

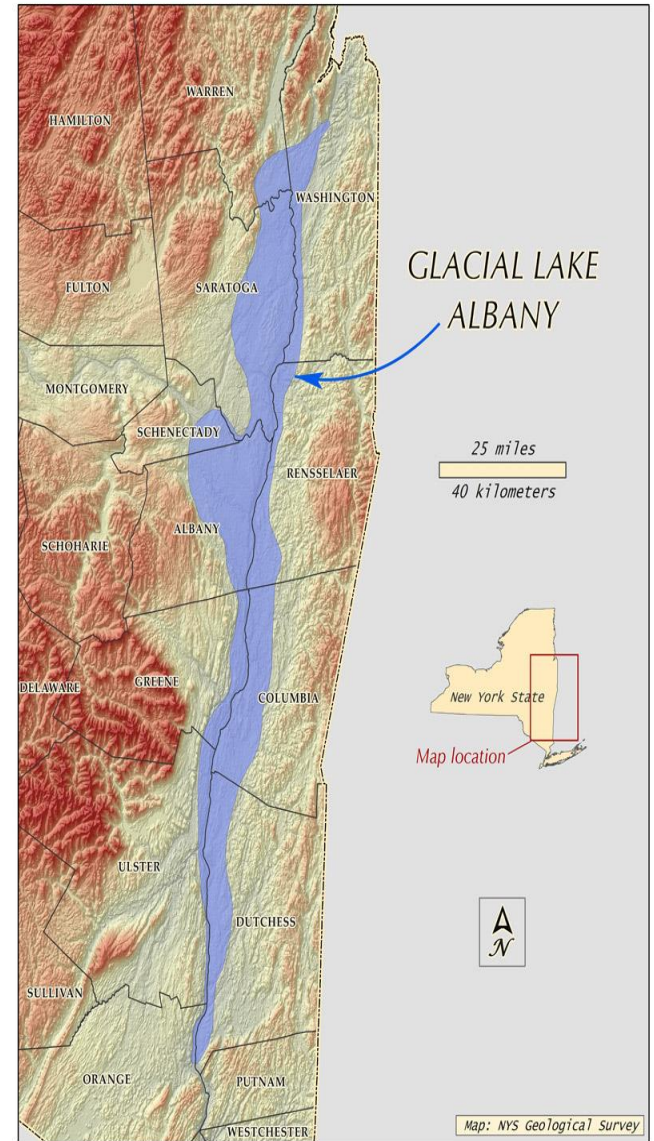
# Massive Glacial Flooding

## Earth2Class 8 Feb 2014

### Dr. Sidney Hemming

Introduction by  
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<http://www.nysm.nysed.gov/nysgs/experience/sites/HUDSONRIVERLAKECLAYS/data/images/lakealbany.jpg>



About 18 ka  
ago at the  
Last Glacial  
Maximum  
(LGM),  
ice sheets  
covered much  
of North  
America



# Some Other LGM Ice Sheets

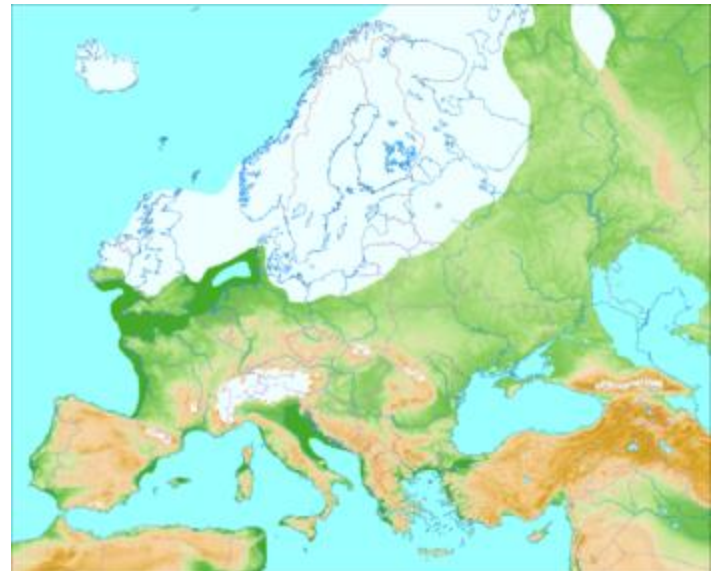
- Patagonian (South America)

[http://en.wikipedia.org/wiki/Patagonian\\_Ice\\_Sheet](http://en.wikipedia.org/wiki/Patagonian_Ice_Sheet)



- Weichselian (Europe)

[http://en.wikipedia.org/wiki/Weichselian#Weichselian\\_glaciation.2C\\_Scandinavia\\_and\\_northern\\_Europe](http://en.wikipedia.org/wiki/Weichselian#Weichselian_glaciation.2C_Scandinavia_and_northern_Europe)



- Greenland and Antarctica



- + Alpine (Mountain) Glaciers – Himalayas, Andes, Alps, Rockies, etc.

