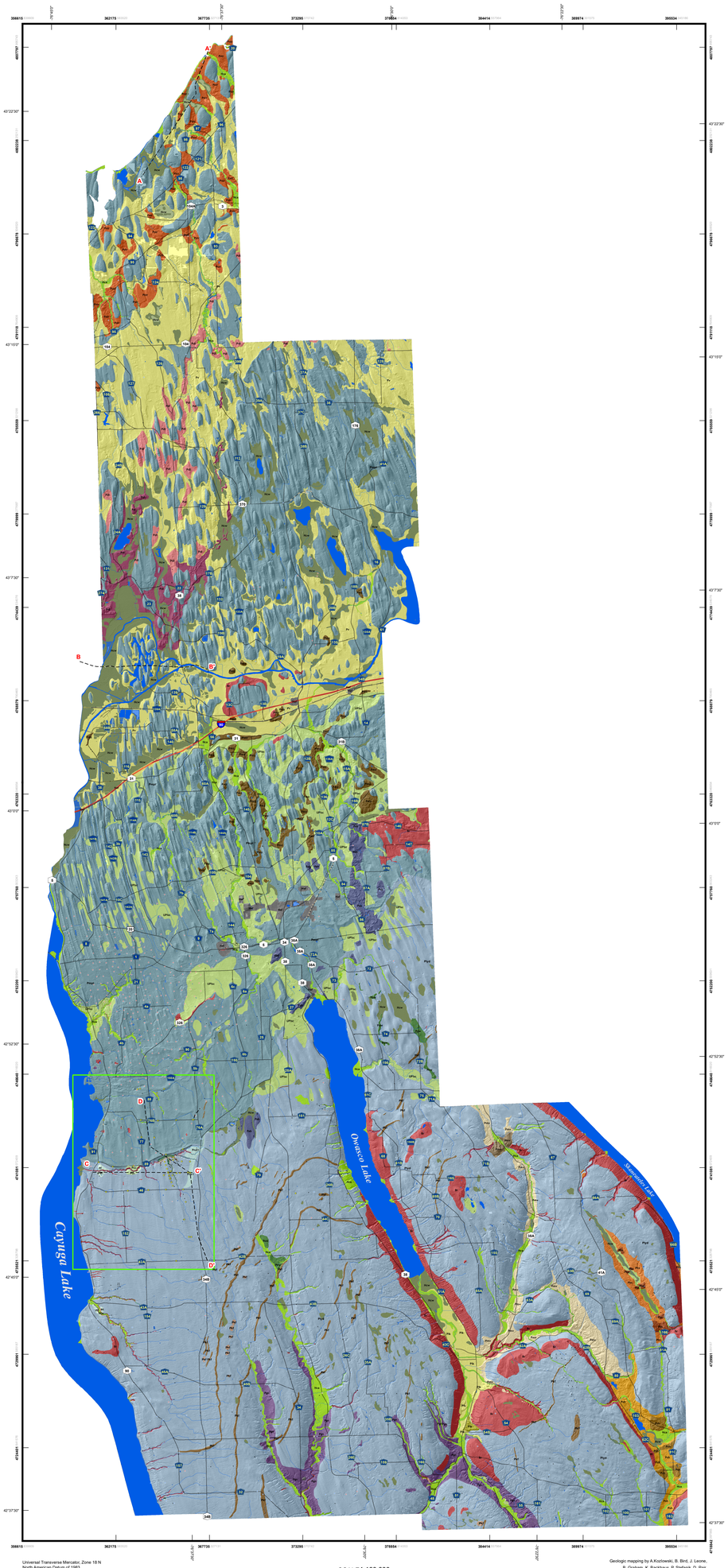
New York State Museum
Mark Schaming, Director

NYSGSX NEW YORK State Museum

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 Cayuga County
(https://gis.ny.gov/gisdata/inventories/member.cfm?OrganizationID=108).
Geographic data layers from 2017 TIGER/Line shapes for transportation and hydrography (https://www.census.gov/cgi-bin/geo/shapefiles/index.php)

Shaded relief from Cayuga County 2 m
Lidar (http://www.cayugacounty.us/portals/0/planning/interactivegis.htm),
10 m DEM from NYS and NYS GIS Clearinghouse
(http://gis.ny.gov/elevation/index.cfm)

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

SCALE 1:100,000

2 1 0 2 Kilometers 4 6 8
2000 1000 0 2000 Meters 4000 6000 8000
2 1 0 2 4 6 8
Miles
5000 2500 0 5000 10000 15000 20000 25000 30000 35000 40000 45000 50000
Feet

