Glacial History of the Bristol Valley

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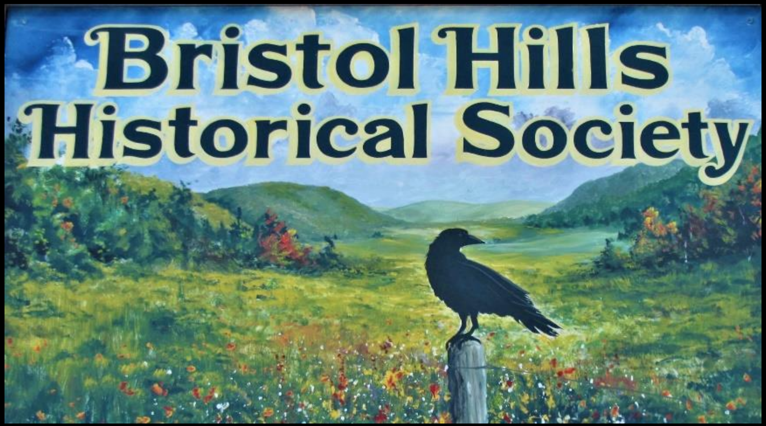
Public Presentation
Wednesday, April 13
7:00 - 8:30pm



Acknowledgements

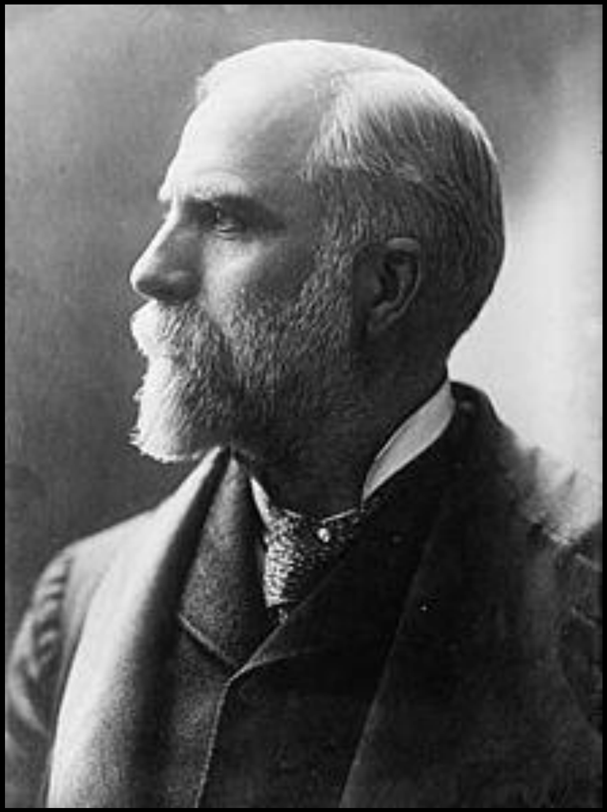
- Dr. Richard Young, SUNY Geneseo
- Dr. David Barclay, SUNY Cortland
- Dr. Henry Mullins, Syracuse University
- FLCC Glacial Geology college students

and

- Herman Leroy Fairchild, University of Rochester

"Fairchild began his investigations in the days of the horse and trolley. Although based primarily on landscape interpretation and therefore focused on the latest glacial episode, Fairchild's concepts of New York glacial geology still serve, more than 50 years later, to stimulate current studies. Without the benefit of remote sensing, air photographs, or even adequate topographic maps, he drew astute conclusions as to the meaning of landscape features of New York State."

Proceedings of the Rochester Academy of Science. 1983.



1850 - 1943

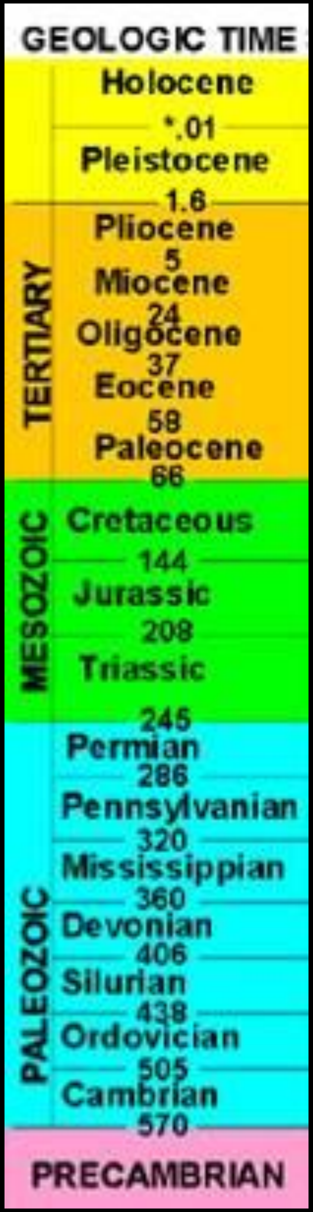
Tonight's educational program will take you back in time to the **Great Ice Age** for a discussion of factors that are responsible for the landscape features we see today in the Bristol Valley.

