



DESCRIPTION OF MAP UNITS

SEDIMENTARY ROCKS

- Quaternary**
- Qal** Alluvium- white to light-gray, unconsolidated clay, silt, sand, and, locally, gravel associated with floodplains.
- Tertiary**
- ss** Surficial sediments- white to light-gray to yellowish-gray unconsolidated sand, clay, and gravel. These sediments cover underlying sedimentary rocks and crystalline rocks, except in drainages. Iron-oxide-cemented sediments occur locally near the base of the sedimentary cover.
  - Gravels** Unconsolidated cobbles, clay, and sand. The gravels consist of cobbles of white to red, subrounded to subangular quartz and, rarely, rock fragments, up to 10 cm in maximum dimension in a matrix of reddish-orange and reddish-brown sand and clay.
- Cretaceous**
- Ku** Undifferentiated sediments- dark-yellowish-orange to moderate-reddish-brown sandy silt with scattered subrounded quartz pebbles up to 15 mm in maximum dimension. Locally, contains a thin bed of grayish-black organic-rich sediment. Includes very-light-gray fine sand, silt, and clay, and iron-oxide-cemented conglomerate.

METAMORPHIC ROCKS

- md** Metamudstone- very fine-grained, thinly bedded to massive, light-tan to very pale-orange to dark-yellowish-orange and yellowish-gray to pinkish-gray metamorphosed mudstone and siltstone. Cleavage surfaces commonly have a phyllitic appearance. Some coarse mica is along bedding planes. Well-developed crenulation cleavage is common. Locally, the metamudstone is very light-gray quartz-sericite phyllite.
- am** Amphibolite- black to greenish-black, slightly foliated to lineated and locally schistose hornblende amphibolite. Occurs as the predominant rock type in a unit in the west-central part of the quadrangle and interlayered with biotite gneiss in other areas. Locally, contains biotite. Chlorite-epidote-rich float occurs in some areas.
- mgn** Biotite gneiss- medium- to coarse-grained, light-gray to medium-light-gray, well-foliated, quartzofeldspathic gneiss. Contains interlayers of light-gray to pale-pink felsic gneiss, white to light-gray, fine-grained muscovite schist, and greenish-black to black amphibolite. Where it is in contact with metamudstone, the gneiss is predominantly fine-grained, white to pale-pink felsic gneiss with scattered biotite flakes. Some felsic gneiss is metatuff containing rock fragments parallel to the direction of the foliation and cleavage. Metamorphic grade increases to the north.
- qms** Quartz-muscovite schist- medium-grained, white to light-gray, quartz-muscovite schist. Commonly contains pyrite disseminated and locally segregated into layers parallel to the schistosity. Includes very minor chlorite schist, quartzite, and intermediate volcanic rock. Commonly with well-developed small-scale folding. Contains quartz pods and quartz veins. Pods and clusters of kyanite are present locally. In places the kyanite is concentrated parallel to the cleavage.
- qk** Quartz-kyanite rock- dense, massive, white quartzose rock containing disseminated kyanite and minor muscovite. Some areas shown as qk on the map consist of float boulders.

INTRUSIVE ROCKS

- Jd** Diabase- fine-grained, dense, black to greenish-black dike rock.
- gr** Granite- fine- to medium-grained, light-gray to pale-pink, massive to slightly foliated granite composed of quartz, feldspar, and small biotite flakes.
- fd** Metafelsite- medium-grained, light-gray dike rock composed of plagioclase, quartz, biotite, muscovite, and epidote.

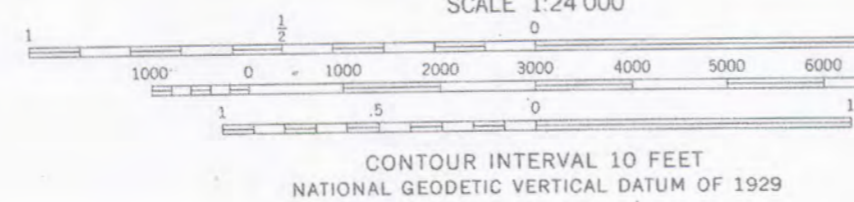
Symbols

- Contact- well located
- - - Contact- approximately located
- 65 Strike and dip of bedding
- 65 Strike and dip of foliation
- 65 Strike and dip of cleavage
- X Strike of vertical bedding
- X Strike of vertical foliation
- X Strike of vertical cleavage
- Po 89-10 Sample location
- △ Outcrop location
- Natural Spring
- Fe Iron prospect
- S Sand pit
- G Gravel pit
- Fe Inactive iron mine

Base map by U. S. Geological Survey  
Geology mapped in 1989-1990  
Digital cartography by Robert O. Walton III

Polyconic projection. 10,000-foot grid ticks based on North Carolina coordinate system. 1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue. 1927 North American Datum. To place on the predicted North American Datum 1983 move the projection lines 12 meters south and 24 meters west as shown by dashed corner ticks

UTM GRID AND 1981 MAGNETIC NORTH  
DECLINATION AT CENTER OF SHEET



QUADRANGLE LOCATION

ROAD CLASSIFICATION

- Heavy-duty
- Light-duty
- Medium-duty
- Unimproved dirt
- U.S. Route
- State Route

POWATAN, N. C.  
SW/4 SELMA 15' QUADRANGLE  
N3530-W7822.5/7.5

1964  
PHOTOREVISED 1981  
DMA 5395 III SW-SERIES V842

GEOLOGIC MAP OF THE POWATAN 7.5-MINUTE QUADRANGLE, NORTH CAROLINA

By  
P. Albert Carpenter III

1990



BEDROCK GEOLOGY AND MINERAL RESOURCES OF  
THE POWHATAN 7.5-MINUTE QUADRANGLE,  
JOHNSTON COUNTY, NORTH CAROLINA

by

P. Albert Carpenter III

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North Carolina Geological Survey

RALEIGH  
1990

State of North Carolina  
Health, and Natural Resources  
James G. Martin, Governor

