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OCTOBER 8-9, 1960

FIELD TRIP GUIDEBOOK

ROAD LOG OF THE GRANDFATHER MOUNTAIN AREA NORTH CAROLINA*

BY
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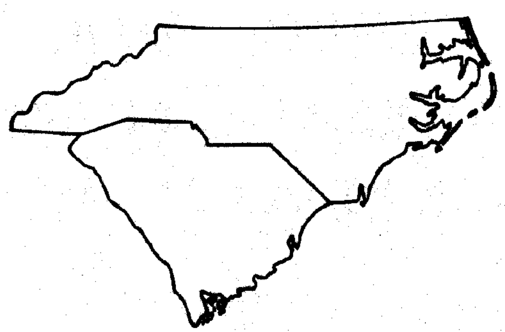
DENVER, COLORADO



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Guidebook for 1960 Annual Meeting
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ROAD LOG OF THE GRANDFATHER MOUNTAIN AREA, N.C.[1]

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Denver, Colorado

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INTRODUCTION

More than a century ago Elisha Mitchell recognized that the rocks of the Grandfather Mountain area in western North Carolina are unusual for the eastern Blue Ridge (Mitchell, 1905. The rocks of the area were briefly described by Kerr (1875, p. 135-136), but the first systematic geologic mapping in the area was that by Keith and his associates in 1894 to 1907 (Keith, 1903, 1905; Keith and Sterrett, 1954). In the southern part of the Cranberry quadrangle, and in parts of the Morganton and Mt. Mitchell quadrangles, Keith mapped upper Precambrian and lower Cambrian sedimentary and igneous rocks in the midst of a complex terrane of schists, gneisses, and granites which comprises the bulk of the Blue Ridge in northwestern North Carolina and Northeastern Tennessee. Keith believed that the younger rocks occupy a complex syncline overridden by thrust sheets of lower Precambrian rocks from three sides. The structure was interpreted on the geologic map of the United States (Stose and Ljuntgstedt, 1932) as a window, since called the Grandfather Mountain window (Stose and Stose, 1944, p. 383).

In 1956 the writers began geologic mapping in four quadrangles which include the Grandfather Mountain window and adjacent portions of the Blue Ridge and Inner Piedmont. Mapping in the Linville and Table Rock quadrangles has been completed; mapping in the Blowing Rock and Lenoir quadrangles is in progress.

During the field trip there will be time to examine only some of the more important rock types and structural features.

SUMMARY OF GEOLOGY IN THE GRANDFATHER MOUNTAIN AREA IN NORTHWESTERN NORTH CAROLINA

The Blue Ridge is composed largely of schists, gneisses, and granitic rocks of early Precambrian age which were involved in large-scale thrusting and subjected to one or more episodes of thermal and dynamic metamorphism during Paleozoic time. These rocks have been thrust northwestward over upper Precambrian and Cambrian rocks of the Unaka belt (fig. 1). The upper Precambrian and lower Cambrian rocks in the Grandfather Mountain window show that the allochthonous[1] rocks traveled relatively at least 30 miles northwestward during the Paleozoic thrusting.

In the Inner Piedmont southeast of the Grandfather Mountain window, the Predominant rocks are gneisses, schists, and granitic rocks of Precambrian and (or) Paleozoic age. These rocks were thrust over those of the Grandfather Mountain window, (STOP 12). The structural relations of the Piedmont rocks to the allochthonous rocks of the Blue Ridge are unknown, but reconnaissance mapping to the southwest of the window, especially in the Pisgah quadrangle (Keith, 1907), suggests that they may also be in fault contact with the blue Ridge rocks (Reed and Bryant, 1960).

Rocks of the Blue Ridge thrust sheet Rocks west and north of the Grandfather Mountain window and structurally overlying it comprise a complex terrane of mica schist and gneiss, amphibolites, migmatites and generally layered granitic gneiss of early Precambrian age intruded by plutons of granite and quartz monzonite of early Precambrian age (STOP 4), stocks and dikes of gabbro of late Precambrian age (Bakersville gabbro, Keith, 1903) and by stocks, sills, and small lenticular bodies of granodiorite, pegmatite, and ultramafic rock of early or middle Paleozoic age. This slices of Cambrian (?) clastic rocks intercalated in the gneisses mark thrust faults in the crystalline terrane.

The mica schist and gneiss and amphibolite southwest of Newland pass northward through a transition zone in which layers and lenses of granitic material become increasingly abundant into layered migmatitic gneiss in which granitic layers predominate, and finally into rudely layered and nonlayered granitic gneiss. (fig. 2). This transition zone between schist and gneiss is wide west of Newland, but to the south, layered gneiss in which granitic layers predominate is in almost direct contact with amphibolite and mica schist lacking granitic layers. (STOP 3).

The granitic rocks and layered gneiss were sheared and partly recrystallized so that they are now cataclastic gneiss, porphyroclastic gneiss, phyllonitic gneiss, phyllonite and blastomylonite (STOP 4). The mica schist and amphibolite have a crystalloblastic texture, except in a few places near the layered gneiss

The schists, gneisses, and amphibolites are intruded by light colored granodiorite (alaskite of Hunter and Mattocks, 1936, and subsequent workers) and mica pegmatites in the

1.*See glossary on last page for definitions of some of the more specialized terms used in this road log.

