GRANITIC PLUTONS OF THE CENTRAL AND EASTERN PIEDMONT OF SOUTH CAROLINA

By H. D. WAGENER and DAVID E. HOWELL

GRANITIC PLUTONS OF CENTRAL AND EASTERN PIEDMONT, S. C. — Wagener and Howell
1973 Carolina Geological Society Annual Meeting

CAROLINA GEOLOGICAL SOCIETY
34th ANNUAL MEETING

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GRANITIC PLUTONS OF THE CENTRAL AND EASTERN PIEDMONT OF SOUTH CAROLINA

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INTRODUCTION

Purposes

Reconnaissance mapping of all major granitic rock bodies in South Carolina was about 80 percent completed as of this writing (February 1973). The work is part of a thorough survey of the granitic stone resources of South Carolina being conducted by the Division of Geology, South Carolina State Development Board. The maps, descriptive text, production figures, etc., will be published in the mineral resources series,

At least one specimen is being collected from each granitic body. These.are being sliced for thin sectioning, and the remainder of each specimen will be kept in open storage in Columbia for ready reference by potential users. Thus, anyone seeking a source of granitic rock for crushed stone, monumental stone or other purposes in or near a particular area in the state will be able to examine maps and specimens prior to visiting a particular site. It is hoped, in addition, that geologists in and near Columbia and Georgia will be spurred by the reconnaissance maps to initiate more detailed studies of South Carolina granitic rocks,

Other slices have been taken from the specimens for the following purposes: bulk chemical, and possibly trace element, data will be obtained from as yet an undertermined number of specimens by Van Price of Furman University; Paul Fullagar of the University of North Carolina at Chapel Hill will run strontium isotope analyses and Rb/Sr whole-rock age determinations on as many of the specimens as are suitable for study. Hopefully some of the data will be available for verbal communication by the time of this field trip.

During the course of field investigations, it became obvious to the author that sufficient fresh exposures exist at quarry sites and flat rock sites throughout the Piedmont to serve as the basis for at least two field trips. The nature of the field work has been sufficient only to raise questions relative to hypotheses of rock origin. It is hoped that this field trip will achieve two ends: (1) to afford professional Piedmont rock investigators the opportunity to debate their way through various hypotheses while standing on the evidence (the field being the ultimate source of all evidential data); and (2) to interest industrial and commercial users of granitic stone in utilizing more of the vast reserves of this commodity available in the South Carolina Piedmont,

Acknowledgments

Norman K. Olson and David E. Howell of the Division of Geology have spent a number of days in the field with the author in areas covered by the field trip, J. A. Piano served ably as field assistant to the author in areas marginal to the field trip area. Villard S. Griffin, Jr. and Robert D. Hatcher, Jr. have been more than generous with their current field data in areas remaining to be worked by the author.

Because this guidebook is not meant to formulate new ideas, to build theses on, to expand or disparage the work of others, and because the data herein will be formally published later, no list of references has been appended. I would like to state, however, that the Geologic Map of the Crystalline Rocks of South Carolina (Overstreet and Bell, 1965) has been an invaluable tool in reconnaissance mapping. To date, unpublished data of others have been relied upon as follows: H. S. Johnson, Jr., parts of McCormick and Edgefield Counties;W. T. McCutchen, Edgefield County; and B. F. Buie, Union County. Published reports have been fully utilized as follows (to date): J. R. Butler, York County; D. T. Secor and H. D. Wagener, Fairfield and Richland Counties; Arthur Keith and D. B. Sterrett, Cherokee County; J. F. McCauley, Newberry County; H. Y. McSween, parts of Greenwood and Fairfield Counties; R. D. Hatcher, Jr., northwestern South Carolina; and V. S. Griffin, Jr., Abbeville and McCormick Counties. Soils maps recently published by the United States Department of Agriculture of Cherokee and Spartanburg Counties have proven very satisfactory guides to areas underlain by granitic rock. The work of D. E. Howell in interpreting and outlining soils map data for use by the author and his enthusiastic insistence that these maps are valuable field tools are very much appreciated.

As president of the Carolina Geological Society for the current year, I would like to take this opportunity to express the appreciation of the Society to the South Carolina Aggre-

