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To the Graduate Council:

I am submitting herewith a dissertation written by Walter Lee Helton entitled "Lithostratigraphy of the Conasauga Group Between Rogersville and Kingsport, Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Geology.

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LITHOSTRATIGRAPHY OF THE CONASAUGA GROUP BETWEEN  
ROGERSVILLE AND KINGSPORT, TENNESSEE

---

A Dissertation  
Presented to  
the Graduate Council of  
The University of Tennessee

---

In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy

---

by  
Walter Lee Helton  
March 1967

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## CHAPTER I

### INTRODUCTION

#### General Discussion

The Valley and Ridge Province of East Tennessee is characterized by several major thrust faults (Figure 1). This study seeks to interpret the stratigraphic and structural relationships of a portion of the Saltville and Carter Valley faults. The area includes much of the northeast portion of Hawkins County, Tennessee, and a small portion of south-central Scott County, Virginia (Figure 2). The irregular, somewhat elongate area extends diagonally across parts of three 7½ minute topographic maps (scale: 1/24,000). The maps are the Plum Grove (179 SE), Church Hill (188 SW), and Kingsport (188 SE) quadrangles of the Tennessee Valley Authority (Figure 3).

This report is mainly concerned with the rocks of the Conasauga Group. Interesting aspects of the study include: (1) the excellent development of an algal limestone member near the middle of the Nolichucky Formation, herein named the Bradley Creek Limestone Member; (2) the disappearance of the Rogersville Shale as a mappable unit; and (3) the convergence of the Carter Valley and Saltville faults.

Detailed mapping was done in an effort to delineate lithologies and structural features, and to ascertain the interrelationships of the Carter Valley and Stanley Valley thrust block strike belts (Figure 3). In order to accomplish these objectives, 18 miles of the

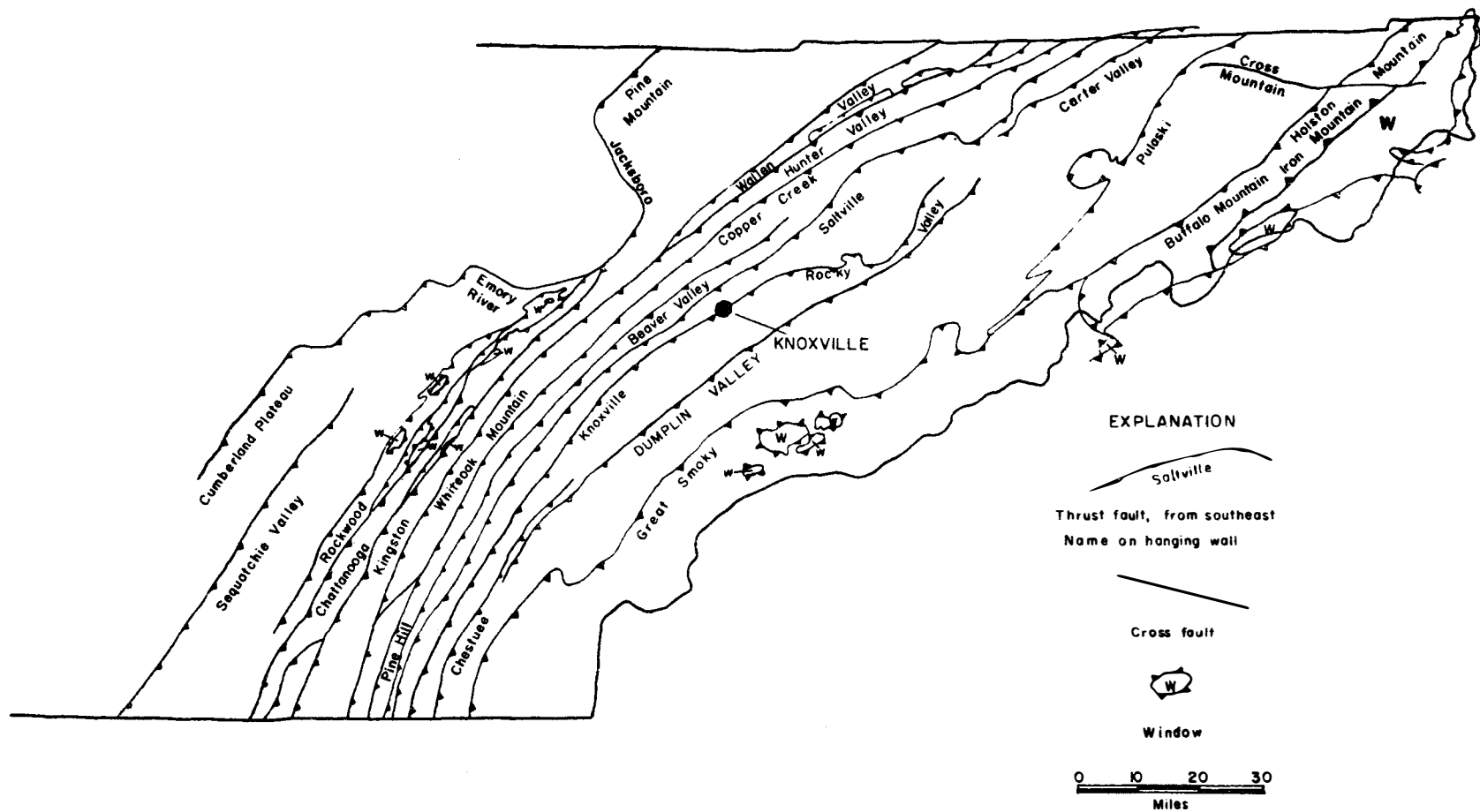


Figure 1. Major faults of East Tennessee.

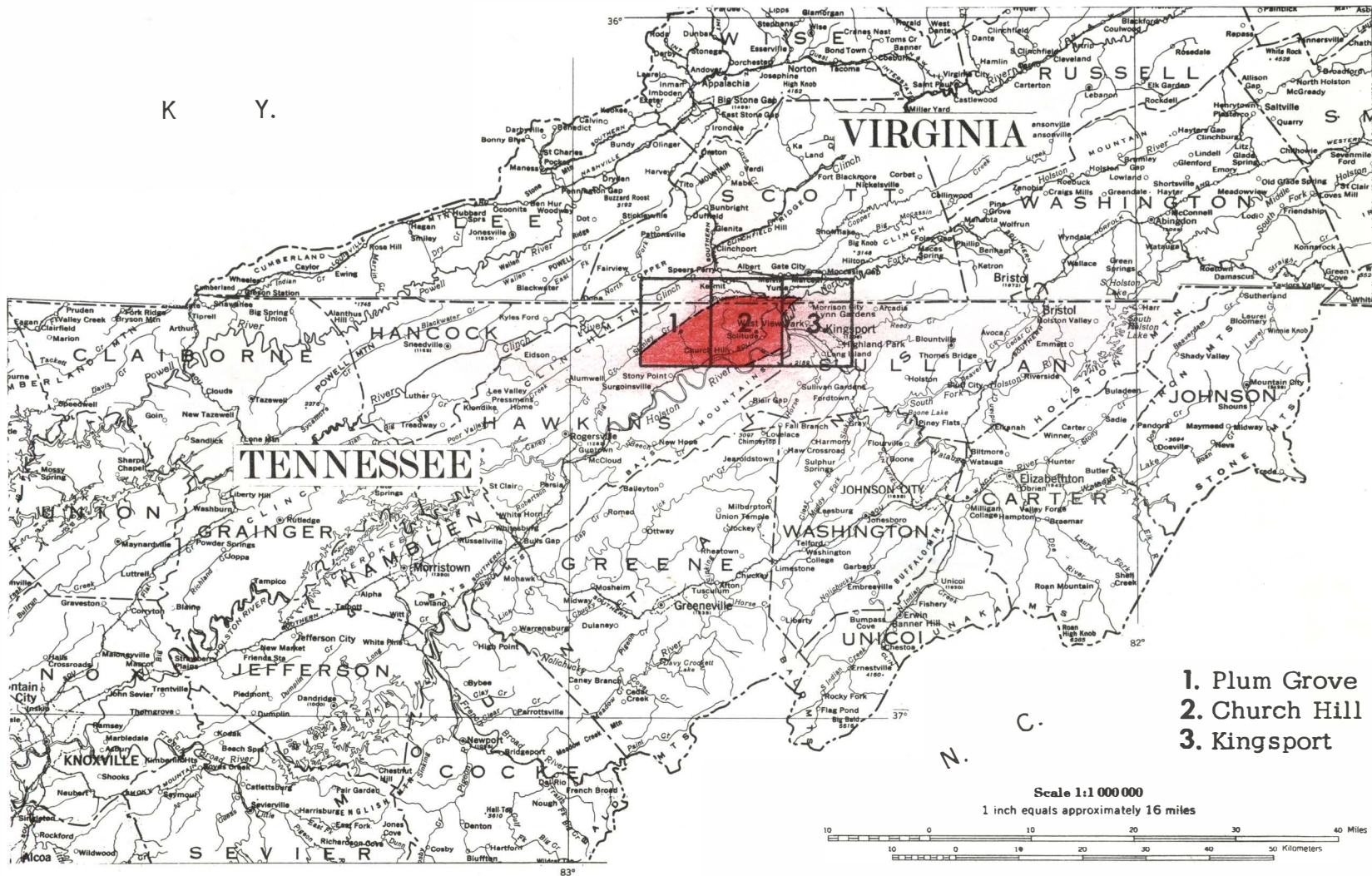


Figure 2. Map showing location of study area (in red).

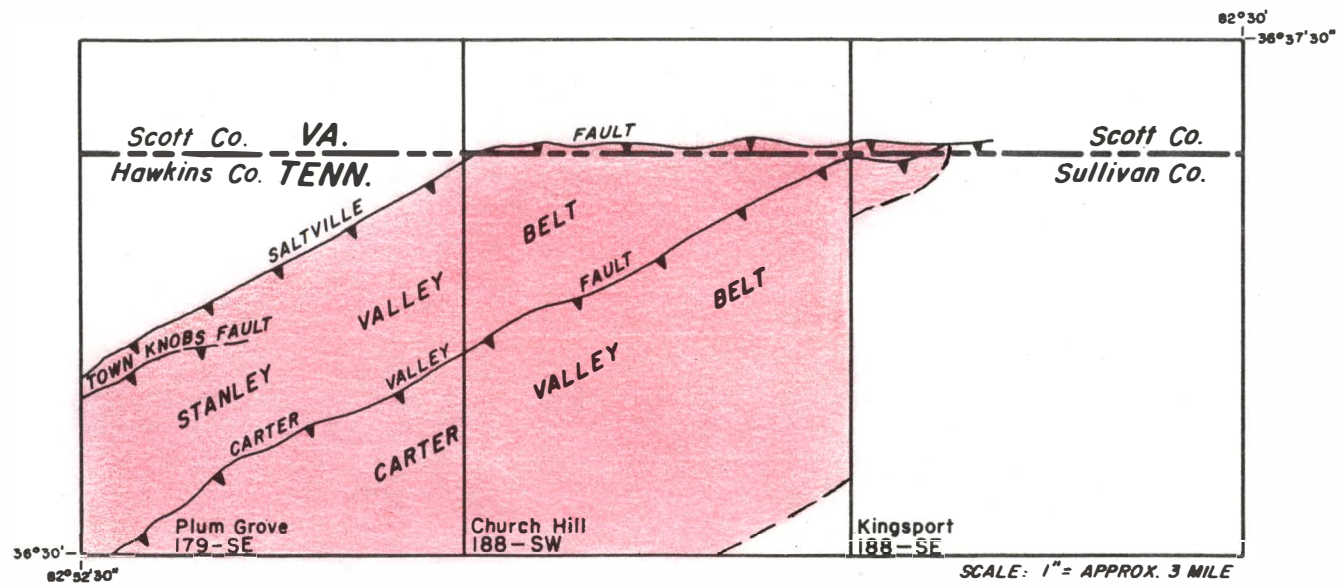


Figure 3. Quadrangle index map. Study area in red. Faults barbed.

Carter Valley and Saltville thrust sheets have been studied and mapped in detail. The mapped area covers approximately 80 square miles.

#### Purpose of Investigation

The main purpose of this investigation was to study, analyze, and synthesize the lithostratigraphic relationships of the Conasauga Group in Carter and Stanley valleys. It is hoped that this study will provide useful data and a more concise picture of the Cambrian stratigraphy of East Tennessee.

#### Previous Investigations

Previous investigations in the area have been limited to regional geologic studies of a reconnaissance nature. Safford (1869) made numerous references to Hawkins County and mentioned the Cambrian shales and limestones in Carter and Stanley valleys.

Campbell (1894) made an excellent map of the area which shows the distribution of the rock units fairly accurately, but due to the small scale of the map, many stratigraphic and structural features were not indicated (Figure 4).

Butts (1933, 1940) described the lithology, distribution, and fauna of most of the units in the same thrust blocks to the northeast in Scott County, Virginia.

Sanders (1952) mapped the rocks of the footwall of the Saltville fault in the Plum Grove quadrangle and northward to the Virginia line in the Church Hill quadrangle.

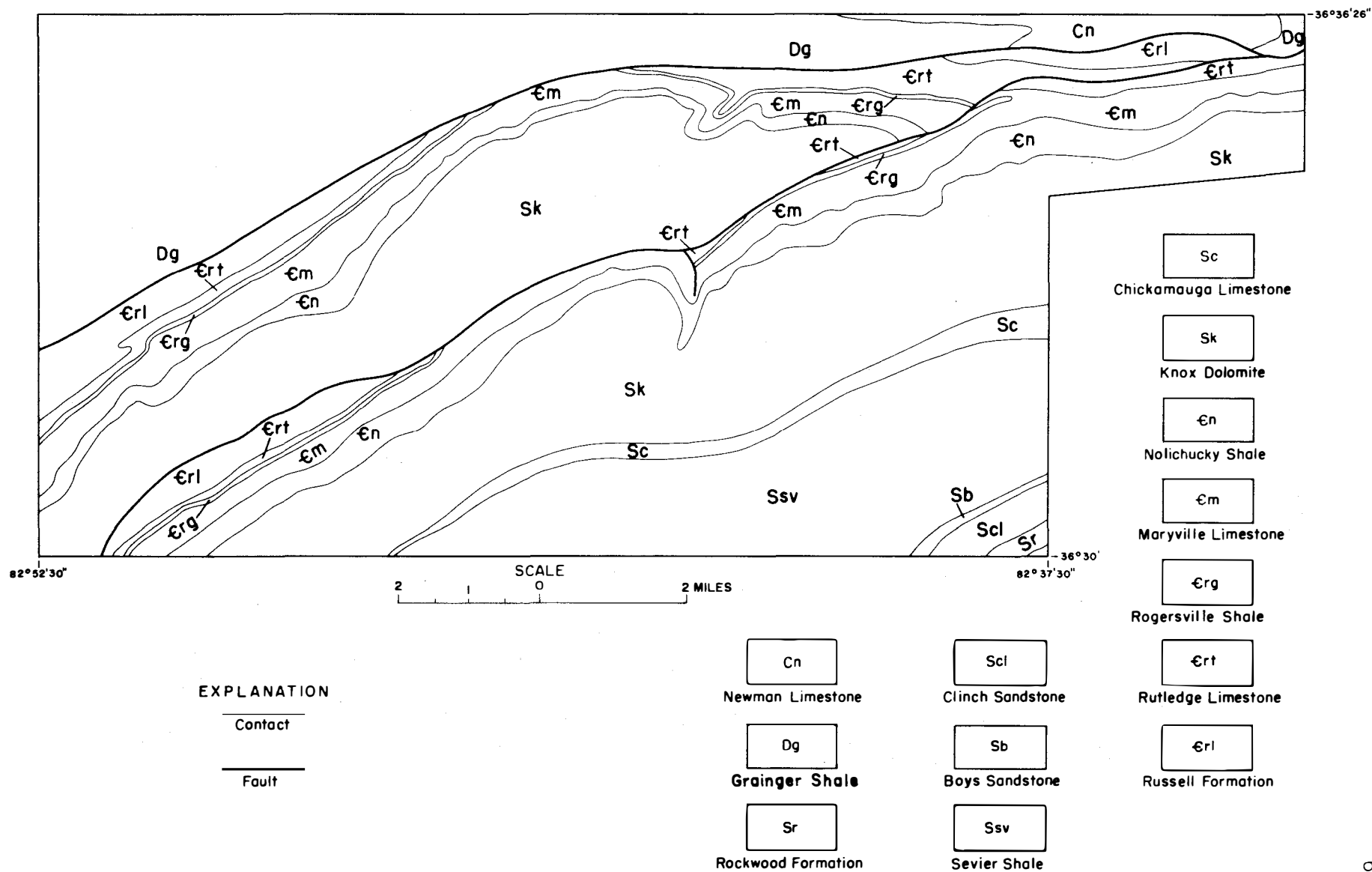


Figure 4. Geology of a portion of the Estillville Folio (after Campbell, 1894).

Rodgers (1953), in a compilation map of East Tennessee, shows practically the same units as Campbell, however, Rodgers separated the Knox Group into five formations in the Carter Valley thrust block.

#### Present Investigation

The present investigation represents the first and only thorough and detailed geologic work in the area. Consequently, several new findings have been uncovered. The author has interpreted the local facies of the Conasauga Group and has attempted to fit his findings into the regional facies framework.

The field work was completed during the summers of 1965 and 1966. Standard geologic procedures were employed in the detailed mapping. Lithologies were plotted by selected colors and the attitude of beds was determined with a Brunton compass. All contacts were traversed by foot. In areas of abundant bedrock exposures, as is the case throughout much of the area, traverses were undertaken with the objective of walking-out and mapping a given contact. Areas underlain by the Knox Group have the least bedrock exposures and were often traversed across strike or in a random fashion.

## CHAPTER II

### STRATIGRAPHY

#### Introduction

The first phase of this study was the preparation of a detailed geologic map. The principal emphasis in the subdivision of the strata was the physical recognition of the stratigraphic units for mapping purposes. As used in this report, stratigraphic classification refers to a lithostratigraphic classification--the organization of rock strata, in natural sequence, into units which may be differentiated by their lithologic character.

Because the different lithologic types commonly intergrade in various degrees in nature, and because the beds formed by these lithologic types and their intergradations commonly are intricately interstratified and intertongued, lithostratigraphic classification is not always a clear-cut and exact procedure. On the contrary, individual judgment will produce considerable variations.

The major concern of the earlier workers in this area (Campbell, 1894), and (Butts, 1933, 1940) was the recognition of time-rock units. Consequently, stratigraphic names, some of which were never clearly defined, were introduced into the area by the inspection of a few ideally exposed sections.

## General Discussion

Approximately 6,500 feet of Lower Paleozoic sedimentary rocks crop out in the study area. The general lithologic variations and thicknesses of units mapped are presented in the columnar section in Figure 5. The rocks crop out in northeast-southwest trending belts which are separated by major thrust faults--the Carter Valley, Saltville, and Town Knobs faults. Each thrust block strike belt is named from the valley in which the rocks occur, and includes the area from one major thrust fault to the next.

Rocks mapped in the thrust blocks range in age from Early Cambrian to Middle Ordovician. Rocks of Late Mississippian age occur in the footwall of the Saltville fault throughout its extent in the area. The names and type localities of the units mapped by the writer are listed in Table I.

The Rome Formation, the oldest rock unit recognized in the Carter and Stanley valleys thrust blocks, is exposed in the hanging wall adjacent to thrust faults.

Throughout most of the extent of the strike belts in the mapped area, the Conasauga Group is represented by six formations of the central phase as described by Rodgers (1953, p. 49). However, in the northeastern portion of the area, the Honaker Dolomite facies of the southeastern phase is recognized.

