SOUTHEASTERN GEOLOGICAL SOCIETY

SEVENTH FIELD TRIP

GEOLOGY OF THE CRYSSTALLINE ROCKS AND OF THE PALEOZOIC AREA OF NORTHWEST GEORGIA

MARCH 31 - APRIL 1, 1951
SOUTHEASTERN GEOLOGICAL SOCIETY
Tallahassee, Florida

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SEVENTH FIELD TRIP

Geology of the Crystalline Rocks and of the Paleozoic Area
of Northwest Georgia

March 31, - April 1, 1951

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Arthur C. Munyan Leader
ACKNOWLEDGMENTS

The Southeastern Geological Society expresses its thanks to Dr. R. O. Vernon, who has served as Chairman of the Field Trip Committee and arranged for the publication of the Guidebook. Dr. A. S. Furcron has prepared the section on crystalline rocks, crossed by the seventh field trip from Atlanta to Bartow County, Georgia, and Dr. A. C. Munyan prepared the text of that portion of the trip over the Paleozoics of Northwest Georgia. The friends and members of the Southeastern Geological Society are indebted to both writers for the tremendous time and effort that have been spent in the preparation of the Guidebook.
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ROAD LOG (FIRST DAY)
Saturday, March 31, 9 A.M.

General Statement

Cars will assemble on campus of Emory University in front of Geology Building at 9 A.M. The procession will follow the leader through Atlanta to the intersection of West Wesley Road and Northside Drive (U. S. 41) where zero point is located.

Leaving zero point, the caravan will be led by A. S. Furcron, Georgia Department of Mines and Geology, who will explain the geology of the northern Piedmont crystalline area.

This portion of the trip will extend to the Piedmont-Paleozoic boundary near Pumpkin Vine Creek on U. S. 41 just south of Emerson, Georgia, and north of Acworth, Georgia.

Points of interest will fall into 2 categories: Localities and Stops.
PIEDMONT SECTION OF TRIP

GEOLOGY OF THE CRYSSTALLINE ROCKS

(Atlanta to Allatoona, U. S. 41)

A. S. Furcron

00.0 West Wesley Road and Northside Drive (U. S. 41) intersection.

We leave Atlanta on the 4-lane highway to Marietta, which branches off of Northside a short distance north of Arden Road. This highway is known as 3-E, or Temporary 41. Crossing the Chattahoochee River, we pass Robbins Field and the Bell Bomber plant on the left as we approach Marietta. We by-pass Marietta on the east and, after passing under the L & N Ry., take the new cut-off, which carries us beyond the northwest side of Kennesaw and across old 41, about a mile south of Kennesaw. Thence, we go into Kennesaw, and from Kennesaw to Acworth. Shortly after leaving Acworth, we leave Cobb County and enter Bartow County, where we cross over that part of the new Allatoona Reservoir represented by the former position of Allatoona Creek, and continuing on 41, we come to generally accepted Paleozoic rocks east of Emerson.

GEOGRAPHY

The first part of this trip will be taken over crystalline rocks from Atlanta to the Cartersville fault near Allatoona in Bartow County. On this trip, we completely cross the Georgia Piedmont, which is regarded as extending from the Atlantic Gulf Divide westward to the Great Valley, a distance in our crossing of about 30 miles. To the north and northeast, there is a high platform on the Georgia Piedmont where it is adjacent to the Blue Ridge Highland. This hilly country is known as the Dahlonega Plateau, and is 1400 to 1800 feet above sea level. Our entire trip will be taken over the
Atlanta Plateau, a broadly rolling surface, ranging between 1000 and 1800 feet above sea level. It contains a few residual mountains, such as Sweet Mountain northeast of Marietta, and Kennesaw Mountain. We will pass the northeast base of Kennesaw just after leaving Marietta.

**INTERPRETATION OF THE GEOLOGY AS PORTRAYED ON THE STATE GEOLOGIC MAP (1939)**

**Rocks of the Atlanta Area**

The geology of the crystalline rocks of Georgia, as compiled and prepared by Dr. G. W. Crickmay, is shown on the Geologic Map of Georgia, 1939, scale 1/500,000. As shown on this map, the city of Atlanta is built on a large area of Carolina gneiss (cgn), which is injected by numerous granites, particularly the Lithonia type (ggn). Also in this vicinity, it is intruded by the Stone Mountain granite, a biotite muscovite granite (cgr), and by a porphyritic granite (cpg), referred to as the Palmetto type, and by peridotite, serpentinite, and other ultramafic rocks (ps). The Lithonia type and porphyritic facies of that type (pgn) are regarded on the map as probably of pre-Cambrian age. The ultramafic rocks (ps) also are regarded as probably pre-Cambrian but are intruded by younger granites. The porphyritic granite of the Palmetto type is classified as probably late Paleozoic, and the Stone Mountain type of the same general age, but later.

The Carolina gneiss was first named and described by Arthur Keith from occurrences in North Carolina; LaForge and Phalen have described it in Georgia on the Ellijay folio; and W. S. Bailey has described these rocks on the Tate Quadrangle, Georgia; Crickmay has indicated its general distribution on the State Geologic map of 1939. This gneiss series is described by these writers as an immense series of interlayered mica gneiss, garnet-kyanite gneiss, mica schist, quartz schist, garnet schist, conglomerate, kyanite-graphite schist, and "fine granitoid layers". Although there are many
granite intrusions and lenses of pegmatite, these writers regard this series essentially as one of metasediments, or paragneisses. In the preparation of the State Geologic Map, the series has remained essentially undivided over a considerable part of the State. In other sections, quartzites, muscovite schist, graphite schist, etc., are distinguished as special lithologic units.

**Brevard Schist**

Referring again to the State Geologic Map, you will find a short distance northwest of Atlanta, a dashed overthrust fault line, which crosses the entire State in northeast-southwest direction. This is known as the Brevard overthrust, and immediately west of it, there is a belt of schist referred to as Brevard schist (bs), shown by blue diagonal lines. The western edge of the thrust block is crossed on Northside Drive in the vicinity of Arden Road, where granites of the overthrust block crop out and are much sheared. The belt of Brevard schist is very narrow at this crossing. The rocks of this belt are described as muscovite schist, muscovite-graphite schist, marbles, quartzite, biotite gneiss, etc. Because of the small scale of the State Map, it is not possible to define exactly this zone of schist, but rocks usually ascribed to Brevard may be seen to occur along this highway between Arden Road and Moores Mill Road. On the State Map, the Brevard schist is placed at the base of the Talladega series, and this series is considered to be younger than the Carolina series and of probably late pre-Cambrian age.

**Crystalline Rocks Northwest of the Brevard Schist**

Between the belt of Brevard schist and the city of Marietta, the southeastward-dipping rocks are classified on the State Map as Carolina gneiss, and from Marietta to the vicinity of Allatoona, the rocks are generally igneous, consisting of thick masses of hornblende gneiss and diorite gneiss, and intrusions of the Lithonia granite type (ggn). Between Allatoona and
Bartow, in a narrow zone between two great thrust faults, the rocks are mapped as undifferentiated Talladega (late pre-Cambrian). The easternmost thrust fault is mapped as a continuation of the Whitestone fault, and immediately east of it, is a narrow zone of Ashland schist (graphite muscovite schist with beds of hornblende gneiss). The westernmost thrust fault is known as the Cartersville fault, separating the metasediments of questionable age (tu) from rocks accepted by all as of Paleozoic age.

