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GUIDE TO THE GEOLOGY OF YORK COUNTY, SOUTH CAROLINA

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INTRODUCTION

York County is situated in the north-central Piedmont of South Carolina, adjacent to the North Carolina state line. It is especially interesting geologically because it straddles the Charlotte belt and extends into the Carolina slate belt to the east and into the Kings Mountain belt to the northwest. The field trip will be essentially a traverse from east to west, starting in the Lancaster County panhandle a few miles east of the York County line.

York County was mapped as a joint project of the S. C. Division of Geology and the York County Mineral Resources Commission. Field work was done mainly in 1962-63. A bulletin on geology and mineral resources of the county is in preparation.

REGIONAL GEOLOGY

Rocks of the Piedmont occur in belts that conform to the regional-northeasterly trend of major structural features. The belts are delineated by gross differences in rock types, grade of metamorphism, and structure. The concept of belts began with some of

the earliest geologic work in the Carolinas. King (1955) and Overstreet and Bell (1965) have recently summarized the geology of the belts in the Carolina Piedmont.

Rocks of the Carolina slate belt are mainly low rank metamorphic rocks of sedimentary and volcanic origin. The Charlotte belt includes medium- to high-rank metamorphic rocks and a complicated sequence of igneous intrusions. Major rock types of the Kings Mountain belt are phyllite, schist, gneiss, quartzite, conglomerate, and marble. The metamorphic grade ranges from medium to low.

CAROLINA SLATE BELT

A narrow extension of the Carolina slate belt underlies part of the Lancaster County-Panhandle and southeastern York County. The major rock types are phyllite and argillite. The phyllite has a prominent cleavage that is nearly vertical and trends northeast. The phyllite is probably formed from felsic to intermediate volcanic rocks and, in some cases, sedimentary rocks. Bedding in the argillite defines north-east-trending folds. Mineral assemblages near the center of the belt are typical of lower greenschist facies and metamorphic rank rises toward each flank. Transitional rocks occurring between the belts are so mapped because they have charac-

teristics of both belts and probably mark a metamorphic gradient. The transitional zone between the Charlotte belt and Carolina slate belt contains foliated granitic rocks, biotite gneiss, phyllite, and fine-grained amphibolite interlayered in a complex manner.

CHARLOTTE BELT

The oldest rocks of the Charlotte belt are mica schist, biotite gneiss, quartzite, and amphibolite. These rocks were invaded by a series of igneous intrusions ranging in composition from adamellite to gabbro. The early intrusions were metamorphosed at least once, because they have metamorphic cleavage, metamorphic textures, and cross-cutting mafic dikes which are also metamorphosed to amphibolite facies. Post-metamorphic intrusions form a series of discordant plutons of gabbro and adamellite (quartz monzonite). The adamellite is generally coarse-grained and porphyritic. The largest adamellite body in York County is the stock with an area of 23 square miles northwest of York. This is the type Yorkville granite. Adamellite exposures south of McConells are the north end of a very large intrusion lying mainly in Chester County. Three stocks southeast of Rock Hill are emplaced along the transitional zone and in the Carolina slate belt.

Gabbro in York County occurs in six intrusions. The Ogden pluton, which is the largest, has an area of 38 square miles and extends into Chester County. These intrusions are part of a chain of more than 20 gabbro bodies found in the Carolina Piedmont from Winston-Salem, North Carolina, to Calhoun Falls, South Carolina.

Rocks of the Charlotte belt are dominantly massive igneous or meta-igneous rocks, so cleavage and bedding are seldom observed. The few readings indicate northeast strikes and nearly vertical dips. The Nanny Mountain structure east of Clover apparently is a plunging fold of northeast trend.

Mineral assemblages of amphibolite facies are common in the Charlotte belt and sillimanite has been found in several places, so metamorphic rank is fairly high.

KINGS MOUNTAIN BELT

The Kings Mountain belt includes schist, phyllite, kyanite quartzite, meta-tonalite, and amphibolite. The largest zone of quartzite occurs at Henry Knob, where some lenses are as much as 100 feet thick. Phyllite and schist range in color from white to dark gray, and probably were derived

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from a variety of pre.-existing rocks. In Kings Mountain Park, phyllite contains outlines of clasts suggestive of volcanic breccia.