CONTOUR INTERVAL: 10 FEET

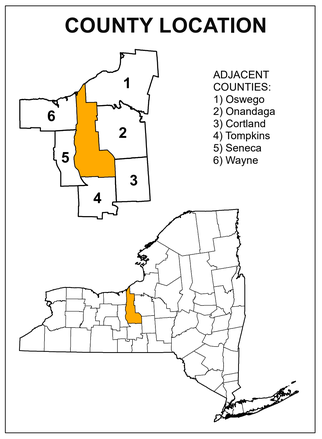
Geologic mapping by A.Kozlowski, B. Bird, J. Leone, B. Graham, K. Backhaus, P. Stefanik, D. Parr, C. Smith, N. Hopkins, S. Staley, and B. Rebeor. 2009-2018

Digital data and cartography, B. Bird, and K. Backhaus, 2017-2018

SURFICIAL GEOLOGY OF CAYUGA COUNTY, NEW YORK

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

2018



SURFICIAL GEOLOGY OF CAYUGA COUNTY, NEW YORK

Andrew Kozlowski, Brian Bird, James Leone and Karl Backhaus

prepared by
Karl J. Backhaus, Brian C. Bird and Andrew L. Kozlowski

Supported in part by the U.S Geological Survey's
National Cooperative Geologic Mapping Program STATEMAP award G17AC00265.

Introduction

The surficial geology of Cayuga County was constructed from 25 individual 7 ½ minute quadrangles mapped between 2009-17 by the New York State Geological Survey (NYSGS) a research unit of the New York State Museum. The mapping was sponsored by the National Cooperative Geologic Mapping -StateMap and Great Lakes Geological Mapping Coalition programs of the United States Geological Survey. Cayuga County covers an area of 864 square miles extending from the shore of Lake Ontario to the southern end of the Finger Lakes in central New York State. Although the county is largely rural, the county seat, the City of Auburn has 27,687 residents approximately 1/3 of the entire county population. The City of Auburn and the county's strategic location among the Finger Lakes made it a natural hub early on to move agricultural products to larger nearby cities like Rochester and Syracuse via the Erie Canal, which cuts through the northern center of the County.
The present-day geology of the northern third of the county is built onto the Ontario Lowlands physiographic province and is dominated by subglacial landforms, meltwater channels and former lake shores. The uplands from Auburn south climb onto the Allegheny Plateau physiographic province. Rolling and subtle streamlined landforms are characteristic of the upland interfluves between adjacent Finger Lake Troughs. The physiography of the southern portion of the county maintains the same rolling uplands but also develops into the steep walled glacial troughs and broad floored valleys extending southward to the through valleys and Valley Heads Moraines in Tompkins County.

This deliverable initiated as a compendium project that began in 2009-2010 when ongoing mapping in the Montezuma Wetlands Complex was underway in western Cayuga County and adjacent Wayne County as part of a Great Lakes Geological Mapping Coalition (GLGMC) project (GLGMC Awards G09AC00460 and G10AC00561). At that time the NYSGS discovered that lidar terrain data was available for Cayuga County and depicted a glacial landscape far more complex than that mapped on the 1:250,000 Finger Lakes Map sheet produced in 1986 by (Muller and Cadwell). In 2011 a dedicated effort to complete geologic mapping of all (25) 7.5-minute quadrangles in the county initiated that culminated with the completion of this surficial geologic map in 2018 (STATEMAP grant awards G11AC20362-G17AC00265). Traditional surficial geologic maps often convey information about grain-size, sorting and composition of surficial materials on the landscape. In producing this map our aim was to maintain the principle characteristics of a materials-based map but also to collect three-dimensional data to evaluate and compile the stratigraphic framework of glacial deposits across the county. This chart is the result of that effort and intended to focus on the geologic framework of valley fill deposits and the chronostratigraphic architecture surveyed by extensive field analyses of outcrops and multiple methods of age dating. Secondary to mapping the materials that comprise surface and subsurface was to identify, classify and delineate various geologic formations and members, to construct a basis for understanding the temporal and spatial extent of the geologic framework present in the county. Further, beyond serving as a visual means to convey the glacial natural history, it is the intent of the authors that this map and information can guide municipalities in land use, environmental, and natural resource decisions.