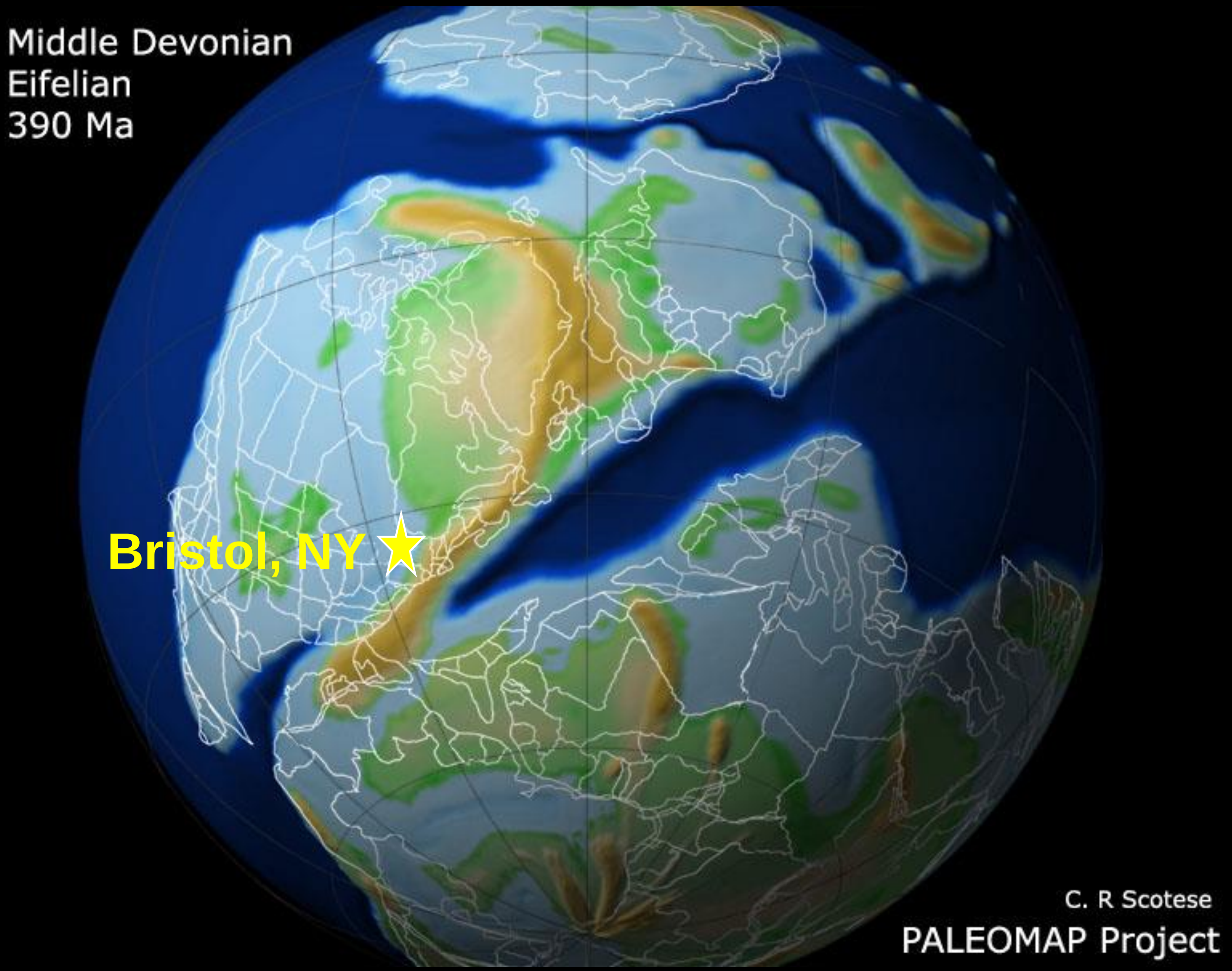
Erosional processes that sculpted the Finger Lake valleys and depositional processes such as recessional moraines that produced proglacial lakes are among the many features that will be examined in detail.

Rapid climate change at the end of the Ice Age brought many changes to the local biota, and some of the local discoveries highlighting these will be presented.

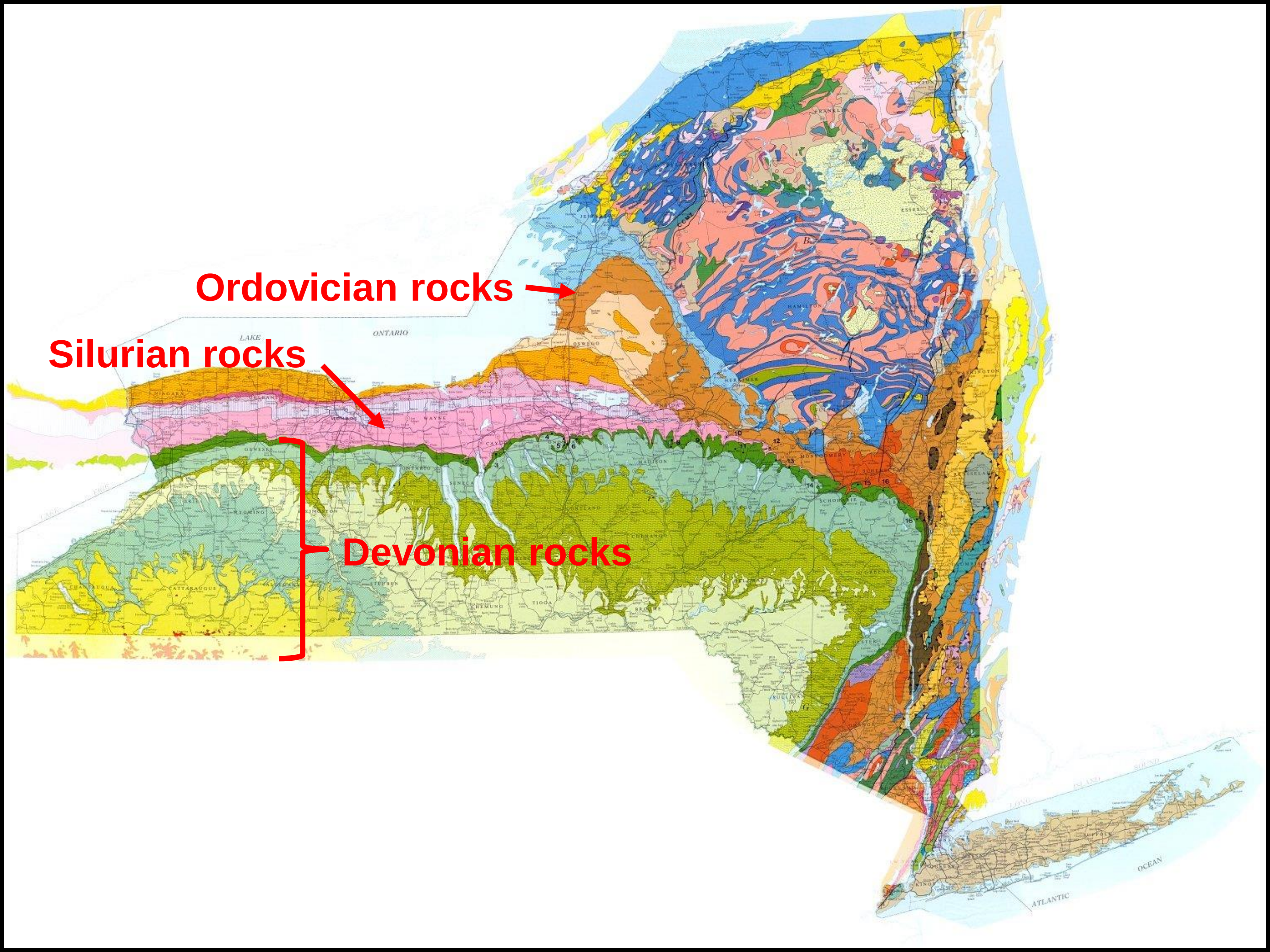
But first, a much longer step back in time!

