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STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES
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GEOLOGIC MAP
NOLAND CREEK QUADRANGLE
NORTH CAROLINA
GM 158-NE

MAP UNITS

Qal Alluvium — Qc Colluvium — Qt Terrace deposit — QUATERNARY

nt, ntq Nantahala Formation
ntq, Tusquitee Quartzite Member

gdf Dean Formation

ghb Ammons Formation
ghb, Horse Branch Member

ggs, ggg Grassy Branch Formation
ggs, Upper schist unit
ggg, Lower metasandstone unit

ga_5, ga_4, ga_3, ga_2, ga_1 Anakeesta Formation
ga_5, Upper black schist unit
ga_4, Upper metasandstone unit
ga_3, Middle black schist unit
ga_2, Lower metasandstone unit
ga_1, Lower black schist unit

gt Thunderhead Formation

Great Smoky Group — UPPER PRECAMBRIAN (?)

DESCRIPTION OF MAP UNITS[1]

Qal **ALLUVIUM**—Unconsolidated stream deposits of gravel, sand, silt, and clay. Only larger bodies shown on map.

Qc **COLLUVIUM**—Unconsolidated boulder rubble derived from resistant rock units. The most notable deposits are downslope from outcrops of Tusquitee Quartzite Member of Nantahala Formation. Only larger bodies shown on map.

Qt **TERRACE DEPOSIT**—Unconsolidated stream deposit; underlies slip-off slope south of Alarka Creek near Grassy Branch. Much smaller deposits, which occur elsewhere, not shown on map.

nt **NANTAHALA FORMATION**—Dominantly black, sulphidic schist interlaminated with dark-gray to white quartzose metasiltstone; contains a few beds of white metaquartzite as much as 3 feet thick. Top of Nantahala not present in this quadrangle; maximum preserved thickness of formation 950 feet.

ntq Tusquitee Quartzite Member—White, fine- to coarse-grained metaquartzite in uniform beds as much as 3 feet thick, separated by thin laminae of black schist. Locally contains units of black to dark-gray schist and metasiltstone as much as 6 feet thick. Tusquitee occupies entire interval from 400 to 800 feet above base of formation, and has conformable and gradational contacts at both top and bottom.

gdf **DEAN FORMATION**—Dominantly metasandstone and porphyroblastic muscovite schist; minor metaquartzite, metasiltstone, muscovite schist, and nodular and bedded calc-silicate granofels (pseudodiorite). Rock types are interlayered in units 30 to 300 feet thick. Metasandstone is gray, fine to coarse grained; composed of quartz, feldspar, and subordinate biotite; beds are as much as 6 feet thick, even, in places graded. Muscovite schist contains porphyroblasts of biotite, chlorite, some garnet, and rarely staurolite, in a gray, quartz-muscovite matrix; individual beds as much as 3 cm thick. Upper part of formation locally removed by faulting. Maximum exposed thickness about 2,000 feet.

gam **AMMONS FORMATION**[2]—Metasandstone with abundant metasiltstone and muscovite schist. Minor rock types include calc-silicate granofels and porphyroblastic muscovite schist; porphyroblasts are mostly biotite and chlorite, rarely garnet or potassium feldspar. Metasandstone is light gray; composed of quartz, feldspar, and subordinate biotite; forms even beds as much as 4 feet thick, which are commonly graded. Metasiltstone is light gray; composed of quartz, feldspar, biotite, muscovite, and minor magnetite; most abundant in lower part of formation. Muscovite schist is gray; composed of quartz and muscovite with small porphyroblasts of magnetite octahedra. Metasiltstone and muscovite schist are commonly interbedded, with individual beds as much as 3 cm thick. The Ammons Formation is 4,000 to 5,000 feet thick. It is conformable at all places with overlying formations, and the basal contact of the Horse Branch Member is gradational vertically and laterally with the remainder of the Ammons.

ghb Horse Branch Member—Mostly dark sulphidic mica schist and metasiltstone; interbedded with lighter colored metasandstone, metasiltstone, and muscovite schist, in layers as much as 2 cm thick. Minor rock types not found elsewhere in the formation include white to bluish-white metaquartzite, in units as much as 8 feet thick; and porphyroblastic mica schist, with garnet and biotite porphyroblasts, in units as much as 12 feet thick. The Horse Branch Member, which represents the upper part of the Ammons, is 500 feet thick and is present only in the southwestern part of the quadrangle.