As part of the original surficial map construction in the Union Springs area (Kozlowski et al., 2016) we discovered that present day east-west gorge system of Great Gully had bisected an older valley system, oriented northwest to southeast. Initial surveys following up on the work of Shumaker (1957) lead to inspection and documentation of numerous outcrops within the valley walls of Great Gully. In these surveys' glacial sediment thickness of more than 125 feet (38 meters) were observed in the central portion of the Gully. Sediments include diamicton (interpreted as till), sorted clay, silt, sand, and gravel from glacial meltwater and glacial lakes and post glacial alluvium and wetland deposits. Our survey was then expanded beyond the gully utilizing exploration boreholes in an attempt to understand the valley dimensions, sediment thickness, geometry and continuity of deposits within the valley fill. The lithologic units that are contained within the buried valley sequences are variable in thickness and suggest episodes of glacial deposition, fluvial/lacustrine deposition and periods of subaerial erosion. Some associated deposits of till display deformation consistent with overriding by ice during readvance that extended south of Great Gully.

Bedrock is exposed at the western end of Great Gully as it approaches Cayuga Lake and at the Eastern end of the Gully tributaries in proximity to State Route 34B. However, within the confines of the buried valley depth to bedrock exceeds 213 feet (65 meters) and may be possibly deeper. Elsewhere on the uplands, within 800 meters of the cross section transect, bedrock is exposed at the surface in road cuts near the intersection of Kings Corners Road and Redmond Road. The bedrock beneath the glacial sediments in the quadrangle is mapped as Devonian in age (Fisher et. al., 1970).

Map and Stratigraphic Units

Cayuga County is covered by a variety of sediment types deposited directly by the glacier, meltwater from the glacier, or post-glacial streams and lakes. In this chart we define the chronostratigraphic framework of glacial deposits in addition to lithostratigraphic character. The stratigraphic hierarchy consisting of geologic groups, formations and members below are described here for the first time for Cayuga County and we have made every attempt to define them following guidance from the North American Stratigraphic Code. In general, our approach follows a combined morphostratigraphic and allostratigraphic approach to define map units based on landforms and correlative stages. In many of the description there is reference to deglacial chronologies for the northeast as reported by Muller & Calkin (1993) and Ridge (2003). The chronostratigraphic descriptions also refer to Phases and Episodes of Late Quaternary time-stratigraphic intervals within the Great Lakes Area as outlined by Karrow et. al., (2000). Attempts to define a chronostratigraphic framework within the map area is largely due to earlier reports of Shumaker (1957) who reported the presence of preserved subtill organics in stratified sand units near Great Gully. Surface materials that are complex or lack sufficient data to assign an age or member are listed as an undefined member and based solely on lithologic data. Two tone colors representing one unit in the legend correspond to variations in grain size, the darker color represents coarser-grained materials such as ice contact facies. Ages reported in descriptions below with an asterisk correspond to calibrated ages.

References

Bird, B.C., and Kozlowski, A.L., 2016, Late Pleistocene Reconstruction of glacial Lake Iroquois: New York State Museum Map & Chart Series No. 80, scale 1:750,000.

Calkin, P.E., and Muller, E.H., 1992, Pleistocene stratigraphy of teh Erie and Ontario Lake Bluffs in New York , in Quaternary coasts of teh United States: marine and Lacustrine systems, Society of Economic and Petroleum Geologists and Mineralogists Special Publication 48, p. 385-396.

Fairchild, H.L., 1934, Cayuga Valley lake history: Geological Society of America Bulletin Vol.45, p. 233-280.

Fisher, D.W., Y.W. Isachsen, and L.V. Rickard., 1970, Geologic Map of New York State. 1:250,000. Consists of five sheets: Ningara, Finger Lakes, Hudson-Mohawk, Adirondack, and Lower Hudson. Map and Chart Series No. 15., 5 geologic bedrock maps: 1:250,000.

Gentoso, M. J., Evenson, E. B., Kodama, K. P., Iverson, N. R., Alley, R. B., Berti, C. & Kozlowski, A. L., 2012, Exploring till bed kinematics using AMS magnetic fabrics and pebble fabrics: the Weedsport drumlin field, New York State, USA. Boreas, Vol. 41, pp. 31–41.

Hopkins, N. R., Evenson, E. B., Kodama, K. P., and Kozlowski, A.L., 2015, An Anisotropy of magnetic susceptibility (AMS) investigation of the till fabric of drumlins: support for an accretionary origin: Boreas, doi: 10.1111/-bor.12138

Isachsen, Y.W., Fisher, D.W. and Rickard, L. V., 1970, Geologic Map of New York, 1:250,000 University of the State of New York, State Education Department, Albany, New York

Karrow, P.F., Dreimanis, A. and Barnett, P.J., 2000, A proposed diachronic revision of late Quaternary time-stratigraphic classification in the eastern and northern Great Lakes area: Quaternary Research, Vol. 54, p. 1-12.

