New York Glaciogram

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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.

Invitation From The Editor

As the title implies, past issues of the *New York Glaciogram* have contained entries weighted toward Glacial Geology. My predecessor believed, as do I, that we should expand the coverage to also include topics that may be closely related to glacial geology, such as limnology, palynology, soil science, ground water geology, environmental geology, etc. Also, please check out the new *Help Wanted* section at the end of this year's volume. I will be collecting contributions for the next edition in the Fall of 2013. Deadline for next year's contributions will be Monday, December 9th, 2013. If you have any meetings, fieldtrips, or other announcements that you would like put on the Glaciogram website, please contact me.

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M.Sc. project in glacial geology and geochemistry. Department of Earth and Environmental Sciences at the University of Waterloo, Canada.

Ph.D. position in the Department of Geology at the University at Buffalo.

Northeast GSA meeting
March 18-20, 2013
Bretton Woods, NH

Quaternary scientists are invited to attend the upcoming Northeast Section meeting of the Geological Society of America. A spectacular venue has been arranged for this meeting – the newly renovated Mt. Washington Hotel and conference center, with beautiful views of Mt. Washington and other peaks of New Hampshire's White Mountains. Special discounted rates for lodging have been arranged at this grand hotel and other lodges in the resort complex, to provide a range of affordable rooms for professionals and students. Bring your skis!

We are taking advantage of this northern location to encourage participation from both sides of the Canada-US border. There will be a wide variety of sessions as described on the meeting website: http://www.geosociety.org/Sections/ne/2013mtg/welcome.htm
It is hoped that Glaciogram readers will consider submitting an abstract for a talk or poster in the theme session described below. **Note that the abstract deadline is fast approaching!**

Theme session title: ***Glacial history of the Canada - New England border region***
Abstract deadline is **December 11, 2012**

Conveners:
Woodrow Thompson (Maine Geological Survey)
Michel Lamothe (Université du Québec à Montréal)

Description: This theme session will address the glacial history of northern New England and adjacent parts of Québec, New Brunswick, and the Lake Champlain region (NY-VT). We invite volunteered talks or posters covering a broad spectrum of topics related to the glacial geology of the region. These may include - but are not limited to - the sequence and chronology of glaciation, ice sheet reconstruction, geochemical dispersal in glacial sediments, meltwater routing, glacial lakes, and the development of our present understanding of the glacial stratigraphy. Presentations linking studies on both sides of the international border are especially welcome.

If you have any questions about this session, please contact Woody Thompson at: Woodrow.b.thompson@maine.gov

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Northeast Friends of the Pleistocene
June 7-9, 2013
Oak Ridges Moraine, Toronto area, Ontario

Preliminary Announcement and Invitation
David Sharpe, Geological Survey of Canada

BACKGROUND

The Oak Ridges Moraine (ORM) is a prominent, hummocky ridge of sandy hills in southern Ontario lying 20-30 km north of Lake Ontario. It is 10-20 km in width and stretches ~160 km eastward from the Niagara Escarpment, a 100 m high Paleozoic cuesta. ORM sits 350 m asl and forms a significant topographic divide between Lake Huron and Lake Ontario (~75 m asl). ORM formed ~13,000 years ago as a result of enhanced meltwater discharge during retreat of the Late Wisconsinan continental ice sheet.

Covering 10,000 km^2, 65% of which lies within the Greater Toronto Area, it is a significant source of sand and gravel and groundwater recharge that filters and slowly releases cool, fresh water to the 65 rivers and streams originating in the ORM. Its unique geologic, hydrologic and economic contributions to the Toronto region led to the pioneering establishment of the Oak Ridges Moraine Conservation Act that controls development in the moraine area. ORM hydrogeological studies also provided guidance for implementing the provincial Clean Water Act, 2005, following the Walkerton water disaster.

The ORM is the best studied moraine in Canada and forms a complex, multi-tiered geological structure that is up to 200 m thick. Improving understanding is based on high-quality surface and subsurface data, such as 25,000 ground sites, ~100 line-km of high-resolution reflection seismic profiles, ground-penetrating radar, and hundreds of deep, continuously-cored boreholes with sedimentological logs and borehole geophysics.

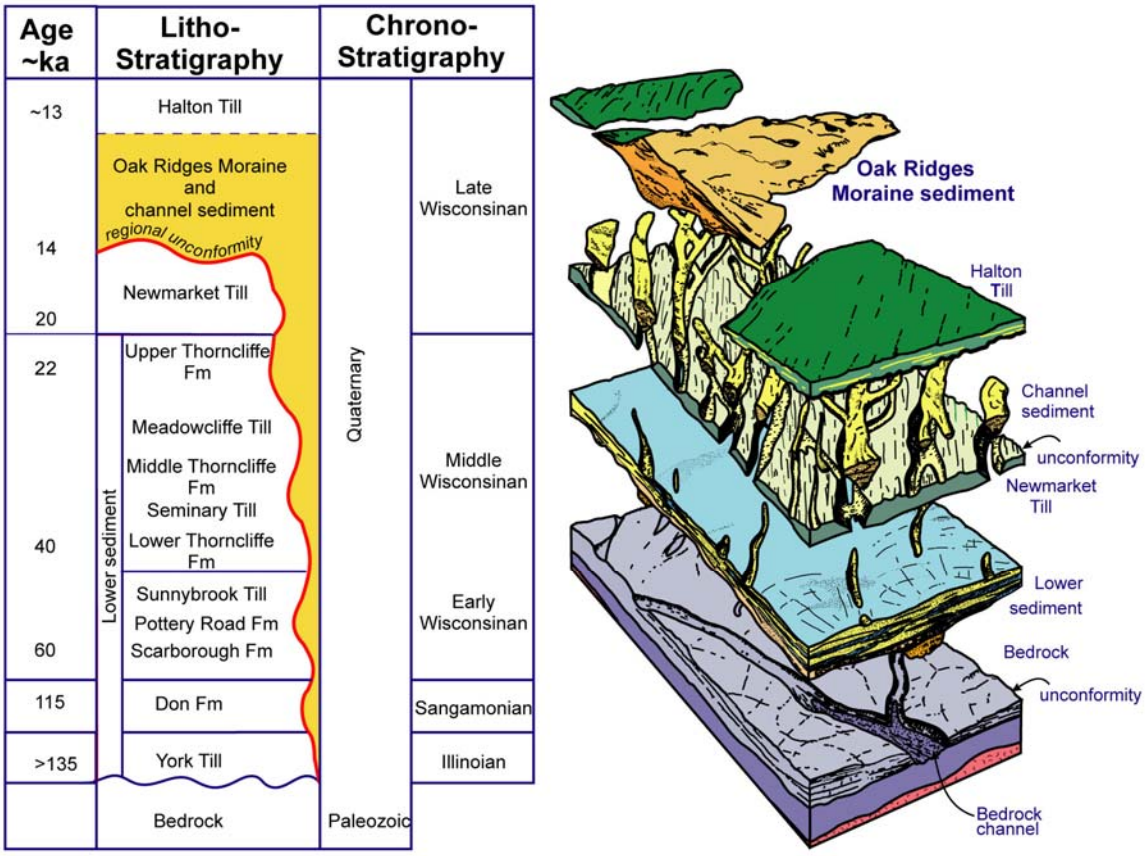
TRIP PREVIEW

The focus of the ORM trip will be the glacial geology of a continental basin and tunnel valleys hosted within the glacial stratigraphy of the Oak Ridges Moraine region. Using digital elevation models, and detailed geological mapping, a system of anabraching valleys has been classified on the basis of length, width and depth. The valleys have been traced beneath the Oak Ridges Moraine using map, geophysical and core data. The trip presents a suite of subsurface data with outcrop sedimentology in support of meltwater process models and depositional environments. Process models are considered to relate to regional subglacial landscapes and are used to explain

the origin of regional unconformities and the formation of tunnel valleys. Depositional process models will be discussed to interpret key sedimentary facies and evidence for rapid flow events into standing bodies of water.

