GEOLGY OF THE BARNESVILLE AREA
AND TOWALIGA FAULT
LAMAR COUNTY, GEORGIA

WILLARD H. GRANT, EMOY UNIVERSITY

GUIDEBOOK FOR THE SECOND ANNUAL FIELD TRIP
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FIELD TRIP - GUIDEBOOK

THE GEOLOGY OF THE BARNESVILLE AREA AND THE TOWALIGA FAULT

DECEMBER 15, 1967

WILLARD HUNTINGTON GRANT

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Geomorphology</td>
<td>3</td>
</tr>
<tr>
<td>Sequence of Rock Units</td>
<td>4</td>
</tr>
<tr>
<td>Structural Geology</td>
<td>5</td>
</tr>
<tr>
<td>Rock Units</td>
<td>6</td>
</tr>
<tr>
<td>Metamorphism</td>
<td>8</td>
</tr>
<tr>
<td>Road Log</td>
<td>10</td>
</tr>
<tr>
<td>References</td>
<td>16</td>
</tr>
</tbody>
</table>

# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index Map (Plate I)</td>
<td>2</td>
</tr>
<tr>
<td>Cross Section Along U.S. 341</td>
<td>14</td>
</tr>
<tr>
<td>Mylonite Thin Section</td>
<td>15</td>
</tr>
<tr>
<td>Geologic Map</td>
<td>In Pocket</td>
</tr>
</tbody>
</table>
INTRODUCTION

The Barnesville area is part of a larger study of the Towaliga-Goat Rock fault system which has been in progress since 1959 and will continue into the indefinite future. Also the mapping has provided the fundamental geologic background so necessary in other types of investigations.

Previous work in the Barnesville area is shown on the State Geologic Map, 1939. The Towaliga fault is described by Crickmay, 1952, p. 49. It is a sharply defined fault dipping steeply to the northwest, which has been traced from the Alabama state line northeastward into Jasper County. It is indicated by a narrow band of mylonite which in some areas shows a fluting at right angles to the movement plane.

The writer wishes to acknowledge the contribution by the Emory University Research Committee for travel funds. The assistance of other members of the Emory University Geology Department is acknowledged. The work of the Field Trip Committee of the Georgia Geological Society is gratefully recognized.
MAP OF GEORGIA SHOWING THE BARNESVILLE AREA
AND ESSENTIAL TOPOGRAPHIC SUBDIVISIONS.
GEOMORPHOLOGY

The area is located on the eastern edge of (LaForge, 1925, p. 59) Midland, Georgia which is a strikingly smooth surface characterized by uniform south trending slopes. The streams flow southeastward to the Atlantic and southward to the Gulf. The drainage pattern is dendritic. LaForge, 1925, p. 62 recognized the Pine Mountain district as being distinct from the surrounding areas. It is characterized by bold sinuous ridges of which Hog Mountain is the eastern extremity. Plate I.

The topography of the Barnesville area is subdivided into three parts. The area north of the Towaliga fault is characterized by two sub-areas. The area underlain by schists is rolling with moderate relief. A much more gently rolling to nearly flat area is underlain by the porphyroblastic gneisses. These topographic differences appear to be due to differential erosion as consequence of weathering.

Hog Mountain stands as a ridge with a relief of about 200 feet above the surrounding terrane. The relief appears to result from the high resistance of the quartzite to disintegration and erosion.

South of the quartzite ridge the topography is gentle and rolling with relief increasing somewhat to the southeast.

Along the Towaliga fault zone swampy conditions exist parallel to the Towaliga Creek.
STRUCTURAL GEOLOGY

There are three major structural areas. The axis of the Barnesville anticline lies south of Hog Mountain. This structure is terminated on the north by Towaliga fault zone.

The second major structural area is the Towaliga fault. It is indicated by a line on the geologic map. Dips along the fault range from 50 to 70 degrees to the north. Although drawn on faulted rocks, this line actually represents the center of a fault zone. Some of the lesser faults associated with the line are indicated on the geologic map, but there are probably many more, which because of weathering are not evident. Intense penetrative deformation is found in the rocks miles south of the fault line. This deformation was probably coexistent with metamorphism as the presence of recrystallized biotite in the blastomylonite indicates. However it is possible that some of this deformation is pre-blastomylonite. Three periods of deformation are recognized in the Towaliga fault zone. The earliest is identified by blastomylonite. Tracing of this movement has not been possible other than it recurs along the fault zone, but it is not identifiable as a single line or zone distinct from other movements. The kind of fault represented by the blastomylonite is not known although the foliation dip at outcrops where it occurs is low. This is the earliest recognizable movement period.