Kozlowski, A.L., Bird, B., Lowell, T.V., Smith, C.A., Feranec, R.S., Graham, B.L., 2018. Minimum Age of the Mapleton, Tully, and Labrador Hollow Moraines Indicates Correlation with the Port Huron Phase in Central New York State, in: Quaternary Glaciation Of The Great Lakes Region: Process, Landforms, Sediments, And Chronology. Geological Society of America, Boulder, Colorado, pp. 191–216. doi:10.1130/2018.2530(10)

Kozlowski, A.L. Mahan, S.A., Bird, B.C. and Feranec, R.S., 2016, A proposed Time-Stratigraphic paradigm for Late Quaternary events in the central Finger Lakes of New York State: Geological Society of America abstracts with programs, Vol. 48, No. 5, p. 40.

Kozlowski, A.L.; Bird, B.C., and Graham, B.L., 2014, Lidar and Landscapes, in Kozlowski, A. L., and Graham, B. L. eds., Glacial Geology of Cayuga County of the Eastern Finger Lakes: Lakes, Lore and Landforms: Northeastern Friends of the Pleistocene, Guidebook for the 77th annual Reunion, Auburn, New York, Guidebook, p. 72-79.

Muller, E.H. and Calkin, P.E., 1993, Timing of Pleistocene glacial events in New York State: Canadian Journal of Earth Sciences, Vol. 30, p. 1829-1845.

Rickard, L.V. 1969, Stratigraphy of the Upper Silurian Salina Group, New York, Pennsylvania, Ohio, Ontario. New York State Museum and Science Service Map and Chart Series #12: 57 pp.

Rickard, L.V. 1975, Correlation of the Silurian and Devonian Rocks in New York State. New York State Museum and Science Service Map and Chart Series #24: 16 pp.

Rickard, L.V. 1989, Stratigraphy of the subsurface Lower and Middle Devonian of New York, Pennsylvania, Ohio and Ontario. New York State Museum and Science Service Map and Chart Series #39: 59 pp.

Ridge, J.C., 2003, The last deglaciation of the northeastern United States: a combined varve, paleomagnetic, and calibrated 14C chronology: New York State Museum Bulletin, 497, p. 15-45.

Savarese, M., Gray, L.M., and Brett, C.E., 1986, Dynamaic stratigraphy amd depositional Environments of the Hamilton Group (Middle Devonian) in New York State, Part 1, New York State Musuem Bulletin 457: pp. 32-56

Shumaker, R.C., 1957, Till Texture Variation and Pleistocene Deposits of the Union Springs and Scipio Quadrangles, Cayuga County, New York: [M.S. Thesis]: Ithaca, Cornell University, p. 44

COUNTY LOCATION

Cayuga Group

Haf — **Anthropogenic Fill (Haf)**
Undefined Member composed of coarse/fine and or crushed rock anthropogenically transported and used for construction purposes.

Hca — **Cayuga Member Alluvium (Hca)**
This member represents stratified, silt, sand gravels and cobbles deposited in rivers, streams and lakes. Principally inferred as post-glacial alluvium, it includes modern channel, over-bank and fan/deltaic deposits. Although these deposits principally are Holocene in age, at the latitude of the Union Springs 7.5-minute Quadrangle isostatic rebound had recovered to a linear stage during the Late Wisconsin (Bird and Kozlowski, 2016). As a result, in the area constrained by the quadrangle modern lake levels closely coincide with lake levels present during the main phase of glacial Lake Iroquois that inundated and occupied the southern Ontario Basin including Cayuga Lake, thus some deltaic deposits in his member may be of Late Pleistocene age.

Hcw — **Cayuga Member Wetland (Hcw)**
This member comprises of peat, muck, marl, silt clay or sand deposited in association with wetlands environments. Various sediments can be present as transitional from one facies to another.

Mapleton Group

Pstr — **Sterling Member (Pstr)**
This member consists of well-sorted fine to medium sand deposited by shallow lacustrine process during the main phase and collapse of glacial Lake Iroquois. Youngest member of the post Port Huron Phase within Cayuga County, overlies the Victory Formation.

Pv — **Victory Formation (Pv)**
This member represents deep to midshore lacustrine deposits of fine sand, silt and clay from glacial Lake Iroquois. This Formation is youngest Pleistocene deposit in northern Cayuga County. Recent reconstructions of isostatically controlled Lake Iroquois (Bird and Kozlowski (2016) display the extent and magnitude of proglacial ponding. In northern Cayuga County portions of the Weedsport Drumlin Field (Gentosso et. al., 2010. Hopkins et. al., 2012) were flooded forming an archipelago. Wave action associated with beaches severely eroded drumlins in some cases recording shorelines, eroded silt, sand and clay accumulated in the lee of drumlins and in some instance's drapes over landforms of the Duck Lake and Montezuma members. This formation represents the final depositional phase of the Post Port Huron Phase in Cayuga County.

