TULANE STUDIES IN GEOLOGY
Volume 6, Number 2 November 22, 1968

PHYSICAL STRATIGRAPHY OF THE POST-BEEKMANTOWN-PRE-LIBERTY HALL LIMESTONES, CENTRAL ROCKBRIDGE COUNTY, VIRGINIA

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CONTENTS

ABSTRACT

In central Rockbridge County, Virginia, lower Middle Ordovician limestones crop out in three northeast striking belts. Structurally, the area of study is a thrust plate bounded by the Staunton-Pulaski and Little North Mountain faults. The Middle Ordovician limestones are separated from the underlying Lower Ordovician Beekmantown Dolomite by a major unconformity. The Blackford Formation and the New Market Limestone vary greatly in thickness because they were deposited on the post-Beekmantown erosional surface. The pre-Whistle Creek disconformity separates the Beekmantown and New Market from the overlying Lincolnshire Limestone, divided into the Whistle Creek Member, the Murat facies, and the Rockbridge facies. The New Market and Whistle Creek contain platy chert; chert nodules are found in the Rockbridge facies. The light-colored Murat facies is composed of coarse-grained detrital limestone. The Whistle Creek Member, Rockbridge facies, and Botetourt Limestone contain finer-grained detrital limestone mixed with a minor amount of terrigenous material. After the deposition of the rusty-weathering Botetourt Limestone, an increase in terrigenous material and a decrease in grain size resulted in the Liberty Hall facies of the Edinburg Formation.

I. INTRODUCTION

Rockbridge County lies in the Appalachian Mountains of west-central Virginia (Fig. 1). The study area includes the county seat, Lexington, located at 37°47′N. latitude and 79°27′W. longitude.

Rockbridge County is characterized by northeast striking structural and topographic features (see Plate 1). The southeastern edge of the county is within the Blue Ridge Mountain Province and is composed of Pre-

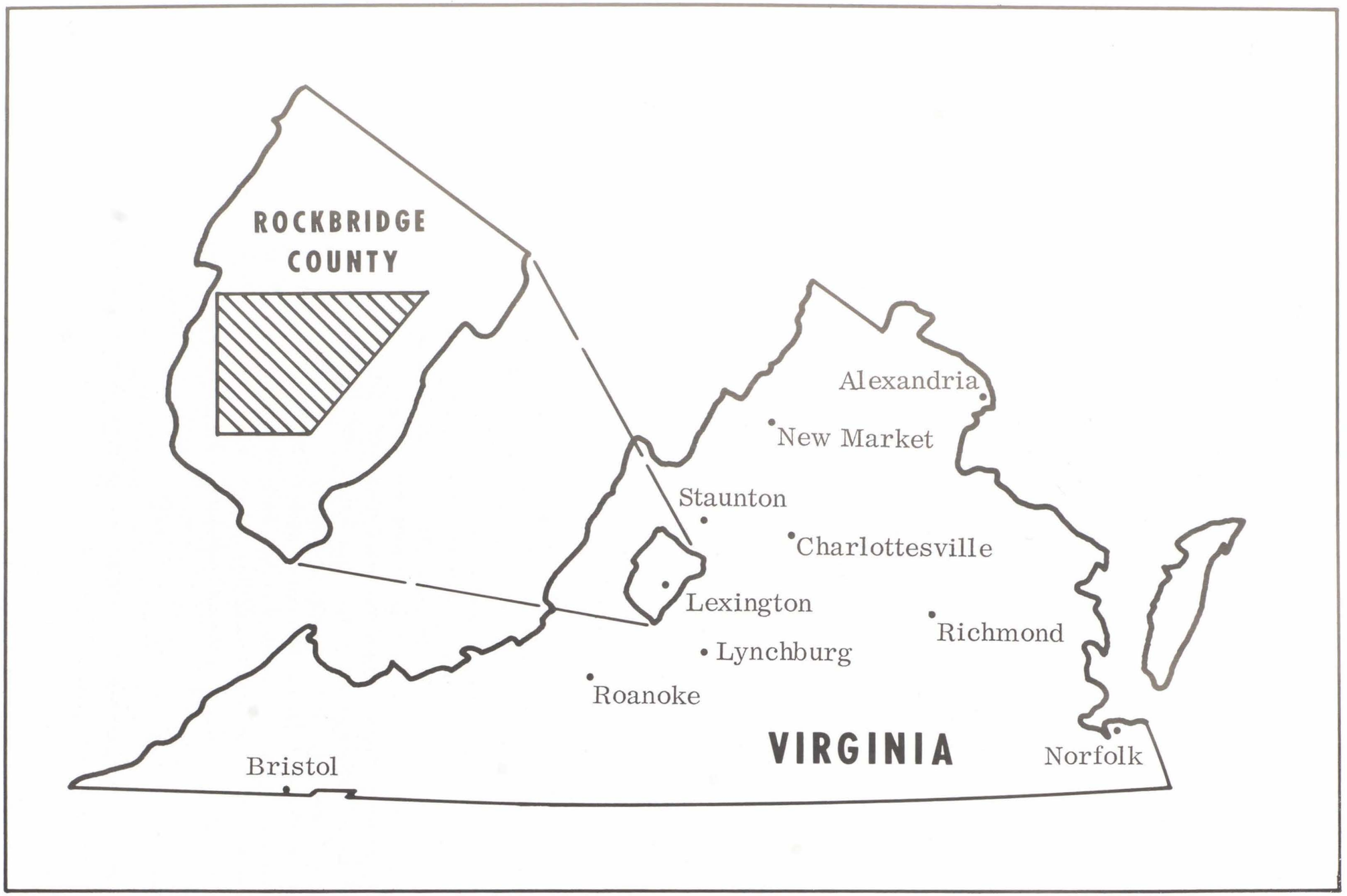

Figure 1. Location Map: the shaded portion of Rockbridge County is the area of study.

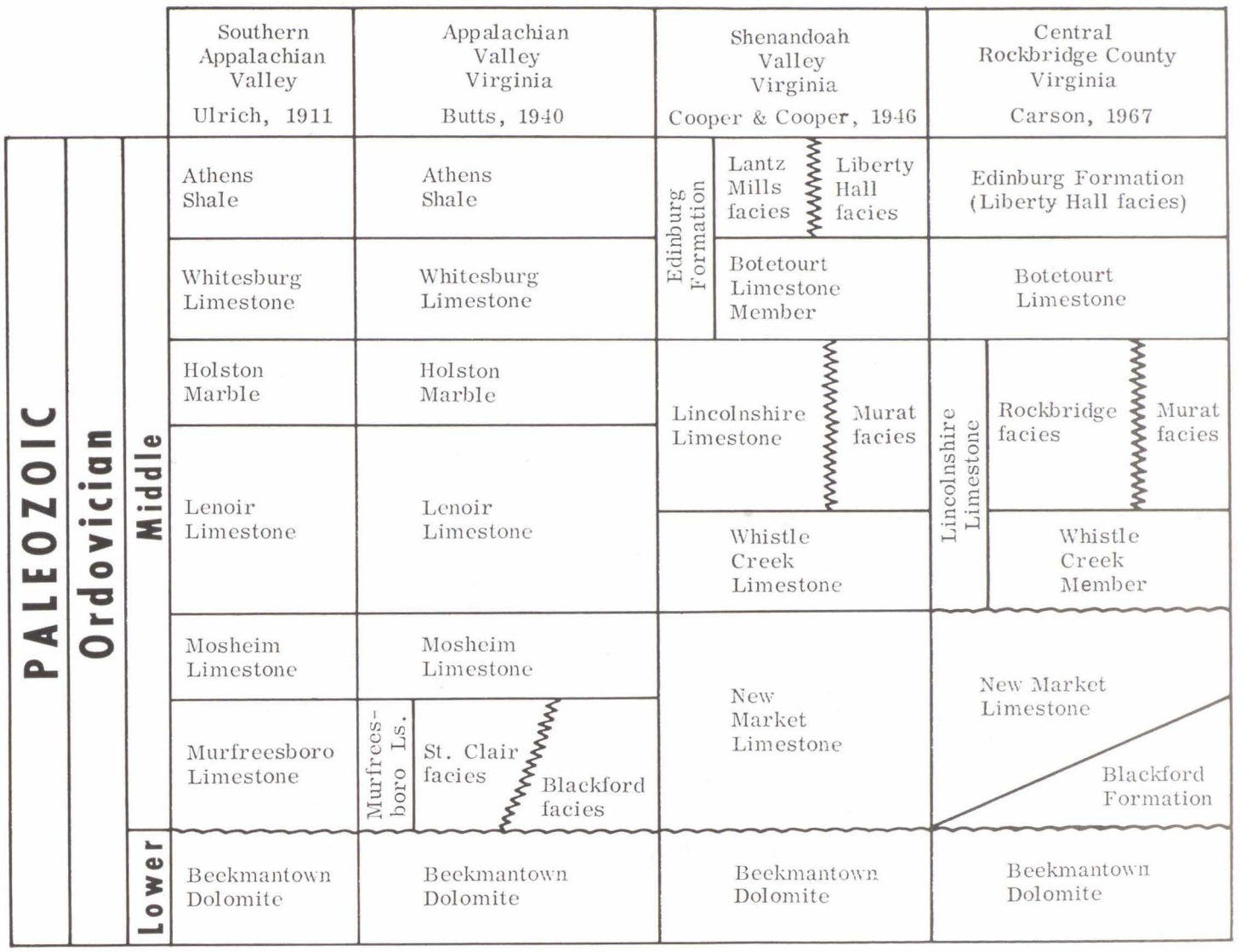

Table 1. Stratigraphic Nomenclature Chart

cambrian igneous and metamorphic rocks and Lower Cambrian clastics. Most of Rockbridge County is in the Valley and Ridge Province of the Appalachians. Central Rockbridge County, including the area of study, lies within the James River Valley. This broad valley with low hills consists of Cambrian and Ordovician dolomites, limestones, and shales. The northwestern portion of Rockbridge County consists of ridges upheld by resistant Silurian sandstones and valleys underlain by less resistant Silurian and Devonian limestones, shales, and sandstones.

Two large buttes, Big House Mountain (elevation 3640′) and Little House Mountain (elevation 3360′), are located seven miles northwest of Lexington. Seven miles southwest of Lexington is the northern summit (elevation 2565′) of Short Hill, a mountain surmounted by resistant Silurian sandstones.

The Maury River (also called the North Fork of the James River) crosses the structural and topographic features. The river descends from 1350 to 1150 feet at Goshen Pass (10 miles north of Lexington), a water gap cut through the Silurian sandstones of Hogback Mountain (elevation 3451′) and Jump Mountain (elevation 3139′). At Lexington the Maury River is at 900 feet, and as the river passes through the Blue Ridge near Glasgow (10 miles south of Lexington), the elevation is 700 feet.

Numerous northeast trending, low-angle thrust faults cross Rockbridge County. Although the post-Beekmantown-pre-Liberty Hall limestones crop out elsewhere in the county, the area of study was limited to one major fault block bounded by the Staunton-Pulaski Fault on the southeast and by the Little North Mountain Fault on the northwest.

Purpose

This study investigates in detail the physical stratigraphy of the lower Middle Ordovician limestones overlying the Beekman-

Figure 2. Unconformity on top of the Beekmantown Dolomite, northwest of Lexington, Virginia, (GS 5a). Below and to the right of the hammer is the Beekmantown Dolomite. Immediately above and to the left of the hammer is the New Market Limestone. The upper quarter of the picture is the Whistle Creek Member of the Lincolnshire Limestone, overlying both the Beekmantown and the New Market.

town Dolomite and underlying the Liberty Hall facies of the Edinburg Formation in central Rockbridge County. The original purpose (suggested to the author by Byron N. Cooper) was to study the facies relationships of the Lincolnshire Limestone in Rockbridge County, but early field work revealed that the stratigraphy of the thin limestones above and below the Lincolnshire is intimately related to the stratigraphy of the Lincolnshire.

Approximately three dozen geologic sections were measured, sampled, and photographed. Large covered intervals limited the usefulness of some sections. At least two polished sections and two acetate peels were made from each different formation, member, and facies; each was examined with a microscope under low-power magnification. Stratigraphic cross-sections, isopach and facies maps were constructed and compared with each other. Studies of grain size and color were incorporated into the study.

Previous Work

Although studies dealing with the stratigraphy of Rockbridge County were published as early as the first decade of the twentieth century, the first significant works were those of Butts (1933, 1940). He described the structure, stratigraphy, and paleontology of the Appalachian Valley. Cooper and Cooper (1946) studied the faunal and lithologic stratigraphy of the lower Middle Ordovician strata of the Shenandoah Valley. The lower Middle Ordovician includes beds younger than the Beekmantown Dolomite but older than the Martinsburg Shale. Cooper and Cooper included descriptions of three sections in central Rockbridge County. Edmundson (1958) published 13 sections in the area of study, including the three by Cooper and Cooper (1946). Recently, the Lexington Quadrangle (Bick, 1960), the Millboro Quadrangle (Kozak, 1965), and the Natural Bridge Quadrangle (Spencer, 1967) have been mapped.

Acknowledgments

The field work for this study was done in the summer of 1966 during an educational leave of absence from Texaco Inc. The field assistants were Richard Brownley and Henry Roberts. Professor Byron N. Cooper of the Department of Geology at Virginia Polytechnic Institute made visits to the field and discussed the area with the writer on several occasions. Professors Samuel J. Kozak, Edgar W. Spencer, and Odell S. McGuire, and Mr. Andrew M. Raring, all of the Department of Geology at Washington and Lee University, and Professor Raymond S. Edmundson of the Department of Geology at the University of Virginia also discussed the problems of Ordovician stratigraphy with the author. The faculty thesis committee for this study was composed of professors Garrett Briggs, chairman, Hubert C. Skinner, and Harold E. Vokes, all of the Department of Geology at Tulane University. Dr. Skinner field-checked the area. The writer is deeply indebted to all these geologists, without whose help the successful completion of the study would have been impossible.

