5
GLACIATION
and
New York State

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The Last Ice Age

❖ **Pleistocene Epoch** began 1.6 mil yrs ago **had numerous periods of ice field expansion.**
- – Coincides with a period of global cooling.
  - ➢ **The last Ice Age started c.100,000 yrs ago.**
- – **Final advance** of ice in N. America (there were many advances and retreats) was during the **Wisconsin Stage** of the **Laurentide Ice Sheet**.
- – Southernmost limit reached c.18,000-22,000 yrs ago, including NYS.

For detailed information see Ch. 12 of "Geology of New York".

OPTIONAL EXERCISE 7 Nature of Glaciation

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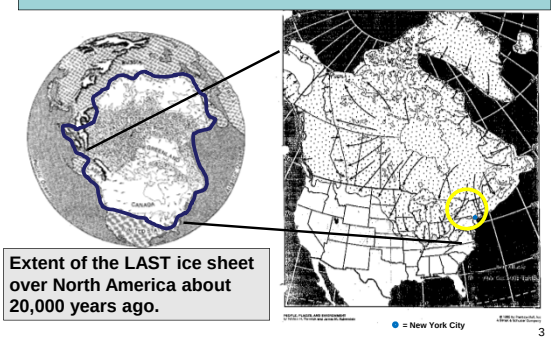
Pleistocene Polar Ice Cap



Extent of the LAST ice sheet over North America about 20,000 years ago.

● = New York City

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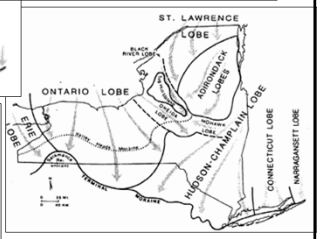
Laurentide Ice Sheet over NYS



Movement of the ice wasn't uniform. Flow was influenced by the force exerted from the weight of the snow, topography and rock resistance (erosion and friction). **Independently moving sections of ice are called LOBES**

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Results of Glaciation in NYS

What did it do to NYS?

1. **Major shaper of the landscape, both by sculpting and dumping.**
2. **Influenced slope angles.**
3. **Etched the drainage system.**
4. **Influenced the location of farms:** soil, boulders and limestone

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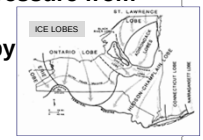
Glacial Dynamics
The nature of moving ice.

1. **Ice sheets move away from their zones of accumulation and push forward in sections (lobes** – see map) **under the pressure from their weight** (called plastic flow).
2. **Ice also moves down slope by slippage** as its weight melts its lowest levels and acts as a lubricant (called basil slip).
3. **The forward edge of the ice sheet (ice front) acts as a "snow plow"** or **"bulldozer."** Scours the land, plucks loose rocks out of the ground and slices all vegetation in its way.



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Glacial Dynamics (cont'd)

4. **All this material** (called **glacial debris**) **is mixed into the ice** as the ice moves forward and down slope.
5. **Moraines** (unsorted glacial debris) **are created**.
6. **The furthest advance** of the ice front is marked by a **ridge** of debris called the **terminal moraine.**

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Glacial Dynamics (cont'd)

7. **The "retreat"** of a glacier is the **melting of the ice front**, creating the *illusion* that the glacier is moving backward. (It melts in place, **not** backward.)
8. **As the ice melts a variety of glacial features is created** as the material picked up is exposed and dropped in place.
9. **A recessional moraine is a low ridge of debris marking the position of the ice front's advance after it retreated**.