The Knox Group consists of siliceous carbonates and corresponds to the northwestern phase (northwest of the Pulaski fault) as described



TABLE I  
NAMES AND TYPE LOCALITIES OF FORMATIONS

| Age              |        | Group            | Formation                                                                                        | Name and Type Locality                                                                                          |
|------------------|--------|------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Mississippian    | Upper  |                  | Pennington Formation                                                                             | Campbell, M.R., 1893. Name taken from Pennington Gap, Va., but type section was described at Big Stone Gap, Va. |
|                  | Middle | Chickamauga      | Sevier Shale                                                                                     | Keith, A., 1895. Named for exposures in Sevier County, Tenn.                                                    |
| Lenoir Limestone |        |                  | Safford, J. M., and Killebrew, J.B., 1876. Named for exposures at Lenoir City, Loudon Co., Tenn. |                                                                                                                 |
|                  |        | (Mosheim Member) | Ulrich, E.O., 1911. Named for exposures at Mosheim, Green County, Tenn.                          |                                                                                                                 |
| Ordovician       | Lower  | Knox             | Mascot Dolomite                                                                                  | Oder, C.R.L., and Miller, H.W., 1945. Named for exposures at Mascot, Knox County, Tenn.                         |
|                  |        |                  | Kingsport Formation                                                                              | Oder, C.R.L., and Miller, H.W., 1945. Named for exposures at Kingsport, Sullivan County, Tenn.                  |
|                  |        |                  | Longview Dolomite                                                                                | Butts, Charles, 1926. Named for exposures at Longview, Shelby County, Alabama.                                  |
|                  |        |                  | Chepultepec Dolomite                                                                             | Ulrich, E.O., 1911. Named for exposures at Chepultepec, Blount County, Alabama                                  |

TABLE I (continued)

| Age      |                      | Group     | Formation                                                                                                | Name and Type Locality                                                                                             |
|----------|----------------------|-----------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Cambrian | Upper                | Knox      | Copper Ridge Dolomite                                                                                    | Ulrich, E.O., 1911. Named for Copper Ridge at Thorn Hill, Grainger County, Tenn.                                   |
|          |                      | Conasauga | Maynardville Formation                                                                                   | Oder, C.R.L., 1934. Named for exposures near Maynardville, Union County, Tenn.                                     |
|          |                      |           | Nolichucky Formation                                                                                     | Campbell, M.R., 1894.<br>Keith, Arthur, 1905. Named for exposures along the Nolichucky River, Greene County, Tenn. |
|          | Maryville Formation  |           | Campbell, M.R., 1894.<br>Keith, Arthur, 1895. Named for exposures at Maryville, Blount County, Tenn.     |                                                                                                                    |
|          | Rogersville Shale    |           | Campbell, M.R., 1894<br>Keith, Arthur, 1896. Named for exposures near Rogersville, Hawkins County, Tenn. |                                                                                                                    |
|          | Rutledge Formation   |           | Campbell, M.R., 1894.<br>Keith, Arthur, 1901. Named for exposures near Rutledge, Grainger County, Tenn.  |                                                                                                                    |
|          | Pumpkin Valley Shale |           | Rodgers, J., and Kent, D.F., 1948. Named for exposures in Pumpkin Valley Hawkins County, Tenn.           |                                                                                                                    |
|          | Middle               |           |                                                                                                          |                                                                                                                    |
|          | Lower                |           | Rome Formation                                                                                           | Hayes, C.W., 1891. Named for exposure at Rome, Floyd County, Georgia.                                              |

by Rodgers (1953, p. 53). All five formations are present and identifiable. However, outcrops are scarce and the units must be separated on the basis of residual products and topographic expression.

The Chickamauga Group corresponds to the rocks described by Rodgers (1953, p. 76) in belts southeast of the Chestuee and Dumplin Valley faults and of the Saltville fault northeast of Morristown (Gray Belt of Safford). In this group, the Lenoir- and Mosheim-type lithologies were mapped together; they are overlain by the Sevier Shale.

The youngest preserved unit involved in the faulting is the Pennington Formation of Late Mississippian age, which occurs in the footwall of the Saltville fault.

Problems encountered in mapping, such as scarcity of outcrops, identification of formations in a faulted sequence, placing of contacts between transitional units, and the mapping of units on weathered versus freshly broken bedrock, are discussed under the description of each formation. Facies relationships are discussed under the heading of Facies Relationships and Interpretation of the Conasauga Group.

A list of the locations of measured section is given in Table II and are shown on Plate II.

#### Description of Rock Units

##### Rome Formation

The Rome Formation is the oldest mapped unit exposed in the area under investigation. For the most part, it consists of variegated

TABLE II  
LOCATION OF MEASURED SECTIONS

| Section No. | Location (Tenn. Coord.)*                                | Unit Measured                                         |
|-------------|---------------------------------------------------------|-------------------------------------------------------|
| SV-1        | 2,927,600E., 794,200N.                                  | Nolichucky Formation and<br>Maryville Formation       |
| SV-2        | 2,939,400E., 800,500N.                                  | Nolichucky Formation                                  |
| SV-3        | 2,946,000E., 808,900N.                                  | Bradley Creek Limestone<br>and Maynardville Formation |
| SV-4        | 2,972,400E., 815,050N.                                  | Nolichucky Formation                                  |
| SV-5        | 2,919,300E., 786,100N.                                  | Maynardville Formation                                |
| SV-6        | 2,919,900E., 793,200N.<br>and<br>2,920,950E., 793,750N. | Composite section of<br>Pumpkin Valley Shale          |
| SV-7        | 2,932,600E., 801,550N.                                  | Rogersville Shale                                     |
| SV-8        | 2,937,000E., 805,250N.                                  | Rogersville Shale and<br>Rutledge Formation           |
| SV-9        | 2,944,300E., 807,650N.                                  | Bradley Creek Limestone                               |
| SV-10       | 2,948,550E., 811,000N.                                  | Bradley Creek Limestone                               |
| SV-11       | 2,943,250E., 809,850N.                                  | Rutledge Formation                                    |
| SV-12       | 2,922,750E., 792,900N.                                  | Maryville Formation                                   |
| SV-13       | 2,987,550E., 816,800N.                                  | Rogersville Formation                                 |
| CV-1        | 2,932,650E., 786,500N.                                  | Nolichucky Formation                                  |
| CV-2        | 2,940,850E., 790,800N.                                  | Bradley Creek Limestone                               |
| CV-3        | 2,960,000E., 801,500N.                                  | Nolichucky Formation                                  |
| CV-4        | 2,980,750E., 808,650N.                                  | Nolichucky Formation                                  |
| CV-5        | 2,924,200E., 782,900N.                                  | Rogersville Shale                                     |

TABLE II (continued)

| Section No. | Location (Tenn. Coord.) | Unit Measured           |
|-------------|-------------------------|-------------------------|
| CV-6        | 2,928,750E., 782,800N.  | Bradley Creek Limestone |
| CV-7        | 2,929,150E., 782,500N.  | Maynardville Formation  |
| CV-8        | 2,929,750E., 787,300N.  | Rogersville Shale       |
| CV-9        | 2,929,900E., 787,600N.  | Rutledge Formation      |
| CV-10       | 2,936,500E., 791,700N.  | Rutledge Formation      |
| CV-11       | 2,989,250E., 816,500N.  | Rogersville Shale       |

\*Tennessee coordinates are given at midpoint of the section.

claystones\* and siltstones and arenite-textured dolomites. Sandstone beds are prominent in some areas and thin limestone beds occur locally. The sandstone is mostly fine- to medium-grained, grayish-brown to red, thin-bedded, micaceous, and some beds are very glauconitic. The thickness of the formation cannot be ascertained in this area because the base of the Rome is concealed by faulting. However, a complete section is exposed in the Stony Creek syncline northeast of Elizabethton and the thickness is approximately 1,200 feet (Rodgers, 1953, p. 45).

Various workers have placed the contact of the Rome Formation with the overlying unit at different lithologic and time-stratigraphic boundaries. As originally defined by Hayes (1891), the Rome Formation extends downward from the highest of several prominent sandstone beds below the Conasauga Shale. Later, Hayes and Keith extended the name to include strata above the sandstone beds up to the base of the first blue limestone bed (Rodgers, 1953, p. 43). In the Estillville Folio (1894), which covers the area presently under investigation, and in the Bristol Folio (1899) which covers an area to the east, Campbell referred to this same general interval as the Russell Formation. To the southeast, especially in northeast Tennessee, the Rome Formation has previously been mapped as the Watauga Shale (Keith, 1903). Rodgers (1953, p. 44) referred to the Rome Formation in that area as the "Watauga dolomite phase." Rodgers and Kent (1948, p. 7) excluded the strata between the

---

\*Claystone is used throughout this report in preference to shale. It indicates grain size and is not used in a structural sense.

uppermost sandstone bed and the massive, blue limestone unit from the Rome Formation and called this lithologically mappable unit the Pumpkin Valley Shale. Therefore, the restricted Rome Formation of Rodgers and Kent is the same as that originally defined by Hayes. Presently, most geologists working in the Valley and Ridge in East Tennessee follow this nomenclature.

The Rome Formation is not very well exposed in the area under investigation. Sandstone beds decrease and are practically absent in the northeastern part of the area. In the southwestern part of the Plum Grove quadrangle in Stanley Valley, the contact between the Rome Formation and the Pumpkin Valley Shale is well exposed in several places and a prominent dolomite bed occurs about 30 feet above the sandstone bed marking this contact. In mapping northeastward, the sandstone beds decrease in thickness and in abundance and the contact is drawn just below the dolomite bed which occurs in the Pumpkin Valley Shale. This dolomite bed forms a prominent ledge on most hillsides and is easily recognized.

The Rome Formation is a relatively easy unit to identify. Even though it is vertically a very heterogeneous formation, laterally, the unit exhibits several characteristic and unifying features. Its most distinctive feature is the red to grayish-red to maroon color. Mud cracks, ripple marks, rain imprints, swash marks, and other primary depositional features are abundant. The siltstone, claystone, and dolomite beds are finely laminated.

In mapping the Rome Formation, dolomite layers were found to be more common in outcrop than any other type lithology. A persistent dolomite unit, 20 to 30 feet thick, can be traced on the northwest slope of the Rome ridges, approximately 60 to 80 feet below the crest of the ridge, and approximately 400 feet stratigraphically below the Rome and Pumpkin Valley contact. The dolomite unit generally shows many fine fractures which have been filled with white chert cement. On weathered surfaces, the dolomite exhibits a yellowish-brown iron stain coating. This dolomite unit is the lowest (oldest) horizon marker which occurs on the hanging wall of the major thrust faults in the area.

From the western edge to the eastern extent of the mapped area, more carbonates and less clastics occur in the Rome Formation to the east and southeast.

The Rome Formation is sparingly fossiliferous but the occurrence of Olenellus indicates an Early Cambrian age.

### Conasauga Group

#### Introduction

The Conasauga Group was named for exposures along Conasauga River in Whitfield and Murray Counties, Georgia (Hayes, 1891, p. 143). In the type area, the Conasauga Group is dominantly a silty claystone but contains lenses and layers of blue-gray limestone. The six formations of the central phase of the Conasauga Group (Rodgers, 1953, p. 49) are recognizable in the Carter and Stanley valleys thrust blocks.

However, in the Cloud Ford to Morrison City area, the Rogersville Shale thins to less than four feet and cannot be located by its topographic expression. With the thinning of the Rogersville, the interval between the Pumpkin Valley Shale and the Nolichucky Formation is mapped as the Honaker Dolomite.

Formations of the Conasauga Group are readily distinguished in an unbroken sequence. The claystone and argillaceous siltstone lithologies of the Pumpkin Valley, Rogersville, and Nolichucky units are easily differentiated in a faulted sequence by their respective colors. Limestone members of the Rutledge, Maryville, Nolichucky, and Maynardville are easily identified, but the dolomite members of the Rutledge and Maryville are very difficult if not impossible to differentiate in a faulted sequence. The average thickness of the Conasauga Group is 2,130 feet. Locations of measured and/or described rock units are listed in Table II, page 14.

The rocks of the Conasauga Group are slightly fossiliferous, but in this study a detailed examination of the fossil content was not attempted. Comprehensive paleontological studies of the Conasauga rocks are recorded by Ulrich (1911), Hall and Amick (1934), Butts (1926, 1940), and Resser (1938).

#### Pumpkin Valley Shale

Rodgers and Kent (1948, p. 7) restricted the Rome Formation by excluding from its top a clastic unit of Early Middle Cambrian age and introduced the name Pumpkin Valley Shale for this unit. In the type

section in Lee Valley, Hawkins County, they measured 360 feet of this unit between typical Rome lithology and limestone of the Rutledge Formation.

In Stanley Valley in the southwestern part of the Plum Grove quadrangle (measured section SV-6), the Pumpkin Valley Shale is approximately 290 feet thick and consists of about 140 feet of green and maroon silty claystone, succeeded by 55 to 60 feet of alternate massive, blue, "ribbioned" limestone and green claystone; this unit is overlain by about 95 feet of green claystone which contains thin beds of limestone near the top. The green and maroon silty claystones are laminated, thin-bedded, and weather to a thin, acid soil. Beds of dolomite up to one foot thick occur near the base of this unit. The limestone beds in the Pumpkin Valley are massive, lithographic, and commonly "ribbioned" with dolomite. The green claystone unit is very thin-bedded, slightly silty, and contains numerous thin layers of limestone.

Measured Section SV-6. Composite section of the Pumpkin Valley Shale.  
Section located one mile southwest of Looney Baptist Church.  
Tennessee Coordinates--2,919,900E., 793,200N., and 2,920,950E.,  
793,750N.

| <u>Unit Number</u>   | <u>Description of Unit</u>                                                                  | <u>Thickness</u> |
|----------------------|---------------------------------------------------------------------------------------------|------------------|
| Rutledge Formation   |                                                                                             |                  |
| 44.                  | Dolomite, brown, highly weathered                                                           |                  |
| Pumpkin Valley Shale |                                                                                             |                  |
| 43.                  | Claystone, grayish-green, silty . . . . .                                                   | 28' 0"           |
| 42.                  | Limestone, grayish-blue to blue, sublithographic;<br>"ribbioned" with dolomite. . . . .     | 3' 4"            |
| 41.                  | Claystone, green, silty, with thin beds of<br>brown siltstone; unit partly covered. . . . . | 64' 0"           |

|                 |                                                                                       |         |
|-----------------|---------------------------------------------------------------------------------------|---------|
| 40.             | Limestone, same as unit no. 42. . . . .                                               | 6' 8"   |
| 39.             | Covered . . . . .                                                                     | 2' 6"   |
| 38.             | Limestone, same as unit no. 42. . . . .                                               | 5"      |
| 37.             | Covered . . . . .                                                                     | 2' 2"   |
| 36.             | Limestone, same as unit no. 42. . . . .                                               | 1' 1"   |
| 35.             | Covered . . . . .                                                                     | 1' 9"   |
| 34.             | Limestone, same as unit no. 42. . . . .                                               | 5"      |
| 33.             | Covered . . . . .                                                                     | 3' 8"   |
| 32.             | Limestone, same as unit no. 42. . . . .                                               | 15' 0"  |
| 31.             | Claystone, grayish-green, silty . . . . .                                             | 2' 6"   |
| 30.             | Limestone, same as unit no. 42. . . . .                                               | 2' 4"   |
| 29.             | Claystone, same as unit no. 31. . . . .                                               | 1' 3"   |
| 28.             | Limestone, same as unit no. 42. . . . .                                               | 5' 8"   |
| 27.             | Claystone, same as unit no. 31. . . . .                                               | 2' 6"   |
| 26.             | Limestone, same as unit no. 42. . . . .                                               | 1' 2"   |
| 25.             | Claystone, same as unit no. 31. . . . .                                               | 1' 4"   |
| 24.             | Limestone, same as unit no. 42. . . . .                                               | 2' 0"   |
| 23.             | Claystone, same as unit no. 31. . . . .                                               | 3' 8"   |
| 22.             | Limestone, same as unit no. 42. . . . .                                               | 2' 0"   |
| 21.             | Claystone and siltstone, green to gray to<br>maroon; unit mostly covered . . . . .    | 99' 0"  |
| 20.             | Dolomite, gray to brown, laminated, silty . . . . .                                   | 1' 2"   |
| 19.             | Siltstone, maroon . . . . .                                                           | 1' 0"   |
| 18.             | Dolomite, same as unit no. 20 . . . . .                                               | 9' 0"   |
| 17.             | Siltstone with interbedded claystone, mostly<br>maroon with scattered green . . . . . | 9' 3"   |
| 16.             | Dolomite, same as unit no. 20 . . . . .                                               | 1' 4"   |
| 15.             | Claystone, green, brown, and maroon, sandy;<br>much interbedded siltstone. . . . .    | 9' 2"   |
| 14.             | Dolomite, gray to brown, massive, highly<br>weathered . . . . .                       | 8"      |
| 13.             | Claystone and siltstone, green and maroon,<br>sandy . . . . .                         | 9' 0"   |
| 12.             | Dolomite, same as unit no. 14 . . . . .                                               | 6"      |
| 11.             | Claystone, green, silty . . . . .                                                     | 1' 9"   |
| Total thickness |                                                                                       | 285' 3" |

#### Rome Formation

|     |                                                                                    |        |
|-----|------------------------------------------------------------------------------------|--------|
| 10. | Sandstone, brown, medium-grained, highly<br>weathered . . . . .                    | 8"     |
| 9.  | Claystone, green, interbedded with siltstone. . . . .                              | 1' 4"  |
| 8.  | Dolomite, dark gray, "ribboned" with siltstone. . . . .                            | 6"     |
| 7.  | Claystone, green to brown . . . . .                                                | 4' 8"  |
| 6.  | Sandstone, very fine-grained, brownish-red;<br>some interbedded dolomite . . . . . | 1' 7"  |
| 5.  | Claystone, red to brown, interbedded with<br>siltstone . . . . .                   | 12' 8" |

- |    |                                                                                                 |       |
|----|-------------------------------------------------------------------------------------------------|-------|
| 4. | Sandstone, fine- to medium-grained, massive,<br>brown, micaceous, slightly glauconitic. . . . . | 8"    |
| 3. | Claystone, dark gray, silty . . . . .                                                           | 8"    |
| 2. | Siltstone, medium-grained, brown, very<br>argillaceous. . . . .                                 | 9"    |
| 1. | Siltstone, medium-grained, red, laminated,<br>3" bedding. . . . .                               | 2' 6" |

In Carter Valley, the Pumpkin Valley Shale ranges in thickness from 160 to 200 feet. In this thrust block, limestone beds are notably absent from the formation when compared to the massive limestone beds which occur in the upper part of the unit in Stanley Valley. In Carter Valley in the Church Hill quadrangle, the Pumpkin Valley Shale is absent due to faulting.

The upper boundary of the Pumpkin Valley Shale is drawn at the top of the highest green claystone unit. The upper part of the formation and the limestone member of the Rutledge Formation are more susceptible to erosion and are valley formers. The clastics of the lower part generally underlie relatively steep slopes, especially where the Rome Formation is exposed.

Several different features help to differentiate the Pumpkin Valley Shale from other formations in the Conasauga Group. Chiefly, the Pumpkin Valley is recognized by its stratigraphic position above the Rome Formation and below the limestone member of the Rutledge Formation. Also, the claystone in the upper part of the formation is distinguished by its green to grayish-green color. The lower part of the formation is characterized by maroon color and the occurrence of silty and sandy beds.

Resser (1938) and Fox (1943) applied the name Rutledge to strata of similar lithology, position, and fauna as those now included in the Pumpkin Valley Shale. Facies relationships of the Pumpkin Valley Shale are discussed on page 59.

#### Rutledge Formation

The Rutledge Formation was named for exposures near Rutledge, Grainger County, Tennessee by Keith (1896), but was first reported by Campbell (1894). In the type section, the Rutledge is largely limestone but in the study area it is divisible into two members, a lower limestone unit and an upper dolomite unit. Therefore, the term "Formation" is preferable to "Limestone" as a formational surname.

Outcrops of the Rutledge Formation are scarce, due in part to the soluble nature of the rocks, and in part to the colluvial material of the Rome and Pumpkin Valley which covers the lower stratigraphic interval of the formation. In the Church Hill quadrangle, the Rutledge is absent in Carter Valley due to faulting (Plate I). It has also been faulted out in the west-central part of Stanley Valley; in other parts of Stanley Valley in the Church Hill quadrangle, it has been repeated by faulting. Therefore, exposed sections which represent total thicknesses of the Rutledge Formation are limited to the southwest portion of the area.

In Carter Valley, a complete section of the Rutledge Formation, 442 feet thick, is exposed in the vicinity of Amis Chapel (measured section CV-10). The description of this section is given below. The

formation thins to 360 feet one-half mile west of Oakdale Church (measured section CV-9). In Stanley Valley, the Rutledge Formation is 315 feet thick in the vicinity of Jenkins Church (measured section SV-11) and the unit thins to 230 feet in the area one-half mile north of Bethel Church (measured section SV-8).

Measured Section CV-10. Section of the Rutledge Formation. Located along Bradley Creek at Amis Chapel. Tennessee coordinates-- 2,936,500E., 791,700N.

| <u>Unit Number</u>   | <u>Description of Unit</u>                                                                | <u>Thickness</u> |
|----------------------|-------------------------------------------------------------------------------------------|------------------|
| Rogersville Shale    |                                                                                           |                  |
| 12.                  | Claystone, pale olive, silty                                                              |                  |
| Rutledge Formation   |                                                                                           |                  |
| Dolomite Member      |                                                                                           |                  |
| 11.                  | Dolomite, medium-gray to grayish-black, lutite textured; unit incompletely exposed. . . . | 350' 2"          |
| Limestone Member     |                                                                                           |                  |
| 10.                  | Limestone, light gray to blue, massive, "ribboned" with dolomite. . . . .                 | 10' 0"           |
| 9.                   | Covered . . . . .                                                                         | 6' 2"            |
| 8.                   | Limestone, same as unit no. 10. . . . .                                                   | 7' 6"            |
| 7.                   | Covered . . . . .                                                                         | 4' 8"            |
| 6.                   | Limestone, same as unit no. 10. . . . .                                                   | 3' 0"            |
| 5.                   | Covered . . . . .                                                                         | 7' 1"            |
| 4.                   | Limestone, grayish-black, lutite-textured, strongly "ribboned" with dolomite . . . . .    | 8' 3"            |
| 3.                   | Covered . . . . .                                                                         | 12' 2"           |
| 2.                   | Limestone, interbedded with dolomite; one and two foot intervals covered. . . . .         | 33' 0"           |
| Total Thickness      |                                                                                           | 442' 0"          |
| Pumpkin Valley Shale |                                                                                           |                  |
| 1.                   | Claystone, olive-gray to green; contains dolomite beds up to three inches thick. . . . .  | 30' 0"           |

Limestone Member

The limestone member is medium dark-gray to grayish-blue, lutite-textured, medium- to thick-bedded, and where weathered it is light grayish-blue and exhibits a "ribboned" or straticulate appearance; the straticulations are due to minute amounts of silt. The only occurrence of oolites in the Rutledge observed by the writer was in the Bethel Church area. Here, the oolites are white and silicified.