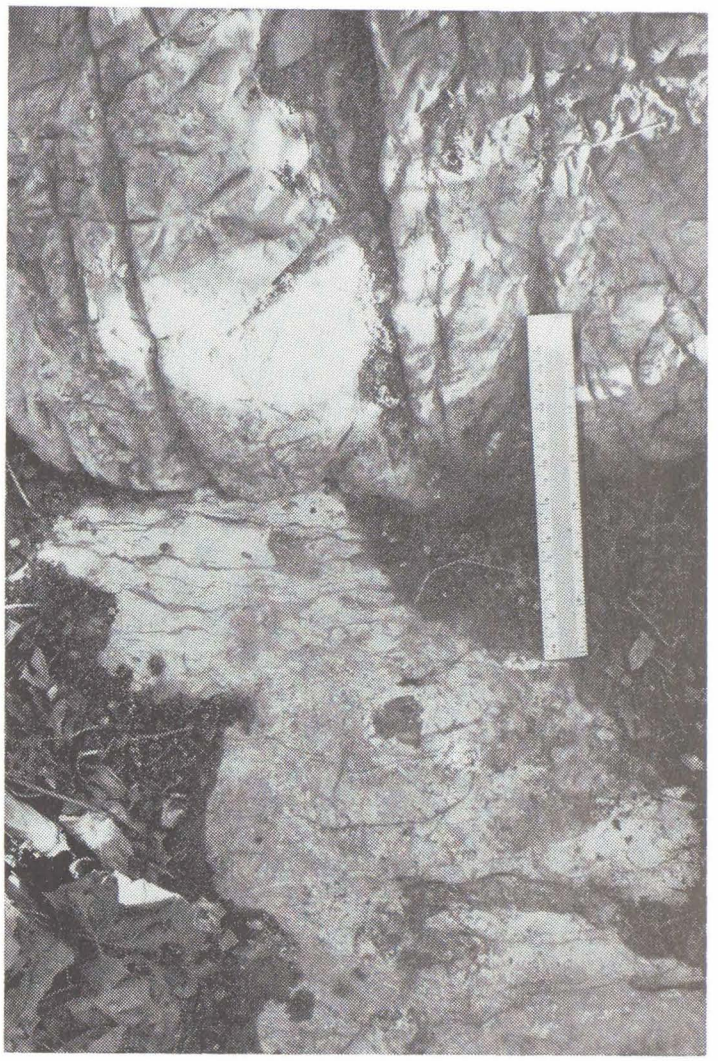

Figure 3. New Market Limestone uncomformably overlying the Beekmantown Dolomite in overturned beds west of Lexington, Virginia, (GS 13). The upper half of the picture shows the intersecting grooves which follow the fracture pattern in the Beekmantown.

II. Physical Stratigraphy

The post-Beekmantown-pre-Liberty Hall limestones of central Rockbridge County exhibit remarkable variation in thickness and lithology (see Table 1). In the sections measured the interval between the Beekmantown Dolomite and the Liberty Hall facies of the Edinburg Formation ranges from 244 to 561 feet. The lithology varies from the calcilutites of the New Market to the very coarse-grained limestones of the Murat facies of the Lincolnshire.

Beekmantown Dolomite

The top of the Beekmantown Dolomite is the lower limit of the section studied in this report. This formation is Lower Ordovician in age and is separated from the Middle Ordovician limestones by a major unconformity (Fig. 2). In the area of study the Beekmantown generally is overlain by the New Market, but in some sections it underlies the Blackford or the Whistle Creek.

The Beekmantown Dolomite consists predominantly of a tannish gray, very fine-grained (0.02-0.3 mm) dolomite. The weathered surface is grayish tan and has distinctive intersecting grooves which follow the fracture pattern (Fig. 3). The dolomite is thick to massive bedded with a few thin-bedded limestones. Chert is not abundant but occurs in some localities as irregular nodules with variegated colors and in other places as beds up to several feet thick. The thickness of the Beekmantown Dolomite is approximately 1500 feet.

Blackford Formation

Butts (1940, p. 126) proposed the term "Blackford facies of the Murfreesboro Limestone" for the chert beds, red dolomites, red and gray shales, dolomitic limestones, and chert conglomerates immediately overlying the Beekmantown Dolomite. He reported that some of the dolomitic layers contain fragments of chert. The name Blackford was retained by Cooper and Prouty (1943, p. 862) for the basal member of the Cliffield

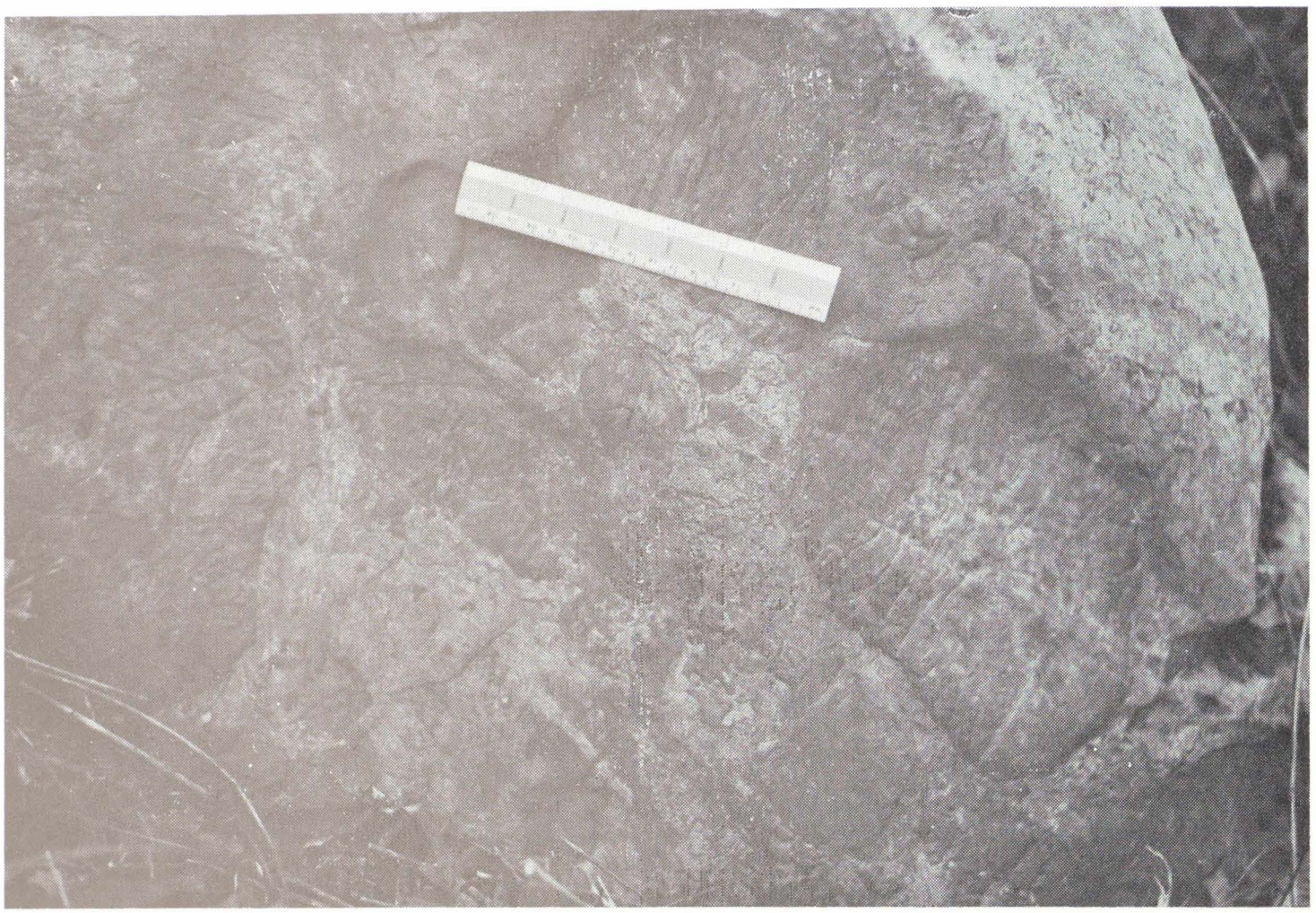

Figure 4. Detrital boulders of Beekmantown Dolomite in the base of the New Market Limestone northwest of Lexington, Virginia, (GS 5a).

Formation in Tazewell County, Virginia. Cooper (1944, p. 55) elevated the Blackford to the rank of formation.

The Blackford Formation is present at two sections in the area (GS 5c: Units 1-4 and GS 8: Units 1-3). In central Rockbridge County the measured thicknesses of the Blackford range from 0 to 45 feet.

New Market Limestone

The term "New Market Limestone" was proposed by Cooper and Cooper (1946, p. 71) for the calcilutites above the Beekmantown Dolomite and below the Lincolnshire Limestone. The typical lithology is dove gray, extremely fine-grained limestone. The color varies from dove gray to drab, medium, or dark gray. The New Market contains a few beds of very fine-grained limestone, especially near the top. Near its base the New Market commonly contains detrital chert and, in places, thin beds of dolomite and/or conglomerate (Fig. 4). The extremely fine-grained texture (less than 0.01 mm) produces a conchoidal fracture. Pyrite is common in a finely disseminated state or as crystals up to 10 mm in diameter. The New Market Limestone contains rare stylolites.

Where fossils are present, they are generally abundant. Fossil algae (*Girvanella*) are found (Fig. 5) near the top of the New Market in three sections, and *Lophospira*, a gastropod, is prolific in parts of most sections. *Tetradium syringoporoides,* a coral, found undisturbed in only a few sections, may be the source of the "birdseyes" (Fig. 6) in all sections. The birdseyes are conspicuous bits of transparent calcite 0.1 to 10.0 mm in diameter. Folk (1959, p. 13) states that the microcrystalline ooze of some calcilutites has been disturbed either by boring organisms or by soft-sediment deformation. The resulting cavities were then filled with transparent calcite. The author was unable to determine whether the birdseyes resulted from replacement of *Tetradium* by clear calcite, filling of worm tubes, or local reworking of the calcareous mud soon after deposition.

The New Market Limestone contains rare to abundant platy chert and, locally, thin beds of chert. Chert nodules in the Rockbridge facies (Fig. 7) are rather irregular masses of chert with the horizontal di-

Figure 5. *Girvanella*-bearing New Market Limestone southeast of Collierstown, Virginia, (GS 12).

Figure 6. Typical birdseye calcilutite lithology of the New Market Limestone southeast of Collierstown, Virginia, (GS 12).

mensions similar to the vertical thickness. The horizontal dimensions of platy chert (Fig. 8) greatly exceed the vertical thickness.

The bedding of the New Market Limestone is thin to massive. Argillaceous laminations are common. The weathered limestone commonly has a thin chalklike layer on the surface. The measured sections of the New Market in central Rockbridge County vary between 0 and 142 feet.

Beds Immediately Overlying the Beekmantown

The basal units of the New Market Limestone are in some places dolomitic limestones, conglomerates, and shales closely resembling the Blackford Formation (Cooper and Cooper, 1946, p. 72-73). As previously stated, the Blackford Formation was originally named as the Blackford facies of the Murfreesboro Formation. The New Market Limestone is essentially the Mosheim Limestone of Ulrich and Butts (Cooper and Cooper, 1946, p. 73) but also includes the Murfreesboro in central Rockbridge County.

Throughout the area, most units immediately above the post-Beekmantown unconformity contain detrital chert, whether they are Blackford, New Market, or Whistle Creek (Fig. 9). In central Rockbridge County it is unimportant whether the basal Middle Ordovician beds consisting of red-brown dolomites, conglomerates, chert, and dolomitic limestones are called Blackford or New Market, as the two formations are at least partly correlative. In Sections 5c and 8 the author has assigned the name "Blackford" to the basal units of the Middle Ordovician because the units resemble the type Blackford more than they do the type New Market.

Lincolnshire Limestone

Cooper and Prouty (1943, p. 863) gave the name "Lincolnshire Limestone Member" to the beds between the Five Oaks and Ward

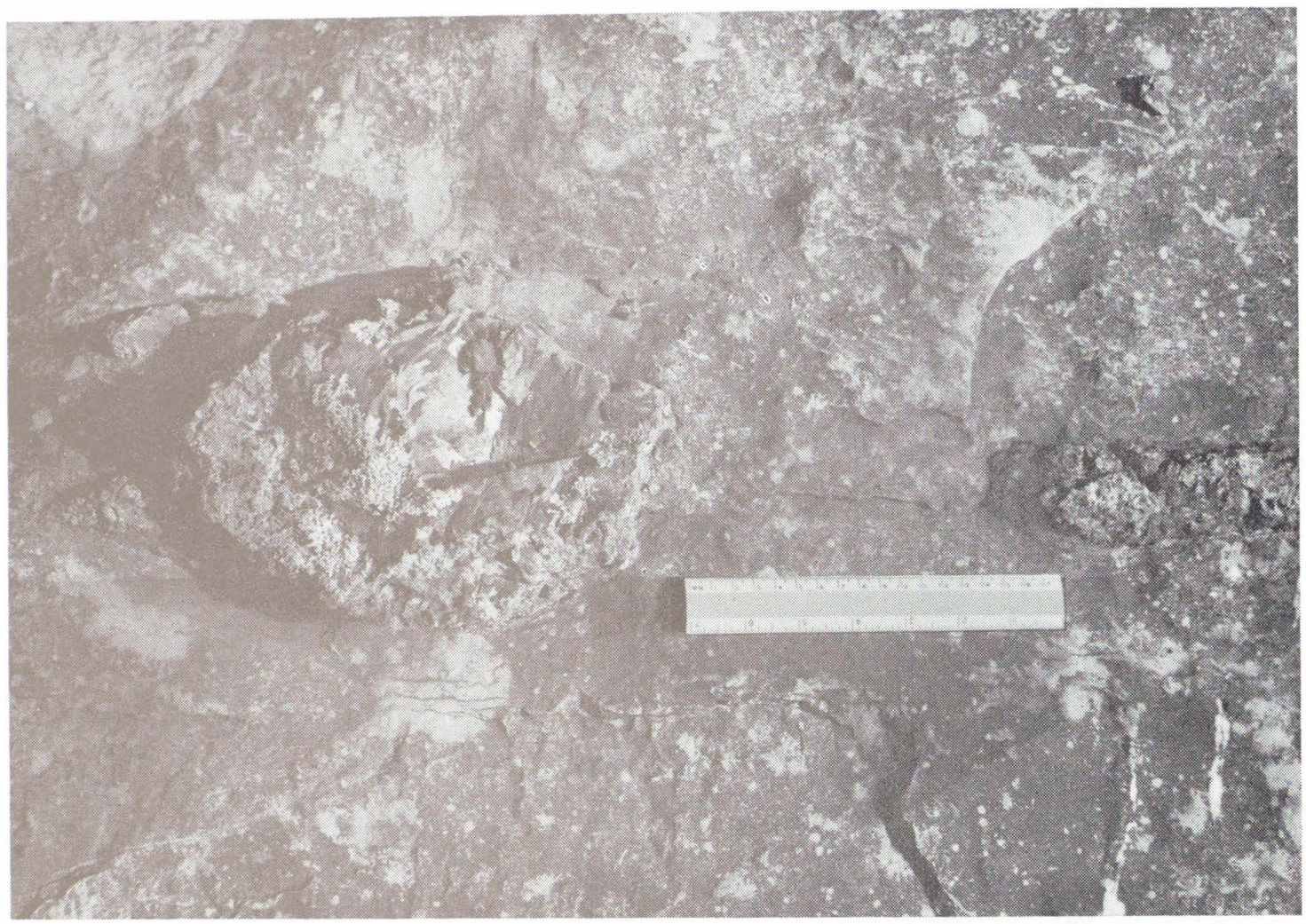

Figure 7. Chert nodules in the Rockbridge facies of the Lincolnshire Limestone west of Lexington, Virginia, (GS 13).

Cove limestone members of the Cliffield Formation in Tazewell County, Virginia. Cooper (1944, p. 58) elevated the Lincolnshire to the rank of formation. Cooper and Cooper (1946, p. 75) extended the use of the name "Lincolnshire" into the Shenandoah Valley to include the dark gray cherty limestones above the New Market or Whistle Creek and below the Botetourt or Edinburg. The Lincolnshire in some localities contains light gray, coarse-grained, non-cherty limestones; Ulrich (1911) and Butts (1940) called these non-cherty limestones the Holston Marble. Cooper and Cooper (1946, p. 53-54, 76-77) showed that the light gray limestones and the dark gray cherty limestones are equivalent and proposed that the light gray, coarse-grained limestones be named the Murat facies of the Lincolnshire Limestone. Confusion has arisen because no facies name was proposed for the dark gray cherty limestones of the Lincolnshire. The terms "non-Murat Lincolnshire," "cherty Lincolnshire," and "typical Lincolnshire" have been used. The author proposes that where the Murat facies is present the equivalent dark gray cherty limestones be named the Rockbridge facies of the Lincolnshire Limestone. The type section is at Murat, five and one-half miles southwest of Lexington (GS 9: Units 9-14, 21).