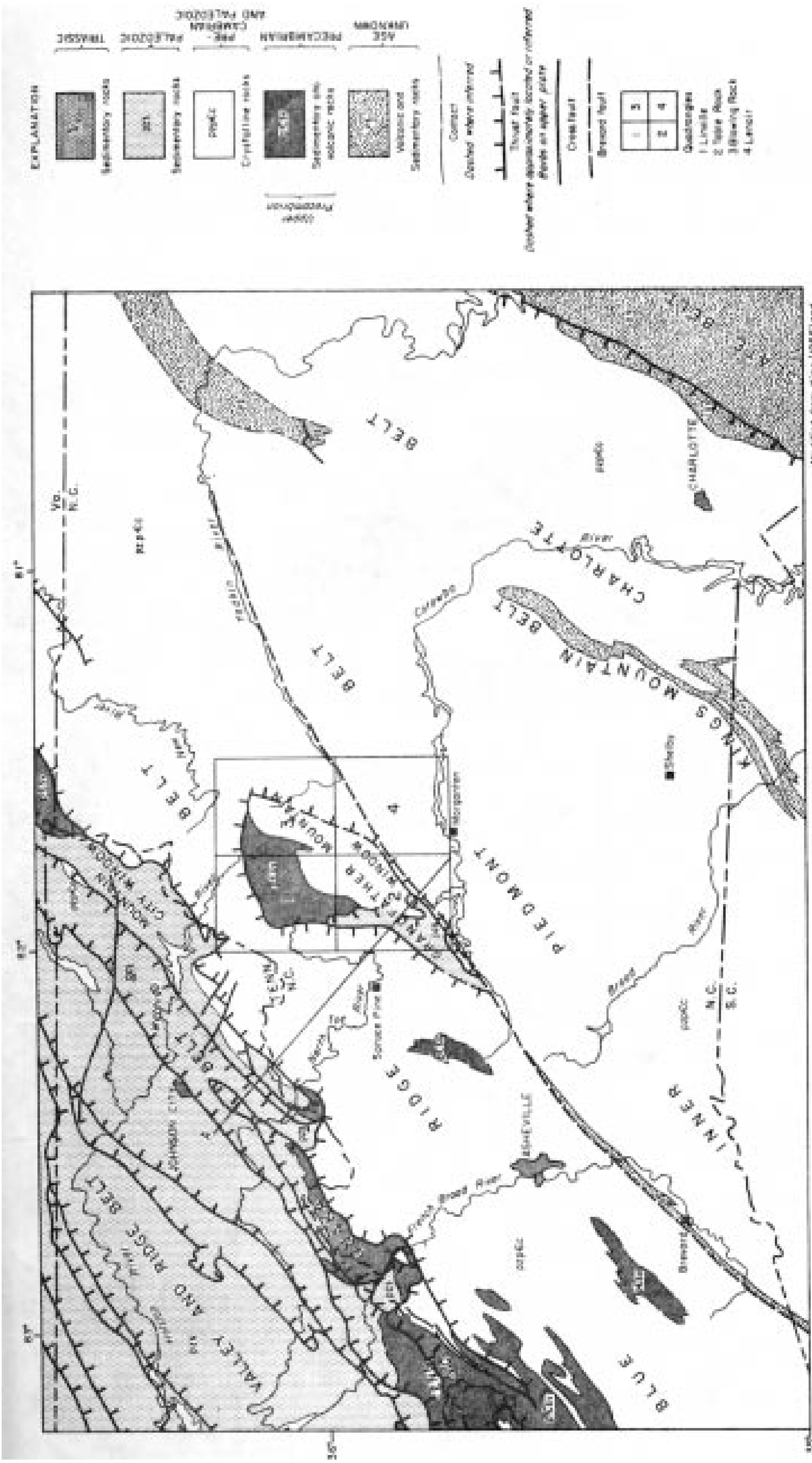


Figure 1.
GENERALIZED GEOLOGIC MAP OF WESTERN NORTH CAROLINA AND NORTHEASTERN TENNESSEE SHOWING LOCATION OF THE GRANDFATHER MOUNTAIN AREA AND MAJOR TECTONIC FEATURES

Spruce Pine district. In many places the granodiorite and pegmatite look cataclastic, but actually, as the microscope shows, they are coarsely recrystallized like the wall rock.

The dikes and stocks of Bakersville gabbro cut the granitic gneisses and migmatites and are clearly younger than the plutonic metamorphism; during subsequent retrogressive metamorphism they have been converted to amphibolite and metagabbro. Near the northern edge of the Spruce Pine district, Wilcox and Poldervaart (1958) inferred that they are older than the pegmatites and granodiorite.

Minerals from the pegmatites have been dated by several methods, and the results are in fair agreement at about 350 million years (Ecklemann and Kulp, 1957; Long, Kulp and Ecklemann, 1959; Tilton and others, 1959). It is not entirely certain whether these results give the age of emplacement of the pegmatites or the age of their metamorphism, but it seems likely that they were emplaced immediately before or during an early stage of the metamorphism in which they were deformed.

ROCKS OF THE GRANDFATHER MOUNTAIN WINDO

In the Grandfather Mountain window granitic rocks of early Precambrian age (STOPS 8, 9, 11) are unconformably overlain by a thick sequence of interlensing arkose, siltstone, shale, graywacke, and volcanic rocks, STOPS 5, 6, 7, 8, 10), all of which probably are correlative with the Ocoee series of late Precambrian age. The basement rocks were pervasively sheared and locally phyllonitized at the same time that the overlying sequence was progressively metamorphosed (STOP 8). Both the basement rocks and the overlying sequence are apparently autochthonous. In the southeastern part of the window is an isolated outcrop strip of predominantly felsic flows and pyroclastics with minor interbedded sedimentary rocks (STOPS 10, 12); this sequence is probably correlative with the main sedimentary and volcanic sequence mentioned above. In the southwestern part of the window arkosic quartzite, quartzite, phyllite and dolomite occur in a thrust sheet between the autochthonous basement and sedimentary rocks of the window and the rocks of the Blue Ridge thrust sheet to the west. They are correlative with the Shady dolomite of Early Cambrian and Cambrian (?) age of the Unaka belt (STOPS 1, 2).