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Glacial Dynamics (cont'd)

10. **Outwash** is **melt water** that flows from the leading edge of the glacier**.** Flowing outwash carries debris which is sorted by the moving water and deposited in front of the moraine *(largest/heaviest material is dropped closest to the moraine; smallest/lightest material farthest away.)*
11. **An "outwash plain" is a landform feature created by outwash deposition.** It ranges is thickness from several feet to several hundred feet. *Deposits may be found tens of miles from the edge of the moraine.*

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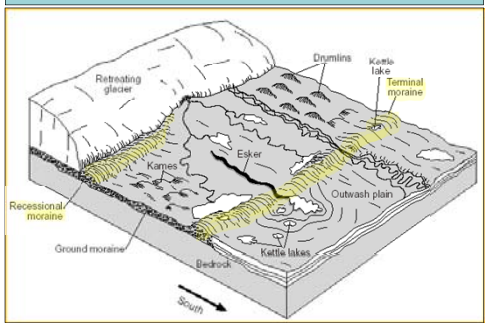
Glacial Landforms



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Mountain Glaciers

In a mountainous area, snow and ice collects at the highest elevations.

- The pressure of the mass of ice moves it down a valley under the force of gravity.
- Unique landform features are created.
  - Cirques
  - Arêtes
  - Horns
  - Lateral and medial moraines
  - U-shaped valleys
  - Hanging valleys

➢**During the last ice age the Adirondacks were covered by both mountain glaciers and the continental ice sheet.**

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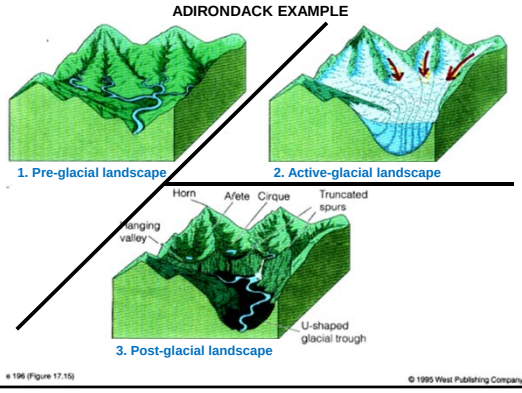
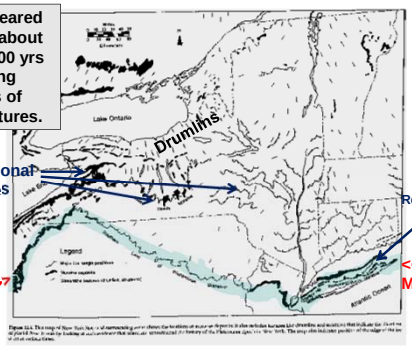
Glacial Features of Mountains



Moraine Deposits in NYS

Ice disappeared from NYS about 8,000-10,000 yrs ago creating thousands of glacial features.



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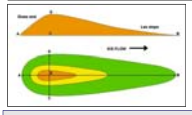
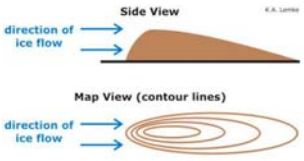
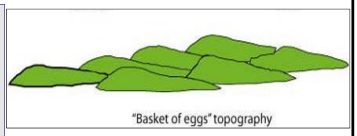
Drumlins





❖ **Drumlins: elongated hills of glacial debris created parallel to the flow of ice.** They are tapered in the direction of ice flow. Individual drumlins can be 200 ft. high and over a mile long.



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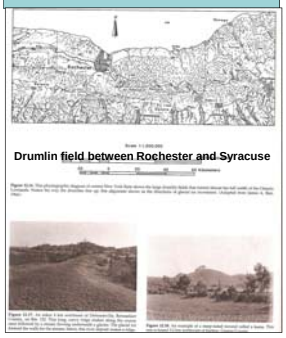
Drumlins



https://www.google.com/maps/@43.043267,-76.8259625,10.43z/data=!5m1!1e4

http://docs.unh.edu/NY/plmy02sw.jpg

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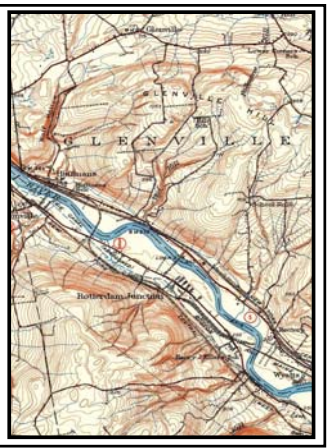
Mohawk River: a glacial valley Schenectady Co.

