New York State Museum Mark Schaming, Director

New York State Geological Survey

Geologic mapping by J.Leone, K. Backhaus and C. Porreca, 2016

Digital data and cartography, K. Backhaus, 2019.

(https://gis.nv.gov/gisdata/inventories/member.cfm?OrganizationID=108) Geographic data layers from 2018 TIGER/Line shapes for transportation and hydrograpghy (https://www.census.gov/cgi-bin/geo/shapefiles/index.php) Shaded relief from 2007 FEMA Delaware-Sullivan 1-meter and the NYS 10-meter lidar data sets (http://gis.ny.gov/elevation/index.cfr 224 MILS Magnetic declination from the NOAA online Declination Calculator CONTOUR INTERVAL: 10 FEE http://www.ngdc.noaa.gov/geomag-web/#declination **UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET**

Iniversal Transverse Mercator, Zone 18 N

Hygrology, and planimetry layers from the

New York State DOT Raster Quadrangle separates for

North American Datum of 1983

SURFICIAL GEOLOGY OF THE NARROWSBURG 7.5-MINUTE QUADRANGLE, SULLIVAN COUNTY, NEW YORK

James R. Leone and Karl J. Backhaus

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prepared by Jamers R. Leone and Karl J. Backhaus

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Rochester, p.197

The geology of the Narrowsburg 7.5-minute Quadrangle was mapped during 2015, 2016 and 2017 as part of the National Parks Service Task Agreement P15AC01482 for Geologic Mapping of the Upper Delaware Scenic and Recreational River (UDSRR). This map is part of Phase I of the mapping project in Delaware and Sullivan Counties, New York. The purpose of this map was to identify and delineate various geologic formations in the Narrowsburg Quadrangle with the intent that this information can guide the National Parks Service and municipalities in land use, environmental, and natural resource decisions. The Narrowsburg Quadrangle is within the Catskill Region of New York near the state border with Pennsylvania. The quadrangle is within the Town of Tusten, Sullivan County. The Hamlet of Narrowsburg is the main community in the quadrangle. The quadrangle is mainly wooded with large tracts of land for lumber and recreation. Bluestone mining is another major land uses in the quadrangle and surrounding area.

Situated at the western edge of the Catskill Mountain physiographic province the landscape varies from floodplain in the Delaware River Valleys to mountainous topography. The highest elevation is at 1,312 feet, or 400 meters, above mean sea level (amsl) in the northeastern portion of the quadrangle with the lowest elevation being 610 feet, or 186 meters, where the Delaware River exits the quadrangle to east. The sediments found in the quadrangle includes sand, gravel, diamicton (till) and bedrock exposed throughout the quadrangle.

The portions of the Narrowsburg Quadrangle within the boundaries of the UDSRR, consist primarily of exposed bedrock, deposits of stratified sand and gravel, till over rock and alluvium on the floor of the Delaware River Valley. The New York portion of the quadrangle is located west of the Delaware River. While much of the area mapped was bedrock ledges and cliffs the Ten Mile River Valley contained hummocky deposits of sand and gravel suggesting stagnant ice left behind by glaciers was the source of these deposits. Hilltops and slopes were mainly bedrock ledges with some lower hills covered with thin till. In some instances, bedrock exposed through the till was had striations recorded on them. The valley floor itself was made up mostly of alluvium sediments.

Clastic Upper Devonian rocks make up virtually all bedrock in this region. These shales, mudstones, fine to coarse sandstone were observed in the area. There is some quartz pebbleconglomerate beds and there is a possibility to have localized lacustrine carbonate beds (Ver Straeten, 2013). Multiple cycles and similar facies, that cover 25 million years, make this area difficult to correlate without spending great amounts of time exclusively mapping the bedrock. Extensive geophysical, geochemical, and fossil identification would need to be carried out to create a comprehensive bedrock map of the region. The age of the rocks spans the Frasnian stage, ~385 million year ago (Ma) to ~360 Ma. In that time, this region was an expansive coastline with a complex river system, transporting massive amounts of sediment coming from the ancestral Acadian Mountains, which occupied present day eastern New England

Field mapping for this quadrangle was completed in 2016 and 2017. Mapping efforts included traversing the quadrangles primarily by vehicle along roadways, with some mapping taking place on private land. Sample collection was taken by pick and shovel from outcrops in drainage ditches, road and streams cuts or within quarry/sand and gravel pits. Sample collection was also taken with a two-meter long hand auger to collect samples below the soil layer where possible. A total of 40 observation points were made during the mapping process, with 21 samples collected for grain size analysis. Twenty-six Geoprobe samples were collected on the Ten Mile River Boy Scout camp along the Delaware River and three along Hickory Lane.

