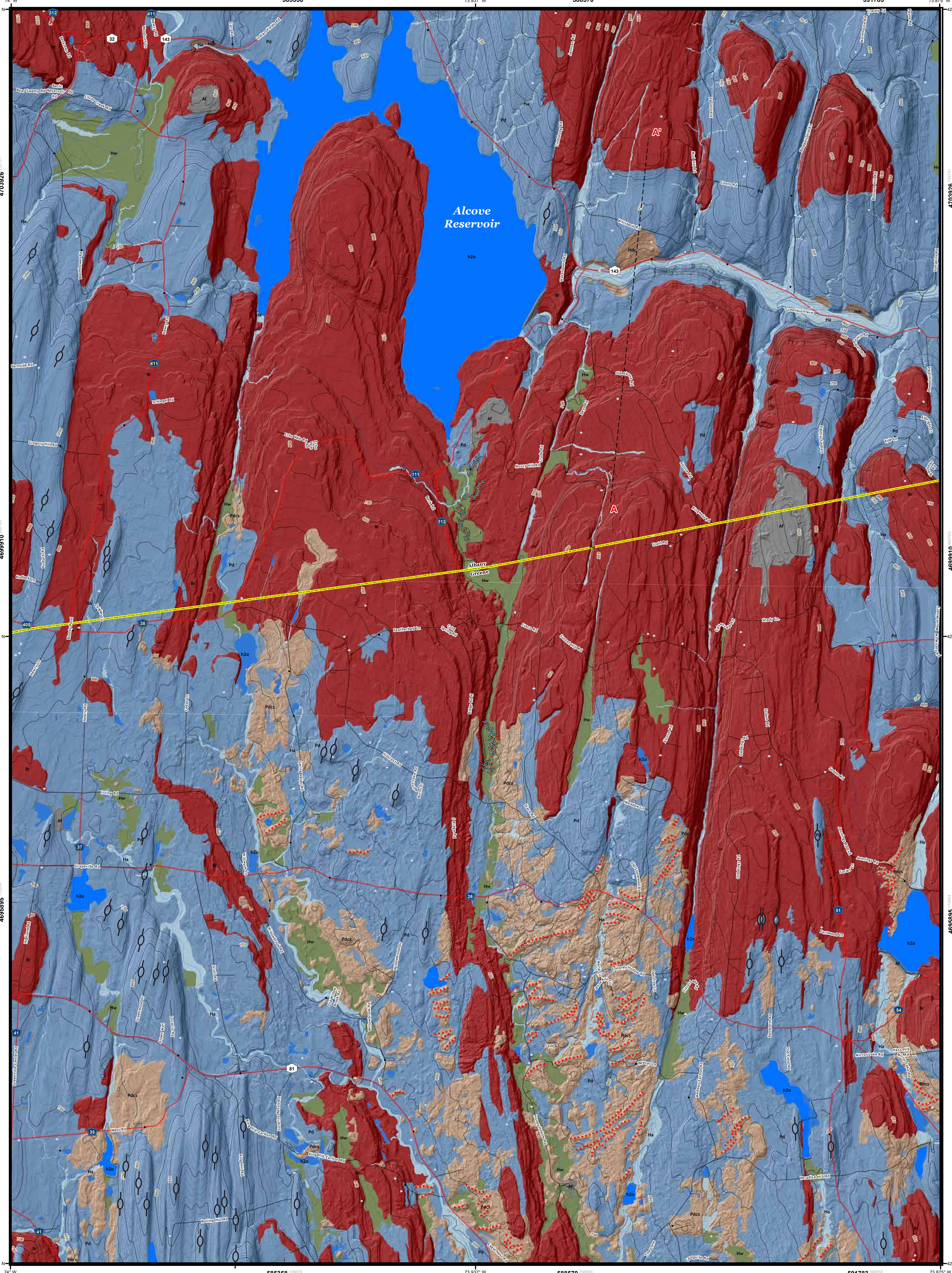

Universal Transverse Mercator, Zone 18 N
North American Datum of 1983

Hygrology, and planimetry layers from the New York State DOT Raster Quadrangle separates for Albany and Greene Counties

