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THE COWEETA GROUP AND COWEETA SYNCLINE: MAJOR FEATURES OF THE NORTH CAROLINA-GEORGIA BLUE RIDGE

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ABSTRACT

The name Coweeta Group is proposed for a group of metasedimentary and possible metaigneous rocks which occur in the east-central Blue Ridge of North Carolina and Georgia and overlie the rocks of the Tallulah Falls Formation. The group is composed of three formations. The oldest is the Persimmon Creek Gneiss. This is overlain by the Coleman River Formation, then the Ridgepole Mountain Formation.

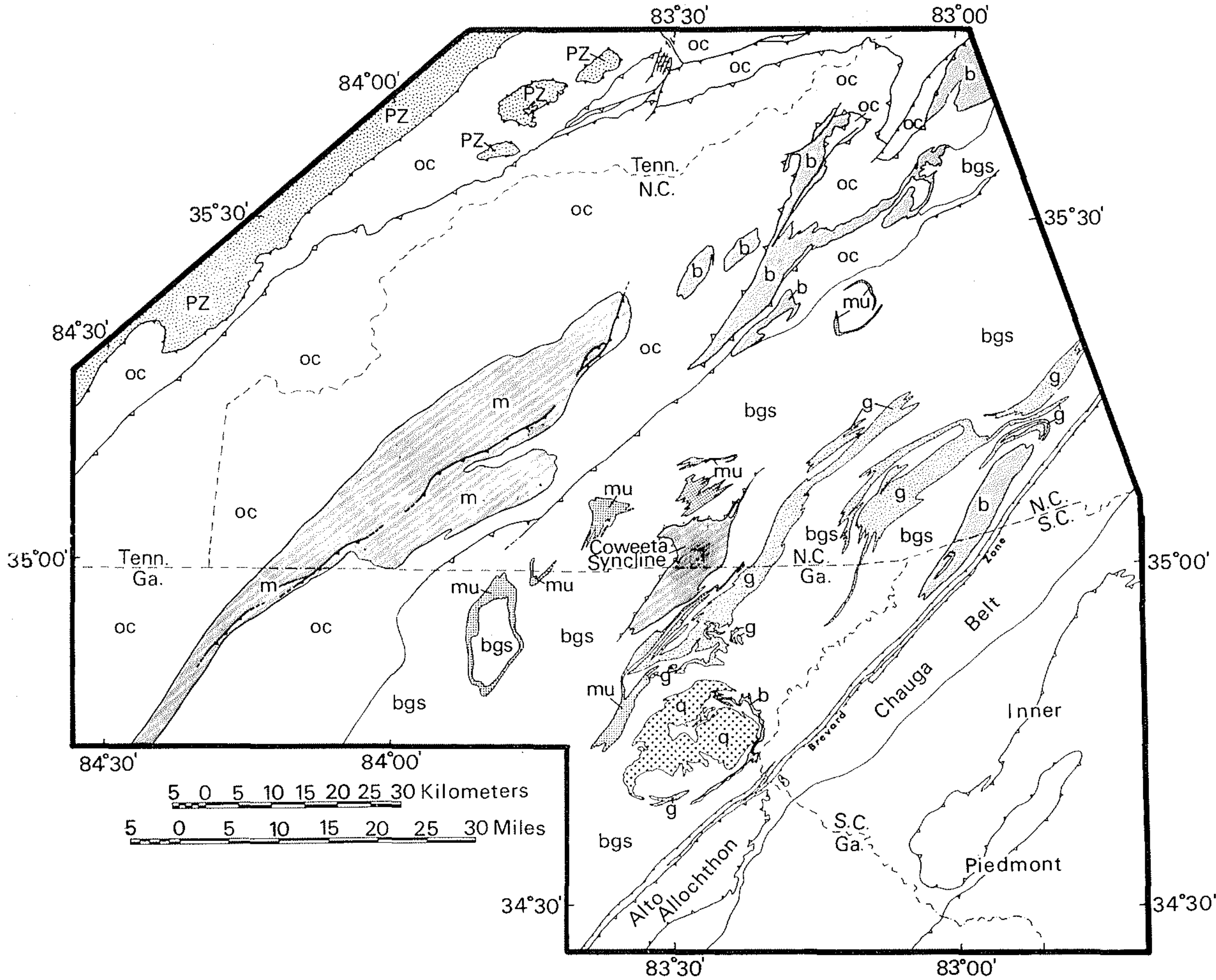
The Persimmon Creek Gneiss is a massive feldspar-quartz-biotite gneiss which is in part interlayered with metasandstone and pelitic schist. The Coleman River Formation consists of metasandstone, mafic poor gneiss (metaarkose?) and pelitic schist. The Ridgepole Mountain Formation has considerable lithologic variation, but biotite garnet schist and impure to clean quartzite dominate. Pelitic schist, metasandstone and metaconglomerate also occur in the Ridgepole Mountain Formation.

