BEDROCK GEOLOGY OF THE CLARKSVILLE QUADRANGLE, ALBANY COUNTY, NEW YORK

prepared by
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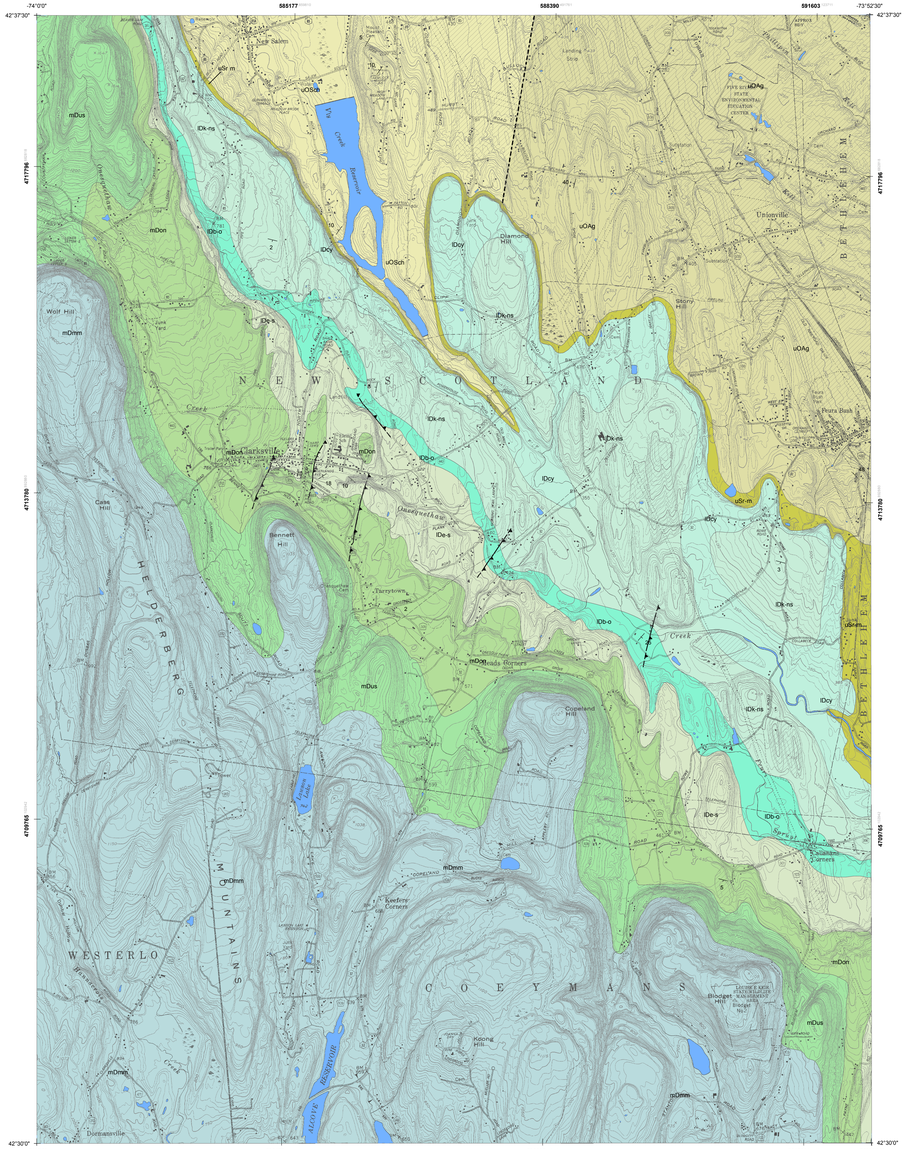

Universal Transverse Mercator, Zone 18 N
North American Datum of 1983

Hydrology, and planimetry layers from the New York State DOT Raster Quadrangle separates for Clarksville 7½ minute quad, DOT edition date 1993, USGS contour date 1953

Topographic map symbols can be found at http://pubs.usgs.gov/gip/TopographicMapSymbols/topomapsymbols.pdf
Magnetic declination from the NOAA online Declination Calculator: http://www.ngdc.noaa.gov/geomag-web/#declination

UTM grid convergence (GN) and 2016 magnetic declination (MN) at center of map

Scale 1:24 000
1 0 1 Miles
1 0.5 0 1 Kilometers
Contour interval 10 feet

'Geologic mapping by T.D. Engel, E.J. Stander, C.A. Ver Straeten 2016
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Bedrock on the Clarksville 7.5 minute quadrangle is represented by diverse sedimentary rocks of Ordovician, Silurian and Devonian age. A total of 14 distinct rock formations stretch across the quadrangle along an overall northwest-southeast trend, with a central belt largely composed of limestone bounded to the northeast and southwest by different-age shale and sandstone belts.

