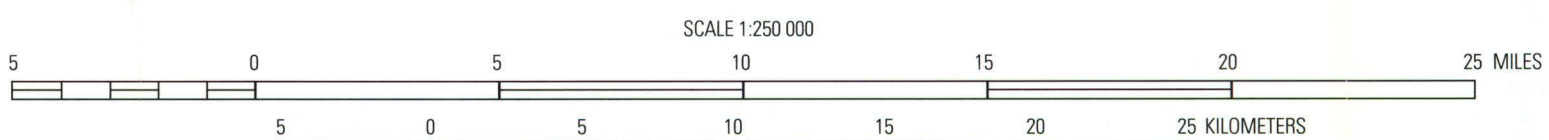


Base from United States Geological Survey, Knoxville, Tenn., N.C.S.C., 1972.
Geology modified from Hayden and Nelson (1971) and the Geologic Map of
North Carolina (North Carolina Geological Survey, 1966).

Robinson, G.R., Jr.; F.G. Lesure, J.I. Marlowe, R.N.K. Foley, and S.H. Clark, 1982. Bedrock geology and mineral resources of
the Knoxville 1x2° quadrangle, Tennessee, North Carolina, and South Carolina. U.S. Geological Survey Bulletin 1979



DESCRIPTION OF MAP UNITS
VALLEY AND RIDGE AND WEST FLANK BLUE RIDGE

- Sedimentary and metamorphic rocks**
- MDu** Mississippian and Devonian rocks, undivided — Includes Greasy Cove Formation, Grainger Formation, and Chattanooga Shale.
 - OC** Chickamauga Group, undivided (Upper and Middle Ordovician) — Limestone, sandy limestone, and calcareous shale; dark gray to red; locally coarse bedded.
 - CK** Knox Group, undivided (Lower Ordovician and Upper Cambrian) — Well-bedded limestone and dolomite; commonly dark colored; locally cherty.
 - Cu** Cambrian rocks, undivided —
 - Conasauga Group** Thin-bedded dolomite and limestone; interbedded shale and siltstone.
 - Rome Formation** Shale and siltstone, variegated red to brown; interbedded fine-grained sandstone and shaly dolomite.
 - Shady Dolomite** Light gray, fine-grained, massive, locally thin-bedded or blocky; locally shaly.
 - CZc** Chilhowee Group, undivided (Lower Cambrian and Late Proterozoic) — Vitreous quartz arenite and feldspathic arenite with interbedded sandy siltstone and shale; conglomerate in lower part.