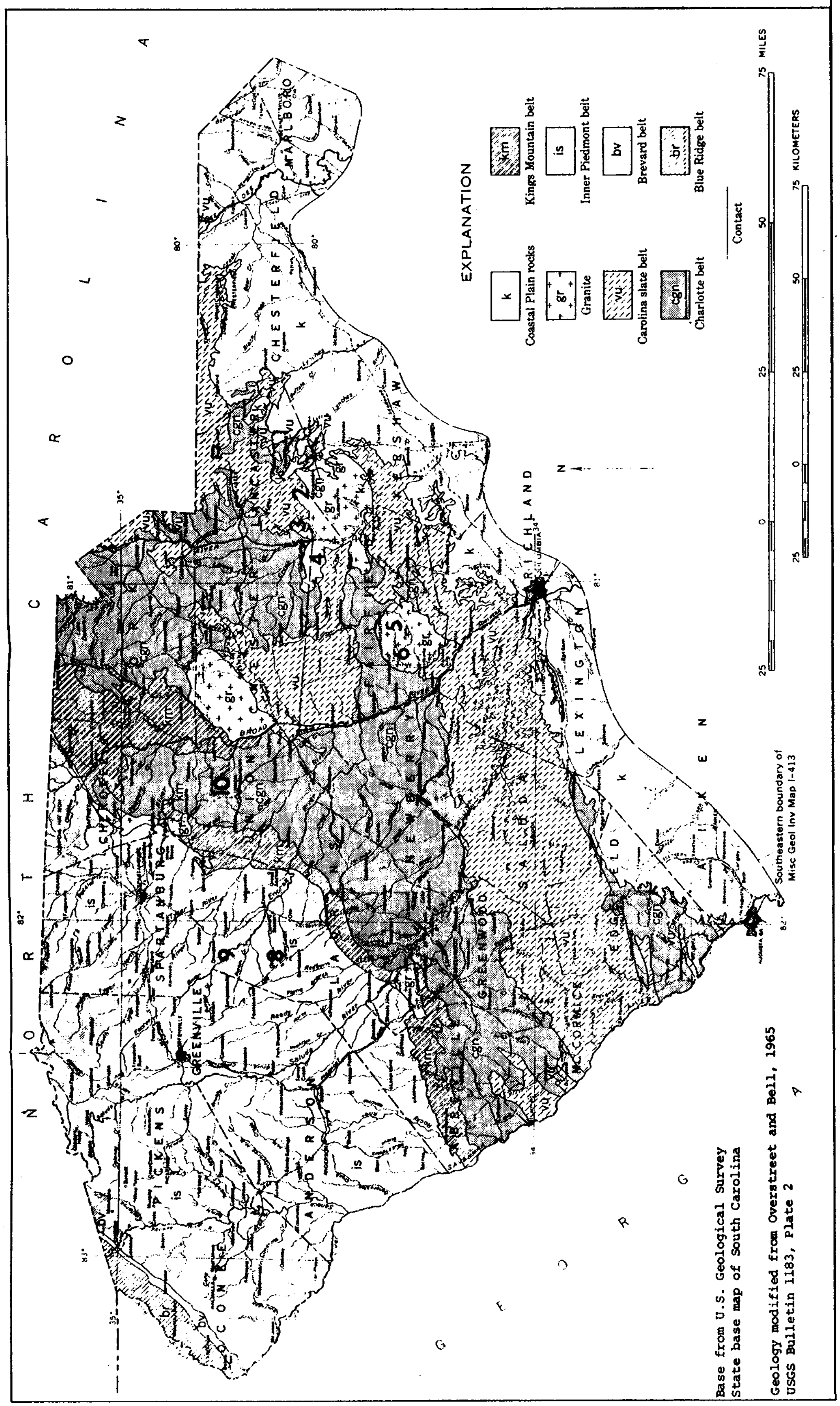

Figure 1. Approximate two-day field trip locations of Carolina Geological Society relative to the generalized geology (Overstreet and Bell, 1965, pl. 1) of the region.

gate Producers Association for sponsoring the evening social hour in Pageland. We also thank the Division of Geology, South Carolina State Development BOard, for publishing this guidebook without charge to the Society. Tessie Rentz was in charge of all guidebook printing. I am also grateful for the enthusiastic support, both financial and field assistance, from the Division during the planning of the trip and preparation of the guidebook.

GEOLOGY OF THE FIELD TRIP AREA

For orientation relative to the region and the principal metamorphic rock belts, the approximate field trip locations (fig. 1) have been superimposed on the map showing geologic belts in South Carolina in USGS Bulletin 1183 (Overstreet and Bell, 1965, pl. 2). Because the general geology of these rock belts has so often been reviewed in the literature, I have assumed that CGS field trip participants are at least somewhat familiar with the established facts or Observations and will not repeat them there. Suffice it to say (I hope) that the granitic rocks which will be visited in the field all appear to be either discrete intrusive bodies of probable demonstrable igneous origin or gneissic bodies of exceedingly debatable origin (this is not to indicate that the origin of the magma of the intrusive bodies is not debatable). To further complicate matters, some of the gneissic bodies have intrusive relationships to their country rock, and some of the probable igneous bodies are partly gneissic. These, of course, are among the oldest problems in igneous and metamorphic petrology. They are amply in evidence in South Carolina granitic rocks, and in many cases exposures are good enough in saprolite and relatively fresh rock so that the structural and chemical-mineralogical relationships could be worked out in some detail.

Large numbers of potentially exploitable stone deposits with very little (usually without) overburden exist in the field trip area and elsewhere. Reserves of granitic stone for crushing in South Carolina are about as unlimited relative to present demand as any mineral commodity on the market. Potential monumental and building stone reserves, although smaller, also approach staggering proportions. The field trip, of course, will touch on only a few of these deposits,

Some overall observations by the author were presented at the 1973 Annual Meeting, Southeastern Section, Geological Society of America in Knoxville. Portions of that abstract are stated below with a few embellishments, and the field trip log has been built around these observations. Throughout the log, at appropriate places, more detailed observations of the body to be examined have been made by the author.

Three principal granitic rock suites or belts trend northeastward in the central and eastern Piedmont of South Carolina: (1) Early or possibly pre-Paleozoic fine- to medium-grained, sheared metagranitic rocks bearing metamorphosed mafic dikes(?), distinctly gneissic in many localities, poorly exposed but concordant with regional trends throughout the central and eastern Piedmont; (2) stock-like, coarse-grained granitic bodies of the eastern Piedmont, similar to the coarse-grained Liberty Hill (Kershaw) granite, clearly intrusive in low-rank metamorphic rocks, but partly concordant in high-rank zones; (3) central Piedmont coarse porphyries similar to the Yorkville adamellite of York County. A body in group 3, partly mapped by Buie (unpublished), underlies roughly 160 square miles in Union and Cherokee Counties, thus being the largest quasi-circular (in plan), apparently intrusive, mass in the state.

A fourth belt of fine-grained, apparently post- or synmetamorphic granitic bodies includes: the Liberty Hill fine granular granite, intruded into the coarse-grained Liberty Hill (Kershaw) granite; the Ri0n (Winnsboro "blue") adamellite, intruded into medium-coarse Winnsboro adamellite of Fairfield County; the Newberry granite, a large (about 140 square miles), exceedingly interesting concordant-discordant intrusive complex; and several small quasi-tabular bodies in Laurens County. These fine-grained granitic rocks were emplaced in a region of east-west trending structures extending across the geographic center of the Piedmont (Newberry and Fairfield Counties, fig. 1).

FIELD TRIP LOG, 1973, ANNUAL MEETING CAROLINA GEOLOGICAL SOCIETY

October 13 (First Day)

ASSEMBLE in Pageland Motor Inn (formerly Red Coach Inn) parking lot, Pageland, S. C. at 7:30 a.m. The trip will start promptly at 8:00 a.m. You will need about 150 miles worth of fuel. Figure 2 indicates our itinerary.