Ancient Oceans





Bedrock Geology of NYS



Turtle Stones

Concretions in the rock - Seneca legend

Calcareous Concretions

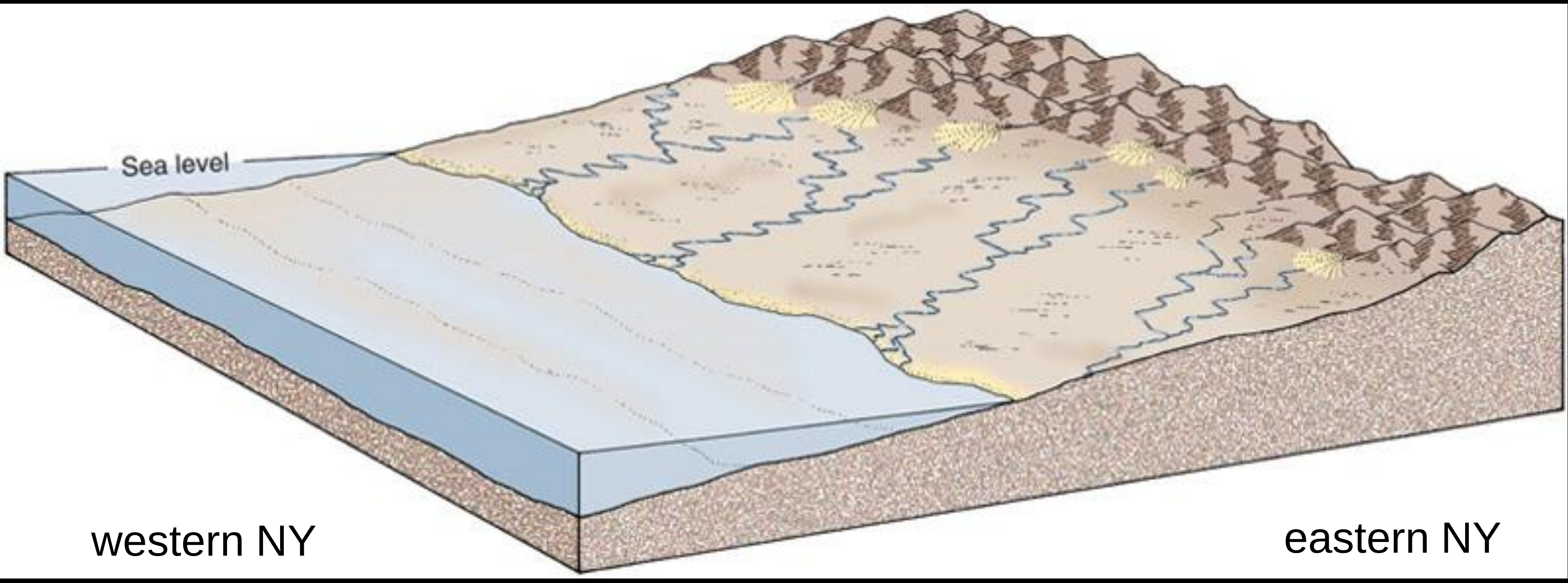
Calcareous concretions are spherical to oval-shaped calcium carbonate concretions that are flattened parallel to the bedding planes. They can range in size from 3 cm to 8 m in diameter. They most often precipitate around a nucleus of fossilized material including plant matter, shells, or even remains of fish. Often when the concretions erode, they can form odd shapes, sometimes resembling fossils. These are very common in the Devonian rocks found in central New York (PRI 2022).

Septarian Nodules

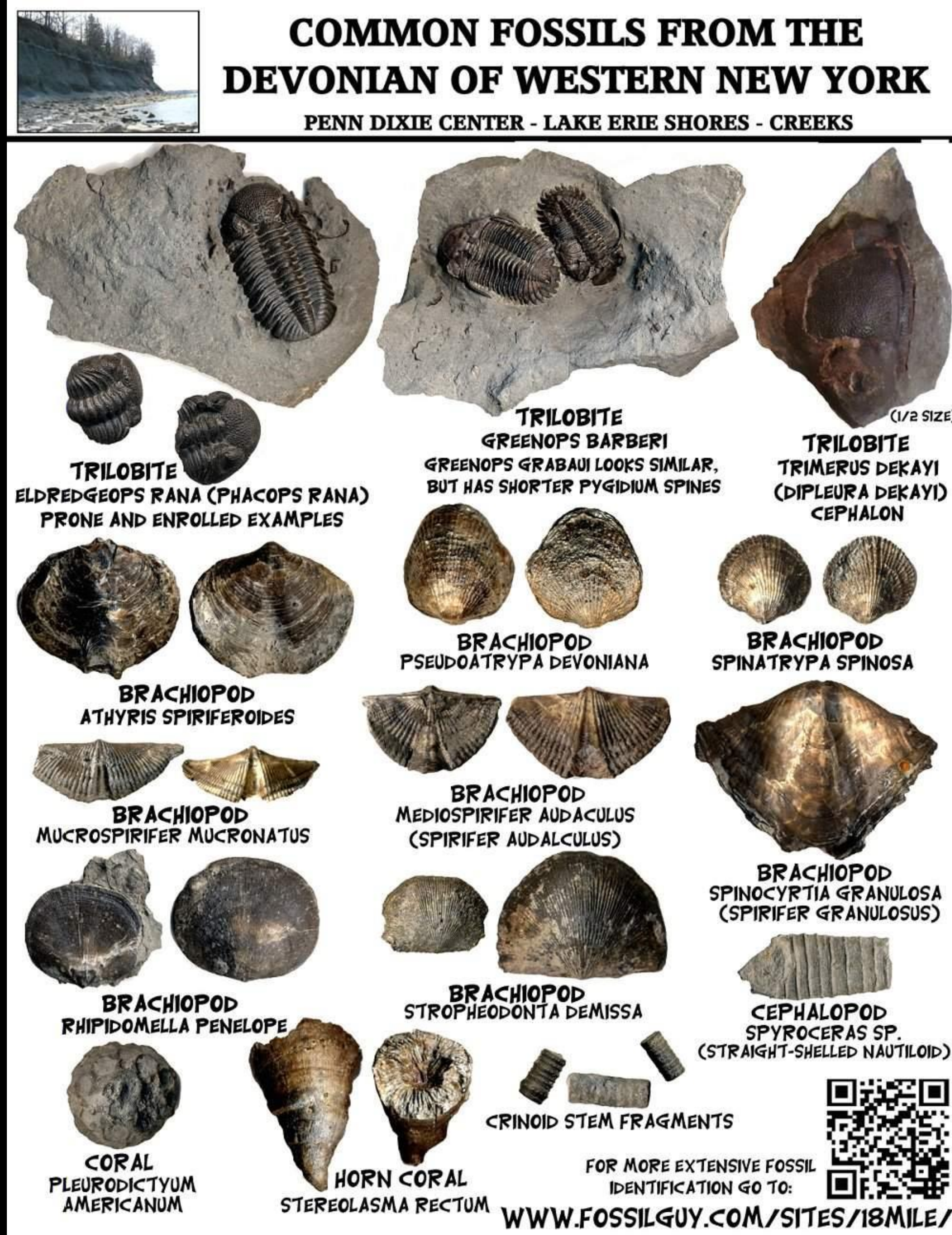
Septarian nodules are distinctly sphere-like concretions that are characterized by a series of cracks that widen towards the center and die out towards the sides of the concretion. These radiating cracks are often crossed by a series of concentric cracks giving them a "turtle-back" appearance. Dehydration of the concretion creates the cracks which then are filled with another crystalline cement, such as calcite or silica. They can range in size from 10 to 100 cm in diameter and usually are made up of a large component of iron (PRI 2022).