Schistose meta-tonalite is a distinctive rock type occurring mainly in the Kings Mountain belt. The rock is strongly foliated to nearly massive and commonly grades into phyllite. Mineral assemblages are characteristic of the upper greenschist facies. The Bessemer granite of Keith and Sterrett (1931) included all of the schistose meta-tonalite and some of the area mapped as phyllite and schist in the present survey.

REFERENCES CITED

Keith, A., and Sterrett, D. B., 1931, Gaffney-Kings Mountain Folio: U. S. Geol. Survey Folio No. 222. Geologic Atlas of the United States, 13 p.

King, P. B., 1955, A geologic section across the southern Appalachians: An outline of the geology in the segment in Tennessee, North Carolina, and South Carolina: in Guides to Southeastern Geology Guidebook for 1955 meeting of Geol. Soc. America, p. 332-373.

Overstreet, W. C., and Bell, Henry III, 1965, The crystalline rocks of South Carolina: U. S. Geol. Survey Bull. 1183, 126 p.

ROAD LOG

Saturday, October 23, 1965

MileageDistanceExplanation

0.01 0.0 Starting point: Town House Motel, 503 E. Main Street, Rock Hill, S. C. From the motel parking lot, go one block S on Spruce Street.

0.1 0.1 STOP SIGN, TURN LEFT on U.S. 21 S.

1.1 1.0 STOP SIGN, TURN LEFT and continue on U. S. 21 S.

1.7 0.6 BEAR RIGHT, continuing on U. S. 21 S.

6.5 4.8 TURN LEFT on S. C. 5.

6.8 0.3 Sharp right turn on S. C. 5.

10.2 3.4 Weathered phyllite in road cut is part of the Carolina slate belt.

10.5 0.3 On the left is the clay pit of Ashe Brick Co. in the upper terrace level of the Catawba River.

11.2 0.7 Catawba River bridge. Biotite gneiss crops out in River S of bridge. Road cuts on E side of the bridge are in saprolite of foliated granite, biotite schist, and minor amphibolite.

11.9 0.7 TURN LEFT on County Road 29-125,

12.6 0.7 STOP SIGN, continue ahead on 29-125.

13.3 0.7 STOP SIGN, continue ahead on 29-125. Village of Van Wyck and plant of Ashe Brick Co. are visible to the left.

14.5 1.2 Residual boulders of fine-grained amphibolite

in road cut.

16.4 1.9 Former home of the founders of the Belk stores, W. H. and J. M. Bell.

17.2 0.8 STOP SIGN, TURN LEFT on U. S. 521.

19.4 2.2 Twelve Mile Creek.

19.6 0.2 TURN RIGHT on County Road 29-161. White phyllite of the Carolina slate belt is exposed along road.

21.3 1.7 TURN LEFT on County Road 29-66.

22.2 0.9 **STOP 1:** Clay pit of Ashe Brick Co, of Van Wyck, S. C. Removal of material over several acres has exposed green to light gray slate and phyllite formed by regional metamorphism of laminated argillite and subordinate beds of coarser clastic rocks. Slaty cleavage is strongly developed and is nearly vertical with a strike of about N 60° E. Folds observed in the pit at various stages of excavation range in wave length from a few feet to less than an inch and generally plunge ENE at about 35°. Cleavage seems to parallel axial planes of the folds. Two Triassic (?) diabase dikes trend NW through the pit and show effects of thermal metamorphism on the surrounding rocks. The larger dike is about 50 feet thick. A thin section from the center of the dike has about 12% olivine.

On leaving this stop, continue westward on County Road 29-66.

23.2 4.0 STOP SIGN, TURN LEFT on U.S. 524.

27.4 4.2 TURN RIGHT on County Road 29-125 and retrace route through Van Wyck.

32.2 4.8 STOP SIGN, TURN RIGHT on S. C. 5.

