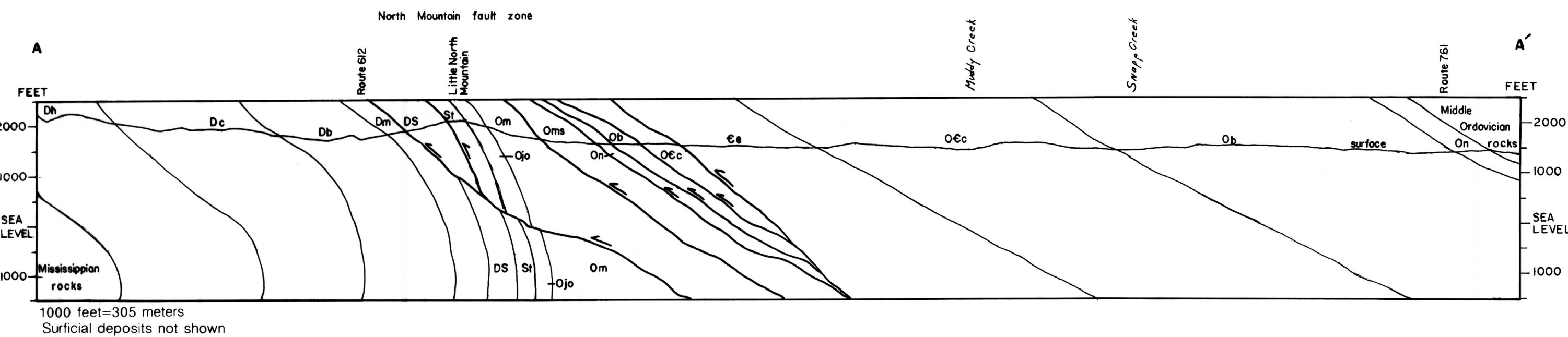
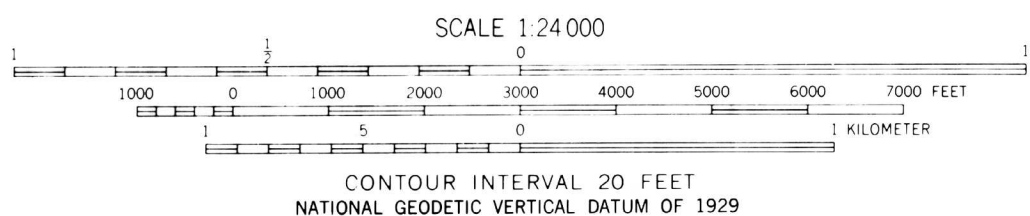
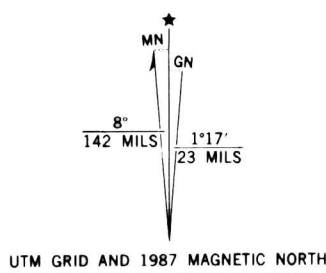


Topography by photogrammetric methods from aerial photographs taken 1965. Field checked 1967.
Polyconic projection. 10,000-foot grid ticks based on Virginia coordinate system, north zone.
1000-meter Universal Transverse Mercator grid ticks zone 17.
1927 North American Datum.



