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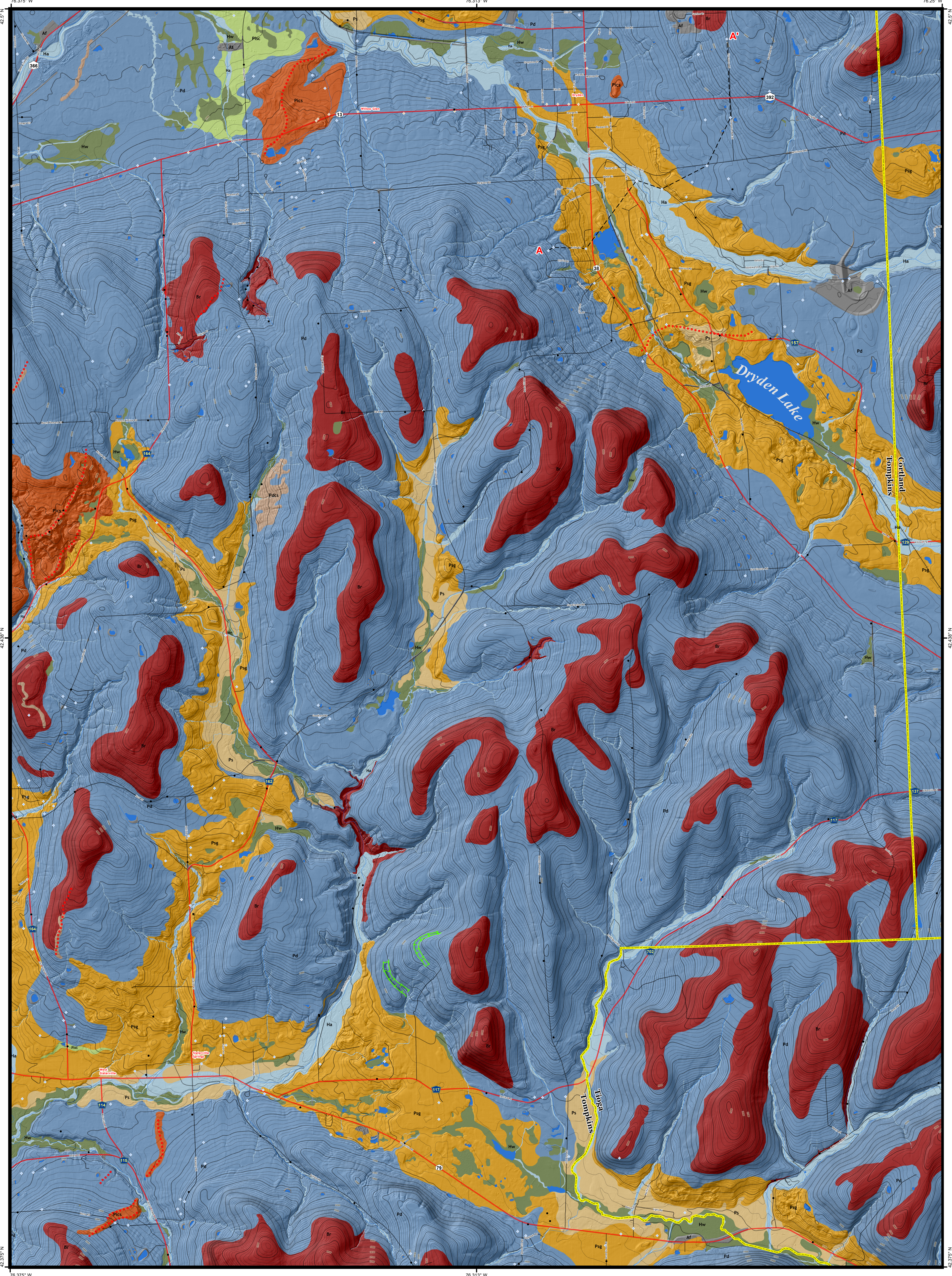