What are the clues that this river valley was not created by the present-day Mohawk River?

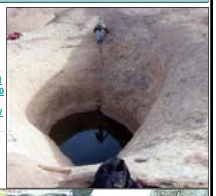
https://www.google.com/maps/@42.8539689,-74.0375243,13.2z/data=!5m1!1e4



Glacial Potholes

https://www.youtube.com/watch?v=Pb8av60XHQg

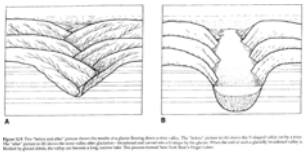
https://www.google.com/maps/@43.0392927,-74.8321215,14.59z/data=!5m1!1e4



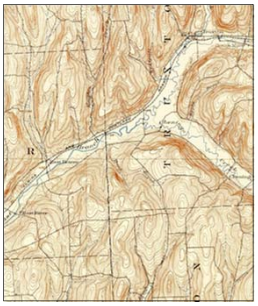
Moss Island Nat'l Natural Landmark on the Mohawk River at Little Falls in Herkimer Co.

- An uplifted fault block of ancient **crystalline** rock.
- Has the best examples of Ice Age **pot-holes created by meltwater** in E U.S.

Creation of a U-Shape Valley



Before glaciation. **After glaciation.**



http://docs.unh.edu/NY/cort03ne.jpg

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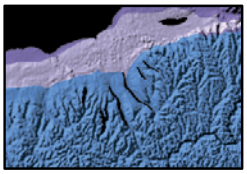
The Finger Lakes

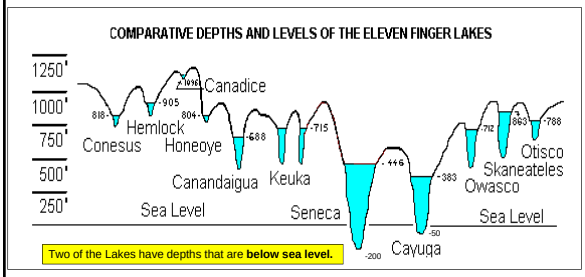


In pre-glacial times, the "**Finger Lakes**" existed as V-shaped river valleys on the plateau surface.

The valleys were **deepened** and **widened by moving ice** (they are now U-shaped).

Their southern outlets were **clogged** by glacial debris, impounding water and creating lakes.

The Finger Lakes



Two of the Lakes have depths that are **below sea level.**

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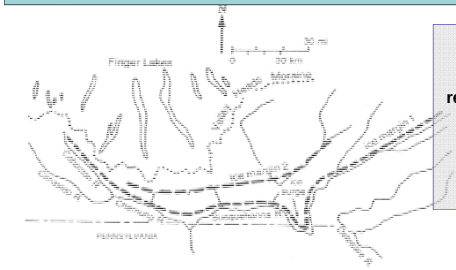
Recessional Moraines of the Southern Tier



Arcuate trends of the Susquehanna River and its tributaries in relation to probable ice stands during Wisconsin deglaciation, and the similar arcuate pattern of the Valley Heads moraine belt. Adapted from Cooper, 1974.

These recessional moraines are responsible for creating the Finger Lakes and the drainage pattern of this area.

https://www.google.com/maps/@42.1833207,-76.6208671,10.11z/data=!5m1!1e4

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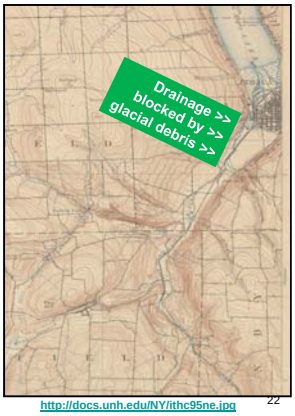
Glacial Dam at Ithaca, NY

Tompkins Co.