34.0 1.8 TURN LEFT on County Road 46-697.

34.8 0.8 Bowaters paper mill.

36.3 4.5 TURN LEFT in Catawba onto a steep dirt road going up and over the railroad, and proceed to the Catawba railroad station.

36.4 0.1 **STOP 2:** Contact, of adamellite (quartz monzonite of the Catawba pluton with white sericite phyllite of the Carolina slate belt. A sharp contact is exposed in saprolite just west of the overpass of the Southern Railway across the Seaboard Air Line Railway. The biotite-muscovite adamellite shows some effect of chilling, as the average grain size is about one mm. at the contact and grades to an average size of three mm. about 10 feet away from the contact. There are no visible effects of contact metamorphism in the phyllite saprolite. The

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Catawba adamellite belongs to the post-tectonic group of intrusive rocks that are generally massive, coarse grained, and discordant.

Just west of the contact, a Triassic (?) diabase dike about 18 feet thick cuts the adamellite. The exposure is worthy of note because the main dike has several small subsidiary dikes less than one foot thick occurring in parallel position on both sides. After this stop, go back over the railroad and turn left on County Road 46-697.

- 37.0 0.6 TURN LEFT on County Road 46-162.
- 37.8 0.8 TRAFFIC LIGHT at intersection with U.S. 21, continue ahead on 46-162.
- 39.5 1.7 STOP SIGN, turn right on County Road 46-161. For the next 2.4 miles the route crosses another post-tectonic, adamellite intrusion of the same type as the Catawba pluton but considerably larger.
- 41.3 1.8 STOP SIGN, turn right on County Road 46-31.
- 42.5 1.2 TURN LEFT on County Road 46-730.
- 43.4 .0.9 **STOP 3:** Eastern contact of gabbro of the South Rock Hill pluton with older rocks of the Charlotte belt. There is a distinct change in topography and soils at the contact. The terrain underlain by gabbro is lower and flatter, with poorly drained, dark brown soils. In contrast, the terrain east of the contact is gently rolling and soils are red and well drained. A low escarpment such as the one at this locality is present around most of the pluton. Gabbro is present at the bottom of the slope and the country rocks show effects of contact metamorphism or at least 200 yards from the contact. A fine-grained black hypersthene-plagioclase hornfels has been formed near the contact, probably from amphibolite layers in the country rock. Along the southern contact of the pluton, pyroxene hornfels and garnet-epidote-clinopyroxene skarn are found.
Continue: west on County Road 46-730.
- 44.1 0.7 STOP SIGN, TURN RIGHT on County Road 46-245.
- 44.6 0.5 TURN RIGHT on un-numbered dirt road.
- 44.7 0.1 **STOP 4:** (Lunch Stop) Quasi-quarry in anorthositic gabbro of the South Rock Hill pluton. The excavations at this locality were made during an unsuccessful attempt to open a quarry in 1964. There are numerous residual boulders in this area and one large series of

boulders (locally called Big Rock) stand about 20 feet high. The rock is 90-95% calcic plagioclase. Dark minerals are mainly olivine, augite, and hypersthene. Some of the rock contains 95% plagioclase and 4% olivine, so it would be more properly called an olivine anorthosite or a troctolite. The rock has a planar structure defined by arrangement of the dark minerals. This structure strikes N to NE and dips steeply toward the W. At the Rock Hill city dump, 1.5 miles NW of this locality, similar structure and well defined layering strike NW and dip steeply to the S. At both localities, the structure is nearly parallel to the margins of the gabbro and steeply dipping toward the center; therefore, the pluton may be funnel shaped.