ROAD LOG WITH INTERPRETATION (ATLANTA TO ALLATOONA)

*1. Junction Arden Road and Northside - Sheared granite of the Atlanta block at the east edge of Brevard thrust. Brevard schist can be seen locally along the highway from here to Moores Mill Road. Just east of Moores Mill Road, muscovite schist, strike N 65 E, dipping southeast 40°, is exposed. This appears to be about the west limit of "Brevard schist" along this highway. The schists are extensively overthrust, thus the belt is narrow; no marble or graphite schist has been noted in this section.

2. Moores Mill Road to Chattahoochee River. I have not observed any definite break between Brevard rocks and those mapped as belonging to the Carolina series. These latter rocks, injected by granite, are much sheared and locally mylonitized between Moores Mill Road and Paces Ferry Road; also, intensely sheared granites occur in this zone. At Beechwood Road, biotite gneiss (metasedimentary) crops out (strike 45 NE, dipping SE 40°). Further on, west of Mt. Paran Road, the two-lane highway runs nearly east and west, and is thus parallel to a prominent east-west joint direction in soaked and granitized biotite gneiss.

3. South side of bridge over Chattahoochee River. Metasedimentary biotite gneiss dipping southeast, much injected by feldspar to produce an

*The roads mentioned intersect the 1-lane highway, and are clearly marked by county signs.
"augen" gneiss of mixed sedimentary and igneous origin. Note: This type of rock might be considered by some geologists as of greater age, but it dips southeast and lies between the rocks described above, and coarse garnetiferous muscovite and muscovite biotite schist which crop out on the west side of the river. Schists dipping steeply southeastward continue along this highway from Chattahoochee River westward 1.7 miles. These are highly metamorphic rocks with a southeast dip. The dip is measured on cleavage and does not necessarily agree with original bedding. A narrow band of crushed rock resembling quartzite may be seen interlayered with the schist 0.65 miles west of the river.

4. 1.7 miles west of the Chattahoochee River, quartzite, quartzite and schist dipping southeast. This zone of quartzite, although it does not appear to be especially prominent at this crossing, has been traced beyond the highway from southwest Georgia northeastward to a point beyond the vicinity of Cumming in Forsyth County. Locally, it is much more prominent and much thicker than at this locality. The quartzite is locally much injected and divided by granite.

5. From this point approximately to the traffic light on the four-lane highway in the outskirts of Marietta, there is a complex of biotite schist and gneiss which is highly injected by granite. It is believed by the writer that this complex underlies the quartzite and rocks above it, i.e. the "Carolina gneiss" of the State geological map. Outcrops are rather poor along this section.

6. A few hundred feet beyond the traffic light mentioned above, quartzite beds occur dipping southeast; also, they are exposed again at the next crossroad, 0.7 miles northwest of this point where they dip south-
east. This arm of quartzite may occur within the complex mentioned above, or it may be a tight overturned infold of the same quartzite mentioned in 4. This band of quartzite strikes northeastward and consists of Sweat Mountain on the Cherokee-Cobb County line. It has not been found to continue beyond that point, thus is believed to be younger than the complex beneath the quartzite; also traced southwestward through Marietta, this quartzite continues southwestward over this complex until faulted out near Roopville in Carroll County.

7. From this point northwestward to a little crossroad about 1/8 mile northwest of the first crossing of Pumpkin Vine Creek just southwest of Allatoona, the complex mentioned in 5 continues. Most of the rocks are igneous, but mica schist belonging to the complex can be observed for a mile or more northeast of Acworth. Perhaps the most prominent rocks of this complex are the hornblende gneisses, hornblende schist and diorite gneisses. The latter type compose a good part of Kennesaw Mountain. Locally the hornblende-bearing rocks are thoroughly injected and soaked by granite to form hybrid rocks, and such rocks may be examined in the fresh cuts along the new part of Highway 41, northwest of the underpass with the L & N Ry. near Marietta.

24.6 Traffic light in Acworth, Georgia
REFERENCES

Bayley, W. S., Geology of the Tate quadrangle, Georgia: Georgia Geol. Survey Bull. 43, 1928.


Geologic map of Georgia: Georgia Division of Mines, Mining and Geology, 1939.


PALEOZOIC SECTION

29.4 Pumpkin Vine Creek bridge.
30.7 Weisner quartzite on right at hill top in road cut.
31.7 Emerson, Georgia.
32.3 Entrance to barite mine in Shady dolomite on right. Note massive Weisner in quarry face.
32.9 South entrance to Allatoona Dam.
33.1 Large, abandoned, open-pit barite mine on left.
33.3 Etowah River.
33.6 Side road to right leading to New Riverside Ocher Company mining ocher and barite.
34.4 City limits of Cartersville, Georgia.
35.3 Junction of U. S. 41 with U. S. 411. Keep straight ahead on U. S. 411 at the traffic light.
37.9 T-intersection with road to north approach to Allatoona Dam. Stay on U. S. 411.
44.6 White, Georgia
45.2 Quarry in Conasauga limestone on left. This supplied aggregate for Allatoona Dam.
52.7 R. R. spur crossing at Flexatile (Fairmount Slate Company). Quarry and plant on right. Conasauga shale being mined and processed. The Conasauga shales at this point lie beneath an overthrust crystalline rock sheet. The shales have undergone low-grade metamorphism which has produced considerable chlorite thus imparting an olive-green color to the "slate". This is the Cartersville Fault.
55.5 Fairmount, Georgia, north side of town at road junction of U. S. 41 with Ga. 51 to Jasper, Georgia. Turn right on Ga. 51.

Stop 1

1.7 miles E on Ga. 51 to winding, climbing road crossing Cartersville Fault scarp. Well-developed fracture cleavage formed in rocks of overthrust sheet on left side of road. Be careful of cars.

0.5 miles east to village of Ryo; turn around at road intersection and return to Fairmount at U. S. 411. Turn right (north) on U. S. 411.
Your speedometer should now read 4.4 miles more than it did when you were at this junction previously -- or 55.5 + 4.4 = 59.9 miles.

71.7 Coosawattee River bridge.

84.7 Chatsworth, Georgia -- will spend the night here -- dinner has been arranged at Chatsworth Hotel which is 1 block north on U. S. 411, then 1 block east - on northeast corner.

(Although it may not look attractive - the meals are delicious - yum! - and they are served country style!)

00.0 Stoplight on U. S. 411 at northeast corner of Murray County courthouse. (Go west 1 block from Chatsworth Hotel and turn right, or north, on U. S. 411 at the stoplight).

Stop 2

1.75 Campground thrust fault -- NE strike. Rome red shales faulted against lower Knox with oolitic cherts and tripoli marking base in L & N RR cut.

4.00 Eton, Georgia, intersection of U. S. 411 with Conasauga Lake Road to east. Turn right, to east. BEWARE OF L & N R. R. CROSSING!

Follow blacktop pavement 1 block, turn left, then right, and proceed eastward to base of large ridge just beyond narrow bridge over small creek.

5.00 Campground Mountain - Weisner(?) quartzites and conglomerates - thrust faults bound mountain on northwest and southeast sides.

Turn around in wide space just east of water gap and return to U. S. 411 at Eton.


