New York Glaciogram

www.newpaltz.edu/glaciogram

50th Anniversary Volume

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Editorial Policy

The *New York Glaciogram* is intended to be an annually compiled collection of informal notes concentrating on Quaternary work that relates to New York State either directly or indirectly. The Glaciogram is not a formal publication and is not circulated to libraries, nor to individuals not engaged or interested in Quaternary research. The information included is often of a preliminary and tentative nature, and as such, should not be quoted without direct communication with the appropriate authors. It is suggested that reference to information in the Glaciogram be identified merely as informal communication. Please contact individual contributors for permission to reprint any information published here.

Editor's Note

Dear Glaciogram Reader,

It has been fifty years since Ernie Muller put into motion the idea of a research newsletter and addressed it to "Friend of the New York Pleistocene". He opened with "*We have talked from time to time of improved means of keeping in touch with others engaged in New York Quaternary research. We have talked but we haven't done anything. The idea was a round robin or newsletter, circulating rapidly enough to be current, yet informal enough to have the advantages of conversation; without the structures of copyright, yet providing immediate availability of information to those who can best use it.*"

You can see from the archive that the idea was popular for a long time with two issues produced annually. Over the last couple of decades, however with the increased use of e-mail and other network based rapid communication options, contributions to the Glaciogram dwindled to the point where even after it became a digital product I still found it hard to get sufficient contribution for an annual issue. This 50th Anniversary Volume is a little thin, but I would like to thank everyone who wrote in with a contribution for making it happen one more year.

This may be it for the New York Glaciogram, but I will keep the web page and archive alive, and if there is sufficient call for another issue next year it will be easy enough to put one together. I will keep the e-mail list going for general community announcements, so let me know if you have a meeting or fieldtrip to announce to the community and I can add it to the webpage or e-mail it out. As most of you know I am also now the coordinator for the NE-FOP website and will maintain that archive as well, although Woody Thompson is currently keeper of that separate e-mail list. I call for us all to give as much support to the Friends of the Pleistocene as possible in the belief that while the role of the Glaciogram may be obsolete, the internet will never replace a good old-fashioned field trip!

Best wishes for the future,

John A. Rayburn
rayburnj@newpaltz.edu
Department of Geology
1 Hawk Dr.
SUNY New Paltz
New Paltz, NY 12561
Phone: 845-257-3767
http://www2.newpaltz.edu/glaciogram

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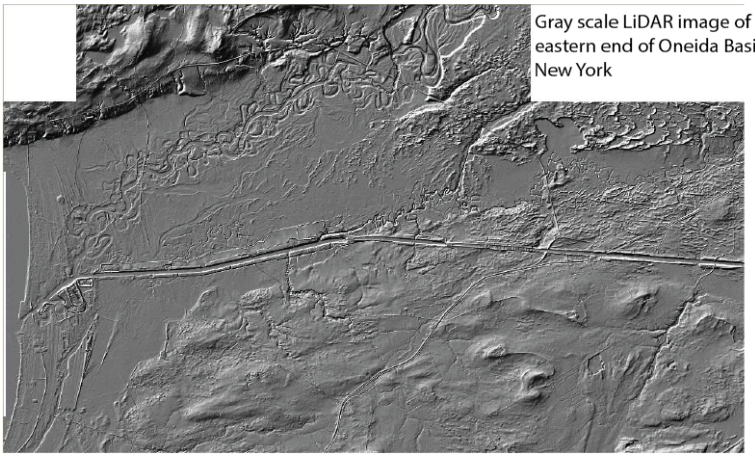
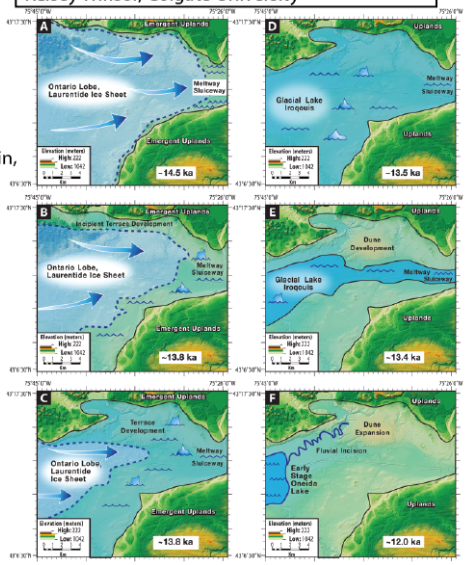
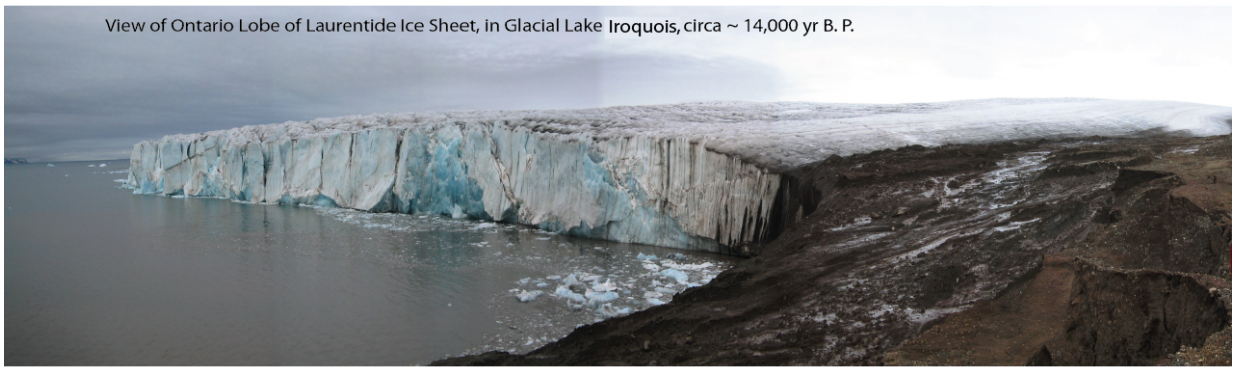


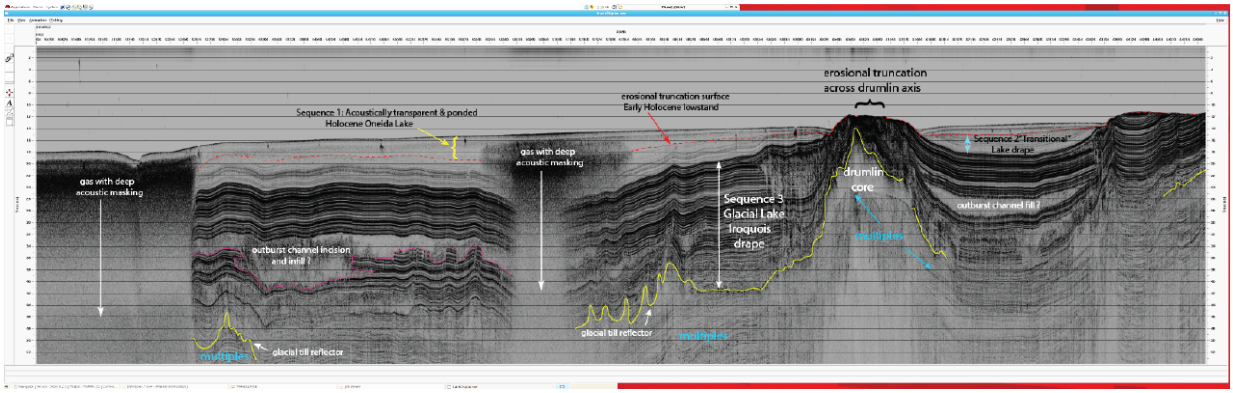
Gray scale LiDAR image of eastern end of Oneida Basin, New York





View of Ontario Lobe of Laurentide Ice Sheet, in Glacial Lake Iroquois, circa ~ 14,000 yr B. P.