ROCKS OF THE INNER PIEDMONT

The Inner Piedmont southeast of the Grandfather Mountain window is composed of gneiss and mica schist of Precambrian or early Paleozoic age (STOP 13) which was invaded by ultramafic rocks and by quartz monzonite sills and plutons of at least two ages. The older quartz monzonite is a strongly foliated and lineated augen gneiss in which porphyroclasts of potassium feldspar occur in a fine grained matrix (STOP 14). The younger (STOP 15) is massive to well foliated and light colored, and may be correlative with the Toluca quartz monzonite of the Shelby area described by Griffiths and Overstreet (1952).

The rocks of the Inner Piedmont differ from the rocks of the Blue Ridge thrust sheet in having less mica schist, amphibolite, and migmatite, different structural and petrographic types of granitic rocks. The pegmatites in the Inner Piedmont are mica-poor pegmatites and typically they contain accessory xenotime, monazite, and zircon. Those of Spruce Pine district are mica rich and typically contain garnet, but lack xenotime, monazite, and zircon.

Adjacent to the boundary of the Grandfather Mountain window, rocks of the Piedmont were sheared to porphyroclastic schist and gneiss and blastomylonite (STOP 12).

ROAD LOG FOR FIELD TRIP OF THE CARO LINA GEOLOGICAL SOCIETY SATURDAY, OCTOBER 8, 1960

Topographic maps: The field trip will pass through the following published quadrangles: Ashford, Linville Falls, Chestnut Mountain, Oak Hill, Morganton North and Collettsville 7 -minute quadrangles and Linville 15-minute quadrangle. General Instructions: Eat a good breakfast and carry a snack because the lunch stop will be late.

Mileage

0.0 Leave center of Morganton (elev. 1,200 ft.), *:00 A.M.; go west on U.S. 70.

1.0 Mimosatel. 1.5 Jct. U.S.70 bypass

1.6 Silver Creek. To the north and northwest are (left to right); Table Rock (elev. 3,020 ft.) Hawksbill (elev. 4,020 ft.), and Grandfather Mountain (elev. 5,939 ft.).

3.1 Boxwood Court

3.5 White alluvial clay in gully fill passes up to red clay, typical of the Piedmont.

5.7 Town of Glen Alpine

7.2 Typical medium-colored, fine grained biotite gneiss with 1- to 6-inch layers of medium -grained schist containing pods of pegmatite.

8.9 Fine-grained, medium-colored biotite gneiss containing sill-like bodies of medium- grained quartz monzonite.

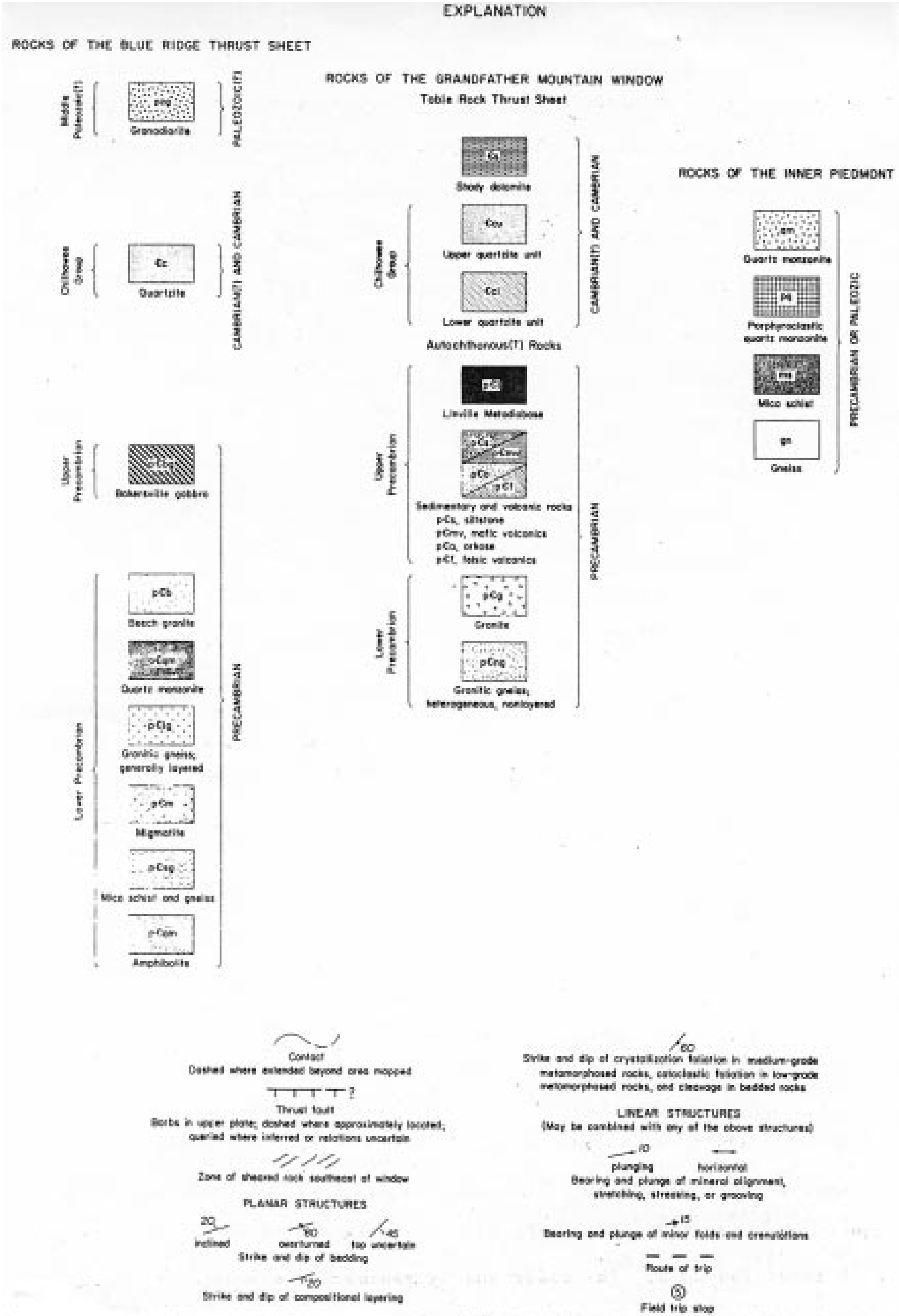
10.8 Fine-grained, light-colored gneiss.