The trip starts at the famous Scarborough Bluffs on Lake Ontario, with a discussion of the regional glacial stratigraphy and units beneath the late-glacial Newmarket Till, truncated by regional unconformities. Subsequent stops highlight inter-valley sediments beneath the Oak Ridges Moraine and outcrop sediments of the ORM interpreted within a subaqueous fan setting. We also review the surface expression of tunnel valleys, eskers, seismic mapping of buried valleys, and regional meltwater concepts for tunnel valley formation, while traversing the length of the Oak Ridges Moraine and beyond to adjacent drumlin fields.

Recently, an international research group (18, mainly oil company reps.) requested a 1-week fieldtrip /training session to the ORM area. The research interest was buried valleys (BVs) in glaciated terrain, as an analogue for similar settings in Ordovician glacial sequences that host economic oil and gas reservoirs in North Africa and adjacent areas. This formal research group considers the ORM BV dataset as a world-class analogue for ancient valleys with oil and gas reservoir potential. We have a guidebook ready to go and ORM is only a few kms away from the Northeast USA — come and join us in the Great White North!



New York State Geological Association
http://www.nysga.net/

The 85th meeting of the NYSGA will be hosted by SUNY Fredonia September 20-22, 2013.

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Geological Association of Canada
http://www.gac.ca/

May 22-24, 2013 in Winnipeg
http://gacmacwinnipeg2013.ca/

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CANQUA-CGRG Biannual Meeting August 18-21, 2013 in Edmonton, Alberta
Contact: Duane Froese, University of Alberta (duane.froese@ualberta.ca)

Join us in Edmonton for the Canadian Quaternary Association biannual meeting August 18-21, 2013. The meeting will be joint with the Canadian Geomorphology Research Group and hosted at the University of Alberta.

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Abstract Deadline: March 30, 2013

Pre-Conference Field Trips:

1. *Jasper and the Athabasca glacier* August 17-18 Led by Nat Rutter (University of Alberta) and Dan Utting (Alberta Geological Survey)

2. *Glacial geomorphology of paleo-ice streams of Southern Alberta* August 16-18. Led by David Evans (University of Durham)

Post-Conference Field Trip:

Stratigraphy and record of catastrophic drainage of Clearwater-Athabasca spillway and geoarchaeology of the Oilsands Region August 21-24, 2013 Led by Duane Froese (Alberta), Robin Woywitka (U. Alberta and Archaeological Survey of Alberta) and Nigel Atkinson (Alberta Geological Survey)

Schedule:

- Preconference field trips from Edmonton (August 16-18)
- Opening reception evening of August 18 at Royal Alberta Museum
- Sessions August 19-21 at University of Alberta)
- Post-conference trip (August 21-24)

Proposed Special Sessions

- The Ice-free corridor connecting North to South for 2 million years- almost never closed? Records of gene flow and paleoenvironments (Charles Schweger and Beth Shapiro)
- Sedimentary DNA and ecosystem reconstructions of past environments (Hendrik Poinar and Beth Shapiro)
- Cryptotephras- methods and prospects for a North American framework (Britta Jensen and Sean Pyne-O'Donnell)
- The 21st Century Surficial Geology Map (Steve Pawley and Nigel Atkinson- Alberta Geological Survey)
- A passion for the Arctic: recent and ancient environmental change in honour of John England's retirement (Trevor Bell and Don Lemmen)
- The Palaeoecology of Extreme Environments (Canadian Association of Palynologists special session - Alwynne Beaudoin and Mary Vetter)
- Sticky and slippery beds under modern and ancient glaciers (Michelle Trommelen and Jeff Kavanaugh)
- Cold regions processes – could we reach the tipping point (Steve Wolfe and Steve Kokelj)
- Dating the Quaternary (Olav Lian and Bert Roberts)

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Vermont Geological Survey

http://www.anr.state.vt.us/DEC/GEO/vgs.htm

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Through a Department of Energy grant to state geological surveys related to geothermal resources, we have been able to archive and make available in digital format older maps and reports. If a mapper is now interested in the 1:62,500 sheets for maps made in the 1960's that were the base for the 1970 Surficial Geologic Map of Vermont, they can all be found on line.

Link from the VGS web site: http://www.anr.state.vt.us/dec/geo/catalog.htm

The server location for the hub funded by DOE is:
http://geothermal.isgs.illinois.edu/ArcGIS/rest/services/aasggeothermal

Look for aasggeothermal/VTSurficialGeology……. (Name of 1:62,500 Quad)

For GIS data for all our newer maps the following link will get you to 14 different projects:

http://maps.anr.state.vt.us/geology/

Recent maps at this site include: The Plainfield 1:24,000 USGS 7.5 minute quadrangle mapped by George Springston of Norwich University; Pico Peak quadrangle mapped by Stephen Wright of the University of Vermont and the Town of Dover mapped at 1:24,000 by John Van Hoesen of Green Mountain College. George Springston continue this season's mapping in the Bristol quadrangle in West Central, VT.

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

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New Surficial Geology maps of NH
The NH Geological Survey recently completed its 2012 field mapping season. Five 1:24000 scale Surficial Geology maps of NH were field mapped.
1. The Warner Quadrangle by Carl Koteff
2. The Center Harbor and Ashland Quadrangles by John Brooks and John Tinkham.
3. The Crawford Notch and Carter Dome Quadrangles by Brian Fowler.

During this fall's NEIGC 2012 Meeting, Brooks and Tinkham led an all day field trip, highlighting a number of Surficial Geology features and puzzles associated with mapping the Center harbor and Ashland Quadrangles.

NE-GSA at Bretton Woods NH in 2013
The NE-GSA Meeting will be held at Bretton Woods, NH from March 16-20, 2013. For registration and details see: http://www.geosociety.org/sections/ne/2013mtg/
K-12 Educators should pay particular attention to the section meeting designed just for them. It will be held all day Saturday March 16, 2013 at Bretton Woods. They may register and sign up for workshop W9 at the same website. Please pass this information along to interested science teachers. Those with question may contact Lee Wilder at: geology@des.nh.gov

NH Geological Survey Publications
All NH Geological Survey Publications can be viewed at:
http://des.nh.gov/organization/commissioner/pip/publications/geologic/index.htm

They can be obtained by contacting the NH Department of Environmental Services, Public Information Center, PO Box 95, Concord, NH 03302-0095; (603) 271-2975; or FAX (603) 271-8013. pip@des.nh.gov
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Maine Geological Survey
http://www.maine.gov/doc/nrimc/mgs/mgs.htm

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Maine Geological Survey

The Maine Geological Survey was funded in 2012 to continue surficial geologic mapping under the USGS STATEMAP program. This year we mapped five 7.5-minute quadrangles in the mid-coast region. MGS geologist Tom Weddle worked in the Lincolnville quad, and Woody Thompson in the Searsport and Castine quads on either side of Penobscot Bay. Carol Hildreth and Alice Kelley mapped the Mt. Waldo and Snow Mountain quads in the nearby lower Penobscot River valley to the north. Much of this area was submerged by the sea during deglaciation, resulting in deposition of grounding-line moraines, glaciomarine deltas, submarine fans, and muddy seafloor sediments (Presumpscot Formation).

