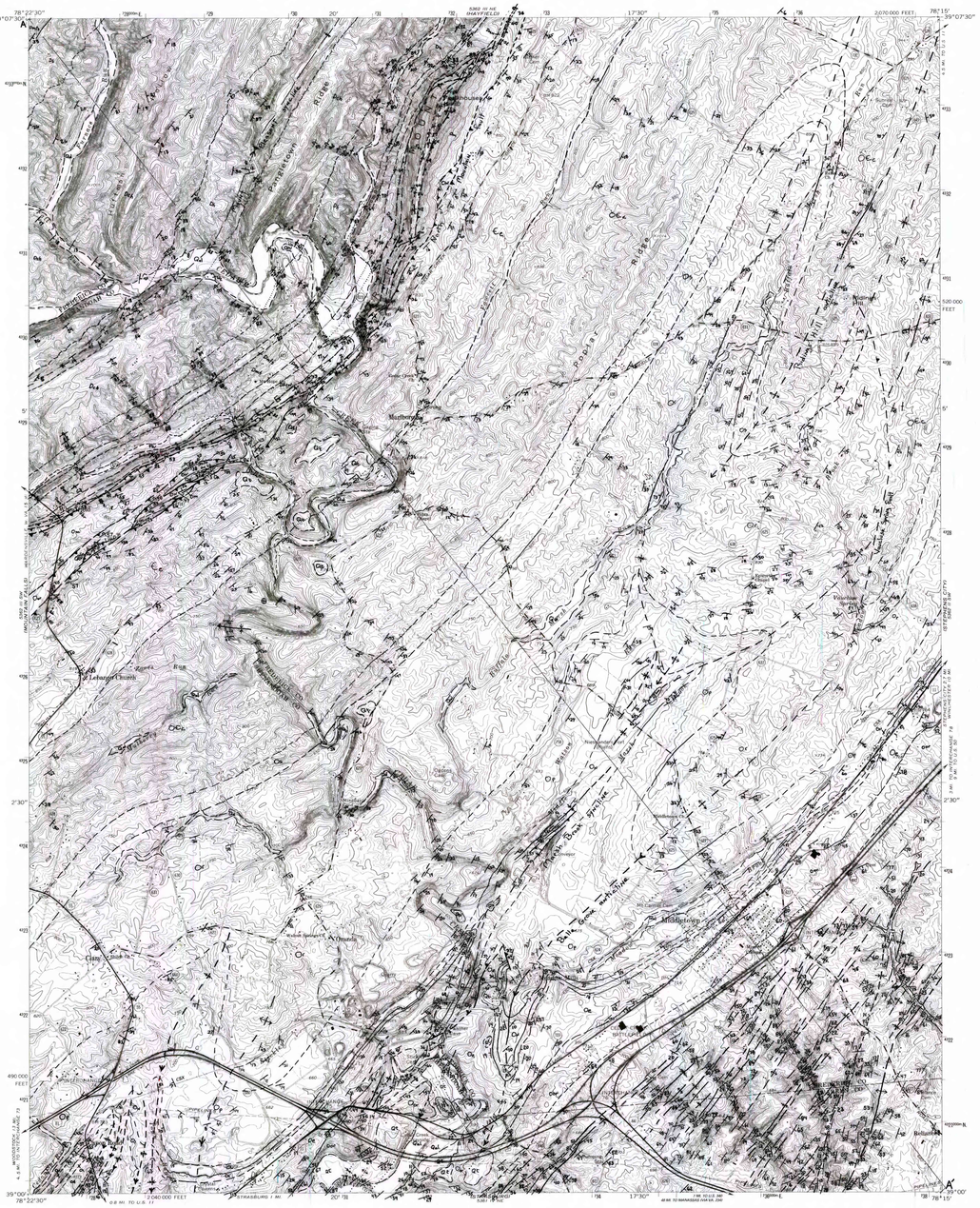
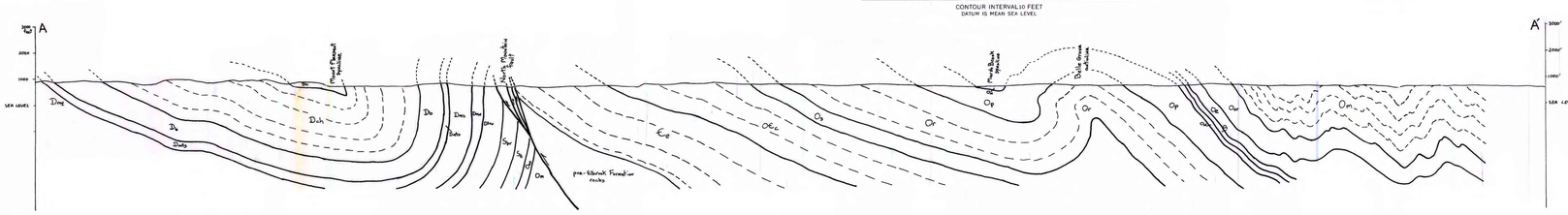


SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION



DESCRIPTION OF MAP UNITS

Qal **Alluvium and floodplain deposits** (Holocene and Pleistocene?)--Clay, silt, and lesser sand with angular to subrounded clasts, up to boulder size, derived from surrounding bedrock. May include tires, beer cans, and other articles of human derivation. In the Martinsburg terrane, consists of well-bedded to crudely-bedded, planar-bedded, light-olive-gray, yellowish-gray, and pale-yellowish-orange to dark-yellowish-orange clayey silt, with weathered shale fragments as much as several cms long; generally not more than 1.5 m (5 ft) thick.

Qt **Terrace deposits** (Pleistocene? and Tertiary?)--Deeply weathered, grayish-orange silt matrix containing leached, generally rounded cobbles as much as 20 cm (8 in) long of reddish-brown and white sandstone, probably derived from rocks of Silurian and Devonian age. Locally as much as 15 m (50 ft) or more thick.

Dh **Hampshire Formation** (Upper Devonian)--Shale, mudstone, siltstone, and minor sandstone, grayish-red to brownish gray, medium to thick bedded, in part micaceous or arkosic; unfossiliferous. Thickness ranges from 0 to about 230 m (750 ft); upper part of formation not present. Exposed along axis of Mount Pleasant syncline in northwestern corner of quadrangle. Base of unit placed at top of highest gray fossiliferous sandstones and shales of the underlying Chemung Formation below redbeds.

Dch **Chemung Formation** (Upper Devonian)--Sandstone, siltstone, and minor shale, interbedded. Sandstone, brownish gray, medium to coarse grained, medium to thick bedded, in part crossbedded, some beds conglomeratic; most abundant in upper part of unit; many beds very fossiliferous. Siltstone, medium to thick bedded, dominant in lower part of unit. Shale is thinly interbedded with sandstone and siltstone throughout section. Interbedded brownish-red sandstones and shales, in beds or sets 1 to 12 m (3 to 40 ft) thick, occur mainly in upper part of unit. Thickness about 760 m (2,500 ft). Exposed along flanks of Mount Pleasant syncline in northwestern corner of quadrangle. Base gradational; contact placed at base of medium- to thick-bedded, fossiliferous sandstones.

Db **Brallier Formation** (Upper Devonian)--Shale, siltstone, and sandstone, interbedded, dark gray to greenish gray, weathr.: light brownish gray; grain size increases irregularly upward in section, sandstones more abundant in upper part; thin- to medium-bedded; sparsely fossiliferous. Thickness ranges from 305 to 457 m (1,000 to 1,500 ft). Exposed along flanks of Mount Pleasant syncline in northwestern part of quadrangle. Base of unit placed at top of thick sandstone unit.

Dmt **Mahantango Formation** (Middle Devonian)--Mudstone, sandstone,and shale; mudstone, dark gray to olive gray, hackly weathering, locally very fossiliferous; bedding obscure; spheroidal weathering common. Sandstone, medium gray, fine grained, medium to thick bedded, commonly massive, locally fossiliferous; in two units at top of formation, separated by mudstone; upper unit 12 to 18 m (40 to 60 ft) thick, lower unit 6 to 12 m (20 to 40 ft) thick; sandstones generally form double ridges; mapped separately (Dmts). Exposed on northwest flank of Little North Mountain and in extreme northwestern corner of quadrangle. Base gradational; placed at base of olive-gray beds.