- On leaving the quarry, turn left (S) on 46-245
- 46.0 1.3 TURN RIGHT on County Road 46-714.
- 47.7 1.7 STOP SIGN, TURN LEFT on SC 901.
- 47.8 0.1 TURN RIGHT on County Road 46-724 just S of Mt. Holly Church.
- 49.8 2.0 STOP SIGN, continue W on 46-724.
- 51.4 1.6 STOP SIGN, TURN RIGHT on County Road 46-655.
- 51.7 0.3 STOP SIGN, TURN LEFT on County Road 46-739. Contact of Ogden gabbro pluton is just W of intersection.
- 54.8 3.1 STOP SIGN, continue across SC-72 onto County Road 46-82.
- 56.1 1.3 Large quartz vein cutting gabbro.
- 56.9 0.8 **STOP 5:** Olivine gabbro residual boulders of the Ogden pluton. This locality is in the south-central part of the Ogden pluton, which has an area of about 38 square miles. Residual boulders here are typical examples of gabbro in a belt of more than 20 known intrusions in the Carolina Piedmont. The gabbro is composed of plagioclase, olivine, augite, hypersthene, brown hornblende, and small amounts of biotite. Olivine is commonly rimmed by other dark minerals in the sequence predicted by Bowen's Reaction Series. The knotty appearance of some weathered surfaces is apparently caused by scattered poikilitic crystals of augite. Continue westward on County Road 46-82.
- 63.5 6.6 STOP SIGN, continue westward on SC-322.
- 63.8 0.3 STOP SIGN, TURN LEFT on US-321.
- 63.9 0.1 TURN RIGHT on SC-322.
- 70.8 6.9 **STOP 6:** Sapolite of mete-diorite and meta-

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tonalite in the Charlotte Belt country rock. Park just west of Turkey Creek bridge. The saprolite here is typical of the coarse, massive meta-diorite of the pre-metamorphic sequence of igneous intrusions. The saprolite is cut by chlorite-rich zones, quartz veins, and small diabase dikes. There has been faulting along some of the chlorite-rich zones.

Turn around and return eastward on SC-322.

72.5 1.3 TURN RIGHT on County Road 46-59.

72.7 0.2 **STOP 7:** Outcrop of coarse-grained meta-tonalite. Coarse meta-tonalite makes up most of the outcrop, but there is considerable variation in the rock. Main minerals are plagioclase, quartz, hornblende, biotite, and epidote. The plagioclase commonly occurs in large zoned crystals. The meta-tonalite grades into more mafic rocks containing the same mineral types, but with smaller grain size and higher proportions of dark minerals.

To return to Rock Hill, go back to the intersection with SC-322, turn right and follow SC-322 into Rock Hill.

ROAD LOG

Sunday, October 24, 1965

MileageDistanceExplanation

0.0 0.0 Starting point: Town House Motel. TURN RIGHT on U.S. 21.

0.4 0.4 TURN RIGHT, continue on U.S. 21 N.

1.5 1.1 Winthrop College, state college for women.

1.9 0.4 Traffic light, junction of U.S. 21 and S.C. 274. STRAIGHT AHEAD on S. C. 274.

2.1 0.2 TURN LEFT on S.C. 274.

5.4 3.3 Intersection With S.C. 161, continue on S.C. 274.

7.7 2.3 TURN RIGHT on S. C. 274.

3.4 5.7 Ferguson's store. On the left is Nanny Mountain, a quartzite ridge on the east limb of a large fold.

15.2 1.8 Intersection of S. C. 274, S.C. 55, and S.C. 5. TURN LEFT on S.C. 55.

17.4 2.2 Outcrops of phyllite and sericite quartzite on the west limb of the Nannys Mountain fold.

21.8 4.4 TURN RIGHT on County Road 46-422.

23.7 1.9 TURN LEFT on unnumbered gravel road into quarry.

23.9 0.2 **STOP 8:** Shepherd quarry in porphyritic biotite adamellite (quartz monzonite) of the Clover pluton. The quarry was opened to provide road metal for U.S. 321 N of Clover in 1961-1962. The microcline phenocrysts are as much as 4 1/2 inches long and long axes of the phenocrysts generally have parallel alignment in the direction N 35° E. Biotite schlieren have an orientation of N 35° E, 33° SE. The rock is cut by granite and aplite dikes trending northwest.

On leaving quarry turn right (S) on County Road 46-422.

25.9 2.0 STOP SIGN, TURN RIGHT On SC-55.

27.2 1.3 Town of Clover, continue ahead on SC-55.