6.35 Ridge crest. Dark red, soil is Tertiary (?) alluvium lying upon Knox. This is good example of reversed topography.

7.3 Sumac Ridge thrust fault. Knox to east thrust over Athens to west.

Stop 3

7.9 Small drain on right/breccia exposed. This is Blackford. Bouldery limestones a few yards to west are Newala. Yellow sandstones to east are Athens.

9.0 Spring Place - Cleveland Road at Franklin School.
Copper Ridge member of Knox. This exposure is near base of Conasauga. Park cars on right of road and lock. Assemble with leader and proceed north in woods about 200 yards to search for doubly-terminated, authigenic quartz crystals. Note nodular yellow chert masses of Cryptozoon.

Crossroads - turn cars around, and return to Spring Place - Cleveland Road at Franklin School. Conasauga shale.

Franklin School - turn left onto blacktop road - watch for holes!

Sumac Creek.

Colvard School crossroads. Heavy bedded massive limestone in sink on right is probably part of Copper Ridge.

Gregorys Mill - Cleveland Road intersection. Turn right (east). Go carefully - rough road.

Base of Middle Ordovician. Here Newala, Mosheim, Lenoir and Athens are found in a lateral distance of about 50 yards.

Proceed eastward across Sumac Ridge, underlain by Athens sandstone, to L & N R. R. BE CAREFUL.

U. S. 411 at Cisco. Stop, Look and Listen for traffic.

Tellico conglomerate dipping eastward. Note limestone and chert pebbles in the dark red quartz sandstone matrix.

Cartersville fault cutting off Bays sandstone. Overthrust sheet is a low grade mica schist.

Turn cars around at small road at hill crest and curve by backing into it and then returning to U. S. 411 at Cisco.

Turn left (south) on U. S. 411 and return to Chatsworth.

Chatsworth - intersection of U. S. 411 and U. S. 76 (1 block south of previous zero point). Turn right from U. S. 411 onto U. S. 76 to Dalton, Georgia.

Spring Place.

Crossing Rome shales at crest of Conasauga River anticlinorium.

Conasauga River.
Cedar Ridge - Contact of Knox with Conasauga shales.

Park cars off pavement. Good synclinorium exposed in cuts along U. S. 76. Heavy bedded limestones on west side of Cedar Ridge are Maynardville which is topmost member of Conasauga.

10.9 Dalton City limits.
11.5 Rome Fault at east base of ridge.
11.8 Intersection of U. S. 76 and Ga. 71 in Dalton - turn right.
Keep straight ahead on Ga. 71 beyond (north of Dalton) and across Mill Creek.
13.0 Road fork at open-air movie theater. Bear left of filling station on paved road.
13.2 Sharp left turn.
13.3 Sharp right turn, watch holes in road.
13.9 Southern R. R. crossing - - BEWARE!
14.9 Turn left on side road at Kittles Store.
Climbing east flank of Hamilton Mountain. Base is marked by over-thrust fault placing Conasauga in contact with Bays.

Stop 2
15.2 Road gap - Bays sandstones, conglomerates, siltstones and bentonite in section downhill to West.

The Bays is underlain by Sevier, then Otrosee, Holston, and at the base on West side of Haig Creek is Knox with Blackford immediately overlying it and marking the base of the Middle Ordovician.
15.7 Turn around at Knox - Blackford contact - return to Kittles Store.
16.5 Southern R. R. -- BAD GRADE CROSSING!
18.3 Ga. 71. Turn left. Watch for traffic.
18.4 Grove Level Baptist Church on right.

Stop 10
24.6 Rome fault. Knox is here thrust over and upon Otrosee shale.

Stop 11
26.3 Stop at white house on right on high bank. Park cars off road and lock. Assemble on driveway to walk about 1/4 mile east to quarry.

Holston "marble" is exposed in quarry face showing bryozoan reef and calcarenite overlying it. Good fossil collecting here.
27.0 Return to cars. Drive north on Ga. 71 to Cohutta crossroads.

Turn around and return to Dalton, Georgia on Ga. 71 to viaduct. Turn right on viaduct across R. R. tracks to business district of Dalton.

The area from Dalton to Chattanooga on U. S. 41 repeats much of the section just observed but various facies distinctions probably exist that, so far, have not been mapped. These lithofacies present various aspects and will require careful mapping to distinguish them.

South of the city of Chattanooga, the Devonian, Mississippian and Pennsylvanian system representatives are best exposed in and on Lookout Mountain.

Those who so desire may follow the Lookout highway from south Chattanooga up onto the mountain toward Lookout Point. All beds are well exposed in cuts along that road.

Time prevents conducting the field party as a unit over that portion of the section.
COLUMNAR SECTIONS
PALEOZOIC
NORTHWEST GEORGIA

ARTHUR C. MUNYAN
1951
GEOLOGY OF THE PALEOZOIC AREA IN
NORTHWEST GEORGIA
A. C. Munyan

Location and Extent

The Paleozoic rocks of Georgia are in that part of the eastern United States known as the Appalachian Valley. The Paleozoic rocks of Georgia underlie all of Dade, Catoosa, Walker, Whitfield, Chattooga and Floyd counties, and most of Murray, Gordon, Bartow, and Polk counties, a roughly quadrangular area of about 3000 square miles in the northwest corner of the State. This area is bounded on the east and south by the outcrop or trace of a great overthrust fault plane on which more ancient rocks are thrust over the Paleozoic rocks, which probably extend eastward and southward beneath the older rocks an unknown distance. The outcrop of one fault trace is near the west base of the high escarpment of the Cohutta Mountains north of the Latitude of Chatsworth. It may be traced southward along the west base of the same escarpment at least as far as Fairmount. Its position is anomalous in the vicinity of Cartersville, but more obvious southwest to the Alabama State line near the southwest corner of Polk County. The fault has been mapped as the line along which an abrupt change from the stratified Paleozoic rocks to the flaky, greenish schist of the overthrust mass occurs.

PHYSIOGRAPHY

The Appalachian Ridge and Valley province is a relatively narrow belt of country extending from Canada to northern Alabama at a somewhat lower altitude than the country on either side. On the southeast, it is bounded by the Blue Ridge Mountains of Virginia, the mountains of eastern Tennessee, and the Cohutta Mountains of Georgia. On the northwest, it is bounded by the

1Location, physiography, and general structural statements are taken from Butts and Gildersleeve's, "Geology of Northwest Georgia", 1948, Ga. Geol. Sur. Bull. 54
eastern escarpment of the Appalachian Plateau - represented by Lookout and Sand Mountains in Georgia.

A complex of ridges - White Oak Mountain, Taylor Ridge, John Mountain, Horn Mountain, Chattooga Mountain, Rocky Mountain, Sand Mountain, Simms Mountain, Lavender Mountain, and Gaylor Ridge - extends northeast through the middle part of the Valley of Georgia, and have been designated the Armuchee Ridges. On either side of these ridges, the Valley is comparatively flat. The flat surface is the northward extension of the Coosa Valley of Alabama and probably represents the Harrisburg peneplane of the northern part of the Appalachian Valley in Pennsylvania and Virginia. The western sector is called Chickamauga Valley, while the eastern is named Rome Valley.

Geologically, the Appalachian Valley is distinguished by folded and faulted stratified rocks: limestone, dolomite, shale, and sandstone; the Blue Ridge is largely, and the high land on the southeast of the Blue Ridge is entirely, occupied by crystalline rocks: schist, gneiss, and granite; the Appalachian plateau is occupied by relatively undisturbed, nearly flat-lying stratified rocks: shale, sandstone, and coal beds.