Dmn **Marcellus Shale and Needmore Shale, undivided** (Middle and Lower Devonian)--Shale, dark gray to black, highly fissile, with interbeds of dark-gray, argillaceous limestone or calcareous shale (Marcellus Shale), grading downward into dark greenish-gray to olive-gray, fossiliferous shale and mudstone (Needmore Shale). Marcellus, about 15 to 150 m (50 to 500 ft) thick; Needmore, 0 to about 6 m (20 ft) thick; base of section locally missing as a result of faulting. Exposed along northwest flank of Little North Mountain. Base placed at top of sandstone or limestone of underlying unit.

DSrw **Ridgeley Sandstone, Helderberg Group, Tonoloway Limestone, and Wills Creek Formation, undivided** (Lower Devonian and Upper Silurian)--Sandstone, limestone, and minor shale and chert. Sandstone, light gray to yellowish gray, fine to coarse grained, medium to thick bedded, locally crossbedded, conglomeratic; locally calcareous, friable when weathered; commonly contains molds of shells; occurs at top of unit (Ridgeley Sandstone) and as sparse interbeds in carbonate units below. Limestone, medium to dark gray, fine grained, fossiliferous, upper part generally nodular bedded, with white chert nodules and lenses near top; lower part argillaceous or laminated. Shale, reddish brown, greenish gray, and gray; occurs as thin interbeds, especially in lower part of unit. Unit highly faulted, locally absent; where present, consists of incomplete sections of formations. Ridgeley, 0 to about 6 m (15 ft) thick; Helderberg, including Licking Creek, New Scotland, and Keyser Limestones, 0 to about 90 m (300 ft) thick; Tonoloway Limestone and Wills Creek Formation, 0 to about 115 m (375 ft) thick. Occurs along northwest flank of Little North Mountain; best exposures in Baldwin Gap and gap of Turkey Run. Base of unit placed at top of underlying red sandstone.

Sbr **Bloomsburg Formation, Keefer Sandstone, and Rose Hill Formation, undivided** (Upper, Middle, and Lower Silurian)--Sandstone, quartzite, and shale. Sandstone, reddish brown to grayish red and gray, fine to medium grained, thin to thick bedded; in upper and lower parts of unit (Bloomsburg and Rose Hill Formations). Quartzite, light gray, fine to medium grained, massive (Keefer Sandstone). Shale, gray, greenish gray, and reddish brown (Bloomsburg and Rose Hill), in lower part of unit and as interbeds in upper part. Exposed in gaps and on northwest slopes of Little North Mountain. Unit highly faulted, formations only partially present or locally absent; 0 to about 150 m (500 ft) thick. Base of unit placed at base of red sandstone beds overlying massive quartzite ledges.

St **Tuscarora Quartzite** (Lower Silurian)--Quartzite, light to medium gray, medium to coarse grained, thick bedded, some beds conglomeratic; parts or all of formation locally removed by faulting, unit 0 to about 120 m (400 ft) thick. Exposed in gaps and along crest of Little North Mountain. Base placed at base of quartzite ledges.

Oos **Oswego Sandstone** (Upper Ordovician)--Sandstone and conglomerate. Sandstone, greenish gray, coarse grained, thick bedded, conglomeratic; conglomerate, interbedded with sandstone, composed of rounded clasts of chert and sandstone as much as 10 cm (4 in) long in a sandstone matrix. Occurs as small fault slices along Little North Mountain; best exposed on northeast end of Funkhouser Knob, where it is about 6 m (20 ft) thick.

Om **Martinsburg Formation** (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, although calcareous intervals in the lower part of the formation; form intervals which may be more than 1.25 m (4 ft) thick; commonly interrupted by thin to thick beds of graywacke siltstone or sandstone. Sandstone and siltstone, immature (generally lithic graywacke, although some contain significant feldspar), commonly graded (fining upwards), lenticular, very fine to fine grained, slightly calcareous to noncalcareous, medium gray on fresh surfaces,and weather grayish orange. Thicker bedded upwards; may reach 3.5 m (12 ft) in thickness towards the top; many beds amalgamated. Many small-scale crossbeds. Comprise less than 10 percent of the formation. Graywacke is more abundant and thicker bedded higher in the section (approximately 2,000 ft above the base of the Martinsburg) where they form conspicuous ribs in creek beds and may comprise as much as 30 percent of some intervals that are several hundred feet thick. The thicker beds are generally graded and display characteristics of complete bouma cycles, although c-e bouma cycles appear to be most abundant. A few load casts. Approximately 800 m (2,600 ft) thick in quadrangle, but may be as much as 1,585 m (5,200 ft) in this part of the Shenandoah Valley.