The rock strata on the Clarksville quadrangle formed over a period of approximately 60 million years, extending from approximately 450 to 388 million years before the present (i.e. the Late Ordovician, Late Silurian and Early to Middle Devonian Periods). They were deposited in a relatively shallow marine sea that flooded New York and, at times, much of eastern North America. While some units (such as the Rondout - Manlius sequence) display features indicative of deposition within the range of low to high tide, others suggest a maximum depth of deposition on the order of a few to several hundred feet (e.g., Union Springs Formation). Most strata were deposited in environments similar to the modern continental shelf, from a few to several tens of feet deep. On two occasions, marine waters withdrew from the region for several millions years, leading to the formation of major erosion surfaces ("disconformities"). The longer of these erosional breaks occurs between the Ordovician Schenectady and Austin Glen Formations and overlying Silurian strata; Approximately 30 million years of time is missing at this level. The lesser break occurs at the contact of the Early Devonian Becraft and Oriskany Formations, where approximately 3-5 million years of time is not preserved in the rocks.

Fossil shells of marine life occur in varying abundance and diversity in the rocks on the Clarksville Quadrangle. They are more common in the limestones, and in the Oriskany Sandstone. Common fossils include brachiopod shells and crinoid fragments, with occasional corals, gastropods (snails), cephalopods and rare trilobite pieces. Bivalves are rare except in the in parts of the Mount Marion Formation. The types of fossils present in the rock units provide information about the environments they lived in (including water depth, salinity, and paleoclimate).

Various bedrock units were quarried on the Clarksville Quadrangle in the past. Little to no quarrying occurs today. Small, abandoned quarries occur scattered across the limestone belt. In the past, Clarksville was an important center for quarrying limestone from the Onondaga Formation. It was utilized for Erie Canal locks in the Albany and Schenectady area, and burned in over 50 small, intermittently used lime kilns to produce purer lime (Hogan, 2005). Throughout the nineteenth century, these provided raw materials for many uses, including for manufacturing, tanning, construction mortar and as agricultural lime. Other historic uses included stone blocks for building homes and chimneys and for foundations for homes and barns, bluestone for sidewalks and curbstones, etc. from the high western margin of the quadrangle, and others. Sandy shales and clayey sandstones (Esopus and Mount Marion Formations) were also quarried in places for gravel. No active commercial quarries are found today on the Clarksville Quadrangle.

Previous geological studies on the Clarksville 7.5' quadrangle include Ruedemann (1930), Johnsen (1958) and other sources listed below.

GEOLOGIC UNITS

Quaternary (Q) material

STRATIGRAPHY: UNITS AND THEIR DESCRIPTIONS
MARCELLUS SUBGROUP

In eastern New York, strata sometimes known as the Marcellus "shale" are divided into two formations; a lower Union Springs and an upper Mount Marion Formation; however, recent study appears to indicate that upper strata of the Mount Marion Formation in the Helderbergs may extend into younger strata, correlative with lower part of the Skaneateles Formation of central to western New York. Classic black to dark gray shales, typical of the Marcellus subgroup in central to western New York, only occur in the lower part of the Marcellus strata in eastern New York (Bakoven Member of the Union Springs Formation). In the Mount Marion Formation, initial thin calcareous strata are succeeded vertically by dark gray shales, siltstones and sandstones, with an overall increase in sandstone upward.

mDmm **MOUNT MARION FORMATION** (mDmm; = upper part of the Marcellus subgroup)

Dark-gray to gray shales and mudstones, and gray to brown siltstones and sandstones, with a few thin shaly to sandy limestones to calcareous sandstones (Hurley and Cherry Valley Members) at the base. Marine fossils often occur in distinct layers separated by thick intervals of non-fossiliferous strata. Overall, the percentage of sand in the rocks increases upward through the formation. Up to at least 1200 feet of the formation occurs in the southwest corner of the Clarksville quadrangle; additional higher marine strata occur on the adjacent Westerlo and Greenville quadrangles. The Mount Marion Formation represents intermediate depth to shallow marine environments (from perhaps a few hundred feet at most, to the shoreline at sea level).