High resolution Chirp seismic reflection profile of central Oneida Lake



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New Hampshire Geological Survey
http://des.nh.gov/organization/commissioner/gsu/index.htm

Rick Chormann
State Geologist and Director
NH Geological Survey
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095
Office Telephone (603) 271-1975
FAX: 603-271-3305
frederick.chormann@des.nh.gov

Lee Wilder
Public Outreach Coordinator
NH Geological Survey
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095
Office Telephone: (603) 271-1976
FAX: 603-271-3305
geology@des.nh.gov

New Surficial Geology maps of NH

The NH Geological Survey recently completed its 2015 field mapping season. Three 1:24000 scale Surficial Geology maps of NH were field mapped:

1. The Melvin Village Quadrangle (Geo-099-024000-SMOF) by Brooks, J.A. and Tinkham, D.A.
2. The Squam Mtn. Quadrangle (Geo-085-024000-SMOF) by Thompson, W.B.
3. The Mt. Dartmouth Quadrangle (formally Mt. Wash West) (Geo-046-024000-SMOF) by Fowler, B.K. and Barker, G.A.

And two, 1:24000 scale Bedrock Geology maps of NH:

1. The Hanover Quadrangle (Geo-091-024000-BMOF) by Peter J. Thompson.
2. The Mt. Dartmouth Quadrangle (formally Mt. Wash West) (Geo-046-024000 SMOF) by Eusden, J.D. Jr., Devoe, M.C., Oxman, G.O., Xiao, S.M.

LiDAR coverage in New Hampshire

Under a cooperative LiDAR Project between the State of New Hampshire, the USGS, National Forest Service, FEMA and the NRCS, much of western and central NH was flown in the Fall 2015 (some 5,200 square miles). Once this data is processed, 85% of New Hampshire will have LiDAR at a DEM of 1 meter resolution. The data will become available late summer 2016 through the state's GIS clearinghouse, GRANIT. http://www.granit.unh.edu/

Geological Society of New Hampshire Summer 2015 Field Trip

On July 11, 2015, the GSNH sponsored a summer field trip to learn about the effects of the Merrimack Village Dam Removal in Merrimack, New Hampshire and the Suncook River Avulsion in Epsom, New Hampshire. Matt Collins (NOAA) and Noah Snyder (Boston College) conducted the visit to the dam removal site in Merrimack. Shane Csiki (NHGS), Thor Smith (USGS-NH), Meghan Arpino and Anne Lightbody (Department of Earth Sciences, UNH), led the visit to the Suncook River avulsion site. Over 40 geologists and interested individuals attended the day long trip. Details at: http://www.gsnh.org/publications/GSNHIssue90Sept2015.pdf

NE-GSA at Bretton Woods NH in 2015

The 2015 NE-GSA Section Meeting was held again at the Omni Mount Washington Hotel at Bretton Woods, NH. It was the 50th Annual Meeting of the Northeast Section. This three day event brought together geoscientist from all over the NE. It was encouraging to have college students making up nearly half of the attendees. The Meeting employed an updated Annual Meeting format as well as a unique 50th Annual Section Meeting celebration, which was well received by all.

New Hampshire's Old Man of the Mountain

This famous post glacial profile and State symbol has been honored through the creation of the Old Man Profile Plaza and Museum at Profile Lake in Franconia Notch, New Hampshire. http://www.oldmanofthemountainlegacyfund.org/
Tourist season 2015 saw a significant number of visitors. The NH Geological Survey posted the Geologic Story of the Old Man of the Mountain in the Museum near the Plaza. That story is also here:
http://des.nh.gov/organization/commissioner/gsu/documents/oldmanmtdisplay.pdf
If you are in the area, the Plaza and Museum are well worth a visit.

NH Geological Survey Publications

A list of NH Geological Survey Publications can be viewed at:
http://des.nh.gov/organization/commissioner/pip/publications/geologic/index.htm These publications (hard copies and/or .PDF's) can be obtained by contacting the NH Department of Environmental Services, Public Information Center, PO Box 95, Concord, NH 03302-0095 (603) 271-8876 pip@des.nh.gov

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Abigail Burt
abigail.burt@ontario.ca
Ontario Geological Survey

3-D Quaternary Mapping at the Ontario Geological Survey

The Ontario Geological Survey (OGS) is continuing its commitment to map Ontario's Quaternary sediments in 3-D. Since the groundwater initiative began in 2002, a total of three studies have been completed (Waterloo Region, Barrie-Oro Moraine and Brantford-Woodstock), two studies are scheduled for release in 2016 (Orangeville – Fergus and South Simcoe) and two are underway (Niagara Peninsula and Central Simcoe). Key objectives of the projects are 1) reconstruction of the regional Quaternary history, 2) development of an interactive 3-D model of Quaternary sediments, and 3) characterization of the properties of the modelled sediment packages that form regional aquifers and aquitards. The models are based on the interpretation of natural and man-made exposures, existing subsurface records (water wells, geotechnical records, etc.) and new drilling and geophysical data.

Area	Size	Number of Layers	Block Size	Publication
Waterloo Region	1,385 km²	19	100 m	GRS 03
Barrie-Oro Moraine	1,290 km²	23	100 m	GRS 11
Brantford-Woodstock	2,715 km²	20	100 m	GRS 10
Orangeville-Fergus	1,550 km²	20	100 m	2016
South Simcoe	1,455 km²	18	100 m	2016
Niagara Peninsula	5,000 km²	-	100 m	in progress
Central Simcoe	1,575 km²	-	100 m	in progress
Total	14,970 km²			

Niagara Peninsula

Field activities were initiated in 2013 and focussed on the examination of natural and man-made exposures as well as soil probe and hand-auger cores. A ground-based gravity survey was completed in the fall of 2013 targeting areas where buried-bedrock valleys were predicted (based on water-well information) and this information was used to better define bedrock valley geometry and help guide subsequent drilling and monitoring well targets. More recently, three shallow seismic lines, ranging from 4.5 to 8.5 km in length, were acquired by the Geological Survey of Canada (GSC) as part of a collaborative agreement. The purpose of the survey was to determine whether multiple thalwegs exist within the Erigan – Chippawa buried-bedrock valley system as well as to define the

lateral extent and geometry of the lower drift gravel beds observed in previous drilling. Downhole geophysical logs were collected for 7 boreholes located adjacent to the seismic lines to determine the geophysical properties, including seismic velocities of the observed lithological units. These will be used to calibrate the seismic data and convert profiles to true depths.