Oor **Oranda*** **Formation** (Middle Ordovician)--Redefined herein to include all rocks above the highest knobby-weathering limestone of the Edinburg Formation up to and including all rocks containing platy limestones interbedded with shales just below the shales of the lowest part of the Martinsburg Formation. Limestone, laminated and very thin bedded to thin bedded, very fine grained, medium gray to grayish black, argillaceous, commonly micro-graded, and weathers olive gray, and grayish orange to dark yellowish orange. Shale, medium gray to medium dark gray, and calcareous. Several thin beds of metabentonite. Contact with the Martinsburg is transitional--limestones become less abundant upwards. A few thin beds of graywacke, siltstone and very-fine-grained sandstone, generally less than 5 cm (2 in) thick, are found near the top. The graywackes are more abundant upwards. The calcareous shale averages 48 percent carbonate (range 45-53 percent) and the limestones average 74 percent (range 65-85 percent). As redefined here the Oranda is many times thicker than the original definition and includes several hundred feet of rock previously included within the Martinsburg Formation. It may be as much as 275 m (900 ft) thick.

Oe **Edinburg Formation** (Middle Ordovician)--Interbedded limestone and calcareous shale. Limestone, medium to medium dark gray, thin to thick bedded, knobby weathering and irregularly bedded, fine to medium grained. Calcareous shale, medium dark to very dark gray. About 150 m (500 ft) thick.

Ol **Lincolnshire Limestone** (Middle Ordovician)--Limestone, dark gray to very dark gray, medium to coarse grained, medium bedded with bedded black chert nodules, and medium-gray, coarse-grained, thin-bedded, bioclastic limestone. Thickness ranges from 23 to 32 m (75 to 105 ft). Base of unit is transitional with underlying New Market Limestone; contact is placed at base of first dark-gray, medium-grained limestone above dove-gray, micritic limestone of the New Market. Top of formation transitional with the overlying Edinburg Formation and placed at base of first very-dark-gray, cobbly-weathering, argillaceous limestone or very-dark-gray, shaly limestone or calcareous shale.

On **New Market Limestone** (Middle Ordovician)--Limestone, medium gray and dove gray, light weathering, micritic, thick bedded, and fenestral. Lower 3 m (10 ft) is medium- to light-gray, thin-bedded, dolomitic limestone interbedded with light-gray dololaminite. Thickness ranges from 44 to 62 m (144 to 203 ft). Base of unit placed at top of last medium-gray, thick-bedded dolostone of the Pinesburg Station Dolomite. Top of formation placed at first dark-gray, medium-grained, limestone of the Lincolnshire Limestone.

Op **Pinesburg Station Dolomite of the Beekmantown Group** (Middle and Lower Ordovician)--Dolostone and dololaminite, medium to light gray, buff to light weathering, fine grained, medium to thick bedded with minor white and light-gray chert nodules. Weathered surfaces exhibit a "butcher-block" structure. Also contains a few thin, medium-gray, fine-grained limestone beds in the lower part. Thickness ranges from 206 to 287 m (670 to 875 ft). Base of unit placed at base of first light-gray, thick-bedded dolostone overlying the dominantly limestone cycles of the Rockdale Run Formation. Top of formation placed at top of last medium gray, thick-bedded dolostone below thin-bedded, dolomitic limestone of the overlying New Market Limestone.