Five members of the Mount Marion Formation occur on the Clarksville quadrangle. From low to high, they are the Hurley, Cherry Valley, East Berne, Otsego and unnamed upper members.

Hurley and Cherry Valley Members: Across the Clarksville Quadrangle, limestone- +/- shale-dominated facies characteristic of these members from the Altamont Quadrangle to Livingston County in western New York begins to change. Increasing mud to sand content begins to convert these units from limestone-rich to siliciclastic-dominated strata. Black chert found locally in the Hurley Member. Outcrops include a ravine on the northeast face of Wolf Hill, above Clarksville South Road south of Clarksville, and on Blodgett Hill.

East Berne Member, Dark-gray shale and mudstone, with minor thin sandstone beds through the member and a thick sandstone at the top. Member marked by distinct basal and top contacts. The former is commonly marked by a small falls over the Cherry Valley Member; the relatively thick capping sandstone also forms a falls in some ravines. This is visible in the northwest part of the quadrangle in a ravine off the northeast face of Wolf Hill, where the East Berne Member is approximately 325 feet thick. Near the south edge of the quadrangle the top of the capping sandstone is also found on the north side of New York Rte. 32, just west of its intersection with New York Rte. 143.

Otsego Member, Shale and sandstone, with an overall increase in the percent sandstone upward through the member. Around East Berne to the west (Westerlo Quadrangle) the base of the Otsego Member is marked by a distinct, three foot thick, relatively fossiliferous bed with rugose ("horn") corals, brachiopods and other fauna (Hallan Hill Bed of Ver Straeten, 1994). On the Clarksville Quadrangle, the coral bed is poorly developed. Its position is marked by the top of the prominent sandstone at the top of the East Berne Member. The top of the Otsego Member is not known on the Clarksville Quadrangle.

Unnamed upper member, Undifferentiated sandstone-dominated strata. These strata are found in the hilltops at the southwest corner of the quadrangle (e.g., Koong Hill, and along Clarksville South Road).

mDus **UNION SPRINGS FORMATION (mDus: = lower part of Marcellus subgroup)**

Dominantly black to dark-gray shales and mudstones, with some thin impure limestone layers, grading in upper strata to buff-colored calcareous shales and siltstones. Strata are generally non-fossiliferous to poorly fossiliferous, with straight and coiled cephalopods, very small conical shells (styliolinids, dacryoconarids), and some small brachiopods and bivalves. The base of the Union Springs Formation, at the contact with the underlying Onondaga Limestone, was not found on the quadrangle. The Union Springs Formation totals approximately 130 feet thick on the Clarksville Quadrangle. Black shales of the Bakoven Member were deposited in deeper, poorly oxygenated environments, perhaps a couple to few hundred feet deep. Shallowing in the upper part of the Union Springs Formation led to deposition of the Stony Hollow Member.

Two members of the Union Springs Formation are found on the Clarksville quadrangle; a lower Bakoven Member and an upper Stony Hollow Member.

Stony Hollow Member: Buff-colored, resistant calcareous shales and siltstones, sometimes with more calcareous concretions. The cap of the Stony Hollow sometimes forms a distinct ledge in stream beds, below the ledge of the Cherry Valley Member. Often laminated to burrowed in texture, the unit is generally non- to poorly fossiliferous, with the exception of a thin fossiliferous unit below the siltstone cap of the unit (= "lower proetid bed" of Griffing and Ver Straeten, 1991). The unit thins across the quadrangle, as the Stony Hollow lithology changes laterally into dark gray shales and mudstones due to facies changes.