A total of 77 continuously cored boreholes, 28 of which have been converted into monitoring wells, were drilled during the 2014 and 2015 field seasons. The Quaternary sediment cover across the Niagara Peninsula, the majority of which was deposited after the Late Wisconsin glacial maximum, has been grouped into a series of regionally-identified sediment packages following previous research in the area (for example Menzies, J. and Taylor, E.M. 1998. Urban geology of St. Catharines–Niagara Falls, Region Niagara; *in* Urban geology of Canadian cities, Geological Association of Canada, Special Paper 42, p.287-321). The lower drift package, representing the oldest Quaternary sediments recognized to date, consists of stony silt to sand till with local deposits of interbedded gravel, dirty gravel and diamicton (possibly eskers) and clean glaciofluvial gravel and/or sand (water-bearing). The lower drift package is overlain by a lower glaciolacustrine unit of rhythmically-bedded silt and clay deposited in glacial lakes Whittlesey and Warren. A late glacial ice advance out of the Lake Ontario basin deposited Halton drift which is dominated by stone-poor to somewhat stony clayey diamicton, often with abundant deformed clay and silty clay laminations, beds and blocks (intraclasts). The Halton unit also includes glaciolacustrine sediments with thin diamicton beds and discontinuous stringers and more rarely, silt to sand is interbedded with diamicton. The gravelly sand, sand and silty sand Fonthill ice-contact–delta complex, deposited in a re-entrant along the Halton ice margin in the east-central study area, forms an important regional groundwater recharge area. Following the retreat of Halton ice north of the Niagara Escarpment, glaciolacustrine sedimentation once again dominated the region. An upper glaciolacustrine unit consisting of rhythmically bedded clay and silty clay blankets the underlying Halton unit across most of the region and collectively they form an effective surficial confining layer. Glacial Lake Iroquois formed below the Niagara Escarpment as the ice continued to retreat northwards and eastwards. There are extensive deposits of Lake Iroquois nearshore sands near Lake Ontario while deeper water silts and clays are found at surface around Niagara-on-the-Lake and north of the main Lake Iroquois shore bluff.

Central Simcoe

Field work began in central Simcoe County in the summer of 2014. A regional reconnaissance mapping investigation was started, continuing into 2015, in order to characterize the surficial geology and develop a better understanding of the shallow subsurface stratigraphic units to support 3-D mapping efforts. New 1:50 000 Quaternary geology maps will be released in 2016 for the Collingwood, Nottawasaga, and western halves of the Barrie and Elmvale National Topographic System map sheets.
The study area is underlain by the Laurentian Buried Valley, generally believed to be a relict pre-glacial fluvial system connecting the Georgian Bay and Lake Ontario basins.

Quaternary glacial sediment infilling the valley exceeds 200m in places. Two seismic profiles (22 km and 12 km in length) were carried out in collaboration with the GSC to assist in evaluating the geometry of sediment groups and the selection of drill targets. Eight boreholes were drilled in central Simcoe County in the fall of 2015. All were drilled within lowlands surrounding southern Georgian Bay and sediment thickness ranged from 36 – 136m. Two boreholes intersected inliers of Grenville province Precambrian basement rock , one of which was over 30 km south of outcrops showing the unconformity at the base of the Paleozoic succession in southern Ontario. Long-term monitoring wells were installed at two locations to measure groundwater quality and allow for future downhole geophysical investigations.

The Quaternary stratigraphy is floored by two tills commonly separated by glaciolacustrine deposits. The lake deposits are bioturbated in places, and hosted detrital organic material in one borehole. The tills are correlated with Illinoian(?) glacial deposits commonly encountered in boreholes in southern Simcoe County. Overlying the lower glacial units are thick deposits of sand with minor gravel and fine-grained intervals. These are tentatively attributed to meltwater systems draining the advancing Laurentide Ice Sheet, as they are generally associated with Newmarket Till, a significant regional Late Wisconsin till sheet. Thin deposits of postglacial lake deposits were exposed in many boreholes and detrital organic material (wood, leaves, and mollusks) were encountered in a single borehole. Organic material recovered from drilling and mapping investigations will be sent for radiocarbon age determination to help better constrain the chronology of regional glacial events.

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Thomas Cronin
tcronin@usgs.gov
U.S. Geological Survey
926A USGS National Center
12201 Sunrise Valley Dr.
Reston, VA 20192

T M Cronin at USGS continues paleoceanography research in the Arctic Ocean with a number of colleagues and institutions focused on the Quaternary and material from 2013 USCGC Healy and 2014 Oden expeditions.

He is also running a sea level reconstruction project along the eastern United States focused on interglacial high stands and some Holocene marsh records, in collaboration with a number of colleagues.

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Thom Davis
pdavis@bentley.edu
Dept. of Natural and Applied Sciences
Bentley University
Waltham MA, 02452-4705

Thom Davis (Bentley University), Paul Bierman and Lee Corbett (both University of Vermont) have been busy over the past 18 months pulling together into three manuscripts lots of "old," unpublished, cosmogenic nuclide exposure age data from Baffin Island and New England summits. Some of you may recall that the three of us presented much of these data in three contiguous talks in the cosmogenic exposure dating session convened by Greg Balco and John Gosse at the NEGSA meeting at Bretton Woods in March 2015. We are pleased to announce that all three manuscripts are now published, or will soon be published, with the citations that follow. Hope to see many of you at NEGSA in Albany. Finally, we wish to extend our gratitude to John Rayburn for keeping *The Glaciogram* alive since Ernie Muller's retirement, which must have been in the last century.

Davis, P.T., Bierman, P.R., and Corbett, L.B., 2015. Cosmogenic exposure age evidence for rapid Laurentide deglaciation of the Katahdin area, west-central Maine, USA, 16 to 15 ka. *Quaternary Science Reviews*, v. 116, p. 95-105.

Bierman, P.R., Davis, P.T., Corbett, L.B., Lifton, N.A., and Finkel, R.C., 2015. Cold-based Laurentide ice covered New England's highest summits during the Last Glacial Maximum. *Geology*, v. 43, p. 1059-1062, doi: 10.1130/G37225.1.

Corbett, L.B., Bierman, P.R., and Davis, P.T., accepted. Glacial history and landscape evolution of southern Cumberland Peninsula, Baffin Island, Canada, constrained by cosmogenic ^{10}Be and ^{26}Al. *Geological Society of America Bulletin*.

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Dave De Simone
hawkeye272david@yahoo.com
De Simone Geoscience Investigations
957 Babcock Lake Road
Petersburg, NY 12138

It's been an interesting year for both research and contract work. First, the research…of sorts. And, I needed a break today from digging up rocks, err conifers, here on the Rensselaer Plateau.

I spent much of the Summer as a Visiting Scientist for the National Park Service (NPS) under the Geoscientists-in-the-Parks Program. I know…weird name and it's new. Go figure.

There's a back story. I represented the VT Geological Survey many years ago - 2007 - at a meeting held at UMass with geologists and selected park managers from the NPS. Bruce Heise and Tim Connors were the NPS geologists at the meeting all the way from their CO base. I'd recently completed STATEMAP mapping in VT that included a NPS property; hence, my inclusion in the meeting.

