BEDROCK GEOLOGY OF THE MIDDLESEX 7.5-MINUTE QUADRANGLE, FRANKLIN, JOHNSTON, NASH, AND WILSON COUNTIES, NORTH CAROLINA

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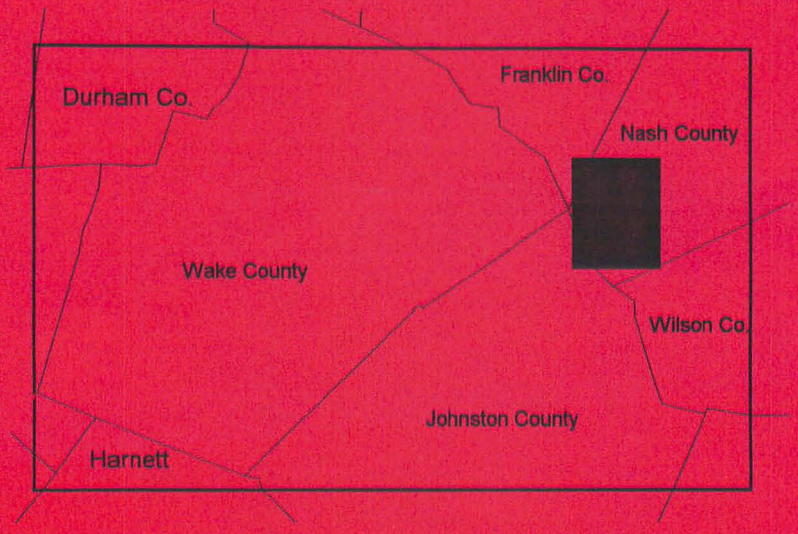

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DIVISION OF LAND RESOURCES
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Jonathan B. Howes, Secretary

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ABSTRACT

The Middlesex 7.5-minute quadrangle includes portions of Franklin, Johnston, Nash, and Wilson Counties. It is located in the east-central portion of the Raleigh 30 X 60-minute quadrangle.

Two northeast-trending metamorphosed Eastern slate belt rock sequences of Late Proterozoic or Cambrian age underlie most of the quadrangle. A lower sequence of metavolcanic rocks is stratigraphically overlain by a sequence of fine-grained metasedimentary rocks. These rocks were deformed and metamorphosed to chlorite grade prior to intrusion of the Sims pluton during the Pennsylvanian period. Earliest folds are at outcrop scale. The axis of a regional-scale antiform lies in the center of the felsic crystal tuff unit of the lower volcanic sequence.

The Sims pluton, located in the southeast corner of the quadrangle, is dated at 287 ± 9 Ma. It is a composite pluton consisting of a megacrystic facies (Conner granitoid) and an equigranular facies (Sims granitoid). Only the Conner phase crops out in the Middlesex quadrangle.

No mines or quarries are active in the quadrangle. The Sims granite is being quarried for crushed stone near the town of Sims (outside the Middlesex quadrangle). A large reserve of heavy minerals (ilmenite, rutile, and leucoxene) is located south of Bailey, North Carolina, in Coastal Plain sediments. The deposit extends into the southeastern corner of the Middlesex quadrangle.

Coastal Plain units of Tertiary to Quaternary age cover crystalline rocks in most of the quadrangle.

INTRODUCTION

The Middlesex 7.5-minute quadrangle includes portions of Franklin, Johnston, Nash, and Wilson Counties (figure 1). It is located in the east-central

portion of the Raleigh 30 X 60-minute quadrangle. Previous geologic mapping in this area was reconnaissance geologic mapping in Franklin County by McDaniel (1980), Johnston County by Wilson and Carpenter (1975), Nash County by Wilson and Spence (1979), and Wilson County by Wilson (1979).