**STRATIGRAPHY**

The rocks of the Valley originated as mechanical sediments, silt, sand, gravel, or as solutions, mainly of lime or magnesium carbonates for the limestone and dolomite; most of which were carried by running water from the Piedmont upland on the southeast into the Paleozoic sea and there spread out as variegated, interfingering sheets covering the ancient sea bottom. The deposits accumulated until their thickness amounted to many thousands of feet, but vary greatly in thickness from place to place due to facies development. However, the existing rocks - shales, sandstones, and limestones, on the basis of the history of their deposition and for convenience, have been divided into systems, which are further subdivided into formations and mem-
bers. The succession, thickness, and names of the systems and formations are shown in the legends on the margins of the accompanying geologic maps.

**STRUCTURE**

By structure, as used here, is meant the attitude of the strata beneath the surface. The Paleozoic rocks of Georgia partake of the structure characteristic of the rocks of the Appalachian Valley generally. The originally horizontal strata have been compressed into anticlines or synclines, that are further broken and displaced by great faults. The folds and faults extend for miles along the direction of the Valley.

The great deformation of the horizontal strata has been produced by enormous lateral pressure exerted from the southeast with the result that the fault planes generally dip toward the southeast. The strata on the southeast of the faults have been shoved upward and laterally (toward the northwest).

**Boundary fault** - The exposed Paleozoic rocks are bounded on the east and south, in places, by a great overthrust fault. Semicrystalline schists presumably have been thrust upward and forward so that they now overlie the stratified Paleozoic rocks along their margin as shown conclusively in the valley of Holly Creek in the vicinity of Hassler Mill, Murray County. Here the crystalline rocks occupy the steep valley walls and clearly overlie fossiliferous Upper Cambrian limestone, which, dipping southeastward at a high angle, crosses the valley in a northeast direction and extends on either side beneath the schists which crop out on the slopes 100 to 200 feet above the limestone at the base of the slopes. Judging from the low, southeast dip of the fault plane on the bluffs above Holly Creek, the northwest movement of the overthrust mass may have been several miles. Probably the stratified Paleozoic rocks extend southeast beneath the thrust a considerable distance.
The Weisner Formation

The generally recognized base of the Paleozoic in eastern North America is a series of heavy-bedded sandstones, quartzites and conglomerates. In the southeastern United States, these have been given various names, among which are the terms "Cochran" for a member near the base, and "Hess", "Erwin" and Weisner for equivalent beds occurring near the top of this particular zone. The Georgia area generally employs the term "Weisner" in preference to the others. It is well exposed in the various barite mines and other exposures in the vicinity of Cartersville, Georgia. The name "Weisner" was taken from a mountain of the same name located in Alabama where some 3000 feet plus of this formation crops out. North of Cartersville toward the Tennessee state line exposures of the Weisner are rare but near Eton, Georgia, in Murray County, located about four miles north of Chatsworth, Georgia, Campground Mountain is composed of rocks which probably belong to this age group.

The strata of Campground Mountain consist of heavy-bedded, light gray, cream-colored to white quartzites and quartzite conglomerates. This lithology is more reminiscent of the Cochran than of the higher beds within this lower Cambrian zone. The Campground Mountain exposures are isolated geographically and structurally by faults which bound the mountain on both its southeastern and northwestern flanks. The absence of fossils makes it impossible to arrive at a conclusive correlation for this sandstone mass, but comparison of other features has led most observers to agree on its probable Lower Cambrian stratigraphic position.

It will be noted along the road exposures just east of Eton that the formation has undergone a considerable amount of folding and fracturing, evidenced by the crushed zone on the southeastern end of the section and by over-turning of the strata on the northwest end of the section. Microscopic
examination shows much of the mica converted into sericite which is smeared out and filamented in long stringers between the quartz grains. Stylolitic intergrowth of the quartz particles is also common. This is interpreted to mean that the quartz grains have undergone a great deal of dynamic compression with differential solution along grain boundaries.

The position of the Campground faults is indicated by mineralization. The northwest overthrust is marked by the presence of barite veins in the limestones immediately adjacent to the fault plain. Good barite may be collected from the abandoned mine which lies on the east side of Mill Creek just east of Eton. This fault is a master over-thrust and is one of the controlling features in this particular vicinity. The southwest fault, on the other hand, is not considered to be of equal magnitude with the fault to the northwest of the mountain interpreted as being a back-thrust or reversed slice fault of the other. Its position is also marked by mineralization and drag of younger formations. The minerals along the fault are jasperoid, and pyrite, both fresh and altered. The altered material now can be found as hematitic and limonitic masses at numerous points along the strike of the fault southwest from the Eton - Conasauga Lake road.

Shady Formation

The Shady dolomite is not present in the Dalton area, but is recognized in the Cartersville section. The dolomite conformably overlies the Weisner¹,

¹Kesler, T. L., 1950, Geology and Mineral Deposits of the Cartersville District, Georgia, U. S. G. S. P. P. 224, p. 10

but is lenticular and does not occur everywhere.

The Shady weathers to ferruginous, ochrous clays containing irregular masses of jasperoid, hematite, and some psilomelane. It is sporadically fossiliferous. The following forms have been collected around Cartersville:
Archeocyathids  
Acrothela (?)  
Kutorgina  
Obolella  
Yorkia (?)  

Hyolithes sp.  
Olenellus sp.  
Rimouskia (?)  
Wanneria sp. (spine)  
Wanneria walcottana  

Nisusia sp.  
Semicircularea sp.  
Helcionella cf. H. rugosa (Hall)  

Kesler states the maximum thickness of the Shady is 30 feet.

The Rome Formation

The Rome Formation is a widely exposed body of rock named from exposures in the vicinity of Rome, Georgia, lying about 50 miles to the southwest of the Dalton quadrangle. Within the Dalton quadrangle there are three major belts of Rome exposures. Two of these occur as north-south trending areas cross the central portion of the Dalton quadrangle and represent the east and west flanks of a slightly faulted, shallow synclinorium. Other areas of exposed Rome within the quadrangle are closely related to over-thrusting.

The Rome consists primarily of sandy shales, siltstones, and sandstones. In less disturbed areas where stratigraphic relationships are clearer it is thought that the lower portion of the Rome is rather moderately heavy-bedded sandstones with interbedded siltstones, while the upper portion may be comprised of thin-bedded, shaly siltstones, fine-grained sandstones, shales and some non-persistent dolomites.

Kesler (1950, pp. 12-17) reports, however, that in the Cartersville area, basal Rome beds are chiefly carbonate rocks, from which the following Lower Cambrian fossils have been collected by Butts:

Alokitokarella sp.  
Ehmaniella sp.  

Elrathiella sp.  
Solenopleura sp.

Kesler has found that metashales overlie the lower carbonate member, but that the two members are complementary sedimentary wedges. The shale is best developed, in general, to the east; the dolomite, to the west in the
district.

The sequence within the Dalton area, does not wholly agree with that of the Cartersville district, but in general only the upper portion of the Rome is exposed there. Rome shales and siltstones show, on weathered surfaces, a reddish, pinkish or yellowish staining with some variegations of purples and maroons. They are nearly always silty and apparently because of this fact are more resistant to erosion than the underlying Conasauga. The Rome of the Dalton area forms low, sharp, round, comby hills, and this is a distinguishing characteristic between the Rome and Conasauga. In some places, Rome sandstones show extensive ripple-markings, mud cracking and other evidence of shallow water deposition.