Striation data collected during the project will be used to help determine changes in ice flow directions during recession of the last ice sheet from the Penobscot valley. Previous mapping in the Bangor area showed late-glacial convergence of ice flow into the valley, where the deeper marine waters favored faster ice retreat in a calving bay. One site on the east shore of Penobscot Bay in Castine records a very unusual earlier flow. The red pencil in the photo marks younger striations formed on a stoss surface by late Wisconsinan regional SSE flow, but crag-and-tail marks (below pen) preserved in a leeside trough indicate unequivocal earlier flow toward the NE!

Lidar imagery recently became available for areas along the Maine coast and has greatly enhanced our perception of moraines and other glacial landforms, as well as raised marine shorelines. Both marine limit and regressive shorelines can be distinguished on many hillsides, offering the potential for locating gravel deposits that typically occur along the former strandlines. These features are often very subtle and may not be readily

visible on the ground, especially in forested areas. Lidar will greatly improve the detail of future bedrock and surficial mapping in Maine, and we hope the area of coverage will be extended!

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I have been mapping the glacial deposits in north-central PA, East Troy, Ulster, & Towanda 7.5'quads, one 7.5' quad below the NYS line. The project is in support of groundwater studies to examine why some streams have been going dry from frac water withdrawal. As a side note, in the 3 quads, there are presently about 150 gas wells with another 300 permitted and to be drilled when the gas price goes up. Also, thanks to hurricane Irine last year, many of the streams have excellent fresh exposures tens to more than a hundred feet high.

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The Lidar imagery, see below, shows a series of slightly sinuous, small scale ridges running obliquely across topographic slopes and parallel to regional ice flow. The features are a few hundred to a couple of thousand feet long, a few tens of ft wide, and a few ft to 20 ft high. Most of the features are actually more bench like then ridge like in form. As the run obliquely across the slope, they have a gentle upslope side and a steeper downslope side. One fresh roadcut and a number poorly exposed roadcuts show the material to be compact stony, silty matrix, till. They are definitely not sand and gravel eskers. I am leaning towards calling them small scale glacially streamlined till ridges.

Has anyone else seen similar forms? Any other suggestions as to what they are?

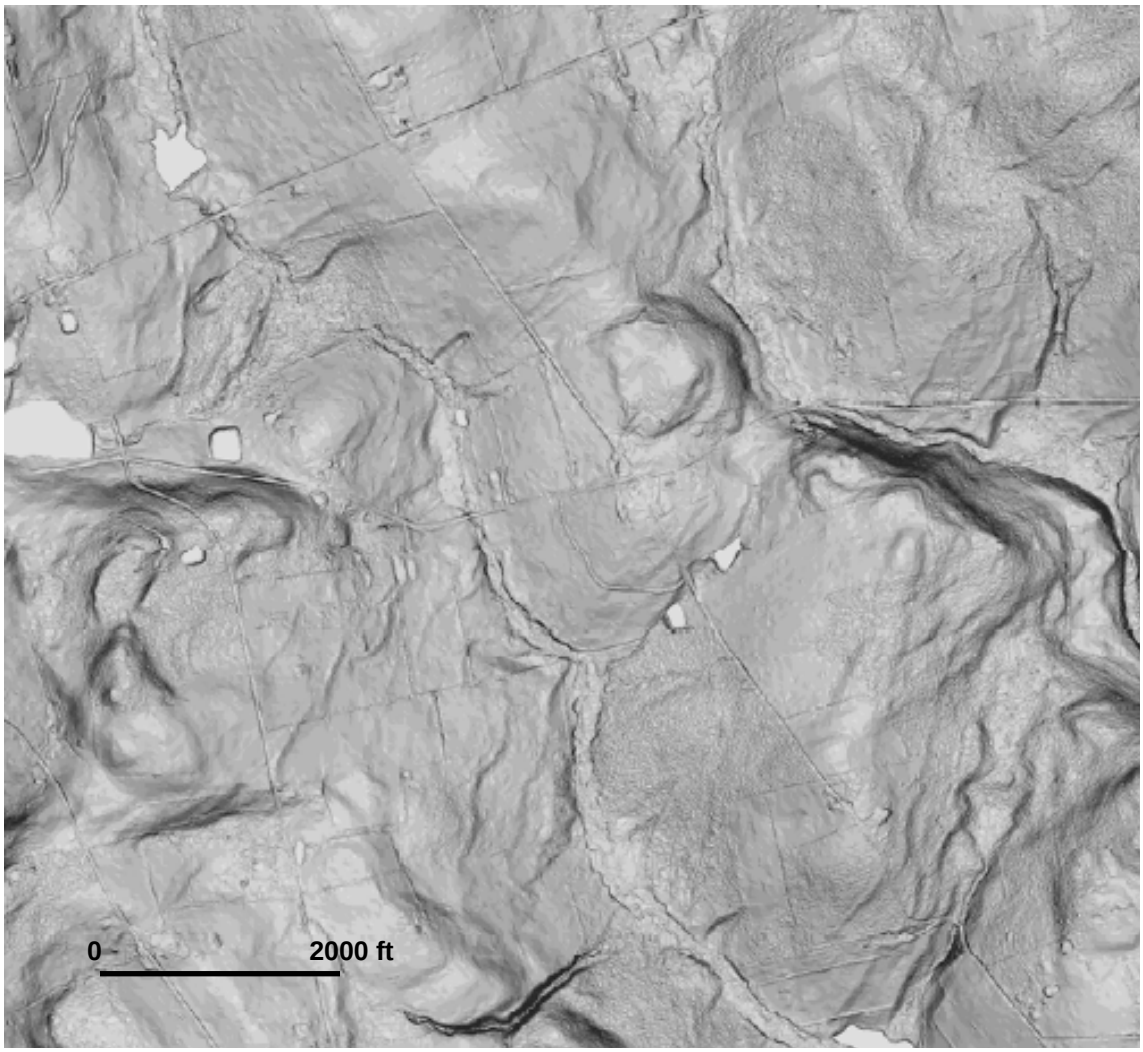

Image is of the north central part of the Ulster 7.5' quad.

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I work as Associate Quaternary Geologist at the Illinois State Geological Survey. In 2012, I completed a Ph.D. program in Earth and Atmospheric Sciences, at the Université du Québec à Montréal (University of Quebec at Montreal – UQAM) on a project on the Quaternary and map glacial sediments. William W. Shilts and I work on the regional stratigraphic framework of the southeastern Appalachians of Quebec and into northern New England.

Complex sequences of ice marginal and frontal deposits have been mapped and documented in the Saint-François and Chaudière river valleys, north of the international border. In most cases, these sediments and landforms, as well as other geomorphological features, are significant indicators of the extent of former ice-dammed lakes primarily because their elevation is intimately linked to well-documented outlets. Their stratigraphic architecture is, however, complex, and their subsurface extent poorly documented.