Another park came up for discussion and I volunteered that it was pretty much all mapped. The Saratoga National Historical Park (SNHP) has the unfortunate location of being on four 1:24K quads. I mapped one of those quads for my MS back in the Pleistocene while colleague Jack Dahl had done another pair of half-quads and frequent contributor here Eric Hanson mapped some of the area, too. I suggested if the NPS ever wanted a park map, it ought to be easy to do. Fast forward to late 2014. Bruce contacted me and said the SNHP had finally come up for mapping. However, they wanted complete quads and not just the park property. They also wanted a bedrock map. Good luck. I haven't mapped rock since they were calling the Hudson Valley stuff Normanskill as opposed to shale-rich melange. Anyway, I bit. The surf map is of some interest to us glacial types. It's a compilation of the field work of the 3 mappers mentioned plus a lot of me filling in-between and making purely discretionary decisions for the users of the map - the Park Manager and staff. It's a 1:24K map. The accompanying bedrock map is a cross between a compilation and an extrapolation based upon some very very old mapping and some newer work from Bill Kidd and Fred Vollmer et al. The rock map is at 1:62.5K. Hope you'll check the maps out at Map Blast in March and attend my talk/poster…whatever session organizers deem appropriate.

At about the time I sent in last year's submission to John for the Glaciogram, I was heading to a new and classical location for some geoarchaeology. Goat Island and Green Island atop Niagara Falls were slated to have a new connecting bridge and archaeology work needed to be done. The contract required a geomorphologist to interpret the shovel test pits and 1x1 meter excavations. It was a soggy few days with wet snow and cold drizzle. Nevertheless, it was a pleasure to walk in the very footsteps of Hall and Lyell, Gilbert and Taylor. Fascinating. I hoped we might excavate into Lake Tonawanda related materials. But, alas, most of our excavations were in a thick and mature regolith developed on dolostone or in late Holocene fluvial gravels that were deposited in broad channel fills cut into that regolith. It wasn't glacial but it was sure a lot of fun. I imagined Hall and Lyell taking some of the same traverses across Goat Island that I did. What a delightful if cold way to connect with the history of our science.

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Robert Dineen
eskers@windstream.net
P.O. Box 197
42 Mill Road
Geigertown, PA, 19523

GLACIAL GEOLOGY of the ALBANY 15-MINUTE QUADRANGLE, eastern New York State

Abstract

The Albany 15-minute Quadrangle is composed of the Albany, Clarksville, Delmar, and Voorheesville 7.5-minute quadrangles. It contains parts of the Helderberg Plateau and Hudson Lowlands. Three major preglacial channels, the Mohawk, Colonie, and Batten Kill-Hudson, formed a trellis drainage system.

The Albany area was covered by the Hudson-Champlain Glacial Lobe, which flowed radially out of the central axis of the Hudson Lowlands into the Mohawk Lowlands and the dipslope of the Helderberg Plateau. Glacial scour modified the interglacial and preglacial bedrock surfaces. The glacier deposited stratified drift and tills as it advanced and retreated across the area at least twice.

The Hudson Lobe retreated north of the Albany Quadrangle during the Erie Interstade. It readvanced to the Middleburgh-Rosendale ice margin approximately 13000 radiocarbon years ago and again retreated. Only the last advance-retreat cycle is recorded in the Albany Quadrangle.

Proglacial Lake Albany flooded the Hudson Lowlands as the ice retreated. The iceberg-studded lake lapped up against the retreating glacier. The lake deposits mask the bedrock topography, which controlled the depth of the lake and the thickness and distribution of the glacial deposits. The deposits are more than 300 ft (>91 m) thick in preglacial channels and thin to absent over bedrock highs.

The Meadowdale-Kinderhook ice margin was deposited by a still-stand of the ice in the Albany area. It dammed Glacial Lake Schoharie in the eastern Mohawk Lowlands and fed meltwater into the ice-marginal Lake Hampton phase of Lake Albany. The Guilderland-Hampton, McKownville-Rensselaer, and Schenectady-Niskayuna margins were built by successive still-stands. Lake Amsterdam was dammed by the former two margins and drained into the Hudson Lowlands when the ice retreated to the Schenectady-Niskayuna ice margin.

Sandy to clayey silt was deposited in front of the retreating ice. Ice-contact sands and gravels were deposited in subaqueous fans at the mouths of meltwater tunnels and by outwash streams draining the adjacent uplands. Sandy silt and turbidite beds were deposited in proglacial Lake Albany by meltwater surges from adjacent valleys, the glacier, and the Ontario Lowlands *via* the Mohawk Lowlands. Sand-laden floods built a

large delta at Schenectady. The sandy prodelta beds prograded across the northern third of the Quadrangle.

Several levels of Lake Albany are recorded on the Albany 15-minute Quadrangle. The water planes of proglacial lakes Hampton and Rennselaer were 350 ft (107 m) and 340 ft (102 m), respectively. Proglacial Lake Albany water planes were 340 ft (102 m, Albany I) and 315 ft (96 m, Albany II), with a short-lived 355 ft (108 m) water plane in-between. The brief 355 ft water level was caused by temporary ponding of a catastrophic flood from the Mohawk Lowlands. The flood eroded Lake Albany I's spillway, causing the level to drop 25 ft (6 m) to Albany II. The Quaker Springs stages of Lake Albany were at 270 ft (82 m) and 250 ft (76 m). The 220 ft (67 m), 190 ft (58 m), and 160 ft (49 m) water planes of the Coveville stage soon followed. The lower water levels did not last long because catastrophic floods from glacial lakes Iroquois, Vermont-Quaker Springs, and Vermont-Coveville, and from the Adirondack Uplands repeatedly eroded the lake outlet. In addition, glacial-isostatic uplift decanted the lowlands southwards.

The rebounded water planes of the Albany I and II stages are concave-up, with an inflection point near Albany. The steeper gradient occurs north of Ravena, where the Hudson lowlands widen significantly. They are less than 2.6 ft/mile (0.5 m/km) south of Albany and greater than 3.5 ft/mile (0.7 m/km) north. Quaker Spring's rebounded gradient is 2.3 ft/mile (0.4 m/km) and Coveville's gradient is 1.8 ft/mile (0.3 m/km).

As the lake levels dropped, northwest and southwest winds scoured the exposed lacustrine sand plains and spread sand across the lake deposits and into the shallow lake waters. The dune-building episode lasted from Lake Albany II to the post-glacial, early Pine Pollen Zone.

The falling levels of the fluvial Fort Ann stage cut erosional terraces at 140 ft (43 m), 110 ft (34 m), 90 ft (27 m), and 40 ft (12 m). The ages of the lower river terraces range from Late Pleistocene (Younger *Dryas*) to Holocene.

The glacial deposits were deeply incised during the Holocene. South of Glens Falls, the modern Hudson occupies the Fort Ann channels, which are cut into drift filling the preglacial Batten Kill-Hudson channel. The Hudson channel at Castleton was scoured to 30 ft (10 m) below present sea level and to 100 ft (30 m) below sea level near Kingston. The Holocene Hudson River has built a tidal delta between Castleton and Catskill. The Hudson's alluvium is over 65 ft (20 m) thick at Catskill. The deltaic sand grades into organic-matter rich silt south of Catskill.