Bakaven Member: Organic-rich black to dark-gray shales and mudstones, with thin; minor limestone beds and limestone concretions. Generally non-fossiliferous to poorly fossiliferous; fossils consist largely of shelled animals that lived up in the water column, not on the sea floor (e.g., straight and coiled cephalopods, and styliolinids/dacryoconarids). The Bakoven Member is approximately 240 feet (73 meters) thick at the north edge of the quadrangle.

mDon **ONONDAGA FORMATION (mDon)**

Light-colored, fossiliferous, coarse- to fine-grained limestones (grainstones, packstones and wackestones), with chert in some intervals. The relatively hard, resistant limestones of the Onondaga Formation commonly form ledges and sometimes cliffs and escarpments. The limestone does, however, dissolve in weak, natural acids, forming some of the best examples of caves and karst in the area (e.g., Clarksville Cave). The Onondaga Limestone forms a broad northwest-southeast band across the of the Clarksville quad. It is overlain by black shales of the Union Springs Formation (Bakoven Member). In the field and on a LiDAR image, the top of the Onondaga forms an often broad flat, sometimes also marked by sinkholes. The base of the formation is indicated by limestone directly overlying fossiliferous sandstone of the Schoharie Formation.

A nearly complete but deformed section of the Onondaga Limestone is found along Onesquethaw Creek along the south edge of Clarksville. In the northwest corner of the quad, the unit is approximately 110 feet thick (33.5 meters; Oliver, 1956). Locally, mapping indicated about 100 feet (30.5 meters), with thinning or thickening across the quadrangle associated with structural folds and faults.

Chert (sometimes called "flint") is common in some intervals of the Onondaga Formation, absent in others. It occurs as layers or irregularly-shaped nodules. In lower parts of the formation the chert is light gray, but dark gray in upper strata. Three members of the Onondaga (Edgecliff, Nedrow and Moorehouse Members, low to high) occur in the Helderbergs region, but are not distinguished on the map. Common corals in basal limestones locally developed into a reef mounds with abundant corals; two of these are found on the Altamont Quadrangle to the northwest. Thin clay layers at some levels are the altered remnants of volcanic ash, erupted from Middle Devonian volcanoes in the Appalachians. One of these altered volcanic ash layers in the upper Onondaga Limestone, absent at the top of the Onondaga Limestone in the Helderbergs, has been dated at 390.0 +/- 0.5 million years old (Roden et al., 1990). Sediments of the Onondaga Formation were deposited in a variety of water depths in a shallow sea (e.g., mid-ramp to shoal type environments), similar to depths found on today's mid-continental shelf to a shallow shoal, where day-to-day waves crash against the sea floor.

IDk-s **ESOPUS AND SCHOHARIE FORMATION (IDs-s)**

On the Clarksville quadrangle, the Esopus and Schoharie formations (below and above, respectively) are mapped as one unit. The two units total approximately 145 feet (44 meters) in the vicinity of Clarksville. On the Altamont quadrangle to the northwest, the combined thickness of the two formations is approximately 120 feet thick (37 meters) at sites where the strata do not appear strongly deformed.

Schoharie Formation. Clayey sandstones, calcareous but sometimes siliceous shales and highly fossiliferous sandstones characterize the Schoharie Formation in the Helderbergs. Strata in some intervals are deformed by folds and thrust faults. Along Rte. 85 north of Clarksville, the Schoharie was measured at 22.6 feet (6.9 meters) thick. The contact with the underlying Esopus Formation is marked by the onset of calcareous strata, and gradational disappearance of Zoophycos trace fossils within a few feet of the top of the Esopus. Three members are present (Gumaer Island, Aquetuck and Saugerties, low to high), as found through Greene and Ulster counties. Siliceous shales, bordering on chert, occur in the middle of the lower member. Water depths varied some during deposition of the Schoharie Formation, largely in mid- to inner shelf type settings, but shallowing to sandy, wave-agitated environments at the top of the formation.