The age of the Coweeta Group is uncertain. An analogous relationship to the Ocoee and Chilhowee Groups, Great Smoky Group and Murphy belt rocks exists between the Tallulah Falls Formation and Coweeta Group, one of a sequence of unclean sedimentary rocks succeeded by a cleaner sequence. It could be a time equivalent unit to the Murphy belt sequence.

The Coweeta syncline is a structure resulting from a history of polyphase deformation. It appears to be overturned toward the east and the west limb is cut off by the pre-or synmetamorphic Shope Fork fault.

INTRODUCTION

The rocks of the Murphy belt have been known for many years as a younger metasedimentary sequence which overlies the late Precambrian Great Smoky Group in a structurally low position in the western Blue Ridge of Georgia and North Carolina. Another sequence of rocks, the Alligator Back Formation, occupying a position in the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Coweeta
Syncline
Brevard
Zone
Chauga
Belt
Inner
Piedmont
Alto
Allochthon
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 20 25 30 Miles

sequence similar to or near the base of the Murphy group was recognized by Rankin and others (1973) west of the Brevard zone along the North Carolina-Virginia border. The Alligator Back Formation likewise occupies a structurally low position.

The purpose of this paper is to describe an additional younger sequence of rocks which also occurs in a structural syncline. These rocks form a lithologically distinct sequence from the adjacent rocks and comprise a sequence of cleaner sediments therefore making it a coherent unit. This sequence, herein named the Coweeta Group, is located in the east-central Blue Ridge along the North Carolina-Georgia border (Figure 1).

Keith (1907, 1952) mapped the rocks of the Coweeta Group as Whiteside Granite, Roan Gneiss and Carolina Gneiss. Hadley and Nelson (1971) mapped these rocks as hornblende-biotite gneiss and biotite schist and gneiss of late Precambrian and Devonian age. This geologist first recognized this group of rocks during the reconnaissance mapping of Rabun and Habersham Counties, Georgia (Hatcher, 1971), but they were shown as Precambrian migmatitic biotite gneiss and granitic gneiss on the geologic map. Berry (1977; unpub. ms.) conducted a study of weathering rates on some of the Coweeta Group rocks. Several thin sections were made and metamorphic mineral assemblages were determined by Berry.

Acknowledgments

Support for early portions of the geologic field work which resulted in recognition of the Coweeta Group sequence was provided by the Georgia Geological Survey and National Science Foundation Grant GA-20321. Support for the detailed mapping of the Coweeta syncline in North Carolina has been provided by the North Carolina Geological Survey Section and the Tennessee Valley Authority. Cooperation of James E. Douglass, Wayne T. Swank and other staff members of the U. S. Forest Service Coweeta Hydrologic Laboratory greatly facilitated geologic mapping of most of the Coweeta syncline. Continued support for detailed geologic mapping has been provided by the North Carolina Geological Survey Section and by National Science Foundation Grant EAR76-15564.

Figure 1. Generalized geologic map of part of the southern Appalachians showing the location of the Coweeta syncline in relationship to nearby features. PZ-Paleozoic sedimentary rocks. oc-rocks of the Ocoee Supergroup. m-Murphy belt rocks. b-Precambrian basement rocks. mu-mafic and ultramafic rocks. bgs-biotite gneisses, schists, amphibolite, migmatite, minor granitic gneiss. q-quartzite. g-granitic gneisses.

The resolution of rock units of the Coweeta Group above the Persimmon Creek Gneiss was made by field assistant Louis L. Acker while mapping the Dillard Quadrangle, Georgia. His work, with slight modifications served as the basis for mapping of the major part of the Coweeta syncline in North Carolina.

A great deal is owed George D. Swingle who taught me the necessity of making systematic and detailed observations in carrying out geologic field investigations, yet to constantly place them into a regional framework.