In most section where the thickness of the Rutledge can be ascertained (measured section CV-10), the limestone member averages 90 feet in thickness. In Stanley Valley between Chapman Cemetery and Cameron Church, the measured thickness of the limestone member exceeds 200 feet. The greater thickness of the limestone member is probably due to faulting within the limestone unit. In the above mentioned area, the contact between the Pumpkin Valley and Rutledge is obscured by colluvium, and in places alluvial material occupying the valley of Stanley Valley Creek.

Dolomite Member

The dolomite member is fine- to medium-crystalline, dark-gray to grayish-black, medium- to thick-bedded, and the rocks give off a petroliferous odor on a freshly broken surface. When weathered, the dolomite is grayish-brown and megascopically the unit show a "hachured" appearance.

## Rogersville Shale

The Rogersville Shale is predominantly a dusky-yellow to pale olive claystone. The unit contains silty layers, especially near the base; dolomite beds up to three feet thick are common in the upper one-third of the unit. Upon weathering, the color of the rock tends to change to a lighter green or yellowish-orange color.

The Rogersville is very widespread and is an excellent marker unit in the central phase of the Conasauga Group. The Rogersville is very well exposed in both Carter and Stanley valleys. The southwestern portion of the Carter Valley road is on the outcrop belt of the Rogersville. It is a very persistent unit and is easily traced since it forms gentle knolls which typically are barren of soil. Where soil is developed on the unit, it is shallow, acid, and green and orange flaky chips are abundant. The flaky clay chips are very diagnostic of the weathered Rogersville and serve to distinguish it from any other claystone unit in the area.

The average thickness of the Rogersville Shale in Stanley Valley is 90 feet, but it is somewhat thinner in Carter Valley. In the southwest part of Carter Valley, where Young Branch crosses the Carter Valley road (measured section CV-5), the Rogersville is 66 feet thick and gradually thickens to the northeast to about 80 feet in the Oakdale Church area (measured section CV-8). The Rogersville maintains this approximate thickness to the northeast until in the area one mile west of Cloud Ford, the unit thins to about 10 feet (measured section

CV-11). Near the Newland Cemetery, four miles east of Cloud Ford, the Rogersville Shale is only three feet thick. In the Morrison City area, the Rogersville Shale is approximately six feet thick. The Morrison City area represents the western extent of the Honaker Dolomite.

Campbell (1894, p. 2) recognized the dolomite facies of the Rogersville and stated: "In Carter Valley east of Cloud Ford this formation becomes a dark, siliceous limestone (dolomite), which cannot be separated from the limestones (dolomites) above and below." Later, Butts (1933) mapped the same strike belt in Scott County, Virginia, and called this interval the Honaker Dolomite. In a railroad cut on the Clinchfield Railroad where it is crossed by the Southern Railroad and the Carter Valley road, one and one-half mile west of Cloud Ford, the writer measured 45 feet of Rogersville Shale (measured section SV-13). At this locality, the Rogersville is dark greenish-gray to grayish-black, very dolomitic, and contains thin dolomite beds throughout the formation.

The Craig Limestone Member of the Rogersville Shale does not occur in the mapped areas. However, it is this writer's opinion that in the Carter and Stanley valleys area, the Craig interval is incorporated in the basal part of the dolomite member of the Maryville Formation. Rodgers and Kent (1948, p. 10-11) measured 47 feet of the Craig Limestone Member in the Lee Valley section overlain by six feet of green claystone. Near Rutledge, 85 feet of the Craig Limestone Member is exposed in a quarry and is separated from the overlying Maryville by 17 feet of green claystone. Rodgers and Kent (1948,

p. 10) stated that, "In general, the member thins to the west and north-west and thickens to the east and southeast. A few miles east-northeast of the Lee Valley section, the overlying shale unit thins to extinction, and the Craig Limestone Member merges with the lithologically similar Maryville Limestone."

#### Maryville Formation

The chief lithology of the Maryville in the type section is limestone. However, in Carter and Stanley valleys, the carbonate sequence (Maryville) between the Rogersville Shale and Nolichucky Formation can be divided into two units, a lower dolomite member and an upper limestone member. For this reason, it is preferable to refer to the unit as the Maryville Formation.

Exposures of the limestone member of the Maryville Formation are abundant. However, the dolomite member occurs in the valleys and a complete section could not be found well enough exposed to be measured and described. The Maryville and Nolichucky contact is expressed topographically by a prominent row of knobs. The Nolichucky caps the hills with 20 to 40 feet of silty claystone and the limestone member of the Maryville occupies the northwest slope of this row of knobs. The dolomite member occupies the lower portion of the northwest slope and the southeast part of the valley down to the Rogersville Shale.

No fossils were found in the Maryville Formation in the area under investigation. However, Rodgers (1953, p. 51) stated that the

contact between the Maryville and Nolichucky formations is approximately the contact between the Middle and Upper Cambrian Series.

### Dolomite Member

The dolomite member averages 540 feet in thickness. It is fine- to medium-crystalline, dark bluish-gray to grayish-black, medium- to thick-bedded, and where weathered, the beds are grayish-brown and tend to become rounded. On a freshly broken surface, many of the dolomite beds have a petroliferous odor.

The writer found a key bed or "marker bed" which occurs in the dolomite member. The "marker bed," a medium light gray, lutite-textured, thick-bedded dolomite, is 25 to 30 feet thick and occurs 150 feet from the top of the Maryville Formation. Upon weathering, the beds are very light gray to grayish-white and can be readily traced along strike and in a faulted sequence. The weathered beds closely resemble some of the dolomite beds in the Mascot Dolomite. The "white dolomite" marker bed is persistent in both Carter and Stanley valleys and can be relied upon as a horizon marker since the stratigraphic interval between it and the top of the Maryville Formation remains constant. To the northwest in the Lee Valley section, the writer studied the Maryville section and located the "white dolomite" marker bed at approximately the same stratigraphic position. The writer spent several days with D. C. Haney in the Looney's Gap, Burem, and Pressmen's Home quadrangles to the west and southwest studying the lithology of the Conasauga Group. The "white dolomite" marker bed is present in the dolomite member in all areas

except Caney Valley. Here, the limestone member of the Maryville Formation thickens to more than 200 feet; however, the "white dolomite" marker bed can still be recognized in the limestone unit.

### Limestone Member

The limestone member of the Maryville Formation is massive, medium dark-gray to grayish-black, and medium- to thick-bedded. Several different textures are common; fine- to medium- to coarsely crystalline, lithographic, oolitic, and pisolitic. The top 25 feet of the unit is silty in the zone transitional with the overlying Nolichucky Formation. In the Carter Valley and Stanley Valley thrust blocks, the limestone member ranges from 85 to 95 feet thick (measured section CV-1).

Measured Section CV-1. Section of the Nolichucky Formation and partial section of the Maryville Formation. Located one-fourth mile south of Oakdale Church on secondary road which connects Carter Valley with Highway 11 W. Tennessee coordinates--2,927,600E., 794,200N.

| <u>Unit Number</u>             | <u>Description of Unit</u>                                                                              | <u>Thickness</u> |
|--------------------------------|---------------------------------------------------------------------------------------------------------|------------------|
| Nolichucky Formation           |                                                                                                         |                  |
| Upper Claystone Member         |                                                                                                         |                  |
| 26.                            | Claystone, grayish-olive, slightly silty                                                                |                  |
| Bradley Creek Limestone Member |                                                                                                         |                  |
| 25.                            | Limestone, sublithographic, medium light-gray, massive . . . . .                                        | .130' 0"         |
| Lower Claystone Member         |                                                                                                         |                  |
| 24.                            | Claystone, olive-green, very silty. . . . .                                                             | .408' 0"         |
| Maryville Formation            |                                                                                                         |                  |
| Limestone Member               |                                                                                                         |                  |
| 23.                            | Limestone, coarsely crystalline, greenish-gray with red mottling; trace of pyrite and chalcopyrite. . . | 8"               |

|                 |                                                                                                                                                                                                       |        |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 22.             | Limestone, dark gray, medium- to coarsely crystalline, massive, oolitic . . . . .                                                                                                                     | 5' 8"  |
| 21.             | Siltstone, brown, very calcareous . . . . .                                                                                                                                                           | 5"     |
| 20.             | Limestone, gray, thin-bedded, very silty. . . . .                                                                                                                                                     | 4' 9"  |
| 19.             | Siltstone, grayish-brown; interbedded with thin layers of silty limestone. . . . .                                                                                                                    | 2' 3"  |
| 18.             | Limestone, medium gray, lithographic, thin-bedded; few calcareous clay partings. . . . .                                                                                                              | 1' 7"  |
| 17.             | Limestone, lithographic to coarsely crystalline, dark gray; coarsely crystalline lithology contains discontinuous streaks of black oolites. Unit also contains some thin claystone partings . . . . . | 6' 7"  |
| 16.             | Limestone, dark gray, finely crystalline, massive; weathers greenish-brown to blue . . . . .                                                                                                          | 1' 4"  |
| 15.             | Limestone, same as unit no. 17. . . . .                                                                                                                                                               | 5' 2"  |
| 14.             | Limestone, dark gray, fine- to medium-crystalline; unit incompletely exposed . . . . .                                                                                                                | 3' 4"  |
| 13.             | Covered, reddish-orange soil. . . . .                                                                                                                                                                 | 3' 9"  |
| 12.             | Limestone, dark gray, fine- to medium-crystalline; few scattered black oolites . . . . .                                                                                                              | 4' 8"  |
| 11.             | Covered, reddish-orange soil. . . . .                                                                                                                                                                 | 14' 6" |
| 10.             | Limestone, lithographic to finely crystalline, light- to dark-gray, massive, slightly "ribboned"; weathers to dark bluish-gray. . . . .                                                               | 17' 7" |
| 9.              | Limestone, lithographic, dark blue, massive; weathers brownish-gray. . . . .                                                                                                                          | 7' 3"  |
| 8.              | Covered . . . . .                                                                                                                                                                                     | 4' 7"  |
| 7.              | Limestone, same as unit no. 9 . . . . .                                                                                                                                                               | 4' 0"  |
| 6.              | Covered . . . . .                                                                                                                                                                                     | 1' 2"  |
| Total Thickness |                                                                                                                                                                                                       | 89' 3" |

#### Dolomite Member

|    |                                                                  |        |
|----|------------------------------------------------------------------|--------|
| 5. | Dolomite, very dark gray, lutite textured, massive . . . . .     | 2' 2"  |
| 4. | Limestone, dark gray, lithographic, shaly . . . . .              | 1' 5"  |
| 3. | Dolomite, same as unit no. 5. . . . .                            | 8' 6"  |
| 2. | Covered . . . . .                                                | 11' 3" |
| 1. | Dolomite, dark gray, fine-grained; section incompletely exposed. |        |

#### Nolichucky Formation

In the type section along the Nolichucky River in Greene County, Tennessee, the Nolichucky is composed of olive-green calcareous shale

with interbedded limestone units which become more numerous toward the top of the formation (Bridge, 1956, p. 11). In Carter and Stanley valleys, the Nolichucky is divisible into three mappable units; a lower claystone member, a middle algal limestone member, and an upper claystone member. Therefore, the term "Formation" is preferable to "Shale" as a formational surname.

With the exception of measured section CV-3, the Nolichucky Formation ranges in thickness from 570 to 730 feet. In general, the formation is thickest in the Carter Valley thrust block. In the west-central part of the Church Hill quadrangle (measured section CV-3), the Nolichucky Formation is 860 feet thick. This area is immediately north of the complexly faulted area in Red Goose Hollow. Therefore, the great thickness in this section is due to structure instead of sedimentation.

#### Lower Claystone Member

The lower claystone member is grayish-olive to olive-green. It is very silty and slightly calcareous, especially near the Maryville contact. Ripple marks and swash marks are present in the more silty beds. Mica flakes are abundant along bedding planes. Weathered chips of the lower claystone unit are prismatic and grayish-brown. The average thickness of the lower unit is 390 feet.

#### Bradley Creek Limestone Member

The limestone member was first mentioned by Campbell (1894, p. 2) while describing the Nolichucky Formation. He stated that,

"In Carter Valley, the center of the formation, is a lentil of massive, blue limestone, which attains a maximum thickness of 400 to 500 feet."

The writer agrees with Campbell that the algal limestone should be placed in the Nolichucky Formation, but measured no more than 210 feet of the unit.

The algal limestone member is well exposed on the northwest side of the second row of knobs south of Carter Valley on Bradley Creek and its many small tributaries (measured section CV-2). To facilitate discussion of this member and also to give it a map name and symbol, the name "Bradley Creek Limestone Member" (Gnbc) is suggested for this mappable unit, which lies between the lower and upper claystone members of the Nolichucky Formation.

Measured Section CV-2. Type section of the Bradley Creek Limestone Member of the Nolichucky Formation. Section located 4,500 feet southeast of Amis Chapel. Tennessee coordinates--2,940,850E., 790,800N.

| <u>Unit Number</u>             | <u>Description of Unit</u>                                                                                               | <u>Thickness</u> |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------|
| Nolichucky Formation           |                                                                                                                          |                  |
| Upper Claystone Member         |                                                                                                                          |                  |
| Bradley Creek Limestone Member |                                                                                                                          |                  |
| 13.                            | Limestone, sublithographic, medium light-gray, blotched with tan, medium- to thick-bedded, weathers light-blue . . . . . | 74' 5"           |
| 12.                            | Limestone, medium dark-gray, medium- to coarsely crystalline, pelletal; weathers brownish-gray . . . . .                 | 16' 9"           |
| 11.                            | Limestone, same as unit no. 13. . . . .                                                                                  | 3' 4"            |
| 10.                            | Covered, red soil; probably limestone . . . . .                                                                          | 5' 4"            |
| 9.                             | Limestone, same as unit no. 13. . . . .                                                                                  | 2' 0"            |
| 8.                             | Limestone, grayish-blue, fine- to medium-crystalline, pelletal; weathers dark grayish-brown . . . . .                    | 7"               |

|                 |                                                                                                     |         |
|-----------------|-----------------------------------------------------------------------------------------------------|---------|
| 7.              | Limestone, same as unit no. 13. . . . .                                                             | 7' 9"   |
| 6.              | Covered; many blue limestone blocks scattered throughout this interval. . . . .                     | 22' 0"  |
| 5.              | Limestone, same as unit no. 13, except faintly "ribboned" near top . . . . .                        | 7' 2"   |
| 4.              | Limestone, same as unit no. 13. . . . .                                                             | 16' 5"  |
| 3.              | Limestone, same as unit no. 13, except slightly argillaceous; faint outline of algal heads. . . . . | 3' 3"   |
| 2.              | Covered, red soil; probably limestone . . . . .                                                     | 3' 1"   |
| 1.              | Limestone, same as unit no. 13. . . . .                                                             | 1' 7"   |
| Total thickness |                                                                                                     | 163' 8" |

The Bradley Creek Limestone Member is characterized by a sub-lithographic texture, but it does contain thin beds which may be fine- to coarsely crystalline, oolitic, or pelletal. The oolitic zones are restricted to the sublithographic texture and the pelletal zones are associated with the medium- to coarsely crystalline textured rocks. The sublithographic rocks are light greenish-gray to grayish-blue and are commonly blotched with tan and light green blebs. The coarser crystalline rocks are dark grayish-blue. Where weathered, the sublithographic rocks are light grayish-blue, whereas the medium- to coarsely crystalline rocks weather brownish-gray. The limestone member is massive and very thick-bedded; some beds are more than 20 feet thick. In many beds, light brown silty stringers are common, which vaguely outline the algal heads.

In the type section, the Bradley Creek Limestone Member is 163' 8" thick. In the southwestern part of the Carter Valley thrust block, the member ranges from 150 to 200 feet thick. To the northeast in the west-central part of the Church Hill quadrangle, the unit

reaches its maximum thickness of 210 feet (measured section CV-3).

The unit thins to the northeast where in the Marshall and Sensabaugh area, it ranges between 40 and 60 feet in thickness.

In the Stanley Valley thrust block, the unit decreases in thickness and shows its minimum development. It ranges in thickness from 4 to 92 feet, but the average thickness is 40 to 50 feet. Most sections measured in this thrust block contain beds of green, flaky claystone interbedded with the limestone near the middle of the unit (measured section SV-2).

Measured Section SV-2. Section of the Bradley Creek Limestone Member of the Nolichucky Formation. Located one-half mile southeast of Bethel Church on east side of road and Renfro Creek. Tennessee coordinates--2,939,400E., 800,500N.

| <u>Unit Number</u>             | <u>Description of Unit</u>                                                                                   | <u>Thickness</u> |
|--------------------------------|--------------------------------------------------------------------------------------------------------------|------------------|
| Nolichucky Formation           |                                                                                                              |                  |
| Upper Claystone Member         |                                                                                                              |                  |
| 15.                            | Claystone, olive green, silty                                                                                |                  |
| Bradley Creek Limestone Member |                                                                                                              |                  |
| 14.                            | Limestone, fine- to medium-crystalline, grayish-blue, pelletal; weathers gray to brown . . . . .             | 1' 5"            |
| 13.                            | Claystone, yellowish-green to greenish-blue, flaky, slightly silty . . . . .                                 | 3' 3"            |
| 12.                            | Limestone, sublithographic, grayish-blue; blotched with tan and green, massive. . . . .                      | 1' 2"            |
| 11.                            | Claystone, same as unit no. 13. . . . .                                                                      | 2' 1"            |
| 10.                            | Limestone, same as unit no. 12, except top three feet is pelletal. . . . .                                   | 21' 0"           |
| 9.                             | Limestone, same as unit no. 14. . . . .                                                                      | 1' 0"            |
| 8.                             | Claystone, same as unit no. 13. . . . .                                                                      | 3' 9"            |
| 7.                             | Limestone, same as unit no. 12. . . . .                                                                      | 3' 5"            |
| 6.                             | Claystone, olive-green, flaky, calcareous, minor intercalations of blue, sublithographic limestone . . . . . | 10' 8"           |

|                                                                                                                   |        |
|-------------------------------------------------------------------------------------------------------------------|--------|
| 5. Limestone, same as unit no. 12, except thin-bedded . . . . .                                                   | 1' 3"  |
| 4. Limestone, same as unit no. 12 . . . . .                                                                       | 1' 8"  |
| 3. Claystone, yellowish-green, silty; contains a four inch brown, argillaceous limestone layer in middle. . . . . | 4' 1"  |
| 2. Limestone, same as unit no. 12 . . . . .                                                                       | 1' 8"  |
| 1. Limestone, same as unit no. 12, except thin-bedded . . . . .                                                   | 1' 7"  |
| Total thickness                                                                                                   | 58' 0" |

#### Upper Claystone Member

The lithology of this unit is somewhat similar to the lower claystone member, however, this unit is less silty and more calcareous than the lower unit. The upper contact of the Nolichucky with the Maynardville is gradational. This transitional lithology consists of alternate laminae of claystone and argillaceous limestone. The average thickness of the upper claystone member is 190 feet.

#### Maynardville Formation

The Maynardville Formation was originally placed in the basal part of the Knox Group when defined by Oder (1934, p. 475). Bridge (1945) considered the fauna of this unit to be more closely related to the Nolichucky than to the Knox, so he called the Maynardville an upper member of the Nolichucky. Rodgers (1953, p. 48) raised the Maynardville to formational rank and followed Bridge in placing it in the top of the Conasauga Group. The Maynardville of this report is the same as that used by Rodgers (1953). Miller and Fuller (1954)

divided the Maynardville into two mappable members, the Low Hollow Limestone Member and Chances Branch Dolomite Member, in the Rose Hill District, Lee County, Virginia. Harris and Miller (1958) also mapped two members in the Maynardville in the Duffield quadrangle, Scott County, Virginia. In Carter and Stanley valleys, both members are easily recognized but because the upper member is poorly exposed the Maynardville was not subdivided on the map. However, in this report, the Maynardville is referred to as a "Formation."