# Ice Sheets Surface/Base Differences

- Thickness may exceed 1000 m
- Surface very cold (exposed to air)  
May increase or decrease annually
- Base warmer (geothermal heat, friction)  
May have underlying streams or lakes  
Helps glaciers flow over the surface

# Types of “Glacial Waters”

- “Proglacial” – next to a glacier  
precipitation, rivers, glacial melt
- Pressurized subglacial – beneath a glacier  
Pressure seals liquid water beneath ice  
Lake Vostok + 400 other Antarctic lakes
- Volcanic subglacial  
Melting from erupting volcano

# More Types of Glacial Waters

- “Supraglacial” – on top of a glacier surface melting &/or precipitation
- “Englacial” – within the ice water flowing between ice crystals
- “Subglacial drainage” water flowing from lake to lake

# Glacial Lake Hackensack

- Narrow lake west of the Palisades (downhill from LDEO)
- Extended from terminal moraine near Perth Amboy northward into Rockland County
- Little Ferry “varves”  
>2,000

brick industry

now small lakes  
in municipal park



# Today—NJ Meadowlands

- Gouged valley between Palisades and hill on which runs Schuyler Ave
- Marsh sediments filled valley
- Hackensack and Passaic Rivers
  - Originally freshwater, but became estuaries as sea level rose
- Climate changed → Paleoindians, Archaic Indians, Eastern Woodland Indians adapted

# Pleistocene Mammals

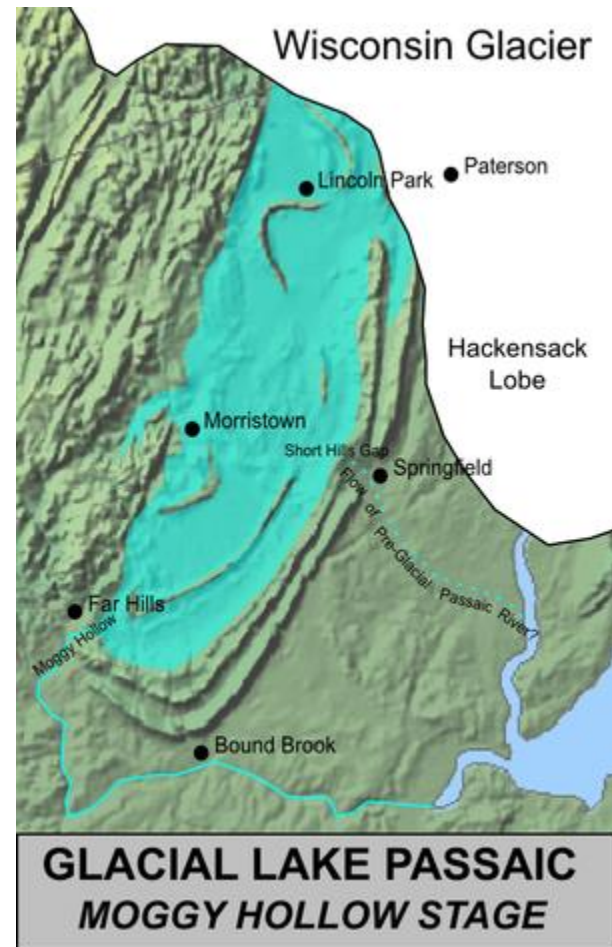
- Mastodons
  - ‘Side-branch’ of elephant family
- Unique teeth



- “Warren Mastodon”
- “Dwarskill Mastodon”

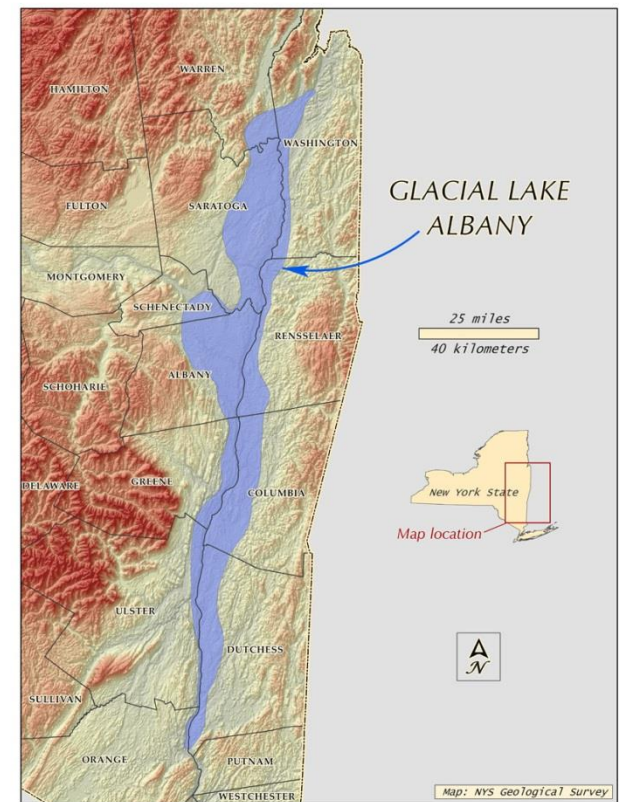
# Glacial Lake Passaic

- Dammed in part by Watchungs (lava flows)
- Drained through Short Hills gap, Moggy Hollow
- Fertile soil farmed for many decades  
“The Garden State”