Department of Environment,  
William W. Cobey, Jr., Secretary

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# **Bedrock Geology and Mineral Resources of the Powhatan 7.5-minute Quadrangle, Johnston County, North Carolina**

by  
P. Albert Carpenter III

## **ABSTRACT**

Geologic mapping in the Powhatan Quadrangle was conducted as part of a cooperative effort (COGEOMAP) between the North Carolina Geological Survey and the U. S. Geological Survey. The mapping will provide 1:100,000-scale geologic map coverage of the Raleigh 30 by 60 Minute Quadrangle. The Powhatan 7.5-minute Quadrangle is in the eastern Piedmont of North Carolina, within the Eastern slate belt. Metasiltstone and metamudstone crop out sparingly in the southern one-third of the quadrangle. Amphibolite, biotite gneiss, and quartz-muscovite schist are in contact with and north of the metamudstone. The boundary between the metasediments and the gneiss, amphibolite, and schist extends east-west across the quadrangle. This contact is a major metamorphic and stratigraphic boundary. A small body of granite was mapped in the northwest portion of the quadrangle, and north-south- and northwest-trending diabase dikes intrude metamorphic rocks. A small felsite dike was also mapped.

A thin sedimentary veneer of variable composition covers crystalline rocks in most of the quadrangle. This veneer ranges in thickness from a few centimeters to a few meters and includes Cretaceous fluvial sand and clay, probable Tertiary marine sands with minor gravel, Tertiary or Quaternary channel deposits, and Quaternary alluvium along streams.

The Powhatan Quadrangle lies at the southeastern nose of the southward-plunging Wake-Warren Antiform and within the Raleigh tectonic block. Primary foliation is a penetrative foliation formed by the planar orientation of minerals. This foliation usually trends approximately east-west or 10° to 20° north from east-west. Dips are to the south. A crenulation cleavage trends north to northeast.

Iron was mined near Little Poplar Creek in the mid-1850's and as recently as 1903. Fire assays run for gold on 3 of 5 samples in the quartz-muscovite schist unit and associated rocks showed gold above the detection limit. The highest value was 140 ppb from pyritic quartz-muscovite schist. A quartz pod at this location contained a small amount of molybdenite. The thicker sand and gravel deposits in the southern part of the quadrangle currently provide sand for construction.

## INTRODUCTION

Geologic mapping in the Powhatan Quadrangle was conducted as part of a cooperative effort (COGEOMAP) between the North Carolina Geological Survey and the U. S. Geological Survey. The mapping will provide 1:100,000-scale geologic map coverage of the Raleigh 30 by 60 Minute Quadrangle. Field mapping is on 7.5-minute quadrangles (1:24,000). As mapping progresses, individual 7.5-minute quadrangles will be released as open-file geologic maps.

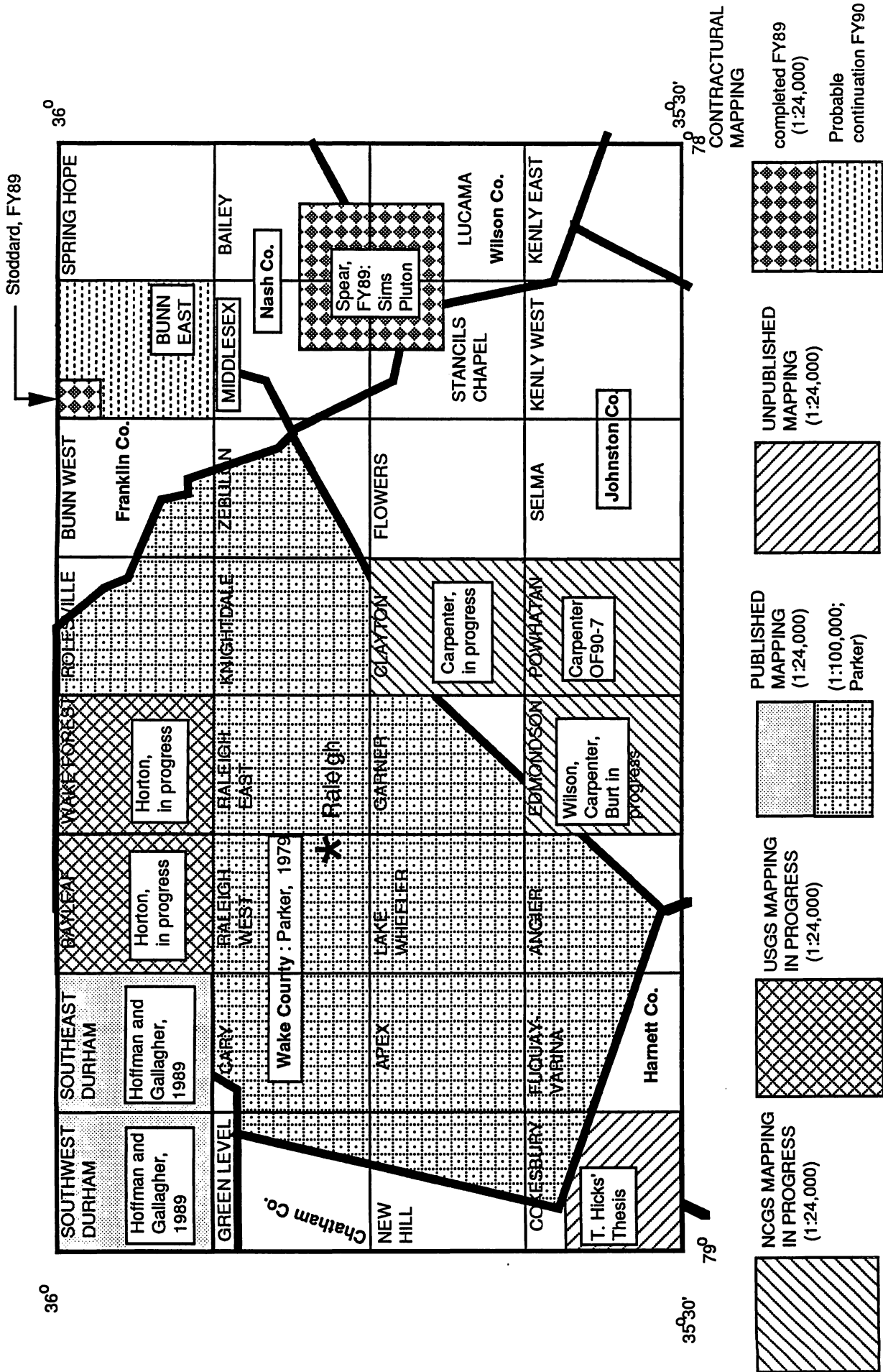
The Powhatan 7.5-minute Quadrangle is in Johnston County in the south-central portion of the Raleigh 30 by 60 Minute Quadrangle (Raleigh 100K sheet) (figure 1). Crystalline rocks in the quadrangle are lithologies of the Eastern slate belt. Most crystalline units are deeply weathered and crop out only in stream valleys. Good exposures of relatively unweathered rock occur along Swift Creek and its tributaries. A thin sedimentary veneer of variable composition covers crystalline rocks in most of the quadrangle. This veneer ranges in thickness from a few centimeters to a few meters, becoming thicker to the south and to the east. The sedimentary veneer includes Cretaceous fluvial sand and clay, probable Tertiary marine sands with minor gravel, Tertiary or Quaternary channel deposits, and Quaternary alluvium along streams. Good exposures of sedimentary rock are in sand and gravel pits in the southern and southeastern portions of the map.