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Eugene Domack
edomack@usf.edu
College of Marine Science
University of South Florida
St. Petersburg, FL, 33701

Work in the Oneida Basin, Ontario Lowland, New York

Eugene Domack[1, 2], Amy Leventer[2], Peter Kopp[1], Jackson Lucas[2] and Kaylie Patacca[2], Chris Sholz[3]

1. College of Marine Science, University of South Florida, St Petersburg FL, edomack@usf.edu
2. Department of Geology, Colgate University, Hamilton New York, aleventer@colgate.edu
3. Department of Geology, Syracuse New York, cascholz@syr.edu

New Varve Records in the Blossvale Valley of Fish Creek

In July of 2015 we described and measured three Quaternary sections that were discovered along a remote section of the upper reach of Fish Creek (FC), between Blossvale and Becks Grove, New York. Here, Fish Creek has deeply incised a single meander some 100 m into an extensive terrace found along the southern boundary of the Tug Hill Plateau with the "Oneida" lowland. The Rome Sand Plains, one feature that lies on top of the terrace, are found ~4 km to the southeast of the meander cut. Hence, these exposures reveal the basal stratigraphy (Figure 1) of an important Late Quaternary landform upon which smaller scale features of an eolian dune field reside. Most of the "terrace" is actually cored with ice contact sediments mostly over compacted and highly deformed muddy diamicts. These gray, glacigenic deposits are abruptly overlain by rhythmically laminated sands, silts, and clays with distinctive varved character. The laminated facies (Figure 2) are then in turn succeeded by cross bedded and climbing ripple cross-laminated fine-grained sands. These are disconformably cut by coarse, gravelly sands with trough cross bedded bed sets, with overlying soil profiles, thus capping the terrace feature. The three stratigraphic exposures demonstrate that the terrace is a composite feature composed of a combination of several depositional and erosional episodes.

Figure 1 and 2: Top photo of upstream section (first of three) on Fish Creek, showing lower third of gray glacigenic deposits overlain by stratified sands, and gravelly sands. Varved intervals are above the contact of the gray glacigenic deposits. Bottom phot shows view of the downstream (third of three) exposed sections along Fish Creek, showing laminated (varved) interval below stratified sands.

New Core Records from Oneida Lake and Glacial Lake Iroquois

We now have a fully equipped research vessel on Oneida Lake on a permanent basis; the ***RV Price*** was transferred from the dock at the College of Marine Science in St Petersburg FL to the Oneida Lake Marina in August, 2015. This boat is equipped with side scan sonar, dGPS navigation, sub-bottom seismic reflection (dual frequency 1 kW transducer), and a full assembly of core booms and winch supports. We utilized a new UWITEK percussion core system in September, 2015 and recovered undisturbed cores of up to 2 m in length (20 cm diameter) from various seismic sequences first identified by our Chirp Surveys conducted in 2013 and 2014 (Figure 3). Of these cores, we recovered for the first time varved sequences which we believe represent deposits from Glacial Lake Iroquois. Varves are some 7- 8 cm in thickness in the two intervals which we recovered, promising a high resolution record of the evolution of the lake basin during the late Glacial time.

Figure 3: Photographs of (left) collected cores aboard *RV Price* (Amy Leventer and Peter Kopp) and (right) cut section of 2 m long core illustrating condensed modern Oneida Lake gyttja overlying brownish red laminated clays.

New Cores from Oneida Basin

In addition to the above lake studies we collected a new suite of cores and excavations from several landform associations in and around the Oneida Basin. The first of these was from the muck land regions south of Oneida Lake where we recovered at least 2 + m of marl (Figure 4) which now has radiocarbon ages (gastropods) in succession from 4410 +/- 30, 5400 +/- 20, to 6830 +/- 35 (uncorrected years BP). We have yet to recover the entire thickness of the marl section at this locality so the potential for a nearly complete Holocene record is promising. We continue to evaluate the modern to pre modern reservoir hard water effect on modern carbonates within Oneida Lake with the first results on living mussels of 390 +/- 15 radiocarbon years.

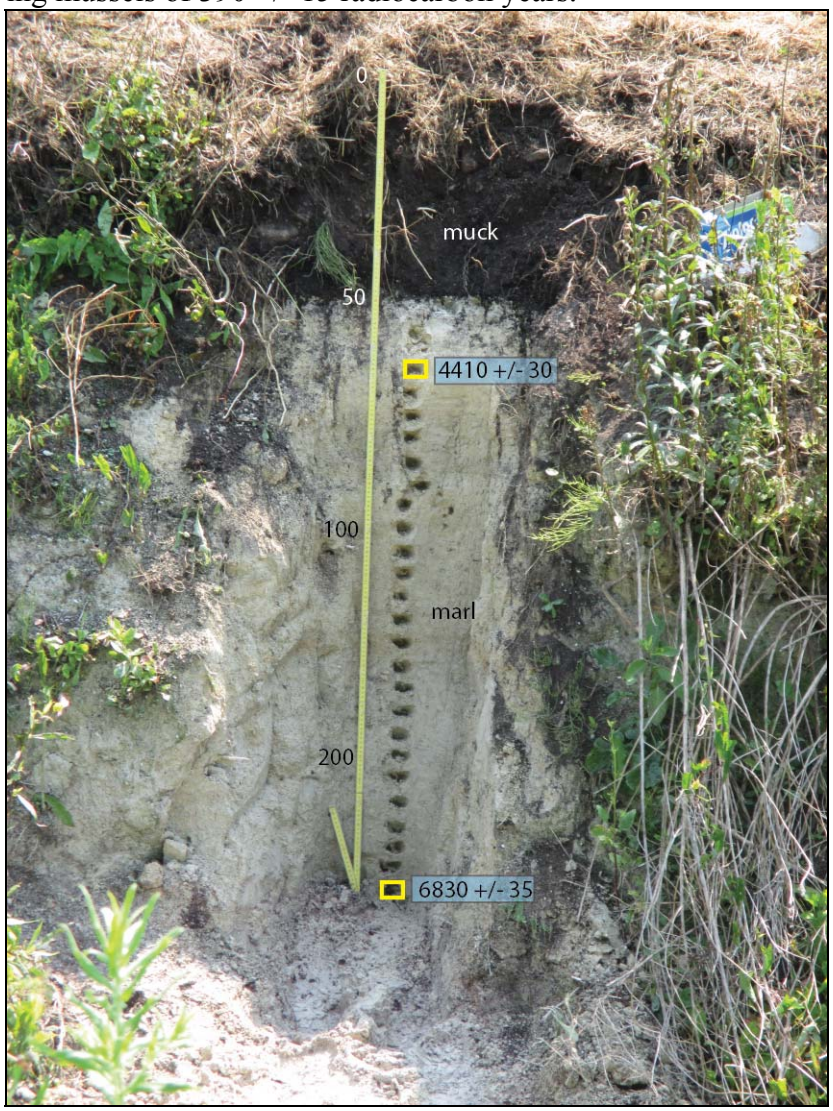

Figure 4: Excavated section of muck and marl with sampling holes and two of the three radiocarbon ages now derived from this section. Marl extends at least another 1 m below the base of this section.

2016 NE Friends of the Pleistocene Field Trip

The planning for the 2016 NE Friends of the Pleistocene field excursion is well underway with a set schedule of June 3-5. More information will be forthcoming with the New Year.