Southern outlet of the pre-glacial valley of present-day Cayuga Lake was filled with deposits from the **recessional moraine**.



http://docs.unh.edu/NY/ithc95ne.jpg

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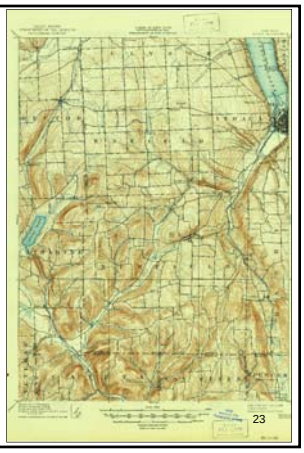
Ithaca Topographic Map

Wide dry valleys and valleys with small streams indicate features that once contained great amounts of water.

Deposits of glacial debris blocked the flow of most of the water draining south.

https://www.google.com/maps/@42.4774856,-76.2180924,9.64z/data=!5m1!1e4



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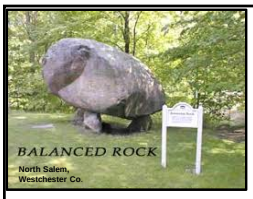
Glacial Erratics



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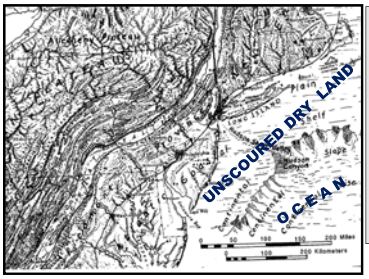
Physiographic Map of Northeast US



Glacial material was deposited on the dry continental shelf.
(NOTE: Sea level lowers during ice ages.)

Terminal moraines mark the furthest extent of continental glaciation.
Recessional moraines mark subsequent ice advances after retreat.

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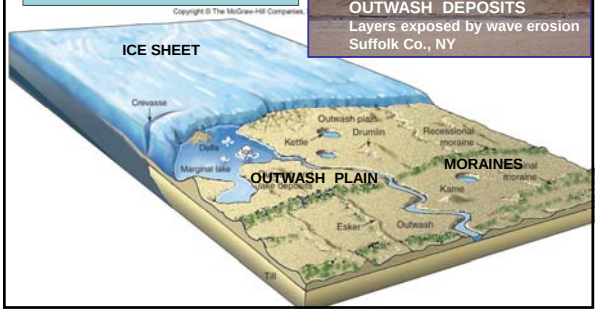
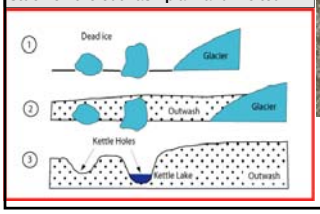
OUTWASH AREA: Beyond the Edge of the Ice Sheet

OUTWASH DEPOSITS
Layers exposed by wave erosion
Suffolk Co., NY



Lake Ronkonkoma
Suffolk Co.

Lake Ronkonkoma is a **kettle lake**.
Created when a chunk of the ice sheet got stuck on the outwash plain and melted.



Because of the high clay content of the sediment, the depression was able to retain the glacial melt water that filled the hallow.

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Mendon Ponds Park
Monroe Co.

Mendon Ponds Park

Kettle lakes south of Rochester, NY.
The ridge in the background is an esker.