The first day of this trip will cover the fine- and coarse-grained premetamorphic and postmetamorphic plutons of the eastern and east-central Piedmont.

Mileage between notations

0.0 Pageland Motor Inn parking lot, Pageland, Chesterfield County, S. C. DRIVE WEST out of Pageland on U. S. Highway 601 S. Road cuts in this area are in Coastal Plain sands.

2.8 Intersection. CONTINUE on U. S. Highway 601 S toward Kershaw.

3.6 Road cuts expose the coarse pink phase of the Pageland granite with prominent xenoliths.

0.9 Lancaster County line.

0.8 More Pageland granite exposures. Note nonconformity (C. P. on granite) on south side of river near top of hill.

2.9 TURN RIGHT (N) at bottom of hill on County Road

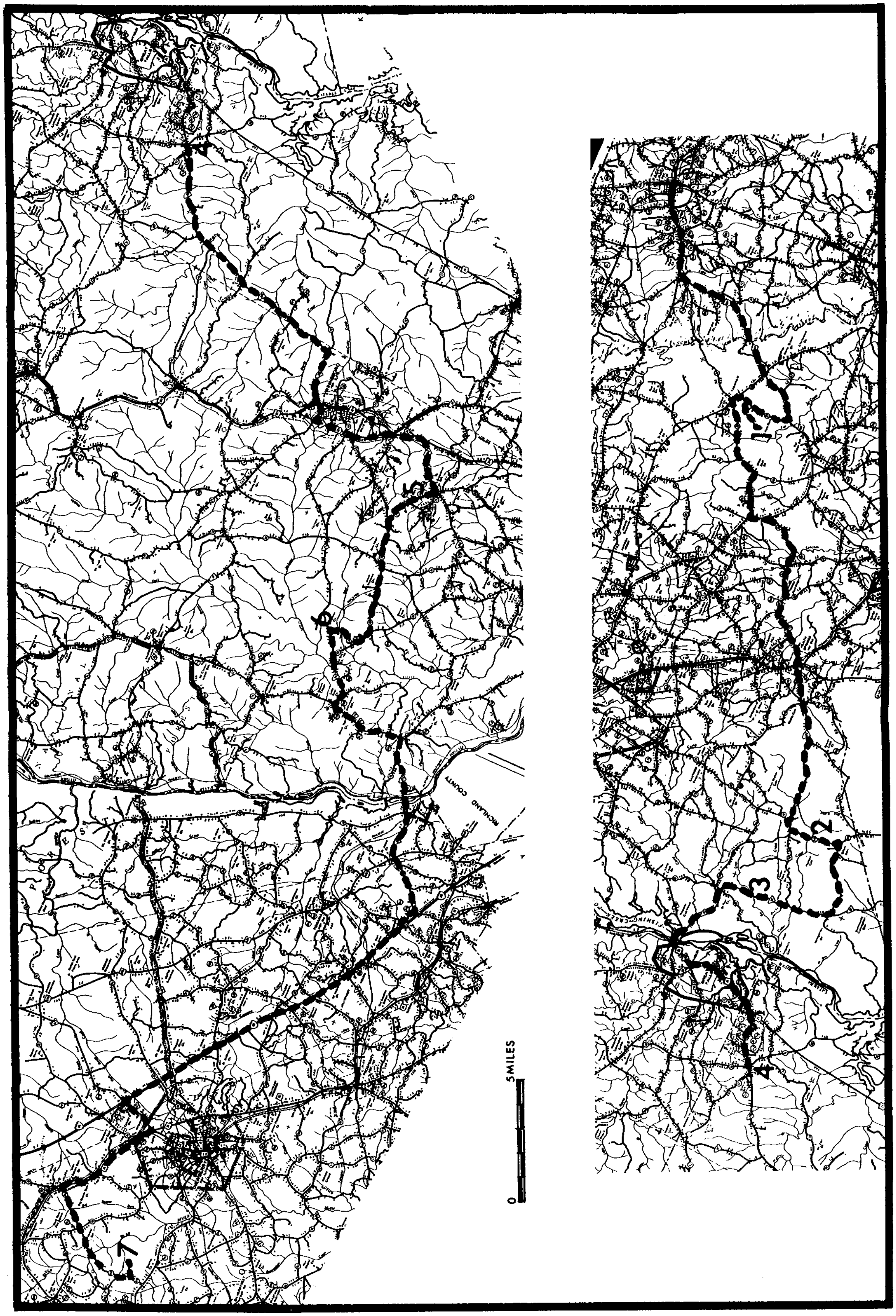

Figure 2. Route of first day of field trip log, 1973 Annual Meeting, Carolina Geological Society.

27.

2.0 TURN LEFT (W) on sand road to Forty-acre Rock. At least 35 feet of C. P. material overlies the Pageland granite along most of this road (seismic data).

1.5 **STOP 1,** Forty-acre Rock, at the western extremity of the Pageland granite. Park along edge of road. This stop involves a good bit of rough walking and scrambling.

A number of acres (any estimates?) of the coarse white phase of the Pageland granite are exposed here on opposing hillsides. Though flat-rock exposures of several acres are typical of coarse-grained granitic rock bodies in the eastern Piedmont, this is the largest one in South Carolina (most are less profusely littered).

Observe pothole-forming weathering processes, which produce soil with help from (or perhaps entirely because of) sedum, lichen, mosses, then grasses, shrubs, gnarled cedars and finally other trees.

PROCEED on foot downhill to waterfall in valley (NOTE: This is a bit of a rough go). Observe extremes in floral community from bare rock at hilltop to valley floor. Observe walk-in minicavern (a "solution" cavity) in granite adjacent to waterfall.

PROCEED up steep bare rock slope above cavern to observe large flat rock exposures in essentially the native state (tourists do not frequent this side of valley). Observe: xenoliths; fractures lined with grasses and gnarled cedars; large sedum-lichen-moss communities; raised rims on some potholes; struggle for ascendancy between soil forming process and erosion; etc.