Pdl — **Duck Lake Member (Pdl)**
This member is represented as ice contact fans and eskers deposited by retreating ice from the Post Port Huron phase, this member is younger than the Montezuma member, but proceeds the Victory Formation of main phase Lake Iroquois. Deposits consist of stratified coarse sand and gravel units, locally cemented. Some deposits may have silt cap less than a meter thick associated with proglacial deposition. These deposits may be correlative with the Pinnacle Hills ice margin south of Rochester, New York.

Pmz — **Montezuma Member (Pmz)**
This member is represented as meltwater channels and kame deposits. This member is older than the Duck Lake Member and represents pro- and subglacial ice-contact deposition and erosion after the. This member is younger than the Auburn member was deposited/eroded during the Post Port Huron Phase.

Pab — **Auburn Member (Pab)**
This member also consists of ice contact fan and esker deposits in and around the Auburn region. This member likely represents the Waterloo Moraine (Fairchild, 1934) a stabilized ice margin after retreat from the Mapleton Moraine. This member is younger and overlies the Mapleton Formation but is older than Montezuma Member.

Pmpl — **Mapleton Formation (Pmpl)**
The Mapleton Formation comprises the uppermost stratigraphic unit north of Great Gully. Principally, it consists of a matrix supported, clast rich diamicton (till) approximately 2-15 meters thick deposited during the Port Huron Phase readvance approximately 15,000 years before present (Kozlowski et. al., 2018). Till is a generic term used to describe poorly sorted admixture ranging from silt sized particles to boulders deposited directly by glacial ice, diamicton is the non-genetic scientific terminology to describe poorly sorted deposits. In some locations the Mapleton Formation has a silt rich semi-stratified appearance that resulted from subaqueous deposition within high-elevation proglacial lakes within the Cayuga Basin. The formation is in direct association with the east to west trending Mapleton Moraine on the north rim of Great Gully that demarks the furthest southern extent of the Port Huron Ice Advance. This glacial till is correlative with the Summerset Till described by Calkin and Muller (1992) along Lake Ontario Shoreline and the Sterling, New York area. We believe this till unit to correlative with the Halton Till in southern Ontario.

Psp — **Springport Member (Psp)**
The Springport Member consists of isolated and discontinuous pockets of well-sorted and stratified sand and gravel, 2-15 meters thick deposited as glacial outwash or in association with meltwater streams that were adjacent to former glaciers prior to the Port Huron Phase advance and hence this member is overlain by the Mapleton Formation. In some localities the cemented gravels and sands convey groundwater and form localized springs and may serve as a framework for water resources. Spring Road south of the Village Union Springs probably derived its name from seeps originating from the Springport member.

Pf — **Farleys Member (Pf)**
The Farley Member consists of bedded sand and gravel with a maximum observed thickness of approximately nine meters deposited as deltas entering a proglacial lake at an approximate elevation of 558 feet amsl within the Cayuga Basin. This delta deposit represents glacial Lake Dana, the second youngest Late Wisconsinan proglacial lake level after glacial Lake Iroquois.

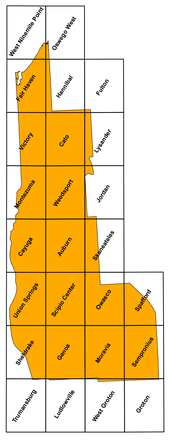
Pco — **Cooney Corners Member (Pco)**
The Cooney Corners Member consists of bedded sand and gravel of unknown thickness deposited as deltaic facies into glacial Lake Warren (of the Cayuga Basin, See Fairchild, 1934), a proglacial lake at an elevation of 692 feet amsl (212 meters amsl) that was building into the Cayuga Basin. The exact age of this stabilized lake level is uknown, but it coincides with a well-developed shoreline and represents the second highest lake level after the Port Huron readvance to the Mapleton Moraine.

Pno1 — **Number One Member (Pno1)**
The Number One Member consists of a bedded and stratified sand and gravel deposited as a deltaic landform into glacial Lake Hall, a high elevation proglacial lake stage occupying the Cayuga Basin at an elevation of 905 feet amsl (275 meters amsl). This member represents the first and highest in elevation of the deltaic deposits observed along the course of Great Gully. Meltwater channels flowing westward along the margin of the Ontario Lobe delivered sediment into the elevated lake stage associated with the Port Huron readvance to the Mapleton Moraine. Similar to the Cooney Corners Member, coincident shorelines are traceable on the lidar terrain models to this member that initiates on the western edge of Scipio Township near the head of Great Gully.