The southeastern sector of the Laurentide Ice Sheet experienced an important episode of ice volume reduction during transition from marine isotope stage 4 to 3, which led to the development of a large glacial lake in the northward-flowing Chaudière and St-Francois River valleys (Québec). This episode is associated with glacial Lake Gayhurst and is reflected by locally thick deposits of glaciolacustrine sediments. Our chronology assigns this interstadial event to a period between ca. 60 to 35 ka. The objectives of this study are to: 1) characterize the sediments and the stratigraphic architecture of the Gayhurst Formation, 2) define the physical lateral extension of the Gayhurst Formation; 3) present a new IRSL chronology of this glaciolacutrine sequence, and 4) bring additional precision to the paleogeographic reconstruction through the interpretation of the ice volume of the LIS and the evaluation of different meltwater routing scenarios through New-Brunswick, Maine and Vermont. Recent field and stratigraphic data that were acquired in the course of a groundwater/Quaternary geology mapping project in the Chaudière and Saint-François valleys will be used to answer these questions.
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Last year I reported on the Cazenovia Creek Fjord of Lake Whittlesey. Upon further review, the call on the field is reversed! The inlet was not a steep sided trench; at that time, it was broad and relatively shallow. The “upper trench” of Cazenovia Creek was a post-Whittlesey excavation. This is a case of inverted stream piracy. Should I call

it be-mouthing? instead of be-heading?

The East and West Branches of Cazenovia drain a portion of the Allegheny Escarpment. Prior to the last glaciation, they joined immediately south of the village of East Aurora, as they do today. However, the main channel continued north-northeast and joined Buffalo Creek about 3.2 miles northeast of East Aurora. Buffalo Creek turned west in the lowlands beyond and emptied into Lake Erie. Two small streams drained the base of the Escarpment south of Buffalo Creek; Smokes Creek and a similar stream that I refer to, for obvious reasons, as Convenient Creek. After the last glaciation, ice-contact deposits from the Erie Lobe, north and northeast of East Aurora village, blocked the connection between Cazenovia and Buffalo Creeks. At East Aurora, an outwash apron at ±940 ft sloped westward, away from the ice-contact deposits and toward Cazenovia Creek. When the Erie Lobe began to retreat, Lake Whittlesey waters extended up Convenient Creek, across the Cazenovia Creek/Convenient Creek interfluve, to East Aurora. The East and West Branches emptied into Lake Whittlesey depositing a ±900 ft delta abutting the west side of the outwash apron.

Lake Whittlesey waters dropped 70 ft, creating Glacial Lake Warren. But, an 880 ft threshold remained at the west end of the former interfluve. An ±880 ft delta was deposited abutting the 900 ft Whittlesey delta at East Aurora. When the dam finally was breached, Cazenovia Creek excavated its Upper Trench 2.9 miles through the interfluve. It is a mostly straight valley cut into bedrock, with vertical sides 60 to 100 feet high, and little floodplain. When Lake Warren drained, it began excavating the headwaters of Convenient Creek, creating its 4.0 mile long Middle Trench with a narrow floodplain. It also is cut into bedrock with steep sides, 60 to 100 feet high. Lake Warren beaches are at the west end of the Middle Trench where the stream exits the Allegheny Escarpment. There may be remnants of Lake Warren deltas but subsequent stream erosion removed almost all pre-existing evidence.

Lake levels dropped an additional 250 ft, in several stages. Cazenovia Creek's floods eroded and enlarged the smaller Convenient Creek channel, creating its 5.5 mile long Lower Trench entirely beyond the Allegheny Escarpment. It removed all evidence of the preglacial stream. Bedrock is prominent on the steep valley sides, 50 to 70 feet high, but the valley bottom is wide enough for a meander belt on the floodplain. After co-opting the Convenient channel, Cazenovia Creek now joins Buffalo Creek about a mile from its mouth at the Lake Erie shoreline, just north of Smokes Creek. In this case the headwaters pirated the mouth of a smaller stream. The new creek bed is 17.6 miles long between East Aurora and its new confluence with Buffalo Creek.

Interestingly, in the 1970's Dennis Hodge, Parker Calkin, and their UB students, reported used remote sensing to locate an ancestral channel of Cazenovia Creek buried beneath the Ontario Lobe Grounding Line Moraine. My guess is that it was an ancestral channel of

Buffalo Creek. Neither Smokes Creek nor Convenient Creek, by inference, produced enough flood discharge to excavate trenches.
****

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News from Grafton Mountain!

Research: Work continued this past field season with John Rayburn's REU students and we made some exciting and unexpected discoveries in the upper Esopus drainage basin in the Catskills. Please see the other contributions for more info and be sure to check out the session at GSA in March.

Business: The geoarchaeology work picked up mid-summer after several years of slow going. It's very rewarding to see the greater emphasis placed on the geomorphological and stratigraphic understanding of archaeological sites. Each project brings the satisfaction of seeing something through from start to finish with tangible increases in basic knowledge. For example, I continue to be impressed by the variety of scenarios I see in backhoe trenches along the Hudson River floodplain. You'd think it would be the same sediment again and again. But, there are subtle and not so subtle differences in the stratigraphy from place to place, project to project. My archaeology colleagues at Hartgen Archeology Associates in Rensselaer, NY, continue to be my primary client. We are getting a lot of data together and hope to put together a scholarly submission to detail some of these findings from buried peat bogs to buried possibly Fort Ann gravels. Has anyone thought about how we see tributaries such as the Mettawee River, Batten Kill, Hoosic River and others display a Holocene pattern of deeply incising their valleys and then subsequently depositing thick alluvium that's now being incised? I've wondered what this says about the Holocene in general.

We recently cored about a dozen augered holes along the lower Wynants Kill and got into Pleistocene glaciolacustrines at shallow depths that were on bedrock, no till present. These weren't thick basal varves but looked more like distal bottomsets of the Wynants Kill. Sorry, but the cores weren't saved as the project couldn't accommodate that option.

Teaching: I'm looking forward to a new adjunct role at the College of Saint Rose this Spring. The opportunity to teach an upper level Hydrogeology course will be an exciting chance to torture a handful of students by taking them in the field to pump test a well (our home well!), investigate big springs in VT (involving a hike to the summit of Mt. Equinox), and visit a few sites where I was involved in contaminant investigation. The torturous part is doing the field work in winter, including a winter hike up Mt.