Universal Transverse Mercator, Zone 18 N
North American Datum of 1983

Hydrology, and planimetry layers from the New York State DOT Raster Quadrangle separates for Cortland, Tioga and Tompkins Counties: (https://gis.ny.gov/gisdata/inventories/member.cfm?OrganizationID=108)

Geographic data layers from 2023 TIGER/Line shapes for transportation and hydrography: (https://www.census.gov/cgi-bin/geo/shapefiles/index.php)

Shaded relief from the Central Finger Lakes 2020 and FEMA 2019 1m lidar data sets: (http://gis.ny.gov/elevation/index.cfm)

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

Field map, notes and draft maps available through the NYSGS Open File: (https://www.nysm.nysed.gov/research-collections/geology/collections/open-file)

SCALE 1:24,000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 500 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL: 10 FEET

Geologic mapping by K. Backhaus, A. Kozlowski and J. Leone, 2019
Digital data and cartography, K. Backhaus, 2019

MN GN
12° 2' 214 MILS
0° 53' 16 MILS

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SURFICIAL GEOLOGY OF THE DRYDEN 7.5-MINUTE QUADRANGLE, CORTLAND, TIOGA AND TOMPKINS COUNTIES, NEW YORK

Karl J. Backhaus, Andrew L. Kozlowski and James R. Leone

2019

SURFICIAL GEOLOGY OF THE DRYDEN 7.5-MINUTE QUADRANGLE, CORTLAND, TIOGA AND TOMPKINS COUNTIES, NEW YORK

prepared by
Karl J. Backhaus

Supported in part by the U.S Geological Survey Cooperative Agreement Number G18AC00232
National Cooperative Geologic Mapping Program (STATEMAP)

Introduction:

The Dryden 7.5-Minute Quadrangle was mapped as part of the 2018 National Cooperative Geologic Mapping Program funded STATEMAP project (award #G18AC00232). This quadrangle was one of twelve quadrangles to mapped as part of the Tompkins County Surficial Geologic mapping project currently being undertaken by the NYSGS starting in 2018 and concluding sometime in the early to 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 50 square mile area.

The Dryden quadrangle is in eastern Tompkins County in the Finger Lakes Region of New York State about 15 miles west of Interstate 81. The Town of Dryden, Town of Caroline and Village of West Slaterville are the main municipalities within this quadrangle. This portion of Tompkins County is rural with large tracts of state-owned forest and private rural farmland. The Robinson Hollow, Hammond Hill, Yellow Barn and Dryden Lake State Forests can be found within this quadrangle. This quadrangle is situated within the Alleghany Plateau physiographic province is generally high elevation ridges to the south and west of the Town of Dryden, and flat lying/hummocky topography in the valleys between them. There is roughly 1,010 feet (308 meters) of elevation change between the highest peak at Star Stanton Hill at 2,011 feet above mean sea level (612 meters-amsl) to the Virgil Creek Valley floor at 1,000 feet-amsl (305 meters-amsl). Dryden Lake, Six Mile Creek, Virgil Creek and the West Branch of the Oswego Creek are the major water bodies in the area.

Bedrock in the area is generally grey shales and sandstones that are Devonian in age (Rickard and Fisher, 1970). The predominant bedrock found in the quadrangle were grey to blue shales with intermittent sandstone beds. Limestones were found outcropping in two spots, but relatively thin in size. According to the Finger Lakes sheet of the Geologic Map of New York State, the bedrock in the quadrangle is comprised of the Cashaqua and Middlesex Shales, Beers Hill Shale; Grimes Siltstone, Dun Hill, Millport and Moreland Shales, Geneseo Shales and the Ithaca Formation - shale, siltstone and the Sherburne Siltstone (Rickard and Fisher, 1970).