The Pageland granite is typical of a series of post-metamorphic coarse-grained plutonic bodies which extend from the Lilesville, N. C. (Pee Dee) granite of John Waskom to Saluda County, S. C. These bodies have roughly circular or ellipsoidal areas of exposure and appear to have been intruded as fluid magma by stoping, wedging apart of wall rock by sill-like apophyses, etc. The country rock is generally volcanic, sedimentary and volcaniclastic material of the well known(?) Carolina slate belt, which has been metamorphosed within or somewhat above regional greenschist conditions. Aureoles of hornfels, phyllite, etc., are prominent around the Pageland body and its sister stock, the Liberty Hill (Kershaw) granite.

The Pageland and Liberty Hill (Kershaw) granites have been and are being quarried for crushed stone and dimension stone, and have enormous potential as sources of pink or white coarse-grained dimension stone. The pink variety is one of the most attractive dimension stones available anywhere in eastern North America.

0.0 RETURN to cars. TURN AROUND and proceed back along sand road to County Road 27.

1.5 TURN LEFT (N) on County Road 27 toward Taxahaw.

0.4 TURN LEFT (W) on County Road 123. Note house on left, which is one of two left standing by that Sherman fellow--Taxahaw never recovered (observation courtesy of Dave Howell).

0.3 TURN LEFT (S) on County Road 37.

1.2 Hornfels produced from volcanic rock in aureole of Pageland granite.

1.0 Leaving contact aureole, passing into mixed metavolcanic rock sequence.

1.2 TAKE RIGHT (W) fork on County Road 86. Quartz-mica phyllite or schist next half mile.

2.0 HARD LEFT on State Route 903. Mineral Mining Corporation is a sericite processing plant using phyllite from the Haile gold mine area.

0.6 OBLIQUE RIGHT (S) on County Road 60.

1.0 Begin unpaved road. Boulders are of felsic volcanic rocks with small basaltic dikes.

1.8 RIGHT, then immediate LEFT, continuing on County Road 60. Boulders on left at utility station have large clasts [lithic-vitric ash fall (?)].

3.0 Old stream channel well exposed on right near top of hill above felsic volcaniclastic phyllites.

1.0 Heath Springs. CONTINUE on winding road.

0.5 STOP, TURN RIGHT.

0.1 TURN LEFT on Duncan Street (unpaved), past RR station, then TURN LEFT on Main Street; Go one block, and TURN RIGHT on State Route 522.

2.7 Exposure of Liberty Hill (Kershaw) coarse-grained granite on left.

1.0 TURN RIGHT (W) on unpaved road (easy to miss).

1.2 Hornfels boulders at top of hill. From this point to the next stop the roads partly follow the complex border zone of the coarse-grained Liberty Hill (Kershaw) granite.

1.7 Bridge over Cedar Creek. For the next mile, granite underlies high places in road and hornfels intervenes in low places.

0.9 TURN LEFT (SW) onto County Road 19.

0.3 TURN LEFT (S) onto County Road 379. Ridge dead ahead is underlain by Liberty Hill fine granular granite.

1.1 Saprolitic road cut with dikes of fine granular granite in coarse granite. The dikes contain inclusions of coarse granite.

0.7 STOP 2. Pull well over on right shoulder. Hillsides on either side of the road are precipitous boulder fields of Liberty Hill fine granular granite. This sort of exposure (scattered megaboulders) typifies the belt of fine-grained postmetamorphic granites of the east-central Piedmont (see Introduction). This particular granite tends to show quartz phenocrysts on weathered boulder surfaces, whereas some other granite bodies of this type have feldspar phenocrysts or are not porphyritic. **At** some localities the fine-grained, east-central Piedmont granites exhibit, indistinct linear features between zones of slightly different mineralogy. However, distinctly gneissic textures (foliation or lineation) are restricted to narrow marginal zones, and evidence of shearing is generally lacking. Inclusions tend to be sharply bordered, but reaction zones between granitic fluids and more mafic inclusions are readily apparent at many localities. These fine granites are among the youngest rock phenomena of the Piedmont, but are cut by basaltic dikes, and, in some localities, thin dikes of pegmatite and aplite.

Note the sharply demarcated boundary of the boulder field. In the saprolite road cut just south of this boundary, a dike (dikes?) and several small apophyses of the fine granite are emplaced in coarse granite. This relationship between the fine- and coarse-grained granites (that is, dikes of fine emplaced in coarse) seems consistent wherever the two occur together in the east-central Piedmont.

0.0 RETURN to cars. CONTINUE south on County Road 379.

0.5 SHARP RIGHT (W) onto unpaved road. This road approximately follows the contact between the fine and coarse granites.

1.6 Note continuous low ridge of fine granite megaboulders on right. At this locality the rock is pink and distinctly quartz-porphyritic. At the town of Liberty Hill, the rock is a standard gray, fine granular granite. (A commercial “blue” granite.)

1.8 STOP. TURN RIGHT (N) onto State Route 97. CAUTION: heavy traffic.

1.2 Crossing northern boundary zone of Liberty Hill (Kershaw) coarse granite. Interfingering of granite and hornfels next mile.

1.0 Road cut in saprolitic metagranite (the Great Falls metagranite).

0.8 **STOP 3.** CAUTION: PULL WELL OFF ROAD onto left shoulder and into gravel pit (very bumpy). metagranite. Mafic dikes(?) in the granite have been metamorphosed to undetermined grade.

This granite (here and at STOP 4) is typical of numerous premetamorphic granitic bodies of the eastern and central Piedmont. Lineation of mafic minerals is generally pronounced. The rock is either severely sheared and very poorly exposed (as here); cut by intersecting shear planes (as at STOP 4); or exhibits a distinct rock cleavage. Metamorphosed mafic dikes commonly crosscut the exposures. Fresh exposures of the metagranites are uncommon to rare, presumably due to facilitation of weathering along shears and cleavage.

