SOUTHEASTERN GEOLOGICAL SOCIETY

ELEVENTH
FIELD TRIP

GEORGIA
CRETACEOUS
AND
CRYSTALLINES

OCTOBER 22-23, 1965
SOUTHEASTERN GEOLOGICAL SOCIETY

11th Field Trip

Guidebook

Some highlights of the Cretaceous and crystalline terranes of Georgia

October 22 and 23, 1965

by

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and

Willard Huntington Grant

Emory University

Atlanta, Georgia

Printed at Emory University
Atlanta, Georgia

for

Southeastern Geological Society
Tallahassee, Florida
SOUTHEASTERN GEOLOGICAL SOCIETY

TALLAHASSEE, FLORIDA

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" " 8 Carbonate Deposits of South Florida. October 1954
" " 9 Late Cenozoic Stratigraphy and Sedimentation of Central Florida. 1960
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Mesozoic Cross-Sections (four charts) for Florida, Southern Georgia and Southeastern Alabama, 1949.
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SOUTHEASTERN GEOLOGICAL SOCIETY

Tallahassee, Florida

presents its

11th Field Trip

Highlights of the Cretaceous and crystalline terranes
of Georgia

Assembly: Tallahassee, Geology Building, Florida State University
Leave: 8:00 a.m., Friday, October 22, 1965
Arrive: Lumpkin, Georgia, 10:00 a.m. Start of scheduled trip
Lunch: Welcome Station, Columbus, Georgia, 12:30 p.m.
Leave: Columbus, Georgia, 1:15 p.m.
Arrive: Woodbury, Georgia, 4:00 p.m.
Arrive: Decatur, Georgia, Candler Hotel, 6:00 p.m.
Dinner: Dining Room, Candler Hotel, 8:00 p.m.
Lecture: Dr. Vernon J. Hurst, University of Georgia, Athens, Ga.
"Field application of experimental petrology"
Leave: Decatur, Georgia, 8:00 a.m., Saturday, October 23, 1965
Lunch: Lithonia, Georgia, 12:00 p.m.
Leave: Lithonia, Georgia, when prepared.
FIGURE 1    MAP OF GEORGIA SHOWING THE PHYSIOGRAPHIC PROVINCES AND SOME CITIES
PART I

Highlights of the Cretaceous terrane of the Coastal Plain, south of Columbus, Georgia

(a) Survey of the exposed Cretaceous rocks of the Coastal Plain of Georgia

(b) Generalized columnar section of the Cretaceous rocks south of Columbus, Georgia (after Eargle, 1955)

(c) Geological map of the Cretaceous rocks south of Columbus, Georgia, showing the field trip route

(d) Itinerary I; Road log from Lumpkin, Georgia to Columbus, Georgia
SURVEY OF THE EXPOSED CRETACEOUS ROCKS OF THE
COASTAL PLAIN OF GEORGIA

Introduction

Much of the data in this survey comes from Eargle (1955), Cooke (1943), and Veatch and Stephenson (1911). This area was also included in the 2d field trip of the Southeastern Geological Society (1944) and in an unpublished road log of a field trip conducted by S. M. Herrick (1956). These may be consulted for more detail.

Cretaceous rocks in Georgia were recognized early by Lyell, in 1849. Since this time, because of the potential mineral wealth and because of their geographic location, these rocks have been subject to much study. These rocks are exposed in a thin band along the Fall Line in Georgia; they are partly overlapped toward the east, and toward the west, where the Chattahoochee River has eroded them, the outcrop band is very wide, as much as 40 miles in some places. The route of the field trip will pass through the wide outcrop band, roughly paralleling the Chattahoochee River.

Down dip, in the subsurface, the Cretaceous System is generally identified only as Tuscaloosa Formation and "post-Tuscaloosa undifferentiated." Much of these rocks are exposed up dip.

One of the most striking features of the Cretaceous rocks of Georgia is the alternation of marine and non-marine (or at least deltaic) sediments. The marine units thicken down dip and the non-marine units correspondingly become thinner, whereas up dip, the marine units thin and the non-marine units become
thicker and generally merge into one great unit generally mapped as "post-
Tuscaloosa undifferentiated" also.

Toward the east, the marine units become very thin also, and even are
lost, due both to sedimentary thinning and erosion. East of the Flint River, only
one marine unit can be certainly recognized; this is the Ripley, and it is very thin.

Westward, into Alabama, more marine rocks become evident and the
amount of non-marine rocks correspondingly becomes less abundant.

It is evident, then, that the Cretaceous exposures in Georgia represent
the deposits of a fluctuating strand line during the Upper Cretaceous and this area
is critical for correlation purposes. These rocks are the easternmost exposures
of the Gulf Coast Cretaceous; the Cretaceous rocks of the Atlantic Coast area are
different.

