biotite schist; minor marble and granitic rock

ЄZma — METAGRAYWACKE, AMPHIBOLITE, AND KYANITE SCHIST — Metagraywacke (biotite gneiss) interlayered and gradational with amphibolite and kyanite schist; minor ultramafic and granitic rock

ЄZmg — METAGRAYWACKE — Contains quartz and microcline porphyroblasts

ЄZbb — BANDED GNEISS — Interlayered with calc-silicate rock, metaconglomerate, amphibolite, sillimanite-mica schist, and granitic rock

ЄZph — PHYLLITE AND SCHIST — Includes phyllonite and interlayered biotite gneiss

ЄZig — INEQUIGRANULAR BIOTITE GNEISS — Weakly foliated to massive, contains plagioclase megacrysts and, rarely, larger megacrysts of quartz and feldspar

ЄZpg — PORPHYROBLASTIC GNEISS — Massive to foliated, granodioritic, migmatitic

ЄZgms — GARNET-MICA SCHIST — Interlayered with amphibolite

Yg — GRANITIC GNEISS (Middle Proterozoic, 1192 my; 27) — Megacrystic, in places contains amphibolite

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

Mc — CHERRYVILLE GRANITE (Mississippian, 351 my; 20,21) — Massive to weakly foliated; contains pegmatites, lithium-bearing on east side

DSc — CAESARS HEAD GRANITE GNEISS (Devonian to Silurian, 409 my; 13) — Equigranular to porphyritic, massive to well foliated; contains biotite and muscovite

SOgg — GRANITE GNEISS (Ordovician to Silurian, 438 my; 17) — Poorly foliated; interlayered with biotite augen gneiss

OЄgm — MIGMATITIC GRANITIC GNEISS — Foliated to massive, granitic to quartz dioritic; biotite gneiss and amphibolite common

OЄg — METAMORPHOSED GRANITIC ROCK (Cambrian to Ordovician, 455-540 my; 10) — Equigranular to megacrystic, foliated to massive. Includes Toluca Granite

Єhg — HENDERSON GNEISS (Cambrian, 524 my; 10) — Monzonitic to granodioritic, inequigranular

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite, local peridotite, serpentinite, soapstone, and other ultramafic rock. Only larger bodies shown

Zg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic, 680-710 my; 18) — Massive to foliated, locally mylonitic

CHARLOTTE AND MILTON BELTS

METAMORPHIC ROCKS

ЄZbl — FINE-GRAINED BIOTITE GNEISS — Massive to strongly foliated; minor layers of amphibolite and muscovite schist

ЄZfg — FELSIC MICA GNEISS — Interlayered with biotite and hornblende gneiss and schist

ЄZbg — BIOTITE GNEISS AND SCHIST — Inequigranular and megacrystic; abundant potassic feldspar and garnet; interlayered and gradational with calc-silicate rock, sillimanite-mica schist, mica schist, and amphibolite. Contains small masses of granitic rock

ЄZv — METAVOLCANIC ROCK — Interbedded felsic to mafic tuffs and flowrock

ЄZmv — MAFIC METAVOLCANIC ROCK — Metamorphosed basaltic to andesitic tuffs and flows, grayish green to black. Locally includes hypabyssal intrusives and minor felsic metavolcanic rock

ЄZfv — FELSIC METAVOLCANIC ROCK — Metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; minor mafic and intermediate metavolcanic rock

ЄZq — QUARTZITE — Massive to well foliated; contains andalusite, kyanite, or sillimanite, chloritoid, and pyrite

ЄZph — PHYLLITE AND SCHIST — Minor biotite, pyrite, and sillimanite; includes minor quartzite

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

IPPg — GRANITIC ROCK (Pennsylvanian to Permian, 265-325 my; 11,9) — Megacrystic to equigranular. Churchland Plutonic Suite (Western group) - Churchland, Landis, and Mooresville intrusives

DSg — GRANITE OF SALISBURY PLUTONIC SUITE (Devonian to Silurian, 385-415 my; 5) — Pink, massive to weakly foliated. Gold Hill, Kannapolis, Salisbury, Southmont, and Yadkin intrusives

DSs — SYENITE OF CONCORD PLUTONIC SUITE (Silurian, 404 my; 9) — Includes the Concord ring dike

DOgb — GABBRO OF CONCORD PLUTONIC SUITE (Devonian to Ordovician, 399-479 my; 24) — Barber, Concord, Farmington, Mecklenburg, and Weddington intrusives

DOg — GRANITIC ROCK — Locally pinkish gray, massive to weakly foliated; contains hornblende

