DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Geologic Map of the Greenville 1 X 2 degree quadrangle GA, SC, and NC

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Open-File Report 89-9

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

1989

DESCRIPTION OF MAP UNITS

Qal — Quaternary alluvium—Unconsolidated bouldery and cobbly gravels, sand, and clay

JTRd — Diabase dike (Jurassic and Triassic?)

sb — Silicified breccia—Cohesive, silicified fault breccia, composed mostly of quartz.

GREAT SMOKY THRUST SHEET

The exposed Great Smoky thrust sheet is underlain by some formations of the Great Smoky Group (Zdg, Zdh, Zghg, Zgw, Zgc, Zgs, Zgu) and the Cambrian age Nantahala Slate (Cgn) of the Murphy Syncline. Interlayered assemblages of thin to thickly layered mica schists and or aluminous schists and metasandstone or metaconglomerate comprise most of the Great Smoky Group

Cgn — Nantahala Slate (Cambrian)

Zgd — Dean Formation—Interlayered schist, and argillaceous to feldspathic metasandstone

Zgh — Hothouse Formation—Metasandstone, interlayered with mica schist and minor metaconglomerate

Zghg — Hughes Gap Formation—Aluminous schist interlayered with conglomeratic argillaceous metasandstone, and abundant thin calc-silicate beds

Zgw — Wehutty Formation—Interlayered sillimanite-graphite-muscovite schist and argillaceous and feldspathic metasandstone

Zgc — Copperhill Formation—Interlayered argillaceous metasandstone, locally conglomeratic, schist and minor calc-silicate beds

Zgu — Undivided rocks of the Great Smoky Group—Mostly schist interbedded with lesser amounts of feldspathic to argillaceous metasandstone, and some calc-silicate beds

Zgs — Interbedded argillaceous metasandstone and garnet-muscovite-biotite schist (Late Proterozoic)

YOUNG HARRIS THRUST SHEET

Intrusive rocks

mu — Ultramafic-mafic complex near Lake Chatuge—Undivided pyroxenite metamorphosed gabbro or olivine troctolite, amphibolite talc-chlorite schist, and some dunite, rare wehrlite, and possibly eclogite

Note — All thrust sheets structurally higher than the Great Smoky thrust sheet contain variably sized lenses and pods of ultramafic-mafic rocks, some of these mapped bodies in higher thrust sheets carry the letter symbol mu

RICHARD RUSSELL THRUST SHEET
Layered or stratified rocks
(stratigraphic order uncertain)

Two major rock assemblages comprise the Richard Russell thrust sheet; the schist of Crooked Creek and the Richard Russell Formation. The schist of Crooked Creek is mostly a garnet mica schist (Ycs), and the principal unnamed members of the Richard Russell Formation include biotite gneiss (Yrg), mixed biotite gneiss and granitic gneiss (Yrgg), and quartz feldspathic gneiss (Yrss); in places the gneisses are interlayered with amphibolite (Yra), quartzite and quartzo-feldspathic gneiss (Yrsg), and biotite schist (Yrs)

Ycs — Schist of Crooked Creek (Proterozoic Y?)—Garnet-mica schist, interlayered with felsic gneiss, amphibolite, hornblende gneiss, calc-silicate layers, quartzo-feldspathic gneiss and/or metagraywacke, minor diamictite and quartzite

Yca — Amphibolite

Ycd — Diamictite

Ycc — Calc-silicate gneiss—Interlayered with amphibolite, and mica-schist

Ycss — Quartzo-feldspathic gneiss and biotite gneiss

Yq — Quartzite

Richard Russell Formation (Proterozoic Y?)—Biotite gneiss, quartzo-feldspathic gneiss, quartzite, mica schist, granitoid gneiss, migmatite, calc-silicate granofels, and minor amphibolite that are interlayered and variably textured

Yrg — Biotite gneiss—Interlayered with schist, hornblende gneiss and amphibolite, calc-silicate granofels, and granitic gneiss

Yrss — Quartzo-feldspathic gneiss—Interlayered with biotite gneiss, mica schist, quartzite, hornblende gneiss, and amphibolite; probably correlates with Coleman River Formation in North Carolina

Yrgg — Mixed biotite gneiss and granitic gneiss—Includes minor quartzo-feldspathic gneiss biotite schist, and amphibolite

Yra — Amphibolite—Grades into hornblende gneiss

Yrsq — Quartzite and interlayered quartzo-feldspathic gneiss

Yrs — Biotite schist and muscovite-biotite schist—Interlayered with felsic gneiss, biotite gneiss, and granite gneiss

