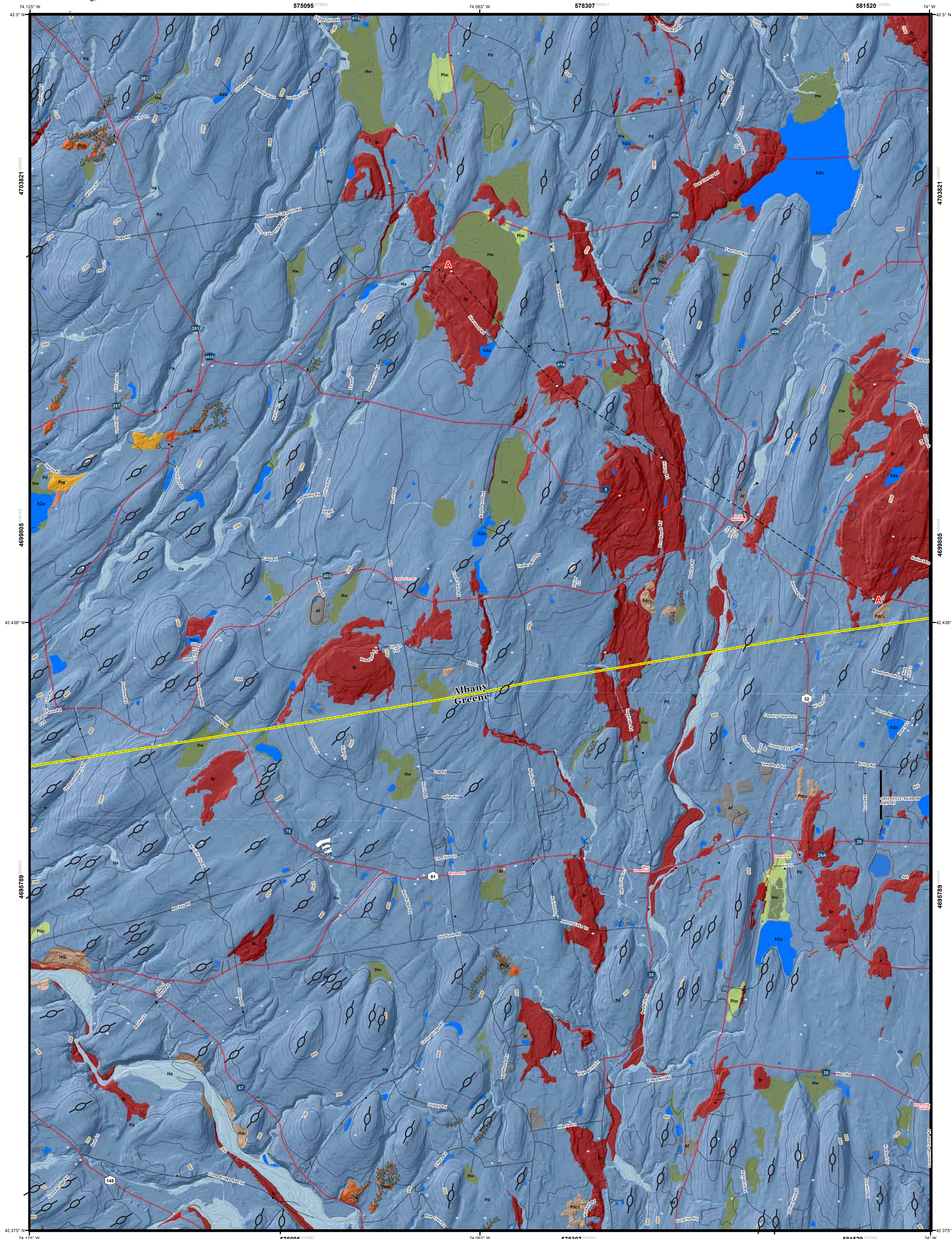
New York State Museum
Mark Schaming, Director

New York State Geological Survey



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

Hygrology, and planimetry layers from the
New York State DOT Raster Quadrangle separates for Albany and Greene Counties
(https://gis.ny.gov/gisdata/inventories/member.cfm?OrganizationID=108).
Geographic data layers from 2021 TIGER/Line shapes for transportation
and hydrograpghy
(https://www.census.gov/cgi-bin/geo/shapefiles/index.php)