## PREVIOUS INVESTIGATIONS

Previous geologic maps of this area are only of reconnaissance scale larger than 1:125,000. Parker (1968), who compiled a reconnaissance map of the eastern Piedmont, divided the metamorphic rocks into high- and low-rank rocks on the flank of the Wake-Warren Anticlinorium. Wilson and Carpenter (1975) compiled the geology of Region J, including Johnston County, at a scale of 1:125,000 (publication scale of 1:250,000). This mapping was primarily a compilation of existing detailed mapping supplemented by road cut geologic mapping where detailed coverage was not available. Crystalline units in the Powhatan Quadrangle were mapped by Wilson and Carpenter (1975) as sericite phyllite, mica gneisses and schists, and felsic igneous complex. Sedimentary cover units were mapped as Coastal Plain sands and clays and gravel deposits. Detailed soil mapping for Johnston County was completed in 1986 by the U. S. Department of Agriculture, Soil Conservation Service (Soil Conservation Service, unpublished).

Farrar (1985a, 1985b) constructed a tectonic and lithostratigraphic interpretation of the region based on reconnaissance mapping of the northeastern North Carolina Piedmont (figure 2). He interpreted the eastern North Carolina Piedmont as “an autochthonous or parautochthonous basement gneiss and schist sequence overlain by an allochthonous volcanogenic sequence.” In

Figure 1. Location of the Powhatan 7.5-minute Quadrangle and Status of Geologic Mapping in the Raleigh 30 by 60-minute Quadrangle



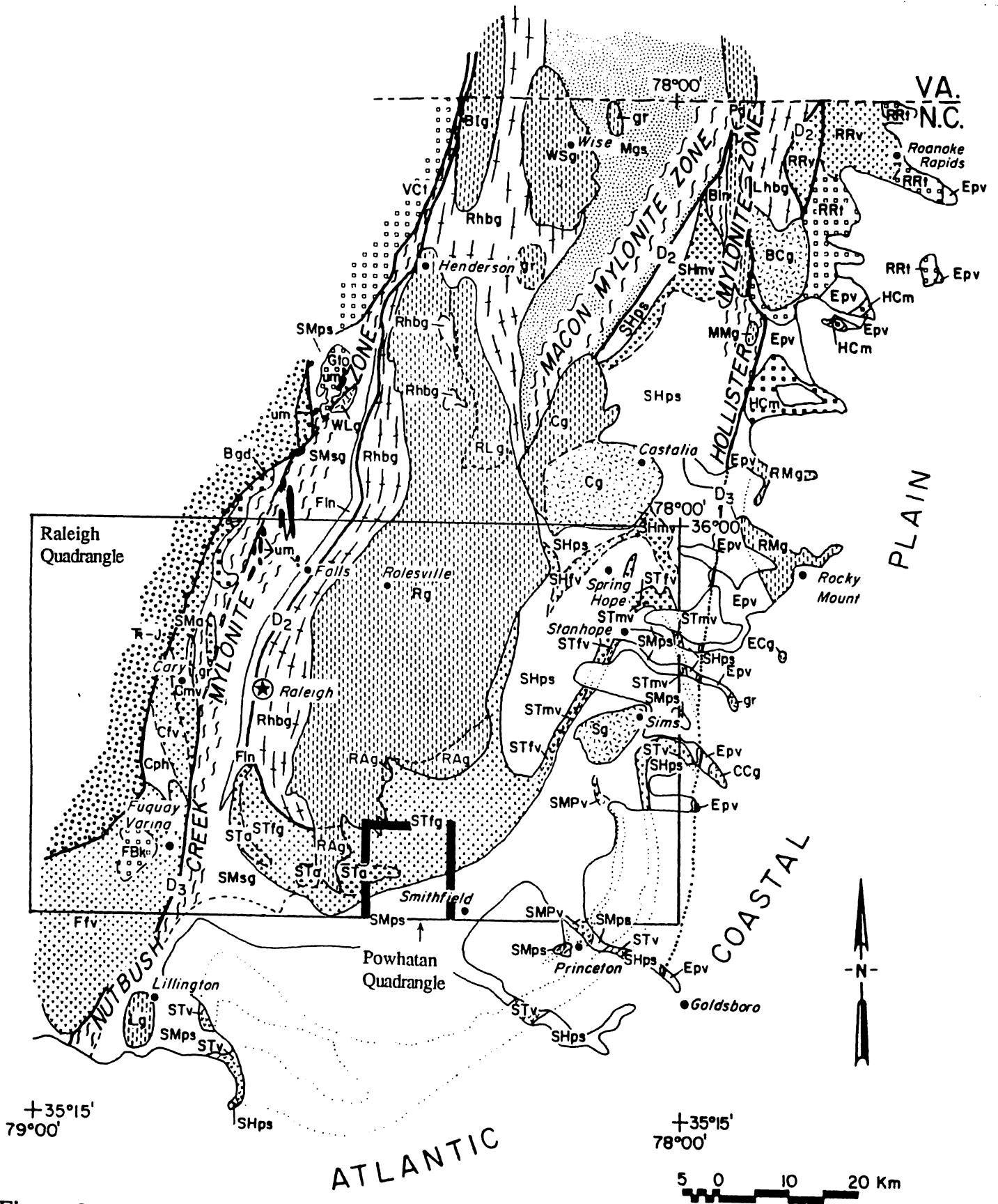


Figure 2. Regional geology of the northeastern North Carolina Piedmont (after Farrar, 1985a). Explanation on following page.