DESCRIPTION OF MAP UNITS

- Qa** Alluvium (Holocene and Pleistocene?)—Clay, silt, and lesser amounts of sand with minor angular to subrounded clasts as much as 4 inches in diameter, derived from local bedrock. May be as much as 10 ft thick along Muddy Creek.
- Dh** Hampshire Formation (Upper Devonian)—Shale, mudstone, siltstone, and sandstone, grayish red, brownish gray, and greenish gray, medium to thick bedded, micaceous and arkosic; unfossiliferous. Brent (1960) reports a thickness of 2,000 ft. Base of unit placed at base of redbeds and at top of highest gray fossiliferous sandstones and shales of the underlying Chemung Formation.
- Dc** Chemung Formation (Upper Devonian)—Interbedded sandstone, siltstone, and minor shale. Sandstone, brownish gray, medium to coarse grained, medium to thick bedded. Siltstone, medium to thick bedded, dominant in lower part of unit. Shale is thinly interbedded with sandstone and siltstone throughout unit. Thickness about 2,000 ft. Base gradational; contact placed at base of medium- to thick-bedded, fossiliferous sandstones. Exposed west of Little North Mountain.
- Db** Brallier Formation (Upper Devonian)—Interbedded shale, siltstone, and sandstone, dark gray to greenish gray, weathers light brownish gray; sandstones more abundant in upper part; thin to medium bedded; sparsely fossiliferous. Thickness about 1,500 ft. Exposed on west side of Little North Mountain and in gap at War Branch.
- Dm** Millboro Shale (Middle Devonian)—Shale, dark gray to black, highly fissile, weathers light gray. Base of unit is faulted out along North Mountain fault zone where 200 to 300 ft is exposed on west side of Little North Mountain and in gap at War Branch.
- Do** Oriskany Sandstone (Lower Devonian)—Sandstone, light gray, weathers yellowish gray, medium to coarse grained, medium to thick bedded. Unit occurs as a fault slice in the North Mountain fault zone. Exposed along War Branch in southwest corner of quadrangle.
- DS** Lower Devonian through Middle Silurian rocks, undivided—Sandstone, siltstone, shale, and limestone; may include Oriskany Sandstone, Helderberg Group, Tonoloway Limestone, Bloomsburg Formation, Keeler Sandstone, and Rose Hill Formation. Individual units may be locally thinned or absent due to faulting. Occurs within the North Mountain fault zone on west slope of Little North Mountain and is poorly exposed.
- St** Tuscarora Quartzite (Lower Silurian)—Quartzite, light to medium gray, medium to coarse grained, thick bedded, some beds conglomeratic. Base placed at base of quartzite ledges along Little North Mountain. Unit is about 300 ft thick; top of unit is probably absent due to faulting. Exposed in Hopkins Gap and along crest of Little North Mountain.
- Ojo** Juniata Formation and Oswego Sandstone, undivided (Upper Ordovician)—Sandstone and shale. Juniata: sandstone, grayish red to brown, fine to coarse grained, thin to medium bedded, shale or mudrock, grayish red. Oswego: sandstone, greenish gray, coarse grained, thick bedded, conglomeratic. Base of unit placed above shale and graywacke sandstone of the underlying Martinsburg Formation. Thickness about 450 ft. Occurs along east slope of Little North Mountain; poorly exposed.
- Om** Martinsburg Formation (Upper and Middle Ordovician)—Graywacke, siltstone, shale, and limestone.
- Oms** Martinsburg Formation, upper part (Upper and Middle Ordovician)—Interbedded shale and lesser graywacke-siltstone and graywacke-sandstone. Shale, medium gray to dark gray and light olive gray, commonly silty, weathers to grayish orange and dark yellowish orange, and generally noncalcareous. Sandstone and siltstone, immature, generally lithic graywacke. Much of unit is absent due to faulting. Occurs along east slope of Little North Mountain within the North Mountain fault zone.
- Oe** Edinburg Formation (Middle Ordovician)—Limestone and shale. Limestone, laminated and very thin bedded to thin bedded, very fine grained, medium gray to grayish black, argillaceous, and weathers olive gray, and grayish orange to dark yellowish orange. Shale, medium gray to medium dark gray, and calcareous. Member includes rocks previously called Oranda Formation and several hundred feet of rock previously included within the lower part of the Martinsburg Formation (Epstein and others, in press). Top and bottom of unit absent due to faulting. Exposed along east slope of Little North Mountain within North Mountain fault zone.
- OOb** Beekmantown Formation (Middle and Lower Ordovician)—Dolostone, limestone, and chert. Dolostone and dololaminite, medium to light gray, buff to light weathering, fine grained, medium to thick bedded with sparse white and light-gray chert nodules. Limestone, bluish gray, medium gray, and dark gray, fine to medium grained, thin to medium bedded, and fossiliferous. Limestone beds also contain intraformational conglomerates, algal bioherms, bioclastic zones, and burrow mottling. Light-gray residual chert occurs in the middle part of Beekmantown outcrop belt and forms hills and ridges such as Green Hill, Hopkins Ridge, and Round Hill. Gathright and Frischmann (1986) divided the Beekmantown into an informal lower dolomite unit, middle limestone and dolomite unit, upper dolomite unit, and upper limestone and dolomite unit. Lithologies within the middle and upper limestone and dolomite units are interbedded and cyclic. Base of unit placed above highest sandstone or limestone of the Conococheague Limestone. Thickness about 3,000 ft. Unit also exposed within North Mountain fault zone.
- OEc** Conococheague Limestone (Lower Ordovician and Upper Cambrian)—Interbedded limestone, dolostone, dololaminite, and sandstone. Limestone, medium gray, fine grained, thin to medium bedded. Dolostone and dololaminite, light gray, fine grained, medium bedded. Sandstone, light gray to tan, reddish weathering, medium to coarse grained, and calcareous. Limestone lithologies include intraformational conglomerates, algal bioherms, ribbon-rock, and oolites. Lithologies occur as carbonate cycles. Lower part of formation consists of gray to tan, reddish weathering, coarse-grained, dolomitic sandstone. Sandstone beds also occur in the upper part of the formation. Base of unit placed below lowest dolomitic sandstone bed. Thickness about 2,500 ft. Upper part of unit well exposed in Joes Creek, northeast of Singers Glen. Also occurs within North Mountain fault zone.
- Ce** Elbrook Formation (Upper and Middle Cambrian)—Interbedded limestone, dolostone, and shale. Limestone, medium gray, fine to medium grained, thin to medium bedded. Dolostone, light to medium gray, fine grained, medium bedded, and yellowish weathering. Shale, dolomitic, gray, and yellowish weathering. Limestone contains algal bioherms, intraformational conglomerates, and dolomite burrow mottling. Formation is lowest stratigraphic unit exposed and forms the hanging wall of the North Mountain fault zone. Base of unit not exposed.