Shaded relief from 2008 Capital District 2m, 2009 West Of Hudson
2m and NYS 10m DEM
(http://gis.ny.gov/elevation/index.cfm)

Magnetic declination from the NOAA online Declination Calculator:
http://www.ngdc.noaa.gov/geomag-web/#declination

SCALE 1:24,000

KILOMETERS · METERS · MILES · FEET

CONTOUR INTERVAL: 10 FEET

Geologic mapping by R. Frieman and S. Grasing, 2022
Digital data and cartography,
R. Frieman and K. Backhaus, 2022

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SURFICIAL GEOLOGY OF THE GREENVILLE 7.5-MINUTE QUADRANGLE, ALBANY AND GREENE COUNTIES, NEW YORK

Richard A. Frieman and Sean P. Grasing

2022

SURFICIAL GEOLOGY OF THE GREENVILLE 7.5-MINUTE QUADRANGLE, ALBANY AND GREENE COUNTIES, NEW YORK

prepared by
Richard A. Frieman and Karl J. Backhaus

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National Cooperative Geologic Mapping Program (STATEMAP)

Introduction:
The Greenville 7.5-Minute quadrangle was mapped as part of the 2021 National Cooperative Geologic Mapping Program funded STATEMAP project (award #G21AC10870). This quadrangle is one of eighteen quadrangles being mapped leading to a complete Albany County Surficial Geologic map which shall be mid-2020's. The purpose of this map was to identify and delineate various surficial and geologic materials with the intent that this information can guide municipalities in land use, environmental and natural resource decisions across its roughly 55 square mile area.

The Greenville quadrangle straddles the boundary between Albany and Greene Counties to the north and south, respectively. The Greenville quadrangle is entirely encapsulated in the Catskill Mountains physiographic province. Nearly 35 kilometers separate the center of the Greenville quadrangle from the state's capitol, Albany, NY to the quadrangle's northeast. Basic Creek Reservoir, serving as an auxiliary water supply for Albany, NY, is located in the northeastern corner of the Greenville quadrangle. Basic Creek Reservoir drains to the south into Basic Creek, which flows through South Westerlo, followed by largely rural land until it exits the southern border of the Greenville quadrangle before flowing through Freehold, NY. Greenville, NY lies near the quadrangle's eastern border with the Alcove 7.5-Minute Quadrangle. The Greenville quadrangle also includes a short section of Catskill Creek in its southwestern corner.

The Greenville quadrangle has around 1,159 ft (353m) of elevation change from its highest elevation at 1,607 feet (489 meters) above mean sea level, in a drumlin-concentrated region in the northwest corner of the quadrangle, to the lowest elevation is 448 feet (136 meters) along Catskill Creek.
Bedrock within the Greenville quadrangle has been previous mapped as Middle Devonian-aged strata; Oatka Creek Shale of the Marcellus Formation (Dhmr) dominate the northeast corner in the vicinity of the Basic Creek Reservoir, and the Plattekill and Ashokan Formations (Dhpl) are exposed throughout the remainder of the quadrangle where not concealed by Holocene sediments (Rickard and Fisher, 1970).

The surficial geologic units in this quadrangle were previously mapped at 1:250,000 scale and were reported to be outwash gravels, kame, till, lacustrine silts and clays, and alluvium (Cadwell and Dineen, 1986). Limited mapping has been completed at a higher resolution than that of Cadwell and Dineen, (1986).

Methodology:
To create the surficial geology map of the Greenville quadrangle, preliminary field maps were created using the ESRI ArcMap 10.8 software and consisted of all available topographic data (roads, lidar surface terrain and hydrography) to plot all field data on including field stops, bedrock outcrops and important site information. Surficial soil sampling employed the use of a five-and-a-half-foot hand auger to allow sampling below the variably thick organic soil horizon (below the topsoil). Other field tools used are an entrenching shovel and pick. These tools are used to remove topsoil and/or eroded sediments from outcrops or exposures to expose fresh sediments for analysis. At each field stop, the coordinates (latitude and longitude in decimal degrees) were taken using a Garmin GPSMAP 66sr, descriptive notes on the sediment found, whether a sample and/or a high-resolution, scaled photo were taken, and the time at which the stop was taken were logged into a field notebook (Frieman_22).