Critical reviews by R. C. Milici, L. S. Wiener and C. E. Merschat are very much appreciated. However, I retain any responsibility for misinterpretations and other errors.

COWEETA GROUP

Introduction

The name Coweeta Group was first used informally by this geologist (Hatcher, 1974). The principal aim of this paper is to propose that the Coweeta Group and the formations making it up be formalized.

The Coweeta Group is named for the upper reaches of Coweeta Creek and its tributaries in the Coweeta Hydrologic Laboratory south of Franklin, North Carolina, the area where the largest outcrop of these rocks occurs in rocks of lower metamorphic grade. It is here that the large syncline preserving these rocks reaches its greatest width. However, just southwest of this area, all units in the sequence are exposed between the crest of Little Ridgepole Mountain and the west side of the valley of Bettys Creek to the east (southwest part of the Prentiss 7 1/2 minute quadrangle; Hatcher, in preparation).

Rocks of the Coweeta Group overlie the Tallulah Falls Formation. There is considerable contrast between the two units. While the Tallulah Falls Formation consists of metagraywacke, amphibolite, muscovite-biotite schist, lesser amounts of aluminous schist and minor quartzite, the Coweeta Group consists of larger amounts of feldspar-quartz-biotite gneiss, metasandstone and quartzite, aluminous schist, garnetiferous biotite schist and minor amphibolite. The contrast between the Tallulah Falls Formation and Coweeta Group is one of a sequence of unclean sediments and a sequence cleaner sediments.

Precise determination of the thickness of the Coweeta Group or of formations therein is impossible because of the nature and intensity of deformation affecting these rocks. The base of the Coweeta Group is known but its top is eroded and has therefore not been observed. The total thickness of the Coweeta Group is estimated to be roughly 2000 to 4000 m, but this estimate may be considerably in error.

The Coweeta Group has been subdivided into three formations: the basal Persimmon Creek Gneiss, overlain by the Coleman River

Formation, which is succeeded by the Ridgepole Mountain Formation. The sequence appears to be conformable and the units are related to each other by complex facies changes (Figure 2).

Persimmon Creek Gneiss

The Persimmon Creek Gneiss is named for exposures along Persimmon Creek in northwestern Rabun County, Georgia (Dillard, Georgia-North Carolina 7 1/2 minute quadrangle). Excellent exposures also exist along Patterson Creek in northwestern Rabun County and the flanks of Pickens Nose, Dryman Fork Creek, Rockhouse Knob and Bearpen Creek and Mountain in southern Macon County, North Carolina.

The Persimmon Creek Gneiss directly overlies rocks of the Tallulah Falls Formation and underlies the Coleman River Formation. The Persimmon Creek Gneiss is the thickest unit in the Coweeta Group, making up one third to one half of its total thickness. The Persimmon Creek Gneiss was subdivided by L. L. Acker into upper and lower members in the Dillard Quadrangle, Georgia (L. L. Acker and R. D. Hatcher, Jr., unpub. data). The lower unit there consists of massive oligoclase-quartz-biotite (muscovite - clinozoisite / epidote - chlorite - garnet) gneiss containing little schist or metasandstone. The upper member consists of intricately interlayered gneiss of the same type as in the lower member along with quartz - oligoclase - biotite - (epidote-chlorite-garnet) metasandstone and biotite-muscovite-quartz (kyanite-oligoclase) schist. Such a twofold subdivision of this unit was found to be not resolvable farther north due to the greater complexity of deformation.

The Persimmon Creek Gneiss is easily identified by its coarse, even-grained texture (see Hatcher, 1974, Figure 6). It commonly forms massive exfoliated cliffs and ledges 3 m. or more high.

Coleman River Formation

The Coleman River Formation is named for exposures along the headwaters of Coleman River, Rabun County, Georgia. These rocks are also well exposed (and perhaps more accessible) along Ball Creek and Henson Creek in the Coweeta Hydrologic Laboratory in southern Macon County, North Carolina.

The Coleman River Formation consists of medium-grained metasandstone, metaarkose and quartz-feldspar gneiss with interlayers of coarse pelitic schist. The quartzofeldspathic layers are foliated and range up to 1 m. thick. The metasandstone and gneiss have a similar appearance but the metasandstone is higher in quartz and contains less feldspar. Both rock types consist of an assemblage of quartz-oligoclase-biotite-epidote-chlorite-(garnet-muscovite) metasandstone and gneiss, while the schist contains the assemblage biotite-muscovite-kyanite - staurolite - quartz - (garnet - oligoclase - epidote - iron oxides).

