May 25, 1959

To the Graduate Council:

I am submitting herewith a thesis written by Adrian Vance Greene entitled "Geology of Newman Ridge and Brushy-Indian Ridge Between Sneedville, Hancock County, Tennessee, and Blackwater, Lee County, Virginia." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Geology.

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Major Professor

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GEOLOGY OF NEWMAN RIDGE AND BRUSHY-INDIAN RIDGE BETWEEN SNEEDVILLE, HANCOCK COUNTY, TENNESSEE, AND BLACKWATER, LEE COUNTY, VIRGINIA

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

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by

Adrian Vance Greene

June 1959

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CHAPTER I

INTRODUCTION

Location and Size of the Area

The area described in this thesis comprises portions of northeastern Hancock County, Tennessee, and southeastern Lee County, Virginia (Figure 1). It includes parts of the Sneedville and Kyles Ford quadrangles (Tennessee Valley Authority and United States Geological Survey topographic maps 170-SW and 170-SE respectively).

The mapped area, bounded on the southeast by the Hunter Valley fault and on the northwest by Blackwater Valley, is approximately fifty miles west of Bristol, Tennessee-Virginia, and fifty-five miles northeast of Knoxville, Tennessee. It is about eleven miles long and three miles wide and encloses approximately thirty-three square miles.

Physiography

General

The mapped area is situated in the western portion of the Ridge and Valley province, a region described by Fenneman (1938, p. 196) as "a lowland (an assemblage of valley floors) surmounted by long, narrow, even-topped mountain ridges."

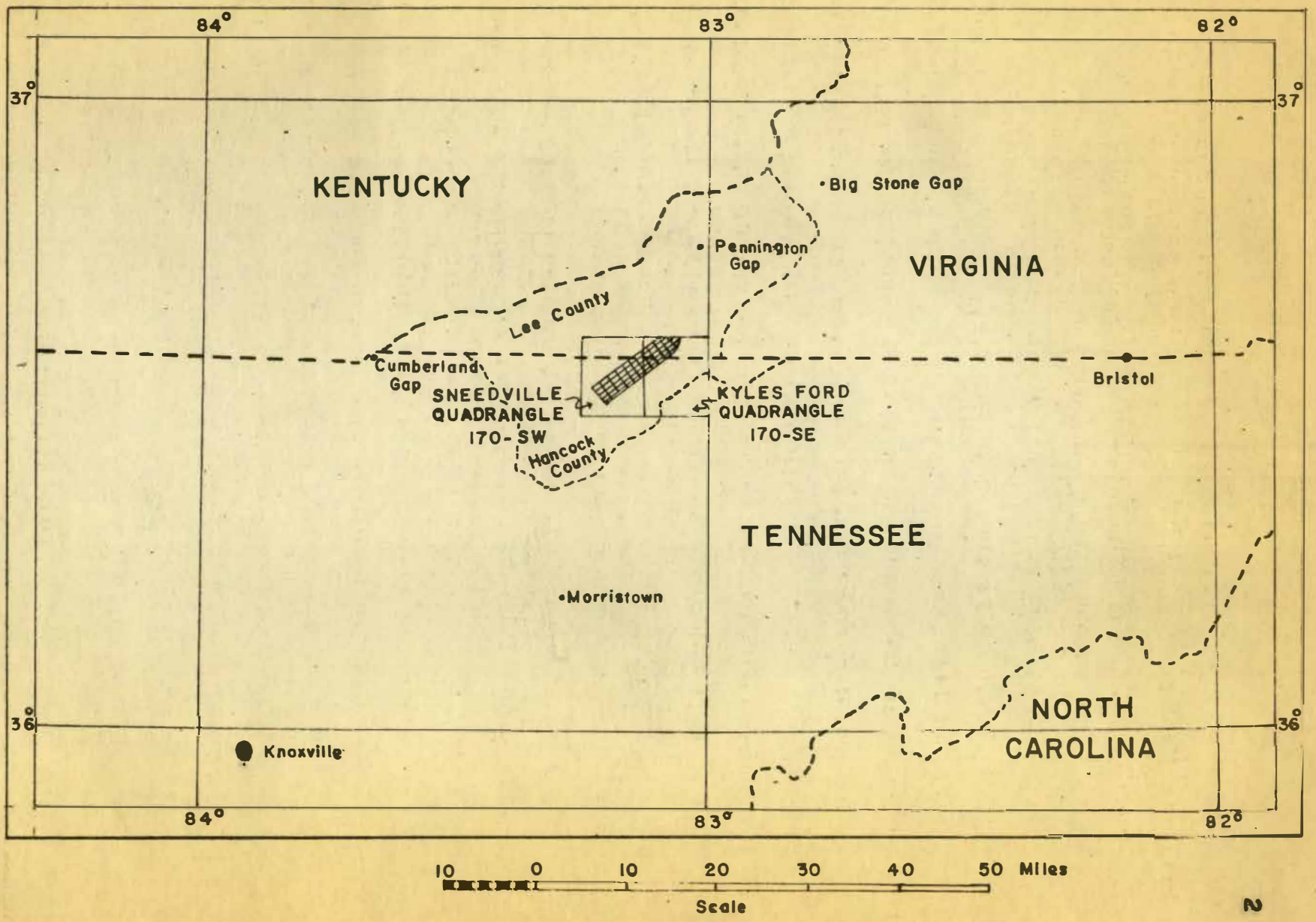


Figure 1. Index map of eastern Tennessee and adjoining states showing location of mapped area.

The major topographic features in the mapped area include Newman Ridge, Brushy-Indian Ridge, Panther Fork Valley, and Blackwater Valley.

Newman Ridge is a northeastwardly-trending hogback approximately thirty miles long and averaging one mile wide. The northern slope is steep and the southern slope is more gentle. Southeast of Newman Ridge, a similar, but lower and shorter ridge is divided by Panther Creek into two segments. West of the creek it is called Brushy Ridge; the eastern segment is called Indian Ridge. Newman Ridge and Brushy-Indian Ridge are separated by Panther Fork Valley. Newman Ridge is adjoined to the northwest by Blackwater Valley.

The highest elevation in the area, approximately 2,560 feet, is on Jabez Knob, about one and one-half miles northwest of Sneedville. The lowest elevation in the area, 1,120 feet, is along the Clinch River. Maximum relief is therefore 1,440 feet.

Drainage

The drainage pattern is of the trellis type with the exception of a limited area of dendritic drainage on the southern side of Brushy-Indian Ridge. The master stream in the area, the Clinch River, is essentially a strike stream, the gradient of which is slightly less than two feet per mile. Blackwater Creek and Panther Creek are also strike streams

through most of their courses. The latter two streams occupy valleys underlain by black shale.

Blackwater Creek flows northeastward from its point of origin for approximately fifteen miles before cutting through the northeastern end of Newman Ridge (outside of mapped area). It then turns south through the structurally-complex area at the northern end of Indian Ridge and joins the Clinch River.

Culture

Paved roads include Tennessee State Highway 33 in the southwestern portion of the area, Tennessee-Virginia State Highway 70 ("The Trail of the Lonesome Pine") at the extreme northeastern boundary, and a county road which extends northwestward from Sneedville to Mulberry Gap. All other roads are gravel or dirt surfaced.

Farming, the main occupation in the area, is concentrated along the Panther Fork Valley, an unusually productive black shale valley.

CHAPTER II

STRATIGRAPHY

Introduction

Strata in the mapped area range in age from Early Cambrian to Late Mississippian, but because of faulting, the stratigraphic sequence from Middle Cambrian to Lower Silurian is absent (Figure 2). Exposed strata are mainly of Mississippian or of Devonian-Mississippian (?) age. Cambrian rocks are present only along the southeastern boundary of the area, and rocks of Silurian age are confined to small sections in the eastern and western portions. Excluding the rocks of Devonian-Mississippian (?) age, approximately 1,200 feet of definite Mississippian strata are present.

Since a portion of the area is in Virginia, the writer has attempted to correlate the Mississippian formations of the Sneedville area with equivalent formations in Virginia. Butts' classical "Geology of the Appalachian Valley in Virginia" (1940) is the chief source of information on Virginia stratigraphy.