At most of the field sampling sites, a soil sample was taken for grain-size analysis. This involves the use of either one or two processes: dry-sieve or wet-sieve analysis. These processes followed the procedure outlined by Bowles (1978), while only using a seven-tiered sieve stack (#5, #10, #18, #35, #60, #120, #230, and Pan) for both dry- (mechanical) and wet- (hydrometer) sieve analysis. The predominantly cohesive (fine-grain dominant) samples were sorted using the wet-sieve analysis, while the cohesionless (coarse-grain dominant) samples were sorted using the dry-sieve analysis.

The final surficial geologic map, cross-section and elevation maps were produced using the ESRI ArcMap and Adobe Illustrator 2020 programs. The cross-sections were created in ArcMap using the XActo Cross-section 10 tool developed by Jennifer Carell, formerly of the Illinois Geologic Survey, and then exporting the cross-section into Adobe Illustrator to connect the stratigraphic units. The surficial geologic map was created by scanning the mylar sheet (GNV_Grasing_Mylar_22) drafted from the geologic field map. Polygons were then produced by digitizing this map in ArcMap and colored according to surficial geologic units found within the quadrangle. The final map was drafted in Adobe Illustrator and exported as a PDF file.

Results:
A total of 72 field stops, including 58 physical samples for grain-size analysis and 16 photographs were complete to map the surficial geology of the Greenville quadrangle. On a few occasions, it was necessary to take multiple, increasingly deep samples at a single location to investigate whether stratigraphy was present. Out of the 72 field stops, 49 were diamicton of various compositions, 11 were bedrock, four were silts and clays, three were sandy clay, two were coarse sand and gravel, and one was sand. The surficial geologic units found within the quadrangle are as follows:

Artificial Fill (Af)
This unit is generally composed of coarse/fine, large cement mounds and/or crushed rock anthropogenically transported and used for construction purposes. This material is used in artificial dams, built to retain water, and large, raised roadbeds for bridges within the quadrangle.

Holocene Alluvium (Ha) and Holocene Wetland Deposits (Hw)
Post glacial sediments occupy the low areas or land depression throughout the quadrangle. Ha is associated with fluvial process in creek valleys throughout the quadrangle. This lithology generally consists of stratified silt, sand, and gravel. Hw is associated with low areas and depressions in the highlands of the quadrangle where wetlands form due to poor drainage. This lithology consists of peat, marl, clay or sand in these areas of poor drainage.

Diamict Colluvium (Hdc)
Unsorted and unstratified deposit of gravel, sand, silt, clay, with boulders/cobbles possible. Described as a mass-wasting deposit at the base of steep hillslopes and cliffs as part of a slump or hillslope failure. Found along river channels where undercutting of the hillslope has occurred under diamict deposits causing rotational failures. Within the Greenville quadrangle, this unit was exclusively mapped along Catskill Creek.

Pleistocene Cobbles to Sand (Pics)
Stratified ice contacted deposits, variable coarse-grained sediment consisting of boulders to sand size particles. May be overlain by flow till. These deposits are typically related to stagnant ice or ice marginal depositional environments. Within the bounds of the Greenville quadrangle, many are found in esker swarms proximal to Catskill Creek, as well as flowing along the western edge of the quadrangle toward Medusa, NY.

Pleistocene Diamicton (Pd)
This unit is a mixture of sediment grains that range from clay to boulders in size. Within the Greenville quadrangle, all diamicton is interpreted to be glacial till, sediment deposited directly beneath the glacier. It is generally matrix supported, clay or sand-dominant, and tan and reddish brown in color. Diamicton is found throughout the quadrangle independent of elevation and underlies much of the other surficial geologic units within the quadrangle. Drumlins are composed of matrix-supported Pleistocene diamicton.

Pleistocene Diamicton (Clast-Supported) (Pdcs)
The unit is an admixture of unsorted sediment ranging from clay to boulders. Generally, clast supported, massive and clast rich. Interpreted as till. Clast-supported Pleistocene diamicton is associate with ice-marginal environments, such as moraines and crevasse fill. Within the bounds of the Greenville quadrangle, Pdcs deposits are sparse and often include massive bedrock boulders which appear to be similar in lithology to the local Plattekill and Ashokan Formations.