Equinox, one of my favorite winter snowshoes. Don't be surprised if a few of you readers get an email from me inviting you to guest lecture and share some of your hydrogeology expertise!
****

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I've been plotting the Lake Albany shoreline features (deltas and beaches)from Newburgh to Schenectady and confirmed my AMQUA impression that you can have any slope on the water planes that you want. Most kame deltas fall on a 2.5 ft/mile line, but the other features form a "cloud" beneath that line. There is a concave-up series of deltas that coincides with the Middleburgh-Rosendale readvance position and another in the Albany-Schenectady area (Delmar or Niskayuna ice margins?). My working hypothesis is that there was a component of rebound that occurred very rapidly as the ice retreated, much like the rebound model developed by G. H. Chadwick in 1928 (GSA Bull v 39, pp. 901-922), and by M. H. Brookfield and I. P. Martini in the early 2000's (see www.uoguelph.ca/~mbrookfi/sequence.html).
****

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Together with Andy Kozlowski (NYSGS) and my student Nate Hopkins we are continuing our study of till kinematics and drumlin genesis using AMS rock magnetism. Last summer we dug 16 backhoe pits ("graves") in a single drumlin and inter-drumlin lowland to extract samples for AMS analysis. As we reported in a recent BOREAS paper the AMS microfabrics are strong and parallel to regional ice flow.. We are currently attempting to determine if there is divergent-parallel-convergent ice flow as the ice passes over/around the drumlin and if the AMS fabrics within, and adjacent to, a drumlin differ in any systematic way. Next Spring we are headed to Sweden to determine which Swedish tills are amenable to AMS analysis with an eye to better understanding the amount of shear occurring in, and adjacent to, paleo-ice streams.
****

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Pleistocene to Present NE North American Dendrochronology Project

A quiet year here in terms of new projects, but the ^{13}C analysis was completed and nearly written up for the logs found at a Younger Dryas site in Bell Creek near Fulton, with ^{18}O data just received for comparison and additional analyses. Written up also were the results of an analysis of logs found in the river bed at the bend of the Genesee River near Houghton, NY, probably buried by a major undercut and/or landslide. At least 10 fully-grown trees, mainly hemlock, had been buried around 600 AD; all were incredibly well-preserved.

And for anyone interested - this year's North American Dendroecological Fieldweek will be held in the Catskills in late June – early July. If you want to learn about tree rings and all aspects of research with them, come check it out!
****

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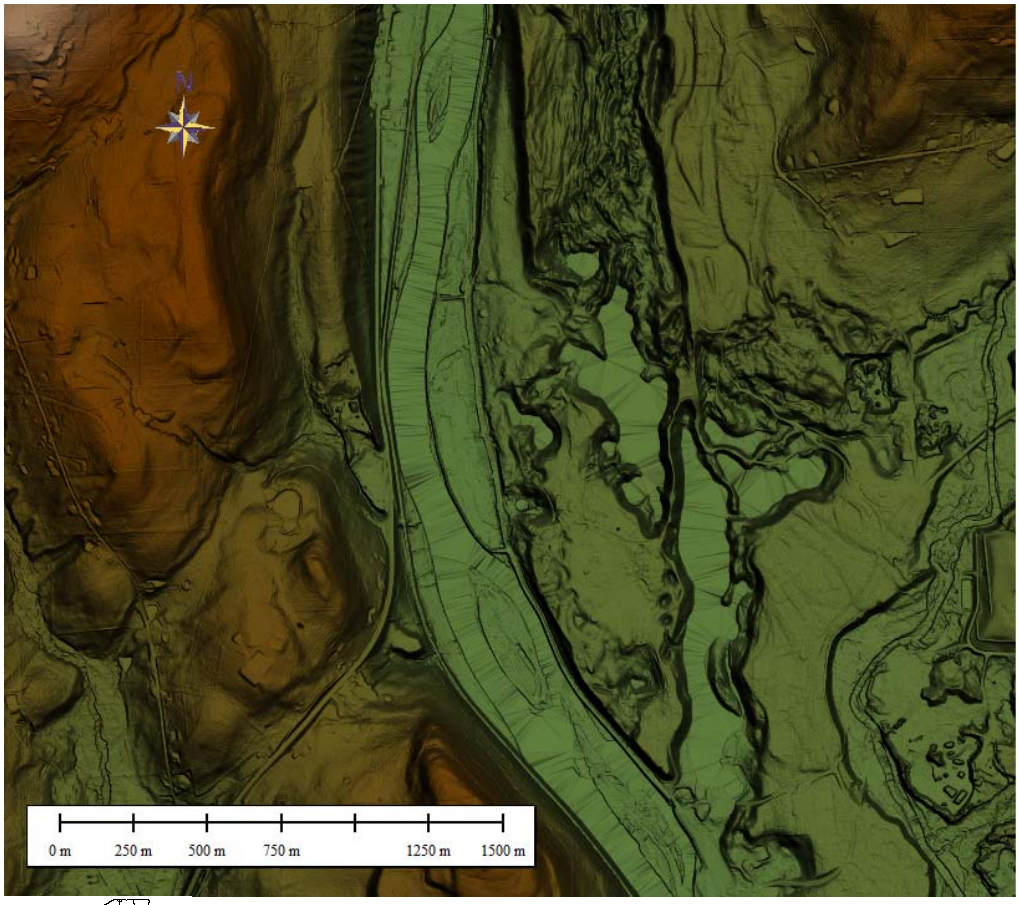
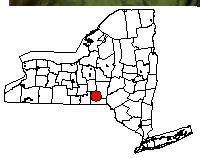
Greetings from Oneonta! Many thanks to John Rayburn for gathering us together to share where we've been this past year. My year has been spent largely in the historic and Holocene, and while not entirely glacial, my path inevitably crosses with glaciers in this part of the world.

I am most excited about the recently released 2 m LiDAR elevation data that is now freely available online through the NYS GIS Clearinghouse. The coverage is partial for the state, but where it is available, it's amazing. Chenango Valley State Park shows exquisite perched (30 m above modern channel) outwash surfaces, with bifurcating channels around bars, interrupted by gravel quarries and ice-cored depressions. The bars, ~ 1 m high, are easily followed over the surface. It does get the juices flowing!





We can map glacial landforms in a far more detailed fashion than with topo maps and current National Elevation data sets. I think my students know what is coming next… This summer I collaborated with Jim Ebert and Damon Matteson (both at SUNY Oneonta) on a dating excursion into a gravel quarry and into what I hoped was the Younger Dryas. We found an extensive charcoal rich horizon in apparent continuity with underlying delta foresets. The layer was oddly colored—oxidized, but appeared conformable with the underlying strata. In my dreams I was hoping for fires from a meteorite impact at 11,700 BP. So much for hopes and apparent continuity. There might not be anything quite as embarrassing as a date, which came back as early 19th century. Perhaps this site is an old charcoal-making plant. Somehow a geologist's interest tends to wane rapidly as one approaches the historic era. Anyway, I learned my lesson. The Anthropocene is everywhere.

Devin Castendyk (SUNY Oneonta) and I have been working to gather groundwater chemistry data for the last couple years, and we have been in the process of gathering local watershed agencies, managers, academics, and industries with interest in local

watershed management into a loose affiliation which we call the Catskill Headwaters Research Institute. We have a web site where we provide links to the data we have collected. I encourage other teachers to take advantage of the online access to the water data we have collected and collated. Most wells (out ~70) have about 35-40 detectable elements. It's a rich data set that is just waiting for exploration.

One other new area I have advanced (or regressed?!) into is sediment coring. I have started collecting lake and reservoir sediment cores from Otsego Lake and other small water bodies around Otsego County. My initial goal is to develop proxies in the cores for big flood events. Thus far we (Christoph Geiss at Trinity College and my students) are looking at grain size and magnetic susceptibility. A Wink vibracorer system has just arrived, and I hope to start probing the shallow subsurface this year. Christoph (and myself) would certainly like to penetrate to the Pleistocene, and we just might if Otsego Lake freezes hard enough this year to support us.