**Tuscaloosa Formation**

The Tuscaloosa Formation, the lowest unit in the section, lies immediately
on top of the crystalline rocks of the Piedmont, in some places with considerable
relief. Its thickness varies, due in part to irregular surface on which it lies and
in part to the erosion which followed its deposition in some places. Also, since it
is probably non-marine in origin, many intraformational unconformities are present.
The average thickness is a little over 250 feet.

Lithologically it is very complex. It is entirely clastic, with much gravel,
sand, arkose, silt, and clay being present in varying amounts and mixtures.
Locally kaolin is present; this kaolin occurs in commercial quantities toward the
east. The various members of the formation are not clearly recognized in this
area. No fossils are known save some plants identified by Berry (1923) as Upper Cretaceous. Halymenites borings are present locally.

Eutaw Formation

This unit overlies the Tuscaloosa Formation disconformably updip and perhaps conformably downdip; the exposures are generally very poor. The thickness varies, but in the field trip area it is about 125 feet.

Lithologically it is predominantly a marine, argillaceous sand and sandy shale, gray to dark gray in color, and locally fossiliferous. There is a coarse basal sand resting unconformably on the Tuscaloosa which in turn is overlain by the marine sand and shale. The basal sand increases in thickness eastward and the overlying shale correspondingly becomes thinner until it disappears altogether.

Paleontologically, the Eutaw Formation is distinct. The basal sand contains many *Halymenites* borings and the shale contains a marine fauna, mostly molluscs. Among the more common fossils are:

- *Ostrea cretacea* Morton
- *Exogyra upatoiensis* Stephenson
- *Anomia argentaria* Morton
- *Placenticeras benningi* Stephenson

Herrick (1956) calls attention to an ostracode fauna, but no Foraminifera are reported.

The Eutaw Formation, being marine, certainly represents overlap after the Tuscaloosa Formation was deposited.

Blufftown Formation

The Blufftown Formation gradationally overlies the Eutaw Formation. The Blufftown can easily be divided into two units, a lower sand, about 150 feet
thick, and an upper marine, shaly sand, about 250 feet thick. The basal sand is very coarse grained and cross bedded. In some places, calcareous nodules occur near the top, but the sand is unfossiliferous.

Marine argillaceous sand and clay occur above the sand. This unit is darker colored than the lower sand and is abundantly fossiliferous. Over 70 species of macrofossils, mostly molluscs, are known from the type section (nearby), and Herrick (1956) lists 34 species of Foraminifera from the formation, mostly from the type section.

The basal sand unit is interpreted as a terrestrial deposit resulting from offlap following the deposition of the Eutaw Formation. The lack of unconformity suggests an increase in the sand influx into the area rather than marine withdrawal. The micaceous sandy marine unit then represents another onlap.

Cusseta Sand

The Cusseta Sand gradationally overlies the marine Blufftown Formation and in places the two actually are intercalated. The Cusseta is over 180 feet thick, but its thickness is difficult to determine because of the poor exposures. Downdip it merges lithologically with the overlying and underlying formations and is difficult to distinguish.

The sand is very coarse, as a rule, with silt and shale beds locally interbedded. It contains plant remains, and locally is a fine source of petrified wood for the local rockhounds. The sand is very strongly crossbedded in some places and is generally considered to be of terrestrial origin.
Ripley Formation

The Ripley Formation conformably overlies the Cusseta Sand, and down dip it is difficult to distinguish the two. Exposures are so poor in the outcrop that contacts are difficult to locate. Its thickness is about 135 feet.

The Ripley is characterized by fine marine sand, generally massive, micaceous, calcareous, and highly fossiliferous. Over 100 species of macrofossils are known, mostly molluscs, and many Foraminifera. Some of the common macrofossils are:

Exogyra costata Say
Ostrea subspatulata Forbes
Anomia argentaria Morton
Ostrea tecticosta Gabb

The marine Ripley represents a marine onlap over the Cusseta Sand.

Providence Sand

The Providence Sand unconformably overlies the Ripley Formation. It is about 180 feet thick, although the thickness varies because of the post-Providence erosion and the terrestrial nature of the unit.

The lower part of the formation is fine sand and clay, but the upper part is very coarse sand which is very cross bedded, kaolinitic, and varicolored locally. These leave little question of its deltaic or terrestrial origin. Locally, thin tongues of marine rocks are known, and down dip, in the area now covered by the backwater of the Walter George Dam, a marine facies is present.

Foraminifera and ostracodes are reported by Herrick (1956), and a large macrofauna is known, mostly molluscs, but all of which are in rocks which are no
longer exposed.