A complete section of the Maynardville is exposed in the southwest part of the Plum Grove quadrangle in the Stanley Valley thrust block (measured section SV-5). At this locality, the limestone member is 52 feet thick and the dolomite member is 58 feet thick. From this section, the Maynardville thickens to the northeast and attains a thickness of 180 feet at Mount Pleasant Gap (measured section SV-4). The Maynardville also thickens to the east and northeast in the Carter Valley thrust block.

Measured Section SV-5. Section of the Maynardville Formation. Located on Surgoinsville Creek, one mile north of the Carter Valley road. Tennessee coordinates--2,919,300E., 786,100N.

| <u>Unit Number</u>             | <u>Description of Unit</u>                                                                                                         | <u>Thickness</u> |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Copper Ridge Dolomite          |                                                                                                                                    |                  |
| 17.                            | Chert, black, oolitic . . . . .                                                                                                    | 3"               |
| 16.                            | Sandstone, brown; contains weathered feldspar . . .                                                                                | 4' 0"            |
| Maynardville Formation         |                                                                                                                                    |                  |
| Chances Branch Dolomite Member |                                                                                                                                    |                  |
| 15.                            | Dolomite, dark gray, massive, laminated, partly "ribbioned"; weathers yellowish-white; this unit is incompletely exposed . . . . . | 58' 0"           |

#### Low Hollow Limestone Member

|     |                                                                                           |        |
|-----|-------------------------------------------------------------------------------------------|--------|
| 14. | Covered, few limestone streaks. . . . .                                                   | 1' 3"  |
| 13. | Limestone, medium gray, oolitic . . . . .                                                 | 7"     |
| 12. | Limestone, sublithographic, laminated, medium-gray; faint outline of algal heads. . . . . | 4"     |
| 11. | Covered . . . . .                                                                         | 2' 3"  |
| 10. | Limestone, same as unit no. 12. . . . .                                                   | 12' 3" |
| 9.  | Limestone, light to dark blue, massive, silty, strongly "ribboned" . . . . .              | 3' 6"  |
| 8.  | Covered . . . . .                                                                         | 1' 1"  |
| 7.  | Limestone, same as unit no. 9 . . . . .                                                   | 1' 1"  |
| 6.  | Covered . . . . .                                                                         | 4' 0"  |
| 5.  | Limestone, same as unit no. 9 . . . . .                                                   | 1' 1"  |
| 4.  | Covered . . . . .                                                                         | 3' 4"  |
| 3.  | Limestone, same as unit no. 9 . . . . .                                                   | 21' 5" |

Total thickness 110' 0"

#### Nolichucky Formation

##### Upper Claystone Member

|    |                                                                                                             |       |
|----|-------------------------------------------------------------------------------------------------------------|-------|
| 2. | Claystone, greenish-gray to yellow, silty . . . . .                                                         | 3' 2" |
| 1. | Limestone, dull gray, sublithographic, thin-bedded, argillaceous; contains thin claystone partings. . . . . | 3' 8" |

#### Low Hollow Limestone Member

The Low Hollow Limestone Member is medium-gray, lutite-textured, and medium- to thick-bedded. Due to differing amounts of enclosed clay and silt, beds may be banded, laminated, mottled, or "ribboned." This limestone member is differentiated from the other Conasauga limestones by its "ribboned" appearance, which is very conspicuous on weathered surfaces.

#### Chances Branch Dolomite Member

The Chances Branch Dolomite Member is medium- to dark-gray, lutite-textured, medium- to thick-bedded, and in places, many of the

beds are finely laminated. The dolomite of the Maynardville is distinguished from the Knox dolomite by the absence of chert in the residuum.

The contact of the Maynardville Formation with the overlying Copper Ridge Dolomite is placed at the bottom of a quartz sandstone bed which averages four feet in thickness. Where the sandstone was absent the contact was drawn at the position where the cryptozoan chert of the Copper Ridge appears. Where the bedrock is exposed, the contact is placed at the position where the dolomite of the Copper Ridge begins to have a strong petroliferous odor. In some outcrops, a three to four inch thick bed of black chert with large oolites overlies the quartz sandstone bed.

### Knox Group

#### Introduction

The Knox Group in this area consists of five mappable formations between the Maynardville Formation and the Lenoir and Mosheim-type lithologies of the Chickamauga Group. The formations mapped are, in ascending order, the Copper Ridge Dolomite, Chepultepec Dolomite, Longview Dolomite, Kingsport Formation, and the Mascot Dolomite.

The Knox Group is a sequence of dolomite with minor limestone about 3,000 feet thick. Exposures of bedrock are scarce and continuous sections rare. This thick sequence is subdivided into formations chiefly by the identification of certain sandstone beds and by the

recognition of different residual siliceous materials resulting from weathering of the various units.

The dolomite and limestone units of the Knox Group weather deeply, resulting in a very cherty, reddish-orange clay residuum that mantles practically all of the Knox belts of outcrop in East Tennessee.

#### Copper Ridge Dolomite

The most distinctive lithology of the Copper Ridge Dolomite is dark-gray to grayish-brown, medium- to coarsely crystalline, thick-bedded, knotty dolomite. Freshly broken surfaces of this rock yield a strong petroliferous odor. This lithology which makes up about 400 feet of the formation is overlain by a light- to medium-gray, fine-grained, medium- to thick-bedded, laminated- to massive dolomite which averages 500 feet in thickness.

In the northeast part of the area, limestone beds are interbedded with dolomite in the lower 200 feet of the Copper Ridge Dolomite. The limestone is dark bluish-gray, medium- to coarsely crystalline, and thick-bedded. A zone several feet thick of edgewise conglomerate was found in the limestone beds one-half mile south of Marshall (Tennessee coordinates: 2,981,100E., 807,600N.). The enclosed pebbles consist of well-rounded, very fine-grained, grayish-white dolomite, and medium-gray, sublithographic limestone. Light- to medium-gray, finely crystalline, thick-bedded limestone also occurs in the upper part of the formation.

The sandstone layer which marks the base of the Copper Ridge Dolomite is dark yellowish-orange to grayish-orange and is characterized by medium-grained, well-rounded, equant quartz grains. In areas where the sandstone bed is not exposed or it does not manifest itself as float, the boundary was placed below the zone where the chert residuum of the Copper Ridge Dolomite appears to be approximately in place. The contact with the overlying Chepultepec Dolomite is drawn below the first sandstone occurring 800 to 900 feet from the base of the Copper Ridge Dolomite. The average thickness of the Copper Ridge Dolomite is 850 feet.

The dolomite of the Copper Ridge weathers deeply to residual clay and produces a tan to dark reddish-orange soil. Several types of residual products occur in the clay and especially in the surface soil. Light colored oolitic chert beds are particularly diagnostic. The oolites generally show color concentric banding, usually with black, white, blue, and light brown colors. The color banding and comparatively larger size of the individual ooids (1 - 1½ mm.) help to distinguish the Copper Ridge oolites from the smaller, uniformly colored oolites of the younger formations of the Knox Group (Bridge, 1956, p. 31).

Another common and distinctive type of chert is dark-colored silicified masses of algal material commonly called "cryptozoan chert." The most abundant but less diagnostic chert in the formation is compact, opaque and dull, grayish-white, with iron and manganese surface stain. Several other varieties of chert occur in this formation and in other units of the Knox Group. For a more complete description of the cherts, see Bridge (1956, p. 25-37).

### Chepultepec Dolomite

The Chepultepec Dolomite consists chiefly of light- to medium-gray, finely crystalline, medium- to thick-bedded dolomite. However, in the southeast part of the study area, the upper 100 feet are light- to medium-gray and bluish-gray, finely crystalline, massive limestone. In the northeast part of the area, thick-bedded limestone layers occur throughout the Chepultepec Dolomite.

In Stanley Valley thrust block, medium- to coarse-grained, subangular to rounded, grayish-brown, friable, porous quartz sandstone layers occur in the bottom four-fifths of the formation. In Gravelly Valley, one-half mile southwest of Cold Springs, eight layers of sandstone were noted. The basal sandstone layer is commonly 10 to 12 feet thick. In the Carter Valley thrust block, only three sandstone layers were recognized. The Copper Ridge and Chepultepec contact is placed at the base of the lowest sandstone bed in this basal sandstone sequence.

Light-colored chert nodules are common in this formation. Oolitic chert is abundant, but in contrast to the oolitic chert in the Copper Ridge, the ooids are small and do not show concentric color banding. The chert is usually bluish-white but the oolites are lighter colored, nearly approaching white. Another type of highly characteristic chert is described as mealy-textured. This chert is porous and cavernous, with many of the cavities preserving the outline of dolomite rhombs. Bridge (1956, p. 40) stated that the dolomoldic chert is virtually restricted to the Chepultepec Dolomite in the Appalachian Valley.

The thickness of the Chepultepec Dolomite ranges from 350 to 700 feet. The upper boundary of the formation, at least for mapping purposes, is arbitrarily drawn at the base of the characteristic Longview cherts.

#### Longview Dolomite

The Longview Dolomite consists of light- to medium-gray, finely crystalline, thin- to thick-bedded dolomite. In the upper half of the formation, massive, finely crystalline bluish-gray limestone beds are interbedded with dolomite. In some localities, the limestone beds make up over one-half of the upper part of the formation. Locally, both the limestone and dolomite are replaced by coarser grained "recrystalline" dolomite. The "recrystalline" dolomite is porous, pinkish-brown, and contains many vugs filled with pink dolomite.

Chert is relatively scarce in the unweathered Longview Dolomite, but upon weathering, this unit yields abundant chert. The chert is light-gray to white, massive, porcellaneous, and blocks as large as two feet across are common.

The contacts of the Longview Dolomite with the overlying and underlying formations were selected on topography, distribution of residual products, and the approximate thickness as determined by Bridge (1956, p. 53) in the Kingsport area. The Longview, on outcrop, occupies the top and southeastern slopes of "Longview ridges" throughout the area of study. The relief of the ridge held up by the formation is as much as 200 feet.

The most characteristic and easily recognized fossil of the Longview Dolomite is the gastropod genus Lecanospira. The thickness of the Longview ranges from 225 to 300 feet.

#### Kingsport Formation

The Kingsport Formation consists of bluish-gray, sublithographic to finely crystalline, thick-bedded limestone, and light- to medium-gray, finely crystalline dolomite, and a minor amount of pinkish-brown, coarse "recrystalline" dolomite. The limestone makes up the greater portion of the lower two-thirds of the formation.

The type section of the Kingsport Formation is on the east side of U.S. Highway 23 one mile north-northwest of Kingsport. The type section is in the Carter Valley thrust block and is three miles northeast of the eastern boundary of the area mapped by the writer. For a more complete description of the Kingsport Formation, see Bridge (1956, p. 51).

Light-colored, compact, iron-stained chert nodules are common in the Kingsport Formation. In addition, compact to finely porous (chalky), white chert occurs as small blocks and chips, along with numerous blocks of loosely cemented quartz sandstone. These sandy layers are generally always present and the layers are confined to the upper part of the formation.

Fossils are not abundant in the formation, but in one locality, approximately midway between Church Hill and Kingsport (Tennessee coordinates: 2,989,800E., 804,250N.), the writer found numerous

beds in which the gastropod genus Orospira is common. As determined by average dip and width of outcrop, the thickness of the formation ranges from 350 to 500 feet.

#### Mascot Dolomite

The Mascot Dolomite consists chiefly of light-gray, sublithographic, and finely crystalline dolomite which weathers to a very distinctive light gray to white color. In the upper 100 feet of the Mascot, bluish-gray, very finely crystalline limestone is interbedded with dolomite.

The chert of the Mascot is similar to that of the Kingsport Formation, but it is more abundant and the nodular chert is much less iron-stained than in the Kingsport Formation.

The lower one-third of the Mascot contains a few thin layers of "chert matrix" sandstone, which upon weathering accumulate as sandstone fragments and residual chert. The contact between the Kingsport Formation and the Mascot Dolomite is placed at the base of the lowest occurring "chert matrix" sandstone.

The Mascot Dolomite thickness ranges from 425 to 600 feet. The contact of the Mascot Dolomite with the overlying Chickamauga Group is drawn at the top of the highest dolomite bed in the section. Several species of the gastropod genus Ceratopea are common in the Mascot Dolomite.

## Knox-Chickamauga Unconformity

The well-known unconformity between the Knox Group of Early Ordovician age and the Chickamauga Group of Middle Ordovician age has been studied throughout East Tennessee and southwest Virginia by many individuals. Laurence (1944) and Bridge (1955) have described the unconformity and the different rock types occurring at this position in several localities in East Tennessee. Bridge (1956, p. 57) stated that in East Tennessee the uppermost formation of the Knox Group is the Mascot Dolomite and that at no place within the State has this formation been completely removed by post-Early Ordovician erosion. Finlayson and Swingle (1962) briefly described an exposure of this unconformity on Norris Lake which clearly shows an angular relationship between the Knox and Chickamauga Groups.

Cooper (1944, p. 33) described this major disconformity as the most conspicuous stratigraphic break in the Paleozoic rocks in the Burkes Garden quadrangle. In Tazewell County, Virginia, local irregularities produced by erosion of the upper surface of the Beekmantown Formation cause the thickness of the formation to vary as much as 400 feet. The local absence of the Ceratopea bed in many places in the county is indicative of post-Beekmantown erosion. Coarse, chert breccias and dolomite conglomerates derived from the Beekmantown immediately overlies the erosional surface at the top of the Beekmantown.

Variations in thickness of the Lenoir-Mosheim unit were noted

in the area mapped but no angularity between the Knox and the Chickamauga could be demonstrated.

### Chickamauga Group

#### Lenoir Limestone

The Lenoir Limestone consists of fine- to medium-crystalline, thin- to thick-bedded, argillaceous, nodular limestone. It is dark gray on a fresh surface but weathers to light grayish-blue. Weathering emphasizes the argillaceous character of the beds and brings out the nodular appearance. Many layers of the Lenoir Limestone are fossiliferous but the unit is chiefly characterized by the abundance of the gastropod Maclurites magnus Lesueur.

The Mosheim Member of the Lenoir is a medium- to thick-bedded, sublithographic limestone. It contains light colored, coarse, isolated crystals of calcite, which gives it a "birdseye" texture. On a fresh surface, it is medium dark-gray but weathers to a light-gray. The Mosheim lithology is generally considered to be a basal member of the Lenoir. In the study area, this is generally true, but the Mosheim type lithology is not restricted to this interval and may in part be a facies of the Lenoir Limestone.

The thickness of the Lenoir Limestone ranges from 30 to 700 feet. The contact of the Lenoir with the overlying Sevier Shale is gradational. The contact was drawn at the top of the highest nodular limestone bed.

## Sevier Shale

The Sevier Shale consists chiefly of grayish-brown to grayish-blue, silty, calcareous claystone. In addition to the claystone lithology, the Sevier contains beds of siltstone, sandstone, finely crystalline limestone, and blue, shaly, nodular limestone. In McPheeter Bend in the southwest part of the Church Hill quadrangle, the writer mapped a lutite-textured limestone lense which had a maximum thickness of 60 feet.

The Sevier Shale is a highly incompetent unit and in many exposures the beds are intensely crumpled. Since only the basal part of the formation was mapped, the complete thickness of the unit is not known for the immediate area. However, Rodgers (1953, p. 81) stated that in the Bays Mountain synclinorium the Sevier Shale is not less than 2,500 feet thick and may be twice that thick.

## Pennington Formation

Approximately 9,500 feet of stratigraphic units between the Sevier Shale (Middle Ordovician) and the Pennington Formation (Upper Mississippian) are present in adjacent areas but in the study area, these units have been faulted out.

In mapping the footwall of the Saltville fault, Sanders (1952) extended the Pennington Formation into the area mapped by the writer. Sanders did not subdivide the formation into members. Harris and Miller (1958) suggested that the Pennington be raised to the rank of

group and to include the Hinton, Princeton, and Bluestone formations. The writer did not map nor subdivide the Pennington units; however, he noted Hinton and Princeton lithologies at several places.

The most common and also the most diagnostic lithology in the Pennington is fine- to medium-grained, greenish- to grayish-brown sandstone. Brownish-red to red sandstone is also common and the overall appearance of this lithology superficially resembles that of the Rome Formation. Other lithologies encountered in the Pennington include claystone, siltstone, argillaceous limestone, and quartz conglomerate. In the vicinity of the junction of Possum Creek and Frozen Branch (Tennessee coordinates: 2,942,700E., 812,500N.), pebble-size quartz conglomerate beds up to 10 feet thick occur in the sandstone unit. A thin coaly claystone (underclay) occurs immediately overlying the conglomeratic sandstone. There is a possibility that the conglomerates and underclay may be Pennsylvanian in age.

In the southwest and central part of the study area, where sandstones are the dominant lithology, the Pennington Formation is a cliff former. To the northeast, claystones and argillaceous limestones become more abundant and the hills are more subdued. The claystone and certain sandstone layers are fossiliferous. The most numerous fossils are bryozoans and brachiopods.

Campbell (1894) called the Pennington Formation the "Grainger Shale" in northern Hawkins County and adjacent Virginia. This error was corrected by Butts in 1933.

### Topographic and Floral Expression of Formations

Certain stratigraphic units are prominent ridge formers, while others are valley formers. In the study area, the Rome Formation is the most prominent ridge former, underlying knobby or comby ridges.

In the Conasauga Group, the highest ridges are capped by the Nolichucky Formation. The Rogersville Shale underlies a row of low, elongate hills having relief up to 40 feet. The Pumpkin Valley Shale occupies the southeast slope of Rome ridges. The Maryville and Rutledge formations are persistent valley formers.

Topographic expression and residual materials are guides to mapping formations of the Knox Group. Due to weathering and differential erosion, the Copper Ridge and Longview underlie broad and somewhat oval-shaped ridges, which generally have 250 feet of relief. The Chepultepec Dolomite commonly occurs in valleys, but locally it underlies ridges having relief up to 300 feet. The Chepultepec knobs occur in areas where the basal sandstone beds thicken. The Kingsport and Mascot occur in valleys. The Sevier Shale commonly produces low, rounded knobs except in areas where sandstone beds thicken. In these places, the Sevier is a cliff former.

In addition to topographic expression, vegetation types and the color of the "A" horizon of the soil profile serve to distinguish individual units (Table III).

TABLE III

RESIDUAL SOILS AND CHARACTERISTIC TREES OF STRATIGRAPHIC  
UNITS IN THE CARTER VALLEY-STANLEY VALLEY AREA

| Formation                 | Member    | Soil                                    | Characteristic<br>Trees |
|---------------------------|-----------|-----------------------------------------|-------------------------|
| Pennington<br>Formation   |           | Gray, thin, acid                        | Deciduous,<br>pines     |
| Sevier<br>Shale           |           | Gray, thin, acid                        | None                    |
| Lenoir<br>Limestone       |           | Reddish-orange<br>thick                 | Cedars                  |
| Mascot<br>Dolomite        |           | Red to orange,<br>cherty, sandy         | Deciduous,<br>pines     |
| Kingsport<br>Formation    |           | Red to orange,<br>cherty                | Deciduous,<br>pines     |
| Longview<br>Dolomite      |           | Gray to brown,<br>very cherty,<br>thick | Deciduous               |
| Chepultepec<br>Dolomite   |           | Red to orange,<br>very sandy,<br>thick  | Deciduous,<br>pines     |
| Copper Ridge<br>Dolomite  |           | Red to orange,<br>very cherty,<br>thick | Deciduous,<br>pines     |
| Maynardville<br>Formation | Dolomite  | Red to orange,<br>thin                  | None                    |
|                           | Limestone | Orange, thin                            | Deciduous,<br>cedars    |
| Nolichucky<br>Formation   | Claystone | Gray to brown,<br>shale chips,<br>thin  | Pines                   |
|                           | Limestone | Orange, thin                            | Deciduous,<br>cedars    |

TABLE III (continued)

| Formation                  | Member    | Soil                                   | Characteristic<br>Trees |
|----------------------------|-----------|----------------------------------------|-------------------------|
| Maryville<br>Formation     | Limestone | Orange, thick                          | Cedars                  |
|                            | Dolomite  | Red, thick                             | Pines                   |
| Rogersville<br>Shale       |           | Gray, shale chips,<br>very thin        | None                    |
| Rutledge<br>Formation      | Dolomite  | Red, thick                             | None                    |
|                            | Limestone | Orange, thin                           | Cedars                  |
| Pumpkin<br>Valley<br>Shale |           | Gray to brown,<br>shale chips,<br>thin | Pines                   |
| Rome<br>Formation          |           | Gray, shale<br>chips, sandy            | Pines                   |

Facies Relationships and Interpretation  
of the Conasauga Group

Introduction and Regional Facies

Regionally, the Conasauga Group is a classic example of a heteropic facies with a clastic lithosome on the west and a dolomite lithosome on the east. Separating these two lithosomes are limestone lithostromes which are mutually intertongued and interfingered with the clastic and dolomite lithosomes (Figure 6).

Because of the lithologic variations in the Conasauga Group across the Valley, three separate phases were described in Tennessee by Rodgers (1953, p. 47). The northwestern phase consists largely of shale, a central phase of alternate shale and limestone, and a southeastern phase principally of dolomite but still including some limestone and a little shale.