The surficial geologic units in this quadrangle were previously mapped at 1:250,000 scale and were reported to be fluvial sand and gravels, outwash gravels, kame moraine, till, thin till over rock, and lacustrine silt and clays (Cadwell et al, 1986). Limited mapping has been completed at a higher resolution than that of Cadwell et al., (1986). Previous small-scale studies were conducted in the Virgil Creek/Dryden Lake valleys by Miller and Bugliosi, (2013) observed similar surficial units with the addition of a till moraine and some units containing a combined surficial and subsurface unit. Their investigation also studies the subsurface topography of the Dryden Lake Valley and observed multiple till, outwash and intermittent lacustrine units, suggesting multiple glacial advances and retreats within the valley.

Methodology:

To create the surficial geology map of the Dryden quadrangle, preliminary field maps were created using the ESRI ArcMap 10.6 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). Another tool used is an entrenching shovel and pick. This tool was used to remove topsoil and/or eroded sediments off of 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 GPS 66st, 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 (TPK_FN4). The field day logs can be found in the Open File report 06-19 by the NYSGS (TPK_SM4).

At most of the field sampling sites, a soil sample was taken for grain-size analysis. This employee 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 CS6 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 (TPK_MY3) 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.

Results:

A total of 161 field stops were taken, with 69 samples for grain-size analysis within the quadrangle. Some stops contained more than one sample as they exhibited stratigraphy either in an exposure or at depth with the hand-auger. The final count for lithologies found during field sampling was: 100 stops were diamicton, 25 were sand and gravel, 18 were bedrock, eight were glaciolacustrine sediment, five were sand and five were alluvium. 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.

Pleistocene Silt and Clay (Plsc)
Stratified, fine-grained sediment consisting of fine sand, silt and clay size particles. Inferred to be deposited in mid shore to deep-water settings of glacial lakes. May include marl, rhythmites, and varves. Plsc is found within lower elevations of Virgil and Sixmile creek valleys and within a large exposure in the Ringwood Preserve along the western edge of the quadrangle.

Pleistocene Sand (Ps)
Well sorted and stratified sand, deposited by fluvial, lacustrine or eolian processes. Inferred as deposits associated with distal glacial environments. Well-sorted sand deposits were observed down-slope from deposits of coarser sand and gravel deposits (Psg), likely due to a decrease in energy during deposition.

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. Psg is found in the on the near the banks of the Dryden Lake/Virgil Creek, Sixmile and East Branch Owego Creek Valleys. Psg is also found as small flat-topped terraces in smaller creek valleys, and in front of the large moraine complexes along the western edge of the quadrangle.

Pleistocene Cobbles to Sand (Pics)
Stratified ice contacted deposits, variable coarse-grained sediment consisting of boulders to sand size particles. Inferred to be deposited with stagnant ice in the form of sand and gravel hummocks with the northeast and northern section of the quadrangle as kame moraine deposits.

Pleistocene Diamicton (Pd)
This unit is a mixture of sediment grains that range from clay to boulders in size. In this quadrangle, all diamicton is interpreted to be glacial till, sediment deposited directly beneath the glacier. It is generally matrix supported, 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.

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. In this quadrangle identified moraines are comprised of clast supported till ranging from gravel rich in some cases showing hummocky topography along the morainal boundary.