Mylonites are rocks with a pronounced foliation which show strong granulation and crushing. Microbreccias are non-foliated rocks which show strong crushing and granulation. Flinty crush rocks are mainly microbreccias which megascopically resemble flint or chert. Microscopic examination is desirable before final identification of these rocks.
The mylonites and microbreccias were formed during the second stage of deformation. This appears to have had a strong strike slip component. Lineations plotted on the geologic map show a drag which indicates that the block north of the fault moved eastward.

The third movement was probably vertical and represents the final recognizable stage. Possibly some of the flinty crush rocks and microbreccias were formed during this phase but the main evidence is striations on slip planes in Lamar County and in Pike County joint rotations which indicate vertical movement. Evidence as to which block moved is lacking.

The third major structure is tight folding north of the Towaliga fault which is cut obliquely by the fault.

SEQUENCE OF ROCK UNITS

South of the fault the apparent sequence from bottom to top is lenticular biotite gneiss, quartzite, garnet-biotite augen gneiss, and biotite schist.

North of the fault the apparent sequence is porphyroblastic biotite-microcline gneiss, overlain by sillimanite-graphite schist. In the contact zone between these two units one or more of the following rocks may occur: garnet quartzite, pyroxene-hornblende quartzite, feldspathic amphibolite, and feldspathic biotite schist. Of these the occurrence of pyroxene-hornblende quartzite or garnet-quartzite are positive indicators of the proximity of the contact.
ROCK UNITS NORTH OF THE TOMALIGA FAULT

Porphyroblastic biotite-microcline gneiss - Hand specimens are light to dark gray in color and poorly to well foliated. The most obvious feature is porphyroblasts of feldspar (almost always microcline), usually somewhat rounded and about 1/2 centimeter in diameter scattered through a gray millimeter grain-size matrix of biotite feldspar and quartz.

Mineral composition: microcline microperthite, quartz, biotite, oligoclase, muscovite, and rarely garnet.

Sillimanite-graphite-mica schist - Hand specimens are all weathered ranging in color from buff to white. Sillimanite is visible in fibrous needles with cracks normal to the needle axis. Graphite occurs in scattered black lustrous flakes generally less than 1/2 millimeter.

Quartz and mica are present in widely varying amounts. Mineral composition: quartz, sillimanite, mica graphite, and sometimes considerable limonite. No fresh samples of this rock are available.

Pyroxene amphibole quartzite - Gray to dark gray vitreous quartzite which occurs in narrow (2 inches to 1 foot) layers or lenticular masses in the contact area between the schist and gneiss unit. Mineral composition: mainly quartz with pyroxene (augite?) altering to hornblende. Plagioclase is labradorite somewhat sercitized. Titanite and sulfides are the accessories. It is usually concealed under a weathered ochre colored rind of quartz and clay mineral.

Garnet quartzite - Hand specimens are usually black on the outside due to weathering. On the freshly broken surface the color is brown and small < 1/2 millimeter garnets may be seen with difficulty using hand lens.
Banding is present in some samples. Mineral composition: garnet, quartz with accessory biotite, muscovite and sulfides.

**Feldspathic amphibolite** - This rock shows as mapable units in other parts of the state but is found here in only minor amounts. The typical hand specimen is millimeter grained, well foliated rock composed mainly of hornblende with a sprinkling of white feldspar. Mineral composition: hornblende, labradorite, and quartz.

**ROCK UNITS SOUTH OF THE TOWALIGA FAULT**

**Biotite gneiss** - The hand specimen is light gray to white with a mineral distribution producing a texture of lenticles a centimeter or less in width and about fifteen centimeters long. In most rocks the lenticles are composed of quartz and feldspar framed in biotite.

**Quartzite** - The typical quartzite is a well foliated rock usually containing muscovite. Foliation in some places is strong enough to give an almost slaty appearance. The quartzite often contains a trace of feldspar.