The relationship between the metagranites and the other premetamorphic Piedmont rocks has not been established. However, in Wagener's Opinion, the similarity of these rocks with the gneiss of the Lake Murray spillway gneiss dome should not be overlooked.

0.0 RETURN to cars. CONTINUE north WITH CAUTION on State Route 97. Continuous exposures of Great Falls metagranite saprolite from here to STOP 4.

4.8 Catawba River (Lancaster-Chester County line). EXTREMELY DANGEROUS intersection beyond west end of bridge.

0.7 LEFT FORK toward Great Falls. The granite is better exposed on this side of the river.

1.1 STOPLIGHT. TURN LEFT (S) onto U. S. Highway 21 and State Route 200.

0.6 CONTINUE on U. S. Highway 21-State Route 200 (right fork).

2.4 OBLIQUE RIGHT onto State Route 200 (Chester-Fairfield County line).

0.5 Fresh exposure of Great Falls metagranite on right, showing schlieren and intersecting shear planes.

0.3 **STOP 4.** LUNCH. Park in the Mitford Baptist Church parking lot.

After lunching, observe intersecting shear planes in megaboulders of metagranite. These S-planes appear to contain annealed mylonite, but have not bean studied microscopically. They have been observed up to about six inches thick, but typically appear as exposed here. The S-planes are more resistant to weathering than the granite, hence in deeply weathered cuts their fragments tend to serve as “guide fossils” to metagranite.

0.0 RETURN to cars. CONTINUE west onto State Route 200.

2.4 Valley on left underlain by gabbro. Begin descent toward granite-gabbro contact.

0.6 Contact between metagranite and small gabbro body. From this point to Winnsboro we traverse a belt of high-rank metamorphic, partly mobilized mafic, intermediate and felsic rock units, which possibly are equivalent to low-rank rocks several miles south in the slate belt.

6.9 High-rank layered units well exposed in this area.

5.3 STOP. Intersection with U. S. Highway 321. CONTINUE west on State Route 200.

0.8 STOPLIGHT. TURN LEFT (S) onto U. S. Highway 321 bypass. The stone houses, schools, etc., hereabouts are of the fine granular Winnsboro Blue Granite (the Rion adamellite).

0.7 Valley marks northern boundary zone (a syntectic zone) of the medium- to coarse-grained Winnsboro adamellite.

2.6 Multiple intersection. CONTINUE south on U. S. Highway 321. You are now on the plateau of the medium-coarse Winnsboro adamellite.

1.4 TURN RIGHT (W) onto State Route 269 toward Rion.

2.5 TURN RIGHT onto County Road 62.

0.1 **RR** overpass (the Rockton-Rion Railroad). Note medium-coarse Winnsboro adamellite just a few feet below the plateau surface.

0.7 **STOP 5.** Park along road edge as best as you can, or in school lot up the road (if unlocked).

A short stop to observe what may be one of the world's most differentiated granites. This phase of the medium-coarse Winnsboro adamellite is a microcline-albite-quartz rock. Its differentiation index (normative albite plus orthoclase plus quartz) is 99.0 The maximum value of this index is 100.0, in which case the rock would be essentially free of Ca, Mg and Fe.

This rock lies at the heart of a controversy regarding the origin of such granitic bodies in the Southeast. Wagener, on the basis of field and chemical studies, concluded that the medium-coarse Winnsboro adamellites and granites were not derived by differentiation from basaltic or intermediate magma, but appear to be products of syntexis of feldspathic arenaceous sediments (The Citadel Monograph Series, No. 10, 1973, 81 p.). Fullagar (1971), Geol. on the basis of Rb/Sr isotope data obtained from several Winnsboro adamellite specimens, concluded that the Winnsboro pluton must be a derivative of mantle material, not the product of syntexis of felsic upper crustal material. There the matter rests, at least for the moment.

Note the thin aplitic dikes in this exposure. These are common features of both the Winnsboro and Rion adamellite plutons. If anyone has a particular interest in aplites, other dikes are well exposed in a small quarry face hidden in a patch of trees a short distance up the farm road.

0.0 RETURN to vehicles. CONTINUE west on County Road 62.

0.4 TURN RIGHT (NW) onto County Road 19. Here the block of country rock between Rion and Winnsboro adamellite contains sillimanite.

1.2 TURN LEFT onto County Road 70 and traverse the Rion adamellite plateau.

3.5 Western margin of Rion adamellite. Country rocks are high-rank schists, quartzites and granofels.

2.1 Muscovite-sillimanite schist exposed in road cut.

0.2 TURN RIGHT (E) onto County Route 114.

0.4 Entering a small body of Rion adamellite.

0.5 Winnsboro Blue Granite quarry. "Winnsboro Blue" is the commercial name for the fine-grained border phase of the Rion adamellite.

0.7 STOP. CONTINUE straight ahead on State Route 213 east, with caution.

0.3 **STOP 6.** Park as far off the road as you can. This road is heavily (or rather, rapidly) traveled.

PROCEED on foot downhill normal to highway on dirt road (south) to small abandoned quarry at end of road. The fresh quarry face was opened about 5 years ago by a Georgia-based company attempting to find a new source of blue granite for the Phillips Granite Company of Winnsboro.

Contact between felsic gneisses and the fine-grained Rion adamellite crosses a corner of the quarry floor. Note the many subtle changes in color index and other mineralogy in the quarried adamellite blocks. How do these changes come about? Note also the many small elongated biotite-rich inclusions of "foreign" rock particles. Are these partly digested inclusions or centers of crystal nucleation? Keep these small inclusions in mind for STOP 7.

PROCEED across small stream on west side of quarry into woods. FOLLOW right bank of stream a few hundred feet through the woods to flat rock exposure.

Exposed here are migmatitic relationships forming part of the field evidence used by Wagener in building a hypothesis of syntactic origin for the medium-coarse Winnsboro adamellite. Layers of fine-grained felsic gneiss can be walked out a short distance into the adamellite, where they have been pulled apart and disrupted. Concordant adamellite layers are sandwiched between the gneiss layers. Note the absence of chilled margin effects; note also the ptygmatic veining in some gneiss inclusions. These effects have been interpreted as evidence of differential fusion of only those gneiss layers having the proper composition to melt Under the prevailing temperature, pressure and water vapor pressure conditions.