11.2 Fresh outcrop of layered amphibolite and biotite amphibole gneiss: layers -2 in., pegmatites 6 in. to 1 ft. thick.

15.0 Fine-grained layered biotite gneiss.

15.2 Jct. NC 126

18.8 Clinchfield RR underpass.


EXPLANATION
ROCKS OF THE BLUE RIDGE THRUST SHEET
Middle Paleozoic(?)
Granodiorite
PALEOZOIC(?)
Chilhowee Group
Quartzite
CAMBRIAN(?) AND CAMBRIAN
Upper Precambrian
Bakersville gabbro
Lower Precambrian
Beech granite
Quartz monzonite
Granitic gneiss; generally layered
Migmatite
Mica schist and gneiss
Amphibolite
PRECAMBRIAN
ROCKS OF THE GRANDFATHER MOUNTAIN WINDOW
Table Rock Thrust Sheet
Shady dolomite
Chilhowee Group
Upper quartzite unit
Lower quartzite unit
CAMBRIAN(?) AND CAMBRIAN
Autochthonous(?) Rocks
Linville Metadiabase
Upper Precambrian
Sedimentary and volcanic rocks
pCs, siltstone
pCmv, mafic volcanics
pCa, arkose
pCf, felsic volcanics
Lower Precambrian
Granite
Granitic gneiss; heterogeneous, nonlayered
PRECAMBRIAN
ROCKS OF THE INNER PIEDMONT
Quartz monzonite
Porphyroclastic quartz monzonite
Mica schist
Gneiss
PRECAMBRIAN OR PALEOZOIC
Contact
Dashed where extended beyond area mapped
Thrust fault
Barbs in upper plate; dashed where approximately located; queried where inferred or relations uncertain
Zone of sheared rock southeast of window
PLANAR STRUCTURES
inclined
overturned
top uncertain
Strike and dip of bedding
Strike and dip of compositional layering
Strike and dip of crystallization foliation in medium-grade metamorphosed rocks, cataclastic foliation in low-grade metamorphosed rocks, and cleavage in bedded rocks
LINEAR STRUCTURES
(May be combined with any of the above structures)
plunging
horizontal
Bearing and plunge of mineral alignment, stretching, streaking, or grooving
Bearing and plunge of minor folds and crenulations
Route of trip
Field trip stop