Cooper and Cooper (1946, p. 74) proposed the term "Whistle Creek Limestone" for the dark gray, irregularly bedded, very cherty limestones between the Lincolnshire and the New Market. The type section is just northwest of Lexington, Virginia (GS 5: Units 4-5). Cooper and Cooper pointed out that where the Whistle Creek is in direct contact with the cherty Lincolnshire (Rockbridge facies), fossils are necessary to locate the boundary. The Whistle Creek has a *Hesperorthis* fauna, whereas the higher dark gray cherty limestones have a *Dinorthis atavoides* fauna. As will be shown later, the Whistle Creek and the Rockbridge facies are very similar in every physical characteristic except the nature of the chert, which unfortunately is not present in all beds of the dark gray limestones. The Whistle Creek contains platy chert (Fig. 8) very similar to that found in the New Market Lime-

Figure 8. Lincolnshire Limestone southwest of Murat, Virginia, (GS 19). Below the hammer is the Whistle Creek Member, containing platy chert in the foreground. Above the hammer is the Murat facies, exhibiting spheroidal weathering.

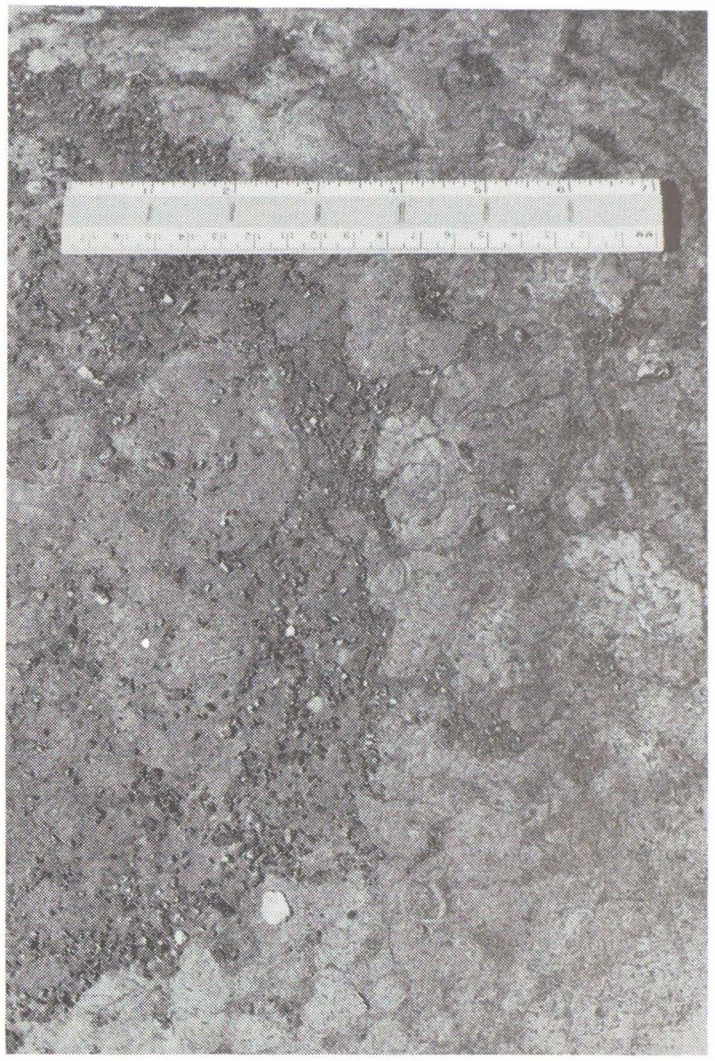

Figure 9. Detrital chert fragments near the base of the Whistle Creek Member of the Lincolnshire Limestone where it unconformably overlies the Beekmantown Dolomite north of Lexington, Virginia, (GS 5d).

stone. The Rockbridge facies contains chert nodules (Fig. 7). In a few sections there appears to be a gradual transition from platy chert to chert nodules. In other sections, non-cherty beds are found between the platy chert of the Whistle Creek and the chert nodules of the Rockbridge facies. In these instances the boundary between the Whistle Creek and the Rockbridge facies is extremely difficult to locate. Where the Whistle Creek is overlain by the Murat facies of the Lincolnshire, the contact is easily recognized. The author proposes that the dark gray limestones containing platy chert and overlain by the Rockbridge facies (containing chert nodules) or the Murat facies be renamed the Whistle Creek Member of the Lincolnshire Limestone.

Although "spongy" weathering is found in some units of all portions of the Lincolnshire Limestone, it is most pronounced in the Whistle Creek Member. The measured composite thicknesses of the formation in the area of study range from 204 to 436 feet.

Whistle Creek Member and Rockbridge Facies

The Whistle Creek Member and the Rockbridge facies together form the Lenoir Limestone of Ulrich (1911) and of Butts (1940). Table 2 shows the similarities between the color and grain size of the Whistle Creek Member and the Rockbridge facies. The data are taken from the seven geologic sections that are the least covered in the interval of the Lincolnshire Limestone. If a particular unit is described as "medium to dark gray, fine- to medium-grained," half of the thickness is assigned to fine-grained, half to medium-grained, and half is assigned to medium gray, half to dark gray.

The Whistle Creek Member and the Rockbridge facies are generally argillaceous and nodular (Fig. 10). They commonly contain

Grain Size*	very fine	fine	medium	coarse
Whistle Creek Member	19.3%	62.3%	17.0%	1.4%
Rockbridge facies	5.6%	58.5%	31.4%	4.5%

1/16 mm 1/8 mm 1/4 mm 1/2 mm 1 mm

*after Folk, 1959, p. 16

Color	medium gray	dark gray
Whistle Creek Member	45.0%	55.0%
Rockbridge facies	31.3%	68.7%

Table 2. Grain size and color comparisons of Whistle Creek Member and Rockbridge facies of the Lincolnshire Limestone

wavy argillaceous and/or siliceous partings. The bedding is irregular. The units are sparsely to abundantly fossiliferous with bryozoans, brachiopods (Fig. 11), echinoderms, sponges, mollusks, trilobites, and ostracodes. These fossils, particularly the bryozoans, are typically silicified and stand out prominently on the tan-to-gray weathered surface of the limestone (Fig. 12). In many sections silicified bryozoans and other fossils also cover the weathered surface of the Botetourt Limestone and the Liberty Hall facies of the Edinburg Formation. In some places the Whistle Creek Member and the Rockbridge facies, as well as the Botetourt Limestone, contain mottled light and dark gray limestone colloquially termed "bryozoan puddingstone."

The Whistle Creek Member in most places disconformably overlies the New Market Limestone (Fig. 13). In a few places the transition from New Market to Whistle Creek appears to be gradational. In three sections the Whistle Creek Member directly overlies the Beekmantown Dolomite. In central Rockbridge County the measured sections of the Whistle Creek vary from 16 to 171 feet. The Rockbridge facies has units as thin as three feet, with an aggregate thickness of 24-268 feet.

Murat Facies

The Murat facies is a light to medium gray, coarse- to very coarse-grained limestone. The purity of the Murat makes it an excellent source of high-calcium limestone.

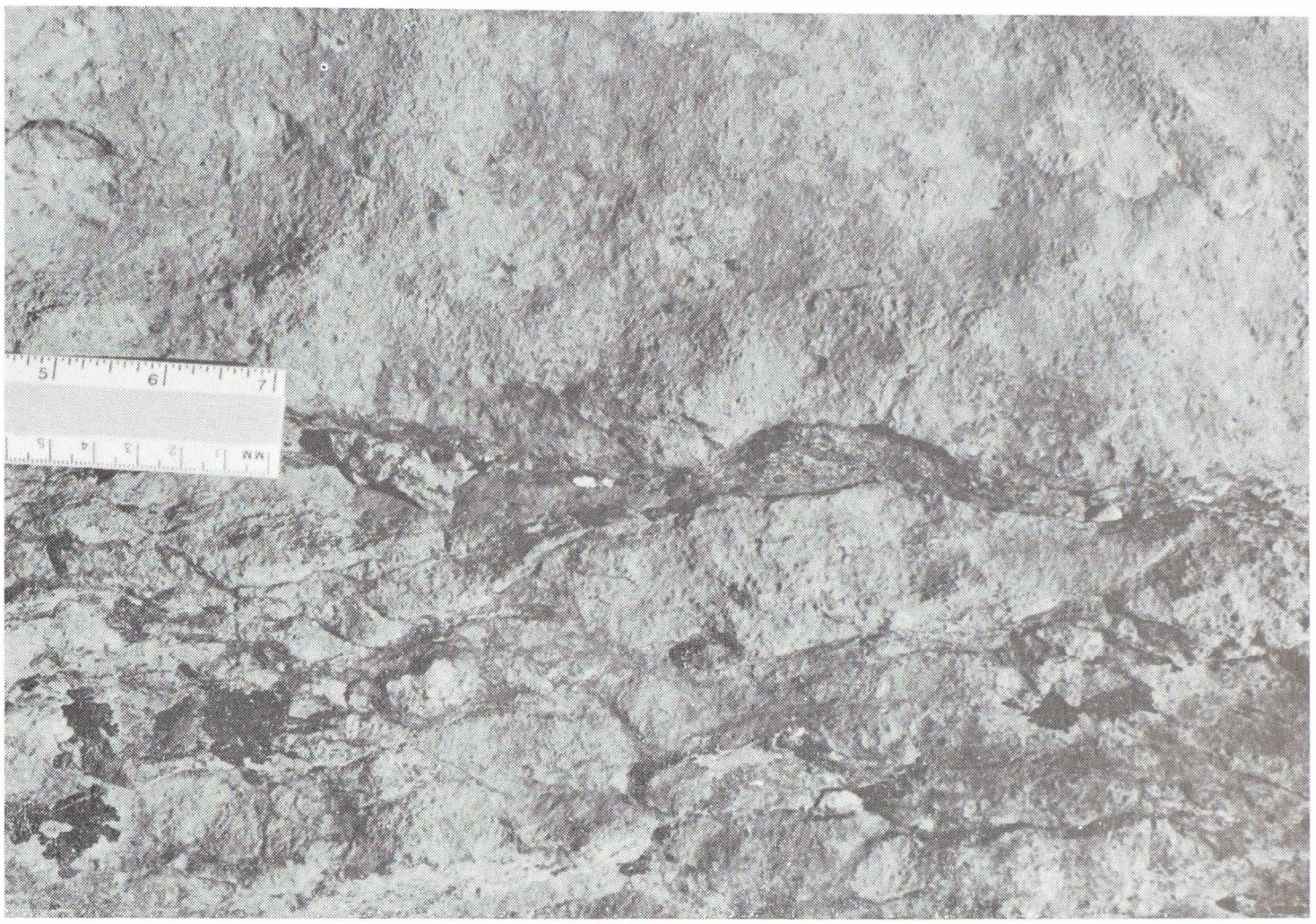

Figure 10. Overturned Lincolnshire Limestone west of Lexington, Virginia (GS 13). Above the ruler is the massive Murat facies. Below the ruler is the argillaceous and nodular Rockbridge facies with wavy partings.

It is interbedded with the Rockbridge facies (Fig. 14); the Lincolnshire Limestone contains as many as seven recurrent beds of the Murat facies (Section 12).

The Murat facies is thick- to massive-bedded with stylolites and rare cross-bedding. The less pure portions of the Murat are slightly argillaceous. The Murat facies is everywhere fossiliferous; bryozoans may comprise up to 90 percent of the limestone. Echinoderm fragments are also common and in places stand out as pink grains in the gray limestone. Other fossils include brachiopods, trilobites, and mollusks.

The grain size of the Murat facies, exclusive of the associated calcareous mud and the larger fossils, is 0.05 to 10.0 mm. The Murat generally weathers to light tannish gray ledges and spheroidal masses. Individual zones of the Murat facies are as thin as two feet; the measured aggregate thicknesses of the facies in the area of study vary between 10 and 227 feet.

Botetourt Limestone

Cooper and Cooper (1946, p. 80) gave the name "Botetourt Limestone Member of the Edinburg Formation" to the thin, brown-weathering, granular limestone above the Lincolnshire Limestone and below the Liberty Hall facies of the Edinburg Formation. G. Arthur Cooper (1956, p. 49) elevated the Botetourt to the rank of formation. In central Rockbridge County the Botetourt Limestone is essentially the same as the Whitesburg Limestone of Ulrich (1911) and of Butts (1940). The formation consists of medium to dark gray, very fine- to very coarse-grained, irregularly bedded limestone (Fig. 15). The grains (0.1-5.0 mm) in some sections have a salt-and-pepper appearance (with variegated colors). In most sections the Botetourt is argillaceous to slightly argillaceous and exhibits rusty weathering. The punky siliceous nodules in the Botetourt superficially resemble chert nodules but are probably products of weathering as many have cores of limestone. The Botetourt is quite fossiliferous with trilobites, brachiopods, bryozoans, echinoderms, mollusks, and ostracodes. In central Rock-

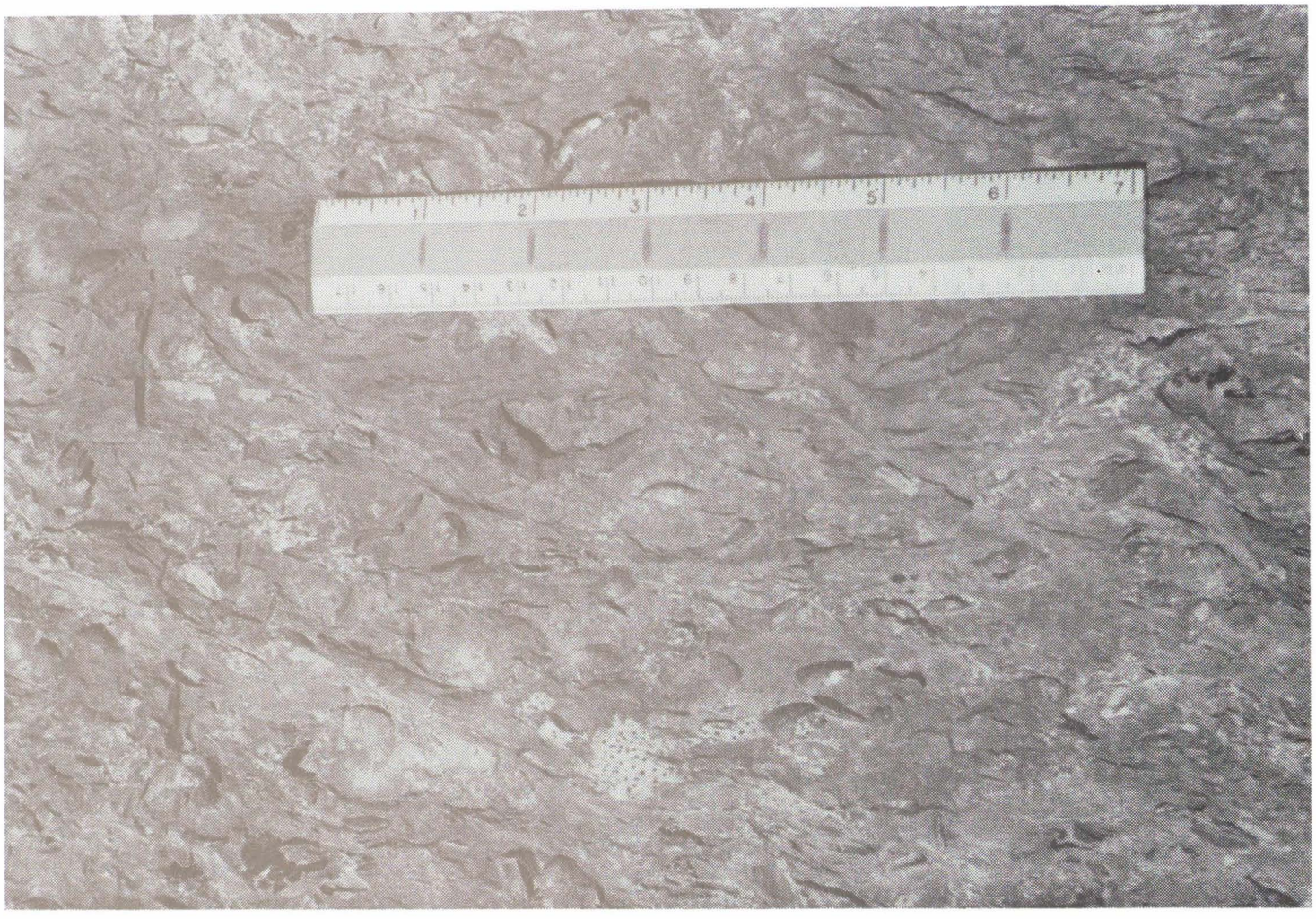

Figure 11. Brachiopods, bryozoans, and other fossils in the Whistle Creek Member of the Lincolnshire Limestone southwest of Murat, Virginia, (GS 19).

bridge County the measured sections of the Botetourt Limestone have thicknesses of 8 to 70 feet.