# EXPLANATION

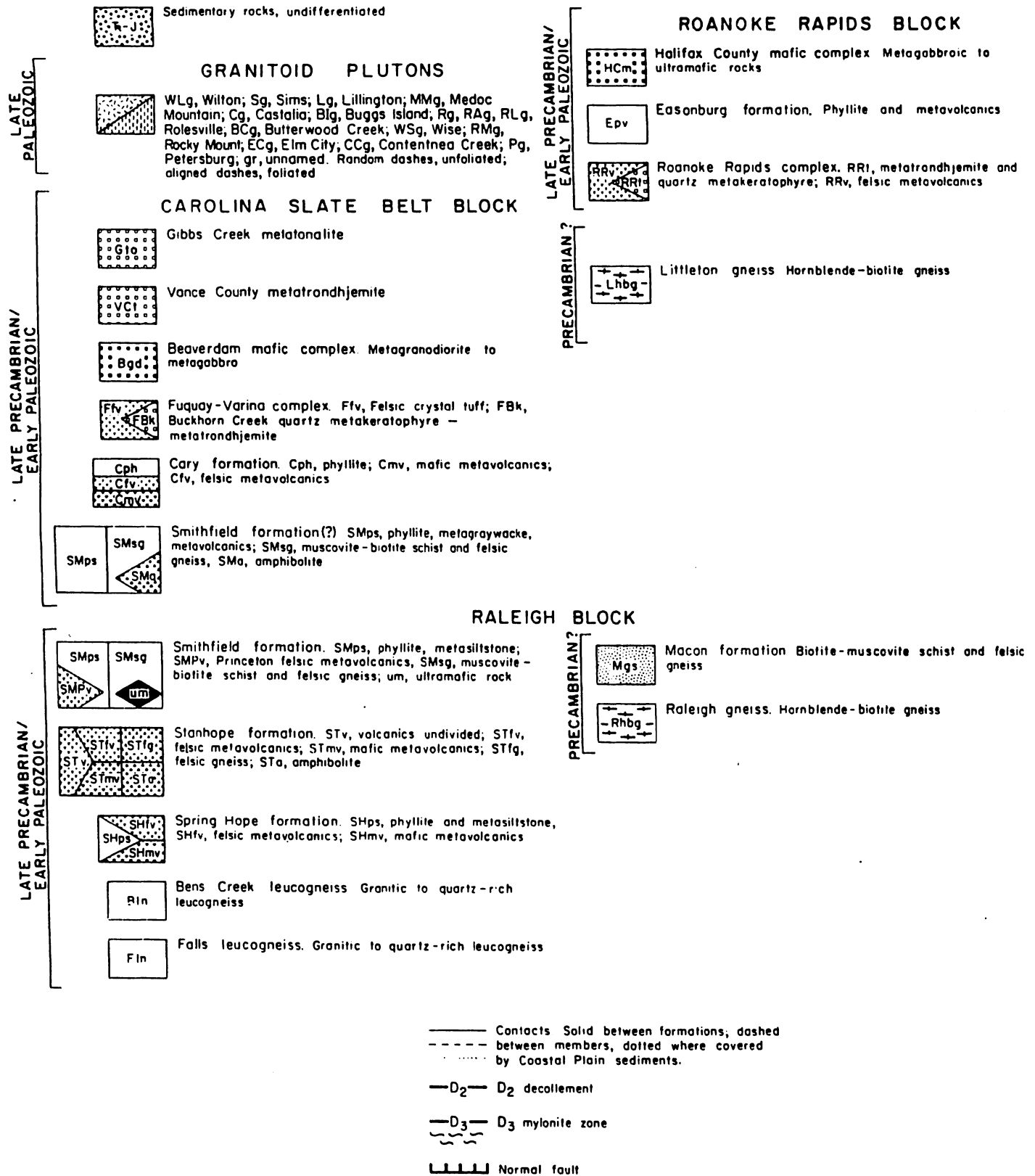


Figure 2. continued.



Farrar's model a regional decollement structurally separates the basement sequence of gneisses and schists from the overlying metamorphosed sequence of volcanogenic sediments, felsic and mafic volcanic rocks, and cogenetic intrusive rocks. Subsequent deformation produced small-scale folds, regional folds, and regional mylonite zones. Farrar divided the northeastern Piedmont into three tectonic blocks: the Carolina slate belt block, the Raleigh block, and the Roanoke Rapids block. Crystalline rocks in the Powhatan Quadrangle are in Farrar's Raleigh block. He included metasediments in the southern one-third of the quadrangle in his Smithfield formation and mapped felsic gneiss and amphibolite north of the metasediments as the Stanhope formation. The contact between the two formations is the approximate location of Farrar's biotite+ almandine boundary.

Horton and others (1989) divided the southeastern United States into tectonostratigraphic terranes. They assigned the area including the Powhatan Quadrangle to their Spring Hope terrane.

## LITHOLOGIC UNITS

Metasiltstone and metamudstone crop out sparingly in the southern one-third of the quadrangle. The boundary between the metasediments to the south and the biotite gneisses to the north extends east-west across the quadrangle between Middle Creek and Swift Creek. This boundary is, in most places, obscured by the sedimentary cover rocks but is a major metamorphic and stratigraphic boundary. Current mapping in the Powhatan Quadrangle delineated three lithologies in contact with and north of the metamudstone. These are amphibolite, biotite gneiss, and quartz-muscovite schist. A small body of granite was mapped in the northwest portion of the quadrangle. North-south- and northwest-trending diabase dikes intrude metamorphic rocks. A small felsite dike was also mapped.