Close folding and faulting of the Rome make difficult the determination of any complete stratigraphic sequence, but if relatively massive sandstones are present, it is likely that they represent the lower portions of the Rome. The boundary between the Rome and the Conasauga is indefinite in most places and usually is determinable only from the fact that the Conasauga shales contain less silty material and in some localities, thin limestones and dolomites. The Rome underlies the Conasauga conformably and may intergrade with it.

The Conasauga Formation

The Conasauga of the eastern portion of the Paleozoic area of northwestern Georgia consists of drab, olive-green and yellowish-green shales with interbedded limestones and dolomites. The top of the formation, in most places, is marked by the presence of 25 or 30 feet of leached, siliceous, or cherty, tripoli-like material whose topmost layer is usually a thin zone of blocky, oolitic chert. Below this uppermost zone, are several hundred feet of heavy-bedded, blue, oolitic limestones and dolomites, that have been designated recently by Rodgers (1948) as the Maynardville.
The massively bedded Maynardville is underlain by a thick section of yellowish and olive-green shales containing thin, non-persistent limestone layers. Petrographic examination commonly shows very small, sub-hedral crystals of authigenic andesine formed in the laminated shales.

A notable characteristic of the Conasauga limestones is the widespread, white calcite veining which creates an anastomosing network through them. Field mapping indicates that this is primarily a feature associated with tectonic zones. The veins resulted from crushing of the rock and subsequent mineralization in the openings.

Usually Conasauga exposures form broad, low-lying, nearly flat valleys which distinguishes its outcrop area from that of the Rome. Again as in the case of the Rome, no complete section of the Conasauga is determinable because of the fact that the Conasauga is an incompetent bed and has been highly folded and faulted.

According to Charles Resser¹, five zones within the Conasauga are recognizable from top to bottom; the Rutledge limestone, the Rodgersville shale, the Marysville limestone and the Nolichucky shale, and at the top, Maynardville limestone. It is uncertain, however, that these members can be recognized in the Dalton quadrangle. According to Resser, the Rutledge, Rodgersville and Marysville are Middle Cambrian while the Nolichucky and Maynardville are Upper Cambrian.

Resser has identified numerous fossils from the Conasauga:

Acrocephalops tutus (Walcott)

Alokistocare americanum (Walcott)

Alokistocarella arcuosa Resser
Coosella ? sp.
Cossia sp. cf. C. calanus (Walcott)
Elrathis georgiensis Resser
Kootenia romensis Resser
Menomonia sp.
Obolus willsi (Walcott)
Olenoides georgiensis Resser

No reliable estimate of thickness can be made for the Conasauga because of the intensity of the intraformational folding and faulting. Butts (1948) indicates a minimum of 2000 feet but states that there may be as much as 10,000 feet to the east. This is probably excessive.

The Conasauga formation seems to be conformable with the overlying Knox beds.

The Knox Dolomite

The Knox Dolomite is in reality not a single formation but a group of formations which in Georgia consists of three and perhaps more members. The component formations, in places, may be distinguished on the basis of difference in chert residues, fossils and other criteria. Within the Dalton area, although an attempt was made to separate them, insufficient exposures were available to make reliable correlations, and as a result, the Knox has been mapped as a unit.

Munyan (1951) believes the Knox to be essentially a terrain and to consist of a series of overlapping units which become progressively younger from Alabama towards Tennessee. Thus, there is a possible equivalency of age between the uppermost Conasauga of Georgia and the lowermost Knox of Alabama. This is indicated to a degree in the correlation chart of the Cambrian formation of North America (Howell, B. F. and others Bull. Geol. Soc. Am., V. 55, 1944) where the Rodgersville, Marysville, Nolichucky and Maynardville
are shown as being the time equivalents of the Brierfield, Ketona and Bibb dolomites of Alabama.

The Copper Ridge dolomite in Georgia is the base of the Knox group. The other two members of the Knox which have been recognized are, successively, the Chepultepec and the Longview at the top. The Copper Ridge and Chepultepec boundary is determinable by the presence of a rather widespread, massive, coarse-grained, buff-colored, quartzose sandstone which is the basal member of the Chepultepec.

In general, few exposures of the Knox dolomite are found. The formation is recognized ordinarily by the presence of great quantities of yellowish, light-colored chert forming prominent ridges. Fossils are scarce, ordinarily, but Cryptozoon reefs occur sporadically near the base of the Copper Ridge.

The Knox-Conasauga contact is, apparently, conformable, and is usually marked by the presence of a tripoli zone, 10 to 30 feet thick, in which thin layers of siliceous oolites commonly occur. Immediately above the tripoli zone there often occurs a thin bed of limestone-edgewise conglomerate.

The Newala Formation

The Newala formation was named from Newala post office, Shelby County, Alabama. It is extensively developed in Alabama and in Georgia but the name is not used in the Tennessee area. Formerly Butts and Gildersleeve (1948, p. 19) included the Newala as the basal member of the "Chickamauga" limestone. This however is an erroneous classification. The Newala limestone is actually of Beekmantown age (upper-Lower Ordovician) and is the equivalent of the Mascot-Kingsport formations in Tennessee which are considered to be members of the Knox group. Therefore, in Georgia it is necessary to consider the Newala as a member of the Knox group.

The Newala is missing over a great deal of the Dalton Quadrangle but does
occur in a narrow strip near the eastern border of the area where it may be found along the west base of Sumac Ridge for a distance of about 8 miles. It is entirely missing elsewhere in the quadrangle and apparently is not exposed between that area and the vicinity just west of Ringgold where it was mapped by Butts (1948 geologic map).

The Newala is predominantly a mixture of interbedded, pearl-gray, dolomites with slight pinkish cast, and dark, moderately fossiliferous, blue-gray limestone. Its thickness is variable from place to place: in the Dalton quadrangle it reaches a maximum of about 235 feet but probably will range elsewhere from 0 to 300 feet.

One of the supposedly diagnostic fossils by which the Newala has been mapped in many places is the gastropod operculum *Ceratopea keithi*. Other fossils which may be commonly observed are *Maclurites* sp., *Orthoceras*, several high-spired gastropods and a few other rarer forms. It should be noted that *Ceratopea keithi* is a guide fossil for the Mascot-Kingsport horizons in west Tennessee but it should be further noted that all of the forms listed above are long ranging forms and probably cannot be used too critically. This is particularly true of *Maclurites*.

The Newala is conformable upon the Longview member of the Knox. The upper contact of the Newala, however, is highly irregular and represents a period of extensive erosion prior to the deposition of younger beds upon it.

Apparently at the end of Newala time considerable warping of the geosynclinal floor occurred with consequent erosion which removed the Newala over large areas of northwest Georgia. Erosion produced a surface which crosses stratigraphic lines as low in the section as Chepultepec beds because in places post-Newala beds rest directly upon Chepultepec strata.
Stratigraphic relations in Ordovician of the Dalton Quadrangle
Post-Knox Ordovician

Blackford

Middle Ordovician time opened, as previously stated, with warping and orogenic movement of both the geosynclinal floor and the source areas to the southeast. The effects of the warping within the geosyncline may now be noted from rocks of Blackford age which are a rather thin sequence composed of fragmental limestone blocks, volcanic ash and old soil materials now cemented into a well defined bed. The Blackford rocks are known to occur at least as far north as Virginia but have not heretofore been recognized in Georgia and there only, so far, in the Dalton Quadrangle.