Pleistocene Silts and Clays (Plsc)
This unit is characterized by sediments ranging from clay to fine sands, often interpreted as having been deposited in deeper, quiescent lacustrine environments. Plsc often exhibits sedimentary structures such as rhythmites and varves. Plsc within the Greenville quadrangle is found proximal to flat regions bound, in part, by bedrock outcrops, and related to the modern formation of wetlands.

Pleistocene Sand and Gravel (Psg)
Characterized as well-sorted and stratified sand and gravel this unit is interpreted to be deposited by glacial meltwater at or very near the glacier and can be found several meters in elevation higher than the present-day river valley floors. These deposits are found within the bounds of the Greenville quadrangle at or near the termini of esker swarms, particularly along the quadrangle western edge.

Summary and Conclusions:
The Greenville quadrangle lies to the west of the Hudson River and south of the Mohawk River, covering a region fully encapsulated in the Catskill Mountains physiographic region. The topography and surficial geology of this quadrangle is strongly influenced by bedrock; bedrock outcrops constrain the development of creeks and bound wetlands, and shallow bedrock beneath Pleistocene deposits may have influenced the development of drumlins. There are more and larger swaths of bedrock exposure within the eastern half of the quadrangle, and here where it is not exposed at the surface, water well data suggest it is often shallow. Bear Swamp is a well-known example of bedrock control on the deposition of sediments within this region. In the modern, the bedrock acts as a dam, impeding flow of water leading to the development of a large wetland. Livingston coring conducted by the mapping division of the New York State Museum/Geological Survey has uncovered lake deposits underlying modern wetland deposits in Bear Swamp, suggesting that it, and perhaps many others in the region, was a glacial lake/pond following the retreat of the glaciers. Organic remains of Pleistocene flora have been recovered from these Livingston cores, but the radiometric dates of this material have not been established by the time of this publication.

Much of this quadrangle is covered by a veil of matrix-supported diamicton (Pd), interpreted as lodgment till transported at the base of the glaciers. Tills of similar composition are found throughout the many drumlins found distributed throughout the Greenville quadrangle. Drumlins are streamlined linear hills that form in a subglacial environment by flow dynamics at or near the sediment-ice interface and are commonly associated with glacial advances. The length, geometry, and orientation of drumlins preserve information regarding ice flow speed and direction. Typically, longer drumlins suggest faster ice flow than shorter drumlins and their linear orientations align with direction of ice flow. Orientations of drumlins within this quadrangle range regionally from ~N10°E to ~N60°E, generally increasing in inclination from the northeast corner to the western border. This suggests the glaciers advanced across this quadrangle gradually taking on a more westward trajectory.

With the Greenville quadrangle, there are also drumlins and clusters that imply a more complex glacial history. Firstly, there are clusters of drumlins that do not share a common orientation. This can be seen in the northeast corner of the quadrangle near Basic Creek Reservoir, as well as in the southeast in proximity to Basic Creek. In these locations there appear to be two orientation sets: ~N10°E and ~N35°E.

Summary and Conclusions Continued....
Examples of these two orientations are commonly seen in adjacent drumlins. Secondly, a portion of these drumlins, especially in the south-central to southwest display geometries characteristic of palimpsests. A palimpsest is a geomorphological term used to describe glacial features that display evidence of over-writing. These palimpsest drumlins display obscured directionality. Within the scope of this product, this phenomenon can be interpreted in two ways: 1. Drumlins were initially deposited with a ~N10°E orientation and were subsequently smeared as the glacier at that specific location began moving in a different direction 2. The over-writing occurred by a second, distinct glacial advance. Further study of this region is necessary to determine which hypothesis is correct.

The numerous esker swarms and isolated, short eskers record evidence of glacial melting. As meltwater flows through channels beneath the glacier, sediment load is sorted, transported, and deposited in sinuous, sometimes braided features that often terminate in small deltas. These features are characterized by laminated coarse sands and gravels (Pics) as the finer sediments are often washed out and end up being deposited in quiescent basins beyond the terminus of the glacier. Some of these esker swarms are found in proximity to other glacial features, such as deltas (Psg) and kames.

Deltas form when sediments settle out along the shores of larger lake systems. Kames are small, conical features relating to supraglacial melting; water flowing/collecting along the top of a glacier may melt a vertical conduit through the body of the glacier. Water that flows through these vertical shafts then deposit the sediment load upon reaching the confined bottom.