### Metamudstone (md)

Rocks of the metamudstone unit are mostly light tan to light orange to greenish gray and bedded. Most outcrops have a phyllitic sheen on cleavage surfaces. Bedding and slaty cleavage are usually parallel to one another, trending between east-west and north 65° east or north 65° west. Dips are 65°-85° southwest or southeast and, locally, are vertical. A secondary (crenulation) cleavage is common, trending N25°-35°E and dipping close to vertical. Toward the north, the phyllitic appearance of the metamudstone increases and gentle folds a few centimeters to a meter across become common. Petrographic examination reveals laminations characterized by concentrations of parallel flakes of white mica and quartz. Quartz is occasionally concentrated into thin layers, which probably represents original bedding. This unit crops out in a few road cuts and along slopes to Middle Creek, Steep Hill Branch, and Swift Creek near its junction with Middle Creek.



### Amphibolite (am)

Black to greenish black amphibolite is composed of hornblende, quartz, epidote, chlorite, muscovite,  $\pm$ plagioclase, and  $\pm$ biotite. Most amphibolite observed in the study area is faintly foliated but distinctly lineated. Some outcrops are schistose. Chlorite-epidote schist occurs locally. The amphibolite is resistant to weathering and results in good exposures, particularly along the north and south banks of Swift Creek in the western part of the quadrangle. To the north and east, amphibolite becomes interlayered with biotite gneiss and felsic gneiss. The contact with the metamudstone unit is not exposed, but, based on the lack of any mafic rock in the metamudstone, a sharp contact is inferred. Petrographically, the amphibolite is composed of hornblende, quartz, epidote, chlorite, muscovite, and opaque minerals. The lack of feldspar and the abundant quartz in the two samples examined petrographically suggest a sedimentary protolith. One sample of amphibolite interlayered with biotite gneiss contains plagioclase and minor garnet and may represent metamorphosed mafic tuff. On aeromagnetic maps the amphibolite unit underlies a broad, irregular-shaped magnetic high of approximately 400 gammas (figure 3).

### Biotite Gneiss (mgn)

The most extensive metamorphic unit mapped in the Powhatan Quadrangle is quartzofeldspathic biotite gneiss. This unit lies north of and east of the amphibolite unit and north of the metamudstone unit. A few outcrops are along Swift Creek one-half mile downstream from Secondary Road 1555 and along Swift Creek between Little Creek and Cooper Branch. The gneiss is deeply weathered, and outcrops of fresh rock are rare. It contains interlayers of amphibolite and felsic gneiss throughout its outcrop area. Muscovite schist occurs locally. The biotite gneiss is composed of plagioclase, perthitic microcline, quartz, biotite, and minor amounts of chlorite, muscovite, epidote, and garnet. Cleavage direction is variable north of the contact with metamudstone but northwest strikes are predominant. Dips range between 40°-65° southeast and southwest. Farther north, the strike of cleavage and compositional layering becomes predominantly northeast with steeper southeast dips. The biotite gneiss unit is interpreted to represent metamorphosed felsic and intermediate volcanic rocks with interbedded coarse-grained sedimentary rocks.

Felsic gneiss is interlayered with the biotite gneiss and contains more quartz and less biotite than does the biotite gneiss. Felsic gneiss is the predominant rock type east of the amphibolite unit and north of the metamudstone unit. Biotite gneiss becomes predominant north of Swift Creek.