OPTIONAL EXERCISE 7
Nature of Glaciation

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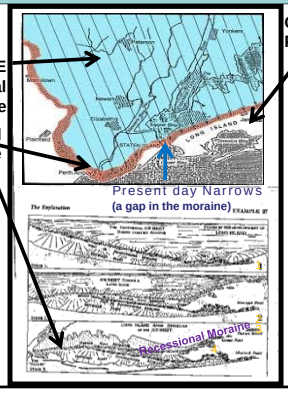
Glacial Topography of SE NYS



ICE LOBE then a glacial lake

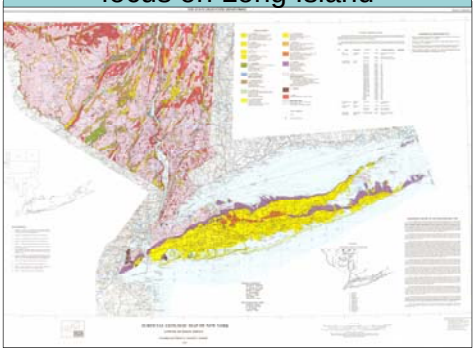
Terminal Moraine

Outwash Plain

The ice sheet in SE NYS:

1. **Furthest extent of the ice creates the *terminal moraine***
2. **Ice recedes leaving behind the South Fork of Long Island**
3. **Ice advances again to create a *recessional moraine.***
4. **When it recedes the North Fork is left behind.**

Surficial Geology of SE NYS
focus on Long Island



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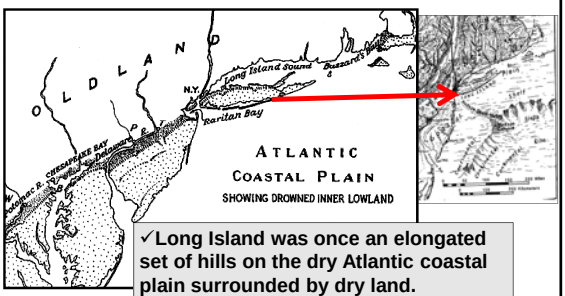
Creation of Long Island



✓**Long Island was once an elongated set of hills on the dry Atlantic coastal plain surrounded by dry land.**
✓**Long Island Sound was a river valley.**

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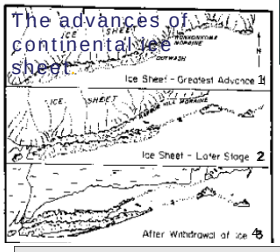
Creation of Long Island



http://youtu.be/4UyocM9bDL4

The **Ronkonkoma** and **Harbor Hill moraines** run from Staten Island to southern New England creating the base of Long Island and Cape Cod.

Glacial Lake Connecticut was created between the Harbor Hill Moraine and the mainland. It filled with meltwater from Connecticut rivers. Excess water flowed through outlets near present-day Fishers Island.

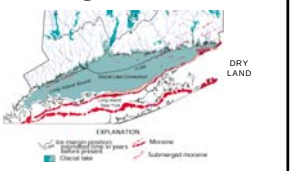
Over time the glacial lake broke through the Harbor Hill Moraine and drained, leaving a river that flowed to the sea and a dry valley.

Creation of Long Island

1. With global warming, the **Atlantic rose and flooded the continental shelf.** The valley filled with salt water creating an estuary. The set of hills (Long Island) became a peninsula.

2. As sea level continued to rise, the waters of **Long Island Sound breached the ridge at its western end.**

3. It **overflowed westward into New York Bay** creating the East River (a strait), and **making the peninsula an island** – Long Island.



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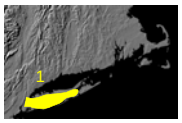
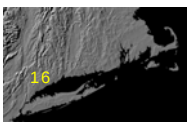
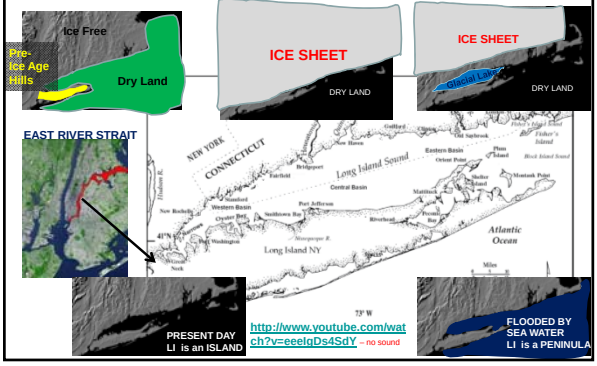
Formation of Long Island and Long Island Sound