Liberty Hall Facies of the Edinburg Formation

The base of the Liberty Hall facies of the Edinburg Formation, which overlies the Botetourt Limestone, is the upper limit of the section studied in this report. The type locality of the Liberty Hall facies is just northwest of Lexington (Section 5). The facies consists of dark gray to black shale and very fine-grained, thin-bedded limestone (Fig. 16). The limestone beds are fossiliferous at some localities. The grain size is 0.01 to 0.2 mm. The thickness of the Edinburg Formation (mostly Liberty Hall facies in the area of study) is approximately 1000 feet.

III. Geologic Sections

Two phrases were used in the geologic sections (Appendix) to reduce the length of the descriptions. "Wavy partings" refers to the wavy argillaceous and/or siliceous bryozoans" (or "fossils") refers to the silicipartings found in the limestones. "Silicified fied bryozoans (or fossils) covering the surface of many units of the weathered limestone.

The lower Middle Ordovician limestones are poorly exposed northeast of Lexington. Sections 1-3 are so close to the Staunton-Pulaski Fault that some of the units are partly sheared. Section 1 is in an area of minor folding and is the thinnest of all the measured sections, resulting, perhaps, from part of one or more limestones having been cut out by minor faulting. Except for scattered outcrops of Lincolnshire Limestone, the area between GS 3 and 4 is largely covered. There is a minor fault between Sections 4 and 5.

The region northwest of Lexington contains an extensive area of gently dipping limestone. Near the Maury River numerous caverns, including Tolley's Cave (Carson, 1964) and Cave Springs, have formed in these limestones. Four sections were described by Edmundson (1960, Geologic Sections 8-11). GS 5 is the type section for the Whistle Creek and for the Liberty Hall facies of the Edinburg Formation. The author measured several partial sections north-

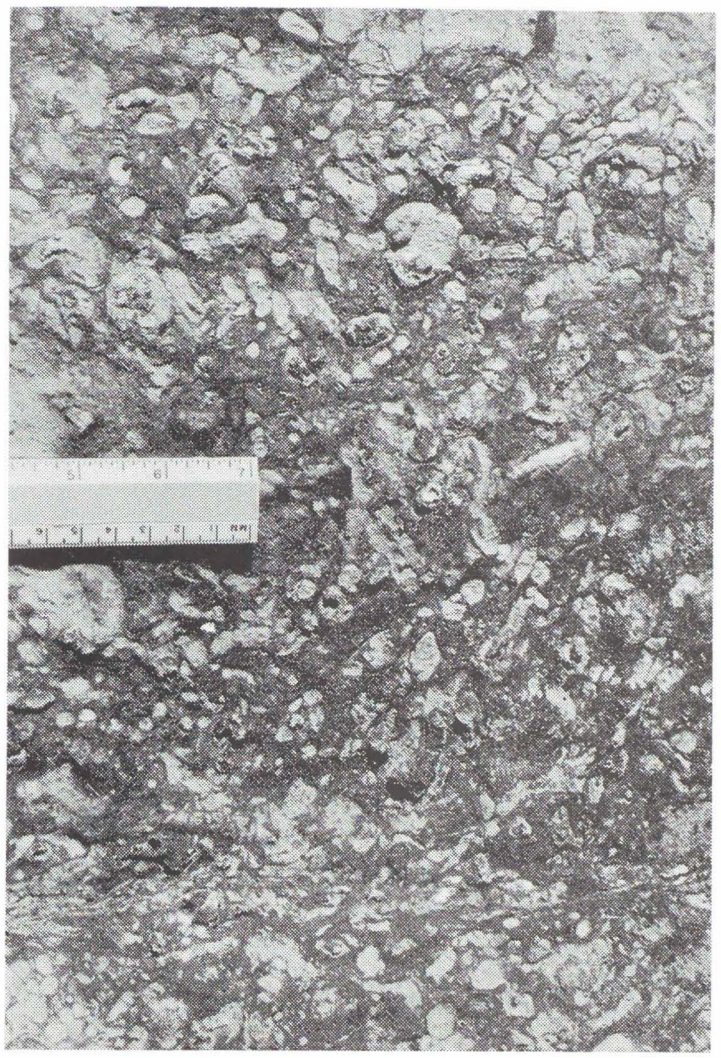

Figure 12. Silicified bryozoans on the surface of the Rockbridge facies of the Lincolnshire Limestone west of Lexington, Virginia, (GS 13).

east of Section 5 in order to study the nature of the post-Beekmantown unconformity and the pre-Whistle Creek disconformity (GS 5a-5e). In Sections 5a and 5e the Whistle Creek Member directly overlies both the New Market Limestone and the Beekmantown Dolomite; in GS 5d the New Market is completely absent.

No exposures adequate for the study of lower Middle Ordovician stratigraphy were found between Sections 6 and 7. GS 9 is the type section for the Murat and Rockbridge facies of the Lincolnshire Limestone. The outcrop belt takes a sharp bend at Section 10, located just northeast of the northern summit of Short Hill. Sections 14 and 15 are located just southeast of the House Mountains, where the outcrop belt again takes a sharp bend. Although GS 15-17 are close to the Little North Mountain Fault, no shearing is evident. Due to minor folding, most of the New Market Limestone and the Whistle Creek Member are repeated in Section 17. Southwest of Section 20 the exposures of post-Beekmantown-pre-Liberty Hall limestones are insufficient for detailed study.

IV. Cross-Sections and Isopach and Lithofacies Maps

Folding and minor faulting in the area of study caused shortening in a northwest-southeast direction. Therefore, the cross-sections and isopach and lithofacies maps (Plates 1 and 2) are not palinspastic representations. In addition, the cross-sections have a vertical exaggeration of over 50 times the horizontal that distorts the variation in thickness of the units. Two problems arose in the construction of the cross-sections and isopach and lithofacies maps. The first was to deduce the thickness of each unit underlying the covered intervals in the sections. The second was to determine the best horizontal datum for the stratigraphic cross-sections. Both problems were solved by constructing additional cross-sections and isopach maps. Although the base of the Whistle Creek Member is used as the horizontal datum in this report, four additional sets of cross-sections were constructed using the tops of the Beekmantown, Whistle Creek, Lincolnshire, and Botetourt as horizontal data. Not included in the plates are isopach maps made of the Rockbridge facies and the Murat facies. The thickness assigned to each unit in a covered interval was estimated from the six isopach maps and the five sets of cross-sections. The disconformity at the base of the Whistle Creek Member was selected for the horizontal datum in the cross-sections.

The cross-sections illustrate the relief of the post-Beekmantown unconformity and the complexities of the Lincolnshire Limestone. The Blackford Formation is found in two "valleys" of the post-Beekmantown erosional surface. On three post-Beekmantown "hills" the Whistle Creek lies directly on the Beekmantown. The thickness of the entire Lincolnshire Limestone is relatively constant compared to the variation in thickness of the Whistle Creek Member, the Rockbridge facies, and the Murat facies. Where one of these three units is thick, the other two are relatively thin, or where two are thick, the third is very thin. This evidence supports the practical basis for designating the Lincolnshire as a single formation.

The New Market isopach map indicates

Figure 13. Whistle Creek Member of the Lincolnshire Limestone disconformably overlying the New Market Limestone southwest of Murat, Virginia, (GS 19).

Figure 14. Lincolnshire Limestone southeast of Collierstown, Virginia, (GS 17). The Murat facies in the center of the picture is interbedded with the Rockbridge facies.

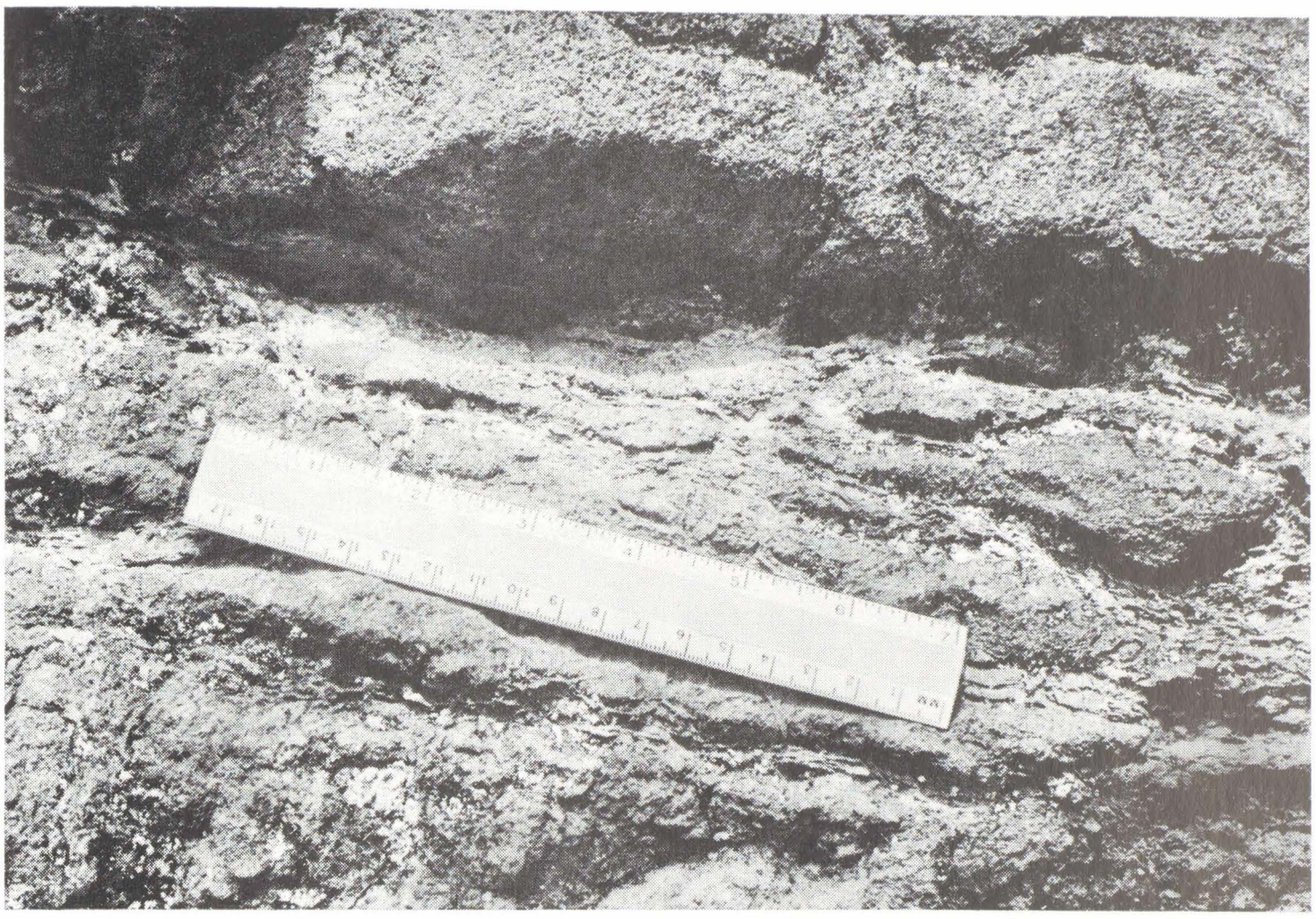

Figure 15. Typical argillaceous Botetourt Limestone southeast of Collierstown, Virginia, (GS 18).