The Greenville quadrangle includes sedimentological/geomorphological evidence of at least one glacial advance, as well as features that preserve a record melting/retreat. Sandy features such as kames and eskers have the potential to be sampled for optical-stimulated luminance (OSL) dating, which will provide a chronographic context for when glacial melting was taking place. This same technique can and will be used for delta deposits but since deltas are exclusively proglacial (occurring in front of the glacier) features, those dates can offer a timeframe from when the glacier had already retreated from portions of this quadrangle. Finally, radiometric carbon dates from Pleistocene flora recovered from isolated lake basins such as Bear Swamp will help complete the chronology of the glacial retreat as they exited the Greenville quadrangle.

References:

Bowles, J.E., 1978, Engineering Properties of Soils and Their Measurement. McGraw Hill Book Company, New York, Second Ed., 213pp.

Cadwell, D.H. and Dineen, R. J., 1986, Surficial Geologic Map of New York, Hudson-Mohawk Sheet, New York State Museum, Map and Chart Series, No. 40.

Rickard, L.V., and Fisher, D.W., 1970, Geologic Map of New York, Finger Lakes Sheet, New York State Museum, Map and Chart Series, No. 15.

DESCRIPTION OF MAP UNITS

Holocene

Af	**Artifical Fill (Af)** Surficial sediment composed of coarse/fine and or crushed rock anthropogenically transported and used for construction purposes.
Ha	**Stratified silt, sand and gravel (Ha)** Sorted and stratified silt, sand, and gravel, deposited by rivers and streams. May include cobbles and boulders. Inferred as post-glacial alluvium and includes modern channel, over-bank and fan deposits
Hw	**Wetland Deposit (Hw)** Peat, muck, marl, silt, clay or sand deposited in association with wetland environments. Various sediments can be present at transitional boundaries from one facies to another
Hdc	**Diamict Colluvium (Hdc)** Unsorted and unstratified deposit of gravel, sand, silt, clay, with boulders/cobbles possible. Described as a mass-wasting deposit at the base of steep hillslopes and cliffs as part of a slump or hillslope failure.