Rome formation

The Rome formation, of Early Cambrian age, was named by Hayes (1891) for Rome, Georgia. Smith (1890) applied the

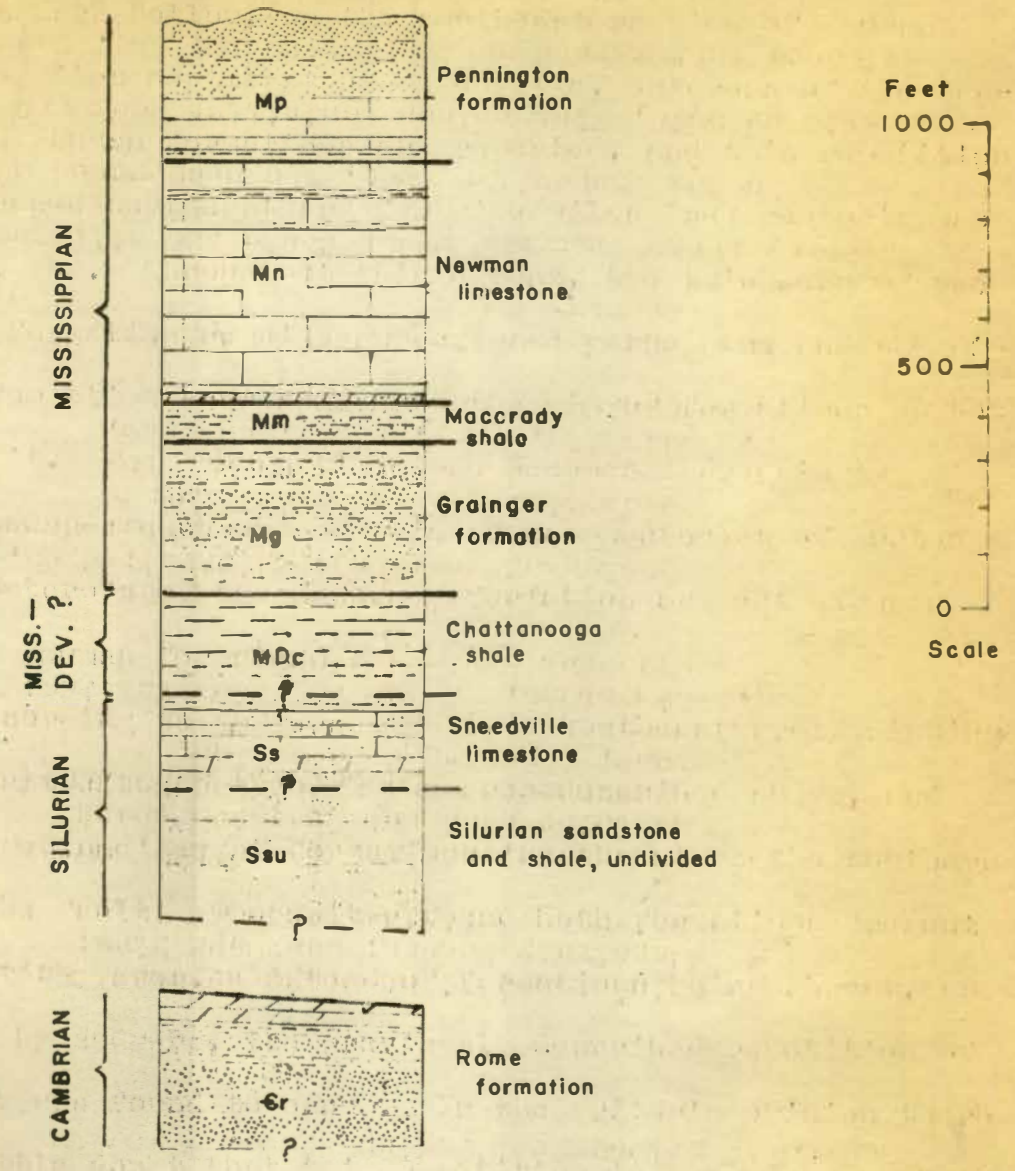


Figure 2. Columnar section of formations in mapped area.

term Montevallo to the same formation about one month prior to the publication of Hayes' work, but despite the priority of the term, it is rarely used. In Virginia, the terms Russell and Buena Vista have been used for the same formation. Stose (1906) applied the name Waynesboro to rocks now known to be equivalent to the Rome formation, and this name is still used north of Roanoke, Virginia.

Keith (1903) used the name Watauga to describe the red shale and dolomite overlying the Shady dolomite in northeastern Tennessee. The Watauga shale is now considered to be the northeastern phase of the Rome formation.

The Rome formation, dominantly composed of clastics in the northwestern part of the Ridge and Valley province, consists chiefly of sandstones, shales, and siltstones, with minor amounts of dolomite and limestone. The shales are green, maroon, buff, and brown in color, are thin-bedded, and often have a glossy appearance on bedding planes due to the high mica content. The maroon shale, one of the most striking lithologies of the Rome formation, weathers to a red soil that forms a vivid contrast to the soils adjoining it.

The sandstones and siltstones vary from thin- to medium-bedded and are commonly ferruginous and glauconitic. Primary features such as ripple marks and raindrop impressions are common in the Rome sandstone (Figure 4).

The carbonates, usually gray in color, vary from fine-grained to coarsely crystalline, and from thin- to massively-bedded. At least fifty feet of carbonates are exposed in the Sneedville area, and consist of impure dolomite with minor amounts of limestone.

The Rome shales and sandstones are commonly deformed (Figures 3, 5), making accurate estimates of thickness difficult to obtain. In northeastern Tennessee, the Rome formation is estimated to be 1,200 feet thick. Elsewhere, the thickness is not known, but Rodgers (1953) believes that it is more than 700 feet in many places.

Strata of Silurian Age

Rodgers (1953) mapped two Silurian rock units in the Sneedville area, namely, an undivided unit of sandstone and shale (probably the Rockwood formation and Clinch sandstone equivalent), and the Hancock (Sneedville) limestone.

The Sneedville limestone was named by Safford (1856) for Sneedville, Hancock County, Tennessee. Referring to Campbell (1894) and Keith (1896), Rodgers (1953, p. 101) stated "Precisely the same rocks in the same area were later named the Hancock limestone." Although the name Sneedville has priority over Hancock, the latter term is the one used by the United States Geological Survey. In this thesis, the term Sneedville, however, is used in preference to Hancock.



Figure 3. Folds in Rome shale. Northeastern end of Indian Ridge



Figure 4. Ripple marks on Rome sandstone. Southern slope of Indian Ridge.



Figure 5. Folds in Rome sandstone. Northeastern end of Indian Ridge.

Rodgers (1953) stated that rocks of both Silurian and Devonian age are present in the Hancock formation, but strata of known Devonian age are apparently limited to outcrops near the igneous bodies in Union County as described by Hall and Amick (1944). Butts (1940, p. 287), in his description of Devonian strata in the Big Stone Gap area of Lee and Wise counties, Virginia, made the statement that "The Helderberg in this area is the upper part of the Hancock limestone." Except for a reference to Keith (1896), he gave no basis for this correlation. In the Sneedville area, no fossils of Devonian age have been found in the Sneedville limestone. In this thesis the formation is mapped as being wholly of Silurian age.

In the mapped area, with the exception of a small exposure of limestone immediately north of Sneedville, Silurian outcrops occur only at the northeastern end of Indian Ridge. A fine-grained, highly-ferruginous sandstone occurs in the lower portion of this section. Above this is a thick-bedded, silty limestone of undetermined thickness with some interbeds of fine-grained, gray dolomite. The limestone, which contains ostracods and Favosites, emits a strongly asphaltic odor when crushed. Overlying the limestone is a medium-bedded, fine-grained, well-cemented sandstone with interbedded layers of siltstone. The sandstone is usually green, but dark-red, highly-ferruginous beds are also present. The

siltstone is brown and contains numerous fossils, mainly brachiopods and Tentaculites.

The limestone present in the section described above is the Sneedville limestone, and the underlying sandstone is the unit mapped by Rodgers (1953) as Silurian sandstone and shale, undivided. As the base of the section is not exposed and outcrops are limited, the thickness of this sequence could not be determined.

Rodgers (1953) stated that a major disconformity overlies the Sneedville limestone. The top of this formation is not exposed, and the disconformity was not observed in the mapped area.

Chattanooga shale

The Chattanooga shale was named by Hayes (1891) for exposures at Chattanooga, Hamilton County, Tennessee.

Rodgers (1953) divided the shale sequence above the Silurian unconformity into two units: the Chattanooga shale, a term applicable only to a dominantly grayish-black shale unit, and an unnamed, thicker unit in which the black shale is divided by a wedge of gray, silty shale, siltstone, and sometimes sandstone. This latter unit is found in the belts between the Saltville and Wallen Valley faults. Stose (1923) at Big Stone Gap, Virginia, named a similar unit the Big

Stone Gap shale. Swartz (1929) divided Stose's Big Stone Gap shale into the Cumberland Gap shale, a basal black shale, the Olinger shale, a silty gray or green shale, and the Big Stone Gap shale (restricted), an upper unit of black shale. This group has been correlated with the Chattanooga shale of Tennessee.

The Brallier shale of Butts (1940) can probably be correlated, at least in part, with the Chattanooga-Big Stone Gap group. Butts (1940, p. 321) gave the following interpretation.

> In the section at South Clinchfield, Russell County, Virginia, the Brallier is typically developed, is 1000 feet thick, and contains no black shale. . . . At Big Stone Gap the section is not fully exposed, but the upper 350 feet, called the Big Stone Gap shale, is much like the Brallier but is dark-colored to black. In Hunter Valley the equivalent of the Brallier contains beds of black shale. . . . It is thought that this transition of the Brallier to black shale continues southwest directly along the strike to Cumberland Gap, where almost all of the interval between the Price sandstone (Mississippian) and the Clinton (lower Silurian) is occupied by black shale. . . . It is surmised that the black shale at Cumberland Gap is in the main a facies of the Brallier or some part of it.

According to Rodgers (1953), the Chattanooga shale becomes progressively thicker eastward and northeastward. It is about 12 feet thick at Chattanooga, 30 to 50 feet thick in Blount County, Tennessee, 50 to 80 feet thick near Clinton, and about 400 feet thick at Cumberland Gap. The threefold

unit is about 400 feet thick at the southwestern end of Clinch Mountain and thickens to 900 feet at the Virginia line.

The age of the Chattanooga shale has been variously placed as Devonian, Mississippian, and Devonian-Mississippian. Current opinion favors the latter, although Hass (1956), after a study of conodonts found within the formation, believes that all of the Chattanooga shale is of Devonian age.

