Base from U.S. Geological Survey 1:24000
Blue Ridge, Ga., 1946 (Photo Revised 1973)
Ellijay, Ga., 1971
Cashes Valley, Ga., 1946 (Photo Revised 1973)
Tickanetley, Ga., 1946

SCALE 1:24,000

0 — 1 MILE
0 — 1 KM

Geology by M. Foose, E. Brown, S. Nicholson, C. Sears, S. Ludington, P. Atelsek, and R. Koeppen, 1981.

GEOLOGIC MAP SHOWING LITHOLOGIES OF FLOAT AND OUTCROP IN THE RICH MOUNTAIN ROADLESS AREA, GILMER AND FANNIN COUNTIES, GEORGIA

by

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

INTRODUCTION

The Rich Mountain Roadless Area, comprising approximately 16,880 acres, is located in northern Georgia, about 8 miles southeast of the town of Blue Ridge. It is the Blue Ridge physiographic province and is centrally located in a roughly 7 to 8 mile diameter area that is slightly higher than surrounding regions. Ridges and valleys radiate outward from Rich Mountain which is the central high point of this circular feature. Topography is moderately rugged with elevations ranging from 4,081 feet to 1,600 feet; slopes steeper than 20° are common. Moderately heavy second growth of hardwood forest covers most ridges and slopes, but do not significantly restrict foot access; however, locally heavy growths of laurel and rhododendron do impair access along many drainages.

The Rich Mountain Roadless Area was classified as a further planning area during the Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979. Field work in this area was done in the fall of 1981 by the U.S. Geological Survey in order to evaluate its mineral resource potential as mandated by the Wilderness Act of 1964. Mapping by M. Foose, E. Brown, S. Nicholson, R. Koeppen, C. Sears, P. Atelsek, S. Ludington, and J. Whitlow constituted more than 3 "man-weeks" of work during which relatively equidistantly separated traverses were run through the area in order to obtain uniform mapping coverage at 1:24,000 scale. This map presents much of the field data accumulated during this work and is meant to supplement the geologic report and more generalized 1:48,000 scale geologic map prepared for this area by Foose (1983).

PREVIOUS STUDIES

Regional geologic mapping of north-central Georgia by LaForge and Phalen (1913) and subsequent discussion by Pulcora (1953) are the only geologic works that specifically cover this area. The region's basic stratigraphic, structural, and metamorphic elements were recognized in detailed studies elsewhere by Hurst (1955) and Dupuis (1975). General studies of the Great Smoky Group which underlies most of this area have been made by Stose and Stose (1949) and Hadley (1970), and the character of rocks which occur in the northwestern most part of the area that have become informally known as the Murphy Marble belt have been described by Powers and Forrest (1971; 1973), and Nohr (1973). Syntheses that place this area in regional perspective have been made by Butler (1973), Hurst (1973), Hatcher (1978), and Hatcher and others (1980).

ROCK UNITS

Rocks near Rich Mountain include both the Great Smoky Group and the Murphy Marble belt. The Great Smoky Group is part of the Ocoee Supergroup (Hadley, 1970) and consists principally of diverse sequences of clastic metasedimentary rocks that show abrupt lateral and vertical variations. Although definition of distinct units is difficult, four have been identified north of the Rich Mountain area (Hurst, 1955). The highest two units, the Hothouse and Dean Formations, are exposed in this area, and are conformably overlain by the distinctive carbonate and clastic units of the Murphy Marble belt. The lowest part of this sequence, the Nantahala Formation, is exposed in the northwestern most part of the mapped area.

Upper parts of the Murphy Marble belt have yielded fossils that are tentatively identified as of Ordovician age (McLaughlin and Hathaway, 1973). Although of uncertain age, the underlying Ocoee group is usually considered to be early Cambrian or late Precambrian. Both sequences have been highly metamorphosed and multiply folded. Studies in areas to the north of Rich Mountain show at least four folding episodes (Hurst, 1955; Power and Forrest, 1971; Dupuis, 1975); isotopic ages indicate a major peak in metamorphism that occurred between 450-480 m.y. was followed by a protracted thermal decline and a possible smaller thermal maximum at 380 m.y. (Butler, 1973; Hatcher, 1978).

GREAT SMOKY GROUP

Lithologically distinct formations with clearly defined contacts do not occur in the Great Smoky Group. However, differing percentages of five lithologies allow rocks in this area to be divided into the Hothouse and Dean Formations.

Fine- to medium-grained biotitic schists that were originally metasiltstones are mostly light gray and contain between 15 and 30 percent micas. Biotite is generally more abundant than muscovite. Quartz is the dominant non-micaceous mineral (usually >80 percent); small amounts of unstrained oligoclase and some unstrained orthoclase are present in most samples. Garnets are rare as are epidote, tourmaline, sphene, zircon, and apatite. Kyanite, sillimanite, and staurolite have not been observed. The abundant micas generally impart a prominent schistosity.