31.1 3.9 TURN RIGHT on road to Henry Knob kyanite pit

31.2 0.1 **STOP 9:** Henry Knob kyanite mine, operated by Commercialores, Inc. Kyanite at Henry Knob was discovered more than 100 years ago and has been mined continuously since 1948. The kyanite ore occurs mainly in somewhat irregular layers and lenses of quartzite in silvery white "fish-scale" sericite schist. The bodies strike about N 35° E and are nearly vertical. The map by Espenshade and Potter (1960, Plate 10) shows that the main ore bodies are two long lenses of kyanite quartzite up to 100 feet thick arranged in echelon. Considerable pyrite occurs in the ore and is recovered as a by-product. The two theories of origin are: (1) Action of hydrothermal solutions on quartzite (Smith and Newcome, 1951), and (2) Metamorphism of clay-rich sands and silts (Espenshade and Potter, 1960). After leaving Stop 9, turn right (W) on SC-55,

33.0 1.8 STOP SIGN, DANGEROUS INTERSECTION with SC-161. Continue westward on SC-55.

35.5 2.5 TURN LEFT on County Road 46-40.

38.1 2.6 STOP SIGN at intersection with SC-5, TURN RIGHT on SC-5.

39.1 1.0 BEAR LEFT on County Road 46-11. CAUTION: POOR VISIBILITY OF ONCOMING TRAFFIC.

39.3 0.2 Exposures of foliated metatonalite and amphibolite cut by diabase dike 15 feet thick.

41.2 1.9 STOP SIGN at intersection with SC-97. Proceed on SC,97 through hamlet of Smyrna.

41.5 0.3 STRAIGHT AHEAD on County Road 46-233;

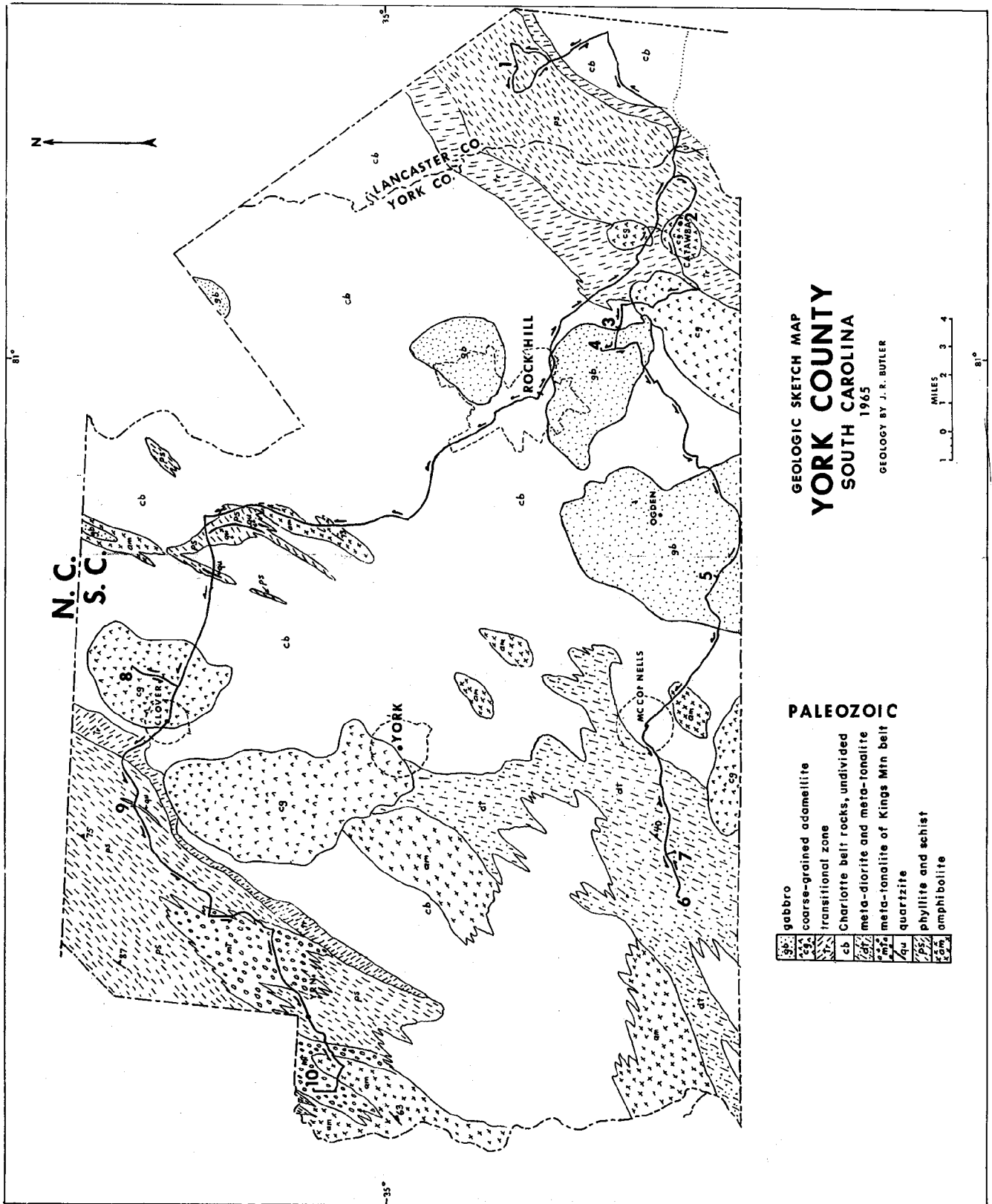
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SC-97 curves to right.