Esopus Formation. Clayey siltstones and sandstones, and dark gray shale to mudstones compose most of the Esopus Formation. Minor chert and thin clay layers occur low in the formation. Layering (bedding) is generally difficult to distinguish, due to extensive burrowing of the sediment by animals (e.g., worms, clams). In the Onesquethaw Creek gorge along the southeast edge of Clarksville, the Esopus is approximately 120 feet (37 meters) thick. During fieldwork, it was discovered that all three members of the Esopus Formation found in Ulster County are present in the Helderbergs (Spawn Hollow, Quarry Hill and Wiltwyck Members, low to high). Each member is capped by a coarser, resistant sandstone cap. Shelly fossils are rare in the Esopus Formation. Strata are not uncommonly deformed by folds and thrust faults. Up to 15 thin clay layers in lowest strata of the Esopus Formation (Sprout Brook K-bentonites) are the altered remnants of volcanic ash, erupted from Lower Devonian volcanoes in the Appalachians. Two of these altered volcanic ash layers have been dated at 408.3 +/-1.9 million years old (Tucker et al., 1998). Water depths varied some during deposition of the Esopus Formation, in mid- to outer shelf-type environments.

IDb-s **BECRAFT AND ORISKANY FORMATIONS (IDb-o)**

Due to their relatively thin combined thickness, the Becraft Limestone and Oriskany Sandstone are mapped together on the Clarksville Quadrangle. The two formations are separated by an erosional unconformity, formed during a time when the sea retreated from the Helderbergs and beyond, and became land. Roughly 3-5 million years of rocks and time are missing at this "Wallbridge Unconformity" here.

Oriskany Formation. Quartz sandstone, often fossiliferous, and cemented by silica (quartz). On the Clarksville Quad the unit is quickly recognized as a sometimes foot-thick, blocky and high resistant black chert layer. In the thick chert or buff to white quartz sandstone, abundant, large brachiopod shell fossils are visible in some layers; the shells themselves are sometimes dissolved away. In the Helderberg region, the attractiveness of the highly fossiliferous rock has long made it a prized building stone, seen in locally in many fireplaces, chimneys, and other decorative stonework.

The Oriskany Sandstone is a thin unit (measured locally at one to 2.5 feet-(0.3-0.7 meters-thick), often fossiliferous, and very hard and resistant. The top of the Oriskany sometimes forms a wide flat surface across the landscape, where overall, less resistant strata of the overlying lower part of the Esopus Formation was stripped away by glacial ice prior to about 16,000 years ago.

The Oriskany Sandstone is sometimes extensively exposed on the Clarksville quadrangle. Along Lower Flat Rock Road southeast of Clarksville, extensive outcrops are visible in the bed of Onesquethaw Creek. The Oriskany ranges from one to perhaps three feet in thickness on the Clarksville Quad. On the adjacent Altamont quadrangle the thickness of the Oriskany Sandstone varied, between one and four feet (1.2 to 0.3 meters). The Oriskany Sandstone unconformably overlies older strata of the Alsen or Becraft Limestone Formations, formed during a major drop in sea level and a withdrawal of marine waters from the region for a few to several million years.

Fossils in the formation include numerous brachiopods and other shelly forms of the Oriskany "big brachiopod" fauna. The sandy sediments of the Oriskany Formation were originally deposited in shallow marine, shoal-type environments, where waves contacted the sea floor on a day-to-day basis.

Becraft Formation. Light-colored, relatively coarse-grained limestone, composed largely of complete to broken shell material, chiefly fragments of crinoids. Ruedemann (1930) reported varying thicknesses of 12 to 27 feet across the Clarksville Quadrangle and southwest corner of the Delmar quadrangle to the east. Fieldwork yielded a range approximating 20 feet (6.0 meters). Rickard (1962) reports 12 feet (3.6 meters) of New Scotland at Thacher State Park.

The lower contact of the Becraft Formation with the underlying New Scotland Formation is gradational. The number of different fossil species in the Becraft is much less than in the New Scotland; however, the Becraft is often a relatively pure mass of whole and fragmented fossil shells, unlike the underlying New Scotland Formation. Fossils in the Becraft Formation largely consist of abundant crinoid fragments and several different species of brachiopods. The most diagnostic fossil of the Becraft Limestone, *Aspidocrinus scutelliformis,* is a shallow bowl-like part of a fossil crinoid, typically on the order of 1-2 inches (3-5 cm) across. Similar to the Coeymans Limestone below and the Oriskany Sandstone above, sediments of the Becraft Limestone were deposited in shallow, shoal type environments, where day-to-day waves brushed the sea floor, but also where at times tidal currents moved sediments about.