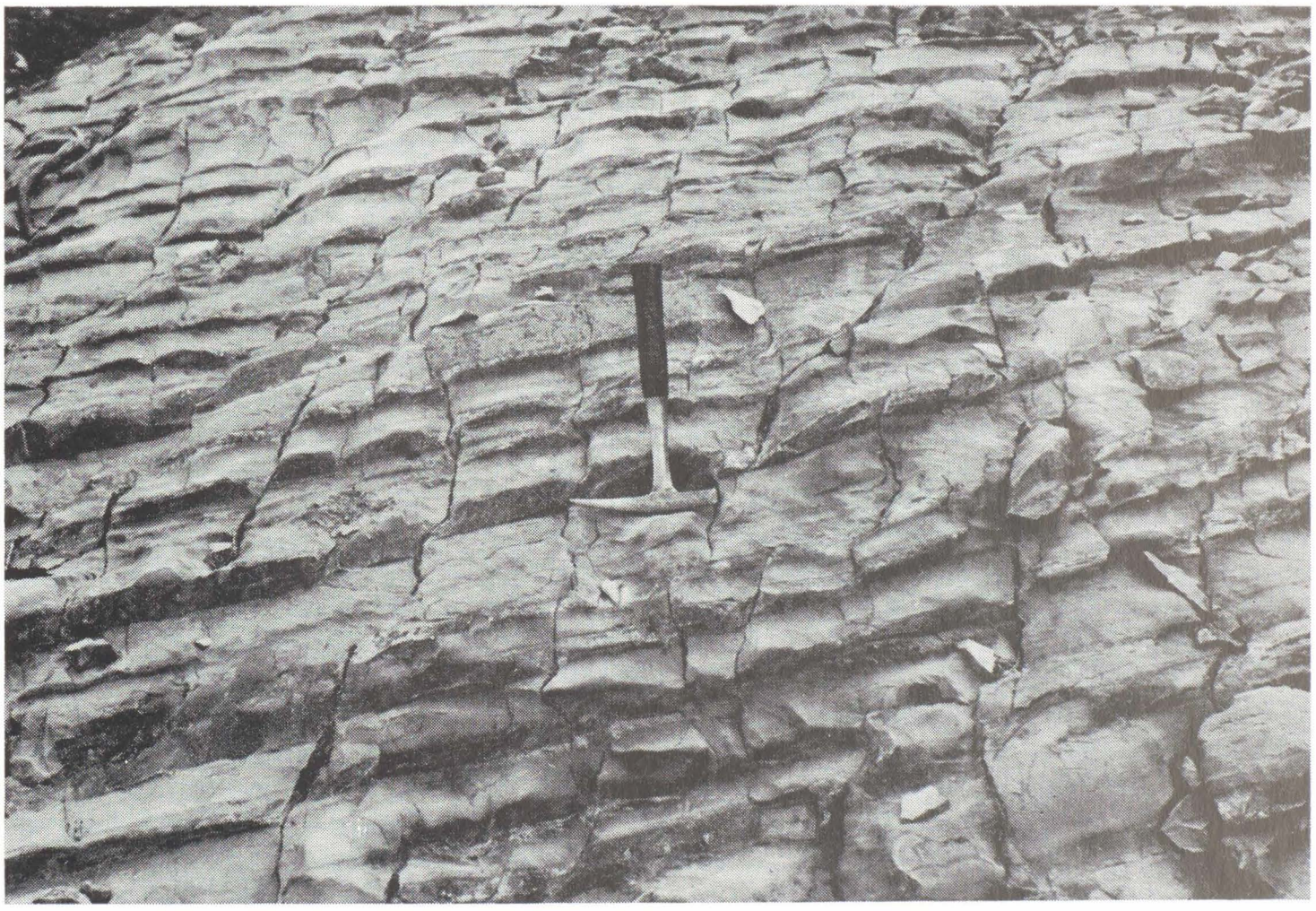

Figure 16. Alternating limestone and shale of the Liberty Hall facies of the Edinburg Formation west of Lexington, Virginia, (GS 13).

that at the end of late Ordovician time there was a high area in the vicinity of Section 5 and a low area surrounding Section 8. The isopach map shows that overall, the New Market Limestone thickens to the northwest.

The isopach map of the Whistle Creek Member also shows thickening to the northwest, with the greatest thickness in the area of GS 17-19. The isopach map of the interval between the Whistle Creek Member and the Botetourt Limestone indicates that the thickest accumulation of the Murat and Rockbridge facies is in a basin around Sections 11 and 12 and extending eastward to Section 6. North and south of this basin were two relatively high areas; one extends west from GS 4 toward GS 14 and 15, and the other is near GS 20. The Murat-Rockbridge lithofacies map is contoured on the percentage of Murat in the post-Whistle Creek-pre-Botetourt interval. The lithofacies map reveals that with the exception of Section 4, the Murat facies dominates to the southeast and the Rockbridge facies is more abundant in the northwest. The same conclusion was reached with isopach maps of the Murat facies and the Rockbridge facies.

Although the Botetourt Limestone is thin compared to the thickness of the underlying limestones, it exhibits remarkable variation in thickness. The isopach map indicates that the two centers of deposition in central Rockbridge County were near GS 5 and 12.

V. Environments of Deposition and Geologic History

As the Beekmantown sea regressed at the close of Lower Ordovician time, an erosional surface with up to several hundred feet of relief was developed. The top of the Beekmantown Dolomite was covered by resistant chert nodules and some boulders of dolomite. In the progressive change from the deposition of dolomite to the deposition of calcilutite, there were temporary fluctuations in the environment. These fluctuations resulted in limestone beds in the Beekmantown Dolomite, dolomite beds in the lower New Market Limestone, and calcitic dolomites and dolomitic limestones in both formations and in the Blackford. Each conglomerate deposited probably indicates an environment of shallow water and high energy. The major unconformity on the top of the Beekmantown was developed when the water was the shallowest (the maximum withdrawal of the sea).

The typical calcilutites of the New Market Limestone were deposited in a quiet environment. Folk (1959, p. 12) believes that calcareous muds or "micrites" imply a rapid rate of deposition and a lack of persistent strong currents. Although the New Market was deposited below wave base, it does not necessarily follow that deposition was rapid. If the pyrite in the New Market is not a post-depositional feature, it indicates a reducing environment in the bottom of the basin of deposition. The abundant *Girvanella, Lophospira,* and *Tetradium* in some beds, however, indicate that at least the upper part of the environment was rich in oxygen. The lows of the post-Beekmantown topography provided quiet places for the deposition of the calcareous mud.

The disconformity at the base of the Whistle Creek Member was probably developed during a partial withdrawal of the sea. Very fine-grained limestones near the top of the New Market and calcilutites near the base of the Whistle Creek indicate that there was not a sudden and permanent change from the quiet New Market environment to the relative high energy of the Whistle Creek environmment.

The Whistle Creek Member, the Rockbridge facies, and the Botetourt Limestone are all composed of detrital limestone mixed with a minor amount of argillaceous material. The Murat facies of the Lincolnshire Limestone is composed of generally larger grains of detrital limestone with almost no argillaceous material. The Murat facies was probably deposited in shallower water than the other lower Middle Ordovician limestones. Wave and current action removed the argillaceous material and moved most of the finer grains of detrital limestone into deeper water. The water depth probably was controlled more by minor tectonics than by transgressions and regressions of the sea. Minor uplift and downwarp in the area of study help to account for the Murat-Rockbridge facies relationships.

In general the Murat facies thins northwestward. This thinning is revealed by the Murat-Rockbridge lithofacies map, which shows the percentage of Murat increasing to the southeast. The source for part of the

detrital limestone in the post-New Market-pre-Liberty Hall limestones may have been reefs which were eroded by wave action. Limestones similar to the Murat facies are being deposited today in such places as Bikini Atoll (Emery, *et al.,* 1954). Although it is possible that some of the fossils comprising the Murat are in growth position, the detrital nature of most of the limestone indicates that it has been transported at least a short distance by waves and currents.

The probable source of the calcareous mud found in the Lincolnshire Limestone is attrition from larger grains of limestone. Most of this microcrystalline ooze was removed from the Lincolnshire by wave and current action, but some of the calcareous mud served to cement the larger grains together. The occasional large zones of calcilutite in the Lincolnshire (particularly the Murat facies) represent places, such as quiet depressions, where the microcrystalline ooze was not removed.

At the close of Botetourt time the detrital limestone available for deposition became finer-grained. As the environment increased in terrigenous material, deposition of the Liberty Hall facies of the Edinburg Formation began.

VI. Appendix—Geologic Sections

Geologic Section 1

Middle Ordovician limestones along State Road 717 and Mill Creek ¼ mile northwest of U. S. Highway 11; 1 mile southwest of Timber Ridge; 5½ miles northeast of Lexington: strike N.60-70°E.; dip 25-30°S.E. (Described by Edmundson, 1958, GS6)

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (18 feet)	
7. Limestone, argillaceous, medium gray, fine-grained; fossiliferous; silicified bryozoans; weathers rusty gray	18
Lincolnshire Limestone (204 feet)	
Rockbridge facies (154 feet)	
6. Limestone, dark gray, fine-grained; black chert nodules; wavy partings	29
5. Limestone, medium gray, medium-grained, massive; a few wavy partings; silicified bryozoans near top; weathers tannish gray	23
4. Limestone, dark gray, fine-grained; slightly argillaceous; wavy partings; silicified bryozoans; weathers tannish gray; partly covered	102
Murat facies (33 feet)	
3. Limestone, light to medium gray, coarse-grained; massive; calcilutite in places; partly sheared; weathers tannish gray	33
Whistle Creek Member (17 feet)	
2. Limestone, medium gray, very fine-grained; slightly argillaceous; a few wavy partings; partly sheared; weathers tannish gray	17
Sharp disconformity	
New Market Limestone (22 feet)	
1. Calcilutite, dove gray; argillaceous near top; tan platy chert near middle; chert and dolomite fragments near base; mostly sheared	22
Sharp unconformity	
Beekmantown Dolomite	

Geologic Section 2

Middle Ordovician limestones along State Road 728 ¾ mile northwest of the junction with State Road 645; 5 miles northeast of Lexington: strike N.55-60°E.; dip 30°S.E. (Described by Edmundson, 1958, GS7)

Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (41 feet)	
9. Limestone, argillaceous, dark gray, medium-grained; weathers rusty gray; partly covered	41
Lincolnshire Limestone (320 feet)	
Rockbridge facies (182 feet)	
8. Covered interval	67
7. Limestone, dark gray, fine-grained; slightly argillaceous; black chert nodules except at top; wavy partings; weathers light gray; partly covered	68
6. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous; calcilutite in places; wavy partings; a few silicified bryozoans; weathers medium gray; partly covered	47
Murat facies (16 feet)	
5. Limestone, light to medium gray, coarse- to very coarse-grained; abundant fossils; weathers light gray	16
Whistle Creek Member (122 feet)	
4. Limestone, medium gray, medium-grained; slightly argillaceous; mottled light and dark gray limestone in places; tan silicified bryozoans; weathers medium gray; partly covered	60
3. Covered interval	53
2. Limestone, medium gray, very fine-grained; argillaceous in places; black platy chert; weathers tannish gray	9
New Market Limestone (54 feet)	
1. Calcilutite, dove gray; birdseyes; argillaceous laminations; pyrite;	

	Thickness Feet
partly sheared; weathers light gray; partly covered	54
Beekmantown Dolomite	

Geologic Section 3

Middle Ordovician limestones just south of Poorhouse Mountain and east of State Highway 39; 4 miles northeast of Lexington: strike N.40-55°E.; dip 35-45°S.E.

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (14 feet)	
7. Limestone, argillaceous, medium gray, medium-grained; abundant fossils; weathers rusty; partly covered	14
Lincolnshire Limestone (355 feet)	
Rockbridge facies (146 feet)	
6. Limestone, dark gray, fine-grained; slightly argillaceous; fossiliferous; scattered black chert nodules; wavy partings; weathers mottled gray and tan; partly covered	115
5. Limestone, medium gray, fine- to coarse-grained; argillaceous in places; fossiliferous; a few wavy partings; silicified bryozoans; weathers light gray; partly covered	31
Murat facies (76 feet)	
4. Limestone, light to medium gray, coarse- to very coarse-grained; abundant fossils; partly covered	76
Whistle Creek Member (133 feet)	
3. Limestone, medium gray, fine-grained; slightly argillaceous and nodular; wavy partings; black platy chert; partly covered	17
2. Limestone, dark gray, fine- to medium-grained; slightly argillaceous and nodular; mottled light and dark gray limestone in places; wavy partings; silicified bryozoans; top weathers to medium-gray spheroidal masses; base weathers to tannish gray ledges; partly covered	116
New Market Limestone (84 feet)	
1. Calcilutite, dove gray; birdseyes; argillaceous laminations; partly sheared; weathers light to medium gray; partly covered	84
Beekmantown Dolomite	

Geologic Section 4

Middle Ordovician limestones ¼ mile northeast of State Road 631 and the Maury River; ¾ mile southeast of Limekiln Bridge; 1¼ miles north of Lexington: strike N.40-50° E.; dip 20°S.E.

	Thickness Feet
Covered interval	
Botetourt Limestone (45 feet)	
8. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous and nodular; abundant fossils; weathers gray to rusty	45
Lincolnshire Limestone (250 feet)	
Rockbridge facies (123 feet)	
7. Limestone, medium gray, medium-grained; slightly argillaceous; fossiliferous; a few wavy partings; weathers medium gray	70
6. Limestone, medium gray, coarse-grained; slightly argillaceous (reddish shale near base); fossiliferous; a few wavy partings; silicified bryozoans; weathers medium gray	40
5. Calcilutite, medium gray; medium gray, very fine-grained, slightly argillaceous limestone in places; silicified bryozoans; weathers light gray	5
4. Limestone, medium gray, coarse-grained; slightly argillaceous; fossiliferous; a few wavy partings; scattered tan to black chert nodules; silicified bryozoans; weathers light to dark gray	8
Murat facies (40 feet) and Whistle Creek Member (87 feet)	
3. Covered interval (upper 40 feet assigned to Murat facies; lower 60 feet assigned to Whistle Creek Member)	100
2. Limestone, medium gray, medium-grained; slightly argillaceous; fossiliferous; silicified bryozoans; weathers mottled tan and gray; mostly covered	27
New Market Limestone (50 feet)	
1. Calcilutite, dove gray; tan to black platy chert; dark gray, very fine-grained limestone in places; pyrite; argillaceous laminations; birdseyes; weathers light gray	50
Covered interval	

Geologic Section 5

Middle Ordovician limestones along U.S. Highway 11 from 1 mile to 2½ miles northwest of Lexington: strike N.40-60°E.; dip 5-10°S.E.

(Modified after Cooper & Cooper, 1946, GS40)

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (70 feet)	
12. Limestone, medium to dark gray, fine- to medium-grained; argillaceous in places; fossiliferous; a few punky siliceous nodules; weathers rusty gray	70
Lincolnshire Limestone (342 feet)	
Rockbridge facies (65 feet)	
11. Limestone, medium to dark gray, fine- to medium-grained; fossiliferous; a few scattered chert nodules	65
Murat facies (70 feet)	
10. Limestone, light to medium gray, medium- to coarse-grained; fossiliferous	70

Thickness Feet

Rockbridge facies (10 feet)
9. Limestone, argillaceous, medium to dark gray, medium-grained; nodular; fossiliferous; scattered chert nodules 10

Murat facies (85 feet)
8. Limestone, light to medium gray, medium- to coarse-grained; fossiliferous 85

Rockbridge facies (30 feet)
7. Limestone, argillaceous, medium to dark gray, medium-grained; fossiliferous 5
6. Limestone, medium to dark gray, medium- to coarse-grained; fossiliferous 25

Whistle Creek Member (82 feet)
5. Limestone, medium gray, medium-grained; fossiliferous; wavy partings 18
4. Limestone, medium to dark gray; fine- to medium-grained; fossiliferous; platy chert; wavy partings 64

Sharp disconformity

New Market Limestone (31 feet)
3. Calcilutite, dove gray, and limestone, medium gray, very fine-grained; slightly argillaceous; detrital chert; pyrite; scattered *Girvanella;* silicified fossils in places 16
2. Calcilutite, dove gray; scattered platy chert 2
1. Calcilutite, dove gray; large birdseyes; detrital chert near base 13

Beekmantown Dolomite

Geologic Section 5a

Middle Ordovician limestones along Whistle Creek and State Road 669; 2¼ miles northwest of Lexington: strike N.40-50°E.; dip 15°S.E.

Lincolnshire Limestone
Whistle Creek Member (85± feet)
2. Limestone, medium gray, fine- to medium-grained; slightly argillaceous and nodular; a few wavy partings; scattered black platy chert; detrital pebbles and boulders of chert and New Market limestone near base; weathers tan to gray ..... 85±

Sharp disconformity

New Market Limestone (0-17 feet)
1. Calcilutite, dove gray to tan; massive; birdseyes; detrital chert pebbles and Beekmantown boulders near base; weathers tan to gray (Fig. 4) 0-17

Sharp unconformity (Fig. 2)

Beekmantown Dolomite

Geologic Section 5b

Middle Ordovician limestones along State Road 665 between Whistle Creek and Cold Run; 2¼ miles northwest of Lexington: strike N.30-40°E.; dip 20°S.E.