Paleo-geography of the Finger Lakes Region

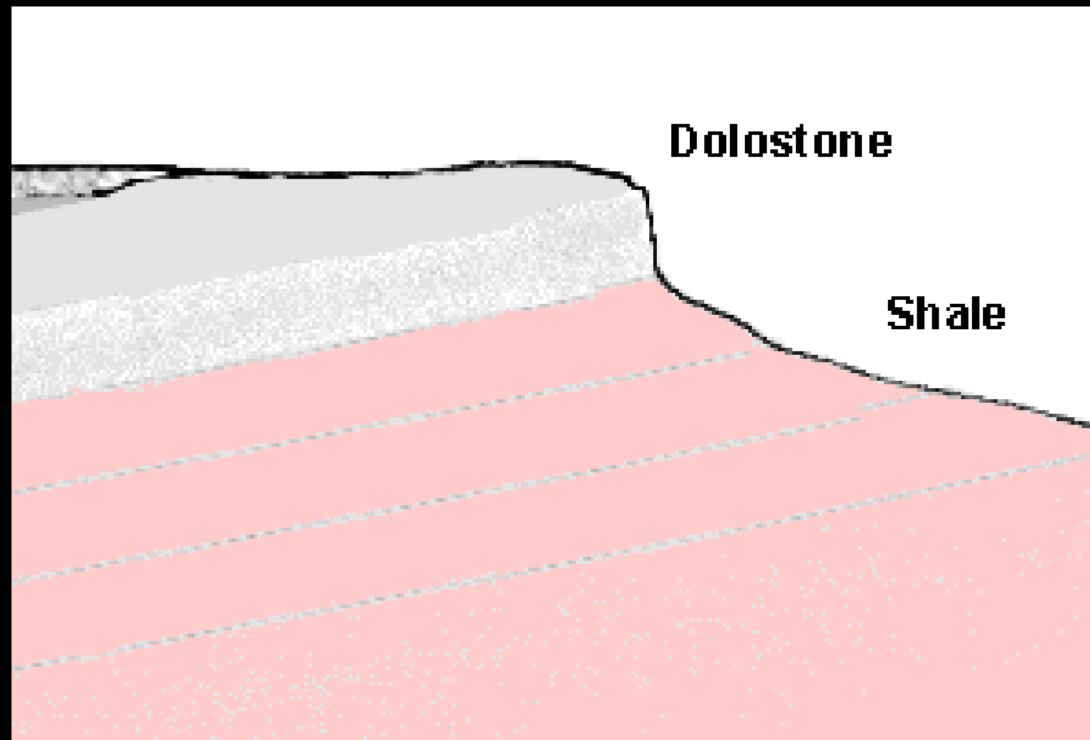
Taconic / Acadian Mts.
(Ordovician) (Devonian)

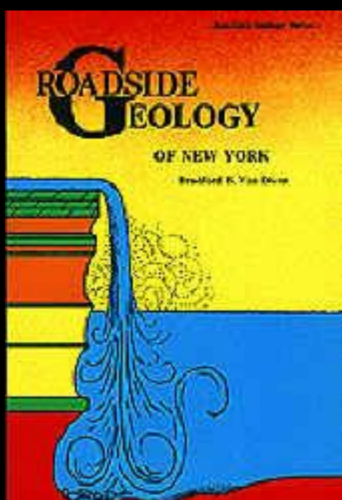


Shallow ocean once found in the Finger Lakes region!


COMMON FOSSILS FROM THE
DEVONIAN OF WESTERN NEW YORK
PENN DIXIE CENTER - LAKE ERIE SHORES - CREEKS
TRILOBITE
ELDREDGEOPS RANA (PHACOPS RANA)
PRONE AND ENROLLED EXAMPLES
TRILOBITE
GREENOPS BARBERI
GREENOPS GRABAUI LOOKS SIMILAR,
BUT HAS SHORTER PYGIDIUM SPINES
(1/2 SIZE)
TRILOBITE
TRIMERUS DEKAYI
(DIPLEURA DEKAYI)
CEPHALON
BRACHIOPOD
ATHYRIS SPIRIFEROIDES
BRACHIOPOD
PSEUDOATRYPA DEVONIANA
BRACHIOPOD
SPINATRYPA SPINOSA
BRACHIOPOD
MUCROSPIRIFER MUCRONATUS
BRACHIOPOD
MEDIOSPIRIFER AUDACULUS
(SPIRIFER AUDALCULUS)
BRACHIOPOD
SPINOCYRTIA GRANULOSA
(SPIRIFER GRANULOSUS)
BRACHIOPOD
RHIPIDOMELLA PENELOPE
BRACHIOPOD
STROPHEODONTA DEMISSA
CEPHALOPOD
SPYROCERAS SP.
(STRAIGHT-SHELLED NAUTILOID)
CORAL
PLEURODICTYUM
AMERICANUM
HORN CORAL
STEREOLASMA RECTUM
CRINOID STEM FRAGMENTS
FOR MORE EXTENSIVE FOSSIL
IDENTIFICATION GO TO:
WWW.FOSSILGUY.COM/SITES/18MILE/