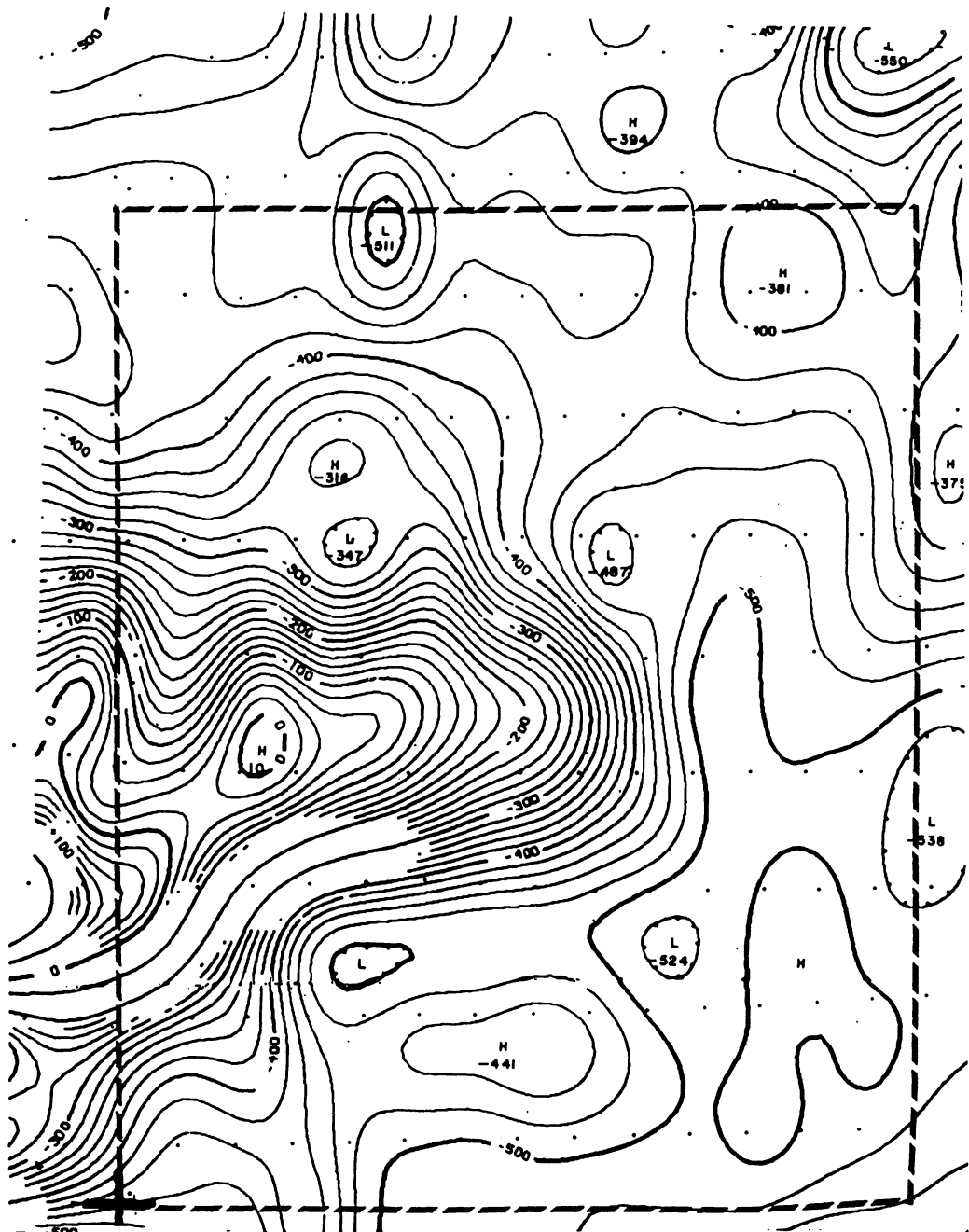


Figure 3. Aeromagnetic map of the Powhatan 7.5-minute Quadrangle.  
Scale 1:100,000. Dots represent flight lines.  
(U.S. Geological Survey, 1976)



Good exposures of felsic gneiss are under the SR 1562 bridge over Swift Creek and along the south slopes to Swift Creek between the bridge and Little Creek. The felsic gneiss is light gray, well foliated and contains quartz, plagioclase,  $\pm$  microcline, biotite, epidote, muscovite, and minor garnet, zircon, and opaques. Some quartz is rounded in thin section. White to pinkish fine-grained quartz-feldspar gneiss with scattered biotite is included in this unit. Some of the felsic gneiss is distinctively metatuff (under the bridge at SR 1562). Some outcrops contain rock fragments elongate in the direction of foliation and cleavage. The rounded quartz grains may indicate that portions of the unit are epiclastic in origin or may be reworked volcanic rocks. The small amount of plagioclase in some samples may indicate a tuffaceous sedimentary protolith. The volcanic appearance of the gneiss is more obvious near the contact with the metamudstone, but the rock becomes more gneissic to the north where stronger metamorphism has destroyed the volcanic textures.

#### Quartz-muscovite Schist (qms)

Quartz-muscovite schist crops out in the east-central part of the Powhatan Quadrangle. The schist lies on the boundary between metamudstone to the south and biotite gneiss to the north. A smaller unit of quartz-muscovite schist is mapped in the northern part of the quadrangle along the contact of a small granitic body with biotite gneiss. The rock is white to light gray with varying amounts of quartz and mica. Pyrite is disseminated throughout the unit and is locally segregated into layers parallel to schistosity. In thin sections, the long dimensions of quartz grains are aligned parallel to the schistosity of the rock. Most of the quartz has irregular boundaries, but some grains have a rounded appearance. The schist commonly has well developed small-scale folds ranging in size from a few centimeters to a meter across. Cleavage direction is variable, reflecting the small-scale folding in the unit. Cleavage dips are to the southeast and southwest. Quartz occurs as individual grains in the groundmass, as pods, and as veins.

Pods and clusters of kyanite occur locally, and, in places, the kyanite is segregated into layers parallel to cleavage. Boulders of quartz-kyanite rock are scattered on the surface of the ground near the intersection of SR 1572 and SR 1563, on the east side of US Highway 70, 0.04 mile north of SR 1598 and at a few other places within the mica schist unit. The boulders consist of scattered kyanite with minor plagioclase and muscovite in a microcrystalline groundmass of quartz. Pyrophyllite is present in the quartz-kyanite rock on US Highway 70 (Stuckey, 1937; Espenshade and Potter, 1960; and Farrar, 1985a).

Quartz-muscovite schist is particularly well exposed along the south slope to Swift Creek. Outcrops up to 7 meters high are almost continuous in some segments of the creek. The lack of feldspar and the rounded appearance of some of the quartz in the schist suggest an argillaceous



sedimentary rock protolith or altered siliceous volcanic rock, possibly an altered hot-spring system.

Minor amounts of chlorite schist and intermediate volcanic rock containing amygdules of radiating epidote crystals occur along Swift Creek near the contact between quartz-muscovite schist and metamudstone.

#### Granite (gr)

Light-gray to pale pink, fine-grained, massive to slightly foliated granite composed of quartz, plagioclase, microcline, orthoclase, muscovite, and biotite crops out in the higher-rank metamorphic rocks in the northern part of the quadrangle. This small body is irregularly shaped and is enclosed by biotite gneiss and quartz-muscovite schist. Contacts with the surrounding rocks are sharp. Good exposures of the granite are along Little Creek at an old mill site east of Carolina Packers farm on SR 1560. Because this small granite body is close to other outcrops of the Rolesville granite, it may be related to the Rolesville granite.

#### Metafelsite (fd)

A narrow, northeast-trending felsite dike intrudes biotite gneiss between Swift Creek and Cooper Branch. The felsite is light gray, medium grained and composed of plagioclase, quartz, biotite, muscovite, and epidote. It probably represents a metamorphosed felsic volcanic dike.

#### Diabase (Jd)

North-south to slightly northwest-southeast-trending diabase dikes intrude both lower and higher rank metamorphic rocks. These dikes are traceable for up to several kilometers. They strongly influence drainage patterns wherever they crop out. Aeromagnetic expression of diabase dikes in this quadrangle is obscured by the broad magnetic high associated with the amphibolite unit.

#### Sedimentary Rocks

Detailed mapping of the sedimentary units was not within the scope of this mapping project. More detailed studies of the sediments will be conducted by geologists of the NCGS Coastal Plain office. The following ideas were developed with Charles W. Hoffman of the NCGS Coastal Plain office.

Unconsolidated sedimentary rocks cover all crystalline units in the quadrangle. This cover



ranges from a few centimeters thick in the northern part of the quadrangle to tens of meters thick in the southern part of the quadrangle. The sediments can be separated into (a) surficial sediments of Tertiary age and (b) underlying sediments of probable Cretaceous age.