Geologic mapping in the Middlesex quadrangle was conducted as part of a cooperative effort (COGEOMAP) between the North Carolina Geological Survey and the U. S. Geological Survey. Field mapping at the 1:24,000 scale in individual 7.5-minute quadrangles is being compiled into a 1:100,000-scale geologic map compilation of the Raleigh 30 X 60-minute quadrangle. Delineation of rock units and structural features of the quadrangle should assist future planning and assessments such as: 1) location of adequate sites for municipal landfills or hazardous waste disposal; 2) planning for highway construction, 3) evaluation of ground-water resources; 4) general construction site assessments; and, 5) exploration for mineral resources.

LITHOLOGIC UNITS

Metamorphic Rocks of the Eastern Slate Belt

Regional stratigraphic relationships for the Eastern slate belt were summarized by Carpenter, Carpenter, and Stoddard (1995). Metamorphic rocks in the Middlesex quadrangle are grouped stratigraphically into a lower sequence of metavolcanic rocks and an overlying sequence of metasedimentary rocks. The metavolcanic sequence is further divided into an upper and a lower volcanic group. The metamorphic rocks are considered to be of Late Proterozoic or early Cambrian age. Metamorphic grade is greenschist facies (chlorite and biotite zones).

Metavolcanic sequence

Metavolcanic units are subdivided stratigraphically into a lower and upper group based on characteristic texture and mineralogy of less altered metavolcanic rocks. The lower group consists of relatively coarse felsic crystal tuff, felsic crystal-vitric tuff, laminated epiclastic rocks, and felsic lithic-crystal tuffs. Goldberg (1994) reports a discordant zircon age of 590±3 Ma for felsic crystal tuff at Webb's Mill in the Bunn East quadrangle (Stoddard, unpublished, 1992). This felsic crystal tuff unit was traced from the type locality in the Bunn East quadrangle into the Middlesex quadrangle. The upper group of unaltered felsic metavolcanic rocks is aphanitic and texturally similar to the bluestone described by Stoddard (unpublished, 1992) in the Bunn East 7.5-minute quadrangle and the Princeton volcanics in the Princeton area. Zircon from the "Princeton volcanics" yielded a preliminary Pb/Pb age of 544 Ma (Horton and Stern, 1994). Felsic volcanic rocks in the upper volcanic group are extensively sericitized and locally silicified. They occur primarily as fine-grained muscovite phyllite. Thin intermediate to mafic metavolcanic units are present in