GEOPHYSICAL SYMBOLS

- Seismic Shot Points
- Passive Seismic Survey Location
- Resistivity Transects
- GPR Transects

QUADRANGLES WITHIN



USGS 7.5-Minute Quadrangles within Cayuga County, New York

Ledyard Group

Pow — **Owasco Member (Pow)**
This member represents ice contact fans of medium-sorted sand and gravel deposited during recession from the Merrifield Moraine. Adjacent to and younger than the Kings Ferry Member.

Pkf — **Kings Ferry Member (Pkf)**
This member is mapped as clast supported diamictons largely associated with recessional moraines. The member is named for the Hamlet of Kings Ferry where the recessional Merrifield Moraine (Kozlowski et. al., 2018) can be observed. Eastward the adjacent Lake Ridge Moraine parallels the Merrifield Moraine. The texture of these deposits tends to be coarser and more granular than that of the Ledyard Formation which underlies this member. We interpret deposits of the Kings Ferry member to represents episodic standstills of glacial ice during a recession from the Valley Heads Moraine (retreat phase of the Port Bruce ice advance) in adjacent Tompkins County. The nested appearance of ridges associated with these ice marginal deposits is bound to the north by the Mapleton Formation.

Pgn — **Genoa Member (Pgn)**
This member represents ice contact fans and kame deposit best observed in and along the Salmon Creek Valley. This member is older than the Mapleton Formation and younger than the Ledyard Formation which it overlies. This member was probably produced in association with recessional ice that constructed the Merrifield Moraine. Deposits range from poor- to well-sorted sand and gravel deposits often displaying chaotic cut and fill relationships associated with meltwater and stagnant ice. Some deposits may be cemented with calcite cements.

Plk — **Locke Member (Plk)**
These deposits consist of sand, gravel and isolated pockets of diamicton associated with recessional ice. Deposits are largely restricted to the glacial troughs (valleys) in the southeastern portion of the County. May occur as ice-contact deltas and or as remnant of breached ice marginal fans and eskers. Excellent examples may be observed in and around Owasco Inlet Valley.

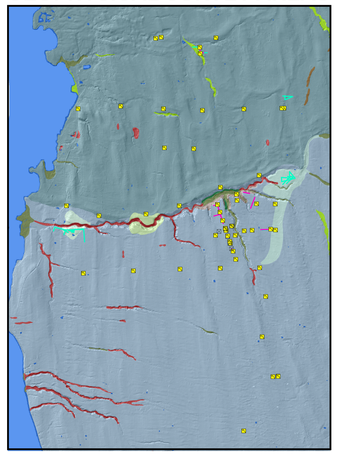
Pmv — **Moravia Member (Pmv)**
This member is mapped as sands and gravels associated with recessional ice. Deposits are restricted to the glacial troughs at elevations higher than the Genoa Member and lower than the Locke Member. The age of the Moravia Member is older than the Genoa Member and younger than the Locke Member. These deposits may occur as ice-contact deltas, with channels eroded within, to marginal fans and kame terraces. Examples of this member are found to the north and east of the Town of Moravia and within the valleys near the Town of Niles.

Psh — **Summer Hill Member (Psh)**
These deposits consist of sand, gravel and isolated pockets of diamicton associated with recessional ice. Deposits are largely restricted to the glacial troughs (valleys) in the southeastern portion of the County. May occur as ice-contact deltas and or as remnant of breached ice marginal fans and eskers. Excellent examples may be observed in and around Lake Como area.

Pbs — **Bear Swamp Member (Pbs)**
This member is constrained to the highest elevation upland ice-contact deposits in the southeast portion of the county and consists of moderately sorted sand and gravel ice-contact fans. Some of these deposits may occur in association with the Kings Ferry Member clast supported diamicton ridges. The age of these deposits is not known precisely but likely represents an early deglacial phase after the Port Bruce Phase.