North of Middle Creek, thin layers of white to yellowish-gray sand cover ridge tops. These sands probably are weathered Tertiary sediments that were, locally, reworked during the Quaternary. The sands contain abundant gravels in some areas and petrified wood occurs, locally, in the basal portions of these gravels. The gravels consist of (a) local channel-fill angular gravels located topographically above present floodplains and (b) more widespread rounded gravels such as those found in the eastern part of the mapped area. Channel-fill gravels are exposed in the Silverstone Subdivision south of SR 1576. The more widespread gravels consist of white, rounded quartz cobbles, but some are iron stained. Sand and gravels which directly overlie crystalline rocks on the interstream divides are shown on the 1985 *Geologic Map of North Carolina* (North Carolina Geological Survey, 1985) as terrace deposits and upland sediment of presumed Tertiary age. The best exposures of the gravels are in a pit north of Little Poplar Creek and 0.2 mile east of SR 1501. Gravels in this pit consist of moderate-reddish-brown sandy clay with scattered rounded quartz pebbles up to 2.5 centimeters in maximum dimension. Conglomerate lenses are moderate reddish orange, consisting of concentrations of subrounded to subangular quartz cobbles and pebbles up to 10 centimeters in maximum dimension and sand.

The Tertiary sedimentary cover becomes thicker south of Middle Creek and gravel becomes less common. The cover may be up to 20 meters thick in this area. Two sand pits north of N. C. Highway 210 show exposures of Tertiary marine sediment. The pits contain moderate-reddish-brown sandy silt with scattered quartz pebbles. A 2-meter-thick layer of light-yellowish-gray sand lies above the reddish-brown sand. This upper zone probably represents weathering and soil development of the underlying sediments.

Probable Cretaceous sediments underlie the Tertiary sediments south of Middle Creek and are exposed in two outcrops. These sediments are assigned a possible Cretaceous age based on lithologic similarities to Cretaceous deposits in southern Johnston and Harnett Counties. A 4-meter-high road cut on N. C. Highway 210, 0.15 mile west of Middle Creek, consists of dark-yellowish-orange to moderate-reddish-orange sand with scattered subrounded quartz grains up to 15 millimeters in maximum dimension. The road cut also contains a thin lens of grayish-black organic-rich sand. Sediments in this road cut are fluvial deposits. Near the lowest end of the DOT sand pit east of SR 1503, a 3- to 6-centimeter-thick bed of iron-oxide-cemented quartz gravel separates overlying Tertiary sands from a white or very light-gray layer of fine sand, silt, and clay. This lower layer of fluvial sediment correlates laterally with the road cut on N.C. Highway 210 at Middle Creek.



## STRUCTURE

The Powhatan Quadrangle lies at the southeastern nose of the southward-plunging Wake-Warren Antiform and within Farrar's (1985b) Raleigh tectonic block. The axis of Farrar's Smithfield Synform, overturned to the northwest, passes south of the mapped area. The primary foliation in the quadrangle is a penetrative foliation corresponding to Farrar's  $S_1$  foliation. This foliation is formed by the planar orientation of minerals and usually trends approximately east-west or  $10^\circ$  to  $20^\circ$  north from east-west. Dips are to the south. A crenulation cleavage (Farrar's  $S_3$  cleavage) strikes north to northeast and dips from vertically to  $80^\circ$  east. This cleavage is pervasive, but is difficult to measure because of poor exposures.

The structure is complex in this area and will be better understood as mapping progresses to other quadrangles. Additional study is needed to interpret all the structural fabrics and determine their relationships to one another.

## ROCK ANALYSES

Whole rock analyses by x-ray fluorescence were obtained for 12 samples, and CIPW norms were calculated for each whole rock analysis. The whole rock analyses and normative mineral compositions are listed in Table 1 and Table 2. Thin sections were prepared for 19 crystalline rock samples and a sample from the organic-rich lens in the road cut on NC Highway 210 was sent to the U. S. Geological Survey for pollen analysis.

## MINERAL RESOURCE POTENTIAL

On the west slope to Reedy Branch, 1500 feet north of SR 1563, prospect pits were opened many years ago (possibly for iron) in quartzite and schist containing limonite-hematite oxidation. A sample from the pit assayed  $<1$  ppb gold.

An iron mine was opened on the west side of Little Poplar Creek in the mid-1850's (Emmons, 1856; and Kerr and Hanna, 1887) and was operated as recently as 1903 (Pratt, 1904). This deposit was apparently in iron-cemented sediment at the base of the sedimentary cover. Pratt reports that the mine was in production during the first six months of 1903 but closed when the smelter at Greensboro closed.

Fire assays with direct current plasma were run for gold on five samples in the quartz-muscovite schist unit and associated rocks. Three of the samples showed gold above the detection limit. The highest value was 140 ppb from pyritic quartz-muscovite schist on a small unnamed



Table 1. POWHATAN QUADRANGLE WHOLE ROCK ANALYSES (in percent)