In the Sneedville area, the Chattanooga shale consists mainly of grayish-black, bituminous shale. When weathered, it is fissile; on freshly exposed surfaces it is often blocky and difficult to split. In the lower part of the formation on the northern side of Newman Ridge, green argillaceous shale, containing elongated concretions, occurs interbedded with the grayish-black shale. In one locality, about three-quarters of a mile northeast of Sneedville, a few thin beds of sandstone, resembling the Grainger sandstone, are present.

Pyrite, common throughout the formation, occurs as small oval nodules, or more rarely as thin laminae. Fossils are few and consist almost wholly of linguloid brachiopods. Conodonts, reported to be a common fossil in certain portions of the Chattanooga shale, were not observed in the mapped area.

The Chattanooga shale weathers to an iron-stained, brown color and forms a thin, silty soil. Erosion of this

formation commonly produces deep strike valleys (Blackwater Valley, Panther Fork Valley) bordered by low, rounded knolls (Figure 7).

Due to deformation, no section of Chattanooga shale in this area can be measured accurately, but it is at least 150 feet thick. The top of the formation is placed below the thin beds of sandstone that underlie the Grainger formation (Figure 6). The base is not exposed in the area.

Grainger formation

The Grainger shale was named by Keith (1895) for exposures southeast of Clinch Mountain in Grainger County, Tennessee. Rodgers (1953) suggested that this might better be called the Grainger "formation" because the rocks include considerable sandstone. In Virginia, the correlative formation essentially is called either the Price or Pocono.

The Grainger formation is composed wholly of clastics in the southeastern part of Tennessee and grades southwestwardly into the cherty limestone of the Ft. Payne chert. Rodgers (1953) recognized the Grainger formation in the belts southeast of the Whiteoak and Wallen Valley faults.

Rodgers' description of this formation (1953, p. 106-107) is as follows:

> The Grainger formation consists of bluish, greenish, and brownish argillaceous shale, sandy shale, sandy siltstone, and generally silty and thin-bedded



Figure 6. Contact of Grainger formation (light-colored beds) and Chattanooga shale. A small reverse fault is shown at left.



Figure 7. Small hill formed in Chattanooga shale on southern slope of Newman Ridge. Valley in foreground is also in Chattanooga shale.

> sandstone. Thin coaly beds and highly glauconitic sandstone layers occur in the upper half of the formation and locally, especially near the top, there are layers of coarse sandstone or even fine conglomerate.

Rodgers stated that the thickness of the Grainger formation in Tennessee is approximately 1,100 feet in Blount and Monroe Counties, about 900 feet southeast of Clinch Mountain, about 500 feet in Hancock and eastern Claiborne Counties, and a little less than 350 feet at Cumberland Gap.

Butts' (1940, p. 337) description of the Price-Pocono formation is generally similar to that given for the Grainger formation by Rodgers.

> The Price-Pocono is generally a clastic formation composed of shale and sandstone but in some places has two or more beds of coal. . . . It contains no limestone. The Price facies of the formation southwest of New River has at the bottom locally a quartz conglomerate, the Cloyd (. . .), containing quartz pebbles as much as 1½ inches in diameter. Elsewhere, (. . .), the basal part is composed of thick- to moderately thick-bedded, fine-grained, purplish sandstone. Near the top the Price is commonly marked by one or more beds of sandstone. . . . Besides the sandstone strata mentioned above, the main constituents of the Price are thin-bedded sandstone, greenish clay, and sandy shale containing relatively thin layers of greenish, micaceous sandstone. A little red shale occurs in the bottom of the Price at Cumberland Gap. . . .

The thickness of the Price formation is reported by Butts (1940) to be about 300 feet at Cumberland Gap, Tennessee, and at Little Stone Gap, Wise County, Virginia; 1,000 feet on Pine Mountain in Virginia; 360 feet at Bluefield, Virginia; and 1,700 feet in Montgomery County, Virginia.

Sanders (1952b) described in detail the Grainger formation in the Greendale syncline in Tennessee. A published abstract (1952a, p. 1295) of his work in that area follows:

> The Grainger formation (early Mississippian) has been traced and mapped in detail in the Greendale syncline northeastward from the type locality in Grainger County, Tennessee, across Hawkins County, Tennessee, to the Tennessee-Virginia line. Four sub-divisions are recognized: in ascending order, basal, lower sandstone, middle, and upper sandstone members.
>
> The basal member, 200 to 300 feet thick, changes laterally from fissile gray shale in Grainger County to fossiliferous green siltstone in Doubling Mountain, Hawkins County, and to yellowish silty shale near the Tennessee-Virginia line.
>
> The lower sandstone member is composed of 75 to 200 feet of very fine-grained, medium-bedded sandstone that locally includes pebbly layers and fossiliferous beds.
>
> The middle member consists predominantly of structureless green, fossiliferous siltstone and also includes a few beds of fine-grained sandstone, shale, and fossiliferous glauconitic material.
>
> The upper sandstone member, 100 to 150 feet thick, consists of gray, coarse-grained, cross-bedded, feldspathic sandstone and conglomerate.
>
> Fossils from the Grainger formation have not yet been studied in detail but seem to indicate the formation spans at least part of the Kinderhook and probably most of the Osage intervals of the Mississippian standard section.
>
> The Grainger formation of the present writer agrees with the "Grainger shale" of Campbell (1894) and requires that the "Grainger shale" of Keith (1896) be redefined in its type area to exclude the Devonian beds Keith included in the lower part of the "Grainger shale."

In the Sneedville area, the Grainger formation consists of alternating beds of sandstones and shales (Figures 6, 8, 9). The shales form thick beds at the top of the formation, but in the lower and middle portions they occur in relatively



Figure 8. Gently dipping beds of Grainger formation in northwestern limb of Newman Ridge syncline. Northern slope of Newman Ridge.



Figure 9. Vertical beds of Grainger formation in southeastern limb of Newman Ridge syncline at Blackwater, Virginia.

thin beds. They are predominantly green in color, although some gray, brown, and red beds are also present. The red beds occur locally in the lower portions of the formation. The shales, silty and containing much mica, are commonly fissile, but they occasionally occur as compact beds.

The sandstones are light-green or grayish-green in color, and weather to purple, brown, red, or darker green. The weathered color often extends inward for an inch or more, and on breaking a piece of this weathered sandstone, a striking contrast of colors is seen. The sandstone is very fine-grained, often almost a siltstone, and thickness of bedding varies from one inch to four feet. Primary flow structure is often found at the bottom of beds. Spheroidal weathering is characteristic of the Grainger sandstone in the mapped area, and is probably due to the numerous small joints present throughout the formation. Solutions along joints probably result also in the small, boxwork-like structures composed of iron oxide that often occur in weathered areas of the Grainger formation. Pyrite is fairly common throughout the sandstone, and minute cubes of galena are occasionally present.

The Grainger formation is not very fossiliferous in the Sneedville area, the fossils when present generally occurring as molds or impressions. Brachiopods, bryozoans, crinoid stems and Taonurus caudi-galli are the common fossils;

however, the latter is much more abundant in the overlying Maccrady shale. A few pyritized plant fossils are also present.

The Grainger formation forms steep slopes covered by thin, sandy soil that is rarely cultivated. A narrow bench is often formed on the shale at the top of the formation. Occasionally erosion has proceeded along the strike of this shale to form a small valley that divides the Grainger from overlying formations. More rarely, small, rounded hills are formed by erosion of the Grainger formation; for example, the almost perfectly rounded hill between Fox Branch Church and School at the northeastern end of Indian Ridge.

The Grainger formation is 325 feet thick in a section measured on the southern side of Newman Ridge.

Maccrady shale (restricted)

The Maccrady shale was named by Stose (1913) for the town of Maccrady, two miles northeast of Saltville, Virginia. Stose's original Maccrady shale consisted mainly of rocks of Warsaw age, and Butts (1927, p. 14) suggested that "the red beds, being of New Providence age, and the overlying limestone of Warsaw age should not be included together in the same formation, and that if the name Maccrady is to be retained its application should be restricted to the red beds at base."

According to Rodgers (1953), a unit corresponding to the Maccrady shale is present in most of the Grainger formation belts in Tennessee, and Butts (1940) stated that the Maccrady shale occurs as far north as Alleghany Station, Alleghany County, Virginia. The beds overlying the Maccrady shale are either of Warsaw or of St. Louis age.

The most distinctive feature of the Maccrady shale is its red color. Butts (1940) stated that this formation consists mainly of coarse-grained, lumpy, red shale or sandy mudrock, although at one area in Washington County, Virginia, limestone is present. Rodgers (1953) described this formation as being composed of red shale and siltstone.

In the Sneedville area, the Maccrady shale consists of red shale in the lower portion, and blocky, red and green siltstone or mudstone with red and green shale in the upper portion (Figure 10). The Maccrady shale, like the Grainger formation, is much jointed, and solutions along this jointing often result in a red and green mottled or veined appearance.

Layers of fine hematite, two or three inches thick, are often found. Granular glauconite is found in thin layers at the top of the formation, along with thin layers and nodules of green chert.

With the exception of the cryptic Taonurus caudi-galli, fossils are rare in the Maccrady shale and consist of molds of crinoid stems, brachiopods, and bryozoans contained in

hematitic siltstone. In all observed localities, Taonurus is present; in fact, abundance of this fossil is generally considered evidence of the Maccrady shale in the Sneedville area (Figure 11). Butts (1927, p. 12) used this fossil to determine the age of the Price formation in Virginia.