Thickness Feet

Lincolnshire Limestone
Whistle Creek Member (85± feet)
2. Limestone, argillaceous, medium gray, fine-grained; slightly nodular; a few silicified bryozoans ..... 85±

New Market Limestone (85 feet)
1. Calcilutite, dove gray; pyrite; birdseyes; abundant gastropods; argillaceous laminations near base; partly covered 85

Beekmantown Dolomite

Geologic Section 5c

Middle Ordovician limestones along State Road 664 ½ mile northwest of Limekiln Bridge; 2½ miles north of Lexington: strike N.55-65°E.; dip 20°S.E.

Lincolnshire Limestone
Whistle Creek Member (85± feet)
6. Limestone, medium to dark gray, very fine- to fine-grained; slightly argillaceous and nodular; silicified fossils ..... 85±

New Market Limestone (80 feet)
5. Calcilutite, dove to medium gray; medium gray, very fine-grained limestone in places; pyrite; birdseyes; platy chert; partly covered 80

Blackford Formation (45 feet)
4. Dolomite, calcitic, tannish gray, very fine-grained; no fracture pattern etched on surface; detrital chert fragments 5
3. Calcilutite, dove to medium gray; birdseyes; partly covered 20
2. Covered interval 12
1. Dolomite, medium to dark gray, fine-grained; slightly argillaceous; detrital chert fragments; pyrite; weathers reddish brown 8

Beekmantown Dolomite

Geologic Section 5d

Middle Ordovician limestones on east side of State Road 631 ¼ mile northeast of Limekiln Bridge; 2¼ miles north of Lexington: strike N.35°W.; dip 20°S.W.

Lincolnshire Limestone
Whistle Creek Member (85± feet)
1. Limestone, medium gray, fine-grained; detrital fragments of chert and Beekmantown dolomite; silicified fossils (Fig. 9) ..... 85±

Beekmantown Dolomite

Geologic Section 5e

Middle Ordovician limestones along the Maury River ⅜ mile east of Limekiln Bridge; 2 miles north of Lexington: strike N.60°W.; dip 20°S.W.

	Thickness Feet
Lincolnshire Limestone	
Whistle Creek Member (85± feet)	
2. Limestone, medium to dark gray, very fine- to fine-grained; argillaceous and nodular in places; fossiliferous; a few detrital chert fragments near base; silicified bryozoans	85±
New Market Limestone (0-30 feet)	
1. Calcilutite, dove gray; nodular in places; birdseyes; detrital fragments of chert and Beekmantown dolomite; argillaceous laminations	0-30
Beekmantown Dolomite	

Geologic Section 6

Middle Ordovician limestones north of State Road 672 just west of Lexington Reservoir; 1¼ mile west of Lexington: strike N.20-30° E.; dip 20-25°S.E.

Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (35 feet)	
4. Limestone, argillaceous, medium to dark gray, fine- to medium-grained; nodular; fossiliferous; weathers rusty gray to brown	35
Lincolnshire Limestone (upper 287 feet)	
Rockbridge facies (50 feet)	
3. Limestone, medium gray, fine- to coarse-grained; argillaceous and nodular in places; wavy partings; a few silicified bryozoans; weathers tannish gray	50
Murat facies (225 feet)	
2. Limestone, light gray, very coarse-grained; abundant medium gray calcilutite; argillaceous in places; a few wavy partings; abundant fossils; weathers light to medium gray	225
Rockbridge facies (12 feet)	
1. Limestone, argillaceous, medium gray, fine-grained; nodular; a few scattered chert nodules; fossiliferous	12
Covered interval	

Geologic Section 7

Middle Ordovician limestones along Union Creek and State Road 674 ½ mile northwest of junction with State Highway 251; 3½ miles southwest of Lexington: strike N.55-65°E.; dip 25-40°S.E.

(Described by Edmundson, 1958, GS12)

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (23 feet)	
24. Limestone, argillaceous, medium to dark gray, very fine- to medium-grained; fossiliferous; nodular; weathers rusty gray to brown; partly covered	23
Lincolnshire Limestone (299 feet)	
Rockbridge facies (20 feet)	
23. Limestone, dark gray, fine-grained; argillaceous in places; light gray echinoderm fragments; weathers to a gray ledge; partly covered	2
22. Limestone, medium gray, medium-grained; slightly argillaceous; nodular; fossiliferous; granular in places; wavy partings; weathers tannish gray	18
Murat facies (179 feet)	
21. Limestone, light to medium gray, coarse- to very coarse-grained; slightly argillaceous; abundant fossils; calcilutite in places; stylolites; weathers to mottled light and dark gray spheroidal masses	120
20. Limestone, light to medium gray, coarse- to very coarse-grained; abundant fossils; weathers to mottled light and dark gray ledges	45
19. Limestone, light to medium gray, coarse-grained; fossiliferous; weathers mottled light and dark gray; partly covered	8
18. Limestone, light gray, coarse-grained; weathers light to medium gray; partly covered	6
Rockbridge facies (62 feet)	
17. Limestone, medium to dark gray, fine-grained; scattered chert nodules; weathers light gray to tan	2
16. Limestone, medium gray, medium-grained; mostly covered	20
15. Limestone, argillaceous, medium gray, very fine- to fine-grained; scattered chert nodules; weathers light to medium gray	4
14. Covered interval	15
13. Limestone, medium to dark gray, fine-grained; slightly argillaceous; fossiliferous; scattered chert nodules; weathers gray to yellowish tan; partly covered	14
12. Limestone, medium to dark gray, medium-grained; fossiliferous; weathers tannish gray; partly covered	7
Whistle Creek Member (38 feet)	
11. Limestone, dark gray, fine-grained; slightly argillaceous; wavy partings; platy chert; weathers tannish gray; partly covered	18
10. Calcilutite, medium gray; very fine-grained limestone near top; platy chert; argillaceous laminations; finely disseminated pyrite; birdseyes; weathers medium gray to yellowish tan with a slightly spongy texture	9
9. Limestone, argillaceous, dark gray to black, very fine-grained; abundant platy chert; weathers light to medium gray; partly covered	11
New Market Limestone (29 feet)	
8. Calcilutite, drab gray; stylolites;	

	Thickness Feet
argillaceous laminations; abundant platy chert; weathers light to medium gray	3
7. Calcilutite, dark gray; argillaceous laminations; birdseyes; weathers light to medium gray	3
6. Calcilutite, dark gray; birdseyes; abundant platy chert; a few gastropods; weathers light to medium gray	2
5. Calcilutite, dark gray; pyrite; gastropods; scattered platy chert; argillaceous laminations; weathers medium to yellowish gray	4
4. Calcilutite, very dark gray; abundant gray to black platy chert; argillaceous laminations; weathers light to medium gray	4
3. Calcilutite, medium to very dark gray; scattered platy chert; birdseyes; argillaceous laminations; weathers light gray to yellow	4
2. Calcilutite, gray; veins and layers of calcite; one layer of platy chert; red iron oxide on bedding surfaces; weathers tan to yellow with a slightly spongy texture	7
1. Calcilutite, gray; dolomite near base; thin veins of calcite; abundant detrital chert; a few stylolites; weathers yellowish gray with a spongy texture	2
Beekmantown Dolomite	

Geologic Section 8

Middle Ordovician limestones in Spring Valley just east of State Road 670; 1 mile northeast of Murat; 5 miles southeast of Collierstown: strike N.55-65°E.; dip 30-40° S.E.

(Described by Cooper & Cooper, 1946, GS41, and by Edmundson, 1958, GS13)

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (42 feet)	
17. Limestone, dark gray, very fine- to fine-grained; slightly argillaceous and nodular; abundant fossils; some light to reddish gray echinoderm fragments; silicified bryozoans; weathers to light gray to brown ledges	34
16. Limestone, medium gray, medium-grained; fossiliferous; slightly nodular; scattered pink and tan grains; weathers to medium to dark gray ledges; partly covered	8
Lincolnshire Limestone (307 feet)	
Murat facies (227 feet)	
15. Limestone, light to medium gray, coarse- to very coarse-grained; slightly argillaceous; abundant fossils; calcilutite near top; weathers to gray ledges and spheroidal masses	22
14. Limestone, light gray, very coarse-grained; abundant fossils; slightly nodular; medium gray calcilutite in places; numerous stylolites; solution grooves; weathers to gray ledges and spheroidal masses	175
13. Limestone, light to medium gray, coarse- to very coarse-grained; abundant fossils; thin- to medium-bedded; weathers to gray ledges	30
Rockbridge facies (50 feet)	
12. Limestone, medium to dark gray, fine- to medium-grained; fossiliferous; scattered black chert nodules; wavy partings; a few silicified bryozoans; weathers light to medium gray	18
11. Limestone, dark gray, fine-grained; nodular in places; fossiliferous; silicified bryozoans near base; weathers light to medium gray	32
Whistle Creek Member (30 feet)	
10. Limestone, medium gray, fine-grained; wavy partings; abundant platy chert; silicified bryozoans; weathers light to medium gray	2
9. Limestone, medium to dark gray, fine- to medium-grained; wavy partings; fossiliferous; scattered platy chert; silicified bryozoans; weathers light to medium gray	16
8. Limestone, medium to dark gray, fine-grained; argillaceous in places; fossiliferous; gray to black platy chert; wavy partings; weathers medium gray	8
New Market Limestone (67 feet)	
7. Calcilutite, medium to dark gray; birdseyes; argillaceous laminations; weathers light gray	4
6. Covered interval	35
5. Calcilutite, dove to dark gray; very dark gray, very fine-grained limestone in places; detrital chert, limestone, and dolomite pebbles near top; tan to gray to black platy chert; weathers tan to medium gray; partly covered	10
4. Calcilutite, dove gray; medium-bedded; argillaceous laminations; detrital black chert pebbles near base; pyrite; birdseyes; weathers tan to light gray; partly covered	18
Blackford Formation (38 feet)	
3. Dolomite, medium to tannish gray, very fine-grained, and conglomerate of dolomite and chert; dolomite contains pyrite and weathers tannish gray with fracture pattern etched on surface; conglomerate consists of boulders of chert (from unit 2) and dolomite (intraformational and/or Beekmantown); entire unit contains scattered detrital chert pebbles; two 6″ chert beds near top (similar to unit 2)	22
2. Chert, brown to blue-black; mas-	

	Thickness Feet
sive; abundant small cavities	2
1. Dolomite, tannish gray, very fine-grained; irregularly bedded; 6-12" chert bed near top (similar to unit 2); scattered detrital white, tan, gray, and blue chert pebbles; silicified fossils near top; weathers tannish gray with fracture pattern etched on surface	14
Beekmantown Dolomite	

Geologic Section 9

Middle Ordovician limestones along Buffalo Creek, State Highway 251, and State Road 675 at Murat; 5½ miles southwest of Lexington: strike N.-S.; dip 25-35°E.

Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (40 feet)	
22. Limestone, argillaceous, dark gray, very fine- to medium-grained; nodular; abundant fossils; mottled light and dark gray limestone in places; weathers yellowish brown; partly covered	40
Lincolnshire Limestone (249 feet)	
Rockbridge facies (12 feet)	
21. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous and nodular; weathers light brown; partly covered	12
Murat facies (122 feet)	
20. Limestone, medium gray, coarse- to very coarse-grained; a few stylolites; cobbles of black and light gray calcilutite; weathers tannish gray	10
19. Calcilutite, medium gray; dark gray argillaceous laminations; light gray, very coarse-grained limestone in places; weathers tannish gray	6
18. Limestone, light to medium gray, very coarse-grained; slightly argillaceous; abundant fossils; stylolites; medium gray calcilutite in places; weathers tannish gray	41
17. Calcilutite, medium gray; light gray, very coarse-grained limestone in places; weathers tannish gray	15
16. Limestone, light to medium gray, very coarse-grained; massive; abundant fossils; a few stylolites; medium gray calcilutite in places; weathers tannish gray	41
15. Limestone, light to medium gray, coarse- to very coarse-grained; massive; abundant fossils; solution grooves; medium gray calcilutite; weathers tannish gray	9
Rockbridge facies (99 feet)	
14. Limestone, medium gray, medium-grained; massive; slightly nodular; fossiliferous; wavy partings; 4" weathered zone near base; weathers tannish gray	11
13. Limestone, dark gray, fine-grained; slightly argillaceous and nodular; a few silicified bryozoans; weathers tannish gray	12
12. Limestone, medium to dark gray, medium-grained; massive; fossiliferous; scattered chert nodules; wavy partings; a few silicified bryozoans; weathers tannish gray	24
11. Limestone, medium to dark gray, fine- to medium-grained; massive; black chert nodules; silicified bryozoans; weathers tannish gray	8
10. Limestone, light to dark gray, fine- to medium-grained; massive; nodular in places; fossiliferous; scattered chert nodules; silicified bryozoans; weathers tannish gray	13
9. Limestone, medium to dark gray, very fine- to medium-grained; slightly argillaceous and nodular; numerous bryozoan colonies near top; mottled light and dark gray limestone in places; deeply weathered near top; weathers tannish gray	31
Whistle Creek Member (16 feet)	
8. Limestone, medium gray, very fine- to fine-grained; massive; fossiliferous, including bryozoan colonies; calcilutite in places; one zone of limestone conglomerate; weathers light to tannish gray	5
7. Limestone, dark gray, fine-grained; argillaceous near base; dark gray, pink, and orange platy chert near top; deeply weathered near base; weathers tannish gray	4
6. Limestone, argillaceous, medium to dark gray, fine-grained; abundant dark gray platy chert; weathers tannish gray	5
5. Limestone, argillaceous, medium gray, very fine-grained; weathers tannish gray	2
New Market Limestone (17 feet)	
4. Calcilutite, medium gray; massive; birdseyes; weathers light gray with sharp irregular surface	9
3. Calcilutite, argillaceous, light gray; birdseyes; weathers tannish gray	2
2. Calcilutite, light to medium gray; slightly argillaceous; nodular near base; medium-bedded; gray platy chert; birdseyes; pyrite; weathers tannish gray	5
1. Calcilutite, medium gray; massive; weathers tannish gray	1
Beekmantown Dolomite	

Geologic Section 10

Middle Ordovician limestones at the end of a farm road leading south from State Road 677; 1 mile southwest of Murat; 4½ miles southeast of Collierstown: strike N.30°W. to N.45°E.; dip 20-30°S.

(Described by Edmundson, 1958, GS14)

Thickness
Feet

Edinburg Formation (Liberty Hall facies)
Botetourt Limestone (38 feet)
5. Limestone, medium gray, fine- to coarse-grained; argillaceous in places; fossiliferous; scattered punky siliceous nodules; wavy partings; silicified fossils; weathers rusty gray 38
Lincolnshire Limestone (376 feet)
Murat facies (17 feet)
4. Limestone, light to medium gray, coarse- to very coarse-grained; weathers light to medium gray 17
Rockbridge facies (24 feet)
3. Limestone, medium to dark gray, medium- to coarse-grained; argillaceous in places; a few wavy partings; weathers medium to dark gray 24
Murat facies (175 feet)
2. Limestone, light to medium gray, coarse- to very coarse-grained; slightly argillaceous; abundant fossils; wavy partings in places; abundant medium gray calcilutite; weathers light to dark gray 175
Whistle Creek Member (160 feet)
1. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous and nodular; black platy chert; wavy partings; silicified bryozoans in places; weathers tannish gray; partly covered 160
Covered interval

Geologic Section 11

Middle Ordovician limestones along State Road 677 on the west side of Kiger Hill; 3½ miles southeast of Collierstown: strike N.10°W.; dip 70-80°E.