Shaded relief from Capital District 2m, West of Hudson 2m and NYS 10m DEM Lidar

Magnetic declination from the NOAA online Declination Calculator

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

SCALE 1:24,000

CONTOUR INTERVAL: 10 FEET

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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

Richard A. Frieman and Sean P. Grasing
2022

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prepared by
Richard A. Frieman and Karl J. Backhaus

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National Cooperative Geologic Mapping Program (STATEMAP)

Introduction:
The Alcove 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 Alcove quadrangle straddles the boundary between Albany and Greene counties to the north and south, respectively. The Alcove quadrangle is entirely encapsulated in the Catskills physiographic province and overlooks the lower elevation Hudson Valley to the east. Less than 20 miles (32 kilometers) separate the center of the Alcove quadrangle from the state's capitol, Albany, New York. Alcove Reservoir, serving as the primary water supply for Albany, NY, is in the northern half of the Alcove Quadrangle. The Alcove Reservoir drains to the southeast into the Hannacrois Creek, which flows through the two most prominent municipalities within the quadrangle: Alcove and Coeymans Hollow, NY.
The highest elevation within the Alcove quadrangle is 1,134 feet (345 meters) above mean sea level at the crest of a drumlin along the western edge of the quadrangle. The lowest elevation is 329 feet (100 meters) above mean sea level in its northeast corner, where the Hannacrois Creek drains toward the Hudson-Mohawk Lowlands physiographic region.

Bedrock within the Alcove quadrangle has been previous mapped as Middle Devonian-aged strata; Oatka Creek Shale of the Marcellus Formation (Dhmr) dominate the regions north of Alcove Reservoir and Hannacrois Creek, 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). Preliminary bedrock strike and dip measurements collected during these surficial geology mapping initiatives suggest the strata north of Hannacrois Creek dip slightly (2-3°) to the north, and the strata south of Hannacrois Creek dip southward at a similar magnitude.

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 (Dineen and Cadwell, 1986). Limited mapping has been completed at a higher resolution than that of Dineen and Cadwell (1986).

Methodology:
To create the surficial geology map of the Alcove 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 (ALC_Frieman_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:
It took 79 field stops, including 43 physical samples for grain-size analysis and 41 that were photographed to complete this surficial geologic map of Alcove 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 79 field stops, 64 were diamicton of various compositions, 12 were bedrock, one was glaciolacustrine silt and clay, one was colluvium, and one was silty fine 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 Alcove quadrangle, this unit was exclusively mapped along Hannacrois 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 Alcove quadrangle, they are found in small, non-continuous esker systems south of Alcove Reservoir and along Grapeville Creek.

Pleistocene Diamicton (Pd)
This unit is a mixture of sediment grains that range from clay to boulders in size. Within the Alcove 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 Alcove quadrangle, Pdcs deposits are almost entirely restricted to its southern half and often includes massive bedrock boulders which appear to be similar in lithology to the local Plattekill and Ashokan Formations.

Summary and Conclusions:
The Alcove quadrangle lies to the west of the Hudson River and south of the Mohawk River, covering a region fully encapsulated in the Catskills Mountains physiographic province. The topography of this quadrangle is strongly influenced by the bedrock promontories that appear along the southern side of the Hannacrois Creek and extend southward, largely unadorned by Pleistocene age sediment deposits, for up to seven kilometers. The most apparent bedrock promontory neatly bisects the Alcove Reservoir. Devonian strata exposed south of Alcove Reservoir and Hannacrois Creek contain long, continuous fractures trending roughly N10°W. Since the retreat of the Hudson Lobe of the Laurentian Ice Sheet, these fractures have become conduits for creeks and subsequent deposition of Holocene alluvium (Ha) or Holocene wetlands (Hw) along lengths where flow is inhibited. The presence of esker systems, comprised of cobble and gravel rich sands (Pics), within the fracture-induced linear depressions, and nowhere else within this quadrangle, suggest that these fractures acted as conduits for subglacial meltwater to flow southward following a hydraulic gradient.