GRASSY BRANCH FORMATION[3]—Consists of an upper schist unit, which is present only east of Little Tennessee River (portion of Fontana Lake); and a lower metasandstone unit. Contacts between units and with overlying and underlying formations are conformable and gradational.

ggs Upper schist unit—Mostly gray to dark-gray porphyroblastic muscovite schist and gray metasandstone. Minor rock types include muscovite schist and bedded and nodular calc-silicate granofels, the latter rare in garnet zone but common at higher metamorphic grade. Porphyroblastic muscovite schist contains abundant porphyroblasts of chlorite, biotite, garnet, and (at sufficient metamorphic grade) staurolite; beds as much as 3 cm thick. Metasandstone is composed of quartz, feldspar, and subordinate biotite; fine grained to pebbly; beds even, commonly graded, as much as 6 feet thick. Upper schist unit ranges from 0 to 500 feet in thickness.

ggg Lower metasandstone unit—Mostly gray metasandstone with subordinate muscovite schist. Metasandstone contains abundant quartz and feldspar and subordinate biotite; grain size ranges from fine to pebbly; beds even, commonly graded, as much as 10 feet thick. Many beds contain calcareous concretions as large as 1 foot in diameter. Separating the metasandstone beds are layers of muscovite schist as much as 1 foot thick. Porphyroblasts, except for sparse chlorite, are generally absent from the schist. Minor amounts of nodular calc-silicate granofels are present; rare in the garnet zone but more common at higher metamorphic grade. Lower metasandstone unit ranges in thickness from about 300 to 500 feet. Contact with overlying upper schist unit and Ammons Formation is gradational and conformable.

ANAKEESTA FORMATION—Extremely heterogeneous formation dominated by a black schist facies and a metasandstone facies, with a transitional gray muscovite schist facies. The two major facies occur in sequences as much as several hundred feet thick; sequences of the transitional facies are rarely more than 100 feet thick.

Black schist facies is mostly black to dark-gray muscovite schist, which contains abundant graphite and pyrrhotite in a quartz-muscovite matrix. Porphyroblasts are common west of the kyanite isograd only chlorite and small manganiferous garnets are present. East of the kyanite isograd the porphyroblasts are plagioclase, biotite, and blades of kyanite as much as 6 inches long. Bedding, which has been tectonically obliterated at most places, consists of layers of black schist 2 to 3 cm thick and layers of sulphidic metasiltstone 1 to 2 mm thick. This facies also contains black metasandstone, fine- to coarse-grained, in beds as much as 6 feet thick; at sufficient metamorphic grade, contains porphyroblasts of kyanite. Minor rock types also associated with the black schist facies include black para-amphibolite and dark tremolitic marble, each in beds as much as 2 feet thick; and magnesian schist and metasiltstone in pods as much as 2 feet across. The metasiltstone pods are composed of quartz and chlorite west of the kyanite isograd, and of quartz and biotite east of the kyanite isograd.

Metasandstone facies is dominated by gray, fine-grained to pebbly metasandstone composed of quartz, feldspar, and subordinate biotite. Staurolite porphyroblasts are rare and kyanite is not present. Beds are even, commonly graded, and are as much as 8 feet thick. Calcareous concretions as large as 1 foot in diameter occur in the metasandstone. Muscovite schist, in beds as thick as 1 foot, separates many of the sandy sequences; porphyroblasts of garnet, biotite, or chlorite rarely present. Nodular calc-silicate granofels is rare in the garnet zone but common at higher metamorphic grade.

Gray muscovite schist is a subordinate facies composed of subequal amounts of gray to dark-gray muscovite schist and metasandstone, with minor other rock types. The lighter colored schist contains porphyroblasts of biotite, chlorite, garnet, and (at sufficient metamorphic grade) staurolite. The darker colored schist also contains porphyroblasts of kyanite and plagioclase at sufficient metamorphic grade. Graphite and pyrrhotite are present in small quantities in the schist of this facies. Bedding of the schist is even and consists of layers 1 to 3 cm thick of light-gray silty schist and dark-gray argillaceous schist. The metasandstone of this facies is gray, fine grained to pebbly; and is composed of quartz, feldspar, and subordinate biotite; beds are as much as 4 feet thick and are commonly graded; staurolite is present at the top of some of the graded beds. Minor rock types in the gray muscovite schist facies include matrix-poor pebbly metaconglomerate, in beds as much as 6 feet thick; and nodular and bedded calc-silicate granofels, the latter rare within the garnet zone but abundant at higher metamorphic grade.