Water wells (41 in total) from the Department of Environmental Conservation and exploratory boreholes (29 in total) by the New York State Geological Survey were also used to decipher the subsurface geology of the Narrowsburg Quadrangle. The subsurface data from this well was simplified using the drillers descriptions to more standard and uniform descriptions.

Field data were digitized in ArcMap 10.6. Polygons were created based upon the lithology of the surface material and the sample and boring locations were plotted. The boring logs and map data were created using the Adobe Illustrator CS6 using the data created in the ArcMap

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 along the Delaware River and its tributaries. 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 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 gravel pits, tributary valleys. The Ten Mile River valley is predominately sand and gravel. This trend continues into the Eldred Quadrangle (Leone, 2019).

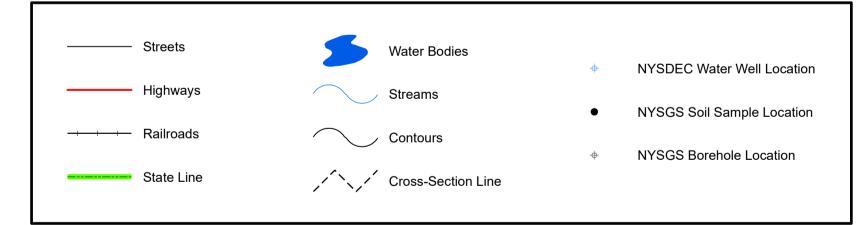
This unit is a mixture of sediment grains that range from clay to boulders in size. In this quadrangle, all diamicton in interpreted to be glacial till, sediment deposited directly beneath the glacier. This material is found throughout the mapped portion of the quadrangle covering most valley walls on the west side of the Delaware River. It is generally matrix supported, sand-dominant, and tan and reddish brown in color.

Summary and Discussion

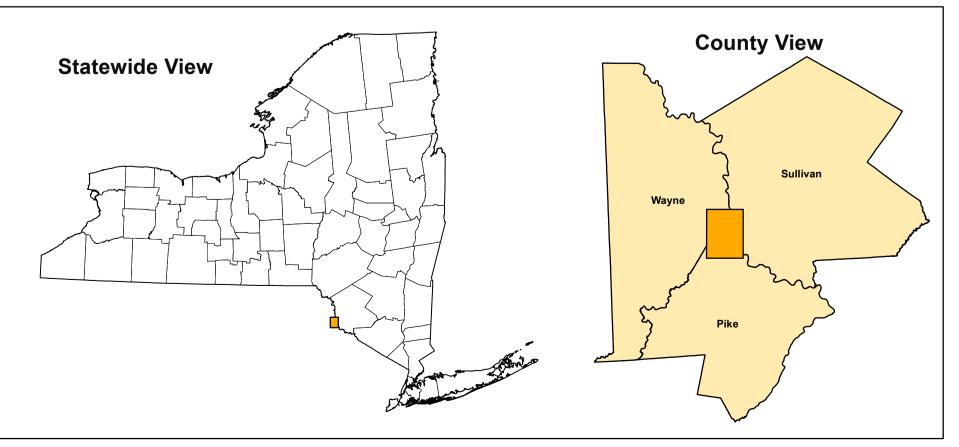
The Narrowsburg quadrangle located on the southwestern edge of the Catskill Mountains. The region, like the surrounding Catskill Mountains, has greenish blue to dark grey sandstones with zones of crossbedding, and red shales of the Devonian Period Catskill Delta making up the bedrock of the mountains. The light brown to reddish brown diamicton, till, is deposited along the slopes of the mountain sides. The nature of the sand and gravel in the tributary valleys are interpreted as related to stagnant ice left behind by retreating glaciers. Striations on exposed bedrock in two locations along Maple Lane southeast of Narrowsburg have a north northeast to south southwest orientation indicated ice movement at one point through the area.

Radiocarbon dates from cross-section B-B', along the Delaware River flood plain were dated to younger than 9,500 years bp and interpreted to be Holocene alluvium. The Geoprobe sample TMR1704 was collected within 20 meters of the shoreline, with TMR1706 being located 30 more meters inland. Cross-section A-A' is higher in elevation north of the B-B' samples. These Geoporobe samples were out of the floodplain of the Delaware River and likely associated with the stratified sand and gravel deposits of the Ten Mile River Valley. While this gave incite to be able to differentiated timing between the Holocene alluvium samples and the Pleistocene Sand and gravel samples it did not give any information about the timing of ice melt out from the region.