Rodgers stated that the central phase occurs in a wide belt extending east and southeast to the Pulaski fault from a diagonal line passing approximately through Madisonville and a little west of Knoxville and Tazewell. Field work by the writer indicates that the line between the central and southeastern phases in northeast Tennessee should be shifted to the northwest of the Pulaski fault (Figure 7).

In Carter Valley northwest of Kingsport in the northeastern part of the study area, the Rogersville Shale thins and the Rutledge and Maryville formations merge to form a carbonate sequence, called the Honaker Dolomite. This facies change is along strike and suggests

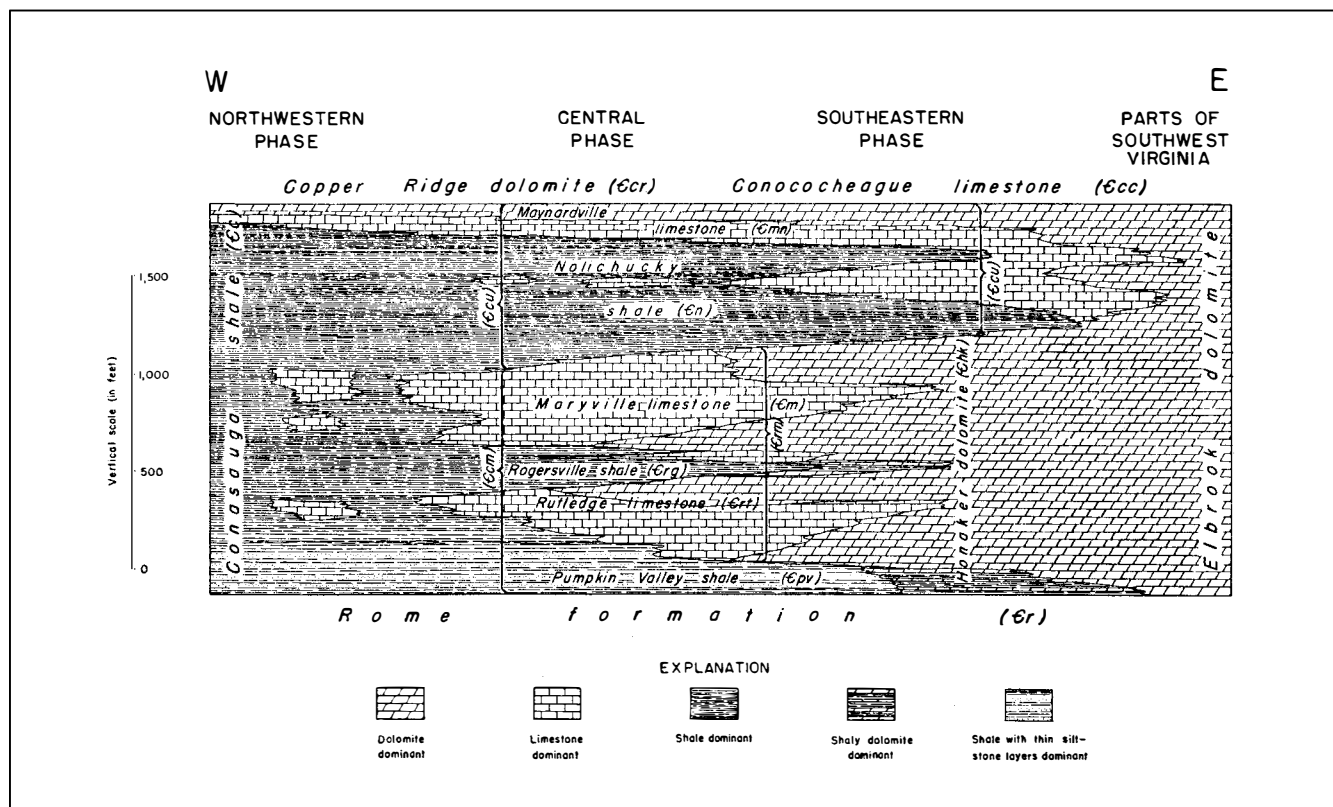


Figure 6. Heteropic facies relationships of the Conasauga Group in East Tennessee and Southwest Virginia.

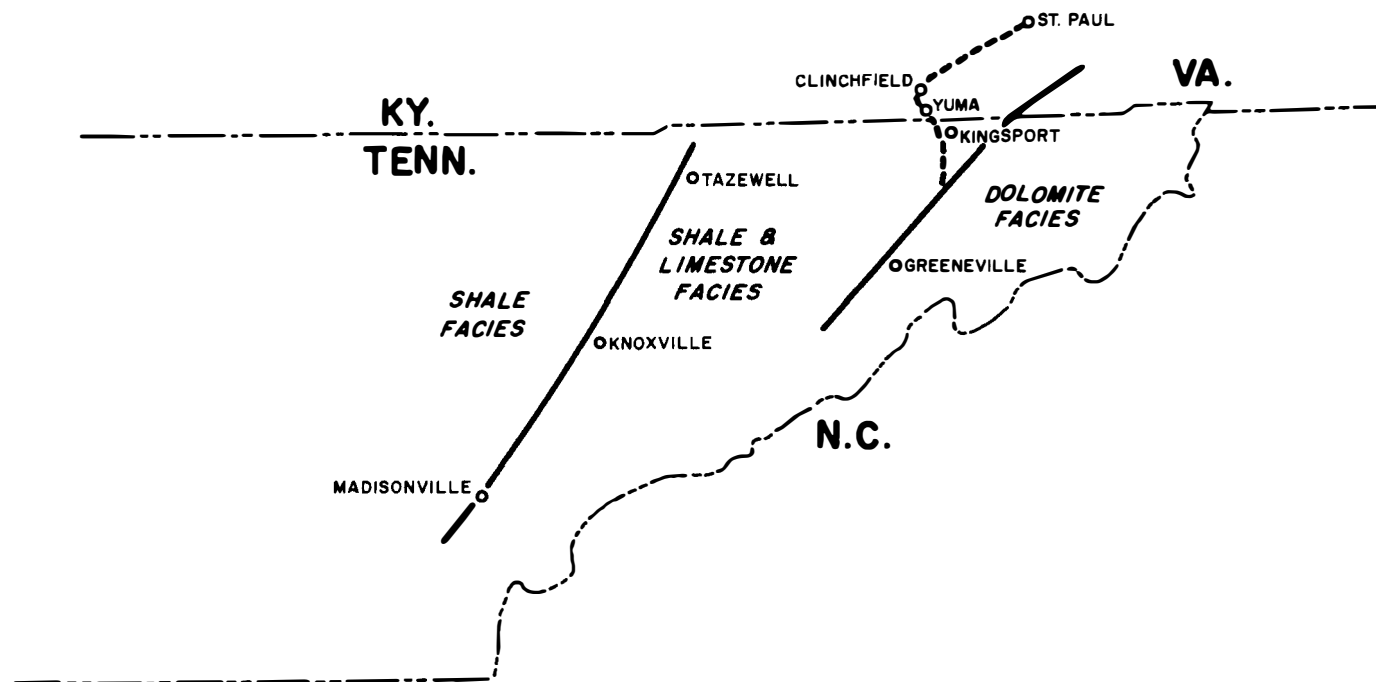


Figure 7. Areal distribution of facies of the Conasauga Group. Solid lines represent previously described boundaries. Dashed line represents boundary as determined in this report.

that structural and sedimentary strikes do not necessarily coincide in the Valley and Ridge.

In the central phase ~~and~~ in most of the study area, one of the outstanding features of the Conasauga Group is the alternate lithotopes which are repeated in vertical succession (Figure 8). Isopic facies of the Conasauga Group suggest that the rocks were deposited in an unstable shelf area or a very shallow miogeosynclinal area. The migration of depositional environments back and forth across the area resulted in first one type of lithotope, than another as a shift of the shoreline occurred, followed by a repetition of the first when a reshifting took place. Due to repeated lithologies, the rocks which resulted from such repetitions of environmental conditions are quite difficult to differentiate in structurally complex areas.

The average thickness of the Conasauga Group is essentially the same in the Stanley Valley thrust block (2,020 feet) and in the Carter Valley thrust block (2,240 feet) (Figure 9). These averages were obtained by measuring individual formations, composite sections, and in places extrapolating the thickness of the Maryville Formation.

The lithology of individual formations of the Conasauga Group is remarkably similar in both thrust blocks. However, the carbonate units are thicker in Carter Valley, whereas the clastic units are thicker in Stanley Valley. In addition to a difference in thickness across Carter Valley fault, the carbonate units also thicken along strike to the east and northeast. This thickening is more pronounced in the Rutledge and Maynardville formations.

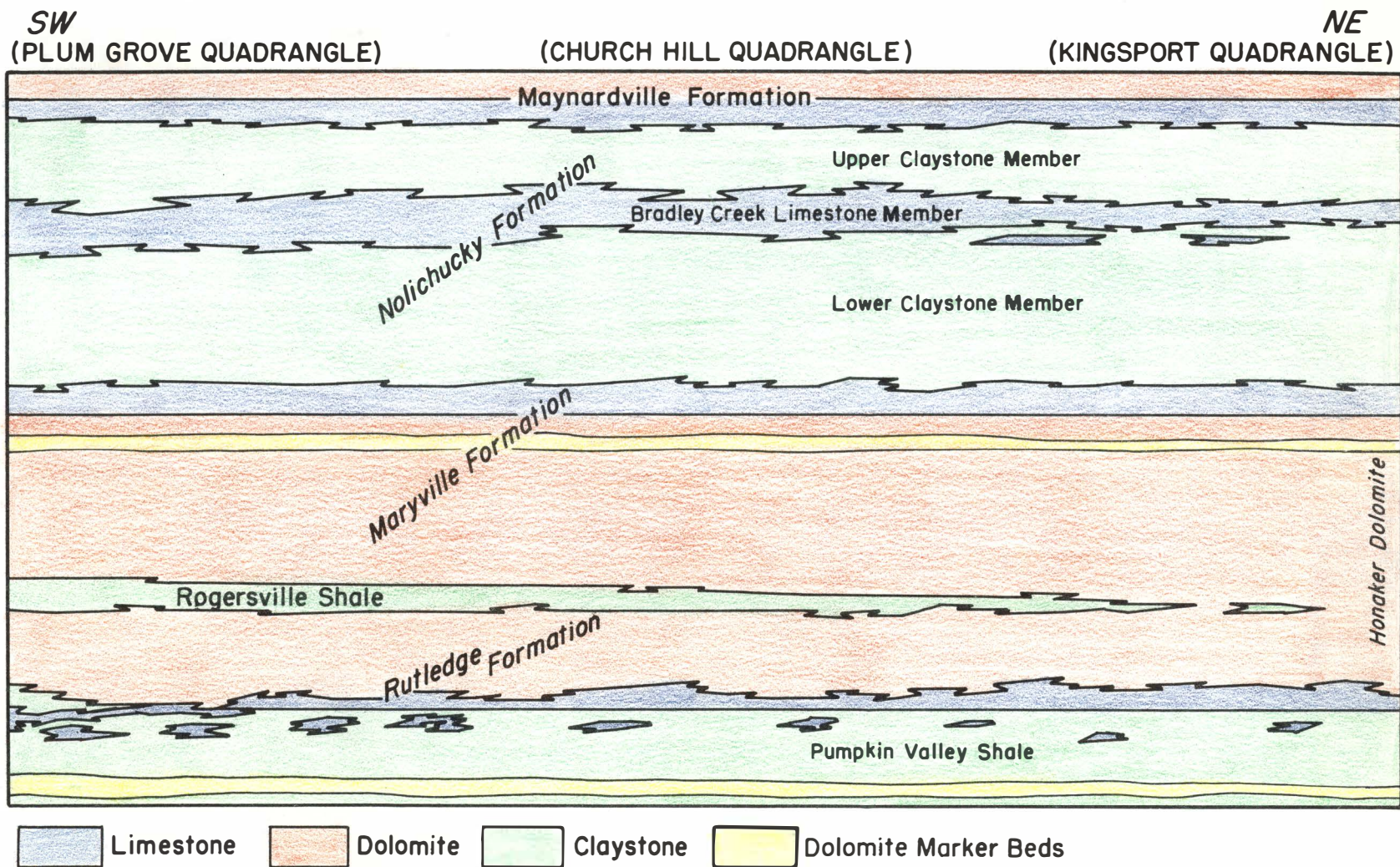


Figure 8. Generalized section showing isopic facies of the Conasauga Group in the study area (not to scale).

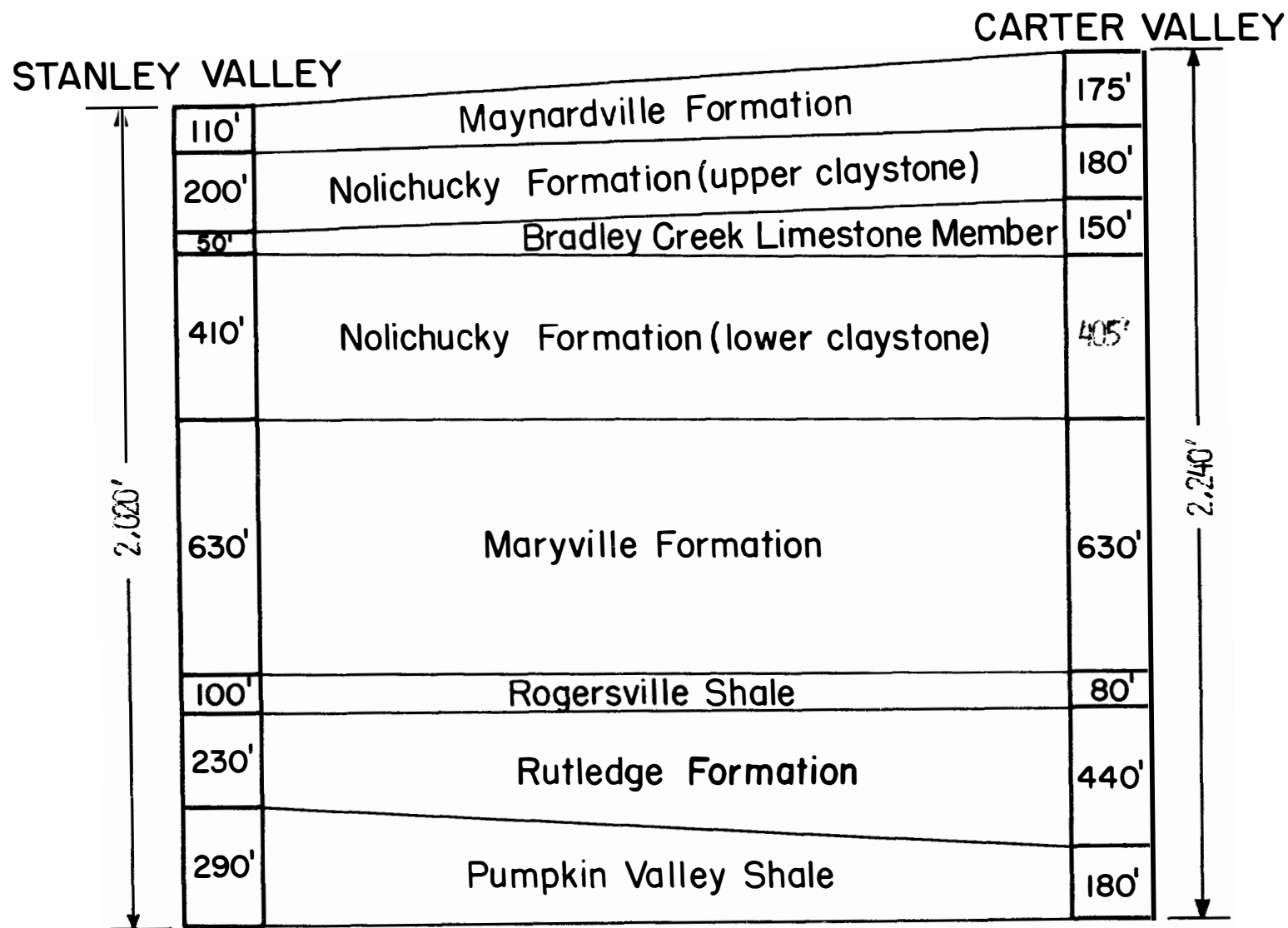


Figure 9. Average thicknesses of formations of the Conasauga Group in Carter and Stanley valleys.

### Local Facies of the Conasauga Group

#### Stanley Valley Belt

#### Facies of the Pumpkin Valley Shale and Rutledge Formation

A composite section of the Pumpkin Valley Shale was described for an area one mile southwest of the Looney Baptist Church (measured section SV-6). In tracing the alternate claystone and limestone unit (I) of the Pumpkin Valley Shale northeastward along strike, it merges into the massive, blue limestone member of the Rutledge Formation with the northeastward thinning to extinction of the green claystone lithostrome (II) (Figure 10). In general, the Rutledge Formation increases in thickness along strike to the northeast in both thrust blocks.

The contact between the Pumpkin Valley Shale and Rutledge Formation must therefore be an arbitrary boundary and is left to the discretion of the mapper. This is an intercalated contact and approximately 150 feet of rocks (I and II, Figure 10) may be placed in either the Pumpkin Valley or Rutledge. The writer placed this interval in the Pumpkin Valley Shale to provide a more practical mapping unit in the study area.

The maroon and green clastics in the lower part of the Pumpkin Valley Shale more closely resemble the Rome lithology than the Conasauga lithology, and the blue limestone and green claystone in the upper part of the Pumpkin Valley are lithologically indistinguishable from similar lithologies in other Conasauga formations. Therefore, in areas where

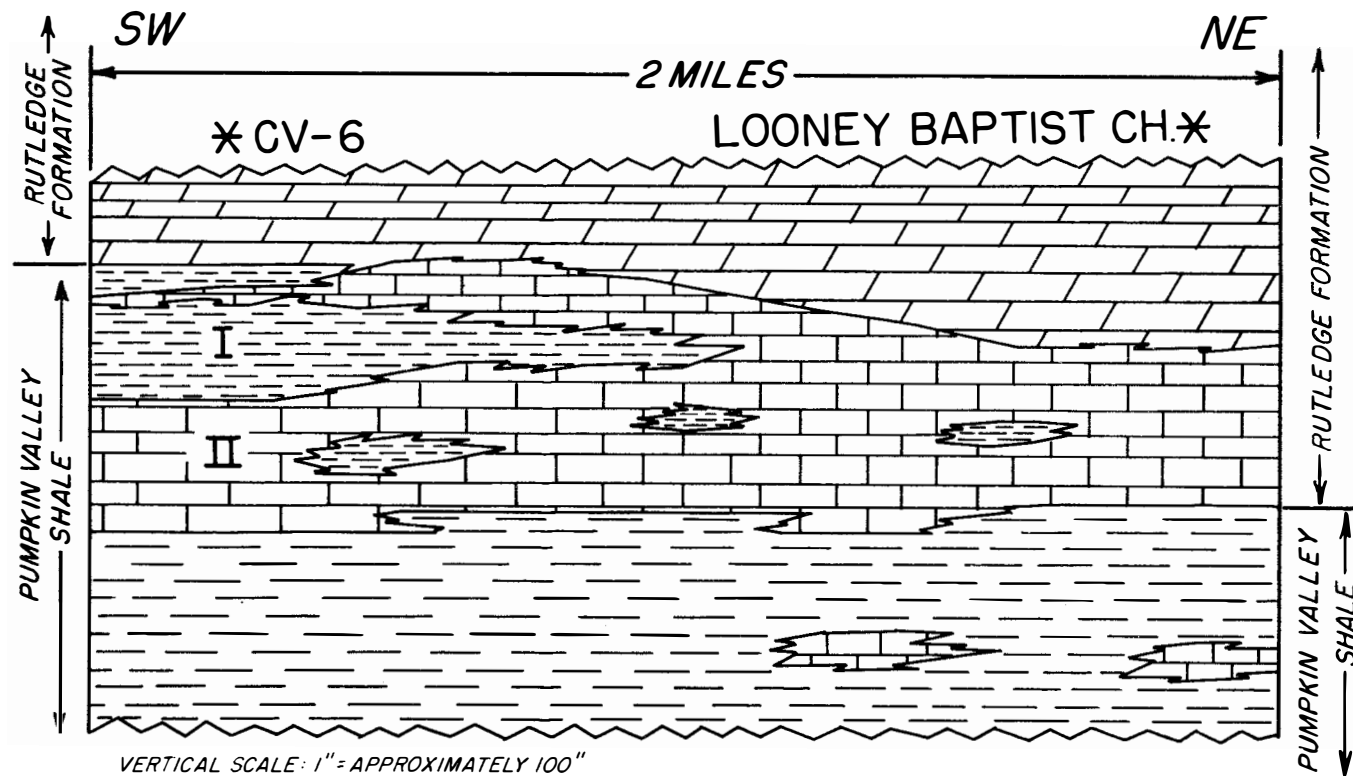


Figure 10. Diagrammatic sketch showing the facies relationships of the Pumpkin Valley Shale and Rutledge Formation in southwest Stanley Valley.

outcrops are scarce, the green and maroon clastics could be placed in the Rome Formation, and the green claystone and blue limestone could be included in the Rutledge Formation.