> The Taonurus is especially significant, as it is the most abundant fossil along the western escarpment of the Cumberland Plateau just east of the Blue Grass region of central Kentucky, where the fossil is present in nearly every sandy layer of the New Providence throughout the full thickness of about 600 feet. Hence the Price formation is correlated with the New Providence. . . .

Although Butts believes the Maccrady shale to be Osagian in age, B. N. Cooper (1944) believes that it could well be of Warsaw age.

In the Sneedville area, the Maccrady shale is 75 feet thick. The base of the formation is placed below the red shale that overlies the Grainger formation, and the upper limit is marked by the carbonates of the Newman limestone.

Newman limestone

The Newman limestone was named by Campbell (1893) for Newman Ridge in Hancock County, Tennessee, and Lee County, Virginia. The name Bangor limestone has been applied to the Newman equivalent in Alabama, but the term Bangor is now restricted to the upper part of the Newman sequence. The term Floyd shale is also used in Georgia and Alabama to describe

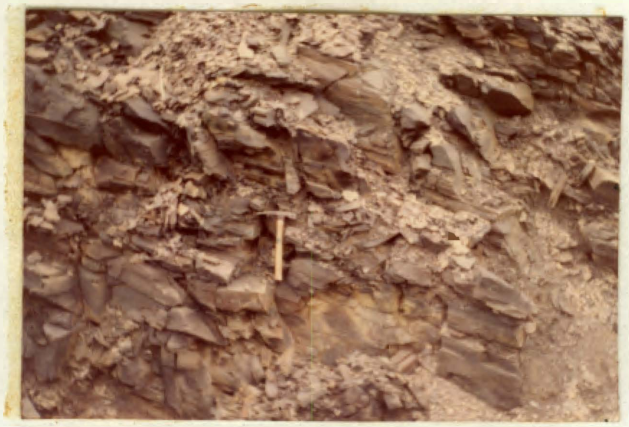


Figure 10. Blocky siltstone of Maccrady shale on Newman Ridge.



Figure 11. Taonurus caudi-galli in Maccrady shale, Newman Ridge.

the lower, shaly equivalent of the Newman limestone. The Greenbrier limestone in West Virginia and part of Virginia is essentially equivalent to the Newman limestone.

According to Rodgers (1953), the Newman limestone varies considerably in Tennessee. The belts near the Cumberland Plateau consist mainly of pure, gray, massive limestone with some shaly limestone, and the thickness varies from 600 to 850 feet. In Blount County, Tennessee, the Newman formation consists of about 1,200 feet of shaly limestone and calcareous shale. Along Whiteoak Mountain, the formation is 1,200 to 1,500 feet thick and is lithologically similar to that in Blount County except that purer limestone occurs in the middle of the formation.

In the Sneedville area, the Newman limestone is composed of massively-bedded limestone with some dolomite, and calcareous shale. The shale, green in color, occurs as thin partings in the lower portion of the formation, but as thick beds toward the top (see geologic section, p. 29).

The dominant color of the carbonate beds is gray, although blue, reddish, and green beds occur irregularly. Dolomite is present in the lower portion of the formation. Oolitic limestone occurs as intermittent beds throughout the formation. The limestone and dolomite at the base are compact, whereas higher the limestone is mainly crystalline, although a few compact beds are present. The basal beds are

sandy, but sand is rare in the upper portion of the formation.

Green or dark-gray chert is common in the basal portion of the Newman limestone. Crystals of fluorite about one-half inch in width are found in the lower part, and an unidentified, amorphous, green mineral is common in the lower and middle parts.

Slightly weathered sections of the Newman limestone are characterized by massive bedding and by marked cross-bedding. In more weathered sections, these features are often absent due to weathering of thin shaly beds.

The top of the Newman limestone is placed below the characteristic unit of shale and thin-bedded sandstone that is present at the base of the Pennington formation.

Measurement of the formation on Indian Ridge indicates a thickness of approximately 500 feet. No complete section is exposed in the area, and measurement was made by tracing beds along strike. This resulted in an unavoidable amount of error in measurement, an error believed to be less than 50 feet.

The Newman limestone in Virginia has been divided into six lithologic units by Butts (1940). Some of these lithologies can be recognized in the Sneedville area.

The Warsaw lithology of Butts is not recognized in the mapped area, rocks similar to the St. Louis limestone being present immediately above the Maccrady shale. These consist

of compact and crystalline limestone with some dolomite. The basal beds are very silty. Bedded chert is usually abundant but in some localities it is virtually absent. Lithostrotionella canadensis and Syringopora cf. S. virginica are commonly present. Below is a measured section of basal Newman limestone from Indian Ridge.

		Thickness Ft.	In.
6.	Limestone, light-gray, crystalline, massively bedded; weathers blue; slightly oolitic at top	8	0
5.	Limestone, similar to Unit 4, but contains abundant greenish chert that occurs as lenses, nodules, and long, pencil-shaped bodies	10	6
4.	Limestone, light-gray, crystalline; abundant Syringopora	4	6
3.	Dolomite, bluish-gray, compact, nodules of green chert (rare); fine, thread-like streaks of calcite; dark-green mineral occurs as streaks	4	6
2.	Dolomite, gray, silty, compact, massively-bedded	3	0
1.	Covered, believed to be mainly Maccrady shale	15	0

Maccrady shale (red and green shale and siltstone)

In the Sneedville area, the occurrence of the diagnostic crinoid, Platycrinus penicillus Meek and Worthen, is evidence that strata equivalent to the Ste. Genevieve as described by Butts is present. This fossil occurs through at least 70 feet of vertical section. At the base of this section

is a bed of gray, massively bedded, crystalline limestone with interbedded layers of oolitic limestone. On weathering, this bed has a characteristic, blocky appearance. It is overlain by a bed of compact limestone, three feet thick, which is stained by the previously described green mineral. Overlying this, a gray, crystalline, sparsely oolitic limestone represents the highest level at which Platycrinus was found. At Caney Sinks, two miles east of Sneedville, brachiopods, tentatively identified as Leptaena sp., were found in this section. To the writer's knowledge no occurrence of this genus has been reported elsewhere above the Burlington limestone of Middle Osage age.

Butts described three formations of Chester age in Virginia: the Gasper limestone, the Fido sandstone, and the Glen Dean limestone (Bluefield shale, Cove Creek limestone). With the exception of the Fido sandstone, which occurs only in the Greendale syncline, the units of Chester age are divided by Butts mainly on fossil evidence. The Gasper limestone is recognized by the presence of Talarocrinus. This fossil is found in the Sneedville area, but it is rare. Other fossils, however, are abundant, and detailed study of these could result in a satisfactory division of the upper units of the Newman limestone.

A list of fossils identified from the upper portion of the Newman limestone follows.

Zaphrentis sp.

Campophyllum (?)

Lithostrotionella prolifera (?)

Fenestrellina, several species

Lyropora cf. *L. ranosculum* Ulrich

Archimedes, several species

Pentremites, several species

Agassizocrinus sp.

Talarocrinus sp.

Composita subquadrata

Dictyoclostus sp.

Cliothyridina

Tooth of *Cladodus*

Generalized Geologic Section of Newman limestone along Indian Ridge

	Thickness Ft.	In.
Newman limestone		
Limestone, drab-gray, mottled with red, thick-bedded; numerous crinoid stems throughout; oolitic in part	24	0
Limestone, gray with reddish tinge, oolitic	4	0
Covered	7	0

	Thickness Ft.	In.
Limestone, porphyritic appearance caused by large white calcite crystals in reddish, compact limestone; grades upward into drab-gray limestone	6	0
Shale, green, fissile, calcareous; weathers to coarse fragments	37±	0
Limestone, light-gray, compact, thick-bedded; greenish at base, very fossiliferous at top; Archimedes abundant, also contains Pentremites and Agassizocrinus	11	0
Limestone, shaly, light-blue, thin-bedded; weathers to shale, largely covered	27±	0
Limestone, light-gray, small oolites, thick-bedded	11	0
Limestone, gray, weathers green, contains small, gray calcite crystals	3	0
Limestone, shaly, green	8	0
Limestone, light-gray, thick-bedded; crinoidal	25	6
Covered	5	0
Limestone, light-blue with green mottling; blue compact, green crystalline; Archimedes abundant	9	0
Limestone, light-gray, alternates with greenish limestone and thin, green shale beds; weathers blocky	17	6
Limestone, shaly, light-blue, fossiliferous	11	6
Limestone, greenish-gray, crystalline, thick-bedded; sparse chert nodules	10	6
Limestone, shaly, light-green; Fenestrellina abundant	3	0
Limestone, gray, crystalline, fossiliferous, thick-bedded; weathers blue	12	0

	Thickness Ft.	In.
Covered	4	0
Limestone, light-green, crystalline	6	6
Limestone, blue, compact, cross-bedded; weathers to white color	10	6
Limestone, light-green, silty, thin-bedded	3	0
Limestone, light-gray, crystalline	5	6
Shale, limy, blue, fissile	2	6
Limestone, dark-gray, oolitic	3	6
Limestone, grayish-green, thick-bedded; contains white calcite crystals, Fenestrellina, Pentremites	13	0
Limestone, light-gray, thick-bedded	10	6
Limestone, light-gray, crystalline; sparsely oolitic	2	0
Limestone, light-green, compact, thin-bedded	3	0
Limestone, light-gray, crystalline; contains Pentremites	5	0
Limestone, grayish-green, compact; shelly	3	6
Covered, probably limestone	3	0
Limestone, greenish-gray; contains black crystals of calcite	2	6
Limestone, light-green, fine-grained; contains crystals of fluorite	3	0
Covered, probably limestone	15	0
Limestone, reddish-gray, silty, thick-bedded	8	0
Limestone, greenish-gray, crystalline, thick-bedded	13	6