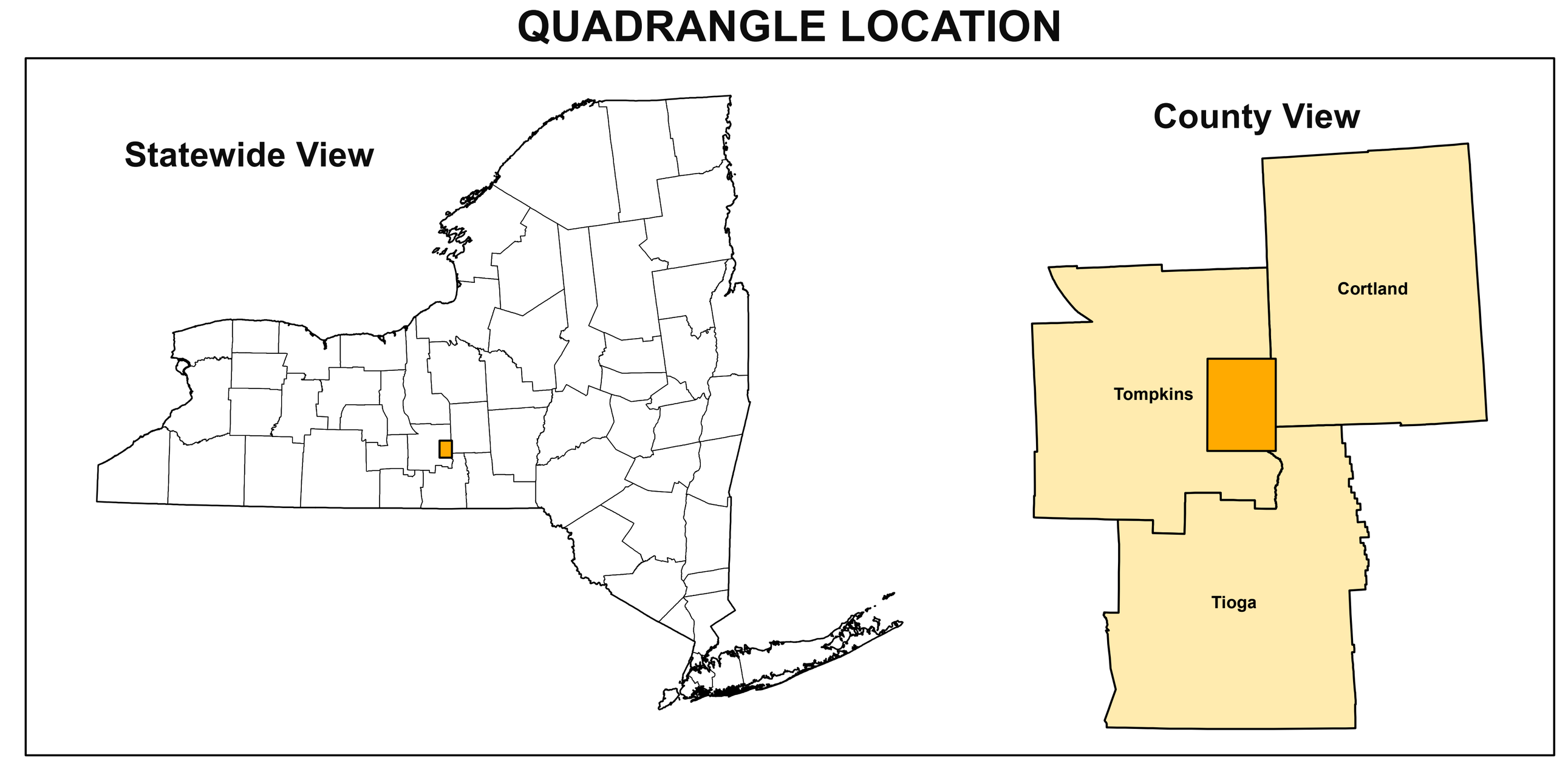
Summary and Conclusions:

Within the Dryden quadrangle lies the northernmost section of mountainous terrain in Tompkins County. These higher elevation ridges are comprised of Devonian shales, sandstones and limestones and have undergone high amounts of erosion since their lithification. Due to the heavy erosion, bedrock generally outcrops at the summits, in deep ravines and some road cuts and are generally comprised of black and grey shales with interbeds of sandstone and limestone. Bedrock outcropping in the ravines just south of NYS Route 13 also contained outcroppings of blue-grey laminated shale. South of Pleasant Hollow Road, this bedrock unit was not seen. Within the Roy H. Park Nature Preserve and the Hammond Hill State Forest, a large, winding bedrock chasm of mainly black and grey shales lies along the Sixmile Creek. This chasm is the largest exposure of bedrock within the quadrangle and is well over 1,500ft (457m) in length and 175ft (53m) in height at its tallest. Atop the bedrock, the most common lithologic unit is diamicton (Pd). The diamicton is made up of mostly mottled to brown silt-dominant diamicton, while the size of the gravel clasts within ranged from pea gravel to boulder in size. This lithologic unit, while widespread, can be diagnostic in showing the movement and interaction of the Ontario Lobe of the Laurentide Ice Sheet in this quadrangle based on its sediment characteristics. The diamicton found in most areas of the quadrangle is indicative of lodgement tills due to their density, bimodal distribution of grains, and contained predominantly local bedrock clasts and many contain faceted clasts. A few diamicton exposures had characteristics of subglacial till as it was stratified, clasts showing some imbrication, faceted, and less consolidated as the lodgments till. At stop DRY-19-143, a lodgement till had undergone compressional stress along with the glaciolacustrine sediment between the till layers. An exposure of subglacial till is found underlain by the folded lodgement till in this exposure. Sand and gravel deposits are the second most abundant lithologic unit within the quadrangle and are found throughout the quadrangle, but generally at lower elevations within valleys. In the Dryden Lake/Virgil Creek and Sixmile/East Branch Owego Creek valleys, sand and gravel deposits were deposited as outwash sediments proximal to the ice sheet and were found to be stratified, medium to coarse sand (Ps) and rounded gravel deposits. These deposits comprise a large area of hummocky topography and either border an ice-margin (Pdcs) or kame-moraine (Pics) deposit and have fine to medium sand deposits down located proximal from this ice marginal landform. Other areas of sand and gravel are in the headwater valleys of the Sixmile Creek as delta terrace deposits into a temporary glacial lake in the higher elevations of the quadrangle. Lastly, as the glaciers advanced and retreated, proglacial lakes were impounded by the ice sheet, ice blocks or by isostatic rebound of the area. Glaciolacustrine sediments (Plsc) were found sporadically throughout the quadrangle. The exposure at stop DRY-19-143 was comprised of glaciolacustrine sediment interbedded with diamicton that had undergone extensive structural deformation. Other glaciolacustrine deposits lie directly behind morainal deposits (Pdcs, or Pics) and were deposited as proglacial lakes impounded between the ice sheet

SYMBOLS

- Street
- Highway
- Rail Trail
- County Line
- Water Body
- Stream
- Contour
- Cross-Section Line
- NYSGS Soil Sample Location
- NYSDEC Water Well Location
- NYSDOT Boring Location
- NYSDEC Oil & Gas Well Location
- Meltwater Channel
- Ice Margin

QUADRANGLE LOCATION



NOTICE

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program STATEMAP award number **G18AC00232** in the year 2019.

Summary and Conclusions Continued....

Glacial landforms found within this quadrangle reflect proximal deposition and erosion due to the type and sediment makeup of each landform. Of the landforms found, none were as large as the Ringwood Moraine in the Ringwood Preserve on the western border of the quadrangle. This moraine is greater than 110-feet in relief at its highest point. This moraine has two steep sides and a ridge no greater than 7 feet wide. The surface is heavily armored and surrounded by hummocky deposits of medium sand to coarse gravel. Smaller fragments of moraines were found throughout the quadrangle and were made of ice-contact sands and cobbles and clast-supported diamictons. A set of meltwater channels were found on the northern edge of the Town of West Slaterville. These channels are cut into bedrock and have a parallel relationship with their size and elevation.