Thickness
Feet

Edinburg Formation (Liberty Hall facies)
Botetourt Limestone (55 feet)
4. Limestone, argillaceous, medium gray, fine- to medium-grained; silicified bryozoans; weathers gray to rusty; partly covered 55
Lincolnshire Limestone (upper 365 feet)
Rockbridge facies (130 feet)
3. Limestone, medium gray, coarse-grained; argillaceous and nodular near top; abundant fossils; scattered chert nodules; wavy partings in places; a few silicified bryozoans; weathers medium gray 130
Murat facies (130 feet)
2. Limestone, light gray, coarse- to very coarse-grained; abundant fossils; weathers to light gray spheroidal masses 130
Rockbridge facies (105 feet)
1. Limestone, medium gray, coarse-grained; slightly argillaceous; fossiliferous; wavy partings in places; weathers medium gray; partly covered 105
Covered interval

Geologic Section 12

Middle Ordovician limestones along Colliers Creek and near the junction of State Highway 251 and State Road 612; 3 miles southeast of Collierstown: strike N.15-25°E.; dip 60-70°W.

(Described by Edmundson, 1958, GS15)

Edinburg Formation (Liberty Hall facies)
Botetourt Limestone (66 feet)
39. Limestone, medium gray, medium- to coarse-grained; slightly granular; weathers rusty gray 8
38. Limestone, argillaceous, medium to dark gray, fine- to medium-grained; nodular in places; fossiliferous; punky siliceous nodules; weathers gray to rusty 58
Lincolnshire Limestone (436 feet)
Rockbridge facies (111 feet)
37. Limestone, argillaceous, dark gray, fine-grained; slightly nodular; a few silicified bryozoans; weathers to tan to gray ledges 24
36. Limestone, medium gray, fine-grained; 6″ weathered zone at top; weathers tannish gray 3
35. Limestone, dark gray, fine-grained; slightly argillaceous and nodular; scattered chert nodules near base and top; weathers medium to dark gray 49
34. Limestone, medium to dark gray, very fine- to medium-grained; slightly argillaceous and nodular; mottled light and dark gray limestone in places; weathers medium to dark gray 35
Murat facies (2 feet)
33. Limestone, light to medium gray, very coarse-grained 2
Rockbridge facies (21 feet)
32. Limestone, medium to dark gray, fine- to medium-grained; massive; slightly argillaceous; mottled light and dark gray limestone in places; scattered medium gray calcilutite; weathers with a spongy texture 21
Murat facies (8 feet)
31. Limestone, light to medium gray, very coarse-grained; scattered calcilutite; fossiliferous; weathers tannish gray with a spongy texture 8
Rockbridge facies (9 feet)
30. Limestone, medium gray, fine- to coarse-grained; slightly argillaceous; fossiliferous; mottled light and dark gray limestone in places; calcilutite in places 9
Murat facies (4 feet)
29. Limestone, medium gray, very coarse-grained; massive; abundant fossils 4

	Thickness Feet
Rockbridge facies (5 feet)	
28. Limestone, medium gray, fine- to medium-grained; slightly nodular; fossiliferous; calcilutite in places; weathers tan to gray	5
Murat facies (6 feet)	
27. Limestone, medium gray, very coarse-grained; massive; weathers tan to gray	6
Rockbridge facies (3 feet)	
26. Limestone, medium gray, fine- to medium-grained; nodular; slightly argillaceous; fossiliferous; calcilutite in places; weathers tan to light gray	3
Murat facies (4 feet)	
25. Limestone, light gray, very coarse-grained; massive	4
Rockbridge facies (9 feet)	
24. Limestone, medium gray, very fine- to medium-grained; argillaceous and nodular in middle; calcilutite near base; silicified bryozoans; weathers light gray to yellow with a spongy texture	9
Murat facies (53 feet)	
23. Limestone, light to medium gray, very coarse-grained; massive; weathers light to dark gray	53
Rockbridge facies (20 feet)	
22. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous and nodular; mottled light and dark gray limestone in places; weathers light to dark gray	20
Murat facies (12 feet)	
21. Limestone, light gray, coarse- to very coarse-grained; abundant fossils; weathers light to dark gray	12
Rockbridge facies (90 feet)	
20. Limestone, medium to dark gray, fine- to medium-grained; argillaceous and nodular in places; scattered chert nodules near base; a few silicified bryozoans; weathers light to dark gray	46
19. Weathered zone of red clay	2
18. Limestone, light to dark gray, fine- to medium-grained; scattered black chert nodules; silicified bryozoans; weathers medium gray	30
17. Limestone, medium to dark gray, fine-grained; slightly argillaceous and nodular; fossiliferous; scattered black chert nodules; wavy partings; weathers medium to dark gray	12
Whistle Creek Member (79 feet)	
16. Limestone, medium gray, fine-grained; fossiliferous; massive near base; nodular near top; wavy partings; weathers tannish gray	11
15. Limestone, medium gray, fine-grained; fossiliferous; argillaceous and nodular near base; massive near top; 6″ weathered zone of red clay in middle; scattered platy chert; wavy partings; weathers tannish gray	9
14. Weathered zone of red clay; abundant fossils	2
13. Limestone, dark gray, fine-grained; slightly argillaceous and nodular; fossiliferous; scattered black platy chert; mottled light and dark gray limestone in places; silicified bryozoans; weathers medium gray to tan with a spongy texture	27
12. Covered interval	7
11. Limestone, medium gray, very fine-grained; finely disseminated pyrite; weathers tan to medium gray; partly covered	14
10. Limestone, dark gray, fine-grained; argillaceous in places; scattered gray to black platy chert; weathers tannish gray with a spongy texture	6
9. Limestone, dark gray, fine-grained; slightly argillaceous; weathers tan to gray with a spongy texture	3
New Market Limestone (58 feet)	
8. Calcilutite, dove gray, and limestone, medium gray, very fine-grained; massive; nodular near base; argillaceous laminations; abundant *Girvanella* near middle; gastropods near base; weathers gray to tan (Fig. 5)	13
7. Calcilutite, medium to dark gray; argillaceous laminations; abundant tan to black platy chert; weathers tan to gray; partly covered	9
6. Calcilutite, medium gray; birdseyes; argillaceous laminations; weathers light gray; partly covered (Fig. 6)	6
5. Calcilutite, drab gray; scattered light to dark gray platy chert; pyrite; argillaceous laminations; weathers medium to dark gray	7
4. Calcilutite, drab gray; birdseyes; weathers medium gray	3
3. Calcilutite, drab gray; abundant gray to black platy chert; weathers medium gray	3
2. Calcilutite, medium gray; scattered gray platy chert; weathers medium gray; partly covered	4
1. Calcilutite, dove to drab gray; birdseyes; abundant stylolites; gastropods; pyrite; weathers light gray	13
Sharp unconformity	
Beekmantown Dolomite	

Geologic Section 13

Middle Ordovician limestones on the northwest side of Rich Hill; 3/8 mile southeast of Toad Run and State Road 676; 4¾ miles west of Lexington: strike N.40-50°E.; dip, overturned, 75-85°S.E.

(Described by Edmundson, 1958, GS16)

	Thickness Feet
Edinburg Formation (Liberty Hall facies) (Fig. 16)	
Botetourt Limestone (13 feet)	
27. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous; siliceous material forming small resistant ridges near base; a few silicified bryozoans; weathers light to dark gray to tan to rusty	13
Lincolnshire Limestone (335 feet)	
Rockbridge facies (92 feet)	
26. Limestone, dark gray, very fine-grained; slightly argillaceous; fossiliferous; siliceous material forming small resistant ridges near base; abundant chert nodules near top; wavy partings near base; weathers light to dark gray to tan	19
25. Limestone, dark gray, fine-grained; massive; slightly nodular near base; scattered black chert nodules near base; wavy partings; weathers light to dark gray	15
24. Limestone, medium to dark gray, fine-grained; black chert nodules; a few wavy partings; weathers light to dark gray (Fig. 7)	13
23. Covered interval	12
22. Limestone, dark gray, very fine- to fine-grained; wavy partings; siliceous material forming small resistant ridges except near top, where there are black chert nodules; weathers light to dark gray; partly covered	33
Murat facies (10 feet)	
21. Calcilutite, medium gray, and limestone, medium gray, coarse-grained; silicified bryozoans; weathers light to dark gray	10
Rockbridge facies (27 feet)	
20. Limestone, dark gray, fine-grained; fossiliferous; mottled light and dark gray limestone in places; abundant silicified bryozoans; weathers light to dark gray; partly covered (Fig. 12)	27
Murat facies (12 feet)	
19. Limestone, medium gray, coarse-grained; massive; abundant fossils; abundant white calcite; weathers light to dark gray	12
Rockbridge facies (22 feet)	
18. Limestone, medium gray, medium-grained; fossiliferous; a few wavy partings; weathers medium to dark gray	9
17. Limestone, dark gray, fine-grained; massive; weathers tannish gray	5
16. Limestone, medium gray, medium-grained; weathers light to dark gray	8
Murat facies (53 feet)	
15. Limestone, light gray, very coarse-grained; abundant fossils; medium gray calcilutite in places; weathers light to medium gray; partly covered	53
Rockbridge facies (11 feet)	
14. Limestone, medium gray, fine- to medium-grained; argillaceous and nodular in places; wavy partings; weathers medium gray; partly covered (Fig. 10)	11
Murat facies (43 feet)	
13. Limestone, light to medium gray, coarse- to very coarse-grained; massive; a few stylolites; weathers light gray	43
Rockbridge facies (33 feet)	
12. Limestone, medium gray, fine- to medium-grained; rare light gray chert nodules; a few wavy partings; weathers tannish gray	3
11. Covered interval	21
10. Limestone, dark gray, fine-grained; slightly argillaceous; fossiliferous; rare chert nodules; weathers medium gray	7
9. Limestone, dark gray, fine- to medium-grained; massive; argillaceous in places; fossiliferous, including prominent bryozoan colonies; weathers medium gray	2
Whistle Creek Member (32 feet)	
8. Limestone, dark gray, fine-grained; gray, brown, and black platy chert; weathers tannish gray	10
7. Limestone, dark gray, fine-grained; scattered black platy chert; wavy partings; weathers tannish gray; partly covered	19
6. Limestone, dark gray, fine-grained; slightly argillaceous; reddish brown to dark gray platy chert; weathers yellowish brown to dark gray	3
Sharp disconformity	
New Market Limestone (43 feet)	
5. Calcilutite, medium gray, and limestone, medium gray, very fine-grained; massive; argillaceous laminations; abundant gastropods; birdseyes; weathers medium gray	6
4. Limestone, medium gray, very fine-grained; argillaceous laminations; gray and brown platy chert; weathers medium gray	4
3. Calcilutite, medium gray to brown; massive; argillaceous laminations; birdseyes; weathers light gray but with orange to brown to black ferruginous stain in places	8
2. Calcilutite, medium to dark gray; birdseyes; argillaceous laminations; abundant brown to gray platy chert; weathers medium gray but with yellowish brown ferruginous stain in places	18
1. Calcilutite, medium to dark gray; birdseyes; argillaceous laminations; scattered platy chert; weathers yellowish gray; partly covered	7
Sharp unconformity (Fig. 3)	
Beekmantown Dolomite	

Geologic Section 14

Middle Ordovician limestones along Whistle Creek and State Road 641 near the junction with State Road 673; 3½ miles northwest of Lexington: strike N.20-35°E.; dip 40°S.E. to overturned, 80°N.W.

Thickness Feet

Covered interval (Botetourt Limestone found 3/8 mile to the northwest)
Lincolnshire Limestone (260 feet)
Rockbridge facies (50 feet)
4. Limestone, medium to dark gray, fine-grained; slightly argillaceous; silicified bryozoans; weathers tannish to brownish gray; partly covered 50
Murat facies (130 feet)
3. Limestone, light gray, coarse- to very coarse-grained; abundant fossils; a few wavy partings; medium gray calcilutite in places; weathers light to medium gray; partly covered 130
Whistle Creek Member (80 feet)
2. Limestone, light to medium gray, medium- to coarse-grained; argillaceous in places; fossiliferous; scattered black platy chert; wavy partings; a few silicified bryozoans; weathers medium gray; partly covered 80
Sharp disconformity
New Market Limestone (70 feet)
1. Calcilutite, dove gray; slightly argillaceous; birdseyes; pyrite; weathers tannish gray; partly covered 70
Beekmantown Dolomite

Geologic Section 15

Middle Ordovician limestones along Whistle Creek and State Road 641 5/8 mile northwest of the junction with State Road 673; 4¼ miles northwest of Lexington: strike N.35-50°E.; dip 25-35°S.E.

Covered interval (Botetourt Limestone found 1/2 mile to the northeast)
Lincolnshire Limestone (lower 275 feet)
Murat facies (5 feet)
7. Limestone, light gray, coarse-grained; fossiliferous; argillaceous in places; weathers light gray 5
Rockbridge facies (55 feet)
6. Limestone, medium to dark gray, medium- to coarse-grained; slightly argillaceous; fossiliferous; a few silicified bryozoans; weathers tannish gray; partly covered 55
Murat facies (10 feet)
5. Limestone, medium gray, very coarse-grained; argillaceous in places; abundant fossils; weathers tannish gray 10

Thickness Feet

Rockbridge facies (100 feet)
4. Limestone, medium to dark gray, medium-grained; slightly argillaceous; fossiliferous; a few silicified bryozoans; weathers tannish gray; partly covered 100
Murat facies (5 feet)
3. Calcilutite, medium gray; argillaceous in places; weathers light gray 5
Whistle Creek Member (100 feet)
2. Limestone, medium to dark gray, very fine- to fine-grained; slightly argillaceous and nodular; weathers gray to tan; partly covered 100
New Market Limestone (90 feet)
1. Calcilutite; dove gray to medium gray; tan to gray platy chert; argillaceous laminations; detrital chert fragments near base; gastropods; weathers light tannish gray; partly covered 90
Beekmantown Dolomite

Geologic Section 16

Middle Ordovician limestones along Sugar Creek and State Road 641 1 mile northwest of junction with State Road 676; 2¼ miles east of Collierstown: strike N.35-50°E.; dip 60°S.E. to 50°N.W.