	Thickness Ft.	In.
Limestone, gray, fine-grained, brittle, thick-bedded; small bryozoans cause dotted effect	24	0
Covered	3	0
Limestone, dark-gray, compact and crystalline interbeds; numerous streaks of calcite	9	0
Limestone, light-gray, compact, brittle; a few black chert nodules; streaks of green mineral	5	0
Limestone, reddish-gray, compact; weathers to light-red color	3	6
Limestone, light-gray, coarsely crystalline, sparsely oolitic; contains Platycrinus	8	0
Limestone, light-gray, crystalline	4	6
Limestone, light-green, compact, silty	3	6
Limestone, light-gray, coarsely crystalline, oolitic; contains Platycrinus	8	6
Dolomite, light-blue, compact; weathers white; conchoidal fracture; fluorite crystals; sparse lenses of chert that weathers sandy	5	6
Limestone, gray, coarsely crystalline; sparse chert nodules; fossiliferous	1	6
Limestone, dark-gray, finely crystalline; weathers to bluish color; many small, white crystals of calcite	6	6
Covered	14	0
Limestone, gray, coarsely crystalline, oolitic in part, thick-bedded	10	0
Dolomite, blue with greenish tint, very compact, silty	3	0
Limestone, gray, coarsely crystalline, thick-bedded, oolitic in part	12	0

	Thickness Ft.	In.
Limestone, gray, compact to coarsely crystalline, thick-bedded, oolitic at top	14	6
Limestone, bluish-gray, finely crystalline	3	0
Dolomite, gray, tinted light-green in part; weathers to dark-brown; sparse nodules of gray chert	12	0
Total	503	feet

Maccrady shale

Pennington formation

The Pennington formation, of Late Chester age, was named by Campbell (1893) for Pennington Gap, Lee County, Virginia.

Butts (1940, p. 333) described the Pennington formation as follows:

> The Pennington formation is almost wholly composed of shale and sandstone and contains but a few thin beds of impure limestone. . . . The sandstone is mainly in thin layers, fine grained, greenish and red. A few beds are conglomeratic. . . . The shale is largely coarse-grained, crumbly or lumpy mudrock, commonly red, but some beds are yellowish or greenish, or nearly black and calcareous. The red color is the most distinctive characteristic of the formation in its northeastern areas.

Rodgers (1953, p. 111) described the Pennington formation as being "heterogenous and varicolored, including red, purple, and green clay shale, pink, red, green, and brown (normally calcareous) sandstone, and yellow shaly or silty fossiliferous limestone."

The Pennington formation in the mapped area differs somewhat from these descriptions (see geologic section, p. 36). The lower portion of the formation contains several beds of blue and gray, crystalline limestone. Green or gray shale, usually argillaceous, is interbedded with the limestone. This shale generally weathers to a characteristic, coarse, sawdust-like appearance. Thin beds of gray, medium-grained sandstone are also present in the lower portion of the Pennington formation (Figure 12).



Figure 12. Shale and thin-bedded sandstone in Pennington formation, Newman Ridge.

Higher in the formation, sandstone is dominant and limestone is absent. The sandstone is thin- to medium-bedded, medium-grained, and mainly green in color, although some pink beds are present. On weathering, this sandstone becomes friable, and abundant flakes of mica are visible.

Fossils are abundant in the lower portion of the formation and consist mainly of Archimedes and other bryozoans, brachiopods, Agassizocrinus, and crinoid stems. In the sandstone higher in the formation, plant fossils are common.

This formation, which caps both Newman Ridge and Brushy-Indian Ridge, is at least 300 feet thick.

Generalized Geologic Section of Pennington formation along Indian Ridge

Hunter Valley fault

	Thickness Ft.	In.
Pennington formation		
Base covered, probably shale and sandstone, upper part is medium-bedded, gray and green sandstone with thin beds of green shale, estimated	200±	
Limestone, blue, coarsely crystalline, silty; scattered crinoid stems and large, tan-colored brachiopods	2	6
Shale, green, fissile	3	6
Limestone, bluish-gray, with a few thin beds of black shale; many productid-like brachiopods	12	6

	Thickness Ft.	In.
Covered	3	0
Limestone, blue-gray, crystalline, thick-bedded	7	0
Limestone, shaly, blue, very fossiliferous	1	6
Shale, green; a few thin layers of fossiliferous limestone	7	0
Limestone, blue, compact, fossiliferous	3	6
Limestone, blue, silty	4	0
Limestone, blue, finely crystalline, thick-bedded, crinoidal	11	0
Limestone, blue, crystalline, thick-bedded	5	6
Limestone, brownish-gray, oolitic, thick-bedded	8	6
Limestone, light-blue, very silty, fossiliferous; weathers to white color mottled with red	3	0
Shale, green and crumbly, with interbeds of green calcareous sandstone; many crinoid stems	9	0
Shale, blue, and green shaly sandstone	8	0
Covered, believed to be mainly gray shale with some gray, crystalline limestone and thin beds of gray sandstone, estimated	75	

Newman limestone

CHAPTER III

STRUCTURE

Introduction

As previously stated, the mapped area is located in the western portion of the folded and faulted Ridge and Valley province. Approximately ten miles southeast of the area is the Greendale syncline, a major structure that contains an enormous thickness of Mississippian strata. To the northwest is the great Cumberland overthrust block, comprising a surface area of 3,000 square miles. This immense block is believed to have moved from two to ten miles in a northwestwardly direction (Butts, 1940). The southern limit of this block is sometimes placed at the Hunter Valley fault extending through Hancock County just south of Sneedville, but Butts (1940) believes that the boundary should be the Wallen Ridge fault, approximately six miles northwest of the Hunter Valley fault.

According to Rodgers (1953), four thrust faults are present in Hancock County, Tennessee. The Wallen Valley fault extends through the northwestern part of the county between Powell Mountain and Wallen Ridge. The Copper Creek fault is in the southeastern part of Hancock County and parallels the northern base of War Ridge. The Hunter Valley

and Clinchport faults extend through the central portion of the county and merge east of Sneedville. The resulting fault continues as the Hunter Valley fault southwestward to near Clinton, Tennessee. Northeastward, the Hunter Valley and Clinchport faults apparently merge again about thirty miles east-northeast of the Tennessee-Virginia state line. In Virginia this fault is called the St. Paul.

Of the faults mentioned above, only the Hunter Valley is present in the mapped area. Other faults in the area include a northwestwardly dipping fault (the Sneedville fault),[1] and two smaller faults, one at either end of Brushy-Indian Ridge. (Plate II)

Hunter Valley fault

Campbell (1893, p. 20) described this fault at Big Stone Gap, Virginia, as follows:

> A profound break--the Hunter Valley fault--stretches from near Rome, Georgia, to the New River, Virginia, and forms the southeastern limit of all known Coal-measures. This is one of the most extensive faults in the Appalachian Province, having a length of 370 miles and a stratigraphic throw of 11,000 feet.

The Hunter Valley fault is exposed on State Highway 33 one-quarter of a mile south of Sneedville, where the Rome

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[1]This fault, northeast of Sneedville, Hancock County, Tennessee, mapped as a southeastwardly dipping fault by Rodgers (1953), is herein named the Sneedville fault by the writer.

formation has been thrust from the southeast over the Chattanooga shale (Figures 13, 14). Butts (1940) described an exposure of the St. Paul fault (considered to be an extension of the Hunter Valley fault) near St. Paul, Virginia, where it dips 12° to the southeast. The Hunter Valley fault at Sneedville dips 30° to the southeast. Possibly this exposure represents a local steepening of the fault. (Plate II)

Except for the squeezing of thin layers of Chattanooga shale along the bedding planes of the Rome formation, there is very little deformation along the fault. Drag is slight, and the southeastwardly dips of the formations on both sides of the fault are approximately the same.

From the exposure south of Sneedville, the Hunter Valley fault extends northeastward along the southern side of Brushy-Indian Ridge with an approximate strike of N65E. Along most of this distance, the Rome formation is in fault contact with the Pennington formation, the youngest rock unit present, but at the northern end of Indian Ridge, the Rome formation has been thrust over Silurian strata. Thus, within a distance of approximately nine miles, the Rome formation is in fault contact with a stratigraphic section ranging from Silurian to upper Mississippian. (Plate II)



Figure 13. Hunter Valley fault south of Sneedville. At the left (southeast) is the Rome formation. At right is the Chattanooga shale.



Figure 14. Closer view of fault shown in Figure 13.

Sneedville fault

In Dark Hollow, on the southeastern side of Newman Ridge two miles northeast of Sneedville, outcrops of the Maccrady and Newman formations are repeated, and this repetition can be traced northeastward for nine miles (see geologic maps Plate Ia, Ib). Throughout this extent, the thickness of the Maccrady formation remains approximately the same and the dip of this formation corresponds to the dip of formations on both sides of it. The Newman limestone becomes increasingly thinner towards each end of this area. Southwest of Horton Hollow, outcrops of the Maccrady formation are not exposed above the Newman formation.