Ss — SHELTON GRANITE GNEISS (Silurian, 429 my; 21) — Poorly foliated, lineated granitic to quartz monzonitic gneiss

PzZq — METAMORPHOSED QUARTZ DIORITE — Foliated to massive

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZm — METAMORPHOSED MAFIC ROCK — Metagabbro, metadiorite, and mafic plutonic-volcanic complexes

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite and peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

ЄZg — METAMORPHOSED GRANITIC ROCK — Megacrystic, well foliated; locally contains hornblende

CAROLINA SLATE BELT

METAMORPHIC ROCKS

ЄZy — YADKIN FORMATION — Metamorphosed graywacke, volcanic sandstone, and siltstone; interbedded with mafic and intermediate metavolcanic flows and tuffs

ЄZmd — METAMUDSTONE AND META-ARGILLITE — Thin to thick bedded; bedding plane and axial-planar cleavage common; interbedded with metasandstone, metaconglomerate, and metavolcanic rock
$CZmd_3$ - Floyd Church Formation
$CZmd_2$ - Cid Formation
$CZmd_1$ - Tillery Formation
(southwest of Asheboro)

ЄZmv — MAFIC METAVOLCANIC ROCK — Metamorphosed basaltic flows and tuffs, dark green to black; interbedded with felsic and intermediate metavolcanic rock and metamudstone
$CZmv_1$ - Cid Formation (southwest of Asheboro)

ЄZfv — FELSIC METAVOLCANIC ROCK — Metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; interbedded with mafic and intermediate metavolcanic rock, meta-argillite, and metamudstone
$CZfv_2$ - Cid Formation (southwest of Asheboro)
$CZfv_1$ - Uwharrie Formation (at Asheboro and to south)

ЄZiv — INTERMEDIATE METAVOLCANIC ROCK — Metamorphosed andesitic tuffs and flows, medium to dark grayish green; minor felsic and mafic metavolcanic rock

ЄZv — METAVOLCANIC ROCK — Interbedded felsic to mafic tuffs and flowrock

ЄZve — METAVOLCANIC-EPICLASTIC ROCK — Metamorphosed argillite, mudstone, volcanic sandstone, conglomerate, and volcanic rock

ЄZc — VOLCANIC METACONGLOMERATE — Includes metagraywacke and metamudstone

ЄZph — PHYLLITE AND SCHIST — Locally laminated and pyritic; includes phyllonite, sheared fine-grained metasediment, and metavolcanic rock. In Lilesville granite aureole, includes hornfels ($CZph_1$), and biotite gneiss and schist (ЄZbg)

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

IPPg — GRANITIC ROCK (Pennsylvanian to Permian, 265-325 my; 11) — Megacrystic to equigranular. Lilesville granite

IPgb — PEE DEE GABBRO (Pennsylvanian, 314 my; 21) — Dark gray to black, medium to fine grained, massive

PzZq — METAMORPHOSED QUARTZ DIORITE — Foliated to massive

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZm — METAMORPHOSED MAFIC ROCK — Metagabbro, metadiorite, and mafic plutonic-volcanic complexes

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite and peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

ЄZg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic to late Cambrian, 520-650 my; 3,21,9,23,28,15) — Megacrystic, well foliated; locally contains hornblende. Chapel Hill, Chatham, Farrington, Meadow Flats, Mt. Moriah, Parks Crossroads plutons, and Roxboro and Vance County suites

SYMBOLS

Contact

Fault

Fault — Showing relative horizontal movement

Normal fault — Bar and ball on downthrown side

Overturned normal fault

Thrust fault — Sawteeth on upper plate

Overturned thrust fault

Anticline — Showing direction of plunge

Overturned anticline — Showing direction of dip of limbs

Syncline — Showing direction of plunge

Dike — Dashed where inferred from aeromagnetic data

Scarp — Hachured on downslope side

Zone of mylonitization

RALEIGH BELT

METAMORPHIC ROCKS

ЄZam — AMPHIBOLITE — Metamorphosed mafic extrusive and intrusive rock; includes hornblende gneiss, thin layers of mica schist, and small nonlayered masses of metadiorite and metagabbro

ЄZbg — BIOTITE GNEISS AND SCHIST — Inequigranular and megacrystic; in places contains garnet; interlayered and gradational with mica schist and amphibolite; includes small masses of granitic rock

ЄZms — MICA SCHIST — Contains garnet, staurolite, kyanite, or sillimanite; includes lenses and layers of quartz schist, micaceous quartzite, biotite gneiss, amphibolite, and phyllite