We are in the syntectic zone that surrounds the Winnsboro plutonic complex. The effects observable here (migmatite and several different apparently intrusive granitic rock types) occur in saprolite and flat rock exposures at numerous localities. The Winnsboro area may have been a "hot spot" of rising syntectic fluids (or, if Fullagar is correct, mantle-derived fluids) during regional metamorphism.

The Rion adamellite has been quarried for many decades at the large crusher quarry at Rion, which is in the medium-grained central phase of the stock, and as the blue granite for dimension stone from the fine-grained phase. The medium-coarse Winnsboro adamellite has been quarried here and there only to a very limited extent. However, it has considerable potential as a source of granite of several shades, including pink around its southern margins.

0.0 RETURN to cars. TURN AROUND and proceed WEST on State Route 213. Another body of Rion adamellite occurs on the west side of Little River.

3.7 STOP and TURN LEFT (S) onto State Route 213 and State Route 215. High-rank metamorphic rocks are very poorly exposed from here to 1-26, but exposures improve markedly on either side of the Broad River.

3.1 DIAGONAL RIGHT onto State Route 213 at Jenkinsville.

0.2 STOP and TURN RIGHT (W) onto State Route 213.

0.9 FORK LEFT onto State Route 213. Right fork goes to Paar Shoals nuclear power plant. Drilling for new dams for a new reactor penetrated hundreds of feet of the western extremity of the Winnsboro syntectic zone, producing magnificent cores of migmatite which will be placed on deposit with the South Carolina State Development Board, Division of Geology.

For the next several miles we traverse road cuts on either side of the Broad River and pass from Fairfield County into Newberry County. These cuts afford excellent opportunities for introducing oneself to the structural complexities of interlayered high-rank metamorphic mafic and salic rocks of the eastern Piedmont.

4.3 STOP SIGN at U. S. Highway 176. CONTINUE west on State Route 213.

2.5 TURN RIGHT (N) onto frontage road.

1.0 TURN LEFT; take immediate RIGHT onto 1-26 north toward Newberry.

9.4 Ridge ahead underlain by the Newberry granite; contact is just west of the State Route 219 underpass.

4.1 EXIT RIGHT onto State Route 121. TURN LEFT (SW) onto State Route 121 at stop sign.

2.1 STOPLIGHT. TURN RIGHT (NW) onto U. S. Highway 76.

0.2 CONTINUE on U. S. Highway 76 (left fork). This plateau is underlain by the poorly exposed western portion of the Newberry granite. Red soil spots in plowed fields are probably inclusions of biotite gneiss.

4.5 TURN LEFT (S) onto County Road 342 toward Old Beaver Dam Baptist Church.

1.9 STOP SIGN. CONTINUE straight ahead. Some relatively mafic country rock units within the granite (or extensions of the Newberry gabbro of McCauley) appear in shallow road cuts.

2.7 TURN LEFT (S) onto County Road 328.

0.4 **STOP 7.** Entrance on left (dirt road by Coggins Granite Industries mailbox). NOTE: Due to road conditions, it may be necessary to walk about a mile. If so, park along edge of paved road. If not, drive down dirt road to quarry. This quarry is intermittently operated for dimension stone.

A unique feature of this quarry is a very thin basaltic dike with glassy borders which has been partly removed. Multiple zonations within the dike and nearly submacroscopic wallrock alteration effects may be observed.

The Newberry granite (probably adamellite) here is a typical commercial blue. Unfortunately (for the quarryman), the subtle color index changes observable in the Rion adamellite at STOP 6 occur here also. Also troublesome are the numerous inclusions; however, it is the inclusions that make this one of the more esoterically interesting quarries in South Carolina.

The inclusions are of biotite gneiss, apparently metamorphosed to high-rank (we are in the Charlotte belt) before being caught up in the granitic fluid. The granite seems to belong in the postmetamorphic fine-grained group. Evidence of reaction, apparently with granitic liquid, is ample here, and includes reaction rims and orbicular structures. In one corner of the quarry are some of the small biotite-rich chip inclusions observed at STOP 6. Here they exhibit an interesting relationship to a larger xenolith.

In the block dump across the small, inclusions can be observed in all stages of assimilation. The final stage is represented by biotite-rich orbs in homogeneous granite *(esophaliths;* Howell, 1973).

0.0 RETURN to vehicles. TURN AROUND and return north on County Road 328.

0.4 TURN RIGHT (E) onto County Road 342.

2.7 STOP. CONTINUE on County Road 342.

1.9 STOP SIGN and RR. TURN RIGHT (S) onto U. S. Highway 76.

4.6 STOPLIGHT. TURN LEFT (N) onto State Route 121.

1.7 TAKE RAMP TO LEFT for 1-26 toward Columbia.

2.5 EXIT RIGHT onto State Route 34. TURN LEFT and cross bridge to Newberry Inn, where our table will be set for feasting at 8:00.

0.0 END OF DAY ONE.

FIELD TRIP LOG, 1973 ANNUAL MEETING CAROLINA GEOLOGICAL SOCIETY

October 14 (Second Day)

DAY TWO, Sunday Morning. ASSEMBLE in Newberry Inn parking lot at 7:30 a.m. Trip caravan departs at 8:00 a.m. You will need sufficient fuel for about 120 miles. Figure 3 indicates our itinerary

The second day of this trip is built around granitic gneisses, metagranite, and coarse porphyritic granite of the central Piedmont.

Mileage between notations

0.0 RAMP RIGHT on 1-26 toward Clinton.

14.0 EXIT RIGHT to State Route 66. TURN LEFT onto State Route 66 toward Joanna [Laurens County).

0.4 TURN RIGHT (N) onto County Road 99 immediately beyond service station.

1.3 SLOW DOWN and observe low ridge in pasture on right. This ridge is underlain by an apparently tabular body of metagranite enclosed by schistose rocks. According to Vil Griffin, infolded layers of granitic rock are characteristic of this part of the South Carolina Piedmont (that is, the southern half of the Charlotte belt, east of the Lowndesville belt). Such granitic bodies are prominent west of the Newberry granite in Laurens County.