According to Rodgers (1953), a southeastwardly dipping thrust fault extends through the area described above, and the Grainger and Newman formations are absent on the southern side of the fault. The writer found both formations present throughout the area. Instead of formations being absent, as indicated by Rodgers, the previously described repetition of formations was found to occur. In the writer's opinion there can be little doubt that this repetition is caused by a northwestwardly dipping thrust fault, herein called the Sneedville fault. The exposed fault southwest of the bridge on State Highway 70 at Blackwater, Virginia (at the northeastern edge of Plate Ib), is believed to be the northeastern extension of this fault (Figures 15, 16, 17, 18).



Figure 15. Fault at Blackwater, Virginia. At left (southeast) is Newman limestone. At right is Grainger formation.



Figure 16. Closer view of fault shown in Figure 15.



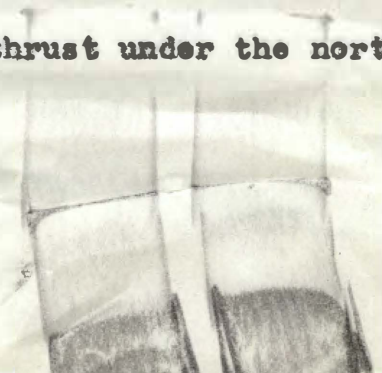
Figure 17. Fault at Blackwater, Virginia. At left (southeast) is Newman limestone. At right is Grainger formation.



Figure 18. Closer view of fault shown in Figure 17.

Northwestwardly dipping thrust faults are not common in the Ridge and Valley province. The writer offers two explanations to account for the northwestwardly dip of the Sneedville fault. The first, based on regional tectonic activity, assumes a pressure from the southeast. The main thrust faults would be expected to dip southeastwardly, but (theoretically, at least) minor, northwestwardly dipping thrust faults should also be present (McKinstry, 1948, 1955). Therefore, the Sneedville fault could be the result of strains resulting from northwestwardly directed forces.

The second explanation is based on local deformation resulting from the movement of the Hunter Valley thrust block. As this block moved across the minor folds in the area, two forces were active along the fault plane: one produced by low-angle, northwestwardly movement, and the other by the tremendous vertical pressure supplied by the weight of the overlying thrust block. The component of these forces would tend to compress the limb of an anticline dipping toward the fault, while the limb dipping away from the fault plane would be subjected to tension. A tension crack could form on the flank of such an anticline, and further movement of the thrust block could cause the crack to develop into a fault with the southeast footwall thrust under the northwest hanging wall (Figure 19).



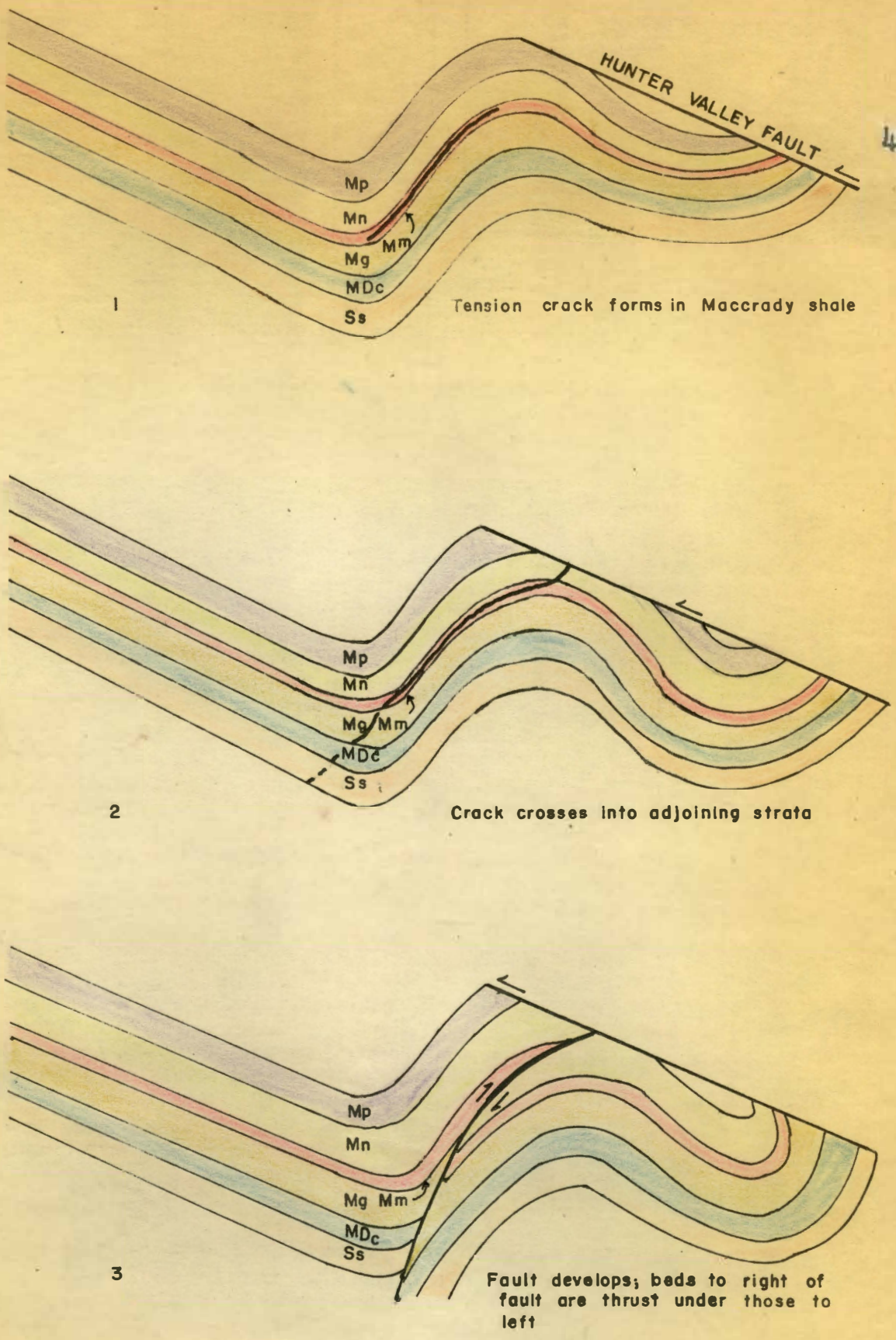


Figure 19. Possible sequence of events that formed Sneedville fault.

The effects of either sequence of tectonic activity suggested above would be similar to the other. The main difference would be that if regional forces produced this fault, the hanging wall has been thrust over the footwall. If movement of the Hunter Valley fault was responsible, the footwall has been thrust under the hanging wall. In either case, shaly beds of the Maccrady formation probably served as a lubricant to the action, and a great part of the fault movement was along the bedding plane of this formation. The Sneedville fault is a combination of a bedding plane fault and a thrust fault.

Minor faults

At the southwestern end of Brushy Ridge, faulting has brought the Chattanooga shale in contact with the Newman limestone. The resulting fault, the throw of which is at least 300 feet, cannot be traced beyond the end of Brushy Ridge, but it probably dies out northwardly. To the south, the fault probably continues in the formations underlying the Hunter Valley thrust; there is no indication that it extends into the thrust block.

The attitude of this fault cannot be determined from the surface evidence available. On cross-section C-C', it is interpreted as a westwardly dipping thrust fault, but it could be a gravity fault with eastwardly dip, or possibly a

strike-slip fault with northward movement of the eastern block.

A similarly striking fault is present at the northeastern end of Indian Ridge. The attitude of this fault cannot be ascertained, but apparently the eastern block has been thrust over the western block. The throw of this fault could not be determined.

Newman Ridge syncline

Newman Ridge is underlain by a syncline that extends from Howard Quarter, Claiborne County, Tennessee, northeastwardly into Virginia. Butts (1940) stated that the overturned portion of the Newman Ridge syncline crops out along the southeast base of Powell Mountain between Duffield, Scott County, and St. Paul, Wise County, Virginia. Its length in Tennessee is approximately 25 miles and in Virginia at least 45 miles, a total length of at least 70 miles.

In the Sneedville area, the northern limb of the syncline has a constant, gentle, southeastwardly dip. The dip of the southern limb varies from gentle to overturned. At the southwestern end of the area, the southern limb is overturned, and small overturned folds occur. Northeastwardly, the dip of the southern limb flattens and the small folds are absent. Farther to the northeast, the dip of the southern limb steepens, and small folds again occur. (Plate II)

Brushy-Indian Ridge syncline

Brushy-Indian Ridge, approximately nine miles long, is underlain by a syncline, the southern portion of which has been overridden by the Hunter Valley thrust block. Only the northwestern limb of the syncline is present throughout most of the length of Brushy Indian Ridge, but at the northeastern end, the axial portion of this structure is exposed.(Plate II)

As was pointed out to the writer by Dr. G. D. Swingle of the University of Tennessee (personal communication), if the interpretation of the northeastern end of this structure is correct, then this is one of the few instances in the Ridge and Valley province of Tennessee where beds in the overridden block of a thrust fault strike discordantly with respect to beds in the thrust block. This condition would indicate that folds existed prior to faulting.

Panther Fork anticline

This anticline is between the Newman Ridge and Brushy-Indian Ridge synclines. To the northeast, this structure probably dies out in a series of small folds. To the southwest, the anticline continues beyond the mapped area.