CENTRAL AND WEST FLANK BLUE RIDGE

- Metamorphic rocks**
- Mb** Brasstown Schist (Lower Cambrian?) — Cross-bedded schist; includes massive quartzite in lower part.
 - Cnt** Nantahala Formation and Tusquegee Quartzite, undivided (Cambrian? and Lower Cambrian) — Nantahala Formation: slate and metasediment, dark gray, laminated to thin-bedded, siltstone. Tusquegee Quartzite: white to light yellowish gray, numerous thin slate layers.
 - Camm** Andrews Formation, Murphy Marble, and Nolichucky Quartzite, undivided (Cambrian?) — Andrews Formation: calcareous cross-bedded schist. Murphy Marble: calcareous to dolomitic marble. Metamorphic talc bodies shown by symbol. Letter and number identifies the county and name of the talc occurrence in list of talc deposits. Nolichucky Quartzite: meta-quartzite with slate.
 - Zmb** Mineral Bluff Formation of Hume (1955) (Late Proterozoic) — Quartzite-schistose schist and phyllite with thin quartzite layers and minor interbedded graphitic schist, garnet-mica schist, staurolite schist, cross-bedded schist, and dark slate.
 - Oose Supergroup**
 - Zw** Walden Creek Group (Late Proterozoic) — Slate to metasediment, local calcareous beds and lenses; interbedded with metasediment and quartzite metaconglomerate.
 - Zg** Great Smoky Group, undivided (Late Proterozoic) — Thick metasedimentary sequence of massive to graded beds of metagraywacke and metasiltstone with interbedded metaconglomerate and metacarbonate, and, in some places, graphitic and sulfidic slate and schist.
 - Zgd** Dean Formation — Sericitic schist with cross-bedding, staurolite, and garnet porphyroblasts; interbedded metagraywacke and quartzite metaconglomerate.
 - Zgq** Sandstone, graywacke, and siltstone — Variably metamorphosed. Beds and lenses of mica schist and calcareous rock locally abundant; garnet, staurolite, and cross-bedded porphyroblasts common in fine grained layers.
 - Zgw** Wahyung Formation — Slate to schist, dark gray, graphitic and sulfidic; includes mica schist, metagraywacke, and metaconglomerate.
 - Zgc** Copperhill Formation — Metagraywacke, massive, graded bedding common; includes dark gray slate, mica schist, and nodular calcareous rock. Includes Thunderbolt Formation of King and others (1958).
 - Zgca** Slate of Copperhill Formation — Slate to phyllite, dark gray, graphitic, sulfidic; includes metagraywacke with local grade bedding.
 - Zga** Anakeeta Formation — Slate to schist, dark gray, graphitic and sulfidic; includes interbedded argillaceous, feldspathic metagraywacke.
 - Zr** Rich Butt Sandstone (Late Proterozoic) — Feldspathic; interbedded with dark argillaceous layers and lenses; includes Cades Sandstone in Cades Cove window. Stratigraphic position uncertain.
 - Zva** Snowbird Group (Late and/or Middle Proterozoic) — Feldspathic metagraywacke, metasediment, and phyllite. Basal schist contains lenses of quartzite-conglomerate.
 - Ybg** Biotite gneiss (Middle Proterozoic) — Pinkish gray to light gray, massive to well-foliated, granitic to quartz monzonitic; includes variably metamorphosed orthogneiss and paragneiss; interbedded amphibolite, calcareous rock, and marble.

Intrusive rocks

- CZmd** Metadiorite (Cambrian and Late Proterozoic) — Equigranular, massive to well-foliated, dioritic to basaltic dikes and sills, variably metamorphosed.
 - Bakersville Gabbro (Late Proterozoic)** — Equigranular, massive to foliated, thin dioritic to basaltic dikes; variably metamorphosed. Symbols show location and trend of larger dikes. Rb/Sr whole-rock age of 734±26 Ma (Goldberg and others, 1985). Also present in east flank of Blue Ridge.
 - Max Peak Granite** — Mottled pink and light green, coarse-grained to porphyritic, massive, contains biotite.
- EAST FLANK BLUE RIDGE**
- Metamorphic rocks (stratigraphic order uncertain)**
- Tallahassee Schist (Late Proterozoic)** — Laminated biotite gneiss — Finely laminated to thin-layered, locally contains massive gneiss and micaceous granule conglomerate; includes schist, phyllite, and amphibolite.
 - Metagraywacke** — Foliated to massive, locally conglomeratic; interbedded and gradational with mica schist, muscovite-biotite gneiss, and rare graphitic schist.
 - Kyanite schist and gneiss** — Massive and interbedded with quartz schist and biotite gneiss. Garnet, staurolite, and (or) sillimanite commonly occur; aluminous.
 - Muscovite-biotite gneiss** — Locally sulfidic; interbedded and gradational with mica schist, minor amphibolite, and hornblende gneiss.
 - Biotite gneiss** — Interbedded with biotite-garnet gneiss, biotite-muscovite schist, garnet-mica schist, and amphibolite.
 - Amphibolite** — Equigranular, massive to well-foliated; interbedded, rarely discordant, metamorphosed intrusive and extrusive mafic rock; may include metasedimentary rock.
- UNCONFORMITY**
- Toxaway Gneiss (Middle Proterozoic, correlated with biotite gneiss unit (Ybg))** — Poorly foliated to well-foliated, equigranular to inequigranular, granitic.
- Helen Sheet**
- Helen Group (Lower Paleozoic and Late Proterozoic)** — Interbedded metasediment, metatuffaceous, aluminous schist, and amphibolite; locally sulfidic. Includes local areas of granitic pegmatite.
- Richard Russell Sheet and amphibolite basement complex**
- Cowarts Group of Hatcher (1979) (Late Proterozoic?)** — Quartz dioritic gneiss and feldspar-quartz-biotite gneiss. Quartz dioritic gneiss predominant.
 - Richard Russell Formation and amphibolite basement complex** — Biotite gneiss and amphibolite (Middle Proterozoic) — Layered biotite-garnet gneiss and biotite-hornblende gneiss; interbedded and gradational with biotite-garnet gneiss, calcareous rock, marble, and amphibolite; locally contains garnet gneiss and rare granitoid facies rocks; locally migmatitic. Larger bodies of amphibolite shown separately as unit PZVa. U/Pb zircon age of 1035 Ma (Stem and Nelson, unpublished) and Rb/Sr whole-rock age of 1214 Ma (Fulager and Odom, 1973; Fulager and others, 1979) from granite gneiss bodies.
 - Corundum-bearing rock** — Layered biotite gneiss containing corundum; may be associated with bodies of ultramafic rock. Smaller bodies shown by symbol. Letter and number identify the county and name of occurrence in the list of ultramafic rock deposits.