In this quadrangle the Anakeesta Formation, about 4,000 feet thick, is divided into five map units of subequal thickness. The contacts between these units, as well as contacts with adjacent formations, are all conformable.

ga_5 Upper black schist unit—Dominated by black to dark-gray muscovite schist of the black schist facies. In the western part of its outcrop area, along Panther Creek, beds of the metasandstone facies comprise about 50 percent of the section.

ga_4 Upper metasandstone unit—Dominated by rocks of the metasandstone facies but includes sequences as much as 50 feet thick of the black schist facies and the gray muscovite schist facies.

ga_3 Middle black schist unit—Dominated by rocks of the black schist facies. In the western part of its outcrop area, along Panther Creek, beds of the metasandstone facies comprise about 40 percent of the section.

ga_2 Lower metasandstone unit—Dominated by rocks of the metasandstone facies but includes sequences as much as 50 feet thick of the black schist facies and the gray muscovite schist facies.

ga_1 Lower black schist unit—Dominated by black to dark-gray muscovite schist of the black schist facies. Metasandstone of the gray muscovite schist facies occurs in the upper part of the unit; the lower part is almost entirely schist.

gt **THUNDERHEAD FORMATION**—Dominantly gray, fine-grained to pebbly metasandstone composed of quartz, feldspar, and subordinate biotite; contains calcareous concretions as much as 2 feet thick. Individual beds are typically graded and are as much as 10 feet thick; commonly separated by thin strata of gray muscovite schist, generally less than 2 feet thick, which only rarely contain porphyroblasts. Formation includes sequences as much as 100 feet thick dominated by gray to dark-gray muscovite schist containing porphyroblasts of biotite, garnet, sparse chlorite, and staurolite (at sufficiently high metamorphic grade); and subordinate metasandstone in beds as much as 3 feet thick. Schist consists of alternating beds as much as 3 cm thick of silty and schistose rock. Bedded calc-silicate granofels, as much as 2 feet thick, occurs in some thicker sequences of mica schist.

REFERENCE CITED

Mohr, D. W. (1973) *Stratigraphy and structure of part of the Great Smoky and Murphy Belt Groups, western North Carolina*: Am. Jour. Sci., v. 273-A (Cooper Volume), p. 41-71.

[1]Detailed manuscript of the map area is on open file with Tennessee Valley Authority, Geologic Services Branch, Knoxville, TN 37902, and the North Carolina Department of Natural and Economic Resources, Mineral Resources Section, Raleigh, NC 27611. Copies may be obtained for the cost of reproduction.

[2]The Ammons Formation was named by Mohr (1973, p. 55-58) for Ammons Branch, a tributary of the Little Tennessee River. The type section, exclusive of the Horse Branch Member, is in the south-central part of this quadrangle along the banks of Fontana Lake from the mouth of the Nantahala River to the mouth of Grassy Branch, a tributary of Alarka Creek. The lowest beds are best exposed along a cliff on the southern bank of the Little Tennessee River between Battles Branch and Lemmons Branch. The highest beds of the Ammons Formation in the region where the Horse Branch Member is absent are exposed along State Route 28 southeastward from the Graham-Swain County boundary. The Horse Branch Member is named for Horse Branch in the southwestern part of this quadrangle, where roadside exposures define the type section.

[3]The Grassy Branch Formation was named by Mohr (1973, p. 54-55) for Grassy Branch, a tributary of Alarka Creek, in the southeastern part of this quadrangle. The formation is divided into two informal units, an upper schist and a lower metasandstone. Typical exposures are along both banks of Fontana Lake in the Alarka Creek-Grassy Branch area, along the north bank of the lake 1.2 miles east of the mouth of the Nantahala River, and along the western bank of Panther Creek, just north of the mouth of Wolf Creek. The latter locality is immediately west of this quadrangle, in the Tuskegee quadrangle.

MINERAL RESOURCES PROSPECTS

Map Number	Name	Mineral Commodity
1	Welch prospect	Sulfides
2	Forney prospect	Sulfides
3	Noland prospect	Sulfides
4	Hyde prospect	Kaolin
5	Unnamed prospect	Beryl
6	Spencer prospect	Quartzite

Contact, dashed where approximately located, short dashed where inferred, dotted where concealed (lake level at approximately 1,600 feet elevation at time of mapping)

32 83 90 — Contact showing dip; overturned contact; vertical contact

U / D ..... Fault, approximately located, dotted where concealed. U, upthrown side; D, downthrown side

PLANAR FEATURES

Where symbols are combined or joined, their intersection marks the point of observation

Strike and dip of bedding
- 51 — Inclined
- Vertical
- 64 — Overturned
- Horizontal

Strike and dip of early metamorphic features
- 72 — Inclined schistosity and microscopic strain-slip cleavage
- Vertical schistosity and microscopic strain-slip cleavage
- 46 — Inclined foliation of metasandstone
- Vertical foliation of metasandstone