IDk-ns **KALKBERG AND NEW SCOTLAND FORMATIONS (IDk-ns)**

The Kalkberg and New Scotland formations (lower and higher, respectively) are mapped together on the Clarksville quadrangle, in part because their contact is both gradational and often covered by surficial sediments. On the Clarksville Quadrangle, the two formations total about 130 feet (39.6 meters). At Thacher State Park, on the adjacent Altamont quadrangle to the northwest, Rickard measured about 115 feet (35 meters). Several thin clay layers in the two formations are altered remnants of volcanic ash deposits (Bald Hill K-bentonites), erupted from Lower Devonian volcanoes in the Appalachians. One of these altered volcanic ash layers was dated at 417.6 +/-1.0 million years old (Tucker et al., 1998).

New Scotland Formation. Fine-grained limestones and calcareous shales and mudstones, with occasional chert nodules. Strata are generally thin-bedded; limestones and shales commonly interlayered. Limestones are generally have a high clay content. Strata are often fossiliferous, with relatively high diversity of varied types of fossils. The lower contact of the New Scotland with the underlying Kalkberg is gradational; the New Scotland is distinguished from the latter by overall more shaly strata, finer-grained limestones, and a more diverse group of fossils. The contact of the New Scotland with the overlying Becraft Limestone is also gradational. Upper New Scotland strata are less muddy, and the limestone layers become thicker and coarser-grained upward, appearing increasingly like the Becraft Limestone above. The most complete exposures of the formation occur along Onesquethaw Creek southeast of Clarksville. Fossils in the New Scotland (over 100 species reported in the region) include diverse brachiopods, along with bryozoans, corals, gastropods, and other fossils including rare trilobites. Rickard (1962) reports 66 feet (20 meters) for the New Scotland Formation at Thacher State Park. At Thacher Park, the unit is locally deformed by folds and thrust faults. Faults and folds were also noted on the Clarksville Quadrangle. The mix of lime/shell and mud sediments of the New Scotland were deposited in deep ramp-type environments, roughly similar to environments on the mid- to outer continental shelf.

Kalkberg Formation. Fossiliferous, medium-grained limestones, with coarser- and finer-grained beds and minor shale/mudstone. Thin- to medium-bedded layering. On fresh surfaces, the Kalkberg Limestone appears darker gray than the underlying Coeymans Limestone, but often weathers to a buff-tan color. Some dark gray chert also present, generally as nodules. The lower contact with the Coeymans Formation is somewhat gradational, indicated by a change to finer-grained strata and more diverse and abundant fossils. Interbedded limestone and shale also denote lower strata of the Kalkberg; this is less notable through the mid to upper part of the formation. Fossils in the Kalkberg Limestone include various brachiopods, bryozoans, and small rugose corals. Rickard (1962) reports 49 feet (15 meters) for the Kalkberg Limestone at on the Altamont quadrangle to the northwest. The Kalkberg Formation was originally deposited in shallow ramp environments similar to the inner continental shelf.

IDcy **COEYMANS FORMATION (IDcy)**

Dark bluish-gray to light gray, coarse-grained limestones (grainstones to packstones). Thick to massive-bedded, with poorly developed layering. The Coeymans Limestone commonly forms a very resistant ledge, best seen capping the cliffs along the Helderberg Escarpment at John Boyd Thacher State Park. It also forms ledges and waterfalls across the Clarksville quadrangle. The lower contact with the Manlius Limestone is marked by a change to coarser-grained limestone from underlying fine-grained limestone or rubbly-appearing chaotically layered stromatoporoid (sponge) reefs; the contact often appears erosional. An easily accessible outcrop of the lower contact and lower to middle Coeymans is found along NY Route 443 at the bottom of the valley two miles east of Clarksville. The Coeymans Formation is relatively fossiliferous, including common crinoid fragments, with brachiopods and scattered mound-like colonial "honeycomb" corals (*Favosites helderbergiae).* The brachiopod *Gypidula coeymanensis* is an index fossil for the Coeymans Limestone; it does, however, also extend up into lower strata of the Kalkberg Formation above. Rickard (1962) reported 37 feet (11.2 meters) of Coeymans Limestone at Thacher Park, to the northwest; approximately 34 feet (10.7 meters) was found on the Clarksville quadrangle. Coeymans strata were originally deposited in 'shoal"-type environments, where day-to-day waves continually impacted against the sea floor.