MINERAL DEPOSIT SYMBOLS

- I. Sediment-hosted stratabound deposits**
- 1** Massive sulfide (Besshi-type, Cu-Zn group of Franklin and others, 1981). Colored section of symbol identifies the principal component of the deposit. **n** is a deposit concealed primarily by cover and zinc.
 - a** Stratabound REE
 - s** Stratabound W (labeled) (and associated placer occurrences)
 - 1** Stratabound molybdenum (and associated placer occurrences)
 - 1** Stratabound Mn (carbonate)
- II. Epigenetic deposits with no igneous association**
- 1** Low-sulfidation quartz vein (and associated placer occurrence)
 - 1** Mississippi Valley-type Pb-Zn deposits
 - 1** Base metal ± barite vein
 - 1** Barite ± base metal, fluorite vein
- III. Magmatic and igneous-associated epigenetic deposits**
- 1** Syenite pegmatite with Zr/REE (and associated placer occurrence)
 - 1** Rare-earth pegmatite (and associated placer occurrence)
 - 1** Zr, zircon
 - 1** Th-REE veins
 - 1** Ultramafic rock-associated PGE/Au (and associated placer occurrence)
- IV. Other symbols**
- 1** Talc schist, soapstone, and serpentinite — smaller bodies shown by symbol.
 - 1** Location and type of ultramafic rock adapted from Larabee, 1966. Letter and number identify the county and name of the occurrence in list of ultramafic rock deposits.