The Dalton occurrences may be observed at places along the west base of Sumac Ridge as well as in western part of the area in connection with the Hamilton Mountain exposures and other outcrops in the vicinity of Varnell. The easternmost exposures lie directly upon Newala limestone but at the western exposures the Blackford rests upon Chepulitepec rocks. This is proof of an angular unconformity between the Knox and lower-Middle Ordovician beds.

Mosheim Formation

The Mosheim formation in the Dalton quadrangle is a thin, poorly exposed, massive, light-gray, finely crystalline (Vaughanite) limestone which probably never obtains a thickness greater than about 40 to 50 feet. It is, in general, a valley former and therefore is seldom exposed. It occurs as a very thin bed about 2 miles west of Cisco on the Gregorys Mill road directly overlying the Blackford and underlying the Lenoir limestone with conformity to both formations.

Ulrich\(^1\) (1911) included the Mosheim in his "Stones River" group, but

\(^1\) Ulrich, E. O., Revision of Paleozoic System, G. S. A. Bull., 1911
Cooper and Prouty\(^1\) (1944) have demonstrated that this group is invalid and cannot be retained as a stratigraphic unit. Similar relations exist for the overlying Lenoir which was also once placed in the "Stones River", but which cannot be so classified.

The Mosheim conformably underlies the Lenoir.

**Lenoir Limestone**

The Lenoir limestone is also poorly exposed over much of the Dalton area and may be seen at the same locality as the Mosheim described above (near Sumac Ridge). One particularly good exposure, however, occurs about 14 miles north of Dalton at a point about a mile beyond the Tennessee-Georgia boundary on State Highway 71. There the Lenoir crops out as a medium coarsely-crystalline, gray limestone of rather massive appearance. Numerous specimens of *Maclurites magnus* occur at that locality preserved in the form of light brown chert. At that exposure the Lenoir is approximately 20 feet thick. It probably is conformable with the overlying Holston "marble".

**Holston "Marble"**

The Holston is chiefly a red limestone with coarse, dense, fossiliferous texture so that it resembles a coarsely crystalline marble. There are, however, two types of the rock which may ordinarily be recognized: one is the coarse phase, massive, with irregular internal structure; the second is much finer grained, cross-bedded, and more extensive than the other.

The coarser phase represents small reef (bioherm) accumulations with slight areal extent, while the second, finer type represents a clastic lime-sand accumulation probably largely derived from sub-aqueous erosion of the reefs. Both phases are reddish, although the reef portions commonly have a light-gray color with reddish markings. In some localities, the finer
clastic beds overlie the reefs and show convergent bedding toward the crests of the reefs. Both types contain appreciable amounts of hematite and manganese in various combinations and percentages. Commercial mines were once operated on such deposits in the Varnell-Cohutta area of the Dalton quadrangle.

Rodgers (1949) has demonstrated, in Tennessee, that the Holston is a facies of the Tellico, while the underlying Athens is the facies equivalent of the Lenoir farther northwest. These same relations hold in Georgia in the Dalton quadrangle.

One significant inference can be drawn in that the Holston limestone is actually a sand accumulation and must be termed a calcarenite, thus clastic materials were deposited during Holston-Tellico time for a great distance out into the geosyncline northwest of the source areas.

Numerous fossils occur in the Holston, but a thorough study of them has not yet been completed. Many varieties of bryozoa in great quantities have, in effect, created bryozoan reefs. Incorporated in them, though, are brachiopods: Refinesquina sp., Camarotoechia sp., etc., also gastropods and a few orthoceroid cephalopods.

The Holston underlies the Ottosee conformably.

Ottosee

The Ottosee shale was named by Ulrich (1911) from exposures in the vicinity of Knoxville, Tennessee. Typically, the formation consists of soft, yellow, laminated, fossiliferous shales and fine-grained siltstones with a high percentage of calcium carbonate. In places, the lime content rises to a point where the formation could, perhaps, be termed an impure limestone.

The formation is of wide areal extent, but in Georgia, to date, has been identified only within the boundaries of the Dalton quadrangle where it occupies rather limited areas in the western part of that region. At some
localities the Ottosee contains considerable quantities of fossils in thin, restricted beds. These have not been investigated thoroughly in the Georgia section and, as a result, little is known about their stratigraphic values. Predominantly, the fossils occur as casts and molds and seem to consist chiefly of bryozoa.

Relationships worked out by Rodgers and King (1950) seem to indicate that the Ottosee is an off-shore facies of the lower Sevier. (See attached cross-section diagram). The Ottosee, therefore, is conformable with underlying beds which, in the Dalton quadrangle, have been identified as Holston.

The Ottosee was placed by Ulrich in the Blount series where it was believed by him to underlie the Tellico, but that relationship has now been proved to be no longer tenable.

Sevier

The Sevier formation was named for exposures in east Tennessee where it was described as a thick series of red shales, siltstones, and sandstones. In Georgia, Sevier is confined to two narrow fault strips in the western part of the Dalton quadrangle. One occupies the Hamilton Mountain section; the other, the section just west of the Rome fault near the Tennessee line. The Sevier consists of dark red to yellowish-red, fine, to coarse-grained sandstones, siltstones and shales in a section about 500 feet thick. No fossils have been found in the bed within Georgia and are reported to be scarce elsewhere. The Sevier is conformable with the overlying Bays sandstone.

Athens-Tellico

The Athens-Tellico section consists of a thick sequence of yellow shales, siltstones, and rather massive, medium-grained sandstones which are overlain by about two or three hundred feet of the red limestone conglomerate of the Tellico. The Athens sequence probably will range about 3500 feet in thickness.
Recent mapping seems to indicate that the Athens-Tellico sequence is a lithofacies of the Ottosee-Sevier section farther to the west. This will mean, then, that the correlation of the Blount group, as set forth by Ulrich, cannot be retained. It is not supported by field evidence.

**Bays**

The Bays sandstone and shale sequence is partly represented in Georgia by isolated exposures in the Hamilton Mountain section just mentioned and may occur in the area immediately east of Cisco, Georgia which is about 10 to 15 miles north of Chatsworth, Georgia, on U. S. 411. The base of the Bays is marked, in the Hamilton Mountain section, by a 3 to 4 foot bed of coarse, quartzose, feldspathic conglomerate which is, in part, a true quartzite. Other, thinner, quartzite conglomerates occur at levels higher in the Bays of Hamilton Mountain but their exact stratigraphic positions are not determinable at present. A thin 12 to 18-inch bed of light-gray, partly translucent, soft, metabentonite also occurs in the Bays in the Hamilton Mountain section. East of Cisco, the Bays, if present, consists of somewhat similar material, but the bentonite bed has not been certainly identified there. The Bays overlies, in the eastern area, the rather prominent Tellico conglomerate with apparent conformity.

**General Summary**

The sequence of the post-Knox Ordovician as revealed in the Dalton section of Georgia supports the contention of King (1950) that sedimentation was interrupted at the end of Lower Ordovician time, but once again was resumed with the inception of Middle Ordovician time, continuing without appreciable break well up into the Paleozoic. The Lower-Middle Ordovician break represents probably the beginning of the Taconic revolution in the southeast United States. There is no evidence of any interruption of an orogenic nature
prior to that time down to the beginning of Chilhowee time, nor is there, as stated, any evidence of orogeny in this section subsequent to Blackford time until about Middle Paleozoic time.
The following Post-Ordovician is not pertinent directly to the field trip but has been included here by Dr. A. C. Munyan to assist those attending the seventh field trip in understanding the stratigraphic relationship of the Paleozoic section as visited on the trip.