Yrp — Irregularly interlayered mica schist, felsic gneiss, and quartzite. This unit may correlate with the Ridgepole Mountain Formation in North Carolina

Pzpc — Quartz diorite to tonalitic gneiss. May correlate with the Persimmon Creek Formation in North Carolina

Intrusive Rocks

Pzm — Metagabbro (Paleozoic)

HELEN THRUST SHEET
Layered or stratified rocks
(stratigraphic order uncertain)

The Helen thrust sheet is mostly underlain by rocks of the Helen Group. The principal rocks include amphibolite (hna, hha), aluminous schist (hns, hhs), mica schist (hs), metasiltstone and metasandstone (hnss, hh, hr, hu, hi), felsic gneiss and schist (hf, hb)

HELEN GROUP (Lower Paleozoic and or Late Proterozoic)—The Helen Group includes the Nacoochee, Horton, and Robertstown Formations

Nacoochee Formation—Interlayered amphibolite, aluminous schist, metasandstone, metasiltstone, and minor quartzite

hna — Amphibolite
hns — Aluminous schist
hnss — Metasandstone and metasiltstone

Horton Formation—Interlayered argillaceous and feldspathic metasandstone and metasiltstone, aluminous mica schist, and amphibolite

hh — Argillaceous and feldspathic metasandstone and metasiltstone
hhs — Aluminous schist
hha — Amphibolite locally mixed with metagabbro

hr — Robertstown Formation—Metasandstone

hu — Undivided rocks of Helen Group—Metasandstone, metasiltstone, aluminous schist, amphibolite, and minor mica schist and minor metagraywacke, and quartzite

Other metasedimentary rocks (Early Paleozoic or Late Proterozoic)

hi — Interlayered metasiltstone, metasandstone, mica schist, phyllite, amphibolite, and rare slate
hs — Mica and aluminous schist interlayered with fine-grained metasandstone
hf — Garnetiferous felsic gneiss and schist
ha — Amphibolite
hb — Fine-grained gray biotite-plagioclase-quartz gneiss, interlayered with amphibolite, and schist

Intrusive Rocks

Pzhdi — Hornblende diorite (Paleozoic)
Pzhg — Tonalitic gneiss (Paleozoic)
Pzhmg — Metagabbro (Paleozoic)

TALLULAH FALLS THRUST SHEET

Layered or stratified

(Except for Tallulah Falls Formation, stratigraphic order uncertain)

The Tallulah Falls Formation (Tl, Tas, 1ga, 1g, and f) together with a variety of unnamed rock units comprise the Tallulah Falls thrust sheet. The principal unnamed units are schist (sg), gniess and schist (gn), an assemblage of amphibolite and schist, and feldspathic gneiss (sa), and amphibolite (a); other less extensively exposed units are also present

Unnamed rock units of the Tallulah Falls thrust sheet that may correlate with the Tallulah Falls Formation (early Paleozoic and(or) Late Proterozoic)

sg Biotite schist and muscovite-biotite schist—Interlayered with biotite gneiss, minor felsic gneiss or metagraywacke, granitic gneiss and amphibolite

gn Biotite gneiss and schist containing irregularly spaced layers of granite to granodiorite gneiss, and migmatite—Interlayered with metasandstone, mica schist, and amphibolite

sa Interlayered amphibolite, biotite schist, biotite-muscovite schist, and quartzo-feldspathic gneiss

a Amphibolite

qe Quartzite

cq Calc-silicate quartzite

mi Migmatite

fg Gray mica gneiss

fs Mylonitized rocks of the Tallulah Falls thrust sheet

Tallulah Falls Formation (early Paleozoic and(or) Late Proterozoic)—In descending order an upper quartzite-schist member, a graywacke-pelitic schist member, a garnet aluminous schist member, and a basal graywacke-schist amphibolite member, form the Tallulah Falls Formation

tq Quartzite-schist member—Interlayered with mica schist

tga Graywacke-schist member—Interlayered with mica schist

tas Garnet-aluminous schist member—Interlayered with mica schist, metagraywacke, and quartzite

tl Graywacke-schist-amphibolite member

f Undivided rocks of the Tallulah Falls Formation

Plutonic rocks

Yt Toxaway Gneiss (Middle Proterozoic)

Yw Wiley gneiss (informal) (Middle Proterozoic)