INNER PIEDMONT

- Metamorphic rocks**
- sb** Sillified breccia — Sillified crushed rock and breccia.
 - bz** Rocks of Brevard fault zone (age uncertain, possibly Permian or Devonian) — Schist, mylonitic gneiss, and phyllonitic, graphitic. Interbedded with feldspathic gneiss, marble lenses.
 - CZbg** Biotite gneiss and schist (Cambrian and Late Proterozoic) — Inequigranular, locally abundant porphyroblasts; feldspar and garnet; interbedded and gradational with calcareous rock, sillimanite mica schist, and amphibolite. Contains small masses of granitic rock.
 - CZma** Mica schist (Cambrian and Late Proterozoic) — Massive and interbedded with lenses and layers of quartz schist, micaceous quartzite, calcareous rock, biotite gneiss, amphibolite, and phyllite. Garnet, staurolite, kyanite, or sillimanite occur locally.
 - CZab** Amphibolite and biotite gneiss (Cambrian and Late Proterozoic) — Interbedded; minor layers and lenses of hornblende gneiss, metagabbro, mica schist, and granitic rock.
 - CZpg** Porphyroblastic biotite gneiss (Cambrian and Late Proterozoic) — Massive to foliated, contains plagioclase megacrysts and, rarely, megacrysts of quartz and feldspar. Granodioritic, locally magmatic.
 - CZgs** Garnet-mica schist — Interbedded with amphibolite.
- Intrusive rocks**
- Jd** Dabose (Jurassic) — Dikes, gray to black.
 - SoC** Cassens Head Granite (Early Silurian and Ordovician) — Equigranular to porphyritic, massive to well-foliated granite gneiss; contains biotite and muscovite. U/Pb zircon age of 435 Ma (Stem and Horton, unpublished).
 - SoG** Granite gneiss (Silurian and Ordovician) — Poorly foliated, interbedded with biotite gneiss. Rb/Sr whole-rock age of 429±22 Ma (Odom and Russell, 1975; as discussed in Harper and Fulager, 1981).
 - Omg** Magnetite granite gneiss (Ordovician) — Foliated to massive, granitic to quartzitic; biotite gneiss and amphibolite common.
 - Ch** Henderson Gneiss (Cambrian) — Monzonitic to granodioritic, inequigranular. U/Pb zircon age of 592 Ma (Shiba and Glover, 1978) and 538 Ma (Odom and Fulager, 1978; Rb/Sr whole-rock age of 535±27 Ma (Odom and Fulager, 1978).

SYMBOLS

- Lithologic contact**
- Fault: bar and ball on downthrown side. Dashed where approximately located.**
- Postmetamorphic thrust fault of late Paleozoic age (probably Permian); teeth on upper plate. May occur along an older reactivated fault in places.**
- Symmetrical fault to early postmetamorphic thrust fault of middle Paleozoic age (probably Devonian); teeth on upper plate.**
- Premetamorphic thrust fault of early Paleozoic age (probably Ordovician); teeth on upper plate. May include some component of postmetamorphic displacement in places.**
- Premetamorphic thrust fault of Middle to Late Proterozoic age; teeth on upper plate. May include some component of younger displacement.**

LIST OF METALLIC MINERAL DEPOSITS AND OCCURRENCES

Deposit number	Deposit name	Commodity
1	Kitchen prospect	Cu
2	Whiting prospect	Cu
3	Fontana mine	Cu, Ag, Pb, Zn, Au
4	Hazel Creek mine	Cu, Ag, Pb, Zn
5	Westfield prospect	Cu, Zn
6	Calhoun prospect	Cu, Zn
7	Unnamed prospect	Cu
8	Slates Bald prospect	Pb, Cu
9	Wells mine	Cu, Au, Ag
10	Savannah mine	Cu, Ag
11	Wataga Creek mine	Cu, Ag
12	Culbache mine	Cu, Ag
13	Moody mine	Cu
14	Gantstock mine	Cu
15	Parker mine	Cu
16	Wayhatch mine	Cu
17	Sageleaf Mountain prospect	Cu
18	Tom Lee prospect	Cu
19	Marcus Poole prospect	Cu
20	Otto mine	Zn, Cu
21	Big Ivy mine	REE, allanite
22	Dewey Moss property	Mg, allanite
23	Herman Moss prospect	magnetite
24	Sandywash placers	W, scheelite
25	Shooting Creek placers	Tl, native
26	East Fork mine	Mn, carbonate
27	Valley placer	Au
28	Ammons Branch placer	Au
29	Fairfield Valley placer	Au
30	Boytown mine	Au
31	Cane Creek placer	Au
32	Canton placers	Au
33	Kirklin mine	Pb
34	Trutter mine	Zn
35	Wills mine	Pb
36	Redmond mine	Pb
37	Paro mine	Pb, Ag
38	Beetee Knob prospect	Barite
39	Mad Tunnel Hollow mine	Barite
40	Darby Tom and Spence mines	Barite
41	West Meyer mine	Barite
42	East Meyer mine	Barite
43	Whitlock Hollow mine	Barite
44	Huff prospects	Barite
45	Oliver mine	Barite
46	Stone mine	Barite
47	Moccasin Gap mine	Barite
48	Mooneyham mine	Barite
49	Krebs mine	Barite
50	Bea Branch prospect	Barite
51	Dry Fork prospect	Barite
52	Williams mine	Barite
53	Cross Mountain prospect	Barite
54	Mine Ridge prospect	Barite
55	Unnamed prospect	Barite
56	Long Mountain mine	Barite
57	Dry Pond Ridge prospects	Barite
58	Doe Branch prospect	Barite
59	Snodgrass and DeWander mines	Barite
60	Nettie and Martha mines	Barite
61	Sandybottom mines	Barite
62	Gargan mine	Barite
63	Zirconia placers	REE, Th
64	Mars Hill pegmatite	REE, Th
65	Ledford mine	REE, Th
66	Cowee Creek placer	PGE, Au