SYMBOLS



QUADRANGLE LOCATION



Leone, J.R., and Backhaus, K. J., 2019, Surficial Geology of the Eldred 7.5-Minute Quadrangle, Sullivan County, New York. New York State Museum Map and Chart Series, No. 114. Ozsvath, David L. and Coats, Donald R.1896; Woodfordian Stratigraphy in the Western Catskill Mountains, The Wisconsinan Stage of the First Geological District, Eastern New York Part 1, New York State Museum Bulletin 455, p. 109-120

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Kirkland, J.T., 1979, Deglaciation events in the western Catskill Mountains, New York. Geological Society of America Bulletin, 90(6),

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Soren, Julian, 1961, The ground-water resources of Sullivan County, New York: New York Water Resources Comm. Bull. GW-46, 66 p

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DESCRIPTION OF MAP UNITS

Holocene 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-glaical alluvium and includes modern channel, over-bank and fan deposits

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

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

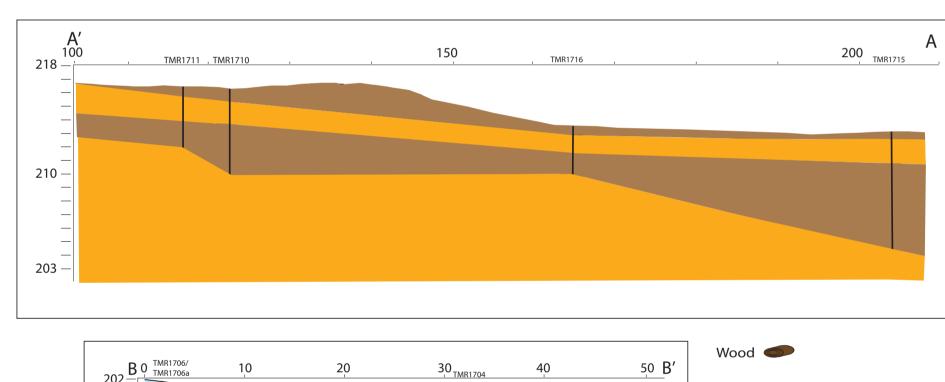
Well-sorted and stratified sand and gravel. May include cobbles and boulders. Inferred to be delta, fan or lag deposits in glacial channels

An admixture of unsorted sediment ranging from clay to boulders. Generally matrix supported, massive and clast-rich.

Pre-Pleistocene

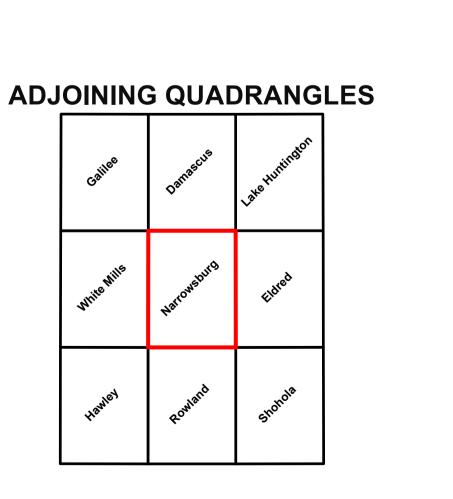
Non-glacially derived, hard rock, pre-pleistocene in age. May be covered up to a meter in diamicton, sand and gravel, or sand and clay in areas marked as Br.

CROSS-SECTIONS A-A' & B-B'



$VE=\sim20x$

QUADRANGLE ELEVATION





1:75,000 scale; 2x vertical exaggeration Feet-amsl Shaded relief generated from 2007 Delaware &

Sullivan Counties 1-meter lidar data set by the Federal Emergency Management Agency.

This geologic map was funded in part by the National Park Service Task Agreement Number P15AC01482 for the Geologic Mapping in Upper Delaware Scenic and Recreational River Phase 1 in the year 2015 The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily presenting the official policies, either expressed or implied, of the U.S. Government. While every effort has been made to ensure the integrity of this digital map and the factual data upon which it is based, the New York State Education Department ("NYSED") makes no representation or warranty, expressed or implied, with respect to its accuracy, completeness, or usefulness for any particular purpose or scale. NYSED assumes no liability for damages resulting from the use of any information, apparatus, method, or process disclosed in this map and text, and urges independent site-specific verification of the information contained herein. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by