These units are shown in their proper perspective in Figure 3. The alternating coarse sand-fine marine sand cycles are very evident here and it is easy to make the case for the fluctuating strand line.
<table>
<thead>
<tr>
<th>TERTIARY</th>
<th>Various formations with various lithologies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROVIDENCE SAND</td>
<td>Very coarse, multicolored cross-bedded sand at the top; finer grained toward the bottom. Locally kaolinitic</td>
</tr>
<tr>
<td>165</td>
<td></td>
</tr>
<tr>
<td>RIPLEY FORMATION</td>
<td>Fine, micaceous, fossiliferous marine sand; locally calcareous</td>
</tr>
<tr>
<td>135</td>
<td></td>
</tr>
<tr>
<td>CUSSETA SAND</td>
<td>Coarse to fine sand; terrestrial fossils; locally kaolinitic</td>
</tr>
<tr>
<td>180</td>
<td></td>
</tr>
<tr>
<td>BLUFFTOWN FORMATION</td>
<td>Upper part fine, micaceous, fossiliferous marine sand; locally calcareous</td>
</tr>
<tr>
<td>410</td>
<td>Lower part coarse, cross-bedded sand</td>
</tr>
<tr>
<td>EUTAW FORMATION</td>
<td>Upper part marine, fossiliferous clay</td>
</tr>
<tr>
<td>130</td>
<td>Lower part coarse to fine crossbedded sand; locally shale and sand</td>
</tr>
<tr>
<td>TUSCALOOSA FORMATION</td>
<td>Much variation, but largely coarse, cross-bedded sand; locally kaolinitic</td>
</tr>
<tr>
<td>260</td>
<td></td>
</tr>
<tr>
<td>PRE-CRETACEOUS</td>
<td>Various lithologies, entirely crystalline</td>
</tr>
</tbody>
</table>

**FIGURE 3** GENERALIZED COLUMNS SECTION OF CRETACEOUS ROCKS SOUTH OF COLUMBUS
FIGURE 2  GEOLOGIC MAP OF THE CRETACEOUS ROCKS SOUTH OF COLUMBUS, GEORGIA, SHOWING THE ROUTE OF THE FIELD TRIP
ITINERARY I

Road log from Lumpkin, Georgia, northward to Columbus, Georgia

<table>
<thead>
<tr>
<th>Mileage</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Cross road, U.S. 27 and Ga. 27 in Lumpkin, Stewart County, Georgia; proceed northward on U.S. 27</td>
</tr>
<tr>
<td>0.2</td>
<td>Road to the left leads to the Providence Canyons; note the historical marker; continue on U.S. 27</td>
</tr>
<tr>
<td>0.5</td>
<td>Railroad passes under the road; the cut is in the Cretaceous Providence Sand</td>
</tr>
<tr>
<td>1.1</td>
<td>Tertiary Clayton Formation contact with the underlying Providence Sand; the Clayton is deep red here; iron ore is often concentrated at the contact.</td>
</tr>
<tr>
<td>3.5</td>
<td>STOP 1. Ripley Formation. The Ripley is underlying the Providence Sand here. This is a characteristic exposure of the Ripley as it seldom occurs in outcrop. The micaceous sand is very fossiliferous, oysters being the most common. Various other types of molluscs occur in the hard, thin, calcareous beds near the base. A microfauna occurs below the calcareous beds. Some of the characteristic macrofossils in this exposure are: Exogyra costata Say Ostrea tecticosta Gabb Ostrea plumosa Morton Anomia argentina Morton Ostrea subspatulata Forbes fish parts, mostly shark</td>
</tr>
<tr>
<td></td>
<td>continue on U.S. 27</td>
</tr>
<tr>
<td>4.2</td>
<td>Cusseta Sand exposures from here to Cusseta City, with one place in the creek bed near Louvale where the underlying Bluffton Formation is exposed.</td>
</tr>
<tr>
<td>19.2</td>
<td>Cusseta City center; turn left at the traffic light; stay on U.S. 27</td>
</tr>
<tr>
<td>20.3</td>
<td>Southern boundary of Fort Benning Military Reservation</td>
</tr>
<tr>
<td>20.8</td>
<td>Intersection with Ga. 26; stay on U.S. 27</td>
</tr>
</tbody>
</table>
21.5 STOP 2. Blufftown Formation. BE CAREFUL OF THE FAST TRAFFIC, PLEASE! The large excavation on the west side of the road exposes admirably the Blufftown-Cusseta contact; the two are clearly conformable. Two distinct oyster beds are evident, with a more varied marine fauna occurring in and below the calcareous, nodular zone near the base. The most obvious macrofossils are:

<table>
<thead>
<tr>
<th>Exogyra ponderosa</th>
<th>Roemer</th>
<th>Corbula oxynema</th>
<th>Morton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anomia argentaria</td>
<td>Morton</td>
<td></td>
<td>fish parts, mostly shark</td>
</tr>
</tbody>
</table>

continue on U.S. 27

25.3 Lower sandstone unit of the Blufftown Formation on the left

28.9 Upatoi Creek Bridge. The Eutaw Formation is exposed in this creek valley and for a short distance along the road to the south, but exposures in general are very poor; fossils can be collected in the bluffs of the creek, but permission from the Provost of the Fort is needed to get off the roads.