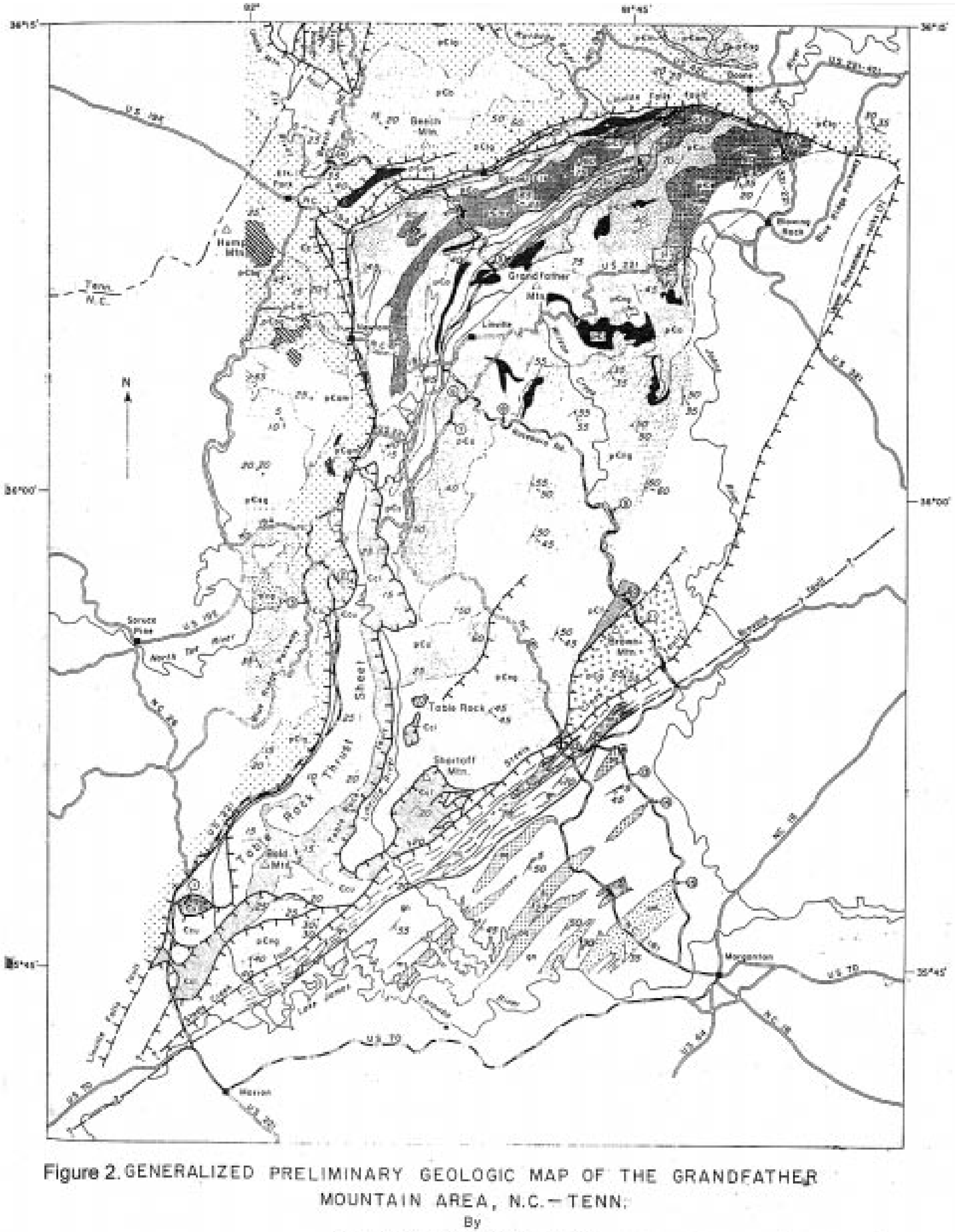


Figure 2. GENERALIZED PRELIMINARY GEOLOGIC MAP OF THE GRANDFATHER MOUNTAIN AREA, N.C.—TENN.

By

Bruce Bryant and John C. Reed Jr.

19.5 Marion City limit.

20.6 US 70 goes right at traffic light.

20.7 US 70 goes left at light. 20.8 Turn right on US 70 and 221.

21.9 Fine-grained gneiss with thin biotite schist and amphibolite layers and boudins; structure complex.

22.8 Jct. US 221 and 70; continue straight on 221.

22.9 Catawba River

24.9 Quartzite slice in "tail" of Grandfather Mountain window on right.

26.2 Another quartzite slice on right

26.3 Well-bedded quartzite of the Chilhowee group dipping west.

26.4 28.6 Gneiss overlies quartzite along Linville Falls fault.

28.8 Turn right to Woodlawn quarry; side road leads 0.2 mile to road metal quarry operated by State Highway Dept.

STOP 1: 0.1 mile east of US 221, fine-grained layered amphibolite and biotite gneiss with small pegmatite pods and a layer of medium-grained, light-colored gneiss. What is rock exposed in cut north of quarry office? Quarry shows thickly-bedded (5-20 ft.) blue gray and white dolomite with small white calcite veinlets. This is believed to be a tectonic slice of Shady dolomite overlying autochthonous (?) basement rocks and overlain by quartzite of the Chilhowee (all within the Grandfather Mountain window). The quartzite is overlain by layered gneiss of the upper plate 0.5 mile to the west. View of Dobson Knob is to the northeast; cliffs of quartzite of the Chilhowee.

29.2 Turn right on US 221. 30.0 Cross Turkey Creek.

30.1 Jct. NC 28. Sign marks site of Kathy's fort.

30.2 Pass into layered gneiss of the upper plate.

31.6 Enter North Cove on flood plain of North Fork of the Catawba River.

32.6 Gneiss of the Blue Ridge thrust sheet in roadcut to left; upper quartzite of the Chilhowee group and Shady dolomite is exposed in railroad cut east of river and in river 200 ft. east.

33.7 Enter Table Rock quadrangle.

34.7 Pine covered hills on the right are west slopes of Linville Mountain underlain by quartzite of the Chilhowee.

38.4 North Fork of the Catawba River, Ashford, N.C. (elev. 1,750 ft.).

39.1 Abandoned quarry in Shady dolomite on left.

39.3 Fan deposits of quartzite detritus from slopes of Linville Mountain.

39.4 Humpback Mountain (elev. 4,260 ft.) ahead.

41.2 Massive, fine-grained white quartzite in the upper part of the Chilhowee dipping west, on right.

41.3 Linville Caverns located in Shady dolomite 0.1 mile northwest.

42.2 Quartzite in stream to west; Shady dolomite makes up slopes to base of prominent cliff; cliff is in gneiss of the blue Ridge thrust sheet; Linville Falls fault exposed at base. New Jersey Zinc Co. drilled several holes in Shady halfway up slope where sphalerite is disseminated in dolomite.

42.6 Outcrop in stream to left exposes contact of Shady with underlying quartzite.

43.3 Cross Linville Falls fault into gneiss of the Blue Ridge thrust sheet.

44.9 Linville Falls P.O. (elev. 3,300 ft.), jct. NC 183 turn right

45.2 Cuts in layered gneiss of the blue Ridge thrust sheet.

45.3 Jct. NC 105 to Linville Falls; straight ahead on dirt road (105).

45.4 Linville Falls parking lot. A 10-minute walk down trail to exposure of Linville Falls fault. This is a national Park so please leave hammers in the bus.