New Publications

Panyushkina, I. P., Leavitt, S. W., Domack, E. W., and Wiedenhoeft, A. C., 2015, Tree ring investigation of Holocene flood-deposited wood from the Oneida Lake watershed, New York, *Tree-Ring Research*, v. 71, p. 83-94.

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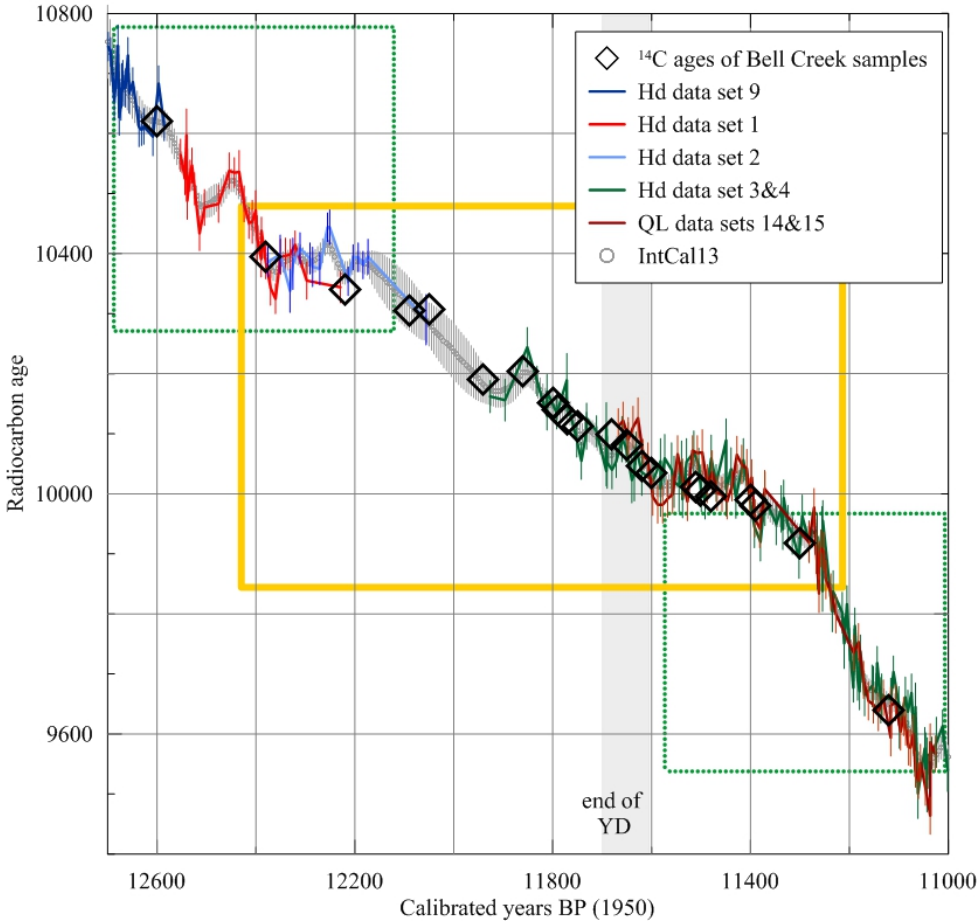
Carol Griggs
cbg4@cornell.edu
Cornell Tree Ring Lab
B48 Goldwin Smith Hall
Ithaca, NY 14853

I directed a two-week field survey of a Younger Dryas site, Bell Creek site near Fulton, NY, to assess the site's potential for providing the wood needed for new ^{14}C data for the period and it was unquestionably successful. With up to 10 people per day we dug 45 trenches to find the extent of the YD log-bearing deposit. We collected over 50 wood samples with potential for tree-ring analysis that date from 12,600 to 11,200 cal BP, plus over 150 for analysis and species identification at different strata. At the base of the last trench of the survey (OBF T45) we found the largest log yet, 30cm in diameter and extending across the trench and well beyond, which dates to 12,400 Cal BP.
Todd Grote recorded the sediments and stratigraphy, with impromptu lectures on the paleohydrology of what we were finding. He and Brita Lorentzen did GPS mapping of the trenches and she collected pollen samples. Cindy Kocik was our records keeper; Bill Mastandrea the photographer, Bill Hecht was our drone cameraman. The excavator, Duane Stevens, was a real asset, suggesting several trench locations that turned out to be "mother lodes" of wood.

We now are doing tree-ring analysis at Cornell, and have some of the new samples crossdating with the tree-ring chronologies from the 2009 collection. Soil sediments will be analyzed by Todd, and pollen samples by Dorothy Peteet.


10800
10400
10000
9600
Radiocarbon age
12600
12200
11800
11400
11000
Calibrated years BP (1950)
end of
YD
14C ages of Bell Creek samples
Hd data set 9
Hd data set 1
Hd data set 2
Hd data set 3&4
QL data sets 14&15
IntCal13

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Nathan Hopkins
nrh211@lehigh.edu
PhD. Candidate
Lehigh University
1 W. Packer Ave
Bethlehem, PA 18015

Edward B. Evenson
ebe0@Lehigh.EDU
Professor, Earth and Environmental Sciences
Lehigh University

Greetings,

Here at Lehigh, Ed Evenson and I are continuing, and diversifying, our work with anisotropy of magnetic susceptibility (AMS) till fabrics. Those of you who attended the 2014 Friends of the Pleistocene trip may remember our discussion of the till kinematics and patterns of ice flow around drumlins of the Weedsport drumlin field. I am happy to say that these results were published in BOREAS in July, and are now available for your continued criticism and/or praise! If you are interested, you can find the paper at the following link (http://onlinelibrary.wiley.com/doi/10.1111/bor.12138/abstract) or in full-text on ResearchGate.

Our work regarding the ice flow/till kinematics of the Baltic Ice Stream in southern Sweden is undergoing revision, but expect to see this article sometime this coming year. Finally, we made an exciting jump from the Pleistocene to the present, and are now focusing our efforts on using AMS to assess the magnitude, distribution, and style of deformation within the stratified basal ice of the Matanuska Glacier, Alaska. If you attended the GSA meeting in Baltimore, you may have seen our poster; however, seeing as how it was posted on the last day of the meeting, you are more likely to have been enjoying your last free beer or heading home.

Looking forward to seeing you all for the 2016 FOP.

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Paul Karrow
pfkarrow@sciborg.uwaterloo.ca
Department of Earth and Environmental Sciences,
University of Waterloo, Waterloo, Ontario, N2L3G1.

I can report an abstract and a full paper as published this year. The abstract was for recent studies on the Toronto interglacial:

Occhietti, S., Lamothe, M. , Karrow, P. F., Richard, P. J. H., and Clet, M. 2015. New studies on the interglacial to early stadial Don and Scaarborough formations of the Toronto area, Canada. Geological Society of America Abstracts with Programs 47, 3.

The successor full paper is in preparation.

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The published full paper is:

Bajc, A. F., Karrow, P. F., Yansa, C. H., Curry, B. B., Nekola, J. C., Seymour, K. L., and Mackie, G. L., 2015. Geology and paleoecology of a Middle Wisconsin fossil occurrence in Zorra Township, southwestern Ontario, Canada. Canadian Journal of Earth Sciences 52, 386-404.