Intrusive rocks

Dr Rabun gneiss (informal) (Devonian)

sy Yonah gneiss (informal) (Silurian)

Ctg Undivided granite, granodiorite, and quartz diorite gneisses (Cambrian to Mississippian)

CHAUGA-WALHALLA THRUST COMPLEX
Layered or stratified rocks
(Stratigraphic order uncertain)

Two major rock assemblages make up the Chauga-Walhalla thrust complex. The formations comprising the Chauga belt part are the Henderson gneiss, Chauga River Formation, and the Poor Mountain Formation; the Walhalla metamorphic suite (informal name) consists principally of a hornblende gneiss amphibolite unit that is locally complexly interlayered with thin to thick granitoid layers, and a biotite feldspathic gneiss

The Chauga belt part of the Chauga-Walhalla thrust complex

Ꞓha Henderson Gneiss (Cambrian)—Principally a granitoid augen gneiss
Ꞓhfc Fine-grained, biotite gneiss
Ꞓhu Undivided Henderson Gneiss (Ꞓha) and biotite gneiss (Ꞓhfc)
Ꞓhm Mylonitic Henderson Gneiss

Chauga River Formation (Early Cambrian or Late Proterozoic)—Includes upper and lower phyllonite schist members (ꞒZcbp), and a medial carbonate member (ꞒZcc); common unnamed mapped units include amphibolite (ꞒZca), quartzite (ꞒZqs), and schist (ꞒZbsc)

ꞒZcbp Lower and upper phyllonitic schist members
ꞒZcc Carbonate member
ꞒZca Amphibolite
ꞒZqc Quartzite
ꞒZbsc Muscovite biotite schist with interlayered biotite schist, metasandstone, quartzite, thinly laminated amphibolite and minor gondite
ꞒZsc Interlayered button mica schist, biotite schist, amphibolite, and minor metasandstone (undivided)
ꞒZgpc Phyllonitic schist and graphitic button phyllonitic schist
ꞒZuc Biotite gneiss and feldspathic quartzite
ꞒZmc Undivided mylonitic and cataclastic rocks

Poor Mountain Formation (Early Cambrian and(or) or Late Proterozoic)—Principally a fine-grained, thinly laminated amphibolite (ꞒZpa), an interlayered metasedimentary assemblage (ꞒZpc), and a quartzite to calcareous quartzite unit (ꞒZpq)

ꞒZpa Amphibolite
ꞒZpc Interlayered mica schist, metasiltstone, metasandstone, quartzite (gondite), biotite schist, amphibolite, and granite (undivided)
ꞒZpq Quartzite and calcareous quartzite

The principal rock unit comprising the Walhalla metamorphic suite of the Chauga-Walhalla thrust complex are an interlayered and foliated hornblende gneiss and amphibolite unit (ꞒZaw), and an assemblage of feldspathic gneiss, schist, metasandstones, amphibolite, and hornblende gneiss (ꞒZgnw). Lesser amounts of

feldspathic metasandstone, quartzite, migmatite, fine-grained biotite gneiss, and feldspathic biotite-muscovite gneiss and schist are also present

Walhalla metamorphic suite (informal name) (Early Paleozoic and(or) Late Proterozoic)

ЄZgnw — Alternating biotite feldspathic gneiss, amphibolite, and hornblende gneiss

ЄZaw — Hornblende gneiss and amphibolite—Interlayered with biotite granitoid gneiss, biotite-muscovite gneiss and schist (ЄZbmw) and muscovitic schist (ЄZmw)

PzZmw — Migmatite—Granitoid gneiss mixed with hornblende gneiss and amphibolite (ЄZaw) or biotite feldspathic gneiss (ЄZgnw)

PzZiw — Injected hornblende gneiss—Migmatite composed of hornblende gneiss or amphibolite (ЄZaw) injected by biotite granitoid gneiss (SOgw)

CZqw — Quartzite

ЄZgw — Garnet-quartz rock (gondite)

ЄZew — Epidosite—Composed mainly of epidote and quartz

ЄZfgw — Fine-grained biotite gneiss and schist—Interlayered with hornblende gneiss and amphibolite (ЄZaw), and with feldspathic gneiss (ЄZgnw)

ЄZbmw — Biotite-muscovite gneiss and schist—Interlayered with hornblende gneiss and amphibolite (ЄZaw) and biotite granitoid gneiss (SOgw)

ЄZlw — Leucocratic plagioclase-quartz gneiss; interpreted as metamorphosed dacitic volcanic rock