Continent on the Rise





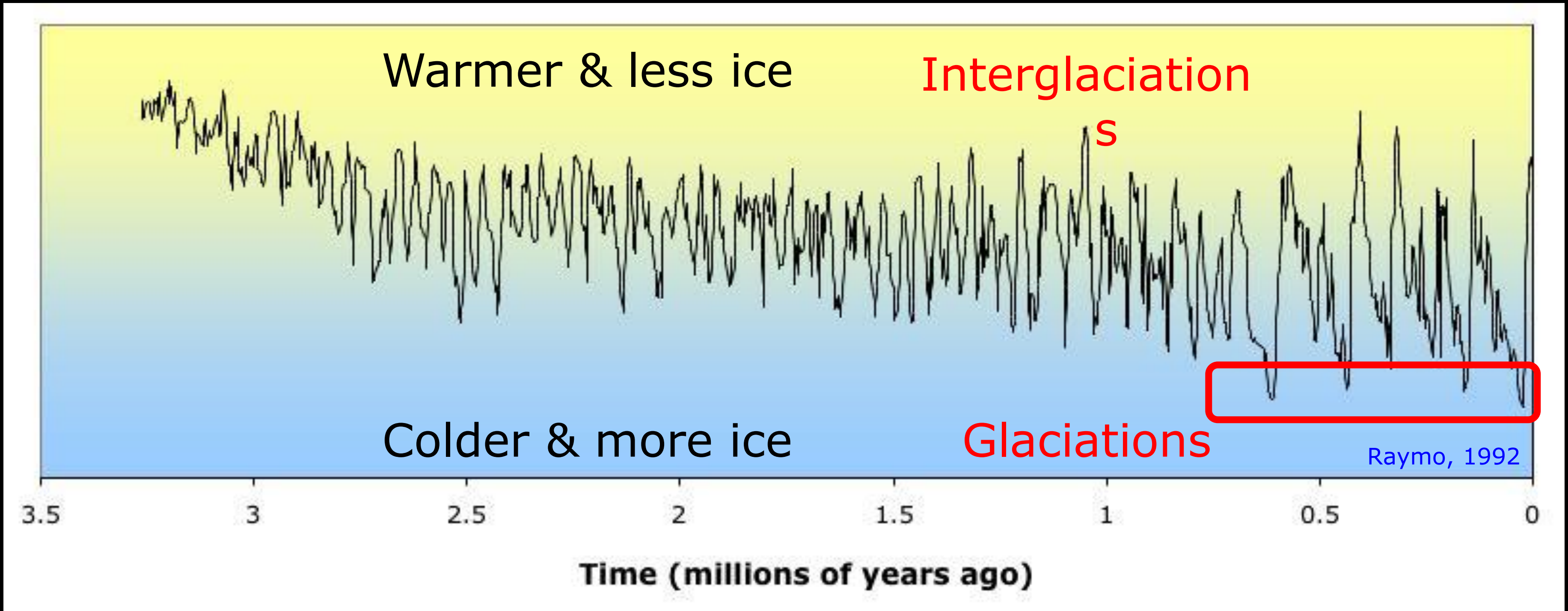
Tilted mesa or cuesta topography

The Pleistocene Epoch, "Great Ice Age"

- Landscapes were repeatedly covered by slowly flowing ice sheets
- Global temperatures were 7° - 14° C colder than today
- Ocean levels fell by over 100 meters or about 330 feet!
- It was a very different time…