Upon completion of field mapping within the Dryden quadrangle, the evidence discovered in this area suggests that multiple glacial episodes as seen in exposures with multiple diamicton layers interbedded with either outwash and/or glaciolacustrine deposits. These exposures suggest at least two advances and one retreat of the ice sheet. An OSL sample was taken in a graded sand deposit between two till layers at DRY-19-101 will help constrain the minimum age of the deposition of the surficial till in the Sixmile Creek valley. Further work is to be done in the Dryden Lake/Virgil Creek valley as an OSL here will help constrain the deposition of these units and their relation to the valleys to the south.

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Miller, T.S., and Bugliosi, E.F, 2013, Geohydrology, Water Quality, and Simulation of Groundwater Flow in the Stratified-Drift Aquifer System in Virgil Creek and Dryden Lake Valleys, Town of Dryden, Tompkins County, New York, United States Geological Survey, Scientific Investigations Report, No. 2013-5070, 118p.

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)**
This unit is generally comprised of coarse-to-fine materials, such as large cement mounds and/or crushed rock, which have been 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.

Pleistocene

Plsc — **Silt and clay (Plsc)**
Stratified, fine-grained sediment consisting of fine sand, silt and clay size particles. Inferred to be deposited in mid-shore to deep water settings of glacial lakes. May include marl, rythmites, and varves.

Ps — **Stratified sand (Ps)**
Well-sorted and -stratified sand, deposited by fluvial, lacustrine or eolian processes. Inferred as deposits associated with distal glacial environments.

Pics — **Cobbles to sand (Pics)**
Stratified ice contact deposits; variable coarse-grained sediment consisting of boulders to sand size particles. Inferred to have been deposited along an ice-margin. May include, interbedded coarse lenses of gravel and clast supported diamictons (flow tills).

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.

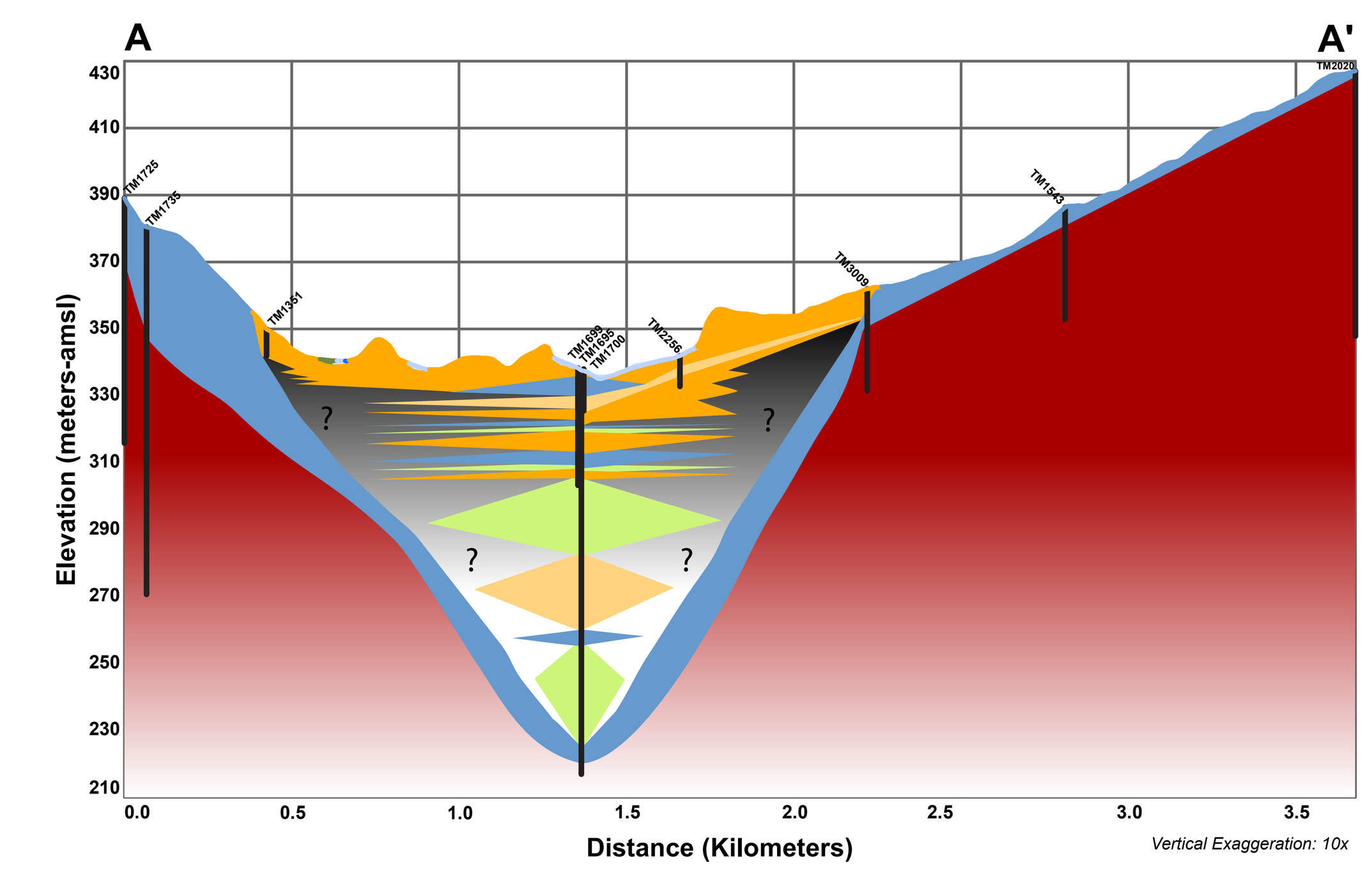
Pd — **Diamicton (Pd)**
An admixture of unsorted sediment ranging from clay to boulders. Generally matrix supported, massive and clast-rich.