#### Facies of the Rogersville Shale and Honaker Dolomite

The average thickness of the Rogersville Shale is 90 feet in Stanley Valley. It thins to the northeast by the gradual addition of dolomite beds to the unit, and it also thins by laterally grading into dolomite in its top and bottom. In the vicinity of Frisco, the Rogersville is faulted out by the Carter Valley fault and the writer was not able to ascertain the facies relationships of the unit in this area. The facies relationship between the Rogersville Shale and Honaker Dolomite is discussed in detail in the Carter Valley belt.

#### Facies of the Nolichucky Formation

The Nolichucky Formation consists of a lower and an upper claystone member, with the Bradley Creek Limestone Member between these two members. The local facies relationships of these units are shown in Figure 11.

The claystone members do not show much variation in thickness along strike. In Stanley Valley, the Bradley Creek Limestone Member, as shown in measured sections SV-1, SV-2, and SV-4, consists of two thin limestone units separated by a 10 to 15 feet thick claystone unit. However, in SV-3, only one four-foot-thick limestone bed is present. At this locality, the lower limestone unit is represented by a

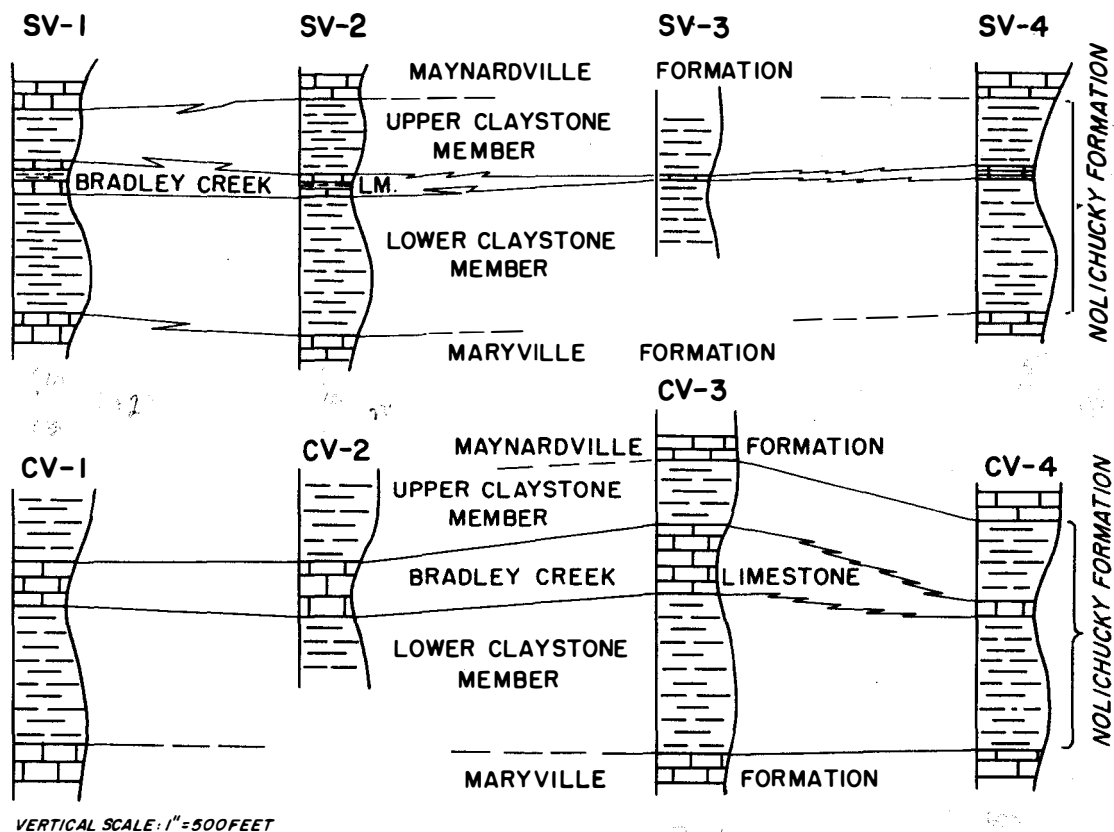
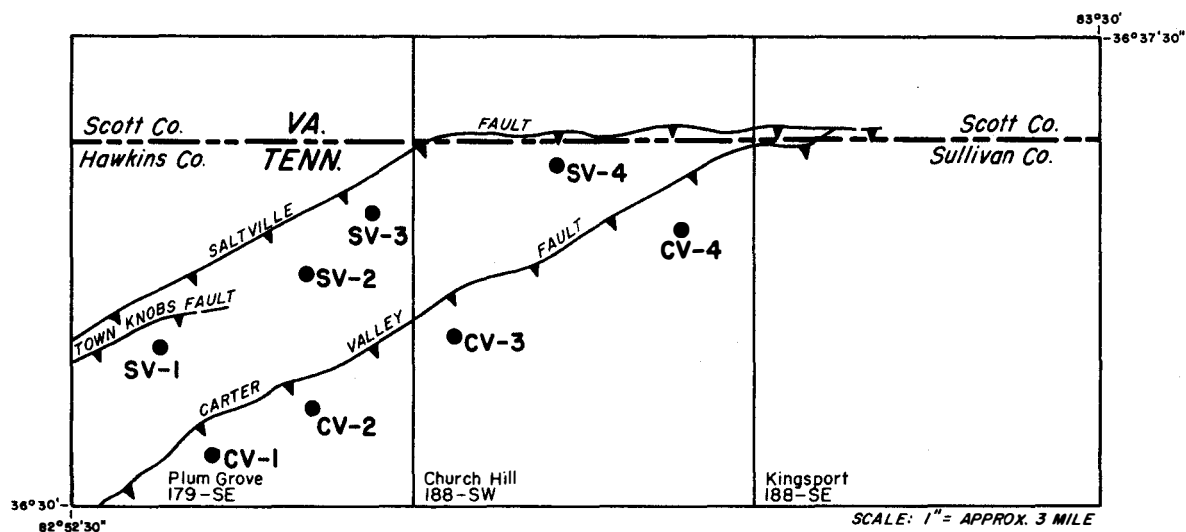


Figure 11. Index map and measured sections of the Nolichucky Formation.

claystone facies (Figure 12). Figure 13 shows the thickness of the Bradley Creek Limestone Member between Stanley and Carter valleys as interpreted by the writer.

#### Carter Valley Belt

#### Facies of the Rutledge-Rogersville-Maryville and the Honaker Dolomite

The Rogersville Shale averages about 80 feet in thickness throughout most of the Carter Valley thrust block. When the Rogersville Shale is traced to the northeast, dolomite beds become dominant. Three miles west of Morrison City, the Rogersville is not recognizable as a mappable unit and lithologically the dolomite members of the Rutledge and Maryville formations are indistinguishable, thereby establishing the Honaker Dolomite as a mappable unit in the Kingsport quadrangle (Figure 8, page 57).

The southeast boundary of the central phase of the Conasauga Group is marked by the disappearance of the Rogersville Shale and the convergence of the Maryville and Rutledge formations, which are largely dolomite, into the Honaker Dolomite. This boundary lies under or not far northwest of the Pulaski fault (Rodgers, 1953, p. 51). Figure 6, page 54, shows the distribution of facies of the Conasauga Group as interpreted by Rodgers (1953, p. 47) and a subsequent interpretation by the writer. The deviation in the strike of the Honaker boundary diagonal to the trace of the Pulaski fault is substantiated by the lithologic changes in the Rutledge to Maryville stratigraphic interval.

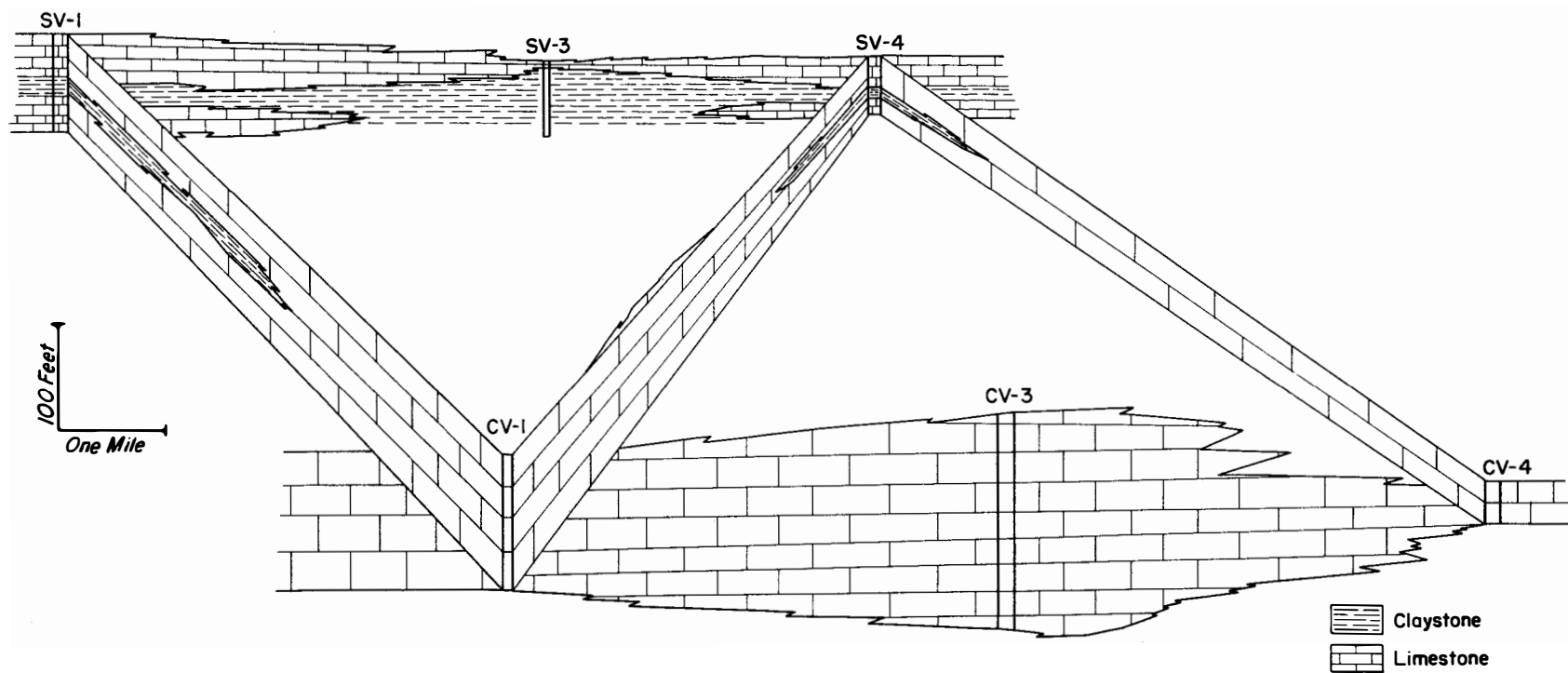


Figure 12. Fence diagram showing facies of the Bradley Creek Limestone Member.

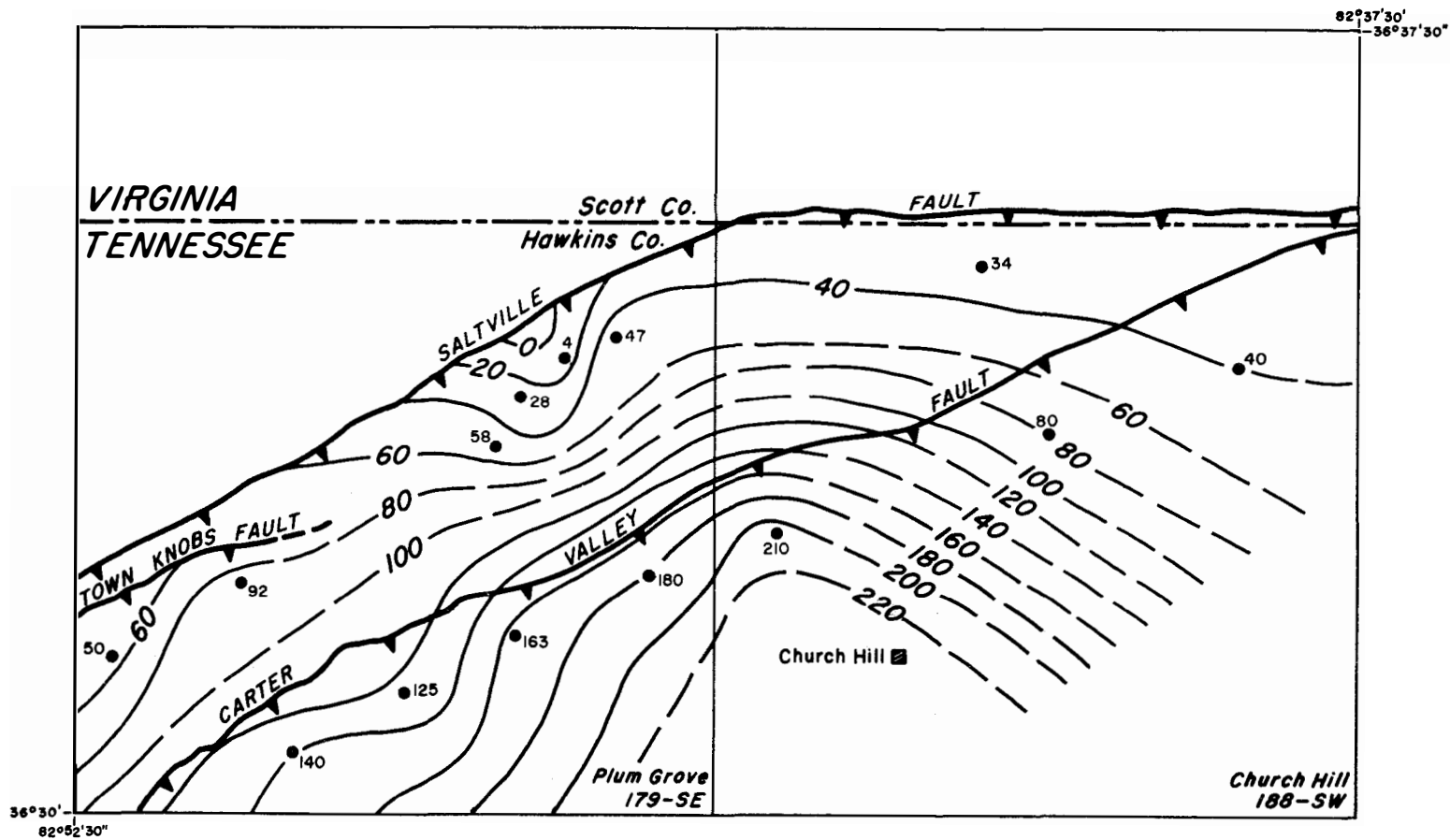


Figure 13. Isolith map of the Bradley Creek Limestone Member.

Byerly (1966, p. 21) described the Honaker in the Greeneville area as dark, almost greenish-black, fine- to medium-grained, saccharoidal dolomite with light gray to bluish-gray, fine-grained dolomite. Rodgers (1953, p. 51) described the Honaker in the belts between the Pulaski and Holston Mountain faults as a dark, shaly, medium-bedded dolomite, which is very cherty in the lower part of the formation but almost free of chert in the upper part.

Throughout the study area, the lithology of the Rutledge and Maryville formations is similar to the lithology of the Honaker as described by Byerly. In Carter and Stanley valleys, the Rutledge has a dolomite-to-limestone ratio of about 4 to 1, whereas the Maryville has a ratio of about  $5\frac{1}{2}$  to 1. Since the dominant lithology of these formations is dolomite, the writer thinks that the dolomite members of the Rutledge and Maryville formations probably represent westward-wedging lithostromes of the Honaker Dolomite. The cherty lithology of the Honaker is not present in the study area, and the writer believes that the carbonate sequence between the Pumpkin Valley and Nolichucky in the area northwest of Kingsport represents a non-cherty western phase of the Honaker Dolomite.

#### Facies of the Nolichucky Formation

The Bradley Creek Limestone Member shows its maximum thickness in the Carter Valley thrust block. In measured section CV-3, the Bradley Creek attains a maximum thickness of 210 feet. In the southwestern part of the study area, the Bradley Creek ranges in thickness

from 120 to 163 feet. It averages about 40 feet in thickness in much of the strike belt in the northeastern part of the area (Figure 11, page 62).

The lower claystone member of the Nolichucky averages 390 feet in thickness and the upper claystone member averages about 190 feet in thickness. In general, where the Bradley Creek Limestone Member thins, the claystone units thicken to include this interval.

Throughout most of the study area, the Nolichucky overlies the Maryville Formation. However, in the northeast part of the area (Morrison City), the Nolichucky overlies the Honaker Dolomite. Farther to the northeast in Virginia, the Nolichucky pinches out and the entire Conasauga interval is called the Elbrook Dolomite (Rodgers, 1953, p. 52).

#### Regional Facies of the Conasauga Group

##### Facies of the Pumpkin Valley Shale and Rutledge Formation

In the Lee Valley Section in northwest Hawkins County (Rodgers and Kent, 1948, p. 9), the top 112 feet of the Pumpkin Valley Shale contains 58 feet of limestone beds or beds of limestone interbedded with claystone. In addition, green claystone which resembles other claystones in the Conasauga Group are restricted to the upper 170 feet, whereas the lower 190 feet of the unit contains maroon and green silty claystone and siltstone which closely resembles the underlying Rome lithology.

In the Dumplin Valley area, Hatcher (1965, p. 30) also described the Pumpkin Valley Shale as containing beds resembling the overlying Rutledge lithology along with a few thin dolomite beds, mainly in the upper part.

Even though this writer believes that rock units should be subdivided as much as practical, he is not convinced of the desirability of retaining the Pumpkin Valley Shale as a mapping unit. This is especially true in areas where the sandstones at the top of the Rome Formation are absent. In such areas, the Pumpkin Valley Shale should either be redefined or omitted.

#### Facies of the Rutledge-Rogersville-Maryville and the Honaker Dolomite

Recently, rocks which resemble the Honaker type lithology have been reported in several places within the central phase of the Conasauga Group.

J. W. Smith (personal communication, 1966) reported a tongue of dolomite of Honaker type in the Maryville Formation in the area southwest of Rogersville. This dolomite tongue can be traced to the Mooresburg-Bean Station area where it wedges out southwestward along strike.

In Dumplin Valley area, Hatcher (1965, p. 41) reported a similar tongue of dolomite, which ranges in thickness from a feather edge to more than 200 feet in the Maryville Formation. He stated that the dolomite tongue thins to the southwest but is present as far to the southwest as the Shooks Gap quadrangle. Along the same strike

belt in the adjacent quadrangle (Maryville) to the southwest, Cattermole (1962) did not refer to the presence of dolomite beds in the Maryville Limestone.

Butts (1933, p. 7) stated that the Honaker Dolomite occurs in the middle part of the Valley in southwest Virginia, between Bristol and St. Paul. From the Pulaski fault southeast of Kingsport, the Honaker boundary cuts across strike and passes through Morrison City, Yuma, Clinchport, and St. Paul (Figure 7, page 55).

#### Facies of the Nolichucky Formation

The contact between the Nolichucky and Maynardville formations is gradational and the writer used lithologic percentages in separating these two mapping units. Limestone lithostromes occur in the transitional phase where the clastics and carbonates interfinger in the interval between the Maryville Formation and the dolomite member of the Maynardville. The Bradley Creek Limestone Member represents such a lithostrome and in some areas where the upper claystone member of the Nolichucky Formation is very thin, some workers in the past have extended the Maynardville Formation to the bottom of the limestone, herein called the Bradley Creek Limestone Member.

Hatcher (1965) included the lithologic entity of the Bradley Creek in the Maynardville Formation in the Dumplin Valley area. He stated that, "The algal limestone member ranges in thickness from one to 200 feet. About midway across the Jefferson City quadrangle, it grades laterally into the shale member." Since mapping units are

delineated on lithology, the writer believes that the algal limestone and the enclosing claystones should be mapped in the Nolichucky Formation. In the Jefferson City area, Bridge (1956) included the upper 315 feet of the Nolichucky Formation as used by this writer in the Maynardville Limestone. Southeast of Rogersville, in the vicinity of Bean Station, the stromatolitic zone pinches in and out of the claystone, thus leaving a complete section of claystone between the Maryville Formation and the limestone member of the Maynardville Formation (Haney, 1966, p. 34). To locate the contact in such a sequence would be difficult, if not impossible, if it is drawn at the base of the thin stromatolitic zone as proposed by Bridge (1956), and Hatcher (1965). The above described circumstance is well illustrated in the area south of Jenkins Church in Stanley Valley. At this locality, the Bradley Creek thins to about four feet and exposures are discontinuous due to coverage by creep.