**Garnet-biotite augen schists and gneisses** - The biotite schist contains biotite, very little muscovite, quartz, sometimes feldspar and kyanite. The schist appears to grade into the gneiss. This occurs by lenticular lumps of schist in the augen gneiss gradually increasing in quantity until the rock is practically all schist with minor quartzo-feldspathic lenticles.

The garnet-biotite gneisses have a texture which is roughly augen gneiss. It is composed of three different phases. A garnet rich phase composed of an aggregation of 1/2 millimeter garnets in irregular masses
a centimeter or so in width and several centimeters in length. Between the reddish brown garnetiferous areas are similarly shaped patches of quartz and feldspar, also millimeter grained. The third phase is composed of quartz-feldspar and biotite which is gray in color. The total effect is a mottled reddish-brown, gray, white rock with a poor foliation. The individual mineral aggregates in the rock are often elongated which produces a lineation. Mineral composition is microcline microperthite, quartz, garnet, iron sulfides, and sodic plagioclase.

The proportion of the minerals vary from place to place thus modifying the appearance of the rock.

Other varieties of rocks associated with the garnet-biotite augen rocks include muscovite-biotite schist, biotite gneiss and near the fault sillimanite-biotite schists.

**MYLONITES AND CRUSH ROCKS**

Texturally there are two types, mylonites which are foliated and crush rocks which are microscopic breccias. Mineralogically they may contain quartz, microcline, plagioclase, muscovite and biotite. The flinty crush rocks are composed mainly of quartz.

**METAMORPHISM**

The area north of the fault corresponds to the sillimanite-almandine-muscovite subfacies of the amphibolite facies while the area south of the fault corresponds to the kyanite-almandine-muscovite subfacies. Rocks transitional between the two subfacies occur as
indicated by the mineral assemblage kyanite-sillimanite-garnet-biotite-quartz. Turner's (1960) classification is used.

In general the faulting seems to be later than the metamorphism. It is possible that faulting and metamorphism occurred simultaneously in the later stages of metamorphism as indicated by the blastomylonites.
ROAD LOG

0 The zero mileage is at the intersection of Georgia State Highway 36 and U.S. Highway 341, near the railroad crossing. (The four lane bypass west of Barnesville.) Head south on U.S. 341.

0.6 miles Crescent House Inn Motel on left

0.9 end of divided highway

3.5 crossroads turn left off U.S. 341 on paved road to Fredonia Church

3.95 Fredonia Church turn left on Fredonia Road

5.0 Stop No. 1

Garnet-biotite augen gneiss. This outcrop shows the rock as a slightly schistose slabby well-jointed rock. The mineral composition is quartz, microcline microperthite, biotite and garnet with a trace of sulfide. Microscopically the texture is somewhat cataclastic.

Continue on paved road

5.65 Bear to right at intersection - road changes to dirt

6.85 Intersection U.S. 341 (Caution! Heavy Traffic) Cross U.S. 41 and continue on dirt road

7.75 Intersection, bear right

8.30 Cross railroad and turn right on to paved road

10.65 Johnstonville crossroads turn left on paved road

10.9 Stop No. 2
Caution! This rock shatters when hit with a hammer.

This is a well-jointed garnet-biotite gneiss, which contains both sillimanite and kyanite. Mineral composition: quartz, garnet, sillimanite, kyanite and minor sulfide. The texture is granoblastic and slightly cataclastic.

11.2 Stop No. 3

Blastomylonite - There are narrow blastomylonite zones in the biotite gneiss. The zones are recognizable by looking for inch wide black bands in which individual minerals are not seen except occasional small feldspar grains. Looking at the surface of the rock, small biotite flakes may be seen. These were formed after mylonitization.

The microscope shows a shredded swirly mylonitic texture with recrystallized biotite. The minerals are oligoclase mostly sericitized, biotite, garnet, microcline and a trace of apatite.

Continue north on paved road.

12.80 Cross Little Towaliga River. The major fault zone probably runs beneath this flood plane and swamp.

13.40 Crossroads, turn right on dirt road

14.45 Stop No. 4

Caution! This rock shatters when hit with hammer.

Flinty crush rock. The rock has a superficial resemblance to flint but careful examination with a hand lens shows a brecciated texture. Some quartz veins also occur here. It is composed mainly of quartz with minor mica and plagioclase?
Turn around and return to paved road.