31.0 Columbus City Limits; stay on U.S. 27

35.6 STOP 3. Lunch in the Welcome Station across the road; PLEASE BE CAREFUL IN CROSSING; THE TRAFFIC IS HEAVY!

The exposures here are of the Quaternary Sand of the Chattahoochee River. These terrace sands are often difficult to distinguish from the sands of the underlying, flat-lying Tuscaloosa Formation, and great care is needed in mapping.
PART II

Highlights of the crystalline terrane between

Columbus and Woodbury, Georgia

(a) Survey of the metamorphic rocks northeast of Columbus, Georgia.

(b) Cross section of Pine Mountain showing the origin of the Warm Springs.

(c) Generalized geological map of the area northeast of Columbus, Georgia, showing the route of the field trip.

(d) Itinerary II; Road log from Columbus to Woodbury, Georgia.
SURVEY OF THE METAMORPHIC ROCKS BETWEEN COLUMBUS AND WOODBURY, GEORGIA

Introduction

The data for this survey comes largely from Hewett and Crickmay (1937) and Crickmay (1952). The accompanying geological map, fig. 4, is generalized from the Geological Map of Georgia, published in 1939.

Three zones, or belts of metamorphic rocks occur in the area of the field trip between Columbus and Woodbury, Georgia. The three belts are separated one from another by two large, east-west trending faults. The northern belt (locally called the Central Piedmont) is separated from the middle belt (locally called Pine Mountain) by the Towaliga Fault. Pine Mountain is separated from the southern belt by the Goat Rock Fault. The southern belt ends where the rocks are overlapped by Coastal Plain sedimentary rocks; the northern belt continues northward to at least Atlanta.

Weathering

The most obvious feature that Coastal Plain geologists will notice about the Piedmont region is the deep weathering. While the weathering on the Coastal Plain is every bit as, if not more, severe, the rock types are different and the results are not so obvious. The deep red clay is residual and is derived from the biotite gneisses. The iron which produces the color comes from ferro-agnesian minerals but is much enriched by subsequent soil-forming processes. The various feldspars are converted to clays, halloysite and kaolinite being quite common. Notice, however, that the nature of the rocks can still be determined, even though the rock is decomposed. Friable, weathered rock material, which
still retains the structure and texture of the original rock is called saprolite, and can be used in geologic mapping. The depth of weathering varies with topography and lithology from surface rock exposures to depths of many tens of feet.

Coastal Plain geologists should profit from a knowledge of the weathering of these rocks, as this is the provenance for much of the material which is seen in well logs.

Rocks south of the Goat Rock Fault

On the state geological map, the rocks of this area are shown as dij, or diorite injection gneiss in the area of the trip; biotite gneiss and schist are also present in this belt, some being injected, but the schists will not be encountered on the trip. Very little data about the rocks in this area is known. The thickness is not known, and the deep weathering, complex structure, and thick vegetation conspire against all but the most ardent field geologists.

The one exposure seen will be in very hard granitic-injected biotite gneiss; it was selected, not necessarily because it is typical, but because it is fresh, relatively unweathered rock.

Rocks of Pine Mountain

The Pine Mountain is described in detail by Hewett and Crickmay (1937) in their report on the Warm Springs of Georgia which are nearby. This area, between two faults, is characterized by schists and interlayered quartzite with some gneiss and granite.

Sparks Schist

This unit is composed largely of mica schist, with some biotite gneiss
and quartzite also present; thin injections of granite are also known. The thickness is unknown, as the base of the formation is nowhere exposed, but inasmuch as it underlies such a large area, it must be very thick. Mica schist, with some sandy beds, and some yellowish amphibolitic (?) beds are exposed at the one stop we make. The evidence of sedimentary origin is very strong here. The metamorphic grade is kyanite muscovite subfacies.

Hollis Quartzite

This quartzite overlies the Sparks Schist and averages about 350 feet in thickness, although locally it varies up to 800 feet. The lower and upper parts are thinly bedded and micaceous, whereas the center portion is massive and dense. Warm Springs, Georgia, have their origin in this lithologic variation in part (see fig. 5). The rock is highly siliceous, but it does contain muscovite and feldspar locally. The upper portion, when weathered, becomes itacolumnite, or flexible sandstone.

Adams (1959) studied the grain-size distribution in the quartzite toward the east, in Lamar County, and came to the conclusion that his data could be explained by an ancient river channel.