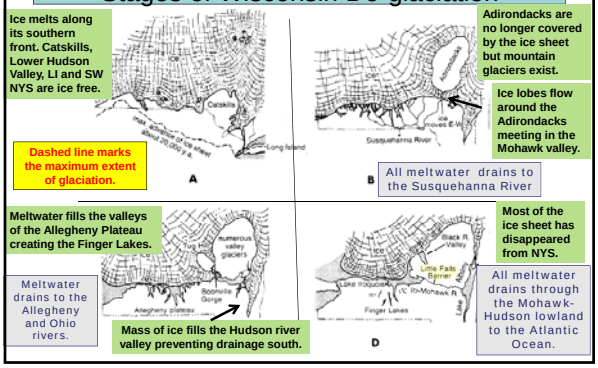
1. **Prior to the last Ice Age Long Island (LI) is an elongated hilly area on the continental shelf. The Atlantic shoreline is over 100 miles to the east.**
2. **Long island Sound (LIS) is a valley drained by a river.**
3. **Advancing glacial ice deepens the valley.**
4. **Edge of ice creates a ridge of glacial debris called Ronkonkoma Moraine, a terminal moraine that extends from Staten Island to Cape Cod**
5. **With global warming the ice front retreats. Melt water flows into the deepened valley depositing freshwater sediment.**
6. **Ice front advances again during global cooling.**
7. **Edge of ice creates a ridge of glacial debris called the Harbor Hill Moraine, a recessional moraine that extends from Nassau County to Rhode Island.**
8. **Harbor Hill Moraine traps melt water forming Glacial Lake Connecticut.**
9. **Water breaks through the moraine between LI and RI, draining the lake.**
10. **With global warming sea level rises.**
11. **Salt water floods the continental shelf and moves into the dry eastern end of former Glacial Lake Connecticut.**
12. **The LI landmass becomes a peninsula.**
13. **With rising sea level, sea water eventually reaches the western end of the former lake bed.**
14. **At the same time, New York Bay, also the site of a glacial lake and a breached moraine (The Narrows) fills with sea water.**
15. **LIS overflows the land divide between it and NY Bay creating a strait now called the East River.**
16. **The LI landmass becomes an island.**

Formation of Long Island and Long Island Sound



http://www.youtube.com/watch?v=eeeIgDs4SdY – no sound

Retreat of the Glaciers in NYS:
Stages of Wisconsin De-glaciation



Glacial Lake Iroquois

https://www.youtube.com/watch?v=0NZOL6cmhOM

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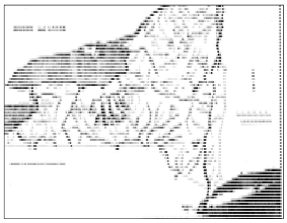
Rivers and Lakes of NYS Today:
A result of glaciation

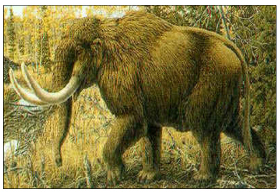
The location of the rivers and lakes of NYS are a result of the physiography created by glacial processes.



Global Warming and Repopulation

As soon as glacial ice left an area, **plants then animals return to repopulate the area**, even though it was still very cold (tundra conditions).

Nearly complete skeletons of large animals, preserved in lake mud from c.10,000+ yrs ago, have been found in various areas of the state. (Cohoes, Watkins Glen, Hyde Park and in Orange County.)



https://www.youtube.com/watch?v=ObJqLo0Wa6g

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Cohoes Mastodon
NYS Museum, Albany

http://exhibitions.nysm.nysed.gov/cohoesmastodon/

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The Nature of New York

NEXT:

C L I M A T E S

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