Fine- to medium-grained biotite-rich arenaceous schists that were initially sandstones are typically massive and buff to light gray. Biotite is generally more abundant than muscovite. Quartz is the dominant mineral (40 to 80 percent), but oligoclase and orthoclase are more abundant than in finer-grained rocks. Proportions of the two minerals vary, but on average they occur in nearly equal amounts and together constitute between 5 and 20 percent of the rock. Some are clearly subrounded grains of detrital origin, but others are porphyroblasts. Other trace minerals are the same as in metasiltstones.

Coarse-grained metaconglomerates contain subrounded pebbles that are up to 10 cm in diameter and are in a fine-grained matrix that is mineralogically like the metasandstones. Pebbles mostly are made of quartz and less commonly orthoclase. Most have been recrystallized to fine-grained polycrystalline aggregates.

Fine- to coarse-grained micaceous schists most often have 1 to 4 cm large biotite porphyroblasts that grow across the foliation in the finer grained micaceous matrix. The spotted appearance of the latter rock type make it an easily recognizable lithology, called the "cross biotite" schist by geologists in the region. The schists consist predominantly of muscovite (30 to 70 percent), quartz (10 to 40 percent), and biotite (10 to 20 percent). Orthoclase and albite-oligoclase occur in varying amounts that make up between 5 and 20 percent of the rock. A minor amount of garnet is generally present. Staurolite occurs in some layers as does sillimanite; kyanite is rare.

Medium-grained calc-silicate rocks that are white to light gray, medium grained, and massive occur as thin layers throughout the area. The rock is mostly quartz (40 to 80 percent) with epidote, hornblende, and garnet each varying between 5 and 40 percent. Minor labradorite and trace amounts of biotite, muscovite, and sphene may be present. Although of sedimentary origin, its granular, igneous-appearing texture has caused it to be commonly referred to as "pseudodiorite".

Hothouse Formation: The lowest unit in the Rich Mountain area is predominantly composed of metasiltstones and slightly lesser amounts of metasandstone. These two rock types form layers that range from several millimeters to 5 m in thickness. Most layers are about 1 m thick. Contacts between layers are generally sharp and most do not exhibit size-grading or cross-bedding. Good exposures of typical metasiltstones occur in cliffs along the south slope of Stover Gap, while metasandstones are well exposed in road cuts near Long Ridge.

Lenses of metaconglomerate are not abundant, but become more common towards the top of the unit. They are well-exposed on the west flank of the syncline that is located near Tickanetley Bald. In this area, they form 1 to 2 m thick coarse-grained lower parts of up to 5 m thick layers that have fine-grained tops.

Schists are rare; however, one possibly laterally continuous 30-70 m thick layer of schist having biotite porphyroblasts is exposed near Turniptown Creek.

Calcsilicate-rich rock is also rare and is mostly found as float near contacts between metasiltstones and schists.

The base of the Hothouse formation is not exposed. It has a minimum exposed thickness of 600 m.

Dean Formation: The conformably overlying unit is predominantly mica schist that contains prominent biotite porphyroblasts. Layers of schist are 1 to 10 m thick. Most have sharp contacts with adjacent rocks, but some grade downward into metasiltstones. Slightly more aluminous schists form laterally continuous layers containing staurolite porphyroblasts and sillimanite.

In the lower half of this unit, metasiltstones, metasandstones, and metaconglomerates form relatively rare layers up to 5 m thick. Their abundance, however, increases upwards so that they may make up most of the highest part of this unit.

Calcsilicate-rich rock is rare and, as in the underlying unit, is most common near contacts of schist and metasiltstones.

Although porphyroblastic biotite schists are characteristic of this unit, they are not abundant along the west side of the area, near Fernimmon Gap. Instead, uniformly fine to medium grained schists occur in this area. Mylonites and stretched pebble conglomerates also occur near here and show this to be an area of intense shearing. It is thus possible that deformation and accompanying recrystallization have aligned and recrystallized the biotite porphyroblasts so the rocks are now equigranular schists and phyllites.

Both the Hothouse and Dean Formations contain varying proportions of the same lithologies, and their contact is gradational. The first major (>200 m thick) micaceous layer in this sequence is thus arbitrarily used to define the base of the Dean Formation.

MURPHY MARBLE BELT

Nantahala Formation: The Nantahala Formation is the lowest unit in a sequence of rocks that have informally become known as the Murphy Marble belt (Powers and Forrest, 1973). It is exposed in the northwestern part of the roadless area. It is a finely laminated gray-black slate. Layers defined by slight color changes vary up to 2 cm in thickness and give exposures a laminated appearance. Petrographic examination shows the unit to be mostly muscovite (30 to 80 percent), quartz (10 to 40 percent) and biotite (10 to 40 percent), with minor orthoclase and oligoclase. Zircon, apatite, epidote, graphite, and pyrite are ubiquitous accessory minerals.