Pleistocene Ice Ages

starting ~2.5 million years ago
ending 10,000 years ago

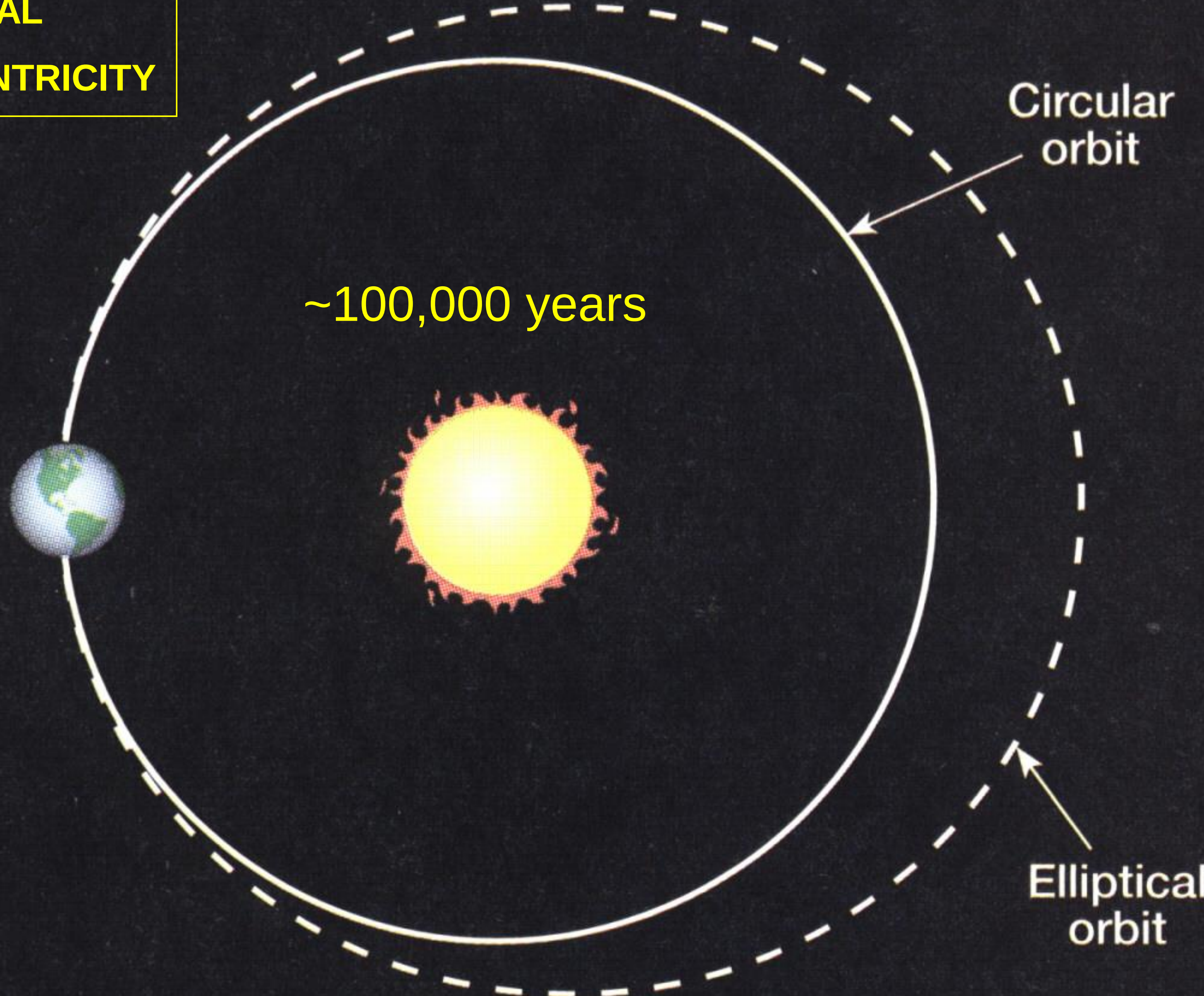


Causes of Glaciation

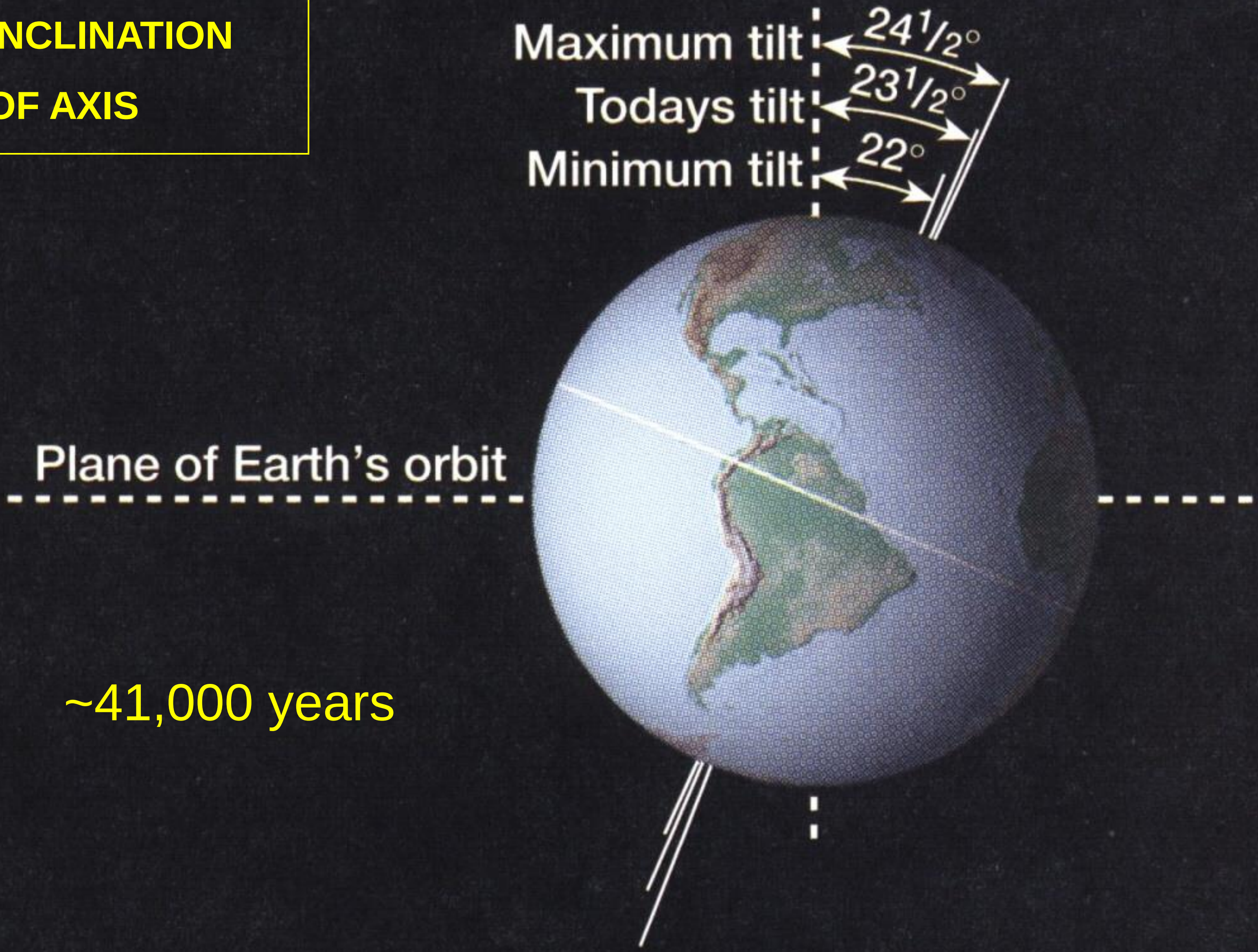
Why the cycles in global temperature?

Milankovitch Hypothesis about effects of orbital variations on earth's heat budget