- 41.7 0.2 Field on left is reported to be the locality where the Sheepshead Nugget, a 27-pound gold-quartz specimen, was found.
- 43.8 2.1 TURN RIGHT on County Road 46-821 at Broad River Church.
- 44.7 0.9 STOP SIGN at intersection, TURN RIGHT on County Road 46-816.
- 45.5 0.8 **STOP 10:** Dixie-Carolina #1 Shaft at the old Carroll-Ross mine. There are more than 30 gold mines and prospects within a five-mile radius of this locality, and a few have substantial recorded production. The Southern Gold mine, one mile to the northeast, produced more than \$130,000 in gold (Minerals Yearbook, 1960, v. 3, p. 917). Gold production has been from a series of northeast-trending quartz veins. Mining on the Carroll-Ross property has been intermittent since the initial workings in the late 1800's. Workings on the property follow several parallel veins which are up to 5 feet thick. Cubes and irregular masses of pyrite occur in the quartz veins. Gold occurs in the native state and in combination with pyrite. The country rock is mainly foliated metatonalite (Bessemer granite of Keith). It is schistose and is composed of feldspar, quartz, sericite, chlorite, biotite, calcite, and opaque minerals. Locally the rock grades into sericite-rich phyllite. Along Wolf Creek, 0.4 mile N of the Dixie-Carolina shaft, the operators have built a small mill with an estimated capacity of 50 tons per day. The mill is intended to produce a pyrite-gold concentrate from ore mined on the Carroll-Ross and adjacent properties. Below the mill there are good exposures in Wolf Creek of fine-grained biotite schist (Roan gneiss of Keith). The schist is mainly composed of biotite, quartz, epidote, hornblende, and chlorite. A prominent cleavage has the orientation N 5° E, 47° SE. Farther to the west in the bed of Kings Creek, amphibolite (more typical of what Keith called Roan gneiss) crop out.

END OF FIELD TRIP. For connections north and west, continue ahead on 46-816 to Blacksburg, follow SC-5 (N) to Interstate 85.

For connections south and east, retrace route through Smyrna to SC-5 and thence to York.



GEOLOGIC SKETCH MAP
YORK COUNTY
 SOUTH CAROLINA
 1965
 GEOLOGY BY J. R. BUTLER

PALEOZOIC

- gabro
- coarse-grained adamellite
- transitional zone
- Charlotte belt rocks, undivided
- meta-diorite and meta-tonalite
- meta-tonalite of Kings Mtn belt
- quartzite
- phyllite and schist
- amphibolite