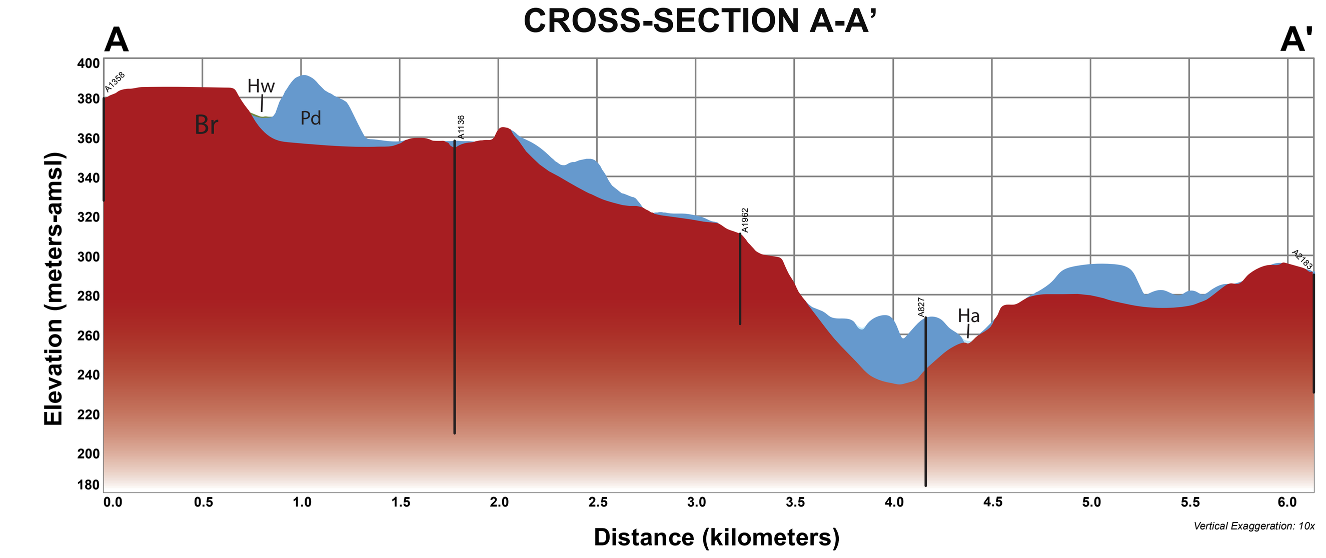
Pleistocene

Plsc	**Silt and Clay (Psc)** Stratified, fine-grained sediment consisting of fine sand, silt and clay size particles. Inferred to be deposited in mid shore to deepwater settings of glacial lakes. May include marl, rythmites, and varves.
Psg	**Stratified sand and gravel (Psg)** Well-sorted and stratified sand and gravel. May include cobbles and boulders. Inferred to be delta, fan or lag deposits in glacial channels or near former ice margins.
Pics	**Cobbles to Sand (Pics)** Stratified ice contacted deposits, variable coarse-grained sediment consisting of boulders to sand size particles. Inferred to be deposited along an ice-margin. May include, interbedded coarse lenses of gravel and clast supported diamictons (flow tills).
Pd	**Diamicton (Pd)** An admixture of unsorted sediment ranging from clay to boulders. Generally matrix supported, massive and clast-rich.
Pdcs	**Diamicton (Pdcs)** An admixture of unsorted sediment ranging from clay to boulders. Generally clast supported, massive and clast-rich.

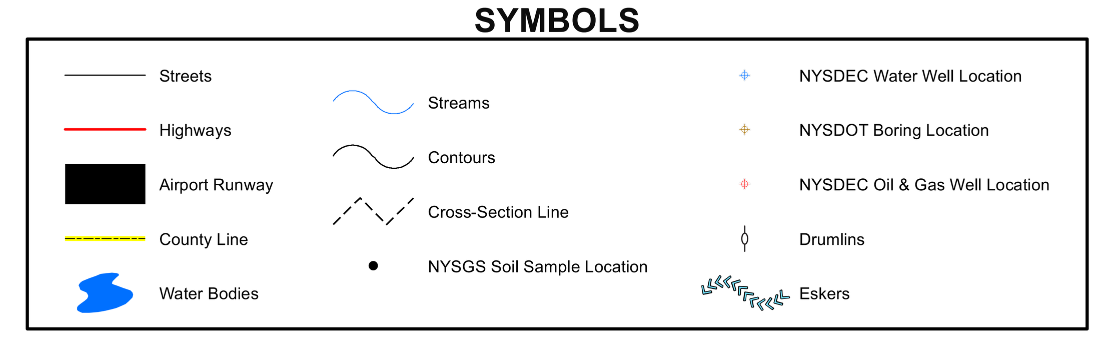
Pre-Pleistocene

Br	**Bedrock (Br)** Non-glacially derived, hard rock, pre-pleistocene in age. May be covered up to a meter in diamicton, sand and gravel, or sand and clay in areas marked as Br.

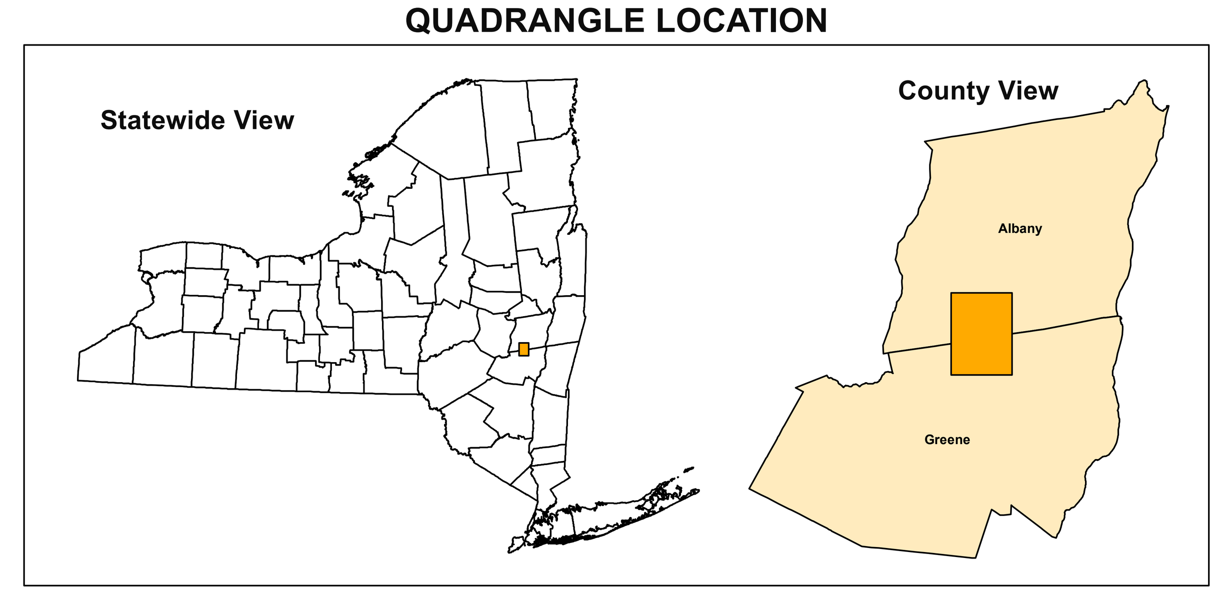
CROSS-SECTION A-A'