Strike and dip of late or postmetamorphic features
- 37 — Inclined megascopic strain-slip cleavage
- Vertical megascopic strain-slip cleavage
- 12 — Bearing and plunge of elongated pebbles

FOLDS

Early bedding folds, formed before or during earliest stages of metamorphism. Only large folds shown
- Anticline, showing axial trace
- Syncline, showing axial trace

Synmetamorphic folds, characterized by axial plane foliation
- Anticline, showing axial trace
- Syncline, showing axial trace
- 24 — Minor fold, showing bearing and plunge of axis
- Horizontal minor fold, showing bearing of axis

Later folds of schistosity, characterized by contemporaneous megascopic strain-slip cleavage
- 25 — Minor fold, showing bearing and plunge of axis

METAMORPHIC ZONES

Adequately defined only within Anakeesta Formation, Isograds based on first megascopic appearance of index mineral. Ticks on high intensity side of isograd

STAUROLITE — Staurolite isograd, approximately located

KYANITE — Kyanite isograd, approximately located

MINERAL RESOURCES

- x — Prospect or sample locality
- Tunnel or adit, abandoned
- be — Beryl
- k — Kaolin
- q — Quartz
- su — Sulfides
- ? — Questionable or approximate location
- 2 — Map numbers refer to descriptions in Mineral Resources Summary

Base topographic map by USGS-TVA 1961

Geologic map cartography and printing by TVA

1000-foot grid based on North Carolina Coordinate System

1000-meter Universal Transverse Mercator Grid ticks, Zone 17, shown in blue

Field and compilation sheets are on open file at Raleigh, N.C.

UTM GRID AND 1975 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

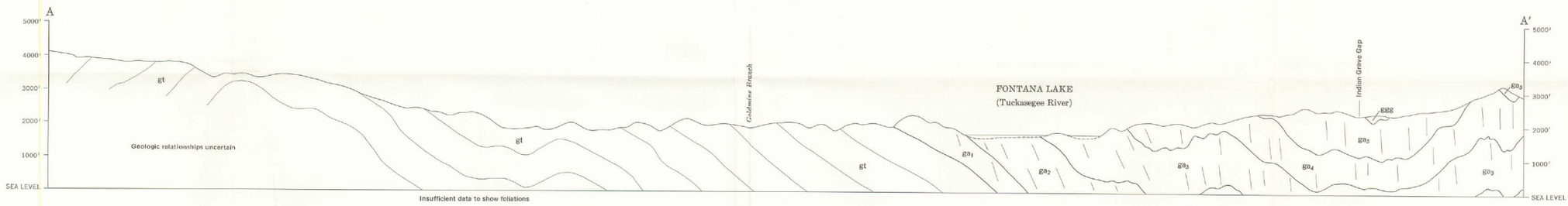
CONTOUR INTERVAL 40 FEET

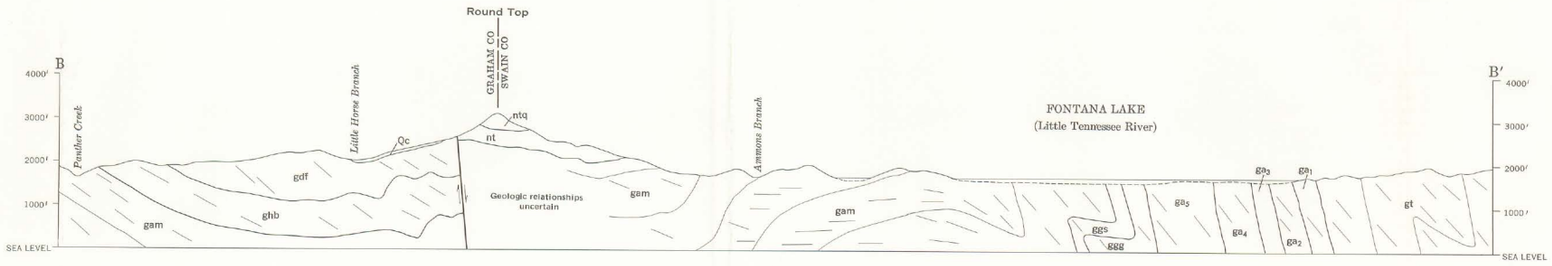
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Geology mapped in 1969-73

Map preparation and editing by R. J. Floyd, L. S. Wiener, and C. E. Merschat





GEOLOGIC MAP OF THE NOLAND CREEK QUADRANGLE, NORTH CAROLINA

By
David W. Mohr
1975