Plyd — **Ledyard Formation (Plyd)**
First identified on the Swayze Farm located near the intersection of Kings Corners Road and Redmond Road where it was first observed, the Ledyard Formation is the name applied to the matrix supported, clast-rich, calcareous diamicton (till) brown to gray in color that blankets the upland surface south of Great Gully. Often observed as 1-2-meter-thick deposit directly overlying Devonian bedrock; however, exploratory wireline coring indicates thicknesses of at least 12 meters are present and extend across the map area. Good examples of shallow till/rock relationships may be observed in roadside ditches along Cooney Corners Road, Dills Road and Kings Corners Road in the central Union Springs map area. Within Great Gully and adjacent tributaries, an underlying bedded fine to medium grained sand and silt unit is traceable and comprises the sand member of the Ledyard Formation. Age assignment of the Ledyard Formation is ambiguous. Theoretically the till sheet should be associated with the Port Bruce Phase readvance hypothesized to have reached a terminal position of the Valley Heads Moraine south of the Finger Lakes Basins slightly prior to 17,000 years before present (Muller and Calkin, 1993; Ridge, 2003). Yet, our field mapping and stratigraphic investigations indicate only a single diamicton (till unit) at the surface of the map area. Multiple age dates from both AMS radiocarbon and optically stimulated luminescence (OSL) on the underlying sand member and organic materials contained within yield an age range of 30,000-40,000 years before present* equivalent with the Farmdale Phase interglacial of (Karrow et. al., 2000). Thus, the direct age relationship with the surface till of the Ledyard Formation may also represent the Nissouri Phase equivalent to Marine Isotope Stage (MIS) 2, associated with the late glacial maximum approximately 25,000 years before present*.

GEOPHYSICAL SURVEY AREAS



GEOGRAPHIC SYMBOLS

- County, Federal and State Routes
- Interstates
- Railroads
- Cross-Section Lines
- Water Bodies
- Streams
- NYSGS Sample Location
- NYSGS Boring Location
- NYSDEC Water Well Location
- NYSDEC Oil & Gas Well Location
- NYSDOT Boring Location
- Inset View

NYSGSX THE NEW YORK STATE GEOLOGICAL SURVEY
The New York State Museum/ Geological Survey
Cultural Education Center
222 Madison Avenue
Albany, NY 12230
Website: http://www.nysm.nysed.gov/
Phone: (518) 474-5812
Email: nysmresearchcollections@nysed.gov

Acknowledgments

The NYSM/NYSGS would like to thank the many landowners that provided access for mapping and investigation. John and Cheryl Roenmeiff of Swayze Farms, James and Larraine Young of Fleming Homestead Farm: John Young, Dan and Tim Littlejohn, Brian Duggan and Dave Connally of Ledyard and Scipio Township. We also want to thank Deirdre DiBiaggio and Katherine Charmicael, William Morgan and Kelly O'Hara of Springport Township. We also wish to thank the Nature Conservancy of Central New York, New York State Department of Environmental Conservation Northern Montezuma Wildlife Management Area, United States Fish and Wildlife Montezuma National Wildlife Refuge and many others who granted access for mapping and coring investigations. This mapping was funded by in part by the United States Geological Survey StateMap Grant, Award numbers G11AC20362-G17AC00265.

Recommended Citation:
Kozlowski, A.L., Bird, B.C., Leone, J.R., and Backhaus, K.J., 2018, Surficial Geology of Cayuga County, New York. 1:100,000 scale, New York State Museum, Map & Chart No. 104, 2pp.

Great Gully Group

Paa — **Aurora Formation (Paa)**
Exposed along the walls in the eastern end of Great Gully, the Aurora Formation consists of a cross-bedded and cross-rippled sand member 2-3 meters in thickness that contains an abundance of organic detritus within the sedimentary structures. These sand units often display alternating oxidized (orange) and reduced (gray) coloration. The organic detritus includes branches and wood fragments that are beyond the range of radiocarbon dating. Multiple optical stimulated luminescence dates on these sand beds yield an approximate age of 60,000-76,000 years before present* The diamicton (till) member of the formation consists of a gray, matrix supported, clast rich, highly jointed unit sometimes in excess of 10 meters thick, but more often less than 3 meters in thickness. An underlying 1-2-meter-thick gray colored, massive, fine-grained sand member brackets the diamicton. Optical stimulated ages on this fine-grained sand indicate burial occurred between 90,000 and 100,000 years before present*. Thus, our interpretation is that the diamicton represents an Early Wisconsin (MIS 4) glacial advance into the Finger Lakes Region and is possibly equivalent to the Guildwood or Greenwood Phases observed in the Ontario Provinces (Karrow et. al., 2000).

Pgg — **Great Gully Formation (Pgg)**
The Great Gully Formation consists of a thin, discontinuous bedded, medium-coarse grained oxidized sand and gravel member often no more than one meter thick that overlies a dark gray, matrix supported, clast rich, jointed, dense and highly indurated diamicton (glacial till) member. This diamicton contains an abundance of black Ordovician Limestone boulders and clasts often faceted and striated in greater abundance than other tills observed within Great Gully. This member is only visible in the eastern end of Great Gully along the floor of the ravine and appears as the lowermost observed till that occupies a north-south buried valley that transects Great Gully. The thickness of the deposit is poorly constrained; however, exploration wireline cores indicate thicknesses of 12 meters are present. Optical stimulated luminescence ages between 90,000 and 100,000 years before present* from the lower member of the Aurora Formation indicate this till unit is likely of Illinoian Age (MIS 6). By association we surmise the discontinuous sand and gravels above the till may represent the Sangamon Interglacial period (MIS 5). The till member is quite likely equivalent to the York Till in Southern Ontario.