The axial portion of this anticline is nowhere exposed, but it presumably follows Panther Fork Valley. Horizontal beds, representing a local widening of this structure, are

present about three miles northeast of Sneedville. At Horton Hollow, two and one-half miles northeast of Sneedville, a change of strike occurs. This is interpreted by the writer to be a small nose in the anticlinal structure.

Rodgers (1953, p. 159) apparently referred to this structure as a "Faulted anticline in Devonian and Mississippian rocks." The only indications of faulting observed by the writer are the local changes of strike and dip mentioned above.

Summary of Conclusions

The major structural features of the mapped area are the Newman Ridge syncline and the Hunter Valley fault. The northwestern limb of the Newman Ridge syncline has a constant, gentle dip, whereas the dip of the southeastern limb varies from gentle to overturned. Along the Hunter Valley fault, the Cambrian Rome formation is thrust over the Mississippian Pennington formation, thus bringing in contact the oldest and youngest formations commonly present in the Ridge and Valley province of Tennessee.

Minor features include a northwestwardly dipping thrust fault (the Sneedville fault), two smaller faults, and a small anticline and syncline.

Rodgers' geologic map of East Tennessee (1953) is essentially correct in the Sneedville area, although his

interpretation of the fault northeast of Sneedville as a northeastwardly dipping thrust fault is apparently in error, and the fault that he maps in the anticline northeast of Sneedville is questionable. The two small faults recognized by the writer at each end of Brushy-Indian Ridge are not mapped by Rodgers.

SELECTED REFERENCES

Averitt, Paul, 1941, The Early Grove gas field, Scott and Washington Counties, Virginia: Va. Geol. Survey, Bull. 56.

Butts, Charles, 1922, The Mississippian series of eastern Kentucky: Ky. Geol. Survey, Ser. 6, vol. 7.

_____, 1927, Oil and gas possibilities at Early Grove, Scott County, Virginia: Va. Geol. Survey, Bull. 27.

_____, 1940, Geology of the Appalachian Valley in Virginia: Va. Geol. Survey, Bull. 52.

Campbell, M. R., 1893, Geology of the Big Stone Gap coal field of Virginia and Kentucky: U. S. Geol. Survey, Bull. 111.

_____, 1894, U. S. Geol. Survey Geol. Atlas, Estillville folio (no. 12).

Cooper, B. N., 1944, Geology and mineral resources of the Burkes Garden quadrangle, Virginia: Va. Geol. Survey Bull. 60.

Cooper, G. Arthur, and others, 1942, Correlation of the Devonian sedimentary formations of North America: Geol. Soc. America, Bull., vol. 53, p. 1729-1794.

Fenneman, Nevin M., 1938, Physiography of Eastern United States: McGraw-Hill Book Company, New York.

Hall, G. M., and Amick, H. C., 1944, Igneous rock in the Norris region, Tennessee: Jour. Geol., vol. 52, p. 424-430.

Hass, Wilbert H., 1956, Age and correlation of the Chattanooga and Maury formations: United States Geol. Survey, Prof. Paper 286.

Hayes, C. W., 1891, The overthrust faults of the southern Appalachians: Geol. Soc. America, Bull., vol. 2, p. 141-152.

Keith, Arthur, 1895, U. S. Geol. Survey Atlas, Knoxville folio (no. 16).

_____, 1896, U. S. Geol. Survey Atlas, Morristown folio (no. 27).

Keith, Arthur, 1903, U. S. Geol. Survey Atlas, Cranberry folio (no. 90).

McKinstry, Hugh E., 1948, Mining geology: Prentice-Hall, Inc., New York.

_____, 1955, Structure of hydrothermal ore deposits: Econ. Ge l., 50th Anniv. vol., Part 1, pp. 170-225 (esp. pp. 176-178.

Rodgers, John, 1953, Geologic map of East Tennessee with explanatory text: Tenn. Dept. of Geology, Bull. 58.

Safford, J. M., 1856, A geological reconnaissance of the state of Tennessee: State Geologist, 1st Bienn. Rept., Nashville.

_____, 1869, Geology of Tennessee, State of Tennessee, Nashville.

Sanders, John E., 1952a, Mississippian Grainger formation in northeast Tennessee: Geol. Soc. America, Bull., vol. 63, no. 12, p. 1295.

_____, 1952b, Geology of Pressman's Home area, Grainger and Hawkin Counties, Tennessee: Unpublished doctoral dissertation, Dept. of Geology, Yale University (in files of Tennessee Dept. of Geology.

_____, John E., 1953, St. Louis limestone (Mississippian) of the southern Appalachians (abstract): Geol. Soc. America, Bull., vol. 64, no. 12, p. 1536.

Smith, E. A., 1890, Report on Cahaba coal field: Alabama Geol. Survey.

Stose, G. W., 1906, The sedimentary rocks of South Mountain, Pennsylvania: Jour. Geol., vol. 14, p. 209.

_____, 1913, Geology of the salt and gypsum deposits of southwestern Virginia: U. S. Geol. Survey, Bull. 530, p. 234: Va. Geol. Survey, Bull. 8, p. 51-73.

_____, 1923, in The Geology and Mineral Resources of Wise County and the coal-bearing portion of Scott County, Virginia: Va. Geol. Survey, Bull. 24.

Swartz, J. H., 1924, The age of the Chattanooga shale of Tennessee: Am. Jour. Sci., 5th ser., vol. 7, pp. 24-30.

_____, 1929, The age and stratigraphy of the Chattanooga shale in northeastern Tennessee and Virginia: Am. Jour. Sci., 5th ser., vol. 17, pp. 431-448.

Weller, J. Marvin, and others, 1948, Correlation of the Mississippian formations of North America: Geol. Soc. America, Bull., vol. 59, pp. 91-196.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS BRANCH

TENNESSEE-VIRGINIA
SNEEDVILLE QUADRANGLE
170-SW

(Rose Hill 161-NE) (Hubbard Springs 170-NW) (Ben Hur 170-NE)
(Back Valley 161-SE) (Lee Valley 171-NW) (Ayres Ford 170-SE)
(Swan Island 162-NE) (Pressmens Home 171-NE)

83°15′ 12′30″ 10′ 83°07′30″
36°37′30″ 36°30′

VA. 610,000 FEET — TENN. 2,840,000 FEET
VA. 140,000 FEET — 820,000 FEET TENN.
TENN. 780,000 FEET — VA. 640,000 FEET
TENN. 2,810,000 FEET — 100,000 VA. FEET

35′ 32′30″

5 Miles

Control by USC&GS, USGS, and TVA
Topography by USGS and TVA from aerial photographs by stereophotogrammetric methods
Field examination by Tennessee Valley Authority, 1946

Maps distributed by the Geological Survey

Scale 1/24 000

2 Miles
5000 0 5000 10000 Feet

Contour interval 20 feet
Datum is mean sea level

APPROXIMATE MEAN DECLINATION, 1947
1° TRUE NORTH MAGNETIC NORTH

Reproduced by the U. S. Coast and Geodetic Survey 1949

Polyconic projection. 1927 North American datum
10,000 foot grid based on Tennessee and Virginia (South) rectangular coordinate systems

ROUTES USUALLY TRAVELED
HARD, IMPERVIOUS SURFACE
OTHER SURFACE IMPROVEMENTS
U.S. ROUTE (33) STATE ROUTE (66)