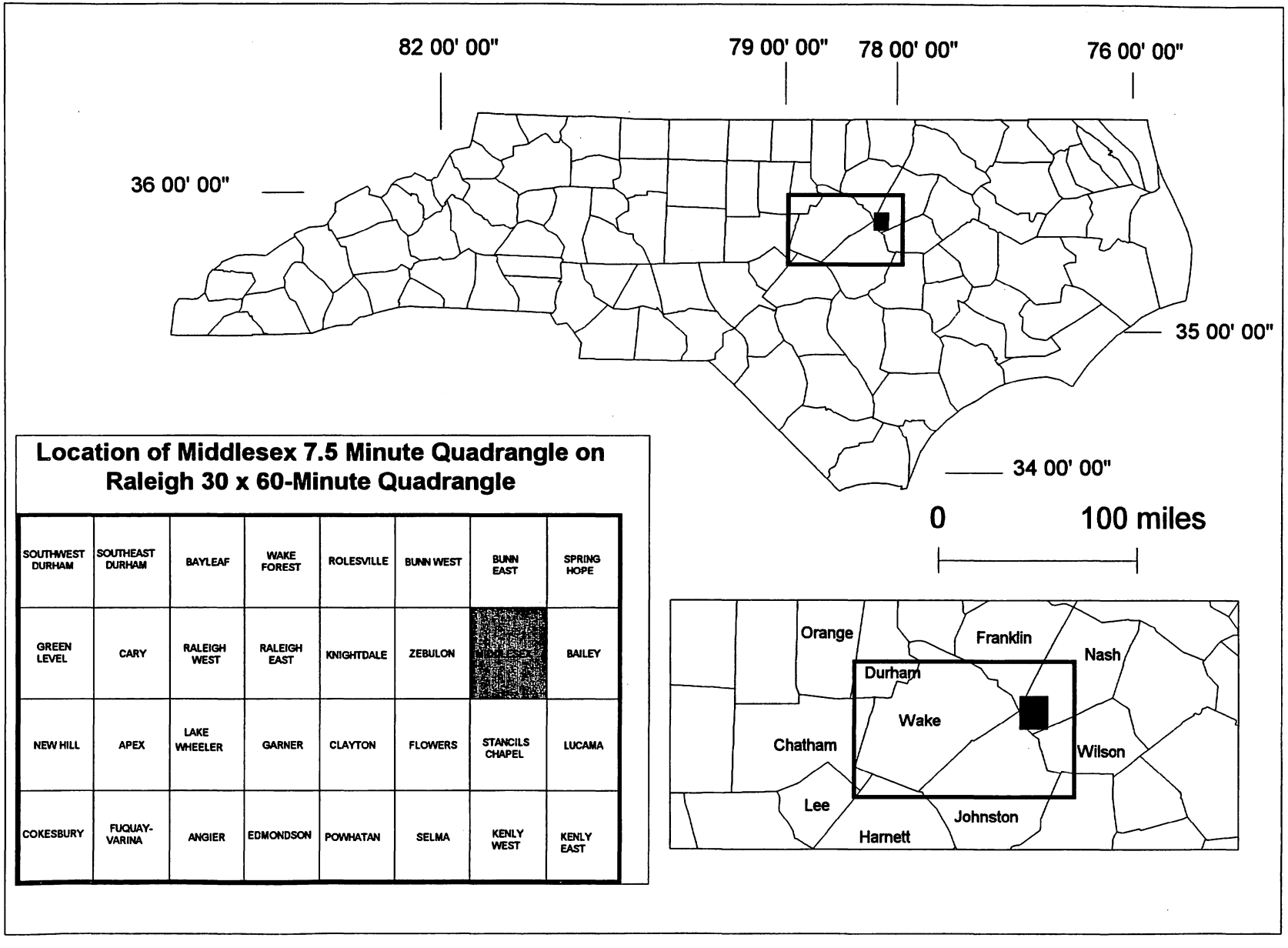

Figure 1. Location of the Middlesex 7.5-Minute Quadrangle in Raleigh 30 x 60-Minute Quadrangle

the upper group.

Lower metavolcanic group

The lower group of metavolcanics is poorly exposed in the western half of the quadrangle. A fresh outcrop of felsic quartz-feldspar crystal tuff is present on SR 1008 east of Little Creek (locality 1, plate 1). This rock is a light-gray felsic crystal tuff with plagioclase and bluish quartz crystals in a finer groundmass of quartz, feldspar, and biotite. Minor quantities of fine muscovite flakes are disseminated in the quartzofeldspathic matrix, but phyllite occurrences are rare in felsic crystal tuff. In the southwestern portion of the quadrangle, the felsic crystal tuff is typically interbedded with medium- to dark-green mafic volcanic rock.

Laminated lithic and lithic-crystal tuffs occupy a narrow unit east of the felsic crystal tuff. The unit is poorly exposed throughout the Middlesex quadrangle and occurs as saprolite consisting of thinly laminated quartzose and micaceous layers, occasionally with flattened clasts of fine-grained quartz and feldspar. A steeply dipping, northeast-trending foliation is defined by alignment of mica flakes and flattened clasts. Small exposures of this unit occur on the west side of NC Highway 231 (locality 2, plate 1) and on SR 1131 in a roadcut adjacent to a small cemetery (locality 3, plate 1). A good exposure of this unit is located in the Stancils Chapel quadrangle, on the west side of SR 2105 and 50 feet west of the roadcut on the slope to Moccasin Creek.