ЄZig — INJECTED GNEISS — Biotite gneiss and schist intruded by numerous sills and dikes of granite, pegmatite, and aplite; minor hornblende gneiss

ЄZfg — FELSIC MICA GNEISS — Interlayered with graphitic mica schist and mica-garnet schist, commonly with kyanite; minor hornblende gneiss

ЄZlg — LINEATED FELSIC MICA GNEISS — White to pink, with strong lineation of muscovite-biotite streaks and prismatic quartz aggregates; planar foliation and layering weak; minor mica schist and hornblende gneiss

ЄZph — PHYLLITE AND SCHIST — Minor biotite and pyrite; includes phyllonite, sheared fine-grained metasediment, and metavolcanic rock

INTRUSIVE ROCKS

Jr — RHYOLITE (Jurassic, 196 my; 6) — Dike, medium to dark gray, phenocrysts of sanidine, anorthoclase, and quartz; commonly with calcite or clay amygdules

Jd — DIABASE — Dikes, gray to black

IPPg — GRANITIC ROCK (Pennsylvanian to Permian, 265-325 my; 11) — Megacrystic to equigranular. Castalia and Wilton intrusives

IPPmg — FOLIATED TO MASSIVE GRANITIC ROCK (Pennsylvanian to Permian, 270-320 my; 4,22) — Megacrystic to equigranular. Rolesville suite, Wise and Lemon Springs(?) intrusives

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite and peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

ЄZg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic to late Cambrian, 520-650 my; 7) — Megacrystic, well foliated, locally contains hornblende; Vance County suite and Buckhorn granite

TRIASSIC BASINS

NEWARK SUPERGROUP

DAN RIVER GROUP

₮d — DAN RIVER GROUP, UNDIVIDED — Basin-margin conglomerate and sandstone, red to brown, interfingering with basin-center sandstone and mudstone, green to brown. Conglomerate shown by pattern

₮ds — STONEVILLE FORMATION — Conglomerate, sandstone, and mudstone, lenticular and laterally-gradational bedding

₮dc — COW BRANCH FORMATION — Mudstone with minor sandstone, gray, laterally-continuous bedding. Intertongues with Stoneville and Pine Hall formations

₮dp — PINE HALL FORMATION — Sandstone, mudstone, and conglomerate, yellowish orange to brown

CHATHAM GROUP

₮c — CHATHAM GROUP, UNDIVIDED — Conglomerate, fanglomerate, sandstone, and mudstone. Conglomerate and fanglomerate shown by pattern

Arkosic sandstone, tan, medium- to very coarse-grained, micaceous

Sandstone and mudstone with thin interbeds of chert and impure limestone

Arkosic sandstone and clayey sandstone, brown; interbedded with brown to dark-gray sandstone and mudstone

₮cs — SANFORD FORMATION — Conglomerate, fanglomerate, sandstone, and mudstone

₮cc — CUMNOCK FORMATION — Sandstone and mudstone, gray to black; coal beds and carbonaceous shale. Grades into Pekin and Sanford formations

₮cp — PEKIN FORMATION — Conglomerate, sandstone, and mudstone

INTRUSIVE ROCKS

Jd — DIABASE — Dikes and sills, gray to black

EASTERN SLATE BELT

METAMORPHIC ROCKS

Rocks of Eastern slate belt are partly covered by Quaternary surficial sediment not shown on map. Bedrock contacts are inferred where concealed by sediment.

ЄZve — METAVOLCANIC-EPICLASTIC ROCK — Metamorphosed argillite, mudstone, volcanic sandstone, conglomerate, and volcanic rock

ЄZfv — FELSIC METAVOLCANIC ROCK — Metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; interbedded with mafic and intermediate metavolcanic rock, meta-argillite, and metamudstone

ЄZiv — INTERMEDIATE METAVOLCANIC ROCK — Metamorphosed andesitic tuffs and flows, medium to dark grayish green; minor felsic and mafic metavolcanic rock

ЄZmv — MAFIC METAVOLCANIC ROCK — Metamorphosed basaltic flows and tuffs, grayish green to black; interbedded with felsic and intermediate metavolcanic rock and metamudstone

ЄZq — QUARTZITE AND QUARTZ-MUSCOVITE SCHIST — Garnet, andalusite, kyanite, or sillimanite occur locally

ЄZmd — METAMUDSTONE AND META-ARGILLITE — Bedding plane and axial-planar cleavage common; interbedded with metasandstone, metaconglomerate, and metavolcanic rock