INTRODUCTION

The Muddy Creek drainage basin occurs in the southern part of the Singers Glen quadrangle and mostly includes Cambrian and Ordovician carbonate rocks of the Shenandoah Valley of the Valley and Ridge province. A small part of the basin includes Silurian and Devonian clastic rocks west of Little North Mountain. Thin deposits of unconsolidated alluvium occur along Muddy Creek and its tributaries. The sedimentary rocks were folded and thrust faulted during the late Paleozoic Alleghanian orogeny. The major geologic structure in the area is the North Mountain fault zone, a zone of thrust faults that generally imbricates Cambrian through Devonian rocks. The Shenandoah Valley generally is gently to moderately rolling with low relief, whereas the area underlain by middle Paleozoic strata west of Little North Mountain consists of a series of ridges and valleys with higher relief. Sinkholes, caves, and springs are fairly common in the carbonate rocks of the Shenandoah Valley.

The geology of this area was previously mapped by Brent (1960) at a scale 1:62,500. The adjoining Bridgewater and Harrisonburg quadrangles to the south and southeast, respectively, were mapped by Gathright and Frischmann (1986) at a scale of 1:24,000. The current mapping was undertaken as part of the National Water Quality Assessment Program (NAWQA) study of the Muddy Creek drainage basin.

GEOLOGY

Approximately 11,000 ft of Middle Cambrian to Upper Devonian sedimentary rocks are exposed in the mapped area and Jurassic diabase dikes occur to the northeast of the Muddy Creek drainage basin. Rocks from the Middle Cambrian Elbrook Formation through the Middle Ordovician Edinburg Formation are dominated by limestone and dolostone, whereas rocks from the Middle and Upper Ordovician Martinsburg Formation through the Upper Devonian Hampshire Formation are siltstone, sandstone, shale, and minor limestone. The Cambrian and Ordovician carbonate rocks underlie the Shenandoah Valley, and Silurian and Devonian clastic rocks occur in the Valley and Ridge province along and west of Little North Mountain. Little North Mountain is held up by the resistant Tuscarora Quartzite.

The Shenandoah Valley and the area west of Little North Mountain are separated by the North Mountain fault zone which extends from central Virginia to south-central Pennsylvania. This fault zone is made up of many fault slivers of older rock units thrust over younger rock units. In this area, the footwall is Devonian rocks of the overturned southeast limb of the West Mountain syncline (Brent, 1960), and the hanging wall is southeast-dipping Cambrian and Ordovician carbonate rocks. The width of the fault zone is as much as 1 mile and contains fault slivers of various Cambrian(?), Ordovician, Silurian, and Devonian rocks (see cross section A-A'). Rocks within the North Mountain fault zone on the southeast side are generally upright, whereas rocks within the northwest side of the fault zone are generally overturned. The change in bedding orientation occurs within the highly deformed Martinsburg Formation. The change from upright to overturned rocks suggests that the North Mountain fault zone developed as a fault-propagation fold. Lower and Middle Ordovician carbonate rocks were derived from the upright limb of an anticline on the southeast side of the fault zone, and Upper Ordovician and Silurian rocks from the overturned limb of an adjacent syncline.

The carbonate rocks exhibit three dominant sets of joints that trend approximately N.65°E., N.5°W., and N.45°W. (fig. 1), but local joints exhibit various orientations.

REFERENCES CITED

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- Gathright, T.M., II, and Frischmann, P.S., 1986, Geology of the Harrisonburg and Bridgewater quadrangles, Virginia: Virginia Division of Mineral Resources Publication 60, 21 p.

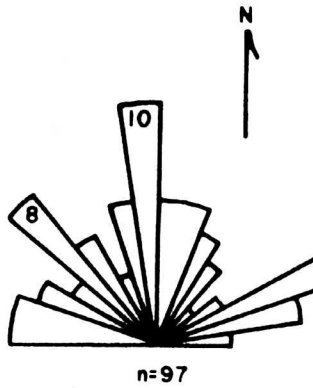


Figure 1. Rose diagram of 97 joint measurements from carbonate rocks of the Shenandoah Valley part of the Muddy Creek drainage basin.

EXPLANATION OF MAP SYMBOLS

- CONTACT—Dashed where approximately located; dotted where concealed
- THRUST FAULT—Dashed where approximately located; dotted where concealed; sawtooth on upper plate
- PLANAR FEATURES
- Strike and dip of bedding
- Inclined
- Overturned
- Strike and dip of cleavage
- Strike and dip of joints
- Inclined
- Vertical
- OTHER FEATURES
- Jurassic diabase float
- Cave entrance
- Sinkhole
- Large sinkhole; greater than 10 ft deep
- Small depression; less than 10 ft deep
- Spring
- Muddy Creek drainage basin divide

CORRELATION OF MAP UNITS

Qa	Holocene and Pleistocene(?)	Quaternary
Dh		
Dc	Upper	
Db		
Dm	Middle	Devonian
Do		
DS	Lower	
St	Upper and Middle	Silurian
Ojo	Lower	
Om	Upper	
Oms		
Oe		
OI	Middle	Ordovician
On		
Ob	Lower	
OOb		
OEc	Upper	Cambrian
Ce	Middle	

by

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