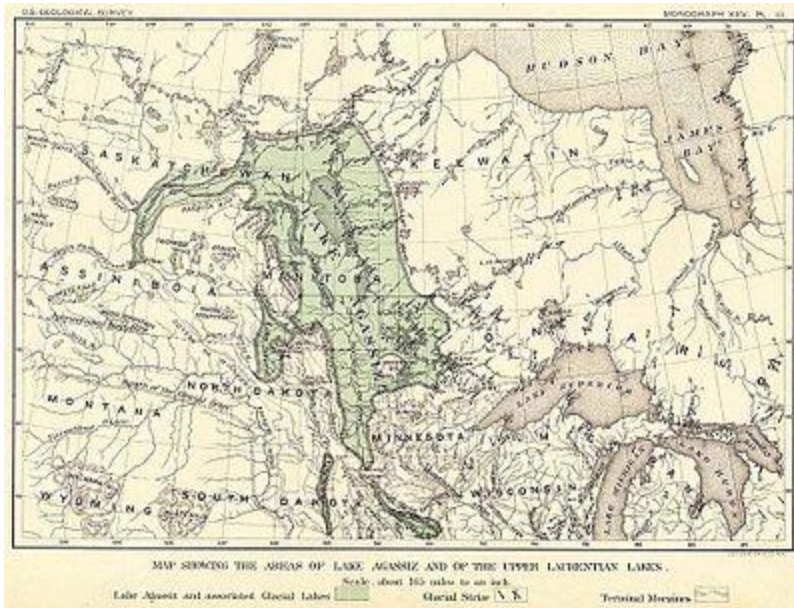
# Glacial Lake Albany

- Shaped course of Hudson River
- Late Pleistocene (16 – 12.5 ka)
- Newburgh to Glens Falls
- Many roadside exposures
- Also basis for brick industry



# Glacial Lake Agassiz

- Recognized early in 19<sup>th</sup> Century
- Covered much of central North America
- Larger in area than all of today's Great Lakes
- May at times have held more water than all lakes today



[http://en.wikipedia.org/wiki/Lake\\_Agassiz](http://en.wikipedia.org/wiki/Lake_Agassiz)

# Glacial Lake Bonneville



[http://en.wikipedia.org/wiki/Lake\\_Bonneville](http://en.wikipedia.org/wiki/Lake_Bonneville)

# Glacial Lakes Around the World

- Great Lakes + (US & Canada)
- Lake District of northern England
- Iceland
- Russia
- Tibet
- Argentina
- New Zealand and Australia

# Glacial Flooding

- Terminal and other moraines may dam melting waters
- Ice dams can hold melt water, but will become unstable and burst
- Pressure-tunneling – tunnel develops and expands rapidly – may collapse as pressure lessens when much has drained out
- Supraglacial drainage – subglacial water forced up and emerges on the surface – brings up base sediments

# Glacial Flood Sedimentation/ Erosion

- Lake bed deposits
  - Well-known in many areas because ‘easy’ to study once their existence was recognized
- Scour over continental surfaces
  - Carries away much of surface materials
- Turbidity currents when they enter the ocean
- Kolks and cavitation – vortexes & vapor bubbles capable of “plucking” large chunks of rocks – create ‘glacial pot holes’

# Glacial Lake Outburst Flood (GLOF)

- Sudden, possible catastrophic release of lake waters when dam breaks
- Sometimes called “jökulhlaups ”
- Massive during end of Pleistocene
- Still can occur today

Remains of steel bridge destroyed by recent outburst flood in Iceland



# Volume of Water Involved

- Can be more than flow of Mississippi
- Can be more than flow of Amazon
- Very rapid/very powerful
- Very short time period
- “Catastrophism” vs. “Uniformitarianism”

# Missoula Flood (Spokane Flood)



- Shaped much of Pacific Northwest landscapes
- Glacial lakes may have re-formed – multiple flood events

[http://geology.isu.edu/Digital\\_Geology\\_Idaho/Module13/LakeMissoula.gif](http://geology.isu.edu/Digital_Geology_Idaho/Module13/LakeMissoula.gif)