ORBITAL ECCENTRICITY

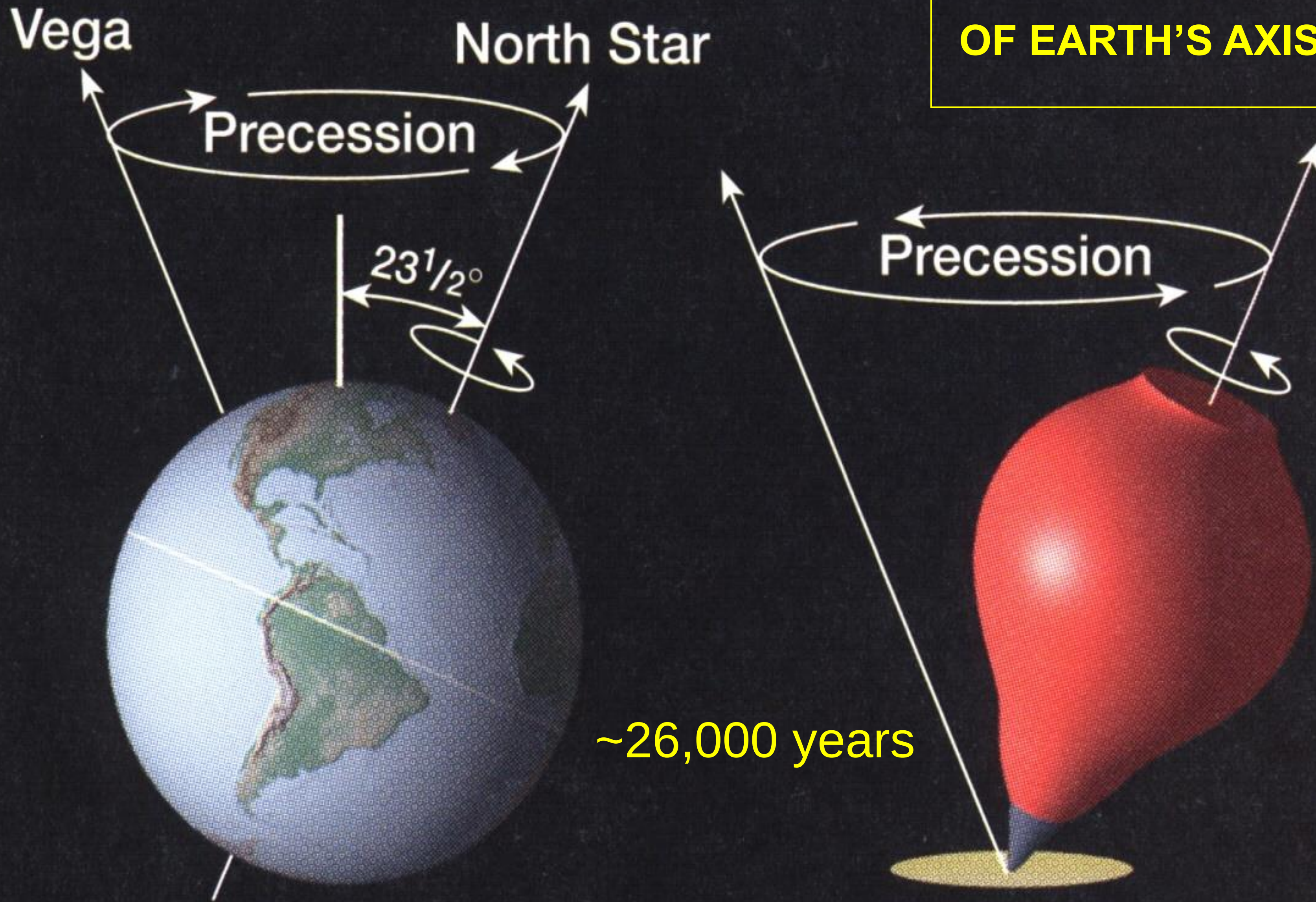


CHANGE IN INCLINATION OF AXIS



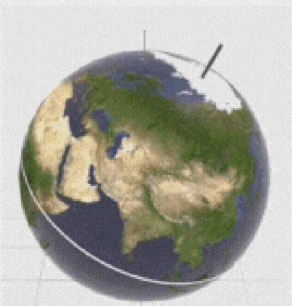
~41,000 years

PRECESSION OF EARTH'S AXIS

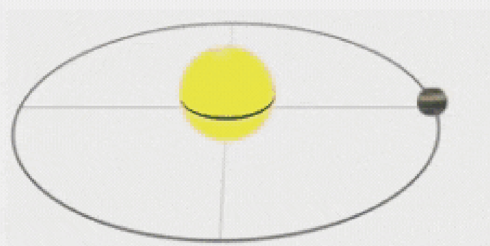


THE THREE MILANKOVITCH CYCLES

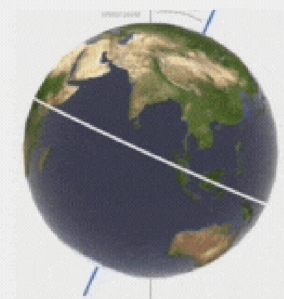
CHANGES IN AXIAL PROCESSION (WOBBLE) IN A 26,000-YEAR CYCLE



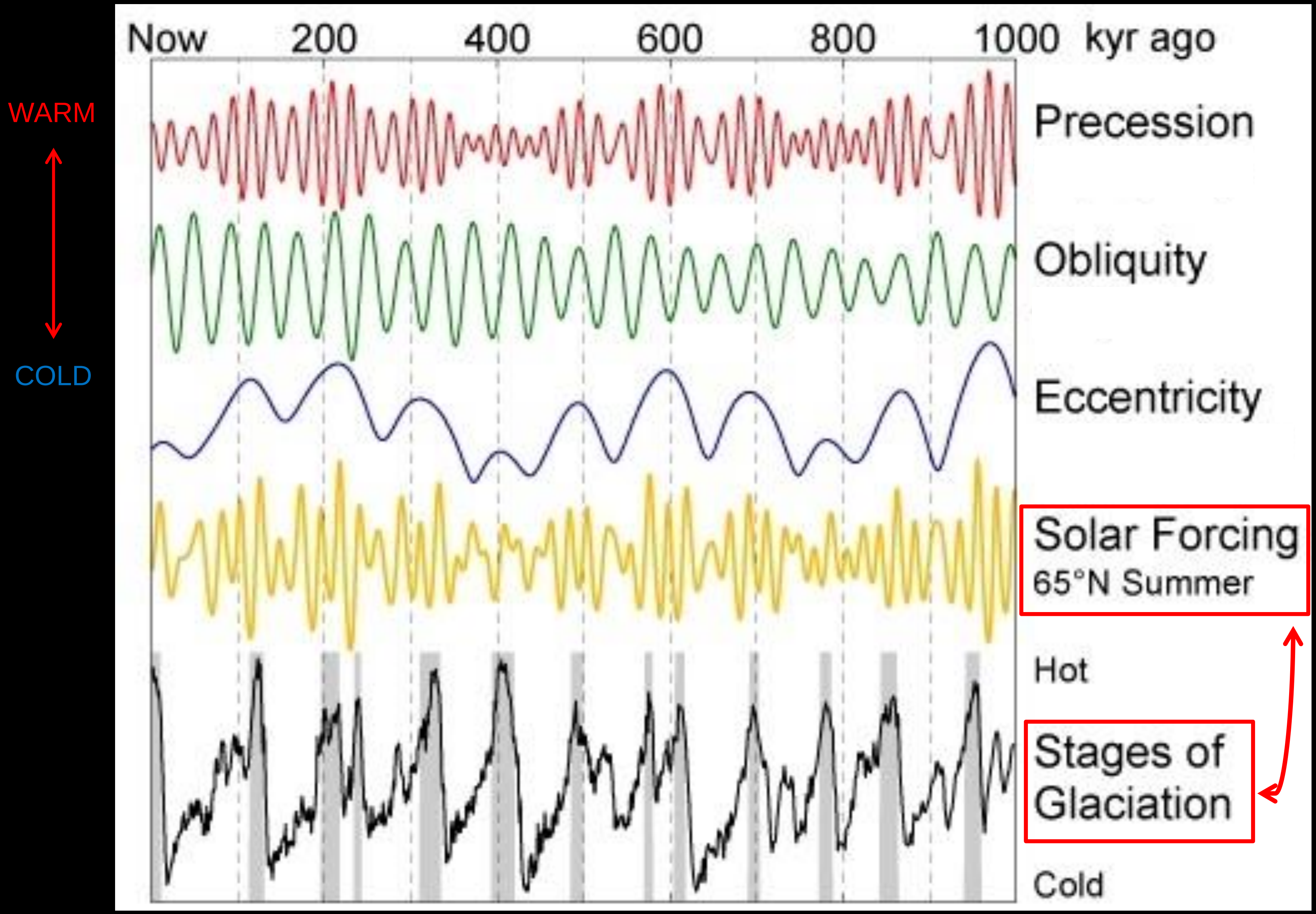
CHANGES IN ECCENTRICITY (ORBIT SHAPE) IN A 100,000-YEAR CYCLE



CHANGES IN OBLIQUITY (TILT) IN A 41,000-YEAR CYCLE



Milankovitch Cycles



How extensive?