Edinburg Formation (Liberty Hall facies)
Botetourt Limestone (28 feet)
6. Limestone, medium gray, medium- to coarse-grained; abundant fossils; granular; slightly nodular; wavy partings; weathers gray to rusty 28
Lincolnshire Limestone (upper 250 feet)
Rockbridge facies (200 feet)
5. Limestone, medium to dark gray, fine- to medium-grained; black chert nodules; wavy partings in places; a few silicified bryozoans; weathers to tannish gray ledges 125
4. Limestone, medium to dark gray, fine- to coarse-grained; fossiliferous; wavy partings in places; a few silicified bryozoans; weathers to tannish gray ledges 75
Murat facies (5 feet)
3. Limestone, light to medium gray, coarse- to very coarse-grained; fossiliferous; weathers tannish gray 5
Rockbridge facies (45 feet)
2. Limestone, medium to dark gray, fine- to coarse-grained; wavy partings; silicified bryozoans; weathers to tannish gray ledges 30
1. Limestone, medium to dark gray, fine- to coarse-grained; black chert nodules; silicified bryozoans; weathers tannish gray 15
Covered interval

Geologic Section 17

Middle Ordovician limestones along Colliers Creek and State Highway 251 ½ to 1 mile northwest of junction with State Road 676; 2 miles southeast of Collierstown: strike N.10-40°E.; dip 70°S.E. to 60°N.W.

(Described by Cooper & Cooper, 1946, GS42, and by Edmundson, 1958, GS17)

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (8 feet)	
46. Limestone, argillaceous, dark gray, fine- to medium-grained; granular; slightly nodular; fossiliferous; weathers rusty gray	8
Lincolnshire Limestone (433 feet)	
Rockbridge facies (177 feet)	
45. Limestone, dark gray, fine- to medium-grained; argillaceous and nodular near top; chert nodules near base; fossiliferous	87
44. Limestone, medium to dark gray, fine- to coarse-grained; fossiliferous; massive; slightly nodular; scattered chert nodules	83
43. Limestone, medium gray, coarse-grained; slightly argillaceous and nodular	7
Murat facies (6 feet)	
42. Limestone, light gray, coarse- to very coarse-grained (Fig. 14)	6
Rockbridge facies (17 feet)	
41. Limestone, dark gray, medium-grained; nodular; scattered chert nodules	11
40. Limestone, medium to dark gray, medium- to coarse-grained	6
Murat facies (5 feet)	
39. Limestone, light gray, coarse- to very coarse-grained	5
Rockbridge facies (7 feet)	
38. Limestone, medium to dark gray, medium- to coarse-grained; fossiliferous	7
Murat facies (11 feet)	
37. Limestone, light gray, coarse- to very coarse-grained	11
Rockbridge facies (40 feet)	
36. Limestone, medium to dark gray, fine- to medium-grained; slightly argillaceous; nodular; scattered chert nodules	40
Murat facies (5 feet)	
35. Limestone, light to medium gray, coarse- to very coarse-grained	5
Whistle Creek Member (165 feet)	
34. Limestone, medium to dark gray, fine- to medium-grained; fossiliferous; wavy partings; weathers brown	22
33. Limestone, medium to dark gray, medium- to coarse-grained; scattered platy chert	8
32. Limestone, medium to dark gray, medium- to coarse-grained; platy chert; weathers brown	4
31. Limestone, medium to dark gray, fine- to medium-grained; scattered platy chert	19
30. Limestone, medium to dark gray, fine- to medium-grained; platy chert; weathers brown with a spongy texture in places	44
29. Limestone, medium to dark gray, fine- to medium-grained; argillaceous and nodular in places; platy chert	24
28. Limestone, dark gray, fine- to medium-grained; argillaceous near top; abundant platy chert	11
27. Limestone, medium to dark gray, fine-grained; slightly argillaceous and nodular; a few wavy partings; scattered platy chert; weathers with a spongy texture in places	33
New Market Limestone (120 feet)	
26. Calcilutite, dove gray	3.5
25. Limestone, clastic, medium gray, very fine-grained; pyrite	3.7
24. Calcilutite, dove gray	2.0
23. Calcilutite, argillaceous, dove gray; thin-bedded; scattered platy chert	5.4
22. Limestone, medium gray, very fine-grained; platy chert	1.4
21. Limestone, dark gray, very fine-grained; abundant platy chert	1.7
20. Calcilutite, dove gray, and limestone, dark gray, very fine-grained; scattered platy chert	34.2
19. Limestone, clastic, medium gray, very fine-grained; scattered platy chert	1.8
18. Calcilutite, dove gray	4.3
17. Calcilutite, dove gray, and limestone, dark gray, very fine-grained; scattered black platy chert; pyrite	10.9
16. Calcilutite, dove gray; wavy partings	3.5
15. Calcilutite, banded light and tannish gray	1.3
14. Calcilutite, argillaceous, mottled light to dark gray; pyrite	12.0
13. Limestone, tan to gray, very fine-grained; slightly argillaceous	0.6
12. Limestone, clastic, medium gray, very fine-grained; abundant pyrite	0.2
11. Shale, tan to gray; mealy	0.2
10. Calcilutite, gray and tan, mottled; gastropods	11.4
9. Limestone, dolomitic, medium gray, very fine-grained; weathers drab gray and mealy	1.0
8. Calcilutite, medium gray; laminated	1.6
7. Limestone, medium gray, very fine-grained; slightly argillaceous; pyrite	2.4
6. Dolomite, clastic, drab gray, very fine-grained; slightly argillaceous; pyrite; detrital chert fragments	1.7

	Thickness Feet
5. Calcilutite, medium gray; weathers buff	0.8
4. Conglomerate, drab gray; detrital pebbles of limestone, dolomite, and chert; weathers drab gray	0.9
3. Calcilutite, dove gray; wavy partings; *Tetradium;* pyrite	5.0
2. Limestone, dolomitic, medium gray, very fine-grained	6.5
1. Conglomerate, tannish gray; detrital pebbles of limestone, dolomite, and chert	2.0
Beekmantown Dolomite	

Geologic Section 18

Middle Ordovician limestones on the northwest side of Buffalo Creek and State Road 612 ¼ mile northeast of junction with State Road 611; 3 miles southeast of Collierstown: strike N.5°E.; dip 20-25°E.

Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (10 feet)	
4. Limestone, medium to dark gray, fine- to medium-grained; argillaceous in places; weathers rusty gray to brown (Fig. 15)	10
Lincolnshire Limestone (upper 240 feet)	
Rockbridge facies (145 feet)	
3. Limestone, light to dark gray, fine- to coarse-grained; argillaceous and nodular near top; fossiliferous; black chert nodules; weathers tan to gray	45
2. Limestone, medium to dark gray, medium- to coarse-grained; fossiliferous; slightly argillaceous and and nodular; medium to dark gray calcilutite in places; a few silicified bryozoans; weathers gray to tan	100
Murat facies (95 feet)	
1. Limestone, light to medium gray, coarse- to very coarse-grained; argillaceous in places; abundant fossils; medium gray calcilutite in places; weathers light to medium gray to tannish gray	95
Covered interval	

Geologic Section 19

Middle Ordovician limestones east of South Buffalo Creek and State Road 611 1 to 1¼ mile south of junction with State Road 612; 3 miles southwest of Murat: strike N.10°E. to N.15°W.; dip 15-35°E.

(Described by Butts, 1940, GS33, and Edmundson, 1958, GS18)

Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (15 feet)	
42. Limestone, salt and pepper (grains light to dark gray, yellow, and brown), medium-grained; abundant fossils; argillaceous in places; a few wavy partings; weathers light to dark gray to rusty; partly covered	15
Lincolnshire Limestone (342 feet)	
Rockbridge facies (89 feet)	
41. Limestone, dark gray, very fine- to medium-grained; fossiliferous; scattered tan to black chert nodules; slightly nodular; wavy partings; partly covered	35
40. Limestone, dark gray, medium-grained; massive; fossiliferous; weathers light gray; partly covered	7
39. Limestone, dark gray, fine-grained; slightly nodular; medium gray calcilutite in places; fossiliferous; silicified bryozoans; wavy partings; weathers light to dark gray	12
38. Limestone, medium to dark gray, very fine- to fine-grained; nodular; slightly argillaceous; fossiliferous; wavy partings; scattered tan to black chert nodules; weathers light to dark gray; partly covered	35
Murat facies (82 feet)	
37. Calcilutite, medium gray; medium gray, very coarse-grained limestone in places; abundant fossils; a few wavy partings; birdseyes; weathers to gray irregular masses	48
36. Limestone, light to medium gray, coarse- to very coarse-grained; a few stylolites; medium gray calcilutite in places; abundant fossils; a few wavy partings; weathers to gray spheroidal masses	34
Whistle Creek Member (171 feet)	
35. Limestone, medium gray, fine- to medium-grained; fossiliferous; wavy partings; nodular near top; abundant silicified bryozoans; weathers tan to gray (Fig. 8)	7
34. Limestone, medium gray, fine-grained; tan to black platy chert; a few wavy partings; silicified bryozoans; weathers medium to dark gray	6
33. Limestone, medium to dark gray, very fine- to fine-grained; massive; wavy partings; nodular near top; abundant silicified bryozoans; weathers medium to dark gray	9
32. Limestone, medium to dark gray, very fine- to fine-grained; fossiliferous; gray to black platy chert; wavy partings; silicified fossils; weathers light to dark gray	7
31. Limestone, medium gray, very fine- to fine-grained; fossiliferous; scattered platy chert; wavy partings; slightly nodular; silicified fossils; weathers medium gray	5
30. Limestone, medium to dark gray, fine- to very fine-grained; mas-	

		Thickness Feet
	sive; black platy chert; wavy partings near base; a few silicified bryozoans; weathers medium gray	11
29.	Limestone, dark gray, very fine-grained; scattered platy chert; nodular in places; fossiliferous; scattered silicified bryozoans; weathers medium to dark gray; partly covered	5
28.	Covered interval	75
27.	Limestone, medium gray, fine-grained; massive; scattered black platy chert; a few silicified bryozoans; weathers light to medium gray	3
26.	Limestone, medium gray, very fine-grained; fossiliferous; gray to black platy chert; weathers light to medium gray	8
25.	Covered interval	10
24.	Limestone, dark gray, very fine-grained; extremely fossiliferous; slightly argillaceous and nodular; scattered black platy chert; abundant silicified fossils; weathers brown to gray with a very spongy texture (Fig. 11)	19
23.	Limestone, medium to dark gray, fine- to medium-grained; extremely fossiliferous; slightly argillaceous; mottled light and dark gray limestone in places; abundant wavy partings; detrital pebbles and cobbles of calcilutite near base; abundant silicified fossils; weathers tan to gray and cavernous	6
	Sharp disconformity (Fig. 13)	
	New Market Limestone (142 feet)	
22.	Calcilutite, dove gray; birdseyes; abundant wavy partings; silicified fossils near top; weathers light tan to dark gray	4
21.	Limestone, tan to dark gray, very fine-grained; wavy partings near top; slightly argillaceous; abundant tan to black platy chert; weathers yellow to tan to dark gray	9
20.	Calcilutite, tan to dove gray; massive; stylolites in places; birdseyes; light to medium gray, very fine-grained limestone in places; pyrite; a few wavy partings; silicified fossils; weathers light tan to medium gray	21
19.	Calcilutite, dove gray; medium gray, very fine-grained limestone in places; gray platy chert; birdseyes; weathers light to medium gray	5
18.	Limestone, medium to dark gray, fine-grained; black platy chert; weathers light tan to dark gray	3
17.	Calcilutite, dove gray; abundant medium gray, very fine-grained limestone; thin- to medium-bedded; birdseyes; tan, bluish gray, and black platy chert; weathers light gray to tan	18
16.	Calcilutite, dove gray; medium-bedded; birdseyes; weathers light tan to gray	4
15.	Calcilutite, dove gray; abundant tan to black platy chert; weathers light tan to gray	5
14.	Limestone, dark gray, very fine-grained; black platy chert; weathers light tan to gray	2
13.	Calcilutite, dove gray; medium-bedded; a few wavy partings; birdseyes; weathers light tan to dark gray	10
12.	Limestone, dark gray, very fine-grained; thin-bedded; birdseyes; weathers light tan to dark gray	2
11.	Calcilutite, medium gray; massive except near base, which is thin-bedded; a few stylolites; pyrite; a few wavy partings; birdseyes; weathers light tan to dark gray	12
10.	Calcilutite, medium to dark gray; massive; tan to gray, very fine-grained, thin-bedded limestone near base; wavy partings in places; weathers light tan to dark gray	8
9.	Calcilutite, medium to dark gray; massive; tan, very fine-grained limestone near base and top; fossiliferous, with abundant gastropods; birdseyes; pyrite; weathers yellow to medium gray	16
8.	Calcilutite, medium gray; tan, very fine-grained limestone near top; dark gray, very fine-grained limestone near base; wavy partings and a few gastropods near top; nodular in middle; weathers yellow to medium gray	3
7.	Calcilutite, medium gray; wavy partings; scattered platy chert; weathers light to dark gray	6
6.	Calcilutite, medium gray; wavy partings; birdseyes; pyrite; 4 deeply weathered zones of calcareous shale	4
5.	Limestone, dolomitic, argillaceous, tan, very fine-grained; massive; weathers yellow to gray	1
4.	Shale, calcareous, orange; deeply weathered	1
3.	Calcilutite, partly dolomitic, tan to gray; birdseyes; wavy partings; detrital limestone pebbles; weathers yellow to tan to gray	2
2.	Calcilutite, dolomitic, tan; slightly argillaceous; birdseyes; a few gastropods; weathers yellow to gray	3
1.	Calcilutite, medium to dark gray; slightly nodular; birdseyes; detrital chert fragments; a few stylolites; wavy partings; scattered platy chert; *Tetradium;* a few gastropods; weathers medium gray	3
	Sharp contact	
	Beekmantown Dolomite	

Geologic Section 20

Middle Ordovician limestones southeast of South Buffalo Creek and State Road 611 1¾ miles south of junction with State Road 612; 3½ miles southwest of Murat: strike N.15-40°E.; dip 15-25°S.E.

	Thickness Feet
Edinburg Formation (Liberty Hall facies)	
Botetourt Limestone (20 feet)	
11. Limestone, light gray to orange, coarse- to very coarse-grained; abundant fossils; weathers gray to rusty	5
10. Limestone, medium gray, medium- to coarse-grained; slightly argillaceous and nodular; abundant fossils; weathers gray to tan to rusty	15
Lincolnshire Limestone (295 feet)	
Rockbridge facies (85 feet)	
9. Limestone, dark gray, very fine- to fine-grained; nodular in places; scattered chert nodules; weathers gray to tan; partly covered	45
8. Limestone, medium gray, medium- to coarse-grained; fossiliferous; weathers tannish gray; partly covered	40
Murat facies (75 feet)	
7. Limestone, light to medium gray, very coarse-grained; abundant fossils; weathers tannish gray	75
Whistle Creek Member (135 feet)	
6. Limestone, light to medium gray, medium- to coarse-grained; slightly nodular; platy chert except near top; fossiliferous; weathers tannish gray	35
5. Limestone, medium gray, fine- to medium-grained; scattered platy chert; fossiliferous; nodular in places; weathers tannish gray	90
4. Limestone, medium gray, very fine- to fine-grained; slightly argillaceous and nodular; abundant tan to black platy chert; weathers tannish gray	10
New Market Limestone (upper 80 feet)	
3. Calcilutite, dove gray; birdseyes; weathers light gray	25
2. Calcilutite, dove gray; abundant gray to tan to black platy chert; weathers light gray	35
1. Calcilutite, dove gray, and limestone, dark gray, very fine-grained; scattered platy chert; weathers light gray	20
Covered interval	

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