ЄZmw — Muscovitic schist

Intrusive rocks

DSg — Undivided granodiorite gneiss and granitic gneiss (Devonian and Silurian)

Slg — Lineated leucogranite (Silurian)

SOch — Caesars Head Granite (Early Silurian to Ordovician?)—Biotite granitoid gneiss or gneissic granitoid, mainly

SOgw — Biotite granitoid gneiss

Pzpg — Porphyritic granite gneiss

PzWgb — Mixed dark gray hornblende gabbro and light gray granitoid

SIX MILE THRUST SHEET
Layered or stratified rocks
(Stratigraphic order uncertain)

The Six Mile thrust sheet mostly consists of interlayered mica schist and garnetiferous schist (ЄZs, ЄZms, ЄZss, ЄZsms), mixed gneiss and schist (ЄZsbs, ЄZsgs), felsic and quartzofeldspathic biotite gneiss (ЄZbs, ЄZgns, ЄZps), calc-silicate rock (ЄZcs), minor amphibolite (ЄZas), quartzite, quartzite schist, and gondite (ЄZmgs, ЄZgss, ЄZgs). Other less well exposed rock units are also present

ЄZis	Injected gneiss and schist (migmatite)—Biotite-plagioclase-quartz gneiss (ЄZsbs) or biotite-muscovite schist (ЄZs) pervasively injected by granitoid rock
ЄZms	Mica schist—Interlayered with quartzite, quartzite schist, gondite, and lenses of granitoid and pegmatite
ЄZs	Biotite-muscovite schist—Interlayered with subordinate layers of sillimanite-mica schist (ЄZss), and amphibolite
ЄZws	White-mica schist—Highly muscovitic
ЄZfs	Fine-grained felsic gneiss—Interlayered with minor amphibolite, biotite schist biotite-muscovite schist, and irregular bodies of granitoid.
ЄZgns	Felsic gneiss
ЄZts	Staurolite-mica schist
ЄZss	Sillimanite-mica schist
ЄZsms	Megacrystic sillimanite-mica schist
ЄZgs	Garnet-quartz rock (gondite)—Locally gradational into garnet-bearing quartzite
ЄZmqs	Magnetite-quartz rock
ЄZgss	Mica schist containing relatively high amounts of interlayered gondite, quartzite, and quartzite schist and some manganiferous schist
ЄZps	Megacrystic biotite (-muscovite) gneiss—Interlayered with biotite-plagioclase-quartz gneiss (ЄZbs), biotite-muscovite schist (ЄZs); and amphibolite (ЄZas)
ЄZas	Amphibolite
ЄZus	Biotite-muscovite schist and gneiss (undivided)—Similar to ЄZs and ЄZms but without amphibolite
ЄZqs	Quartzite
ЄZsgg	Microcline gneiss, biotite schist, and mixed granitoid—Granitoid locally porphyritic, includes some bodies of Elberton Granite; locally deformed to microbreccia, protocataclastic, and mylonite series rock close to and in the Lowndesville shear zone
ЄZsgs	Undivided biotite schist and biotite felsic gneiss with interlayered amphibolite, biotite-muscovite schist, quartzo-feldspathic gneiss, and granitoid
ЄZcs	Calc-silicate gneiss and schist—Biotite-muscovite schist (ЄZs) and biotite-plagioclase-quartz gneiss (ЄZbs), intergradational with characteristic interlayers (0.5-30 cm thick) of slabby calc-silicate granofels
ЄZbs	Biotite-plagioclase-quartz gneiss—Contains subordinate biotite-muscovite schist (ЄZs), megacrystic biotite gneiss (ЄZps), amphibolite (ЄZas), rare garnet-quartz rock (ЄZgs), and granitoid (SOsg)
ЄZsbs	Interlayered biotite gneiss and biotite-muscovite schist—Biotite-plagioclase-quartz gneiss (ЄZgs) and biotite-muscovite schist (ЄZs) undivided. Includes subordinate layers of megacrystic biotite gneiss (ЄZps), sillimanite-mica schist (ЄZss), and minor amphibolite (ЄZas)

Intrusive Rocks

Mė	Elberton Granite (Mississippian)
DSg	Undivided granodiorite gneiss and granitic gneiss (Devonian and Silurian)—See description under Chauga-Walhalla thrust sheet
SOch	Caesars Head Granite (Early Silurian to Ordovician?)—See description under heading of Chauga-Walhalla thrust complex
SOsg	Biotite granitoid gneiss—Pluton at Antreville overlaps boundary between Six Mile and Laurens thrust sheets
Pza	Anderson metagabbro (Paleozoic?)—Metagabbro, amphibolite, and variably foliated transitional rocks
u	Altered ultramafic rocks of Inner Piedmont—Dominantly chlorite-tremolite schist