R. O. Vernon
POST-ORDOVICIAN PALEOZOIC

The following discussion has been taken from Butts and Gildersleeve, Geology and Mineral Resources of Paleozoic Area in Northwest Georgia, 1948, Georgia Geological Survey Bulletin 54.

SILURIAN SYSTEM

Sequatchie Formation

The Sequatchie formation was named from Sequatchie Valley, Tennessee.

The Sequatchie formation is composed of shale and sandstone, more or less of which in their unweathered condition are somewhat calcareous. A few beds of rather thick to massively bedded limestone occur. In some sections there are thin layers of fine quartz conglomerate or grit. At other places thick to massive beds of very fine-grained, rusty, fossiliferous sandstone occur. In places the layers are rather thick and compact and distinctly reddish. The reddish layers are commonly near the contact with the Trenton, and serve for the differentiation and recognition of the two formations. This red color is a distinctive feature of the Sequatchie formation.

The Sequatchie is known to be present wherever its horizon crops out as far east as the northwest slope of White Oak Mountain, and its southward continuation, Taylor Ridge. It has not been observed, however, in the ridges carrying the Red Mountain formation east and south of Tunnel Hill to and including Lavender Mountain. It may be present in those areas, however, although unobserved.

The thickness of the Sequatchie seems to be about 250 feet.

The following fossils were collected from the Sequatchie: Rhombotrypa quadrata, Dalmanella meeki, Leptaena richmondensis, Platystrophia ponderosa, Rafinesquina sp., Rhynchotrema capax, Sowerbyella sp., Byssonychia radiata,
Modiolopsis concentrica. The Rhombotypa, Leptaena, and Rhynchotrema are distinctive Richmond forms of the Cincinnati region of southwestern Ohio and southeastern Indiana and indicate the Richmond age of the Sequatchie. Northward, the typical Sequatchie occurs at Cumberland Gap, Virginia-Tennessee, and farther north the formation is represented by the red, nonmarine Juniata formation in Virginia and Pennsylvania, and by the Queenston shale in New York and Canada.

Red Mountain Formation

The Red Mountain formation was named from Red Mountain just east of Birmingham and Bessemer, Alabama. As the formation is of the same character in Georgia as in Alabama, the use of the name has been extended into Georgia. The Red Mountain is the same as the Rockwood formation, except that the Rockwood included the Sequatchie and on Taylor Ridge probably included the Maysville.

The Red Mountain is almost entirely composed of sandstone and shale. The sandstone is generally in thin layers interbedded with shale, but in the basal part strata of thick-bedded sandstone as much as 50 feet thick occur. The sandstone is usually fine-grained and gray, but many layers of ferruginous, rusty sandstone occur. In Lookout Valley and westward the upper part of the formation is largely a finely fissile, greenish shale. In the lower half of the formation are thin beds of limestone, some coarse-grained and bluish-grey, and some more or less ferruginous and mottled red. Thin, more or less lenticular and nonpersistent beds of fossil and "oolitic" iron ore (hematite) occur.

The Red Mountain formation, owing to its thick and hard beds of sandstone, makes conspicuous ridges. White Oak Mountain and its southward continuation, Taylor Ridge east of Summerville, are examples. Rocky Face
Mountain is another example where the thick ledge, white sandstone capping its top, is a striking object in the landscape, both looking west from U. S. Highway 41 northwest of Dalton and looking east from the road east of Rocky Face village. This sandstone is known as the White Oak Mountain sandstone. Other prominent ridges make up a complex in the region around Villanow. They end south of Villanow in John and Horn Mountain. Lavender Mountain and Mount Alto (Horseleg Mountain) southwest of Rome are other examples.

The Red Mountain formation crops out along both sides of McLemore Cove and along the southeast base of Pigeon Mountain. It occurs on both sides of Lookout Valley and extends north into Johnsons Crook east of Rising Fawn. It is best developed and most conspicuously displayed on the summit and upper southeast slopes of White Oak Mountain and Taylor Ridge and on Rocky Face Mountain.

The best exposure of the Red Mountain formation is in the road cuts on U. S. Highway 27 on the southeast slope of Taylor Ridge in the space between 1 1/4 miles and three-fourths of a mile northwest of Gore. There are excellent exposures along U. S. Highway 11 southwest of Chattanooga and in a cut on the Nashville, Chattanooga and St. Louis Railroad, 1 1/4 miles north of Wildwood, where the railroad runs for a distance in Georgia just south of the state line. Another good exposure is along the Central of Georgia Railroad at the south end of Lavender Mountain west of Lavender, and another in McDaniel Gap through White Oak Mountain, 10 miles north of Ringgold. Still another good exposure is along U. S. Highway 41 in the bed of Chickamauga Creek, one mile east of Ringgold.

The thickness of the Red Mountain formation varies from about 150 feet west of Lookout Valley to about 500 feet in White Oak Mountain and Taylor Ridge.
The Red Mountain formation is moderately fossiliferous. The fossils are divided into two groups which are quite separate from each other and correspond to two quite distinct divisions or formations.

In the lower division the following forms have been collected: scalloped crinoid stem plates, *Helopora fragilis*, *Camarotoechia* cf. *C. neglecta* Foerste, *Dolerorthis flabellites*, *Dalmanella edgewoodensis*, *Leptaena* sp., *Herbertella daytonensis*, *Platymerella manniensis*, *Platystrophia reversata*, *Sowerbyella transversalis* var. *prolongata*, *Hermotoma subulata*, *Phacops pulchellus*.

The fossils of the above list show that the lower part of the Red Mountain is approximately of the age of the Brassfield limestone of Ohio and Indiana. The Brassfield is partially equivalent to the Albion sandstone, upper or White Medina of New York, and of the Tuscarora quartzite of Pennsylvania, and the Clinch sandstone of Virginia and Tennessee.

In the upper division the following fossils have been collected: *Monograptus clintonensis*, *Anoplotheca hemispherica*, *Atrypa reticularis* (Silurian form), *Chonetes novascoticus*, *Pentamerus* "oblongus", *Rhipidomella hybrida*, *Stropheodonta convexa*, *Encrinurus* cf. *E. ornatus*, *Gyronema* cf. *Polu-umita transversa* Prouty, *Calymene* "niagarensis", *Zy gobolbina conradi*. These are all well-known and persistent Clinton fossils and prove the Clinton age of the upper part of the Red Mountain. In Lavender Mountain, Taylor Ridge, and White Oak Mountain a bed of yellowish clayey rock (tripoli), with *Pentamerus oblongus* and *Anoplotheca hemispherica*, two of the distinctly Clinton fossils, occur and are quite widespread, apparently below the middle of the Red Mountain, and it indicates that the boundary between the Clinton and Brassfield is somewhat below the middle of the Red Mountain. West of Lookout Valley the Clinton is apparently much thinner than the Brassfield.
DEVONIAN SYSTEM

Armuchee Chert

The Armuchee chert is named from the town of Armuchee at the northeast end of Lavender Mountain. The Armuchee succeeds the Clinton. No strata of upper Niagra age -- Rochester shale, and Lockport dolomite, nor of Cayuga age -- McKenzie limestone, Wills Creek formations, Tonoloway limestone, nor of Lower Devonian age -- Helderberg limestone, nor of Oriskany sandstone are present, so that there is a hiatus of considerable magnitude between the Clinton and Armuchee.