15.60 Intersect paved road. Turn right.

15.80 Stop No. 5

Caution: Watch caved area in road cut.

Porphyroblastic biotite - microcline gneiss. A typical good exposure of this rock unit. Mineral composition of a sample from this locality is quartz, microcline, oligoclase, biotite, and muscovite. The texture is somewhat cataclastic. Continue on northwestward.

16.80 Stop No. 6

Sillimanite-graphite schist and feldspathic biotite-muscovite schist. The sillimanite-graphite schist has never been seen fresh. In general thin sections of weathered material will contain quartz, sillimanite (both fibrolite and euhedral crystals) some muscovite, sometimes limonite. Sometimes all of the sillimanite appears altered to muscovite. Elsewhere rocks less frequently found contain quartz, garnet, biotite, muscovite, sillimanite, minor feldspar, and a trace of zircon.

18.60 Liberty Hill crossroads - turn left on Georgia Highway 36

20.50 Road forks turn right to Milner

23.50 Milner road intersects U.S. 41 (Heavy Traffic) Methodist Church on left. Turn left.

23.65 Turn right off U.S. 41 on Zebulon Street, second block down, cross railroad.

23.75 Intersection, turn right toward water tank. Park along edge of road.

---LUNCH---
23.85 Intersection, turn left in front of Milner High School

25.0 Stop No. 7

Caution: The quartzites shatter when hammered.

Contact between the sillimanite-graphite schist and porphyroblastic biotite-microcline gneiss. In addition to the major rock types already described are some minor rock types which are limited in their distribution to the vicinity of contact zones. The garnet quartzite is usually black on the weathered surface. When broken it is brown and often banded. It is composed mainly of garnet, then quartz with minor amounts of biotite and muscovite and traces of sulfide. The amphibole quartzite is usually weathered to a limonitic color on the outside and is a vitreous gray color on the fresh interior. The mineral composition is mainly quartz, hornblende, pyroxene, clinozoisite, labradorite somewhat sericitized, and minor amounts of sulfide and titanite.

Feldspathic amphibolite also occurs here. It is composed of green hornblende, labradorite, and minor quartz. The typical hand specimen has a limonitic clayey rind which when broken open shows a black foliated interior with white feldspar grains.

26.70 Stop No. 8

The rocks on the waste pile were removed from the underground gas storage facility. They include variations of the porphyroblastic biotite-microcline gneiss unit which are almost never seen fresh. A sample of the light colored granitoid gneiss contains quartz, oligoclase somewhat sericitized, microcline, biotite and muscovite. The dark gray
gneissic phase contains biotite, muscovite, garnet, oligoclase and quartz. There are many intermediate compositions between these described rocks.

Turn around and return on the same road to Milner.

29.70 High School in Milner — go straight, cross railroad

29.90 Intersect U.S. 41 by Phillips 66 gas station, turn right on U.S. 41 and continue

33.00 Fork, turn right off U.S. 41 on to U.S. 341 (The four lane bypass around Barnesville.)

33.30 Stop No. 9

Figure 1. Cross section and road cut through the quartzite and mylonite along U.S. 341
Exposure of the main Towaliga fault with mylonite and a complete section through the quartzite into the underlying biotite gneiss. Figure 1 shows the general relations. The mineral composition of the quartzite is mainly quartz with a small percentage of muscovite and traces of iron oxides and feldspar.

Figure 2. Mylonite thin section, F-Feldspar, M-Muscovite, and C-finely crushed and slightly recrystallized quartz

The mylonite, Figure 2, is intensely foliated and contains millimeter sized and smaller porphyroclasts of feldspar. The mineral composition is quartz (finely crushed), porphyroclasts of microcline plagioclase mostly unturned and muscovite and minor biotite.

Continue down the four lane bypass (U.S. 341), move over into left lane.

34.05 Turn left into Barnesville at crossroad
34.30 Fork into U.S. 41, bear right
35.05 Cross railroad in Barnesville, keep left.
35.15 Turn left at stoplight on to Georgia Highway 36. Cross railroad again, stay on Georgia 36 straight.
36.40 Stop No. 10

Narrow road rather well travelled - watch for cars.

Augen gneisses are exposed grading down into muscovite quartzite and then quartzite. Minor faults occupied by quartz veins are exposed.
REFERENCES