Manchester Schist

This mica schist and biotite gneiss overlies the Hollis Quartzite, but its thickness is unknown because the top is nowhere exposed. It resembles the Sparks Schist save for the igneous intrusions known in the Sparks. The Manchester Schist also contains intercalated quartzites which resemble very much the Hollis, and mapping requires careful attention and caution. On the state map the Sparks and Manchester Schists are not distinguished.
Rocks north of the Tonaliga Fault

The area north of the fault is underlain by a great variety of rocks, of which biotite-plagioclase gneiss and muscovite-biotite schist are the most important. The schists often contain sillimanite and garnet, and less commonly, graphite. Amphibolites of various kinds are intercalated with the giotite-plagioclase gneisses.

Structural geology of the region

Much folding is evident within the Pine Mountain area and also within the areas both north and south of the Tonaliga and Goat Rock Faults respectively. The rocks to the north and south of Pine Mountain have not been described in detail in print.

The Goat Rock Fault

The Goat Rock Fault is generally recognized by lithologic discontinuities and by zones of mylonite. It is generally recognized by a zone of increased deformation also. The state map has it as a thrust fault, with the southern side up.

The Tonaliga Fault

The Tonaliga Fault, north of Pine Mountain, is generally indicated by lithologic discontinuities, zones of mylonite, and increased deformation, just as is the Goat Rock Fault. In some areas, the mylonite zones form resistant ridges, although in the area of the trip, no ridges are evident. The state map shows the Tonaliga Fault is to be a thrust fault with the northern side up, but detailed mapping farther east suggests that as many as three distinct movement directions have occurred.

Age of the rocks

The age of the rocks and the metamorphism is most certainly pre-Cretaceous. The state map considers them pre-Cambrian, but there is no clear evidence. Adams (1930) suggests that they are Paleozoic.
FIGURE 5  CROSS SECTION OF PINE MOUNTAIN  
SHOWING ORIGIN OF WARM SPRINGS

According to Hewett and Crick-ay (1937), meteoric water enters the lower, porous portion of the quartzite in the higher elevations of Pine Mountain and, because of the hydraulic head which develops, moves downward, trapped between two impermeable units, the gneiss and the middle portion of the quartzite which is dense. The water is heated by the natural thermal gradient of the region, and, upon encountering the Towaliga Fault zone, can enter into the upper porous portion of the quartzite. Still confined between two impermeable units (the schist is dense and impermeable), the water proceeds upward under artesian pressure and escapes at the surface. The temperature is 88 degrees at the surface.
FIGURE 4 GENERALIZED GEOLOGICAL MAP OF THE AREA NORTHEAST OF COLUMBUS, GEORGIA, SHOWING THE ROUTE OF THE FIELD TRIP
ITINERARY II

Road log from Columbus, Georgia northeastward to Woodbury, Georgia

<table>
<thead>
<tr>
<th>Mileage</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.6</td>
<td>STOP 3. Lunch in the Welcome Station across the road; PLEASE BE CAREFUL IN CROSSING: THE TRAFFIC IS HEAVY!</td>
</tr>
<tr>
<td></td>
<td>continue northward on U.S. 27</td>
</tr>
<tr>
<td>44.3</td>
<td>Railroad overpass</td>
</tr>
<tr>
<td>46.9</td>
<td>Junction U.S. 80, U.S. 27 Alt. and Ga. 85; stay on U.S. 27 Alt. and Ga. 85</td>
</tr>
<tr>
<td>48.2</td>
<td>CRYSTALLINE ROCKS! Quartz veins occur in the mottled red clay. This is the first good exposure of the Piedmont material along the road on the route of the trip. Note the gravel on the surface across the road.</td>
</tr>
<tr>
<td>53.5</td>
<td>STOP 4. Biotite injection gneiss exposure here is a very good one; in general, the weathering is very keep and only red clay remains. This is a biotite-quartz-feldspar gneiss, with granitic intrusions; some garnet and epidote is also present. On the state map this is part of the diorite injection gneiss unit.</td>
</tr>
<tr>
<td></td>
<td>continue on U.S. 27 Alt. and Ga. 85</td>
</tr>
<tr>
<td>54.4</td>
<td>Divided highway ends</td>
</tr>
<tr>
<td>60.3</td>
<td>City of Waverly Hall</td>
</tr>
<tr>
<td>62.0</td>
<td>This is the vicinity of the Goat Rock Fault; the evidence is not well exposed at this area and nothing is to be seen. North of here the route passes into Pine Mountain.</td>
</tr>
</tbody>
</table>

21
Mileage | Discussion
--- | ---
68.0 | Junction U.S. 27 Alt. and Ga. 85E and 85W
STOP 5. Sparks Schist. This fine exposure of what is locally mapped as the Sparks Schist (but not distinguished on the field trip map) shows the various types of schist and the evidence for sedimentary origin. It is largely a muscovite schist with many sandy zones; feldspar and some heavy minerals are also present. Note the yellowish layers and the lens-like layers; this is amphibolitic. The black stains are likely to be hydrated MnO.
continue on U.S. 27 Alt. and Ga. 85 E

74.1 | Junction U.S. 27 Alt., Ga. 85 E, and Ga. 41; turn left on Ga. 85 E and Ga. 41.