ЄZph — PHYLLITE AND SCHIST — Minor biotite and pyrite; includes phyllonite, sheared fine-grained metasediment, and metavolcanic rock

INTRUSIVE ROCKS

Jr — RHYOLITE (Jurassic, 196 my; 6) — Dike, medium to dark gray, phenocrysts of sanidine, anorthoclase, and quartz; commonly with calcite or clay amygdules

Jd — DIABASE — Dikes, gray to black

IPPg — GRANITIC ROCK (Pennsylvanian to Permian, 265-325 my; 11,21,1,29) — Megacrystic to equigranular. Castalia, Lillington, Medoc Mountain, Sims, Contentnea Creek (?), and Elm City (?) intrusives

IPPmg — FOLIATED TO MASSIVE GRANITIC ROCK (Pennsylvanian to Permian, 270-320 my; 8) — Megacrystic to equigranular. Butterwood Creek intrusive and Rocky Mount intrusive suite

PzZq — METAMORPHOSED QUARTZ DIORITE — Foliated to massive

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite and peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

ЄZg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic to late Cambrian, 520-650 my; 22) — Megacrystic, well foliated; locally contains hornblende. Fountain intrusive

COASTAL PLAIN

QUATERNARY

Qp — SURFICIAL DEPOSITS, UNDIVIDED — Sand, clay, gravel, and peat deposited in marine, fluvial, eolian, and lacustrine environments. Quaternary deposits not shown at altitudes greater than approximately 25 feet above mean sea level (Suffolk Scarp, in part)

TERTIARY

Tp — PINEHURST FORMATION — Sand, medium- to coarse-grained, cross-bedding and rhythmic bands of clayey sand common, unconsolidated

Tt — TERRACE DEPOSITS AND UPLAND SEDIMENT — Gravel, clayey sand, and sand, minor iron-oxide cemented sandstone

Tpyw — WACCAMAW FORMATION — Fossiliferous sand with silt and clay, bluish-gray to tan, loosely consolidated. Straddles Pleistocene-Pliocene boundary

Tpy — YORKTOWN FORMATION AND DUPLIN FORMATION, UNDIVIDED
Yorktown Formation: Fossiliferous clay with varying amounts of fine-grained sand, bluish gray, shell material commonly concentrated in lenses; mainly in area north of Neuse River
Duplin Formation: Shelly, medium- to coarse-grained sand, sandy marl, and limestone, bluish gray; mainly in area south of Neuse River

Tob — BELGRADE FORMATION, UNDIVIDED
Pollocksville Member: Oyster-shell mounds in tan to orange sand matrix, indurated locally
Haywood Landing Member: Fossiliferous clayey sand, gray to brown. Members grade into each other laterally

Tor — RIVER BEND FORMATION — Limestone, calcarenite overlain by and intercalated with indurated, sandy, molluscan-mold limestone

CASTLE HAYNE FORMATION

Tecs — Spring Garden Member: Molluscan-mold limestone, indurated, very sandy. Grades downward into a calcareous sand and laterally into Comfort Member

Tec — Comfort Member and New Hanover Member, undivided
Comfort Member: Bryozoan-echinoid skeletal limestone, locally dolomitized, solution cavities common
New Hanover Member: Phosphate-pebble conglomerate, micritic, thin; restricted to basal part of Castle Hayne Formation in southeastern counties

Tpa — BEAUFORT FORMATION, UNDIVIDED
Unnamed upper member: Sand and silty clay, glauconitic, fossiliferous, and locally calcareous
Jericho Run Member: Siliceous mudstone with sandstone lenses, thin bedded; basal phosphatic pebble conglomerate

CRETACEOUS

Kp — PEEDEE FORMATION — Sand, clayey sand, and clay, greenish gray to olive black, massive, glauconitic, locally fossiliferous and calcareous. Patches of sandy molluscan-mold limestone in upper part

Kb — BLACK CREEK FORMATION — Clay, gray to black, lignitic; contains thin beds and laminae of fine-grained micaceous sand and thick lenses of cross-bedded sand. Glauconitic, fossiliferous clayey sand lenses in upper part

Km — MIDDENDORF FORMATION — Sand, sandstone, and mudstone, gray to pale gray with an orange cast, mottled; clay balls and iron-cemented concretions common, beds laterally discontinuous, cross-bedding common

Kc — CAPE FEAR FORMATION — Sandstone and sandy mudstone, yellowish gray to bluish gray, mottled red to yellowish orange, indurated, graded and laterally continuous bedding, blocky clay, faint cross-bedding, feldspar and mica common

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Intrusives named in literature are listed in legend with appropriate map symbol