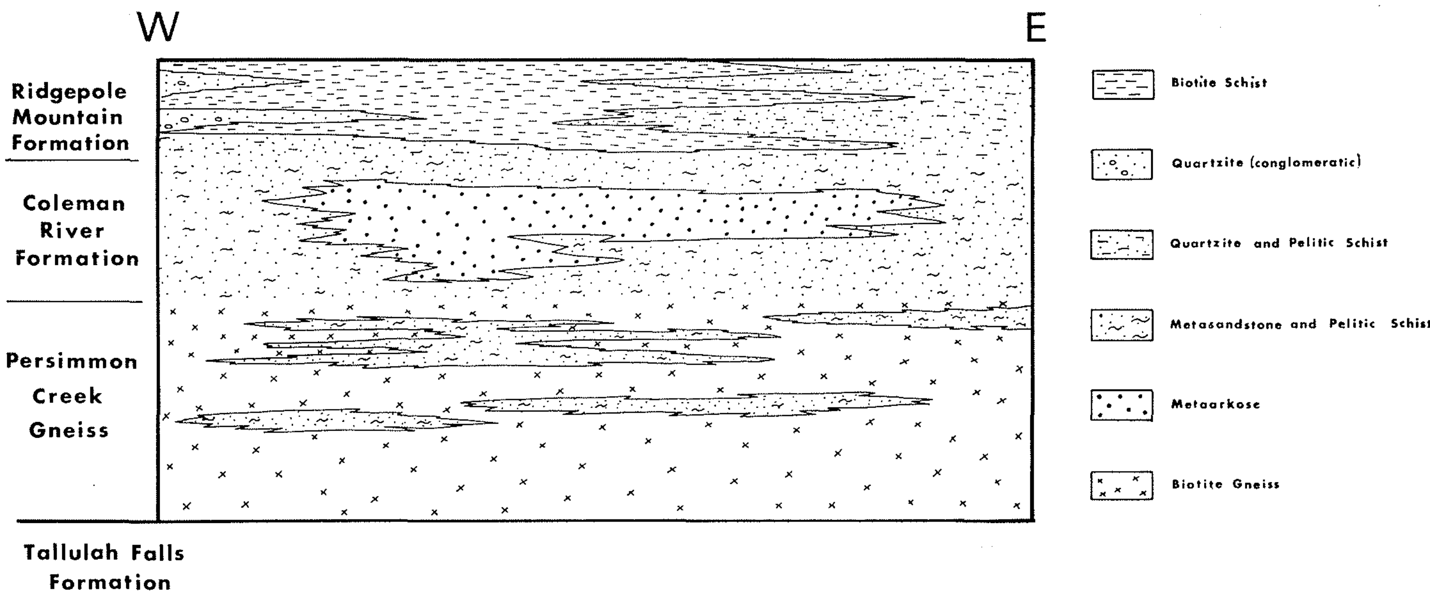

Figure 2. Possible facies relations in the Coweeta Group within the Coweeta Syncline.

Calcsilicate quartzite is also a minor but common constituent in this unit in some areas.

A structural-textural feature common in the Coleman River Formation is metasandstone possessing thin laminations or a "pin-striped" texture (see Hatcher, 1974, Figure 7). These laminations may be oriented parallel to the dominant foliation but commonly are not indicating that they represent an earlier S-surface which has not been transposed into what appears to be S_1. However, the laminations may be the product of initial transposition of bedding thereby making the present S_1 actually S_2 (very likely in light of my observations elsewhere in the Blue Ridge and Piedmont). Pinstriping of this type has been described in the Alligator Back Formation in the eastern Blue Ridge of northwestern North Carolina by Rankin and others (1973, p. 17). The pinstripped metasandstone also occurs in the overlying Ridgepole Mountain Formation, but less abundantly than in the Coleman River Formation.

Ridgepole Mountain Formation

The Ridgepole Mountain Formation, the uppermost unit of the Coweeta Group, is named from exposures on Ridgepole and Little Ridgepole Mountains, North Carolina, accessible by foot via the Appalachian Trail. More accessible exposures of this unit also exist along the road following Ball Creek in Coweeta Hydrologic Laboratory.