The portion of the Alcove quadrangle to the north of these significant bedrock promontories is characterized by a till shadow (Coates, 1966; Braun, 2006). This feature is most distinct proximal to Hannacrois Creek. Bedrock plateaus north of Hannacrois Creek are bound to the south by a thick deposit of diamicton (Pd) (see cross section A-A'). Water well logs in this region suggest the thickness till deposits immediately south of the bedrock in some cases exceed 130 feet (39.6 meters). Hannacrois Creek is at lower elevation than the bedrock to the north (the "lee" side, facing away from flow), but still overlies 60-78 (18.3 to 23.7m) to feet of alluvium and glacial till before hitting bedrock at depth. Along the creek, large rotational failures (mapped as Holocene diamict colluvium, Hdc) demonstrate the scale of this till deposit. Till continues to thin southward until it pinches out south of the alluvium deposited by Hannacrois Creek, giving way to the large bedrock promontories. Till shadows are not uncommon across New York. Till shadow regions are formed when southward-moving glaciers encounter transverse-to-flow valleys and flow stagnates (Ozsvath, 1985). A stagnated glacier deposits diamicton until the glacier overcomes the elevated bedrock exposure on the south (the "stoss" side, facing toward flow).

Moving southward past the bedrock exposures that dominate the midsection of the quadrangle, the landscape becomes dominated by hummocky terrain. Field mapping has indicated that these mounds and knobs consist of mostly clast-supported diamicton, often including large, angular boulders of similar lithology to the local bedrock. Some of these mounds are irregularly shaped, while many display some sense of linear geometry. The composition and angularity of these boulders emplaced within the diamicton suggest that this till has not been transported far from where they were plucked. These clast-supported diamicton (Pdcs) knobs and linear mounds are interpreted within the bounds of this quadrangle as moraines. Moraines are features deposited at the toe of a stagnated glacier as the ice flow either thrusts sediments to the terminus of the glacier or is deposited by material flowing from atop or within the ice itself. The linear mounds demonstrate episodic glacial retreat; the ice deposited sediments at a local maximum, then retreated to the north and advanced again but did not reach its previous extent before deposited another linear moraine. The knobs may reflect a chaotic ice-marginal environment depositing irregular deposition of lodgment till or irregular moraine features, intermixed with sporadic, roughly north-south oriented crevasse-fill deposits. These moraine deposits are underlain by a blanket of matrix-supported lodgment till that presumably directly overlies bedrock.

Summary and Conclusions Continued...
Throughout the quadrangle, with a notable concentration in the southwest, are drumlins of various lengths. Drumlins are streamlined linear features 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. Within the Alcove quadrangle, drumlins found proximal to the bedrock exposures are typically shorter than the drumlins further to the south and west. This suggests that the ice was slow coming off the bedrock promontories and not particularly conducive to the formation of drumlins. Further to the west and southwest, drumlins are longer and can be seen in dense concentrations. Ice flow is interpreted to have been faster in these regions. Additionally, there seems to be two distinct drumlin orientations: nearly 0 (due north-south) and 10-15 east of north. The more inclined drumlins are most prominent along the western edge of the quadrangle. The two distinct orientations could be a result of a single glacial advance with local differences in flow dynamics, or possibly the result of two distinct advances of different flow directions.

The surficial geology within the Alcove quadrangle tells a story of glacial advance, stagnation, and retreat. The lodgment till blanketing much of the quadrangle and drumlins consisting of similar sedimentology indicate the relative direction and speed of glacial advance across the quadrangle from north to south (or possibly north-northeast to south-southwest). The large swaths of bedrock exposure may have retarded the ice advance regionally. Further from the bedrock exposures, the ice sped up again, depositing long, streamlined drumlins. The till shadow in the north/northeast of the quadrangle demonstrates brief stagnation of the glacial advance due to large changes in the bedrock topography. Within this shadow, a thick package of till was deposited in a pre-existing, transverse-to-flow valley. This valley was reclaimed in the modern by Hannacrois Creek, which is simultaneously eroding the till shadow and depositing alluvial sediments. Finally, the hummocky topography consisting of irregular to linear mounds of clast-supported tills and north-south oriented crevasse fill records the episodic and chaotic melting and retreat of the glacier back to the north of the quadrangle.