74.4 | Manchester City limits

74.5 | STOP 6 (optional). This is a fine exposure of the base of the Hollis Quartzite which overlies the Sparks Schist. There is no good parking spot here; the only one is on the east side of the road just short of the top of the hill.
continue on Ga. 85 E through Manchester.
The route passes through the Manchester Schist which is difficult to distinguish from the Sparks Schist; they are often mapped together with the Hollis Quartzite (and some other quartzites also) intercalated.

82.4 | STOP 7. Gravel overlying deeply weathered mica schist and gneiss. Note the scour and fill nature of the deposit, as well as the size and angularity of the quartzite boulders. Most of the boulders are deeply weathered, suggesting an old age for the deposit. This could be interpreted, however, as a Coastal Plain interliner, Tertiary terrestrial deposits, or, less likely, relatively recent alluvium. Deposits of this sort and at this elevation are scattered about, but few are extensive.
continue on Ga. 85 E

83.6 | Bridge; mica schist in the road cuts along here.
**Discussion**

84.0 STOP 8. Towaliga Fault zone. Here is a slightly graphitic sillimanite schist which may have been derived from an aluminous shale. It is highly foliated, and almost mylonite near the southern end of the exposure. The deformation is very intense as the fault is approached and the lineations become pronounced. This fault is south of the exposure, but north of the bridge, as the mica schist there is not as deformed. This fault is often occupied by a mylonitic quartz, especially farther to the east, and the surface expression is often as a series of ridges formed by the resistant mylonite.

85.4 WOODBURY, GEORGIA, Junction Ga. 85 E and 85 W; and Ga. 18 end the first day of the trip!

There are several ways to get to Decatur from here.

(1) continue northward on Ga. 85 to its junction with I-75 just south of Atlanta; continue northward on I-75 into Atlanta and continue to the Junction of I-20 in the city; turn east (right) on I-20 toward Augusta. Careful! This is a hard one to get into; there is only one pass, then you go way out of the way to get back; continue on I-20 to the junction of Ga. 155; turn northward on Ga. 155 and continue to the square in Decatur; the hotel is near the square.

(2) At Woodbury, turn right on Ga. 18 and continue to Zebulon; turn northward (left) on U.S. 19 and continue to Griffin; at Griffin, turn northeastward on Ga. 155 and follow it to the square in Decatur; the hotel is near the square.
PART III

Highlights of the Stone Mountain-Lithonia area,

DeKalb County, Georgia

(a) Survey of the geology of the Stone Mountain-Lithonia area.

(b) Generalized geological map of the Atlanta-Stone Mountain area.

(c) Itinerary III; Road log, Decatur, Georgia, to Stone Mountain, Lithonia, and vicinity.
A SURVEY OF THE GEOLOGY OF THE STONE
MOUNTAIN-LITHONIA, GEORGIA, AREA

Most of the data in this survey and that of the itinerary for the field trip comes from Herrmann (1954) and Grant (1962).

This area has been the subject of investigation for many years. Purrington (1894) first described Stone Mountain as a laccolith. Watson (1902) described the Stone Mountain Granite and the nearby Lithonia Gneiss both petrographically and chemically. Lester (1938) also did detailed petrographic studies. Crickmay (1939) mapped the area in reconnaissance, and in 1952 he discussed the origin of the granite and the gneiss. The first detailed map of the area, and the most complete one to date is that of Herrmann (1954). Others who have contributed detailed data to the knowledge of the area are: Cofer (1948), Walter (1958), Hanson (1958), Hopson (1959), Grant (1963), Wright (1963), and Mohr (1965).

The country rock

The country rock, into which the Stone Mountain Granite has intruded, and of which the Lithonia Gneiss may be a migmatitic phase, is porphyroblastic-biotite-plagioclase gneiss which contains minor amphibolites and schistose layers.

The stratigraphic sequence of the area is partially understood, but is not important in this survey since only the major rock types will be seen on the field trip. The most abundant rock is porphyroblastic biotite plagioclase gneiss. Biotite gneiss, biotite amphibolite, and feldspar amphibolite are also common in some areas. Garnet-mica schist and quartzite are confined to a narrow band less than one mile in width. The Lithonia Gneiss, a migmatite, may be the equivalent of the porphyroblastic gneiss.
The presence of both sillimanite and kyanite place the metamorphic grade in the lower part of the sillimanite-almandine-muscovite subfacies and the upper part of the kyanite-almandine-muscovite subfacies. The local presence of the low-grade assemblage talc-actinolite-chlorite indicates a post-metamorphic hydrothermal alteration, possibly related to the granite.