The Ridgepole Mountain Formation contains the greatest variety of lithologies ranging from pelitic schist to coarse biotite garnet schist to clean quartzite to muscovite-chlorite quartzite to garnetiferous metasandstone. The pelitic schist is similar to the aluminous schist in the Coleman River Formation. The biotite-garnet schist is also similar except for the dominance of biotite and flattened garnets which range up to 8 cm. in maximum diameter. The quartzites contain varying amounts of quartz, muscovite, chlorite, epidote, plagioclase and garnet. Some of the quartzites may have been conglomeratic. One specimen observed consists of quartz and muscovite in which each is separated into discrete flattened elliptical domains suggesting a protolith of mud matrix conglomerate.

Several lithologies of the Ridgepole Mountain Formation, e. g., biotite-garnet schist and clean quartzite, occur together in some areas. In other places, a single lithology dominates the outcrop belt of the unit. Some of the more impure sandstones and schists appear to be gradational into those of Coleman River Formation so that in places the boundary is difficult to ascertain.

The upper contact of the Ridgepole Mountain Formation has not been observed. It is assumed to be eroded.

Discussion

The rocks of the Coweeta Group comprise a distinctive sequence in the east-central Blue Ridge of North Carolina and Georgia. Within the group there are certain rock units, such as the Coleman River which are very uniform in character (metasandstone, metaarkose and schist) but at least one, the Ridgepole Mountain Formation is a very complex unit which grades into the unit below and contains several different facies (Figure 2).

The mineral composition and texture of the Persimmon Creek Gneiss suggest it is an orthogneiss. However, the interfingering and interlayering with metasedimentary rocks suggest a sedimentary origin. The Persimmon Creek Gneiss may once have been a fine-grained volcanic deposit which, due to its grain size, was more susceptible to a greater degree of recrystallization with resultant coarse texture and homogeneity. If it is of volcanic origin, the source of the volcanic material is unknown. It could also have been an intrusive which was emplaced near the metamorphic peak.

The age of the Coweeta Group is equivocal, like most of the other rock units of this portion of the Blue Ridge. The underlying Tallulah Falls Formation rests upon rocks that are likely 1100 m. y. old (Hatcher, 1976). The Tallulah Falls Formation is thought to be late Precambrian, possibly equivalent to part of the Ocoee Supergroup (Hatcher, 1971, 1973). The Coweeta Group could likewise be equivalent to part of the Ocoee and have a late Precambrian age. Its similar structural setting, relatively clean character and stratigraphic position suggest the possibility that it is equivalent to the Murphy belt rocks whose age is also equivocal (Hurst, 1955; Hadley, 1970; Power and Forrest, 1971; McLaughlin and Hathaway, 1973; Wiener, 1976). Whatever the age of the Coweeta Group, there is a repetitious trend among sedimentary rocks which immediately overlie basement to be impure and then succeeded by a cleaner sequence, reflecting changes in depositional environments. This may represent both lower relief source areas and filling (closing?) of a previously deep basin at the time of deposition of the Walden Creek and Chilhowee Groups, Murphy belt rocks and Coweeta Group. Another possibility is that these higher units formed by recycling of detritus (L. S. Wiener, written comm., 1977).

It appears likely that rocks belonging to the Coleman River and Ridgepole Mountain Formations occur farther west in the sillimanite zone in the central Blue Ridge. Detailed geologic mapping in Rainbow Springs and Shooting Creek quadrangles reveals a sequence and lithologies similar to these units (Hatcher, unpub. data). The Persimmon Creek Gneiss is either absent or has changed significantly in character.

Table 1. Mineral Assemblages in the Coweeta Group.

Unit/Lithology	Assemblage*
Ridgepole Mountain Formation	
Biotite-Garnet Schist	B M G C Q P
Quartzite	Q M C E G B St Mt
Pelitic Schist	M B G Ky C
Coleman River Formation	
Metasandstone	Q P M B E C G Mt
Quartz-Feldspar Gneiss	Q P M B G
Pelitic Schist	M B Q G Ky St Mt
Persimmon Creek Gneiss	
Biotite Gneiss	P Q B M E G C Ap Mt
Metasandstone	Q P M B E C G Mt
Pelitic Schist	M B Q G Ky St Mt

*Minerals listed in descending order of abundance.