EARLY DEVONIAN — *MIDDLE DEVONIAN* — *QUATERNARY*

LATE ORDOVICIAN — *LATE SILURIAN*

oSm **MANLIUS AND RONDOUT FORMATIONS (uSrm)**

Limestones and dolostones, with minor shales, formed in shallow tidal to supratidal environments. These two units are mapped together, as the Rondout Formation at the bottom is only a few feet thick to perhaps locally absent across the quadrangle.

Manlius Formation

Generally light gray-colored, fine-grained limestones (micrite, wackestone), with buff to yellow weathering dolostone intervals, and irregular reef layers of stromatoporoid sponges. The Manlius Formation forms the bulk of the lower portion of the Helderberg escarpment cliffs, well seen along the Indian Ladder Trail at Thacher State Park. The thinly-laminated dolostones are most notable in the recessed "upper bear path" in the cliffs at Thacher State Park. No complete section of the Manlius Limestone was measured on the Clarksville quadrangle. On the Clarksville Quadrangle, the Manlius Formation is approximately 50 feet (15.2 meters) thick. On the Altamont Quadrangle to the northwest, the Manlius Limestone is 52 feet (15.8 meters) thick at Thacher State Park (Rickard, 1962).

The Manlius Formation was deposited in tidal environments on the margin of the Late Silurian seaway, between just above to a little below low tides. Stromatoporoid reefs, indicated by chaotic-appearing layering in the middle to upper Manlius Formation, formed in shallow depths slightly below low tide.

Rondout Formation, Chrysler Member. Non-fossiliferous, fine-grained, blue to yellowish-brown dolostone, limestone and shale, a few feet in thickness to apparently absent across the Clarksville Quadrangle. On the eastern edge of the Altamont Quadrangle to the northwest, the Rondout Formation is 5 feet (1.5 meters) thick (Rickard 1962). The Chrysler Member was chiefly deposited in supratidal environments, just above high tides.

SCHENECTADY AND AUSTIN GLEN FORMATIONS (uOsc-ag)

Interlayered sandstones and shales comprise these two units across the Clarksville Quadrangle. The strata are time-equivalent: they were deposited laterally at the same time. The feature that distinguished them is the absence versus presence of structural deformation (folded and faulted strata in the Schenectady versus Austin Glen, respectively. The boundary between the two units is denoted by an approximately north-south line across the upper central portion of the map, based on outlined in Vollmer (1980), Plesch (1994) and Kidd et al. (1995). Across the broader Capital District, both the Schenectady and Austin Glen Formations are tremendously thick.

uOsch **Schenectady Formation**

Sandstones and black to gray sandy to clay-rich shales, thin to massive layered, and commonly interbedded. The proportion of sandstone to shale varies vertically through the formation. Goldring (1935) estimated 1800 to 2000 feet (548 to 610 meters) for the Schenectady Formation on the adjacent Altamont quadrangle, succeeded by 410 feet (125 meters) of strata assigned to the "Indian Ladder Beds", for a total of up to nearly 2400 feet (731 meters). Goldring, however, only reported the Indian Ladder Beds on the Altamont Quadrangle, to the east of this map. Fossils are rarely found, overall. The Schenectady Formation is interpreted to represent relatively deep water, foreland basin turbidite slope-type environments.

uOAg **Austin Glen Formation**

Sandstones and black to gray sandy to clay-rich shales, thin to massive layered, and commonly interbedded. Similar to the Schenectady Formation, except that they often appear structurally deformed. As with the Schenectady Formation, fossils are rarely found in the Austin Glen Formation; it was deposited in relatively deep water, foreland basin turbidite slope-type environments.