Stop 2: Linville Falls fault. A hundred yards upstream fro upper falls overlook is exposure of Linville Falls fault. Foliated but nonlayered granitic rock overlies arkosic quartzite of the Chilhowee group in the Table Rock thrust sheet within the Grandfather Mountain window. About 18 in. of blastomylonite occurs along the fault plane here. The plane dips gently to the west. The gneiss forms the upper falls and the fault is at the base of the falls. At the overlook notice the two prominent lineations in the arkosic quartzite; a northwest - trending lineation formed by elongated clasts and streaks of mineral grains and a northeast -trending lineation formed by the axes of minor folds and crenulations. These are the two common lineations found in the rocks of both the upper plate and the Grandfather Mountain window; they are interpreted as being in a and b respectively. (Rest rooms at trail junction will probably be open; short coffee break at bus.) Turn around and head back to Linville Falls P.O. 46.6 Turn right on US 221.

47.3 Right on cloverleaf and south on Blue Ridge Parkway

48.3 View over Brushy Creek valley to west; large clay pits in saprolite granodiorite (alaskite of Hunter and Mattocks, 1936); small mica mines to north on slope of Doe Hill.

48.8 **STOP 3:** National Park; no collecting allowed; leave hammers in bus. Exposures of layered gneiss overlain by biotite-muscovite schist and gneiss containing sheared pegmatites. Layered biotite gneiss contains various amounts of feldspar in different layers and minor layers of amphibolite and calc-silicate rock. Note isoclinal folds in lower part of outcrop and the northwest-trending cataclastic lineations. To the south biotite-muscovite schist and gneiss and layered amphibolite are in fairly sharp contact with the layered biotite gneiss; these rocks are quite typical of much of the rock in the eastern part of the Spruce Pine district. Note the large pod of rudely zoned muscovite-garnet pegmatite in the schist.

49.8 Chestoa view; buses will turn around here and pick us up at the outcrop.

53.3 Jct. US 221, go north on 221.

54.6 Jct. NC 194.

55.6 Flood plain of the Linville River

56.1 Altamont

56.2 Hills on right are of quartzite of the Chilhowee in the Table Rock thrust sheet; left side of valley is in gneiss of the Blue Ridge thrust sheet.

57.1 Enter Linville quadrangle.

58.1 Road cuts in layered gneiss.

58.2 Cross Linville Falls fault.

59.1 Cuts in siltstone of the late Precambrian autochthonous sequence.

60.0 Jct. NC 194 and US 221; bear left on NC 194.

60.0-66.8 Road approximately follows Linville Falls fault, but crosses it several times between 60.0 and 63.4; layered gneiss to west, siltstone unit of autochthonous sequence of the Grandfather Mountain window to east.

62.3 Miller Gap (elev. 3,757 ft.) Atlantic-Gulf drainage divide.

63.4 Newland (elev. 3,620 ft.); highest county seat in eastern North America.

66.8 Smoky Gap; route cuts into the northwest corner of the window around head of Blevens Creek Valley.

67.2 Contact between siltstone and underlying arkose and arkosic quartzite.

67.3 Cross back into siltstone.

68.2 Folds in siltstone asymmetric towards the west.

68.3 Cross the Linville Falls fault into gneiss of the Blue Ridge thrust sheet which is quartz dioritic in this area and partly layered.

69.4 Tectonic slice of quartzite of the Chilhowee group in gneiss exposed on northeast side of road.

69.5 Hump Mountain (elev. 5,587 ft.)ahead.

70.3 Jct. US 19 E; go straight.

70.4 Turn Right on NC 194.

72.4 Elk River, a tributary of the Watauga.

72.5 Turn left on Beach Mountain road (No. 1308).

73.1 **STOP 4.** Contact of Beech granite with layered gneiss. The Beech granite is the coarse-to medium-grained light-gray to pink nonlayered cataclastic gneiss. Contact cuts across layered gneiss slightly and movement of unknown amount has occurred along it. Coarser grained Beech granite on corner up road is typical. The layered gneiss consists of dark, fine-grained layers of dioritic or quartz dioritic composition now actinolite-epidote-biotite schist and gradations to coarse-grained, light colored blastomylonitic quartz diorite gneiss; contains white feldspar-rich pegmatite stingers and pods. In some places porphyroclasts of biotite and amphibole megascopically visible. Note prominent lineation.

73.2 Buses turn around and head back to NC 194.

74.0 Beech Mountain (elev. 5,506 ft.) ahead. 75.4 Alluvial fan from Beach Mountain.

75.9 Outcrop of nonlayered quartz monzonite gneiss.

76.5 Tectonic slice arkosic quartzite in gneiss on left. (Quartz pebble conglomerate is exposed in Elk River just southwest of here.)

76.7 Alluvial fan from Beech Mountain.

77.4 Cross Linville Falls fault into window. 77.5 Outcrops of uppermost siltstone unit of autochthonous sequence.

78.5 Banner Elk (elev. 3,740 ft.); go right on NC 184.

78.6 On right, conglomerate is arkose.

79.1 On left, metamorphosed basalt flow, now greenstone.

79.2 View of Grandfather Mountain (elev. 5,939 ft.) ahead; Hanging Rock (5,212 ft.) and Four diamond Ridge to left.

80.0 On left, outcrops of mafic volcanic rocks.

80.7 On left, outcrops of Arkose. 81.3 On left, outcrop of siltstone.

81.4 **STOP 5.** Lowest siltstone in western part of the Grandfather Mountain window and overlying arkose. Siltstone in east cut: dark gray containing brown-weathering lenses and beds of calcareous sandstone and quartz-calcite-chlorite segregations. Tight plastic folds overturned to west. Note lineation. Arkose in west cut: contains quartz and feldspar clasts as much as 1 in. in diameter, shaly lithic fragments. Dark beds rich in heavy minerals. Cleavage poorly developed. Prominent crossbedding and graded bedding indicate tops of beds are to the west. Such obvious bedding is not typical of the arkose of the autochthonous sequence. Grandfather Mountain immediately to east.