Q - quartz
M - muscovite
B - biotite
G - garnet (probably almandine)
P - plagioclase (mostly oligoclase)
C - chlorite
Ky - kyanite
St - staurolite
E - epidote-clinozoisite
Mt - magnetite (or similar opaque)
Ap - apatite

METAMORPHISM

The rocks of the Coweeta Group have been metamorphosed to lower to middle amphibolite facies assemblages (Table 1). Pelitic (aluminous) schist contains both staurolite and kyanite. Both kyanite and staurolite are very fine-grained, have an irregular habit and appear to have been broken during deformation. Neither mineral is oriented parallel to S_1 foliation.

Garnets are euhedral to anhedral to skeletal (Figure 3). Many have a poikiloblastic texture while those in one sample have experienced more than one episode of growth. The latter have clear cores and poikiloblastic rims.

Chlorite occurs as a replacement mineral in many samples and appears to have developed as a retrogressive overprint. Epidote-clinozoisite replaces plagioclase in several sections probably resulting

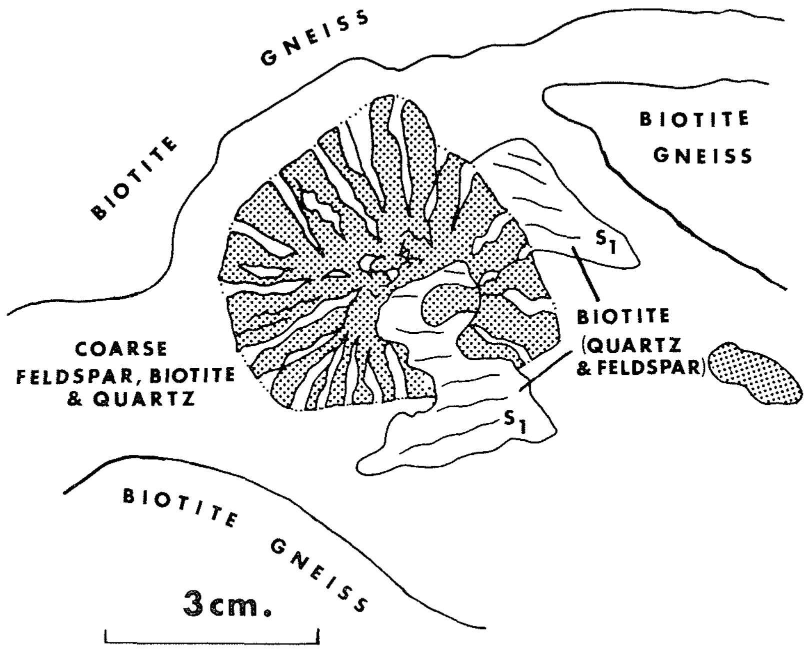

Figure 3. Garnet illustrating a common texture of garnets on all scales in Persimmon Creek Gneiss.

from the same retrogressive event. Late muscovite prophyroblasts which have grown across the S_1 foliation and do not appear at present to parallel any known S-surface may also have formed during this event.

COWEETA SYNCLINE

The Coweeta Group rocks are preserved in a structurally low area of the Blue Ridge of North Carolina and Georgia (Figure 1). They were first observed in a west-dipping series of rocks which appears to have been overturned toward the east. Large-scale earlier folds exist which have east-west and northeast axial trends. Their vergence is not known at present. Thus the Coweeta syncline is a polyphase structure (Figure 4) whose form was established during F_1 and F_2 folding (see Hatcher, 1976, Table 3; Hatcher, 1977, Table 1). F_1 folds are isoclinal and recumbent; F_2 folds are post-metamorphic upright folds formed under flowage conditions. Later folding has modified the structure only slightly on the macroscopic scale.

The northwest limb of the Coweeta syncline is cut off by the pre- or synmetamorphic Shope Fork fault (Hatcher, 1976). This fault was formed as a tectonic slide during F_1 folding and was refolded by F_2 and later folds (Figure 4). Its extent farther north and south is unknown.