1.6 Interlayered metagranitic rock and biotite-rich foliated rock in saprolitic cuts on both sides of creek.

0.2 TURN RIGHT onto unnumbered poorly paved road at top of hill.

0.5 TURN LEFT onto unnumbered service road and pass under I-26.

0.3 TURN LEFT onto first paved road northeast, away from I-26.

0.4 RR crossing.

1.0 Large boulders on right, including “steamship” megaboulder of a prominent tabular body of metagranite,

0.7 TAKE LEFT FORK to stop sign. TURN LEFT (N) onto State Route 26.

0.5 STOP SIGN. TURN LEFT (W) with caution onto State Route 72.

4.2 RAMP RIGHT (N) onto 1-26. Get in left or center lane.

1.6 VEER LEFT onto U. S. HighWay 276 toward Greenville.

15.7 EXIT RIGHT to State Route 101. TURN LEFT onto State Route 101 toward Gray Court. TURN RIGHT (N) onto frontage road at south end of bridge.

0.8 **STOP 8.** Pull into parking areas by office of Vulcan Materials Company. Note: If there has been rain, the quarry floor will be muddy.

Quarry in gneisses associated with the Gray Court metagranite, which is fine- to medium-grained, gray, and generally exhibits rock cleavage on weathered surfaces. In a pavement exposure across the Interstate, the metagranite grades into the coarse porphyroblastic gneiss observable here. On initial visitation, this quarry raises as many questions as it answers, thus confirming everyone's suspicion that Charlotte belt rocks are still confusing, even where observable unweathered in three dimensions. It is now being demonstrated, however, particularly by Vil Griffin, Bob Hatcher and Bob Butler, that long-term persistence and “Lawsonesque” determination *can* unravel such puzzles as confront us here even where the number of exposures is discouragingly small.

Despite the diversity of granitic rock types in this quarry, the rock is suitable for crushed stone purpose.

Here is ample evidence that all rocks of granitic composition so far exceed the desired minimum abrasion resistance and strength tests as to make insistence on performance of these tests by the construction industry a little silly. *Any* sufficiently massive granitic body, however complex, is a potential source of crushed stone. Obviously, the supply of granitic rock for crushed stone purposes in South Carolina, especially in the Charlotte and migmatized Inner Piedmont belts, far exceeds any conceivable demand for several generations.

0.0 RETURN to cars. RETURN to State Route 101.

0.5 TURN LEFT (NE) onto State Route 101 toward Woodruff.

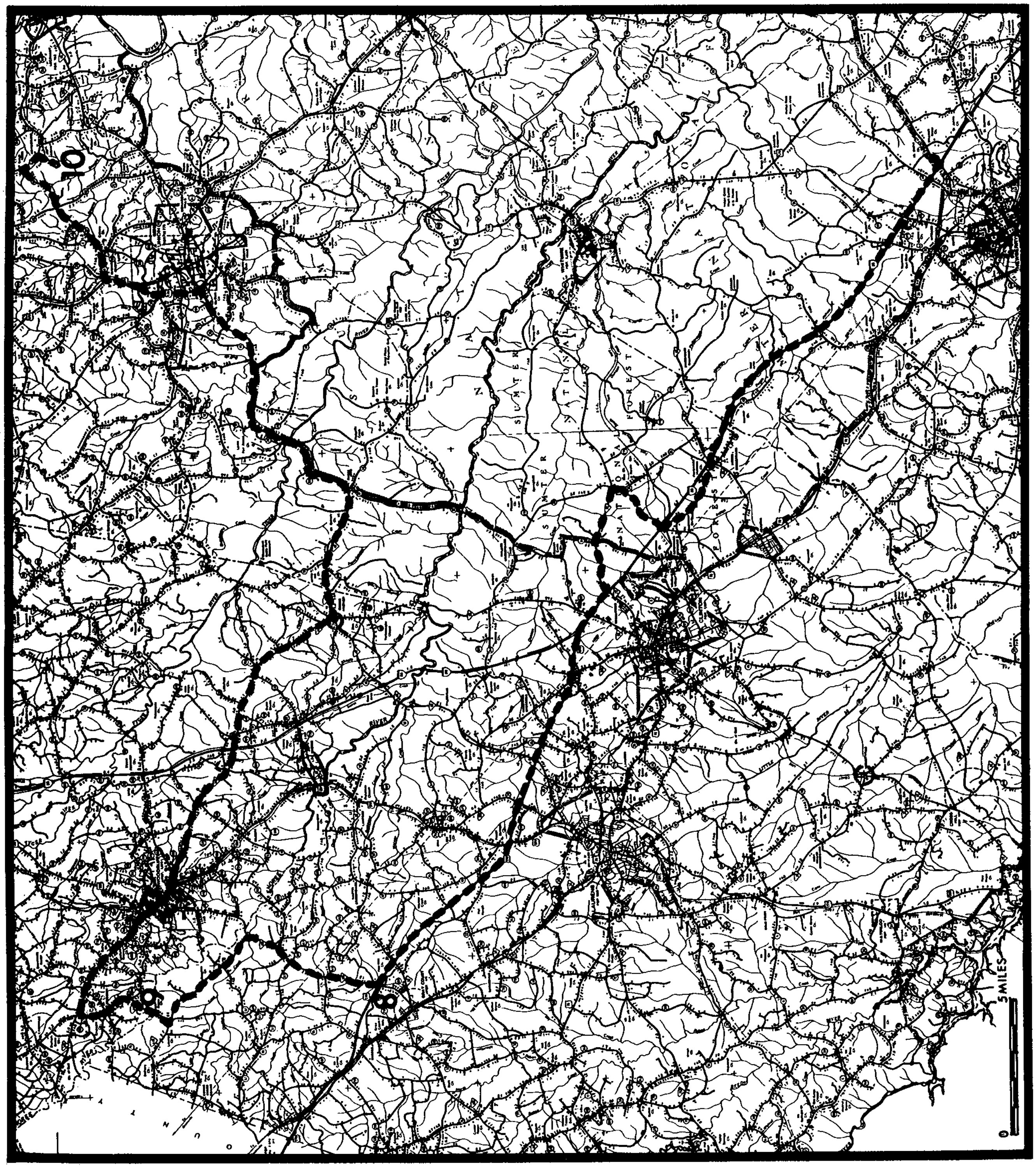

Figure 3. Route of second day of field trip log, 1973 Annual Meeting, Carolina Geological Society.