82.2 Linville Gap (elev. 4,045 ft.); Gulf-Atlantic drainage divide. Turn right on NC 105. Outcrop of Linville metadiabase on left.

83.1 Alluvial fan from ridge of arkose to west (Flattop Mountain). To left, view of Grandfather Mountain and footbridge. From base of cliff to valley bottom extensive fan deposits of arkose cover siltstone and metadiabase. To Linville route traverses valley eroded in siltstone.

86.1 Linville (elev. 3,689 ft.) Jct. NC 105 and US 221 and NC 181; go south on 221.

86.2 turn left on Roseboro Road.

87.2 Outcrop of lowest arkose.

88.1 Blue Ridge Parkway, go right.

88.2 **STOP 6.** Flat Rock parking space; lunch. If the weather is good we will eat on flat rock, a large slab of arkose overlooking Linville, a 5-minute walk by trail (elev. 4,100 ft.). National Park; leave hammers in bus. The rock here is typical of the coarser upper part of the lower arkose member of the autochthonous sequence of the Grandfather Mountain window and is similar to much of the rock on the ridge of Grandfather Mountain along strike to the northeast. It contains clastic feldspar to 1 in., squashed argillite fragments to 1 in. long and quartz pebbles to 1 in. Bedding, although not obvious, can be seen locally. Rock is probably folded in a series of fairly tight folds overturned to the west. Drive south on Parkway.

88.7 **STOP 7.** National Park; leave hammers in bus. Conglomerate in upper part of lowest arkose of autochthonous sequence. Contains pebbles of quartz, feldspar, argillite, quartzite, light-colored granitic rock, pegmatite, jasper (?), volcanic rock (?). Notice the flattened and stretched aspect of the fragments of less competent rock. Cleavage is the prominent structure; bedding is visible near south end of outcrop.

89.3 Buses drive to Lost Cove Cliff overlook, turn around and pick us up at outcrop.

90.0 Turn right on Roseboro road. 91.4 View of Lost Cove Cliff overlook; folded unconformity between basement rock and arkose is exposed on cliffs.

92.5 **STOP 8.** Contact of progressively metamorphosed arkose of late Precambrian age with retrogressively metamorphosed granite rock of early Precambrian age. In the west part of the cut is light-green sericite arkose containing clasts of quartz and feldspar. To the east is cataclastic gneiss containing porphyroclasts of potassium feldspar and fine-grained sericite and biotite. In this exposure the composition of the gneiss ranges from quartz diorite to quartz monzonite and is generally granodiorite. Small pegmatite lenses and pods found in the gneiss are lacking in the arkose. Note the lineation.

94.3 Roseboro (elev. 2,200 ft.).

94.7-95.1 Phyllonite zone in gneiss.

96.8 Rockhouse Creek.

98.4 Edgemont, (elev. 1,600 ft.) in Wilson Creek valley; turn right.

98.5 Enter Table Rock quadrangle.

99.4 Cross Wilson Creek

99.5 **STOP 9.** Old road-metal quarry in nonlayered gneiss of the autochthonous sequence in the Grandfather Mountain window. Well-foliated, coarse-grained biotite quartz monzonite flaser gneiss. Mica-poor pegmatites 2 in. to 1 ft. thick parallel with foliation extend to 100 ft. long. Some contain sulphides. Pegmatites are fine to medium grained. Zircons fro gneiss in this outcrop give ages ranging from 670 to 1,020 million years (Tilton and others, 1959).

100.4 Mortimer Forest Service Station; turn right on Wilson Creek Road.

101.1 Cross Wilson Creek. You have just passed through the remains of the village of Mortimer which was abandoned after being nearly destroyed by the 1940 flood.

102.3 Diabase dike of Triassic (?) age in gneiss.

102.4 Harper Creek; saprolitized terrace gravel to south

103.4-103.9 Phyllonite gneiss at intervals.

104.4 Contact between felsic volcanic rocks and gneiss.

105.4 Cross Wilson Creek. **Stop 10.** (Small stream from valley has safe drinking water.) Felsic volcanic rocks. Outcrop by bridge is medium-gray vitreous tuffaceous (?) quartzite or crystal tuff. To north it contains white lithic fragments. Follow the old railroad grade 500 feet northwest, passing through cuts in similar rock. Here are two 40-foot layers of dark-green amygdaloidal meta-andesite. The amygdules are elongate in the regional a direction. They are very well exposed on the face below the roadbed. Note the complicated contact relations suggesting that the felsic volcanics (tuff?) were unconsolidated when the andesite flow extruded. Although these rocks do not form continuous outcrop with the main part of the autochthonous sedimentary and volcanic sequence, similar rocks are found near the base of the sequence north and west of

Blowing Rock (not yet mapped).

105.2 Pass into fine grained biotite gneiss.

105.3 Brown Mountain to right.

105.4 Slabs of granite in stream

106.2 **STOP 11.** Coarse-grained, strongly lineated, faintly foliated, cataclastic granite gneiss. Lineation defined by flattened spindle-shaped aggregates of fine-grained new biotite with scattered old biotite.

108.0 Eastern boundary of Grandfather Mountain window.

109.0 Turn right on Adako Road.

109.1 Red clay colluvium.

110.9 Terrace gravel composed of granite from Brown Mountain overlies gneiss saprolite and is overlain by 3-4 foot red clay colluvium.

112.8 Turn left on Worry Road.

119.5 Turn right; sign to Morganton.

121.4 (across bridge) to Morganton.