Well, not a lot of glacial material in this update, but somewhere in here, a glacier flows through it.
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As a retired marine geologist from the Cornell geology department I decided to learn something about the glacial geology of the Sixmile watershed in which I live. It was supposed to be a pretty routine review of what was known, but I've had one surprise after another.

The remnant surface that was assumed to be the floor of pro-glacial Lake Ithaca turned out to be a till surface and there were no overlying lacustrine sediments on this till. A large delta near Brooktondale, which was interpreted as built into Lake Ithaca, had tills interbedded with the foresets and overlying the entire structure. Lake Ithaca was supposed to have a surface elevation of 980' but recent Lidar topography clearly shows that the 980' elevation is on a large alluvial fan. Coring in the overflow channel indicates that the overflow elevation is less than 960'. Moreover, it appears that this channel is more likely the result of a rapid emptying of the local lake into which the delta was built.

There are pro-glacial lake sediments in the Sixmile valley but these have a maximum elevation of about 780' and are a coarsening upward sequence. Such a sequence is more attributable to an inundation event than to a retreating glacier. I've just gotten an OSL sample of the basal silt and hope to place these sediments in a chronology of ice retreat.

Initially I thought I'd just take a brief look at the varved clays that Vic Schmidt mapped, but wandering in the adjacent tributaries made it clear that there was much more to the story than he realized. Recent mapping has shown that the varved clays are part of a much more widespread and varied array of sediments than previously thought. In addition to varved clays are other pro-glacial lacustrine sediments, sub-aqueous fan deposits and a deformation till. The lacustrine clay suite had been divided into four varve series separated by fluvial gravels but only the basal series is varved. The gravel beds are mass flow deposits from the lakeshore. The sands and gravels interpreted as sub-aqueous fan deposits have a large component of exotic clasts and show strong clast imbrication indicating flow from the NW. Both units are overridden by a deformation till that has a silt to coarse sand matrix enclosing pods of gravel and red clays. Bedding, where observed, is highly contorted. Nine radiocarbon dates indicate a 34-38 ^{14}C ka age for the lacustrine sediment and the deformation till is no more than a few thousand years younger. This till defines a Cherrytree Stade glacial advance to the Appalachian Plateau, much further south than has been generally accepted.

Other information that might be of interest is that we are about to drill a hole in the Cayuga Inlet to sample and date the sediments beneath those worked on by Hank Mullins. I've also sweet talked Dorothy Peteet into coring a large bog just south of the Valley Heads moraine in Inlet valley. Perhaps we can add some constraints to the local age of the Valley Heads moraine.
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Since last year, the Cabot Head paper was published in the Canadian Journal of Earth Sciences 49, 576-589 (2012) and coauthored with P. Kor, D. Cowell, and R. Kristjansson with the title "The Cabot Head Archipelago: evidence of glacial Lake Algonquin on the northern Bruce Peninsula, Ontario". A related paper "Postglacial lake shoreline surveys and lacustrine paleobiotic records in northern Bruce and Grey counties, Ontario", coauthored with Gerry Mackie, is in press in the Journal of Great Lakes Research and expected to appear in 2013. The latter extends the shoreline studies of Stanley (1937) west from Cape Rich, in southwestern Georgian Bay, and documents fossil molluscs, ostracodes, and plants from shallow-water Nipissing deposits, whereas deep-water Algonquin deposits are generally barren. Together, the two papers report the occurrence of Lake Algonquin shorelines in the middle of the Huron and Algonquin basins on the Bruce Peninsula, which forms a partial land bridge between the mainland in the south and the north shore.

Lab work continues on processing of 2003 samples of the Don Fm. from the Don Valley Brickyard in Toronto. The work progresses slowly with part-time student help funded by

a work/study program with one student employed in each of the three academic terms per year. The focus of attention is on the microvertebrates, specifically fish, (scales, teeth, vertebrae, and other bones). An article on this work with Kevin Seymour (Royal Ontario Museum) has been submitted to the ROM magazine.

A project with Darrell Kaufman, University of Northern Arizona, is based on using amino acid racemization (AAR) to compare ages of various sub-till organic sites. Thus far we have samples picked for the Don Brickyard at Toronto, Innerkip and Zorra (both near Woodstock). We hope to add to that Woodbridge (also Toronto) and Fernbank, New York.

Other progress on sub-till organic sites is stagnant as we wait on pollen, insect, and vertebrate studies to complete Zorrra , Innerkip, and campus sites. As I have often said in recent years "you just have to live long enough".
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Since I joined the Department of Geological Sciences at SUNY Geneseo in 2007, all of my current work is on Pleistocene glacial records in the western U.S. I am working with Jeff Munroe (Middlebury College) on reconstructing the extent and timing of mountain glacier and pluvial-lake changes during the last glaciation in the northern Great Basin, Utah and Nevada. The project involves field mapping; lake-sediment coring in high alpine basins; cosmogenic surface-exposure dating of glacial features; radiocarbon dating of shoreline deposits of Pluvial Lakes Clover and Franklin; and numerical modeling of glaciers and lakes. I am also working with Eric Leonard (Colorado College), Mitch Plummer (Idaho National Lab) and Joe Licciardi (University of New Hampshire) on a similar project in the Rocky Mountains. This research involves cosmogenic-exposure dating of glacial features and numerical modeling of latest Pleistocene glaciers to limit temperature and precipitation of the Pinedale Glaciation along the continental divide (northern New Mexico to northwestern Montana).

Jeff Munroe and I have some forthcoming contributions on the mountain glacier and paleolake chronologies in Nevada. These include articles in the Journal of Quaternary Science (Munroe and Laabs, 2012), GSA Bulletin (Munroe and Laabs, in press) and Earth and Planetary Science Letters (Laabs et al., accepted).

As noted in previous postings, I have developed a cosmogenic-nuclide preparation lab at SUNY Geneseo. The lab is designed for processing of rock and sediment samples for cosmogenic aluminum and beryllium in preparation for AMS analysis. Although my

research focuses primarily on glacial/paleoclimate history in the western U.S., I am interested in exploring collaborative research opportunities elsewhere, especially in New York State.
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We are happy to let readers know that a special issue of the Journal of Paleolimnology entitled "Holocene water levels and paleo-hydrology of the Laurentian Great Lakes" was published early in 2012 as Volume 47 No. 3. The issue contains 13 papers in addition to its introductory editorial. Collectively, the papers touch on topics in all of the Great Lake basins. Two that pertain to New York directly indicate that hydrologic closure and lowstands below outlets persisted in the early to middle Holocene for 4000 years in Lake Ontario and 6000 years in Lake Erie.

Michael Lewis and John King
Guest Co-editors
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I'd like to make the Glaciogram community aware of the P3 paper that Dorothy Peteet, Roger Anderson, and I published this year.