The amphibolites

The origin of the amphibolites which are intercalated with the other metamorphic rocks is a subject for debate. Some of the mineral assemblages indicate a sedimentary origin for some of them and a still unknown origin for others. However, one of the most common amphibolites which has a mineral composition of about two thirds hornblende and one third plagioclase is very widespread in this area and in the Central Piedmont. Chemical analyses of these rocks is similar to those of basalt; their field relations and compositional uniformity suggests an igneous origin.

Diabase

Throughout the area, in long, tabular bodies, is to be found diabase. These were mapped and described by Lester and Allen (1950). In general, the dikes trend northwest-southeast, and vary in thickness from a few to tens of feet. Since they intrude all the rocks of the area, and because of similar mineral and chemical composition to the known Triassic dikes farther to the north in South and North Carolina, they are considered Triassic.

Stone Mountain Granite

The Stone Mountain Granite is, mineralogically, an adamellite. The term
granite is generally used for field work. It is medium grained (1-1/2 mm), composed roughly of quartz (30 percent), oligoclase (30 percent), microcline (30 percent), and mica, mainly muscovite (10 percent). Biotite, zircon, and apatite constitute the accessories.

The main mass of the granite body is very extensive and could certainly be classed as a stock. However, according to Mohr (1965), it was probably intruded from the east as a tabular mass extending to bulbous at approximately the present site of the mountain. The physiographic feature of Stone Mountain is but one portion of the entire body, but perhaps the most well known.

The Stone Mountain Granite is intrusive into the metamorphic country rock, and follows some of the metamorphism. Numerous intrusive contacts can be found; xenoliths are known; discordant dikes are numerous, and the uniformity of the mineral composition point to the intrusive origin. Regional metamorphic trends are not present in the granite.

Lithonia Gneiss

The Lithonia Gneiss is a migmatite. It is a greyish white, and banded, the bands being both highly crumpled and relatively straight. Granitic bands also occur, as do garnet segregations. Pegmatite and aplite dikes occur throughout the entire mass also. The composition of the rock is variable because of the numerous biotite-rich, garnet-epidote, and quartz-rich layers in many exposures.

Geologic history

The original sedimentary rocks were sandy and argillaceous, some of
which were probably graywacke. Deformation, rising temperature, and pressure subjected the rocks to regional metamorphism. During this period the Lithonia migmitization occurred.

Stone Mountain Granite was intruded after the early deformation was complete, as the granite body deflects the regional lineation. This has been correlated with the Appalachian Revolution, thereby giving the granite a late Paleozoic age. Folding in the schists and quartzites show two directions of deformation, an earlier one with a northeasterly trend and a later refolding with a northwesterly trend.

Diabase dikes intrude the entire area, including the granite, and may well be Triassic. This is the last geological event recorded in the area save erosion.
FIGURE 6 GENERALIZED GEOLOGICAL MAP OF THE ATLANTA–STONE MOUNTAIN–LITHONIA AREA SHOWING THE ROUTE OF THE FIELD TRIP
ITINERARY III

Road log from Decatur, Georgia, to Stone Mountain, Lithonia and vicinity

<table>
<thead>
<tr>
<th>Mileage</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Parking lot of the Candler Hotel in Decatur; turn left (northward) on U.S. 29 (Church Street); continue on U.S. 29</td>
</tr>
<tr>
<td>1.3</td>
<td>Junction with North Decatur Road; large shopping center on left; continue on U.S. 29</td>
</tr>
<tr>
<td>2.6</td>
<td>Amphibolite outcrop on the left at the entrance to the shopping center; continue on U.S. 29</td>
</tr>
<tr>
<td>7.6</td>
<td>Center of Tucker, Georgia; traffic light; cross the road and bear right on Ga. 236 immediately on the other side; continue on Ga. 236</td>
</tr>
<tr>
<td>11.4</td>
<td>A good exposure of deeply weathered biotite-plagioclase gneiss here and in the vicinity; this is near the contact with the Stone Mountain Granite; continue on Ga. 236</td>
</tr>
<tr>
<td>11.9</td>
<td>Junction with U.S. 78; Ga. 236 ends here; turn left on U.S. 78 toward underpass; prepare to stop</td>
</tr>
</tbody>
</table>
| 12.2    | **STOP 9. Stone Mountain Granite.** This exposure is near the contact of the granite and the country rock. Note the small xenoliths, the jointing and the extensive weathering.  
Quartz       33.0  
Microcline   27.4  
Oligoclase   29.5  
Muscovite    8.6   
Biotite      11.5  
Continue on U.S. 78 |
| 12.8    | Stone Mountain Lake, created by damming Stone Mountain Creek. Stone Mountain Park is the best, then, by a damsite. |
| 13.2    | Junction with the Stone Mountain Park Road; **DO NOT GO INTO THE PARK**; stay on U.S. 78 |
| 14.5    | Divided highway ends; stay on U.S. 78 |

30
16.1 Yellow River (Watch for next turnoff, it sneaks up on you).