124.8 Jct. NC 181; turn left to Morganton.

126.2 Center of Morganton; buses will continue to Mimosatel and Boxwood Court to let off passengers.

SUNDAY, OCTOBER 9

0.0 Leave Morganton 8:00 a.m.; head northwest on NC 181.

0.1 Cross Catawba River.

1.4 Cross NC 126; signs commemorate Andre Michaux's journey in 1794-95 and mark rendezvous of “over the mountain” men on their way to battle of King's Mountain.

1.5 Typical red clay colluvium.

3.0 Enter Table Rock quadrangle.

3.1 Oak Hill (elev. 1,320 ft.); view of Table Rock (elev 3,920 ft.) and Hawksbill (elev. 4,020 ft.); long level ridge to southwest is Shortoff Mountain (elev. 3,000 ft.).

4.3 Poor exposures of sillimanite schist in roadcut.

4.5-4.7 Level Ridge top.

6.8 Zion Church; saprolite outcrop of fine-grained, well-layered gneiss with boudins of pegmatite.

7.9 Irish Creek

9.3 Terrace gravel on gneiss saprolite.

10.0 Roses Creek

10.1 Andalusite-bearing schist in roadcut.

11.5 Joy Crossroads; roadcut in schist and gneiss in shear zone.

11.7 Steels Creek.

12.5 Steels Creek fault. Southeastern boundary of the Grandfather Mountain window.

12.6 Entrance to Steels Creek Park.

STOP 12: Across creek are fresh and weathered outcrops of gray metamorphosed felsic volcanic rocks. (rhyolite or quartz latite) containing quartz phenocrysts 2-3 mm. and feldspar phenocrysts to 4 mm. This rock resembles that found near the base of the autochthonous sedimentary and volcanic sequence west and south of Blowing Rock. Return to roadcut on NC 181 just south of park entrance. This cut shows saprolite derived from felsic volcanics overlain by 2-5 ft. of greenish sericite quartzite containing quartz clasts to 3 mm. And K feldspar clasts to 5 mm. The quartzite is overlain to the southeast by fine-grained, faintly layered biotite gneiss. Note the strong lineation. The quarry to the southwest shows quartzite slices in gneiss. Metavolcanic rock is exposed along the strea below the quarry.

13.8 Joy crossroads; turn left.

14.0 Upper Creek.

14.3 Gray alluvial clay passing to red clay.

15.0 Worry Road, turn right.

16.4 **STOP 13.** Saprolite exposure of typical schist and gneiss of the Inner Piedmont. Well-layered biotite gneiss with some interlayered mica schist is involved in complex, isoclinal folds overturned to the northwest. Fold axes trend northeast. Gneiss saprolite contains a few layers and boudins of orange-brown to ochre punky saprolite derived from amphibolite. Fresh amphibolite and various stages in graduation into this saprolite can be seen near southeast end of cut. Pods and layers of cataclastic pegmatite, some with muscovite books as much as 1 in. in diameter are intercalated in the gneiss and schist. These pegmatites contain a different heavy mineral suite than that reported from Spruce Pine pegmatites, and do not contain large muscovite books.

17.0-17.1 Typical Piedmont topography on saprolite; steep gullies and flat ridges.

17.9 Enter Lenoir quadrangle.

18.8 **STOP 14.** Roadcut in saprolite. The biotite-quartz monzonite augen gneiss which here is intercalated with finer grained nonporpyroblastic gneiss and schist is the older of the two granite gneiss mapped in this part of the Piedmont. Here the augen gneiss contains the characteristic potassium feldspar porphyroclasts jacketed with quartz and albite. Note the intense northeast-trending lineation defined by the spindle-shaped porphyroclasts. The augen-gneiss typically occurs in large concordant sill-like bodies parallel to the regional "grain" of the structure. This exposure is near the margin of such a body. Would you interpret this rock as an intrusive with inclusions of the wall rocks and much lit-par-lit injection near its contacts, or as a granitic rock produced by granitization of certain layers in the normal gneiss?

19.8 Worry crossroads.

20.7 Turn right, sign to Morganton.

21.5 **STOP 15.** Marginal phase of quartz monzonite, which is the youngest plutonic rock we have found in the area mapped to date in the Inner Piedmont. Fine-grained, rather equigranular layered biotite quartz monzonite with small pegmatite veinlets and inclusions of fine-grained amphibolite, some of which have biotitic selvages. Some of the biotitic layers in the quartz monzonite may be derived from the amphibolite. Outcrop is largely saprolite and the amphibolite forms the orange- brown-ochre saprolite. Layering dips east at a low angle. Black spots in amphibolite saprolite probably from garnet.

21.6 Warrior Fork, cross bridge and turn left to Morganton

24.2 View of South Mountains ahead.

26.0 Jct. NC 181, turn left to Morganton.

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GLOSSARY

a lineation-lineation parallel with the direction of tectonic transport.

Allochthonous-having traveled a considerable distance in a thrust sheet.

Autochthonous-essentially in place.

B lineation-lineation in the plane of movement perpendicular to the direction of tectonic transport.

Blastomylonite-a rock which has been more or less completely crushed and partly or wholly recrystallized.

Boudin-sausage-shaped segment of a bed or layer.

Cataclastic-mechanical breakdown of a rock through pervasive shearing.

Porphyroclast-a large unrecrystallized mineral fragment set in a cataclastic or recrystallized cataclastic matrix.

Phyllonite-rock resembling a phyllite formed by mylonitization followed or accompanied by recrystallization.

Progressive metamorphism-the mineralogical adjustment of unmetamorphosed rocks to metamorphic conditions of lower grade metamorphic rocks to conditions of higher grade.

Retrogressive metamorphism-the mineralogical adjustment of relatively high grade metamorphic rocks or igneous rocks to metamorphic conditions of lower grade than that of their previous recrystallization or initial crystallization.