LAURENS THRUST SHEET
Layered or stratified rocks
(Stratigraphic order uncertain)
(Early Cambrian and(or) Late Proterozoic)

ЄZgl	Biotite (hornblende-sillimanite-microcline-muscovite) gneiss—Interlayered with schist, quartzo-feldspathic gneiss, quartzite or quartz-muscovite schist, granitoid gneiss, granodiorite gneiss, amphibolite and metagabbro
ЄZsl	Gray sillimanite schist
ЄZml	Marble
ЄZal	Amphibolite

Intrusive Rocks

Pcg	Granite of Cold Point (Pennsylvanian)
Dgg	Granite gneiss of Gray Court (Devonian)
Pzgf	Granite gneiss
Pzgg	Undivided granite gneiss and granodiorite gneiss
Pzpgg	Porphyritic granite gneiss

PARIS MOUNTAIN THRUST SHEET
(Stratigraphic order uncertain)
(Early Cambrian and(or) Late Proterozoic)

ЄZsp	Sillimanite-mica schist
ЄZap	Amphibolite
ЄZqp	Quartzite

Intrusive Rocks of Paris Mountain Thrust Sheet

Pzgp	Granite gneiss (Paleozoic)

CHARLOTTE THRUST SHEET
Layered or stratified rocks
(Stratigraphic Order Uncertain)
(Cambrian and(or) Late Proterozoic)
Rocks commonly assigned to the Carolina Slate belt

ЄZt	Siliceous crystal-lithic metatuff—Interlayered with some phyllite
ЄZf	Interlayered crystal lithic metatuff, graded crystal metatuff, phyllite, and siliceous rocks interpreted as metamorphosed lava
ЄZv	Interlayered rhyolitic crystal metatuff, crystal-lithic metatuff, siliceous metamorphosed glomeroporphyritic lava, greenstone, and phyllite
ЄZp	Phyllite
ЄZqq	Quartzite and quartz-muscovite schist—Interbedded quartzite, schist, and phyllite crystal-lithic metatuff, and mafic lava(?)
ЄZq	Quartzite
ЄZzft	Phyllite and tuff—Phyllite, interlayered with metamorphosed crystal tuff, and lava

Rocks commonly assigned to the Charlotte belt
(early Paleozoic and or Late Proterozoic)

g	Biotite gneiss—Interlayered with hornblende gneiss, muscovite schist, biotite gneiss or metasandstone, pods and layers of granitoid gneiss and pyroxene gabbro
s	Biotite schist—Interlayered with granitoid gneiss
bm	Muscovite-biotite schist—Includes some amphibolite, biotite gneiss, and granite
gs	Quartz-feldspar gneiss
ma	Muscovite schist—Interlayered with amphibolite (ca), and granitoid rock
ca	Amphibolite
ug	Undivided greenstone, amphibolite, metagabbro, and granitoid gneiss
ga	Undivided granitoid gneiss, amphibolite, and biotite schist

Rocks commonly included in the
Lowndesville belt of Griffin (1979)

ЄZpp	Phyllonite with thin layers of chloritic schist, quartzite, metasiltstone, and amphibolite; contains some zones of blastomylonite, mylonite, and cataclastic rock; mapped as ЄZm
ls	Undivided cataclastic and mylonitic rocks of the Lowndesville shear zone

Intrusive rocks

Pc	Coronaca pluton (Permian)
Mg	Granitic to dioritic gneiss (Mississippian)
	Concord Plutonic Suite (Devonian and Silurian)

DScs	Syenite
DScp	Pyroxenite
DScgs	Undivided gabbro and syenite
DScgb	Hornblende gabbro
Pzp	Porphyritic granite to granodiorite gneiss (Paleozoic)
Pzd	Quartz diorite (Paleozoic)
Pzdg	Diorite and gabbro (Paleozoic)
Pzgd	Mixed diorite gneiss and granite gneiss (Paleozoic)

MELANGE COMPLEX

m	Mafic-ultramafic complex--Includes ultramafic rocks, gabbro, diorite, amphibolite, mafic dikes, and granitic bodies in a gabbroic(?) matrix

Intrusive rocks

mu	Undivided ultramafic rocks
PzZmg	Granitic gneiss