This quadrangle may hold information regarding the timing of these events that have yet to be explored. The till shadow was deposited in a pre-existing valley between two bedrock plateaus. Beneath the till, alluvium deposited before the advance of the glaciers may be preserved. Drilling through the till may uncover dateable materials or optically stimulated luminescence (OSL) compatible sand deposits at depth. This would add to the ever-increasing understanding regarding the number of glacial advances and retreats in the northern Catskills and Hudson-Mohawk region.

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DESCRIPTION OF MAP UNITS

Holocene

Af — **Artificial 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

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).

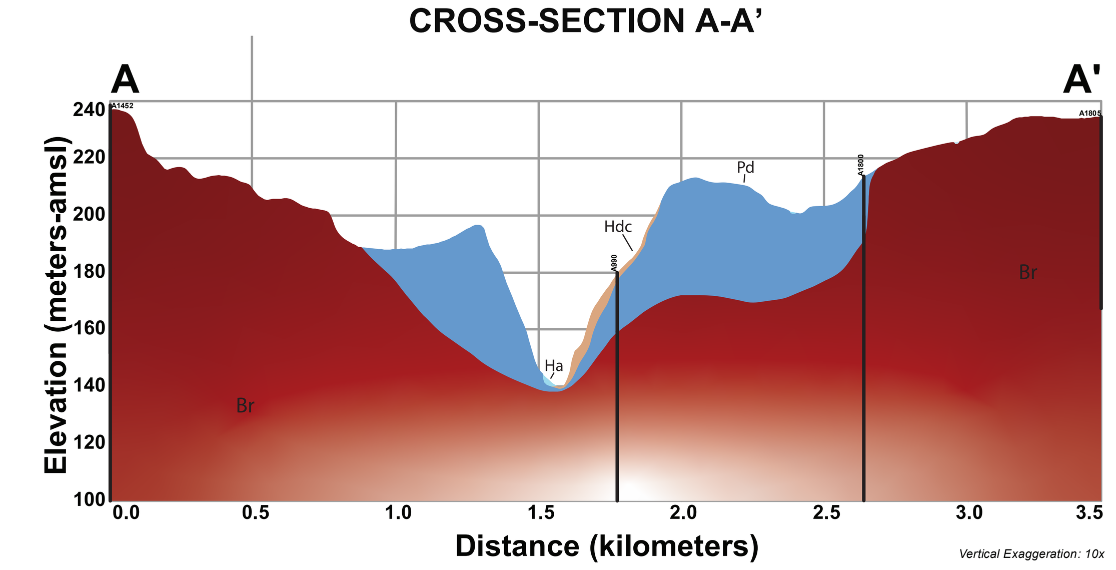
Pd — **Diamicton (Pd)**
An admixture of unsorted sediment ranging from clay to boulders. Generally matrix supported, massive and clast-rich.

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.

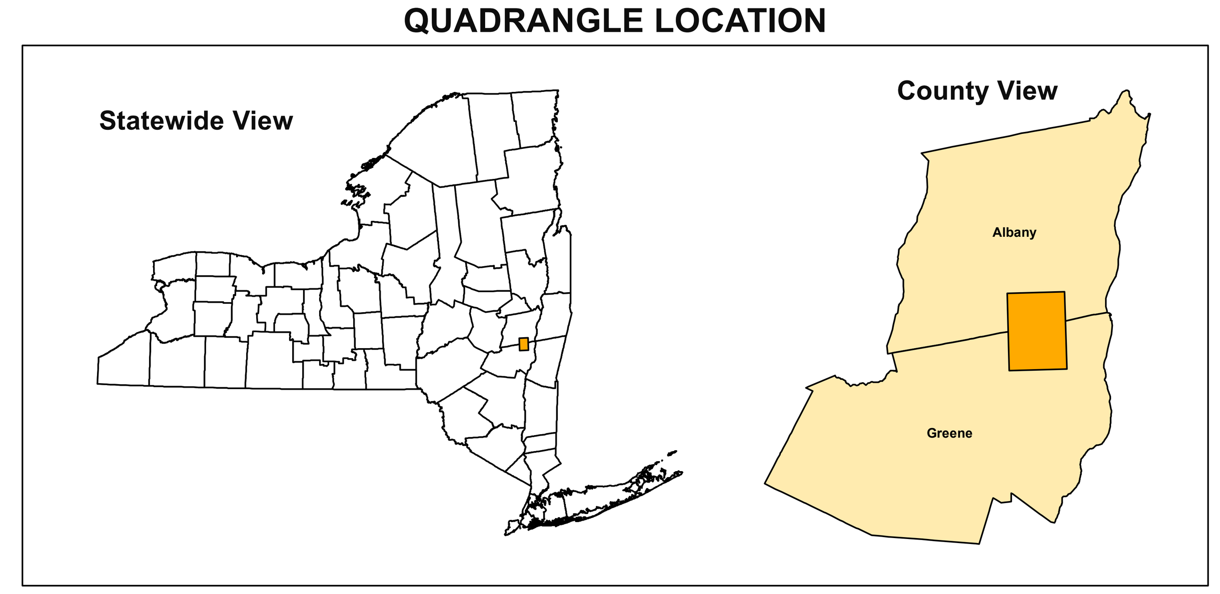
CROSS-SECTION A-A'