As indicated by the list of authors, this is a site with a sub-till fossilliferous channel fill that yielded plant macrofossils, pollen, molluscs, ostracodes, and microvertebrates. Insects were also present and it is dated 43 to 50 K years. It is located centrally near Woodstock, Ontario.

With completion of laboratory processing of samples in December, 2014, and renewed activity by S. Cumbaa, National Museum in Ottawa, and K. Seymour, Royal Ontario Museum, vertebrate fossil study is moving ahead for the classic Don Brickyard in Toronto. A corresponding study of plants by J. McAndrews and F. McCarthy is about to be submitted for publication, coauthored by P. Karrow and L. Kerr-Lawson.

The Fort Erie project (see Glaciogram 2013, 2014) has ostracodes identified by B. Curry and molluscs are well advanced by I. Picard with report awaited. Microvertebrates are planned for study by K. Seymour, Royal Ontario Museum.

At North Bay, the site of the outlet for glacial Lake Algonquin, a study of a kettle hole pond in a Lake Algonquin delta by coring is yielding data on plants, isotopes, dating of the age of the kettle and other biotic groups. There are indications of tephra in the core and identifications are anxiously awaited.

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Ben Laabs
laabs@geneseo.edu
Department of Geological Sciences
SUNY Geneseo
Geneseo, NY 14454

Greetings, Glaciogram readers!
I am excited to report that my term as department chair is almost over, and I look forward to (mostly) being a scientist again. Despite a frustrating lull in my research program at SUNY Geneseo, my students, colleagues and I have made some interesting discoveries in the realm of glacial chronologies in the western U.S.

Jeff Munroe (Middlebury College) and I are nearly finished revising a chapter about mountain glaciation in the Lake Bonneville Basin, to be part of a forthcoming book about the current scientific thinking about Lake Bonneville. The chapter includes new and (mostly) old cosmogenic ^{10}Be chronologies of glacial deposits, with ages recalculated

using new and improved production rate and scaling models. The models are starting to converge, giving us more confidence in comparing cosmogenic ^{10}Be exposure ages of moraines with the radiocarbon-based chronologies of the Lake Bonneville. This provides a very useful framework for understanding the climatic and hydrologic links between glaciers and the lake.

I continue to think about the impact of new ^{10}Be production rate models on the chronology of mountain glaciation on the west. Eric Leonard (Colorado College), Joe Licciardi (UNH), Jeff Munroe and I are writing a review on this subject for QSR, while contributing to the volume of chronological data on this important record.

Additionally, I continue to look for ways to use ^{10}Be to develop the chronology of glacial deposits in New York State. The Cosmogenic Nuclide Preparation Lab at SUNY Geneseo is processing dozens of samples every year for ^{10}Be exposure dating, and I hope to get involved with more local studies of the glacial record. If you are interested in developing new, collaborative research involving my cosmogenic nuclide lab, please get in touch!

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Mike Lewis
lewis.bowerman@ns.sympatico.ca

Was the northern boundary of the N-S drumlin field in Wayne County trimmed by a subsequent WSW flow of ice and meltwater?

The question in the title above came to us while revisiting bathymetric and seismic reflection profiles in eastern Lake Ontario in conjunction with onshore digital elevation models earlier this year during preparation of a presentation at the spring AGU joint meeting with the Geological Association of Canada in Montreal. East of Sodus Bay, NY, the N-S drumlin field is truncated at the Lake Ontario shoreline (see figure). West of Sodus Bay the northern boundary of the drumlin field lies onshore and trends WSW for at least 40 km to Rochester, NY, where it occurs 11 to 12 km south of the Lake Ontario shore. The boundary crosses the glacial Lake Iroquois beach and the Lockport (Niagara) bedrock escarpment so its formation is not associated with either of these features.

We note that the trend of the northern boundary of the N-S drumlin field parallels WSW-trending drumlins in the deep water of eastern Lake Ontario (see figure). This parallel relationship leads us to suggest a WSW flow of ice and meltwater followed the N-S flow such that the southern edge of the WSW flow extended onshore where it obliterated the northern portion of the N-S drumlin field in New York.

An early description of the offshore Lake Ontario drumlins appeared in Lewis et al. (1997). Also, Shaw and Gilbert (1990) have proposed the N-S and WSW drumlins were

formed in succession by subglacial meltwater floods. Neither publication discussed interaction of the WSW flow with drumlins of the N-S flow in New York State. We would appreciate hearing from readers of this newsletter about any previously published or current ideas concerning the formation of the northern boundary of the drumlin field in Wayne County, NY.
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Cheryl J Moss
cmoss@mrce.com
Mueser Rutledge Consulting Engineers
14 Penn Plaza - 225 West 34th Street
New York, NY 10122-0002

This year's update is really an extension of last year's letter asking if anyone had information on the marine 20 Foot Clay/Wantagh Formation found in the subsurface along the south shore of Long Island. NE-GSA 2015 confirmed that there is still no clear consensus on the age of the unit (Sangamon vs. early/mid Wisconsinan?).

Our lab is currently so buried with south shore samples related to post-Sandy rebuilding projects that I haven't had a chance yet to analyze any of the data - but as I continue to look through all of the samples I'm getting some possible ideas for a future GSA topic. One possibility, Rampino & Sanders (1981) found barrier island sediments within the Wantagh Formation in Nassau County and it's starting to look like they're present in parts of New York City too. If anyone has new information on the ages of the glacial/interglacial strata in NYC and Long Island please get in touch. Unfortunately trying to date the samples is well outside the scope of the projects.

Meanwhile, I've submitted an abstract for NE-GSA 2016 detailing the stratigraphy across the Hudson River at the new Tappan Zee Bridge. Now that most of the basic foundation elements are in, it seemed like a good time to publish what was found.

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Dorothy Peteet
peteet@ldeo.columbia.edu
Lamont–Doherty Earth Observatory
Palisades, NY 10901

We are continuing our research on the timing and nature of deglaciation of the northeastern Laurentide. New sites include Tamarack Pond, Black Rock Forest and Cedar Swamp, High Rock State Park. Students Mio Alt and Rebecca Snyder are involved...We are collaborating with Dan Karig (Cornell) at sites near Ithaca, New York that include Spencer Swamp and a section south of Cayuga Lake that represents the Erie Interstadial.

John Rayburn
rayburnj@newpaltz.edu
Dept. of Geology
SUNY New Paltz
New Paltz, NY 12561

It has been a busy year for some of my smaller student oriented research projects. I have continued work with Alex Bartholomew (SUNY New Paltz) and students to investigate the flood records in the Schoharie Creek drainage basin. This year in collaboration with Carol Griggs (Cornell) we have analyzed carbon isotopes from the rings of White Ash trees to see what they can tell us about the floods. (Abstract submitted to NE-GSA). I have also been working with Tara Curtin (Hobart & William Smith) on a core our joint Paleoclimate classes took from a marsh between Seneca Lake and Lake Ontario that bottomed in Glacial Lake Iroquois sediments. (Another submitted NE-GSA abstract.) I have also had a couple of students looking into the water quality of streams and rivers around our area with weekly samples taken through the year. (Perhaps an abstract for next year?) Did you happen to catch my presentation at GSA in Baltomore? With the assistance of Shannon Mahan (USGS) David DeSimone, Amie Staley (now at the Minnesota Survey), Byron Stone (USGS), and I were able to get an OSL age from varved lake clays in the Catskills and come up with an ice advance age for our region of 27,580 ± 740 years (1 σ), and an estimated ice advance rate to LGM on the order of 50 m/year.