LIST OF TALC AND ULTRAMAFIC ROCK DEPOSITS, BY COUNTY

Map No.	Deposit	Rock type
North Carolina		
Barren County:		
B1	Democrat	dunite
B2	Morgan Hill	dunite
B3	Juno	serpentinite
B4	Newfound Gap	dunite
B5	Bee Tree	pyroxenite
B6	Lake Eden	pyroxenite
Cherokee County:		
C1	Regal Talc mines	talc in marble
C2	Hayes	talc in marble
C3	Southern Mineral Co.	talc in marble
C4	Valley Town Mineral Co. and Biltmore Talc Co.	talc in marble
Clay County:		
CL1	Buck Creek	dunite
CL2	Behr	peridotite
CL3	Lake Chauga	dunite, trochilite, olivine gabbro, pyroxenite
CL4	Thumping Creek	olivine
CL5	Isabel (Shooting Creek)	amphibolite
CL6	Scully Mountain	biotite schist (?)
Haywood County:		
H1	Hornity Grove	dunite
H2	Retreat	garnet gneiss
Henderson County:		
HE1	occurrence	soapstone
Jackson County:		
J1	Balsam Gap	dunite
J2	Middleton	dunite
J3	Dark Ridge	dunite
J4	Adlie	dunite
J5	Webster	dunite, soapstone
J6	Chestnut	dunite, soapstone
J7	Cane Creek	dunite
J8	Cowarts (McChastain?)	pyroxenite
J9	John Lovelock	pyroxenite
J10	Cowarts	pyroxenite
J11	Henderson	dunite
J12	Byson	dunite
J13	Manus	peridotite
J14	Holken	dunite
J15	Alders	peridotite
J16	Sharp Cliff Mountain	peridotite
J17	Brookston	peridotite
J18	Rattlesnake	peridotite
J19	Hogback Creek	dunite
J20	Sagehite	dunite
J21	Asbestos	dunite
J22	Bad Creek	pyroxenite, dunite
J23	Jennings #2 (Whitewater)	pyroxenite
J24	prospect	pyroxenite
J25	Cobbide Mountain	peridotite
J26	Round Mountain	peridotite
Macon County:		
M1	Adams Place	soapstone
M2	Vance Jennings	soapstone
M3	Moore Knob (Ammons, Angell)	dunite
M4	Bad Mincey	dunite
M5	Ellyaj Creek	dunite
M6	Deposit #9 (Ellyaj, Hgdon, McCune)	dunite
South Carolina		
Greenville County:		
G1	Tigerville	biotite and ultramafic (?) rock (serpentite?)

PRELIMINARY BEDROCK GEOLOGIC MAP OF THE KNOXVILLE 1x2° QUADRANGLE, TENNESSEE, NORTH CAROLINA, AND SOUTH CAROLINA