SNEEDVILLE, TENN.-VA.
170-SW
Edition of 1947
N3630-W8307.5/7.5

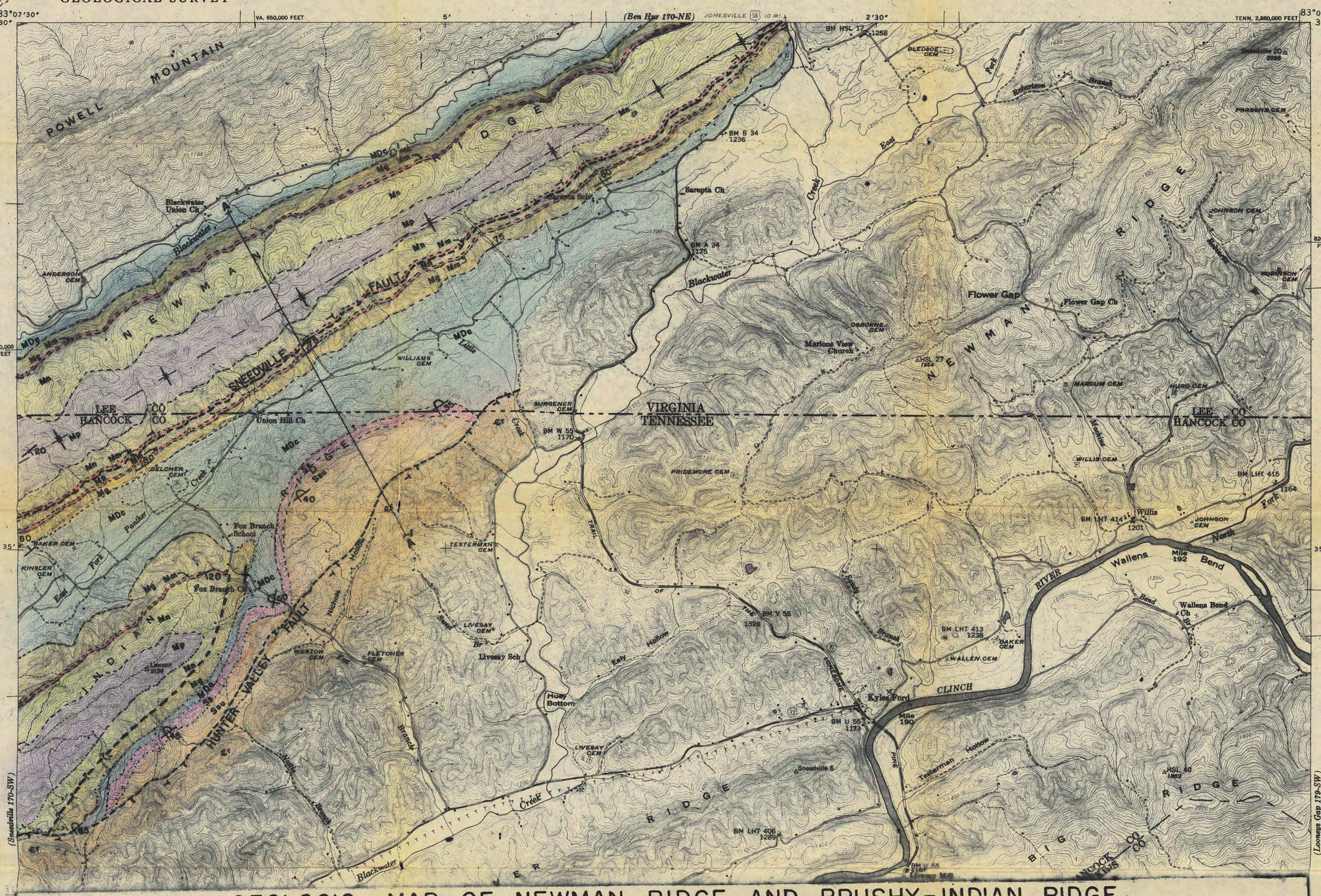
Plate Ia

Greene

UNITED STATES
DEPARTMENT OF THE INTERIOR
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UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS BRANCH

TENNESSEE-VIRGINIA
KYLES FORD QUADRANGLE
170-SE



GEOLOGIC MAP OF NEWMAN RIDGE AND BRUSHY-INDIAN RIDGE FROM SNEEDVILLE, HANCOCK COUNTY, TENNESSEE, TO BLACKWATER, LEE COUNTY, VIRGINIA

EXPLANATION

MISSISSIPPIAN
- Mp — Pennington formation
- Mn — Newman limestone
- Mm — Maccrady shale

DEVONIAN
- Mg — Grainger formation
- MDc — Chattanooga shale

SILURIAN
- Ss — Sneedville limestone
- Ssu — Silurian sandstone and shale, undivided

CAMBRIAN
- Er — Rome formation

Strike and dip of beds

Strike and dip of overturned beds

Strike of vertical beds

Horizontal beds

Contact, dashed where approximately located, dotted where inferred

Thrust fault, showing direction of dip, dashed where approximately located, T on upper plate

Fault, direction of dip unknown

Probable fault

Syncline, showing trace of axial plane, dashed where approximately located

Geology by Adrian V. Greene 1958-1959

Control by USC&GS, USGS, and TVA
Topography by USGS and TVA from aerial photographs by stereophotogrammetric methods
Field examination by Tennessee Valley Authority, 1947

Maps distributed by the Geological Survey

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

APPROXIMATE MEAN DECLINATION, 1949

SCALE 1:24000

1 MILE
7000 FEET
1 KILOMETER

Contour interval 20 feet
Datum is mean sea level

Polyconic projection. 1927 North American datum
10,000 foot grid based on Tennessee and Virginia (South) rectangular coordinate systems

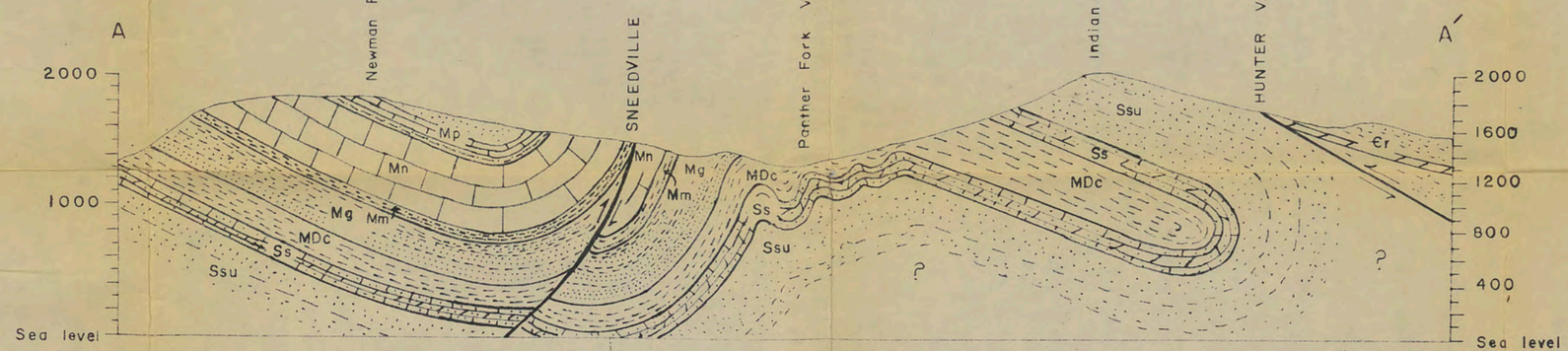
ROUTES USUALLY TRAVELED.
HARD, IMPERVIOUS SURFACES
OTHER SURFACE IMPROVEMENTS
U. S. ROUTE
STATE ROUTE

KYLES FORD, TENN.-VA.
170-SE
Edition of 1950

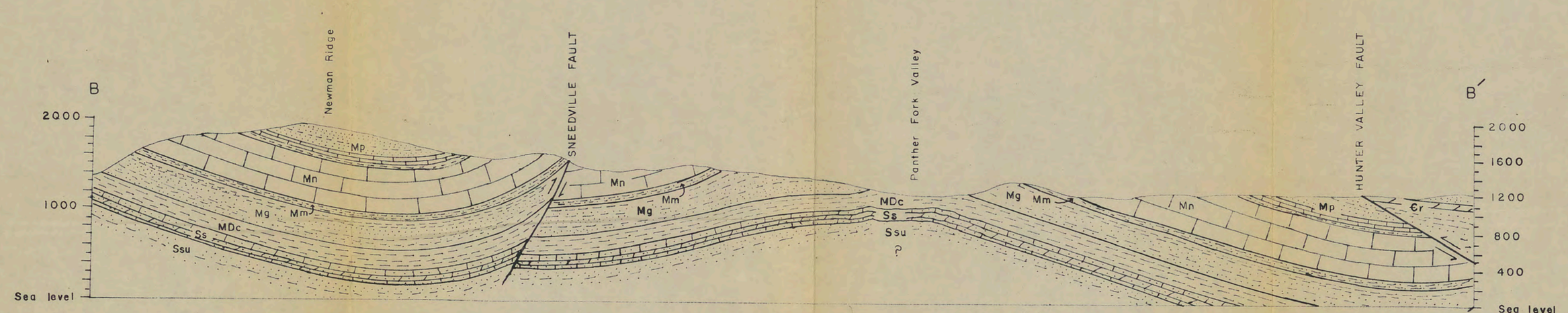
N3630-W8300/7.5

Plate Ib

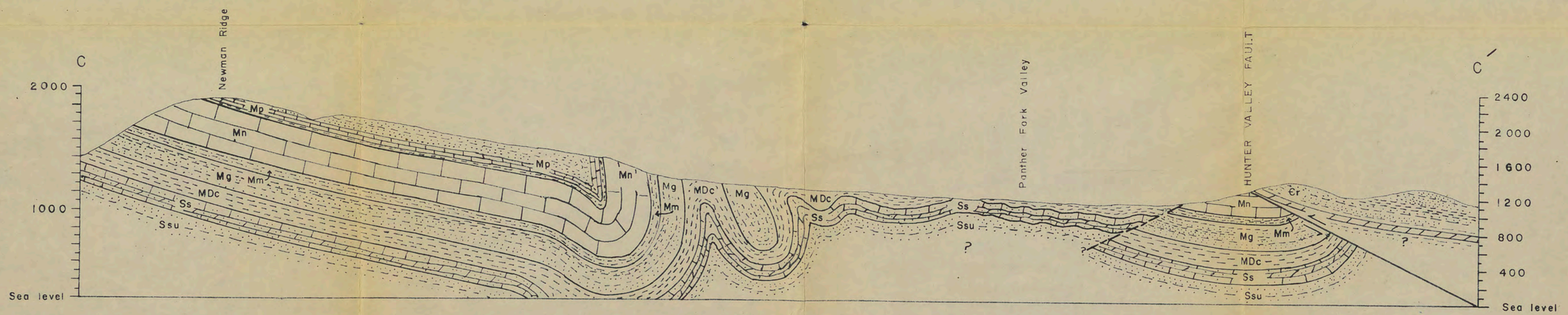
GEOLOGIC CROSS SECTIONS



SECTION ALONG LINE A—A'



SECTION ALONG LINE B—B'



SECTION ALONG LINE C—C'

0 Mile

0 500 Scale 5000 Feet

Plate II

Greene