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

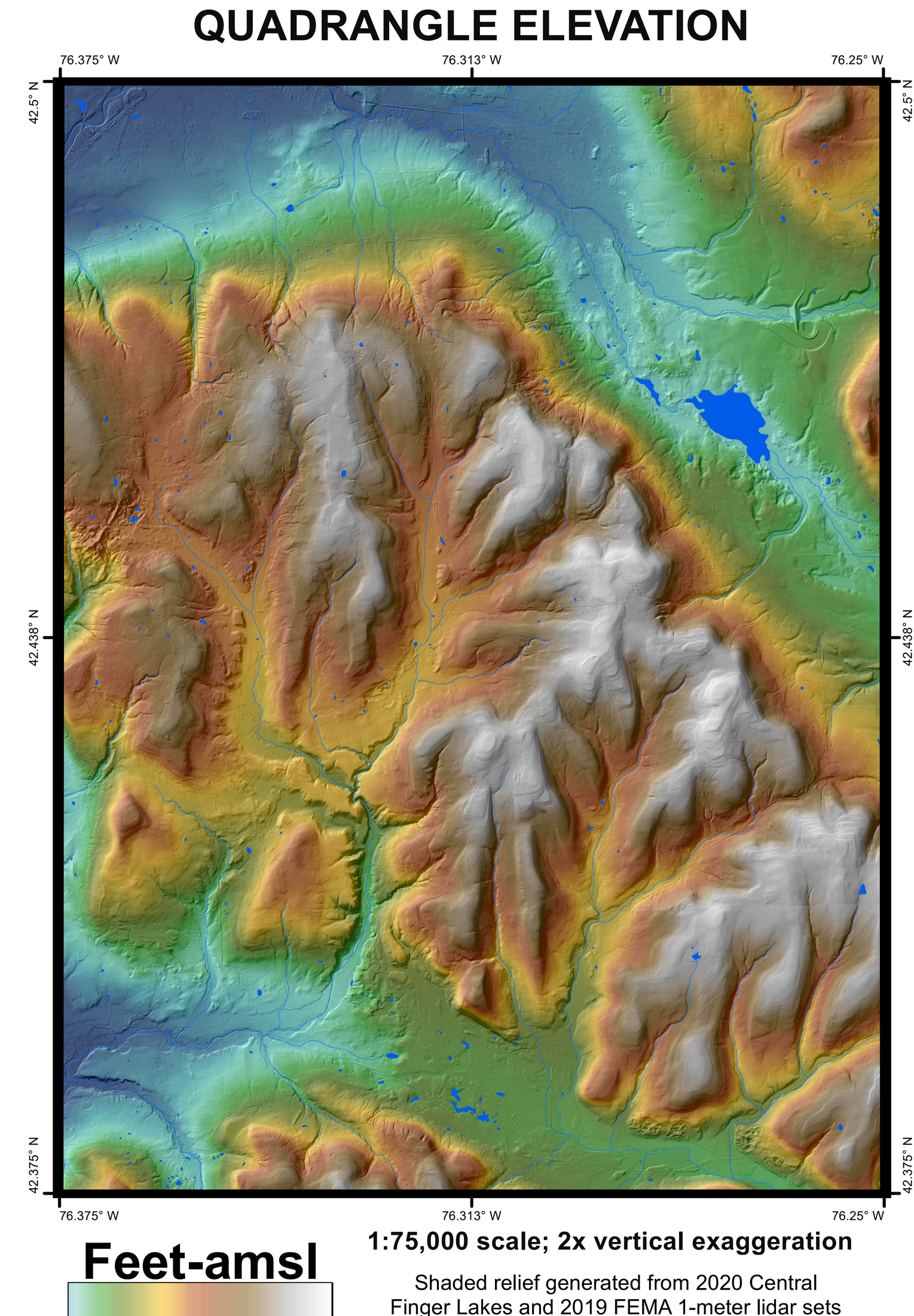
Pre-Pleistocene

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

CROSS-SECTION A-A'



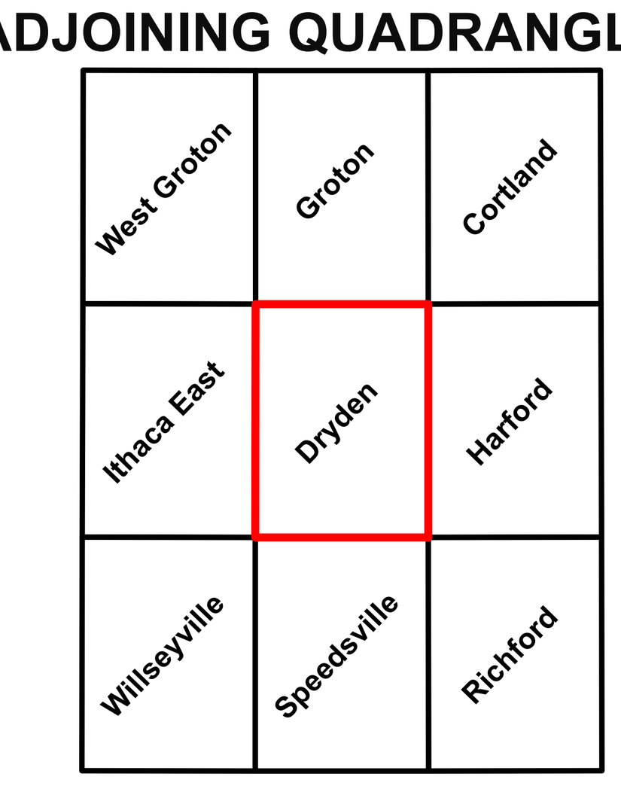
QUADRANGLE ELEVATION



1:75,000 scale; 2x vertical exaggeration

Shaded relief generated from 2020 Central Finger Lakes and 2019 FEMA 1-meter lidar sets

ADJOINING QUADRANGLES



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