4.3 Leaving Gray Court metagranite-gneiss complex. The more mafic gneisses and amphibolites between here and the next bridge contain pods of vermiculite, which are extensively quarried in this area.

1.0 Bridge over Durbin Creek. Pavement exposure downstream shows more granites and gneisses--probably migmatitic.

0.1 TURN LEFT (W) onto paved road immediately after crossing bridge.

1.5 STOP SIGN at County ROad 67. CONTINUE straight ahead.

2.9 INTERSECTION with unpaved road to left and paved road to right. TURN RIGHT (N).

0.3 STOP. BEAR RIGHT (N) onto State Route 418. CAUTION: heavy traffic.

0.4 **STOP 9.** Pull WELL OFF ROAD along cut on right. A short stop to examine weathered granitic gneisses interlayered with schists, typical of the Charlotte belt. Here coarse-grained gneiss grades into or is interlayered with thinly layered schists and gneisses. Note the large feldspar metacrysts in these gneisses and the general rock texture for comparison with coarse porphyritic granite at STOP 10.

0·0 RETURN to cars. CONTINUE north on State Route 418.

0.6 ALTERNATE STOP. Enoree River, Van Pattons Bridge (Laurens-Spartanburg County line). Enormous pavement in river bed exposes coarse porphyritic granite with large inclusions of biotite schist and gneiss· This granite is similar to, but not necessarily related to, the granite at the STOP 10· Between here and Woodruff, roadcuts exhibit interlayered schists and gneisses. The porphyritic granite beneath Van Pattons Bridge may be a barely unroofed pluton.

4.0 STOP SIGN. TURN RIGHT onto State Route 146 and State Route 101.

0.2 MERGE with U. S. Highway 221 in the town of Woodruff·

0.8 STOPLIGHT. CONTINUE straight ahead on State Route 146 through Woodruff.

0,3 TAKE LEFT FORK on State Route 146 toward Cross Anchor.

0.2 TURN LEFT at stoplight on State Route 146 to Cross Anchor·

5.7 Large vermiculite pit (inactive) on left owned by W.R. Grace & Company.

6·8 Cross Anchor. TURN LEFT at blinker onto State Route 49. Rock types in road cuts change within one mile to biotite schists and amphibole gneisses; deeply weathered schists predominate·

4.7 Road cuts in thin amphibole schists and gneisses interlayered with biotite schists.

3.5 Vermiculite-bearing rock in road cut near south end of bridge·

0.3 Amphibolites at margin of Buffalo gabbro of Jack Medlin.

0.3 Entering Buffalo gabbroic pluton.

1.1 Leaving Buffalo gabbroic pluton.

0.6 Deep, dark road cuts in thoroughly weathered biotite-feldspar rock exceedingly rich in biotite. In the black and dark brown zones, much of the “biotite” is vermiculite. The rock has little foliation, despite the high biotite content and has no proper pigeonhole in standard rock classification schemes. A metasomatic phenomenon?

2.8 JUNCTION State Route 215 and U. S. Highway 176 bypass around Union. TURN LEFT (NW) onto bypass U. S. Highway 176 at stoplight. We have entered the Bald Rock coarse porphyry, the largest discrete granitic pluton(?) in South Carolina; Certain boundaries of this body are difficult to identify because of similarities with gneissic country rock,We travel continuously in this body to the next stop which is about in the middle of it.

1.5 STOPLIGHT. CONTINUE on U. S. Highway 176 bypass.

0.8 YIELD to merging traffic. CONTINUE north on U. S. Highway 176.

1.1 TURN RIGHT (E) onto County Road 4.

1.8 TURN RIGHT (E) onto County Road 57. Note the deep weathering in this area of the Bald Rock coarse porphyry. Variations in density of phenocryst population are reflected by soils which are deeply gullied. The rock commonly contains 10 to 12 percent biotite, which weathers to brassy golden vermiculite.

4.0 STOP at junction with State Route 9. TURN RIGHT (SE) onto State Route 9 WITH CAUTION.

0.8 TURN RIGHT onto dirt road and proceed across RR tracks.

0.3 Large oak tree on left. TURN RIGHT onto field road and drive to quarry.

0.2 **STOP 10.** Quarry opened in large pavement exposure of Bald Rock coarse porphyry. Please note the following: orientation of schlieren and inclusions; distribution and orientation of phenocrysts, zoning of phenocrysts; etc.

What is the origin of this rock? How is it related to such rocks as the gneisses of STOP 9? We are in an arm of the Charlotte belt that extends into the Kings Mountain belt. This arm principally consists of the Bald Rock pluton. Similar coarse porphyritic granitic plutons(?) occur to the northeast in York County (the Yorkville adamellite) and to the southeast in Laurens County. How are these rocks related to the Kings Mountain belt and to the high-rank gneisses with which they are primarily associated? Notice the sericitization along some joint faces on quarried blocks. How do the highly mineralized zones of eastern Cherokee County and the apparently metasonatic pods of vermiculite quarried in Laurens County fit into this scene? Some of these questions probably were first asked in the nineteenth century. They remain unanswered.

Despite the several large and easily accessible pavement exposures, ideally suited for quarrying, the Bald Rock coarse porphyry is not being appreciably utilized at present.

0.0 END OF TRIP. You can reach Lockhart and Chester from here by turning right (E) onto State Route 9. Take State Route 9 west to U. S. Highway 176 and Spartanburg.

Cheers!