Medium- to dark-green mafic tuff, mafic lithic tuff, and mafic intrusive rock occur at two locations within the laminated epiclastic rock and laminated tuff unit. Quartz-tourmaline rock is present locally. The mafic tuff unit contains a variety of mafic rocks and includes intrusive rocks that may have been feeder dikes for the overlying mafic volcanic unit.

Upper metavolcanic group

The upper metavolcanic group consists mainly of felsic volcanics with interbedded meta-andesite and metabasalt, particularly near the top of the sequence. The felsic unit consists of several lithologies based on outcrop and thin section analyses. These include the following:

1. Unaltered vitric and vitric-crystal tuffs characterized by plagioclase phenocrysts in a fine grained groundmass of quartz+plagioclase+potassium feldspar.

2. Sericitized tuffs in which feldspar has been replaced by muscovite. The dominant mineral assemblage is muscovite+quartz. Minor amounts of chlorite and black opaque minerals are common. These rocks are typically fine-grained, light-gray to silvery, crenulated, sericite phyllite. Quartz phenocrysts are preserved.

3. Sericitized and silicified tuffs. These rocks are similar to the sericite phyllites noted above, but they contain more quartz and less muscovite. Chloritoid

and pyrite are common accessory minerals in these rocks in the Stancils Chapel quadrangle, where gold, and possibly base metal mineralization, is associated with this lithology.

Phyllite is primarily white to light-gray crenulated phyllite and fine-grained schist composed of white mica with disseminated black opaque minerals. The phyllite is interpreted to be hydrothermally altered felsic volcanic rock.

Siliceous phyllite is poorly exposed in the quadrangle. It is traceable, in part, by float from concordant lenses of massive quartz where the unit extends into the south-central part of the quadrangle. These massive quartz lenses commonly contain inclusions of green muscovite phyllite. Small exposures of siliceous phyllite are exposed at localities 4 and 5 (plate 1).

At locality 6 (plate 1), fine- to medium-grained felsic tuff occurs within altered felsic volcanics. The rocks are comprised mainly of quartz and feldspar with layers of fine mica, and minor magnetite. A thin section from this rock contains fine-grained lithic clasts in muscovite-chlorite phyllite. In the field near this locality, sparse quartz float contains tourmaline.

Mafic volcanic rocks in the quadrangle include silver gray to greenish sericite-chlorite phyllite, chlorite-epidote granofels, and greenstone (actinolite-epidote-chlorite-plagioclase). Abundant disseminated magnetite is associated with epidote in some samples.

Mafic volcanic rock at locality 7 (plate 1) includes chlorite-epidote granofels. In thin section the rock contains sericitized plagioclase, in a groundmass of biotite, quartz, clinozoisite, muscovite, and plagioclase.

Mafic to intermediate volcanic rock is exposed at locality 8 (plate 1). A thin section from this rock is composed of chlorite, epidote, quartz, minor plagioclase, and actinolite with calcite in veins, layers, lenses, and patches. At the head of a small drainage, mafic volcanic rock contains epidote amygdules in outcrop (locality 9, plate 1). The most pronounced positive aeromagnetic anomaly in the Eastern slate belt closely parallels the trend of these mafic volcanic rocks.

Metasedimentary sequence

The laminated argillite consists of thin, commonly crenulated, mica-rich phyllitic layers, that alternate with thicker, more massive, quartzose layers (locality 10, plate 1). The scale of layering is variable from microscopic to megascopic. Commonly, phyllitic layers are 1 mm or less thick, and the quartzose layers are 3 to 4 mm thick. In the Stancils Chapel 7.5-minute quadrangle to the south, blackish coloration of the phyllitic layers suggests that the argillite is locally graphitic. Muscovite and chlorite form the phyllitic layers. These minerals, plus quartz,

comprise the siliceous layers.