Near Greeneville, Tennessee, approximately 20 miles south of the study area, the problem of selecting a contact between the Nolichucky and Maynardville formations is rather simple, in that only a single thin (100 to 200 feet) unit of claystone is present (Byerly, 1966, p. 40). The claystone lithology represents the Nolichucky and all lithologies between it and the Copper Ridge are included in the Maynardville. Figure 14 illustrates the writer's interpretation of the facies relationships between the Conasauga units in the Greeneville area and the study area. The Bradley Creek Limestone Member is interpreted as a lithostrome of the Maynardville Limestone in the Greeneville

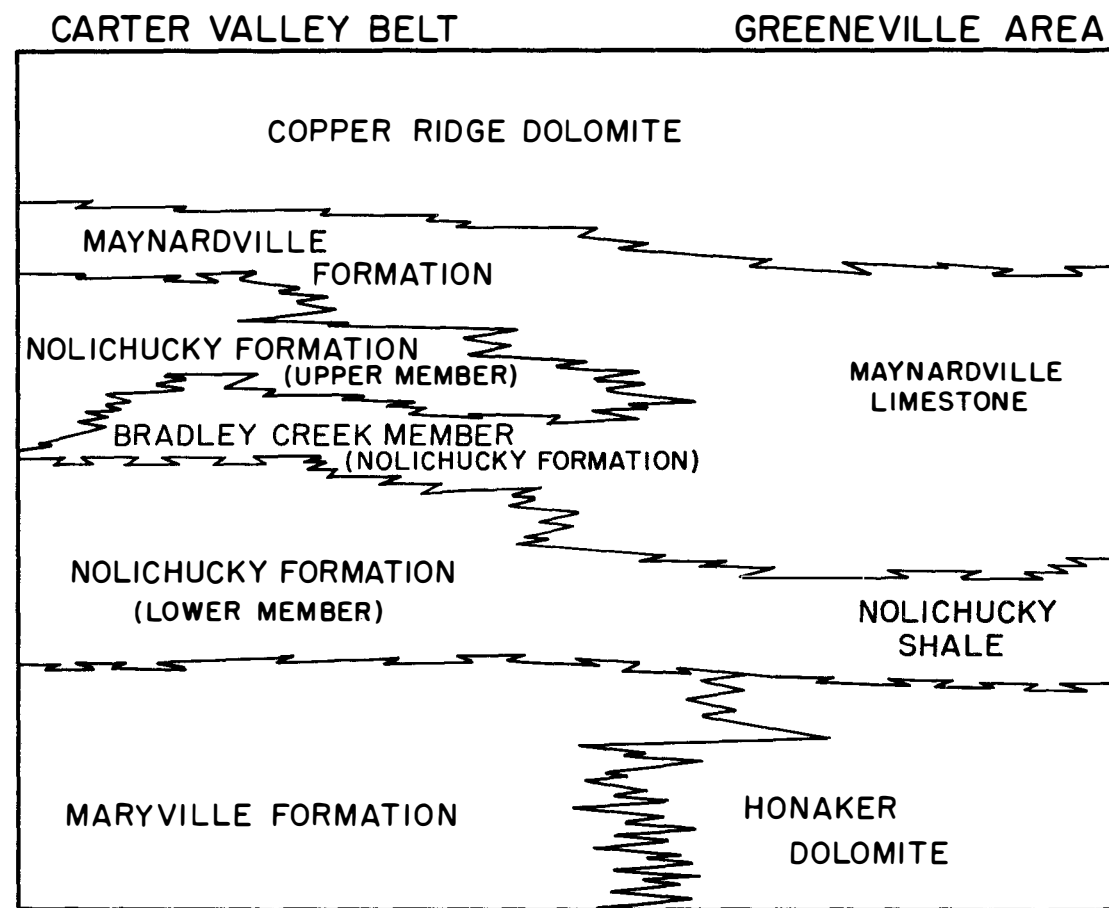


Figure 14. Interpretation of the regional facies relationships of part of the Conasauga Group.

area. The lithology of the Bradley Creek and the basal portion of the Maynardville Limestone of the Greeneville area is quite similar. It appears that the abrupt lateral thickening of the Maynardville is due to algal limestone (stromatolitic bioherms) at the base of the unit.

In the Morristown quadrangle, Oder and Milici (1965) placed the contact between the Nolichucky and Maynardville formations at the top of the upper claystone unit, thus including the stromatolitic limestone (Bradley Creek Member) and the upper claystone unit in the Nolichucky Formation. The writer agrees with this interpretation and places the boundary at the top of the upper claystone unit.

#### Summary of Stratigraphic Contributions

The major stratigraphic contributions of this study concern the rocks of the Conasauga Group. This study has shown a significant westward shifting of the boundary between the central and southeastern phases of the Conasauga Group as defined by Rodgers (Figure 7, page 55). This boundary change was necessitated by the thinning to extinction of the Rogersville Shale in the northeast part of the study area. In this structurally complex area, the writer was unable to measure sections of the Rutledge and Maryville formations and thereby ascertain whether these units thicken at the expense of the Rogersville Shale. However, the information gathered from a limited number of outcrops, seems to indicate not a thinning of the claystone lithology by the deletion of its top or bottom, but the gradual addition of dolomite beds throughout the formation. In this area, the Honaker Dolomite is

recognized as a facies of the Rutledge, Rogersville, and Maryville formations.

The dolomite members of the Maryville and Rutledge formations are similar in lithology and indistinguishable in the field. However, this problem is in part resolved by the discovery of a dolomite marker unit. This unit is referred to as the "white dolomite" marker bed. Stratigraphically, the unit occurs 150 below the top of the Maryville Formation. The color of the rock is light-gray on a freshly broken surface, but upon weathering, it presents a white, slightly chalky appearance. The recognition of this marker bed helped the writer in differentiating the dolomite members in the Conasauga Group.

The writer also recognized a limestone facies in the upper part of the Pumpkin Valley Shale. Because of this facies relationship, the boundary of the Pumpkin Valley Shale and Rutledge Formation must be an arbitrary boundary in local areas.

The recognition of an algal limestone lithostrome which the writer has named the Bradley Creek Limestone Member of the Nolichucky Formation is another contribution. It is present in both thrust blocks and serves as an excellent marker horizon in identifying the lithologically similar limestone units of the Conasauga Group in structurally complex areas. The Bradley Creek ranges in thickness from 4 to 210 feet, and is thicker in Carter Valley than in Stanley Valley. This limestone unit has been recognized in other areas throughout much of the Valley and Ridge in East Tennessee.

In the study, area, sandstone beds which form the boundary between the Rome Formation and Pumpkin Valley Shale, are recognized in the southwestern part of the area, but to the northeast the sandstone beds decrease in thickness and also in abundance. A well-defined dolomite bed occurs in the Pumpkin Valley Shale about 30 feet above the sandstone bed marking the contact in the area to the southwest where the sandstone beds are prominent. In mapping northeastward, this dolomite bed was used as a guide or marker bed in placing the contact between the Rome and Pumpkin Valley. In mapping the Rome throughout the area, dolomites were found to be more abundant in outcrop than any other type lithology. In the Carter Valley thrust block at Morrison City, more than one-half of the exposed Rome is dolomite.

The lithology of the individual formations of the Conasauga Group in Carter Valley and Stanley Valley thrust blocks is remarkably similar. The carbonate units are slightly thicker in the Carter Valley thrust block than in Stanley Valley. They also thicken along strike to the east and northeast in both thrust blocks. This thickening is more pronounced in the Maynardville and Rutledge formations.

## CHAPTER III

### STRUCTURAL GEOLOGY

#### Regional Setting

The Southern Appalachians are commonly subdivided into four physiographic provinces (Figure 15). King (1950, p. 10) gives a summation of the general structure of these physiographic divisions as follows:

To the northwest are the gently deformed Cumberland and Allegheny Plateaus, a foreland area. Next southeast is the Valley and Ridge province, made up of much more strongly folded and faulted Paleozoic sedimentary rocks. Beyond is the Blue Ridge, composed of older Paleozoic and Precambrian rocks that are not only strongly folded, but are more or less metamorphosed. This is succeeded by the Piedmont Plateau whose rocks are strongly metamorphosed and invaded by granite plutons, but with considerable areas of meta-sedimentary rocks to the southeast. The rocks of the Piedmont pass southeastward beneath the deposits of the Atlantic Coastal Plain and their further extension in this direction is lost to view.

#### Valley and Ridge Province

The Valley and Ridge Province of East Tennessee and southwest Virginia is dominated by thrust faults. The majority of these faults were originally mapped as high angle reverse faults, but detailed mapping has shown that many are low angle thrust faults. One of the major problems relative to structures in the Valley and Ridge, is the (yet unanswered) question of their behavior at depth. Rodgers (1949) thoroughly reviewed the two basic concepts dealing with this problem. Although the "no-basement" theory, also called the "thin-skinned"

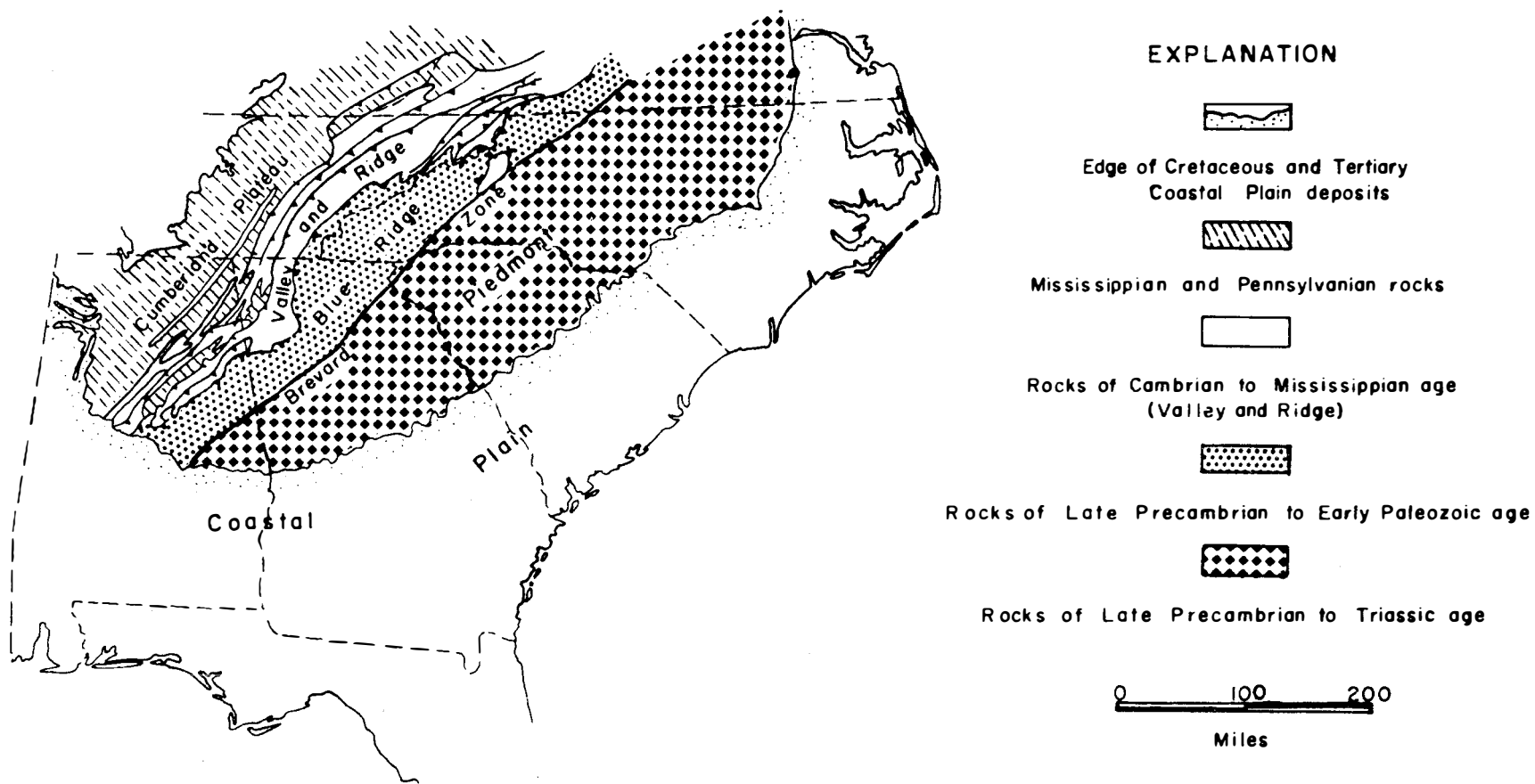


Figure 15. Generalized geologic map of a part of the southeastern United States.

concept, is accepted by most recent local workers. Cooper (1961) is one of several geologists who favor the "basement" theory, also called the "thick-skinned" concept, in which the major folds and faults are believed to be passively related to the Precambrian crystalline rocks.

#### Description of Major Structural Features

##### Saltville Fault

The Saltville fault is one of the major faults in the southern Appalachian region. Stevenson (1885, p. 121) named the fault for Saltville, Virginia. The fault had previously been called "the Holston River Downthrow" and also the "fault of the North Fork of the Holston." Other names for the fault are the Bland and Clinch Mountain (Butts, 1940, p. 457). The extent of the fault was originally interpreted by Butts (1940, p. 457) as extending from Craig County, Virginia southward to Cassard, Virginia, a distance of over 200 miles. Subsequent studies by Munyan (1951) show that the Saltville fault does not end at Cassard but continues across Tennessee into Georgia to a point several miles south-southwest of Dalton. Rodgers (1953, p. 133) suggested that the Saltville, Beaver Valley, and Knoxville faults merge a few miles south of Dalton to form the great Rome fault, which continues across Georgia and far into Alabama.

In Stanley and Carter valleys, a segment of the Saltville fault approximately 18 miles in length was mapped. Throughout the extent of the Saltville fault zone in the study area, the footwall consists of

rocks of the Pennington Formation. The fault trace was mapped from the point where it enters the Plum Grove quadrangle on the southwest to U.S. Highway 23 in the Kingsport quadrangle. The hanging wall consists of rocks of the Rome Formation except in small areas where the Pumpkin Valley, Rogersville, Rutledge, and Maryville units are in contact with the Pennington Formation (Plate I).

In the southwest part of Stanley Valley, the rocks of the hanging wall and footwall can be seen in contact on a logging trail which crosses Stanley Knobs (Tennessee Coordinates: 2,926,600E., 800,600N.) into the Lick Branch area. The fault trace is also easily reached in the area where Frozen Branch and Possum Creek join (Tennessee Coordinates: 2,942,000E., 809,900N.). In the Church Hill quadrangle, the Saltville fault swings east and parallels the Stanley Valley road for several miles; the fault is easily reached at several locations within this area. An excellent area for studying the fault is one-half mile north of Frisco along a secondary road. The best exposure of the fault plane occurs at the Tennessee and Virginia line on U.S. Highway 23.

The dip of the fault plane cannot be specifically determined in the Plum Grove quadrangle; however, using the three-point method along several segments of the trace, it was determined that the average dip is from 40 to 50 degrees south near the surface. North of Morrison City on Highway 23, immediately north of the Tennessee-Virginia state line, the fault plane is exposed and the measured dip averages 50 degrees to the south. Averitt (1941, p. 31) stated that in southeastern Scott County, Virginia, the plane of the Saltville fault dips

southeast at an angle less than 30 degrees and the minimum angle may approach zero in some places.

The stratigraphic displacement varies, but it is at least 15,000 feet. The maximum horizontal displacement along the fault may never be known, but the presence of the Glenwood School klippe suggests that the minimum horizontal displacement is in excess of one mile (Averitt, 1941, p. 30). Approximately 15 miles southwest of the study area, Haney (1966, p. 94) reported a minimum net slip on the Saltville fault of three miles.

About nine miles northeast along the Saltville fault trace from the southwest margin of Plate I, a "bend" occurs in the trace of the Saltville fault. Here, rocks of the hanging wall consists of formations of the Conasauga Group, whereas the Rome Formation forms the contact rocks along the major extent of the fault. Southwest of the "bend" area, the strike of the Saltville fault is approximately 65 degrees northeast, whereas east of the "bend" the strike is approximately east. The "bend" area appears to be the boundary between the steeply dipping beds and the less steeply dipping beds. Southwest of the "bend" area, both the hanging wall and footwall beds dip approximately 35 to 50 degrees to the southeast. East of the "bend" area, the beds dip between 40 and 60 degrees to the south.

#### Carter Valley Fault

The Carter Valley fault was named for Carter Valley in Hawkins County, Tennessee, and Scott County, Virginia. An 18 mile segment of

the fault was mapped in the study area (Plate I), however, the fault continues to the southwest of the mapped area (Haney, 1966). Rodgers (1953, p. 134) stated that the Knoxville, Rocky Valley, and Carter Valley faults may represent a continuous zone of faulting, although it may not be possible to prove that they are continuous.

The Carter Valley fault enters the southwest part of the study area about 1,000 feet northwest of the junction of Young Branch and Carter Valley road. At this point, the Rutledge Formation is faulted over the Kingsport Formation. Within 500 feet to the northeast, the Pumpkin Valley Shale is in contact with the Mascot Dolomite. Approximately 500 feet further northeast, the Rome Formation forms the contact rocks of the hanging wall, and Chepultepec Dolomite forms the footwall. This relationship continues to the northeast for about five miles. In the vicinity of Sunrise School, the fault trace swings east and the stratigraphic displacement decreases, as the Rutledge Formation is thrust over Chepultepec Dolomite. Two miles further to the northeast, the stratigraphic displacement is still less. Here, the footwall structure is a syncline, in which the Mascot Dolomite has been preserved, and the hanging wall is the Maryville Formation. The trace of the fault continues to the northeast and in the vicinity of Kinhead Cemetery, the Rutledge Formation is thrust over the Nolichucky Formation. In the Frisco area, the footwall is the Rutledge Formation and the Rome Formation reappears on the hanging wall. This stratigraphic relationship exists for the next three miles to the east. One-half mile northwest of Morrison City, the Carter Valley fault merges with the Saltville fault.

One thousand feet northwest of the junction of Young Branch and Carter Valley road, the rocks of the hanging wall and footwall can be seen in contact. The fault trace is accessible in all water gaps formed in the Rome ridges in the southwest part of the area. The trace of the fault is just as accessible in the remainder of the area to the northeast, but due mostly to the paucity of outcrops it is somewhat more difficult to recognize. Where the fault crosses the North Fork of the Holston River, especially on the Sullivan County side of the river, both the hanging wall and footwall rocks are well exposed.

In general, the hanging wall beds dip 40 to 55 degrees to the southeast, whereas the footwall beds dip between 15 and 25 degrees southeast. The stratigraphic displacement varies, however, the maximum displacement approximates 5,200 feet and the minimum displacement is as small as 100 feet.

In the southwestern part of the study area and also in the extreme northeastern part, the trace of the fault is expressed topographically by the "comby" ridges which are due to the presence of resistant beds in the Rome Formation on the hanging wall.

#### Town Knobs Fault

Haney (1966, p. 76) named the Town Knobs fault for Town Knobs, which are located approximately one mile north of Rogersville, Hawkins County, Tennessee. The Town Knobs fault occurs in the southwest part of the study area (Plate I). The fault is on the northwest side of a row of comby ridges, which are between Stanley Knobs and Stanley

Valley. From the point of entrance into the study area, the fault extends one and one-half miles to the northeast and then swings sharply to the east for one-half mile and then terminates in the Maryville Formation.

The fault is accessible in four water gaps, two of which are traversed by roads and the other two by logging trails. The maximum stratigraphic displacement is about 900 feet. The beds dip about 40 degrees southeast on both the hanging wall and footwall.

In the southwestern part of the area, the Rome Formation is faulted over the limestone member of the Rutledge Formation. In the area where the trend of the fault is east, the Rutledge Formation on the hanging wall is overturned.

#### Greendale Syncline

The Greendale syncline was named by Butts (1940, p. 457) for the community of Greendale, Washington County, Virginia. The structure extends from northeast of Bland, Virginia, southwest to the southern end of Clinch Mountain, 25 miles northeast of Knoxville, a distance of 170 miles.

Sanders (1952, p. 172) stated that the Greendale syncline is a great doubly-plunging syncline and belongs among the major structural features of the Valley and Ridge province of the Southern Appalachians. The Pennington Formation, which is generally the youngest stratigraphic unit in the Valley of northeast Tennessee, is preserved in the axial portion of the syncline.

In the northeast part of the Pressmen's Home area and throughout most of its extent northeastward in Virginia, the Saltville fault cuts across the Greendale syncline near the axial plane, so that the overthrust block almost completely covers the overturned southeast limb (cross-section A-A', Plate III). Throughout this distance, the trace of the Saltville fault is in nearly all localities parallel to the trace of the axial plane of the syncline, which commonly appears as a simple, large, asymmetric, overturned fold. Where the axial plane of the syncline can be observed, it strikes 55-60 degrees east and dips about 75-80 degrees southeast (Sanders, 1952, p. 167).

The thickness of the Mississippian units in the Greendale syncline at the fault boundary is 6,000 to 7,000 feet (Butts, 1940, p. 457).