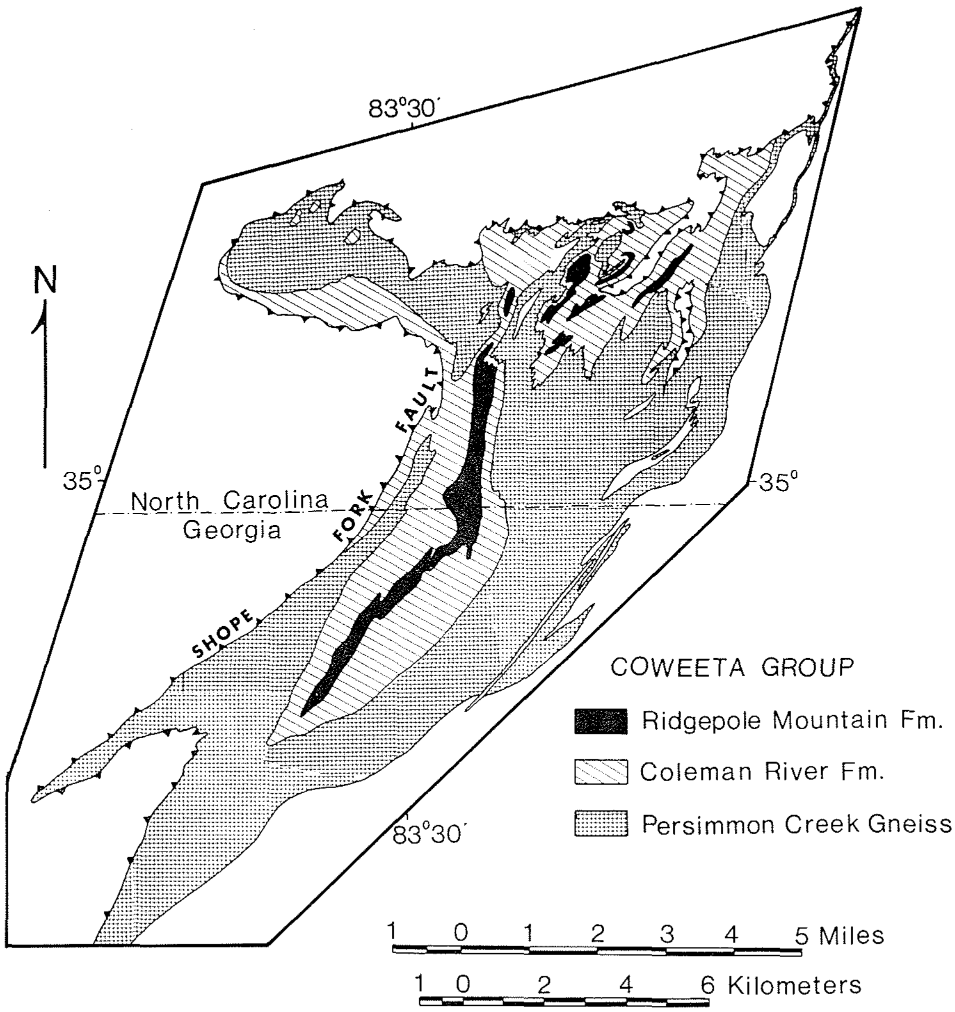

Figure 4. Map showing distribution of Coweeta Group rock units in the Coweeta syncline. Unpatterned areas are underlain by other rocks.

Likewise it is not certain how far southwest into Georgia the Coweeta syncline extends, since detailed geologic mapping is lacking along its projected trend.

CONCLUSIONS

1. The Coweeta Group consists of three formations overlying the Tallulah Falls Formation: the Persimmon Creek Gneiss, Coleman

River Formation and Ridgepole Mountain Formation.

2. The Persimmon Creek Gneiss is mostly massive biotite gneiss with interlayered metasandstone. It may be an intrusive body or a metasedimentary rock type but its textures, homogeneity, interlayering and lack of a contact aureole bring forth the possibility that it is derived from metamorphism of fine-grained volcanic material.

3. Coleman River and Ridgepole Mountain Formations are metasedimentary units. The former is a fairly uniform assemblage of pelitic schist, metasandstone and metaarkose. The latter is a complex assemblage of metaquartzite, metasandstone, metaconglomerate, pelitic schist and biotite garnet schist.

4. Rocks of the Coweeta syncline were progressively metamorphosed to the staurolite-kyanite subfacies of the amphibolite facies and later retrograded by greenschist facies metamorphism.

5. The Coweeta syncline is a structure resulting from polyphase deformation. It is east vergent and the northwest limb is cut off by the Shope Fork fault.

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