The Armuchee is generally a gray chert, but in Mount Alto (Horseleg Mountain), on the west side near the north end, it includes beds of calcareous fossiliferous sandstone which weather to a friable condition and brown color from the iron oxide present. At the south end of Lavender Mountain is about 50 feet of chert overlain by 15 to 20 feet of sandstone. It is uncertain whether this sandstone belongs with the Armuchee, but a similar sandstone in Frog Mountain, Alabama, and named the Frog Mountain sandstone, seems to be of Onondaga age, the same as the Armuchee, and for that reason it is, at present, thought that the sandstone in question can best be included in the Armuchee.

The following fossils have been collected from the Armuchee:

Favosites cf. F. shriveri, Cladopora cf. C. labrosa, Pleurodictyum sp., Cyathaphyloid coral, Anoplia nucleata, Eodevonaria arcuata, Meristella rostellata?, Orthotetes pandora, Pentagonia cf. P. uniangulata, Spirifer divaricatus, Spirifer duodenarius, Spirifer macrothyris?, Rhipodomella cf. R. vanuxemi. Most of these fossils are of common occurrence in the Onondaga limestone northward to New York, and westward to the Falls of the Ohio at
Louisville, Kentucky. The *Eodevonaria*, *Pentagonia* and three species of *Spirifer* are especially characteristic of the Onondaga, and the Onondaga age of the Armuchee seems well assured.

**Chattanooga Shale**

The Chattanooga shale was named from the City of Chattanooga. It is a densely black, highly fissile or slaty shale. Generally, there is in the upper part of the Chattanooga a layer of greenish clay one to two feet thick, full of black nodules an inch or so in diameter. These are supposed to be phosphatic, as they are elsewhere. This clay is supposed to be the same as the Maury Green shale in middle Tennessee.

The Chattanooga is universally present wherever its horizon crops out on the surface, and it is thus a reliable horizon marker and datum plane from which to identify and measure the formations above and below. Its outcrop is shown on the geologic map by a thin dash, black line. It everywhere marks the base of the Mississippian (Carboniferous) formation from Alabama and Georgia north to southern Virginia.

Some of the best places to see the Chattanooga are the following: on Armuchee Creek just below the mill dam just west of Crystal Springs, Floyd County; in a highway cut just north of the Tennessee, Alabama, and Georgia Railroad, and 1,000 feet north of the State line, and just southeast of St. Elmo, Tennessee; just south of the State line at the same locality; in the gap through Shinbone Ridge on the road west from Lafayette; on U. S. Highway 11 at the underpass beneath the Southern Railway southwest of Chattanooga; and on the road at the north end of Mount Alto on the west slope about one mile south of West Rome.

The thickness of the Chattanooga varies from a few feet up to 30
feet. One of the thickest developments appears to be in Shinbone Ridge west of Lafayette.

The Chattanooga is but slightly fossiliferous. A few small specimens of Lingula occur here and there, and the linguloid forms Barroisella and Lingulipora have been collected in Alabama. Conodonts, minute, serrate fossils, supposed to be teeth of some small fish-like animal without bony skeleton that could be preserved, occur. From the similarity or identity of some of these conodonts with species from the Mississippian Sunbury shale of Ohio and other regions, Ulrich has concluded that the Chattanooga is Mississippian. From the apparent stratigraphic continuity of the Chattanooga with Upper Devonian formations in southwest Virginia, the writer believes that the Chattanooga is Upper Devonian.

MISSISSIPPIAN SYSTEM

The Mississippian System in Georgia is composed of two diverse facies of rocks of equivalent age. In Lookout and Pigeon Mountains the Mississippian is composed of limestone and chert except for the Pennington shale at the very top. This, excluding the Fort Payne chert at the bottom, has been called the Bangor limestone in former accounts of the geology of Georgia, as in the Ringgold and Rome folios. East of White Oak Mountain, Taylor Ridge, and Gaylor Ridge the Mississippian is prevailingly a shale with intercalated beds of limestone. This facies is named the Floyd shale from Floyd County, where it is fully developed and was first recognized as a distinct facies and regarded as a distinct formation. In Rocky Mountain north of Lavender and in the west side of Little Sand Mountain east of Gore, the name Bangor limestone was used, but the Bangor of those areas corresponds to only a small part of the Bangor of Lookout and Pigeon Mountains.

The name Bangor limestone was taken from Bangor, Alabama, 32 miles
north of Birmingham. Here the Bangor succeeds the Hartselle sandstone. So the type of the Bangor could only be limestone above the Hartselle sandstone. Elsewhere in Alabama and in Georgia where the Hartselle is thin or absent the name was also applied to lower limestone, that is to limestone below the horizon of the Hartselle sandstone. As this lower limestone has been divided and the sub-divisions given other names, Bangor was no longer applicable in the broader sense, and in 1926 the application was restricted to the limestone above the Hartselle sandstone, extending up to the Pennington shale. In Georgia, the name, as has hitherto been used, "Bangor limestone" includes the following Mississippian units as exposed in the section at the north end of Lookout Mountain, named in descending order:

Pennsylvanian system
Pottsville formation
Walden formation
Lookout sandstone (rim rock)

Mississippian system
"Bangor" limestone
Pennington shale
Bangor limestone (restricted)
Hartselle sandstone
Golconda limestone
Gasper limestone
St. Genevieve limestone
St. Louis limestone
Hiatus, Warsaw limestone absent
Port Payne chert

Devonian system
Chattanooga shale

Pennsylvanian System
Pottsville Formation

The Pennsylvanian System or, according to the usage of the U. S. Geological Survey, the Pennsylvanian series of the Carboniferous System, is named from western Pennsylvania where it was earliest brought to attention by extensive coal mining. The Pottsville formation, or, often put in the form of the Pottsville group, was named from Pottsville in the anthracite coal field of eastern Pennsylvania.
The Pottsville is composed entirely of thick sandstone, conglomerate, and shale beds. Its distinctive characteristic everywhere is its many beds of coal of which there are a few in Georgia. At the base of the Pottsville is a thick and persistent sandstone resting upon the Pennington shale. This sandstone was named the Lookout sandstone by Hayes from its conspicuous display as the rim rock at the top of Lookout Mountain. The Lookout is a coarse, thick-bedded, conglomeratic sandstone, 150 feet or so thick. It is said to include a coal bed or two. It corresponds to the Sewanee conglomerate of Walden Ridge and of the Cumberland Plateau in Tennessee. It is supposed that the sandstone or Rocky and Little Sand Mountain between Subligna and Lavender is "Lookout." Below what appears to be the equivalent of the "Lookout" in the northwest corner of the State, in the vicinity of the abandoned Cole City, is about 300 feet of shale and sandstone with two workable coal beds. This body of rock seems to correspond to the Gizzard formation of the east escarpment of the Cumberland Plateau west of Pikeville, Bledsoe County, Tennessee.

The main body of Pottsville rocks occupies the central axis on the summit of Lookout Mountain. Outlying areas are in the northwest corner of the State west of Lookout Valley and in Rocky and Little Sand Mountain already mentioned.