GEOLOGIC SYMBOLS

Contact, definite
Contact, inferred
Contact, approximate
Schenectady Formation and Austin Glen Formation Separation
Thrust Fault, definite
Thrust Fault, approximate

QUADRANGLE LOCATION

NOTICE

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OVERVIEW: KARST ON THE GALLUPVILLE QUADRANGLE

Karst is a landform created by the dissolving of the underlying bedrock, generally limestone. Evidence of karst includes the presence of caves, sinkholes, disappearing streams, solutionally-enlarged joints, and springs; and by the general absence of surface streams.

On the Clarksville quadrangle karst is found in the Coeymans, and Manlius Limestones; the Becraft Limestone; and the Onondaga Limestone. The longest caves are found in the Onondaga, but considerable karst is found in all listed limestone units.

The longest known cave on the quadrangle is Onesquethaw Cave, open only by written permission, and about a mile long. Other caves included Clarksville Cave, Diddly Cave, and the Chatter-douse-Hole System.

Many of the major caves are associated with faulting. Much of Clarksville Cave is formed on the strike of a thrust fault. Most of Onesquethaw's passage is associated with the dip of a fault, though about 1200 feet is formed on the fault's strike.

The waters of Onesquethaw Creek sink into limestone in multiple places. At normal flows, there are stretches of the creek that are dry. Clarksville Cave carries an underground segment of the Onesquethaw Creek.

Flowstone deposits from Onesquethaw Cave were dated to about 21,000 years BP. This suggests an age for the last interstadial period during the Wisconsinan glaciation.

OVERVIEW: STRUCTURAL GEOLOGY OF THE CLARKSVILLE QUADRANGLE

Structurally, the Ordovician sedimentary rocks of the Clarksville quadrangle dip relatively steeply E/W, while the overlying Silurian-Devonian strata dip more shallowly from 2-5 degrees to the south-southwest (approximately 160 feet per mile). Toward the eastern margin of the quadrangle, trends shift to a more north-south oriented strike, with steeper dips to the west, approaching orientations and dip angles characteristic of the Hudson Valley Fold-Thrust belt to the south. The south-southwestern oriented dip on the quadrangle is related to uplift of the Adirondack Dome; the more westward-oriented dip is related to Devonian and/or Carboniferous-Permian stages of the Appalachian Orogen.

Large scale brittle deformational features, such as thrust faults, are common in the vicinity of Clarksville proper, and are particularly well exposed along the Onesquethaw Creek just south of the village center. The majority of thrusts parallel the bedding of the deformed units, while splays originating from the basal thrust frequently interleave adjacent units.

Ductile structures are also present in the map area, particularly in the vicinity of Clarksville. Small scale folds related to thrusting are found along the Onesquethaw just south of the village, while larger, open, upright folds are found along Route 443 just north of Clarksville. These latter folds parallel structure found in the Schenectady beds along the Vly Creek in Delmar, suggesting that both probably developed during the Acadian orogeny.

Small scale fractures, commonly referred to as joints, were observed over the entire quadrangle, and generally share a roughly south-southwest to north-northeast orientation. In the limestone belt, these joints are often solutionally enlarged by slightly acidic surficial waters, leading to the formation of caves and surficial karst features.

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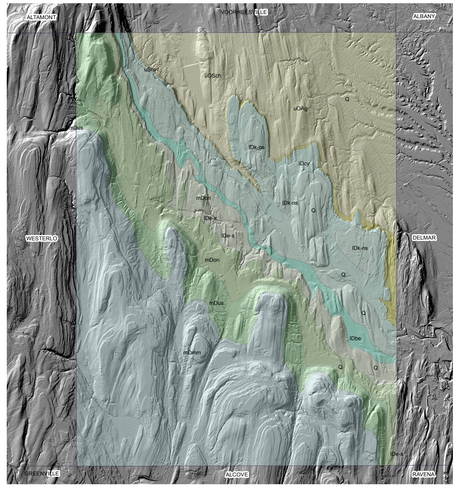
[1] NOTE: Older New York State Museum publications are available as free downloads at http://www.nysm.nysed.gov/publications/bulletin/index.html.

SHADED TERRAIN MAP AND SURROUNDING QUADRANGLES



1:62 500 scale; 2x vertical exaggeration
Shaded relief generated from NYC-CDP LiDAR data and National Elevation Dataset 1/3 arc-second data from the US Geological Survey.

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