Sample Number	Rock Name	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	Fe <sub>2</sub> O <sub>3</sub>	MnO	TiO <sub>2</sub>	P <sub>2</sub> O <sub>5</sub>	Cr <sub>2</sub> O <sub>3</sub>	LOI	Sum	Rb	Sr	Y	Zr	Nb	Ba
Po 89-18	Metamudstone	61.3	18.1	<0.01	0.76	0.3	4.44	9.2	0.02	0.88	0.06	<0.01	4.85	100.1	179	51	<10	180	12	796
Po 89-23	Metamudstone	58.8	19.1	0.05	1.71	0.25	4.25	7.79	0.13	1.04	0.09	<0.01	5	98.4	171	81	30	228	32	1000
Po 89-19	Felsic gneiss	66.5	15.9	4.21	0.44	5.4	0.92	4.84	0.15	0.68	0.17	<0.01	1.23	100.6	55	365	33	228	26	253
Po 89-26	Felsic gneiss	77	11.9	0.13	0.15	5.29	2.41	1.77	0.03	0.16	0.03	<0.01	0.39	99.4	68	64	44	257	19	748
Po 89-28	Felsic gneiss	77.4	11.5	0.67	0.37	3.29	4.04	1.77	0.14	0.15	0.02	<0.01	0.54	100.1	114	77	75	270	<10	969
Po 89-29	Qtz.-mus. schist	76.8	6.54	<0.01	0.25	0.23	1.79	8.8	0.01	0.6	0.02	0.01	5.08	100.2	89	<10	22	215	<10	115
Po 89-30	Qtz.-mus. schist	73	20	<0.01	0.14	0.25	0.68	3.18	<0.01	0.54	0.07	<0.01	1.47	99.4	34	35	25	278	15	225
Po 89-31	Chl.-epid. rock	48.9	15	10.6	6.28	0.62	0.12	13.9	0.25	1.29	0.16	0.01	2.77	100	22	256	27	74	10	86
Po 89-32	Quartzite	97.3	0.46	<0.01	0.07	0.03	0.11	0.93	0.01	0.64	0.02	0.02	0.47	100.1	<10	<10	<10	140	18	102
Po 89-37	Metafelsite	69.2	15.6	1.91	0.64	4.15	3.44	2.26	0.04	0.4	0.13	<0.01	1.54	99.5	108	374	12	197	<10	1020
QK-70	Qtz.-kyanite rk.	89.3	7.35	<0.01	0.06	0.02	0.01	0.36	0.02	1.17	0.05	0.01	0.62	99.1	11	<10	12	786	19	95
Po 89-20	Amphibolite	54.4	16.6	13.2	3.79	1.01	0.1	8.22	0.15	0.72	0.13	0.03	1.77	100.2	13	602	18	64	<10	70

Table 2. POWHATAN QUADRANGLE NORMATIVE MINERAL COMPOSITIONS (in weight percent)

Sample	Q	C	OR	AB	AN	DI	HE	EN	FS	MT	IL	CR	AP	HM	RU
Po 89-23	38.94	15.13	27.01	2.27				3.36	6.97	3.96	2.12			0.22	
Po 89-19	22.52		5.49	46.11	16.58	0.62	2.29	0.28	1.2	3.19	1.3			0.4	
Po 89-26	36.99	0.43	14.41	45.26	0.45			0.26	0.16		0.27			0.07	1.68
Po 89-28	41.09	0.54	24.04	28	3.21			0.67	0.33	0.37	0.29			0.05	1.41
Po 89-29	68.32	4.47	11.22	2.06				0.51	8.92	3.23	1.21	0.02		0.05	
Po 89-31	10.08		0.74	5.44	39.18	5.82	6.04	11.67	13.9	4.19	2.54	0.02		0.38	
Po 89-32	96.97	0.29	0.65	0.25				0.16	0.02			0.03		0.05	0.93
Po 89-37	27.8	1.93	20.79	35.88	8.81			1.24	0.51	0	0.78			0.31	1.94
QK-70	90.48	7.42	0.06	0.17				0.13	0.03			0.03		0.02	0.37
Po 89-20	16.91		0.6	8.71	41.25	10.58	9.85	3.41	3.65	3.28	1.39	0.05		0.31	



tributary to Swift Creek. The tributary is located between SR 1577 and SR 1578. A quartz pod at this location contains a small amount of molybdenite. Moss panned from the stream below the waterfall on this tributary contained one color of gold. While these samples were not high in gold, they do indicate the need for additional sampling in the schist unit. The quartz-muscovite schist unit could represent an altered hot spring system associated with the last stages of felsic volcanic activity prior to deposition of the overlying sedimentary sequence.

Several areas within the quartz-muscovite schist contain quartz-kyanite masses. Limited outcrop makes it difficult to determine the relationship of the quartz-kyanite to the enclosing schist. The bodies may be pods and stringers. Quartz-kyanite boulders are common in fields and woods near the intersection of SR 1572 and SR 1563 and along US Highway 70, 0.4 mile north of SR 1598. This latter location is described by Espenshade and Potter (1960) and Stuckey (1937) and is known as the Corbett kyanite deposit. Pyrophyllite also occurs at this location.

The thicker sand deposits in the southern part of the quadrangle currently provide sand for construction. Surficial sands north of Middle Creek are generally too thin to be economically viable sand sources. The gravel deposits in the eastern part of the quadrangle are good sources of coarser construction aggregates. Concentrations of heavy minerals were not noted in the cover sediments, although no sampling was conducted and terrace elevations were not mapped.

## CONCLUSIONS

Outcrops in the Powhatan Quadrangle are sufficient to provide lithologic and structural control for geologic mapping. Road cut exposures are poor but major drainages such as Swift Creek and its tributaries and Middle Creek contain relatively fresh outcrops. The contact between the metamudstone and the higher rank metamorphic rocks to the north is a regional metamorphic and stratigraphic boundary. This contact has been traced eastward from the Edmondson Quadrangle into the Powhatan Quadrangle. The contact can likely be extended further to the east, although it becomes increasingly obscured by the sedimentary cover. Within the higher rank metamorphic rocks, individual units that are regionally traceable include the more extensive amphibolite and schist units. Intrusive rocks that can be delineated include granite, metafelsite, and diabase. Locally, felsic gneiss can be distinguished from more mafic biotite gneiss.

In much of the quadrangle, sedimentary cover over the crystalline units is thin. Several types of gravel units are associated with the surficial sediments. These include 1) local gravels associated with old stream channels and located topographically above present floodplains and 2) the more widespread gravels located on interstream divides in the eastern and southeastern parts of the quadrangle. The age and origin of the more extensive gravels is not known, but will be studied



as geologic mapping continues. The thicker sediments south of Middle Creek include possible marine sediments. These sediments should be examined more closely to determine their age and origin and to determine the extent to which they can be mapped.

Assays indicate that gold is associated with the quartz-muscovite schist unit. This unit may represent a hot spring system. Additional gold sampling will help determine the extent of the gold mineralization. If the hypothesis holds true of a hot-spring system associated with late-stage volcanic activity, extension of the metamudstone-gneiss boundary to the east may reveal additional volcanic alteration systems.

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