SYMBOLS

- Streets
- Highways
- County Line
- Water Bodies
- Streams
- Contours
- Cross-Section Line
- NYSGS Soil Sample Location
- NYSDEC Water Well Location
- Eskers
- Ice Margin

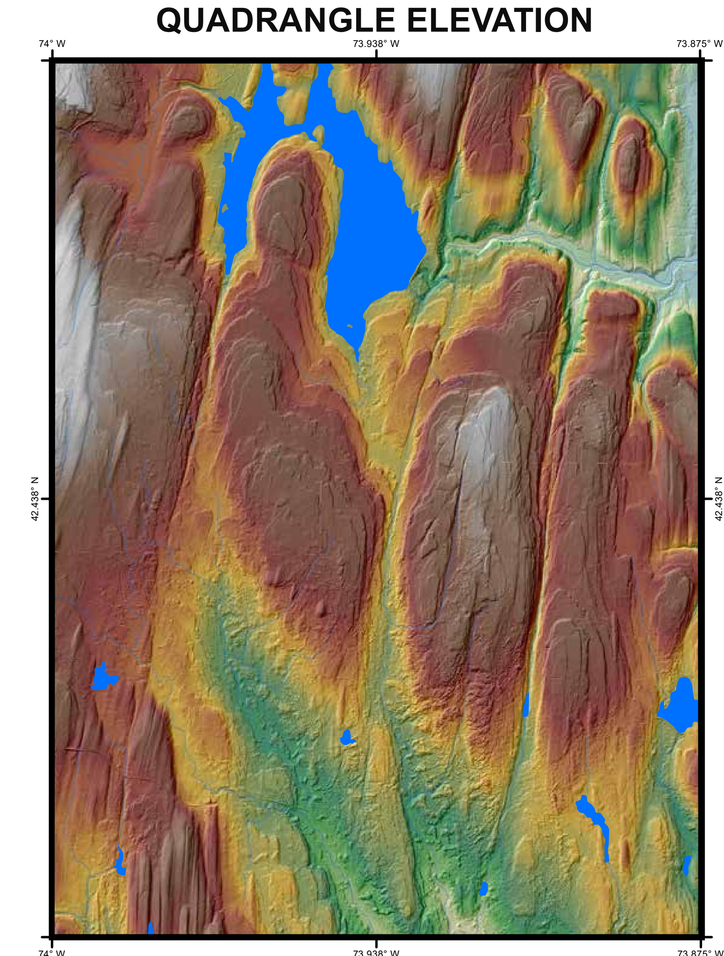
QUADRANGLE LOCATION



ADJOINING QUADRANGLES

Westerlo	Clarksville	Delmar
Greenville	Alcove	Ravena
Freehold	Leeds	Hudson North

QUADRANGLE ELEVATION



1:75,000 scale; 2x vertical exaggeration

Shaded relief generated from 2008 Capital District 2-meter lidar set, the 2007 West of Hudson 2-meter, and the 2000 NYS 10-meter lidar set by the United States Geological Survey.

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