Menking, K.M., Peteet, D.M., and Anderson, R.Y., 2012, Late-glacial and Holocene vegetation and climate variability, including major droughts, in the Sky Lakes region of southeastern New York State, Palaeogeography, Palaeoclimatology, Palaeoecology v. 353-355, p. 45-59

Here's the abstract:

Sediment cores from Lakes Minnewaska and Mohonk in the Shawangunk Mountains of southeastern New York were analyzed for pollen, plant macrofossils, macroscopic charcoal, organic carbon content, carbon isotopic composition, carbon/nitrogen ratio, and

lithologic changes to determine the vegetation and landscape history of the greater Catskill Mountain region since deglaciation. Pollen stratigraphy generally matches the New England pollen zones identified by Deevey (1939) and Davis (1969), with boreal genera (*Picea*, *Abies*) present during the late Pleistocene yielding to a mixed *Pinus*, *Quercus* and *Tsuga* forest in the early Holocene. Lake Minnewaska sediments record the Younger Dryas and possibly the 8.2 cal kyr BP climatic events in pollen and sediment chemistry along with an ~1400 cal yr interval of wet conditions (increasing *Tsuga* and declining *Quercus*) centered about 6400 cal yr BP. Both Minnewaska and Mohonk reveal a protracted drought interval in the middle Holocene, ~5700–4100 cal yr BP, during which *Pinus rigida* colonized the watershed, lake levels fell, and frequent fires led to enhanced hillslope erosion. Together, the records show at least three wet–dry cycles throughout the Holocene and both similarities and differences to climate records in New England and central New York. Drought intervals raise concerns for water resources in the New York City metropolitan area and may reflect a combination of enhanced La Niña, negative phase NAO, and positive phase PNA climatic patterns and/or northward shifts of storm tracks.
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Google Earth Overlays of the Surficial Geology sheets for NY are available here:
http://ottohmuller.com/NYSurficialMaps/

Kml files from many (1956-74, 1980-86, 1989, 1994) of the roadlogs from NYSGA guidebooks are available here:
http://ottohmuller.com/nysga2ge/Files.html

And you can mix and match your own stops from a Google Fusion Table here:
https://www.google.com/fusiontables/DataSource?snapid=S790104O7cU

I expect to upload some of my huge DEM jpg files made from mdms, with and without the Fairchild tilt removed, soon. When I do, they'll be here:
http://ottohmuller.com/Maps

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Greetings from our group at Lamont Doherty Earth Observatory! We appreciate all your efforts to make this newsletter happen, John Rayburn! Of interest to the glacial geologists in New York, this year we published a paper in GRL which is a compilation of basal macrofossil AMS ^{14}C ages from lakes and wetlands along the southeastern Laurentide margin. It argues for deglaciation at 16-15 calendar kyr. The gap between previous age estimates from bulk dates is 9-5,000 calendar years, which is significant and has major implications for our understanding of the linkages between the ocean and atmosphere. In light of our new data, we provide a framework for reinterpreting the considerably older (28– 23 cal. kyr) existing chronologies, based on ^{10}Be exposure ages and varve sequences from large valleys throughout the northeastern U.S. The research included a senior thesis project by Calder Orr and significant contributions by postdoctoral student Jonathan Nichols. We continue to core more lakes/bogs in the NY/NJ/Conn region and are working on a paper summarizing the earliest fauna and flora of the region as deglaciation occurred. We would be interested if any of you to the north of us would like to work together in defining the timing of ice retreat northward…just let us know.

Peteet, D., Beh, M., Orr, C., Kurdyla, D., Nichols, J. and T. Guilderson. 2012. Delayed deglaciation or extreme Arctic conditions 21-16 cal. kyr at southeastern Laurentide Ice Sheet margin? Geophysical Research Letters 39, L11706, doi:10.1029/2012GL051884 .

We also published a record of deglaciation from Lakes Mohonk and Minnewaska with lead author Kirsten Menking (Vassar College) which highlights droughts in the region.

Menking, K., Peteet, D., and Anderson, R. Late-glacial to Holocene climate variability, including major droughts, in the Sky Lakes region of southeastern New York State. 2012. Palaeogeography, Palaeoclimatology, Palaeoecology 353-355: 45-59.

Our continuing focus on the Hudson tidal marshes (Ph.D student Sanpisa Sritrairat and colleague Tim Kenna) resulted in a paper late last year documenting the last millennium of human impact and climate change at Tivoli North Bay, Hudson River NERR site.

Sritrairat, S., Peteet, D., Kenna, T., Griffin, Sambrotto, R., K., Chillrud, S., Kurdyla, D., and Guilderson, T. 2012. A history of vegetation, biodiversity, sediment and nutrient dynamics at Tivoli North Bay, Hudson River, NY. Estuarine, Coastal, and Shelf Science 302-303: 24-35.

We have a book chapter edited by Robert Henshaw linking paleoclimate/paleovegetational records from the uplands in the Hudson Valley to the estuarine marsh records.

Peteet, D., Markgraf, S., Pederson, D., and Sritrairat, S. 2011. In: Henshaw, Robert, editor, *Environmental History of the Hudson River, Linking Uplands to the Hudson River:* Lake to Marsh Records of Climate Change and Human Impact over Millennia, SUNY Press. Ch. 9, pp 123-134.

Finally, a continuing focus of our research is examining the relationship between paleoecology and carbon storage in peatlands and salt marshes. Undergraduate students Alicia McGeachy (Spelman College), Allie Madison, Frankie Pavia, and Souha Ouni (Columbia Univ.) and postdoc Jonathan Nichols are also major contributors.
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Hello Dear Glaciogram Readers,
I am now in the midst of year number six at SUNY New Paltz, and it has been a great year for research! This past summer we wrapped up our 3 year REU program in the Catskills and David De Simone will be reporting on the results of our mapping and glacial history interpretation at NE-GSA. We have found in a valley south of Hunter Mountain that there are two lacustrine units – an older clay rich one and a younger silt/sand rich one – both with overridden and deformed upper beds and both overlain by red tills. Last year we reported only one such unit, but Hurricane Irene gave us some amazing new exposures. We are not sure of the ages of either of these units.

The initial results of my tree-ring work in the Champlain Valley with David Barclay (SUNY Cortland) have been submitted in two manuscripts to a special New York State volume of Tree-Ring Research. One paper focuses on the ecological and human history of our ~400 year record and the other on meteorological interpretations (specifically drought conditions) modeled from the record. I have also submitted a paper (along with Fred Vollmer from SUNY New Paltz) on a new varve correlation in the Champlain Valley to a special edition of GFF – The Journal of the Geological Society of Sweden. I will be presenting the findings of this paper in Woody Thompson's NE-GSA session in March.

I would like to thank all the contributors to this 44th edition of the New York Glaciogram. Hope to see everyone at a meeting or in the field soon!

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Work on varves continues at Tufts with a major publication of results from drilling in the Connecticut Valley and a reworking of Ernst Antevs' New England Varve Chronology as the new North American Varve Chronology (NAVC). The reference is:

Ridge, J.C., Balco, G., *Bayless, R.L., *Beck, C.C., *Carter, L.B., *Dean, J.L., *Voytek, E.B., and *Wei, J.H., 2012, The new North American varve chronology: a precise record of southeastern Laurentide ice sheet deglaciation and climate, 18.2-12.5 kyr BP, and correlations with Greenland ice core records: American Journal of Science, v. 312, p. 685-722, doi:10.2475/07.2012.01.
(former students at Tufts as co-authors)*

The paper provides the history of varve chronology in New England, an explanation of how we revamped the varve chronology as the NAVC, links to the updated sequence in the supplemental data, a new calibration and deglacial history, and a matching of the varve sequences to Greenland ice cores. Both records show the same climate variations after 16 kyr BP at stadial to sub-century scales. Our web site, the *North American Glacial Varve Project*, is still active and constantly expanding. See the site at: http://eos.tufts.edu/varves/ . There are lots of pictures of varves here as well as tons of varve record data and explanations of our coring, lab, and analysis techniques. The site is being used by many courses in glacial geology. I hope to soon add a section on glacial varve deposition.