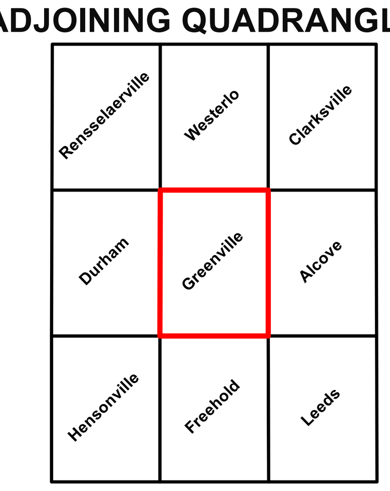
SYMBOLS



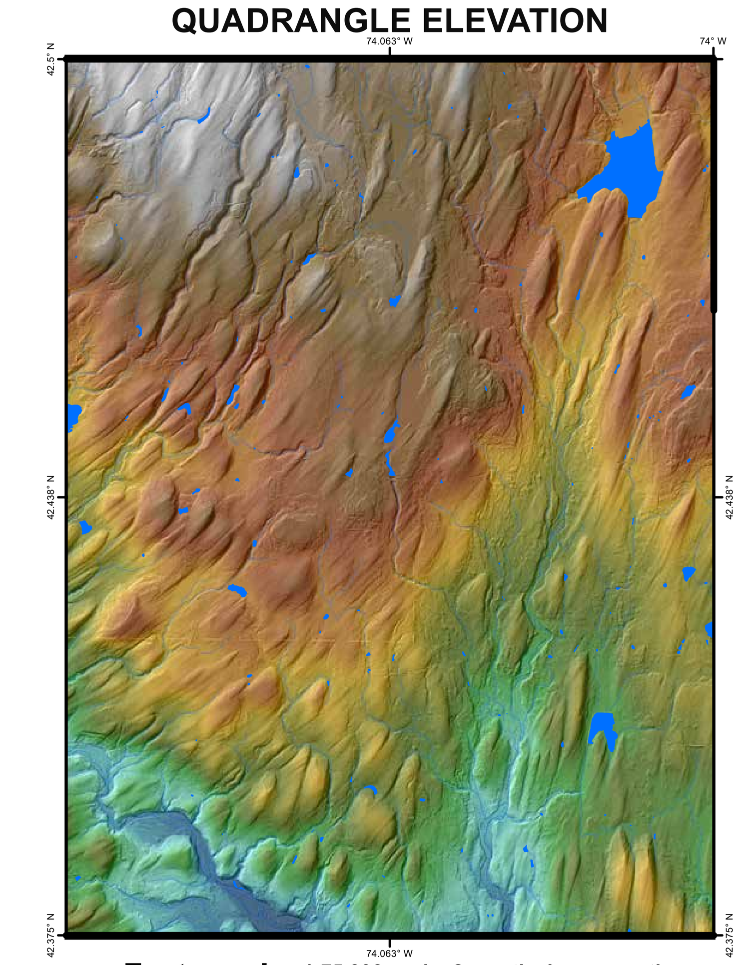
QUADRANGLE LOCATION



ADJOINING QUADRANGLES



QUADRANGLE ELEVATION



1:75,000 scale; 2x vertical exaggeration
Shaded relief generated from 2008 Capital District 2m, 2009 West Of Hudson 2m and NYS 10m lidar data sets.

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