The contact between the Nantahala and Dean Formations is placed at the base of distinctly laminated rock and has been described as being gradational and conformable (Ruttall, 1951; Hurst, 1955; Powers and Forrest, 1971; Dupuis, 1975). Although not exposed, mylonites and stretched pebble conglomerates occur in the vicinity of this contact and indicate that this area may also be a zone of shearing.

OTHER ROCK TYPES

Tonoflint/aplites: Fine-grained, light gray, massive igneous rocks are exposed in two areas (0.6 miles north of Big Bald Mountain and near Stoney Gap). They consist mainly of strongly zoned, 1 to 2 mm oligoclase phenocrysts in a fine-grained, equigranular matrix composed predominantly of plagioclase, less abundant quartz, and trace biotite and muscovite. It is not exposed well enough to reveal relationships with the surrounding Hothouse Formation, but similar rocks elsewhere occur as 2 cm to 8 m thick intrusive sills (Dupuis, 1975).

Quartz veins: Quartz veins occur throughout the area, but are most abundant in the zone between Rich, Little Bald, and Tickanetley Bald Mountains. Veins range up to 1 m in thickness and consist entirely of quartz. No sulfides were observed. Fracture cleavage displayed by some veins and strong undulatory extinction in thin section show that the veins were emplaced before deformation was completed.

STRUCTURES

Rocks in the Rich Mountain Roadless Area have experienced a complex deformational history. Multiple deformations are evident from cross-cutting rock fabrics observed in thin section and in outcrops. However, only two periods of deformation appear to have regional importance.

The earliest and most intense deformation generated northeast-trending, step-shaped folds that have anticlines with relatively long, gently dipping southeast and short, steeply dipping northwest limbs. Most of these folds have axes that trend on average N.39°E. and plunge gently to the north. Axial surfaces of folds mostly trend between N.30°E. and N.60°E. and dip from 40° to 70° to the southeast. The folds have axial planar fabrics that in argillaceous rocks are produced by alignment of biotite and muscovite; some less mica-rich rocks show 1 to 2 mm spaced sub-parallel fractures. The relationship between cleavage and bedding provides a reliable indicator of bedding top directions.

An indistinct second period of folding that trends to the northwest cross-folds these early structures. The effect of the later folding is best seen where the contacts between the Nantahala, Dean, and Hothouse Formations are bent around northwest-trending axial surfaces. No exposures of these younger folds have been observed, but some outcrops have northwest-trending schistosity that is probably axial planar to these structures. The schistosity trends N.35° to 70°W. and dips 40° to 60° northeast. The orientations of these fold axes vary depending on the earlier orientation of the folded rock layering.

Dumbbell-shape fault offsets were not recognized in this area, although the existence of some faulting is shown by the local occurrence of mylonites. Mylonites are best developed in the northwestern part of the area, near Fernimmon Gap.

METAMORPHISM

Mineral assemblages in this area are characteristic of middle amphibolite facies metamorphism. Diagnostic minerals occur only in aluminous rocks where the assemblage quartz + muscovite + biotite + oligoclase + garnet ± staurolite ± sillimanite ± kyanite is common. Assemblages in more aluminous rock lack garnet, staurolite, and the aluminous silicates. The occurrence of muscovite with aluminum silicates shows these rocks to be metamorphically below the breakdown of muscovite to orthoclase that takes place in upper amphibolite facies rocks.

Kyanite and sillimanite occur but have not been observed to coexist in the same rock. Kyanite is rare and generally ragged in appearance, while sillimanite is more abundant and often occurs as euhedral prisms. These observations suggest that the polymorphic transition of kyanite to sillimanite has taken place as a result of increasing temperature.

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SYMBOLS

Approximate boundary of Roadless Area

Contacts, approximately located

Contact of mappable unit within formation

Strike and dip of compositional layering

Inclined — Showing tops — Vertical

Strike and dip of rock cleavage

Direction and plunge of fold axis

Orientation of lineation

Orientation of fold axis and axial surface

Syncline

Anticline

Overturned anticline

Trace of fold axial surface

Rock Units

N — Nantahala Formation - thinly laminated black to light gray slates.

D — Dean Formation - mostly mica schist with lesser amounts of interlayered metasiltstones and metasandstones.

H, H_G — Hothouse Formation - mostly metasiltstones and metasandstones with minor amount of mica schist that locally makes a traceable horizon (H_G).

CORRELATION OF MAP UNITS

N — Lower Paleozoic — Murphy Belt Group

D, H — Upper Precambrian to Lower Paleozoic — Great Smoky Group of the Ocoee Supergroup

Lithologic Symbols

Fine- to medium-grained biotite-poor (0-15%) arenaceous schists and biotitic meta-arkoses; some contain small (<1 cm) feldspar clasts.

Fine- to medium-grained biotite schists.

Fine- to coarse-grained muscovite schists with biotite porphyroblasts developed across foliation.

Coarse quartz-pebble conglomerate with fine-grained biotite matrix.

Medium-grained calc-silicate rock.

Finely laminated gray shales.

Vein quartz.

Patterns modified by ⌀ or ○ indicate float.

MAP LOCATION