Intrusive Rocks

This report briefly describes the Sims pluton. More detailed studies of the Sims pluton will be presented in a report by Speer (in preparation). The Sims pluton occupies the southeast corner of the Middlesex quadrangle (plate 1) and the pluton overall is oval. The Sims pluton is a composite body with a megacrystic granitoid lithology (the Conner granitoid) and an equigranular biotite granitoid lithology (the Sims granitoid). Only the Conner granitoid crops out in the Middlesex quadrangle. The Sims granitoid is not exposed in the Middlesex quadrangle, but may underlie the Coastal Plain sediments in a small area in the extreme southeast corner of the quadrangle (plate 1).

The Conner granitoid (localities 11 and 12, plate 1) is a pale-orange to moderate-orange-pink coarse-grained biotite monzogranite. It contains abundant tabular, subhedral to euhedral alkali feldspar megacrysts up to 5 cm in a finer groundmass, which gives the rock a hiatal or inequigranular texture. Biotite is locally altered to muscovite, chlorite, epidote, and rutile. Accessory minerals include apatite, carbonate minerals, fluorite, monazite, and zircon. Opaque minerals are hemoilmenite, pyrite, chalcopyrite, and pyrrhotite.

Unconsolidated Sediments

Alluvium

Unconsolidated clay, silt, sand, and gravel occur as flood plain deposits along streams and rivers throughout the quadrangle. The widest alluvial deposits are associated with Turkey Creek and Moccasin Creek.

Coastal Plain sediments

Coastal Plain sediments in the southeastern portion of the Middlesex quadrangle were described by Hoffman and Carpenter (1992). Upper and lower units were established from auger drill data and field mapping. This drill data is restricted to the southeast corner of the quadrangle, primarily on units over the Sims pluton.

The Coastal Plain Office of the North Carolina Geological Survey is conducting a detailed geomorphic and subsurface study of the Coastal Plain in the eastern half of the Raleigh 100K quadrangle as part of the STATEMAP program. That study will evaluate Coastal Plain units throughout the Middlesex and other

quadrangles. This mapping will be incorporated into revised releases of the Middlesex and other quadrangles as that mapping progresses.

Coastal Plain sediments in the southeastern corner of the quadrangle are possibly of Pliocene age and consist of an upper and a lower unit (not delineated on the geologic map). The lower unit consists of medium to coarse sands and gravels. These sediments are poorly sorted, and sand grains are generally angular to subangular in shape. Sands of the overlying upper unit are much finer, better sorted, and show greater rounding of quartz grains. In the southeastern portion of the quadrangle, sands of the upper unit at elevations above 240 feet comprise a major reserve of heavy minerals that extends onto adjacent quadrangles. The heavy mineral assemblage consists of ilmenite, staurolite, kyanite, sillimanite, zircon, rutile, and tourmaline.

STRUCTURE

The dominant structural fabric in the Middlesex quadrangle is a N10° - 20° E foliation that parallels the trend of the rock units. The foliation dips steeply to the northwest or southeast. The northeast trend also parallels the axes of two regional F_2 folds, the Smithfield synform and an unnamed antiform.

The axis of an unnamed antiform trends northeast through the center of the felsic quartz crystal tuff (plate 1). A crenulation cleavage, locally visible in outcrop and hand samples, varies from N 40°W to N 30° E. This crenulation cleavage is, in places, parallel to the axes of regional F_3 folds described by Farrar (1985). The more northwesterly trends may be parallel to smaller folds on the limbs of the F_3 folds. The axis of the Smithfield synform (F_3) lies southeast of the quadrangle.

MINERAL RESOURCES

No mines or quarries are active in the quadrangle. The Sims granite is quarried for crushed stone near the town of Sims, in the Bailey quadrangle. A large reserve of heavy minerals (ilmenite, rutile, and leucoxene) is located south of Bailey, North Carolina, in Coastal Plain sediments (Carpenter and Carpenter, 1991; Hoffman and Carpenter, 1992). The Sims granite in the Stancils Chapel quadrangle contains greisen that may have economic quantities of commercial-grade mica (Carpenter, Tanner and others, 1995).

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