Plans for next year include a long awaited sabbatical in the Fall with a good dose of field mapping. I'm heading back to Glacial Lakes Vermont and Albany with David DeSimone to see what we can see.

Hope to see you all at the NE-GSA in March and the NE-FOP in May!
(Many limited edition Glaciogram stickers still available!!!!)

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Robert Titus
titusr@hartwick.edu
Dept. of Geol. and Envi. Sciences
Hartwick College
Oneonta, NY 13820

Johanna Titus
Dept of Allied Health and Bio. Sciences
SUNY Dutchess
53 Pendell Rd
Poughkeepsie, NY 12601

Robert Titus, of Hartwick College, and **Johanna Titus**, of SUNY Dutchess, continue to syndicate their weekly geology columns to seven different newspapers of the Columbia/Greene Media newspaper chain. They also publish in every quarterly issue of *Kaatskill Life* magazine, and monthly columns in the *Woodstock Times*, for a total of about 75 columns per year. Their writings are about general geological topics of the Catskills and Hudson Valley. By no means are all of them about glacial geology, but a lot of them are. This year they did a series of 12 columns about how Hudson Valley

landslides are closely related to the sediments of Glacial Lake Albany. Recently, they did a short series of columns about the ice age history of Windham.

Of note, this year, was their publishing an article about the geology of the Catskill Front in *Earth* Magazine's *Travels in Geology* series. Much of that article was about the ice age history of the Catskills' fabled Wall of Manitou.

They are continuing their researches into how ice age history affected the sites painted by the members of the Hudson River School of Art, especially those located along the Art Trail, established by Cedar Grove, the Thomas Cole Historic Site. This year they did a series of columns on the Art Trail, relating ice age history to many of the classic painting done by those painters. That was for the Columbia Greene Media. They literally made news, this year, with their identification of Vroman's Nose as likely being the site that Thomas Cole used in his "Course of Empire" series of paintings. The Oneonta *Daily Star* did a feature article about this – on their front page.

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Local scientists link Vroman's Nose to iconic painting

By Joe Mahoney
Staff Writer

For decades, art historians wondered precisely where in Italy the craggy mountainous formation in a famous series of landscapes painted by acclaimed 19th-century painter Thomas Cole was located.

They couldn't find it there because it is actually one of the most distinctive geological formations in the Schoharie Creek Valley, Vroman's Nose, according to two local scientists, the wife-and-husband team of Johanna and Robert Titus.

Robert Titus is a professor of geology at Hartwick College, while Johanna Titus is a biology instructor at the State University Duchess campus. The two have chronicled their explorations and hikes of the Catskills for years in several publications.

Both are knowledgeable about the role of geology in art, and it was Johanna who first noticed what both have concluded is the "dead-ringer" resemblance between Vroman's Nose and Cole's famous series called The Course of Empire.

Cole is the founder of what has been branded the Hudson River School of art, a genre that has been described by the Albany Institute of History and Art as "exaltations of wild and uncultivated nature" with "captured landscapes of pastoral repose, scenes that signified abundance, prosperity, and refinement."

Cole created the five-part "Empire" series of paintings in the years 1833 to 1836. The paintings offer a cyclical view of a civilization as it appears, matures and finally collapses.

Once she noticed the similarity with Vroman's Nose, Johanna Titus postulated that Cole had traveled along the Schoharie Turnpike, now known as state Route 145, on his way to the Duanesburg home of one of his first patrons, George Featherstonhaugh, a geologist, in December 1825 for what proved to be a three-month stay.

He often made sketches during his travels, and he likely took out his pad when he encountered the striking formation called Vroman's Nose, she said.

"There were only two ways to get there then, and that was to either go up the Erie Canal or go over land, and the only real road then was the Schoharie Turnpike," Johanna Titus said. "As you travel north (heading into the town of Middleburgh) you come over a hill and once you get down the hill you can see Vroman's Nose. It smacks you right in the face. It would have really caught his eye."

As an artist who set out to create moods and tell a story through his work, Cole was known to combine different unrelated scenes into a single work in order to make the point he hoped to convey, she said.

"Most times, he used several different themes that he liked or thought appropriate, and put them together when he formed a painting, or a story, with them." she said. "This is very much in keeping in what he did."

The Tituses said they believe that Cole, who appreciated the company of geologists, used the mountain in the backdrop of the panels to project the enormity of geological time. The one flourish that Cole added in the rendering of Vroman's Nose was a large boulder perched at the peak, something the real formation lacks.

Boulders found in such places are known as glacial erratics, remnants of the Ice Age, and the Tituses said they believe it was Cole's symbol of "deep time."

And while there is no smoking gun evidence to connect

See PAINTING, Page 7

'The Arcadian (Pastoral State),' an 1836 painting by Thomas Cole, is shown at top. Local scientists Johanna and Robert Titus have postulated that the mountain formation shown in this and other Cole paintings is Vroman's Nose, in Schoharie County, shown above.

France launches air

Robert and Johanna are very popular speakers, and made about 25 public presentations in 2015. They did, as examples, lectures about the ice age histories of the towns of Rhinebeck and Saugerties for local history groups. They also helped celebrate "Furnace

Day" for the Copake History Society by giving a presentation about the ice age history of that town.

They continue to work with numerous other civic groups. This year, most notably, they worked with the Poughkeepsie Library and narrated, for them, a fund-raising boat ride down the Hudson River. They described the ice age history that the group was passing on that boat ride. More than 80 people came along. Once again, this year, Robert led an Ice age geology walk at Olana, Frederic Church's mansion, for the annual *Hudson Valley Ramble*.

Their book "The Hudson Valley in the Ice Age" has gone to a second printing and still sells well. They are contemplating update their book "The Catskills in the Ice Age." They have received public recognition for their work. They were listed as Greene County "legendary locals" Also they were named as "Greene County honorees" by the Zadock Pratt Museum.

Bob and Johanna ask you to consider keeping them up to date on your research. They can adapt your work to publicize it in their columns. They are at randjtitus@prodigy.net

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Michael Wilson
Michael.Wilson@fredonia.edu
SUNY Fredonia

Dick Young and I, both retired from full-time teaching but maintaining research space (Young at Geneseo and Wilson at Fredonia), have begun working on developing a more detailed chronology of late Pleistocene, Holocene and Anthropocene events at the West Valley nuclear facility. We are early in the project and have nothing to report beyond background information given on the DOE-NYSERDA project website. Sean Bennett at UB is a colleague on the erosion-prediction project working with modern erosion measurement and localized modeling, and Greg Tucker and Sandi Doty (Colorado) are working on wide-area modeling. I also continue in my six-year appointment as one of New York's members on the Ohio River Valley Water Sanitation Commission (ORSANCO) which meets three times per year. The Commission discussed Harmful Algal Blooms at our October meeting in Buffalo and we will be discussing micro-plastics at the February meeting in Cincinnati. Meetings are open to the public. The June meeting will be in Pittsburgh.