17.4 Junction with Ga. 264; Gulf Station on the left; turn right on Ga. 264.

18.2 STOP 10. Deeply weathered biotite gneiss. This is a strongly foliated, light gray biotite gneiss which occurs with intercalated biotite-bearing amphibolites which range in thickness from 5 inches at this outcrop to 3 feet nearby. Foliation varies from thin, 1-3 mm parallel bands of slightly varying mineral composition to an almost slate-like cleavage which may be caused by weathering.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Quartz</td>
<td>46.2</td>
</tr>
<tr>
<td>Oligoclase</td>
<td>37.8</td>
</tr>
<tr>
<td>Microcline</td>
<td>11.2</td>
</tr>
<tr>
<td>Biotite</td>
<td>4.6</td>
</tr>
<tr>
<td>Others</td>
<td>0.2</td>
</tr>
</tbody>
</table>

continue on Ga. 236

20.2 Junction with Ga. 124; turn right on Ga. 124 toward Lithonia.

20.9 Centerville; continue on Ga. 124.

22.3 STOP 11. Diabase dike on the east side of the road. A thin dike is intruding schistose biotite plagioclase gneiss. The dike is very jointed and weathering is proceeding slowly, forming a typical dark red oxidized zone around the outside of each boulder. The gneiss is sillimanite grade, but the kyanite-sillimanite boundary is nearby, as kyanite occurs in rocks about 1 mile away.

continue on Ga. 124

24.0 Yellow River again; stay on Ga. 124

24.8 STOP 12. On the top of the ridge. Intercalated biotite gneiss and amphibolite. This exposure shows the lithologic variation of this gneiss. Within ten feet vertically may be seen granitic layers, amphibolite layers, quartzite, and porphyroblastic biotite gneiss. This exposure strongly supports the hypothesis of a sedimentary origin for the metamorphic rocks.

continue on Ga. 124

25.2 Bridge

25.9 STOP 13. Contact of the Lithonia Gneiss with the country rock and igneous intrusions. In the vertical road cut may be seen a granite dike, a few feet across, intruding distorted amphibolite layers in the biotite gneiss. Toward the south one finds more granite, amphibolite, quartzite, and mica schist, the latter lying on the Lithonia Gneiss.
<table>
<thead>
<tr>
<th>Mileage</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Granite dike</strong></td>
</tr>
<tr>
<td></td>
<td>Quartz 22.1</td>
</tr>
<tr>
<td></td>
<td>Oligoclase 43.1</td>
</tr>
<tr>
<td></td>
<td>Microcline 28.0</td>
</tr>
<tr>
<td></td>
<td>others 7.8</td>
</tr>
</tbody>
</table>

continue on Ga. 124

27.0 Railroad crossing

29.3 Quarry in the Lithonia Gneiss on the right

30.2 Railroad crossing in Lithonia; stay on Ga. 124 and pass through Lithonia but prepare to turn soon.

30.5 Junction Ga. 124 and Klondike Road in Lithonia; abandoned used car lot on the left; turn left on Klondike Road; bear left at the fork immediately after the junction

30.9 Intersection U.S. 278; continue on Klondike Road

31.1 Overpass of I-20
STOP 14. Park under the overpass. South of the overpass is a fine exposure of the amphibolite; fresh rock is available here due to recent excavation. To the north of the overpass, on the outside of the fence, in the borrow pit, is a fine exposure of lineated mica schist, amphibolite, and quartzite in a probable sedimentary sequence; the quartzite contains about 10 percent sillimanite toward the base.

continue southward on Klondike Road

33.5 Entrance to the Reagan Quarry on the right; continue south on Klondike Road

33.7 STOP 15. Lithonia Gneiss at Mount Arabia. Park on the right BUT NOT IN THE ROAD LEADING FROM THE COFFEY QUARRY, PLEASE! Cross the road to Mount Arabia and exposures in various quarries. Here the migmatitic origin of the gneiss is clearly shown. There are 3 main phases, a granitic, non-foliated phase, a foliated phase, and a highly contorted foliated phase. Garnet segregations are present also. These have been interpreted as residues of the original country rock, although no orientation is evident.

return northward on Klondike Road to the Junction of U.S. 278

END OF FIELD TRIP AND LUNCH STOP
From this junction, there are several ways back home. One could follow U.S. 278 back to Decatur and Atlanta, or follow U.S. 278 westward just a few hundred yards to the junction with Evans Mill Road. Turn left on Evans Mill Road and enter onto I-20 toward Atlanta.

Continue westward on I-20 to its junction with I-75 in Atlanta; turn southward toward Macon on I-75 and continue toward Macon and Valdosta; there is a short stretch where I-75 is not complete.
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<th>Title</th>
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</tbody>
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Southeastern Geological Society, 1944 \ Southwest Georgia Coastal Plain, 2d field trip, 63 p., Tallahassee, Fla.


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