Several new projects are underway. Along with Greg Balco (Berkeley Geochronology Center), Paul Bierman and Ben DeJong (UVM), and Dylan Rood (UC Santa Barbara) we are attempting to create a beryllium-10 record from the varves in the Connecticut Valley. If a Be-10 secular variation record can be recorded in the varves it could then be correlated to the Be-10 record from Greenland ice cores and would provide an exact correlation of climate events in Greenland and across the North Atlantic to the edge of the southeastern Laurentide Ice Sheet.

I am also currently working on a model that allows a minimum estimate of the meltwater generated by melting of the ice sheet in the Connecticut Valley that is dependent on recession rate, the ice sheet profile (basal shear stress model), and estimated flow rates. At a minimum it appears that glacial melting would have created an annual discharge of meltwater at least 30X the current annual meteoric discharge. I am also working on other projects with students. This past summer we collected varves from units in the western Mohawk valley (upper and lower Newport beds of the West Canada Creek Valley in Ridge and others, 1990, 1991). Matching of these varves to New England and the Hudson

Valley would provide an exact matching of glacial events but this work has been frustrated by the many mass movement events that interrupt the varve sections in New York. This summer my students and I are planning on separating ostracods from varves (they occur in both the New England and NY varves) for O and C isotopic analysis. In the Connecticut Valley the O isotopes should allow us to separate glacial and meteoric (tributary) water sources for the glacial lakes that spanned the time of deglaciation but continued into non-glacial time in a record of paraglacial varves.
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Robert and Johanna Titus have written and published a book entitled "*The Hudson Valley in the Ice Age: a Geological History and Tour.*" Their publisher is Black Dome Press. The book describes the ice age features and history of the Hudson Valley. It is popular science, specifically written for the general reader and early indications are that it is selling well.

The book is well suited for you to explain the nature of your science to your friends and relatives. Robert is at the Department of Geology at Hartwick College and Johanna is at the Biology Department at SUNY Dutchess College. Robert and Johanna also continue to write regular geology columns for *Kaatskill Life* magazine, The *Woodstock Times* and the Hudson/Catskill newspaper chain. Many of these columns are about ice age geology in the Catskills and Hudson Valley.

Robert is writing regular columns on popular geology writing for the Science and Society Division of the Geological Society of America. He earlier published a book about the ice age history of the Catskills for Purple Mountain Press
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My research activities this summer focused on mapping the northern half of the Pico Peak Quadrangle enabling me to complete the quadrangle I started mapping during August of 2011. The quadrangle straddles the Green Mountains at the latitude of Sherburne Pass (the pass US Route 4 uses to cross the mountains) and includes, on the eastern side of the mountains, the uppermost reaches of the Ottauquechee and Tweed Rivers. The Irene storm, at the end of August 2011, was a large rainfall event in this part of Vermont and the resulting erosion created many useful exposures. Particularly

noteworthy in some of the landslide faces are two different diamicts. The lower diamict rests directly on bedrock and is the common basal till of the area while I interpret the upper diamict as debris flow deposits derived from basal till. Distinguishing them in the woods is, of course, almost impossible. Other notable observations include a system of ice-marginal channels in the foothills of the mountains, esker systems on both the east and west sides of the mountains, the upper Ottauquechee River valley almost completely filled with a thick section of esker and outwash gravels (by far the largest aquifer in the area), and a narrow, high-elevation glacial lake in the north-draining Tweed River valley. Notably, the catastrophic draining of this lake into the White River Valley (occupied by Glacial Lake Hitchcock) may be responsible for a short series of anomalously thick varves exposed along the Third Branch of the White River and measured by Fred Larsen and his students. Most of the historic settlements in the town of Sherburne (now Killington) and most of the modern town offices have all been constructed on alluvial fans. Most of the fans in the area were active during Tropical Storm Irene both eroding new channels and depositing aprons of debris. I will be presenting some of this work in the “Getting the Work Done” session at the Bretton Woods GSA meeting in March.

After measuring hundreds of NW-SE striations cutting across the mountains in northern Vermont, I have been intrigued by NE-SW striations farther south in the Green Mountains that were described by Ackerly and Larsen in the 1987 NEIGC field guide. Field work this fall has shown that the southwestward ice flow across the mountains and into the Champlain valley did not extend any farther south than approximately Sherburne Pass (a short distance north of Pico Peak). My very preliminary calculations indicate that the ice margin in the Champlain Valley lay a few kilometers north of Glens Falls, New York when ice began flowing into the Champlain valley. The abrupt change in ice flow may be a response to a rapid drawdown of ice in the Champlain Valley possibly due to a rapid calving event. Extensive striation measurements collected along ~145 km of the Green Mountains from Fayston to Ludlow will be used to clarify our understanding of ice flow across the mountains. I also plan on presenting this work at the NE GSA meeting in March.
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M.Sc. project in glacial geology and geochemistry.
Department of Earth and Environmental Sciences at the University of Waterloo, Canada

The Department of Earth and Environmental Sciences at the University of Waterloo in southern Ontario, Canada, seeks applications to fill one graduate position (MSc level) in the area of glacial geology and geochemistry. The anticipated start date is May 2013. The purpose of the MSc thesis project is to test innovative methodologies to trace in glacial sediments the geochemical signature of altered rocks that are diagnostic of alteration haloes surrounding buried uranium mineralization. The study also involves mapping glacial dispersal patterns in 2D and 3D using new surface and subsurface data.

The study area is located in the Thelon Basin of central Nunavut in northern Canada, a highly prospective area for uranium. A B.Sc degree in Geosciences (e.g. Geology, Earth Sciences) or a related field (e.g. geological engineering) is required and candidates are expected to have a record of academic excellence and some prior background in relevant disciplines such as glacial geology and sediment geochemistry. In addition, candidates are expected to have strong interest in statistical and spatial analysis techniques, and in economic geology. The project is one component of a larger study which involves academic researchers, undergraduate and graduate students, as well as professional geoscientists from the mining industry. Communication skills and the ability to work in a team are thus important. Financial support in the form of a Graduate Research Scholarship and Teaching Assistantships will be available to the selected student for the duration of the project (2 years) provided satisfactory progress is maintained. Interested candidates should contact Dr. Martin Ross at maross@uwaterloo.ca (1-519-888-4567 x.38171) to obtain further details about the research project and the application/selection procedure for the MSc position. The project is funded by Cameco Corporation and the Natural Sciences and Engineering Research Council (NSERC).

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Ph.D. project in glacial geology.
Department of Geology, University at Buffalo

Seeking motivated student for a PhD position in the Department of Geology at the University at Buffalo. The position involves field and lab research on NSF-funded project to investigate the mountain glacier and ice sheet history of Greenland during the Holocene. Methods employed are radiocarbon dating, Be exposure dating and lake sediment analysis. Applicants with research experience in the above techniques are preferred; assistantship available. Interested applicants should contact Jason Briner (jbriner@buffalo.edu) prior to February 1, 2013.