Or **Rockdale Run Formation of the Beekmantown Group** (Lower Ordovician)--Interbedded limestone and dolostone. Limestone, bluish gray, medium gray, and dark gray, fine to medium grained, thin to medium bedded, and fossiliferous. Dolostone, medium gray, fine to medium grained, medium bedded, and crystalline. Limestone beds also contain intraformational conglomerates, algal formations, bioclastic zones, and burrow mottling. Gray chert nodules common. Lithologies occur as carbonate cycles. Thickness is approximately 460 m (1,500 ft). Base of unit placed at base of first crystalline dolostone or dololaminite bed overlying the dark-gray, thick-bedded limestone of the Stonehenge Limestone. Top of formation placed at first light-gray, thick-bedded dolostone of the overlying Pinesburg Station Dolomite that occurs above the limestone and dolostone cycles of the Rockdale Run.

Os **Stonehenge Limestone of the Beekmantown Group** (Lower Ordovician)--Limestone, dark gray, fine to medium grained, thick bedded, and fossiliferous with crinkly laminations and minor black chert. Also contains algal bioherms, intraformational conglomerates, bioclastic beds, and minor dolostone beds. Thickness ranges from 185 to 200 m (600 to 650 ft). Contact with underlying Conococheague Limestone is gradational, and base of unit placed at first dark-gray limestone with crinkly siliceous laminations and above dolostone that caps the Conococheague carbonate cycles. Top of formation placed at base of first thick, crystalline dolostone or dololaminite bed of the overlying Rockdale Run Formation.

OCc **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 buff, 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 90 m (295 ft), the Big Spring Station Member, consists of gray to buff, reddish weathering, coarse-grained, calcareous sandstone, medium-gray, fine-grained limestone with intraformational conglomerate, and light-gray, fine-grained dolostone. Sandstone beds occur in the Big Spring Station Member in the lower part of the formation and in the upper part of the formation; these sandstones form topographic ridges. Thickness ranges from 670 to 795 m (2,200 to 2,600 ft). Base of unit placed below first calcareous sandstone bed of the Big Spring Station Member above the Elbrook Formation. Top of formation is gradational with overlying Stonehenge Limestone and placed at base of first dark-gray limestone with crinkly siliceous laminations above the carbonate cycles of the Conococheague.

Ꞓe **Elbrook Formation** (Upper 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 dolomoettled beds. Thickness is at least 700 m (2,300 ft). Formation is lowest unit exposed in quadrangle and occurs on the hanging wall of the North Mountain fault. Top of formation placed at base of first calcareous sandstone of overlying Conococheague Limestone.

*The definition, name, and stratigraphic particulars of the Oranda Formation are tentative and subject to revision pending discussions with geologists of the Virginia Division of Mineral Resources.

CORRELATION OF MAP UNITS

Qal	Holocene	Quaternary
Qt	Pleistocene(?)	Quaternary
Unconformity		
Dh	Upper Devonian	Devonian
Dch	Upper Devonian	Devonian
Db	Upper Devonian	Devonian
Dmts	Middle Devonian	Devonian
Dmt	Middle Devonian	Devonian
Dmn	Lower Devonian	Devonian
DSrw	Upper and Middle Silurian	Silurian
Sbr	Upper and Middle Silurian	Silurian
St	Lower Silurian	Silurian
Oos	Upper Ordovician	Ordovician
Om	Upper Ordovician	Ordovician
Oor	Middle Ordovician	Ordovician
Oe	Middle Ordovician	Ordovician
Ol	Middle Ordovician	Ordovician
On	Middle Ordovician	Ordovician
Op	Lower Ordovician	Ordovician
Or	Lower Ordovician	Ordovician
Os	Lower Ordovician	Ordovician
OCc	Lower Ordovician	Ordovician
Ꞓe	Upper Cambrian	Cambrian

EXPLANATION OF MAP SYMBOLS

CONTACT--Long dashed where approximately located; short dashed where inferred; dotted where concealed

FAULTS--Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where doubtful

Thrust fault--Sawteeth on upper plate.

Strike-slip fault

FOLDS--Shows trace of axial surface and direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed

Anticline

Syncline

Overturned anticline

Overturned syncline

PLANAR FEATURES

Strike and dip of bedding

Inclined

Vertical

Horizontal

Overturned

Strike and dip of slaty cleavage

Inclined

Vertical

PRELIMINARY GEOLOGIC MAP OF THE MIDDLETOWN QUADRANGLE, FREDERICK AND SHENANDOAH COUNTIES, VIRGINIA

by
Randall C. Orndorff, Jack B. Epstein, and Robert C. McDowell

1993

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