Pkc — **Kings Corners Formation (Pkc)**
The Kings Corners Formation consists bedded silt, sand and gravel, with sand and silt facies that are overconsolidated, indurated and or semi-lithified. It also contains multiple diamicton units (till member). These deposits have only been observed in deep exploration boreholes directly beneath the Great Gully Formation. The age of the formation is unknown but as it underlies the Illinoian age till it is presumed to represent Pre-Illinoian alluvial, lacustrine and glacial environments.

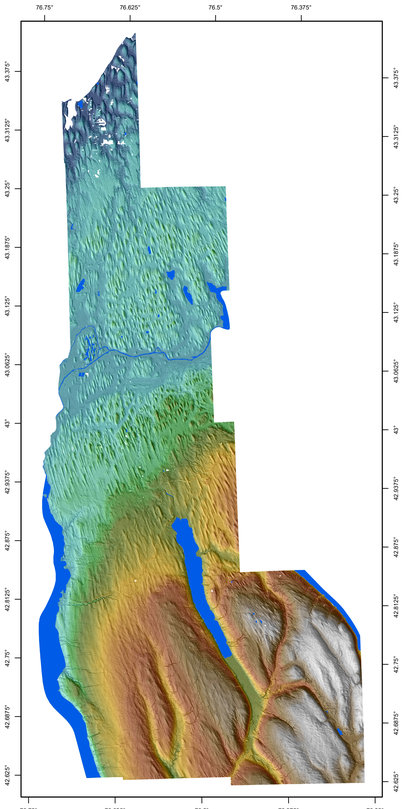
Pbnkr — **Bunker Formation (Pbnkr)**
Exposed by erosion associated with incision of Great Gully, the Bunker Formation consists principally of a gray colored, matrix supported, clast rich, over consolidated and highly jointed diamicton (glacial till). This indurated unit is abundant in red and green clasts of the upper Ordovician Queenston Shale and black Ordovician Limestones. The till unit is occasionally interbedded with sporadic sand and silt lenses and generally appears thicker than two meters but has been observed in wireline cores and outcrops as thick as 14 meters. Underlying the principle till member unit are stratified, sometimes cross-laminated sand and silt beds that range in thickness from 1-4 meters. Associated with the sand and silt units is indurated peat member 0.25-0.5 m in thickness. This paleosol serves as important marker bed and has been encountered in several exploration boreholes. The sand, silt and peat are interpreted as lacustrine and near shore sediments deposited during an interval of high lake level during a phase we term as glacial Lake Nanette within the Cayuga Basin. The sand units often contain organic detritus and wood and the upper contact between the till unit often displays shearing and deformation. The age of the Bunker Formation is Middle Wisconsin (MIS 3) and the till member is bracketed in age by the overlying sand member of the Ledyard Formation (~40,000 years before present*) and multiple age dates from AMS radiocarbon, optical stimulated luminescence (OSL) and pollen spectra from the underlying sand and peat member that consistently yield and age between 50,000 and 55,000 years before present*. The till unit is consistent with a regionally recognized glacial episode known as the Brimley Phase observed in Southern Ontario and the organic sand dominant facies are consistent with Interstadial Port Talbot Phase recognized in buried deposits along the north shore of Lake Erie.

Undefined Group

Br — **Bedrock (Br)**
Despite the predominance of surficial deposits left by glaciers various bedrock units are present at the surface of the landscape in many places across Cayuga County. Since the purpose of this map was delineate the surficial deposits and associated geologic framework the bedrock map units are undefined. Generally, the rock units from north to south are associated with Silurian Age Salina Group which underlies the northern 1/3 of the county. Continuing in a southward progression is the Middle Devonian Onondaga Formation, Middle Devonian Hamilton Group, Middle Devonian Tully Limestone and finally the Late Devonian Genesee Group. For details on

Plsc — **Lacustrine Deposits (Plsc)**
Undefined Member associated with proglacial lake deposits of bedded or stratified silt and clay. These deposits lack sufficient data to define a member association at

SHADED RELIEF and ELEVATION MAP



Feet-amsl
210 1875

1:250,000 scale; 2x vertical exaggeration

Shaded relief and digital elevation model generated from 2000 Cayuga County New York Lidar data set from National Oceanic and Atmospheric Admintration.

New York State Museum Map & Chart No. 104

ISSN:0097-3793 ; ISBN:978-1-55557-306-5