#### Description of Minor Structural Features

##### Structures South of the Carter Valley Fault

In the area south of the Carter Valley fault between Alexander Creek and Hord Creek, four faults have been recognized. East of Red Goose Hollow, the trace of the faults is based upon the recognition of lithologic units. To the west, outcrops are scarce and the trace of the faults is often inferred from topography and the identification of residual products.

In this area, the Bradley Creek Limestone Member of the Nolichucky Formation is repeated several times. At several localities within

the area, part of this unit, commonly 60 feet thick, can be traced for several hundred feet and then the unit is lost in the great thickness of the Nolichucky claystone members.

On the northwest side of this structure, the Maryville and Nolichucky contact is unbroken by faulting. However, the units are folded into an anticline on Alexander Creek. The associated faults are diagonal-slip faults and are believed to be penecontemporaneous with the development of the Carter Valley fault. In general, the hanging walls on the southeast side have been pushed to the southwest and the hanging walls have moved to the northwest.

North of Loyd Ridge near Cooper Cemetery (Tennessee coordinates: 2,967,700E., 805,500N.), a fault splits off of the Carter Valley fault. Diagnostic outcrops were not observed in this area. The evidence for the fault is the repeated section of Rogersville Shale in the area south of Grange Hall School.

About 1,500 feet north of the previously mentioned fault, another fault is inferred to split off of and to parallel the Carter Valley fault. The hanging wall of this fault is Rutledge and the footwall is the Maryville Formation.

In the area between Sensabaugh Ridge and Click Ridge, several small tear faults have been mapped. Evidence for the existence of these faults is the repetition of the Maryville Formation. The maximum stratigraphic displacement is approximately 520 feet in that the faulting involves mainly the limestone member of the Maryville Formation and the lower claystone and Bradley Creek members of the Nolichucky Formation.

Seven hundred feet north of and parallel to Click Ridge, a thrust fault has been mapped for about two and one-half miles. West of the Clinchfield Railroad, the evidence for the fault is based upon the change in dip of the strata. East of the Clinchfield, large blocks of silicified material accompany the change in dips. Near the eastern extent of the fault, outcrops of the "white dolomite" marker bed in the Maryville Formation shows that the stratigraphic displacement is approximately 150 feet as Maryville is thrust over Maryville.

#### Structures North of the Carter Valley Fault

In Gravelly Valley near the Morning Star Church (Tennessee coordinates: 2,964,500E., 812,800N.), the writer mapped a thrust fault which has a stratigraphic displacement of less than 200 feet. This fault dies out near the Maynardville and Copper Ridge contact, and an anticline has developed in the incompetent Conasauga units to the northeast.

North of Gravelly Ridge in the vicinity of Monroe Branch, a thrust fault was mapped in which Maryville is faulted on Maryville. This fault is parallel to the Maryville and Nolichucky contact and can be traced for about one mile. The stratigraphic displacement is between 100 and 200 feet. Where the fault crosses Monroe Creek, the fault is exposed and the fault plane dips about 60 degrees south. Evidence for the existence of the eastern extent of this fault is based upon the abundance of silicified material and also upon the increased dip of the hanging wall beds.

In the eastern part of Stanley Valley in the Church Hill quadrangle, a thrust fault extends from the Center Valley Church (Tennessee coordinates: 2,967,200E., 818,000N.) four and one-half miles east to the Frisco area. At the western extent of this fault in the vicinity of Monroe Branch, Rutledge is faulted on Rogersville. Approximately one mile east of Monroe Branch, Rogersville is absent and stratigraphically, Rutledge is on Rutledge. About two and one-half miles east of Monroe Branch in the vicinity of Bellamy Cemetery, the fault bifurcates. The southern splay extends one and one-half miles and then connects with the Carter Valley fault. Throughout much of the extent of this splay, Rutledge is thrust over Rogersville. The northern splay extends to the Frisco area where it dies out in the Pumpkin Valley Shale.

A tear fault occurs about 1,000 feet south of the Town Knobs fault in the vicinity of Looney Baptist Church. At this locality, the Rogersville Shale has been offset and the minimum horizontal displacement is approximately 1,200 feet.

South of Cold Springs, in the southwestern part of the area, a mass of rock 1,000 feet by 3,000 feet was mapped and interpreted as a slice. The slice consists of rocks of the Pumpkin Valley Shale and the Rutledge Formation. The rocks in the slice are highly deformed, but it appears that the slice is right side up.

The hanging wall of the slice is Rome and the footwall is in part Longview and in part Chepultepec. Therefore, the slice is of an intermediate age and fits the classic description of a slice. It is

thought by the writer that the slice was once part of the synclinal footwall (cross-section A-A', Plate III) which has been detached and carried upward during faulting.

Southeast of Frisco on Pine Ridge, the Carter Valley fault is offset approximately 800 feet by a tear fault. The writer has inferred that this fault continues to the east for two and one-half miles and then connects with the Saltville fault. Evidence for the existence and continuance of the fault is based upon: (1) the offset between the Pumpkin Valley Shale and Rutledge Formation contact which exists between two ridges on Pine Ridge; (2) the thick section of Rutledge on the north side of Pine Ridge. It appears that the duplication of section takes place in the limestone member of the Rutledge; (3) where the fault crosses the North Fork of Holston River, Pumpkin Valley Shale is faulted over the Rutledge Formation, and (4) the rocks in the area between Hash Hollow and the point where the fault merges with the Saltville, are intensely deformed and beds along strike of the inferred fault are vertical or nearly vertical, whereas the beds dip less steeply in both directions away from the fault.

Two synclines which involve rocks of the Knox Group occur in the footwall of the Carter Valley fault. The western syncline is in the Young Branch area. The more pronounced syncline of the two is in the central part of the study area in the vicinity of Hord Cemetery. In both synclines, the Mascot Dolomite is the youngest rock present. The axes of both synclines are oriented north-south and are perpendicular

to the strike of the fault. From this observation, we may conclude that the folding predates faulting.

### Interpretation

#### General Discussion

Structure sections on Plate III illustrate the writer's interpretation of the behavior at depth of the folds and faults exposed at the surface throughout the area. In the subsurface projections of the faults, the writer has tried to maintain the measured or calculated thicknesses of the formations. The writer infers that the fault planes are largely restricted to the incompetent units. That is, the fault planes of the larger thrust faults are parallel to the bedding of thick incompetent units. This glide plane principle was originally applied to the Southern Appalachians by Rich (1934).

#### Saltville Fault

The Saltville fault, as indicated by its straight-line trace, has a high dip. Approximately 15 miles to the southwest, Haney (1966, p. 70) states that the dip of the fault plane ranges from 10 degrees to 27 degrees.

The Rome Formation is believed to have served as the major glide plane for the Saltville fault in the study area. The Pennington Formation comprises the rocks of the footwall along the 18-mile segment of the trace of the Saltville fault in the study area. The Pennington

Formation occupies an overturned syncline and is overridden by the Rome Formation of the hanging wall. The footwall southeast of the Saltville trace must therefore be an incompetent unit which is stratigraphically lower than the Pennington Formation. The writer assumes that the glide plane in the footwall probably consists, at least in part, of the Martinsburg Shale.

Because the two glide zones mentioned above are stratigraphically about 9,500 feet apart, an upward deflection of the fault from the Rome Formation to the Martinsburg Shale must have occurred at depth somewhere beneath the thrust sheet to the southeast. The writer believes that a minor part of this deflection took place in the vicinity of The Cliffs fault and the major refraction took place along the Pulaski fault and farther to the southeast.

The Saltville fault is similar to the other thrust faults in the Valley and Ridge province, in as much as it has broken upward from a more deeply seated decollement. The decollement inferred by most workers in this general area is the Rome Formation, mainly because of its common occurrence in the hanging walls of major faults, and sub-ordinately because it is probably the first major incompetent formation above the basement.

#### Carter Valley Fault

The Carter Valley fault, like the Saltville fault, also presents a straight-line trace and has an inferred high dip, but not as high as the Saltville. The writer believes that the Carter Valley fault

represents a splay that has broken upward from the same decollement or sole as the Saltville fault. The footwall of the Carter Valley fault consists predominantly of carbonates and the rocks are synclinal (Plate III, sections A-A', B-B', C'C', D'D').

#### Relationship of Stratigraphy to Structure

In the Valley and Ridge, several fine-grained clastic units are well-known as incompetent units. The oldest of these units, the Rome Formation, is evidently the glide zone of several major faults. The Rome Formation is present on the hanging walls of the three major faults in the study area. The Pumpkin Valley, Rogersville, and Nolichucky also are incompetent units but only minor faults are associated with these formations.

In the Alexander Creek area south of the Carter Valley fault, the Nolichucky Formation is involved in much of the faulting and most of the displacement has probably taken place within this unit. In the southwest part of the area mentioned above, several faults occur in the Knox Group. Here, as is the case in Gravelly Valley (Plate III, section C-C'), only the Copper Ridge and Chepultepec units are involved in the faulting. The Knox Group is the main buttress in the Carter Valley area. It is a 3,000-foot-thick competent unit through which stresses are transmitted. The tight folds and numerous faults in the Conasauga Group are controlled by the alternating sequence of competent and incompetent rocks.

## CHAPTER IV

### CONCLUSIONS

The following conclusions are presented from the study of the lithostratigraphy of the Conasauga Group in Carter and Stanley valleys:

1. The Conasauga Group presents classic examples of isopic and heteropic facies.
2. The lithology of the individual formations of the Conasauga Group is remarkably similar in both thrust belts.
3. The carbonate units of the Conasauga Group thicken eastward and southeastward and the claystone units thicken westward and north-westward.
4. The Pumpkin Valley Shale is a transitional unit which has a Rome lithology in the lower half of the formation and Conasauga-type lithologies in the upper one-half of the unit.
5. The Rogersville Shale thins to less than four feet in the northeastern part of the study area and the Rutledge and Maryville formations merge to form the Honaker Dolomite.
6. The Bradley Creek Limestone Member of the Nolichucky Formation thickens to the southeast of the Carter Valley strike belt. The Bradley Creek Member may be a northward extending tongue (lithostrome) of the Maynardville Limestone which occurs south of the Pulaski fault.

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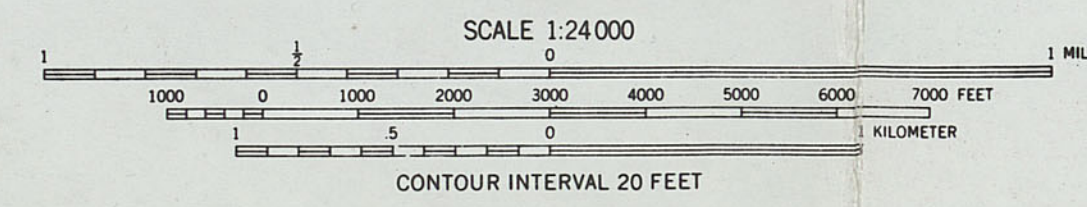
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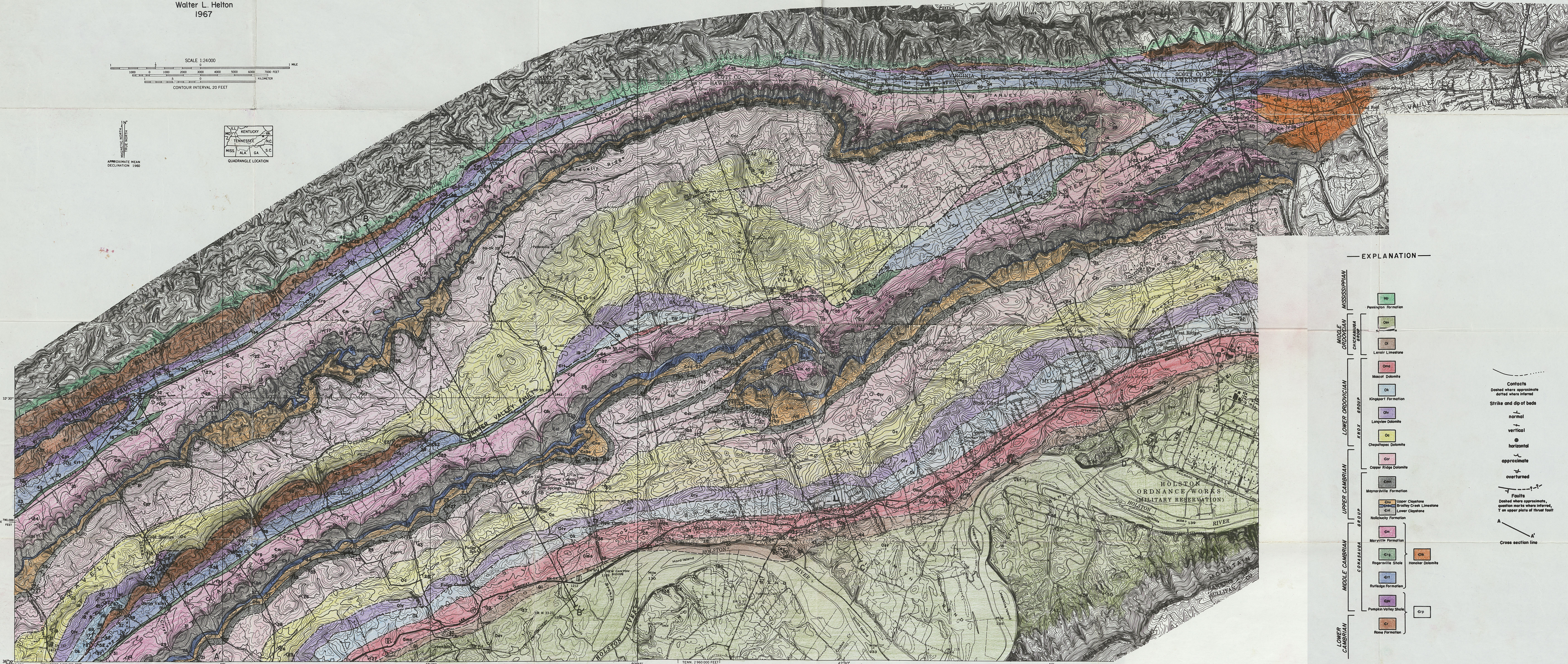
# PLATE I

## GEOLOGIC MAP CARTER VALLEY AND STANLEY VALLEY AREA Hawkins County, Tennessee

By  
Walter L. Helton  
1967



MAGNETIC NORTH  
TRUE NORTH  
APPROXIMATE MEAN  
DECLINATION 1960



### EXPLANATION

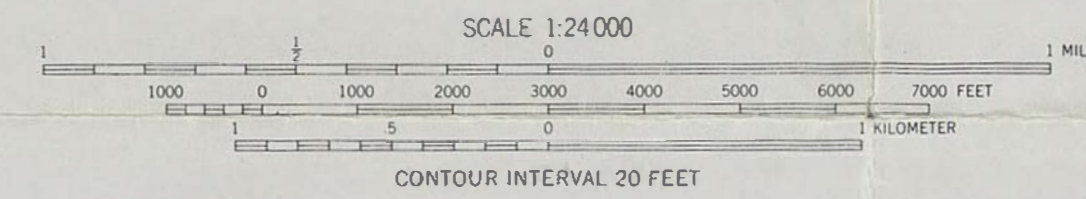
|                   |  |                         |
|-------------------|--|-------------------------|
| MISSISSIPPIAN     |  | Pennington Formation    |
|                   |  | Chickamauga Group       |
|                   |  | Lenoir Limestone        |
| MIDDLE ORDOVICIAN |  | Mascot Dolomite         |
|                   |  | Kingsport Formation     |
|                   |  | Longview Dolomite       |
|                   |  | Chaputpec Dolomite      |
|                   |  | Copper Ridge Dolomite   |
| LOWER ORDOVICIAN  |  | Maynorville Formation   |
|                   |  | Upper Claystone         |
|                   |  | Bradley Creek Limestone |
|                   |  | Lower Claystone         |
| UPPER CAMBRIAN    |  | Holladay Formation      |
|                   |  | Maryville Formation     |
|                   |  | Rogersville Shale       |
| MIDDLE CAMBRIAN   |  | Rutledge Formation      |
|                   |  | Pumpkin Valley Shale    |
|                   |  | Rome Formation          |
| LOWER CAMBRIAN    |  | Honaker Dolomite        |

Contacts  
Dashed where approximate  
dotted where inferred  
Strike and dip of beds  
normal  
vertical  
horizontal  
approximate  
overturned  
Faults  
Dashed where approximate,  
question marks where inferred,  
T on upper plate of thrust fault  
Cross section line

# PLATE II

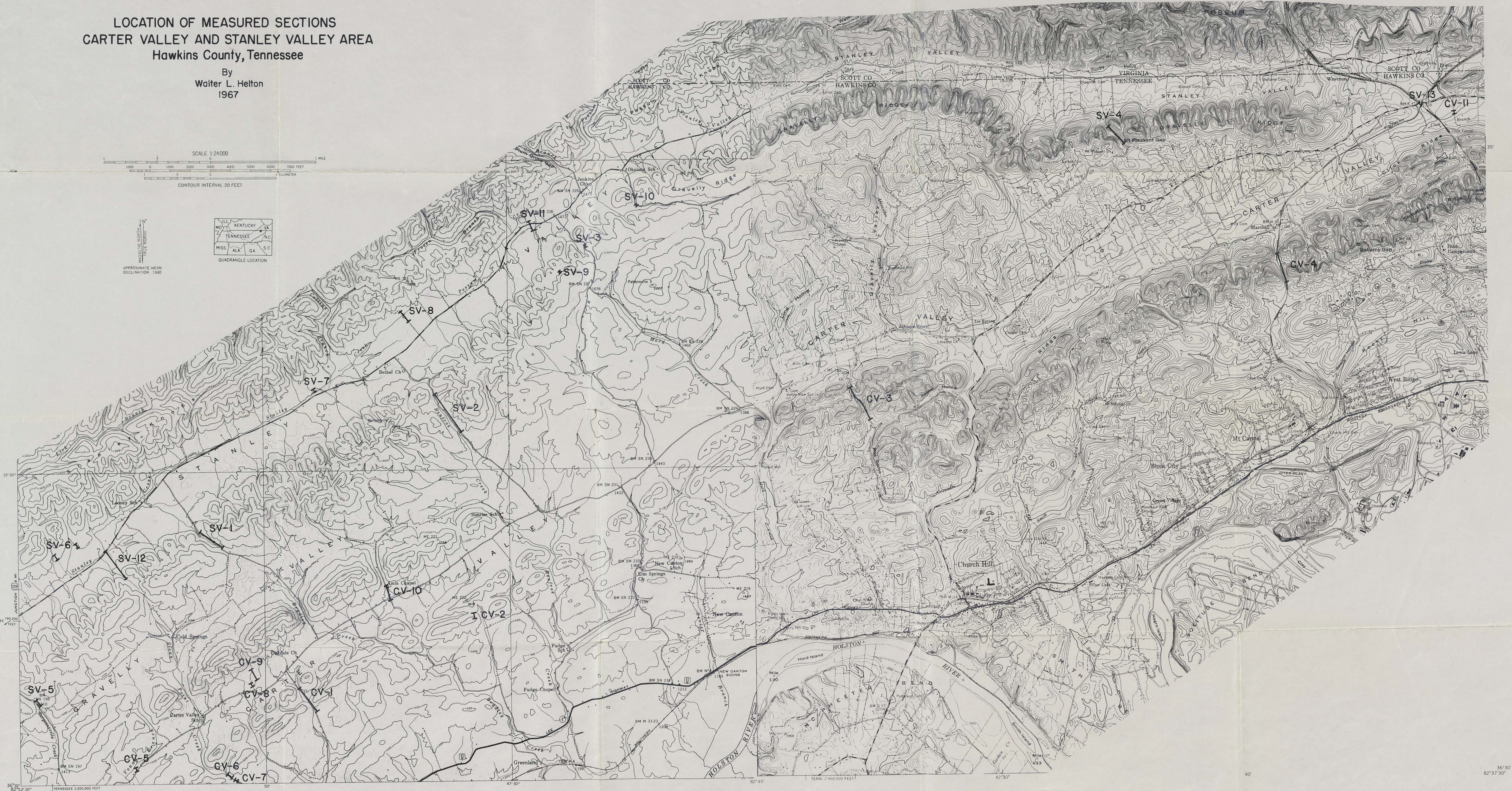
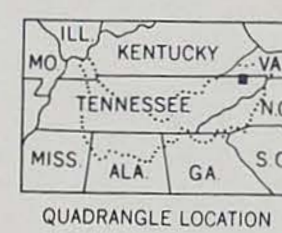
## LOCATION OF MEASURED SECTIONS CARTER VALLEY AND STANLEY VALLEY AREA Hawkins County, Tennessee

By  
Walter L. Helton  
1967



MAGNETIC NORTH  
TRUE NORTH

APPROXIMATE MEAN  
DECLINATION 1960



# PLATE III

## GEOLOGIC CROSS SECTIONS CARTER VALLEY AND STANLEY VALLEY AREA Hawkins County, Tennessee

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### —EXPLANATION—