- 10% of our modern landscape is covered by glacial ice.
- During the Great Ice Age,

  32% of the global land surface was ice covered!

In the Southern Hemisphere

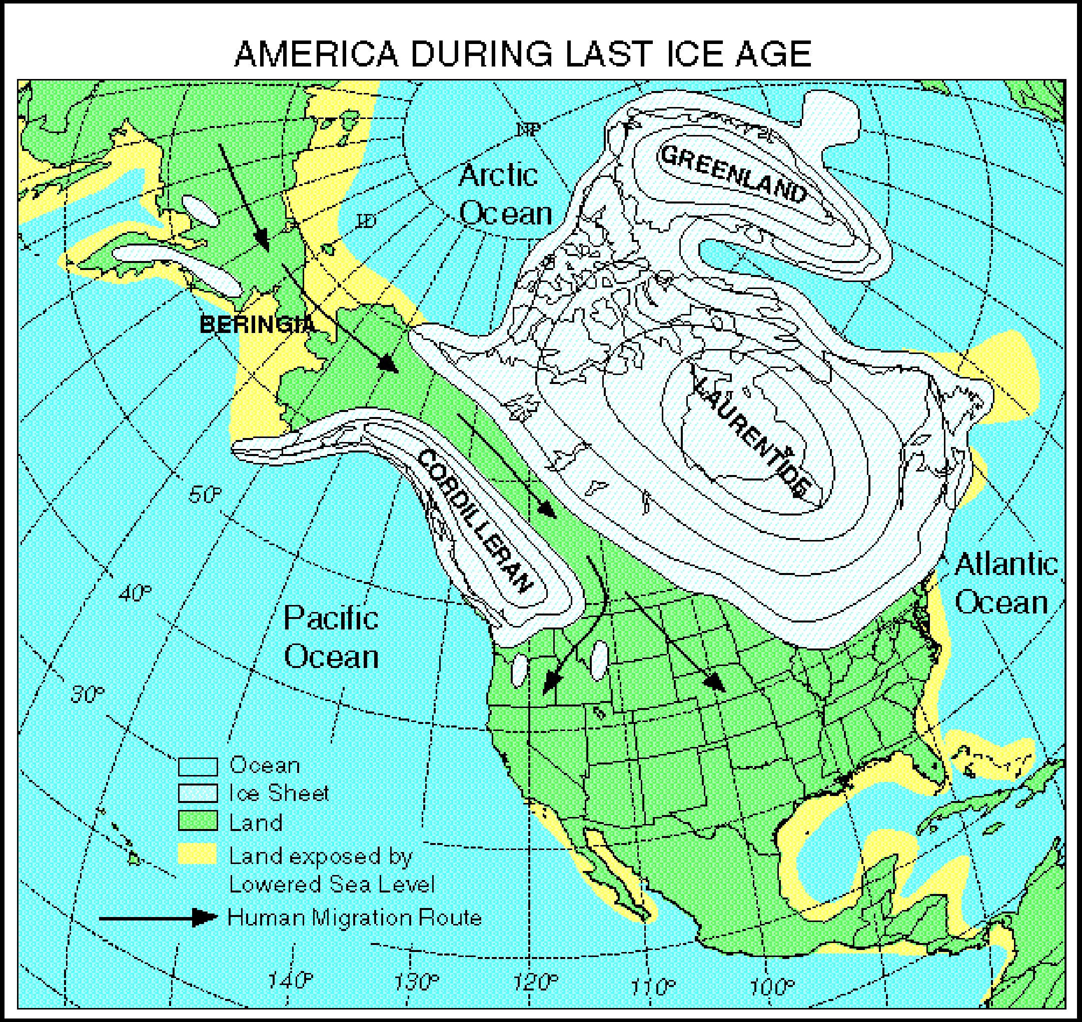
- Australia
- New Zealand
- Argentina
- Antartica

Glacial valley in
Southwest Tasmania

In the northern hemisphere– 3 continental ice sheets

- North America
- Europe
- Siberia

North American Ice Sheet Centers



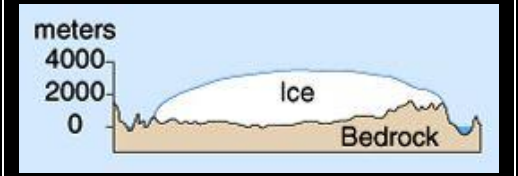
Today

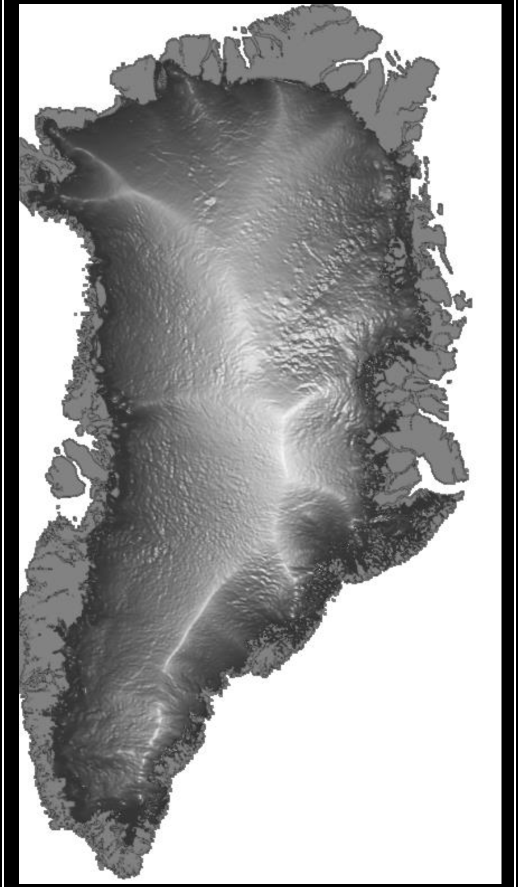
Quaternary North America - Ron Blakey

20,000 years ago

Quaternary North America - Ron Blakey

Greenland IS

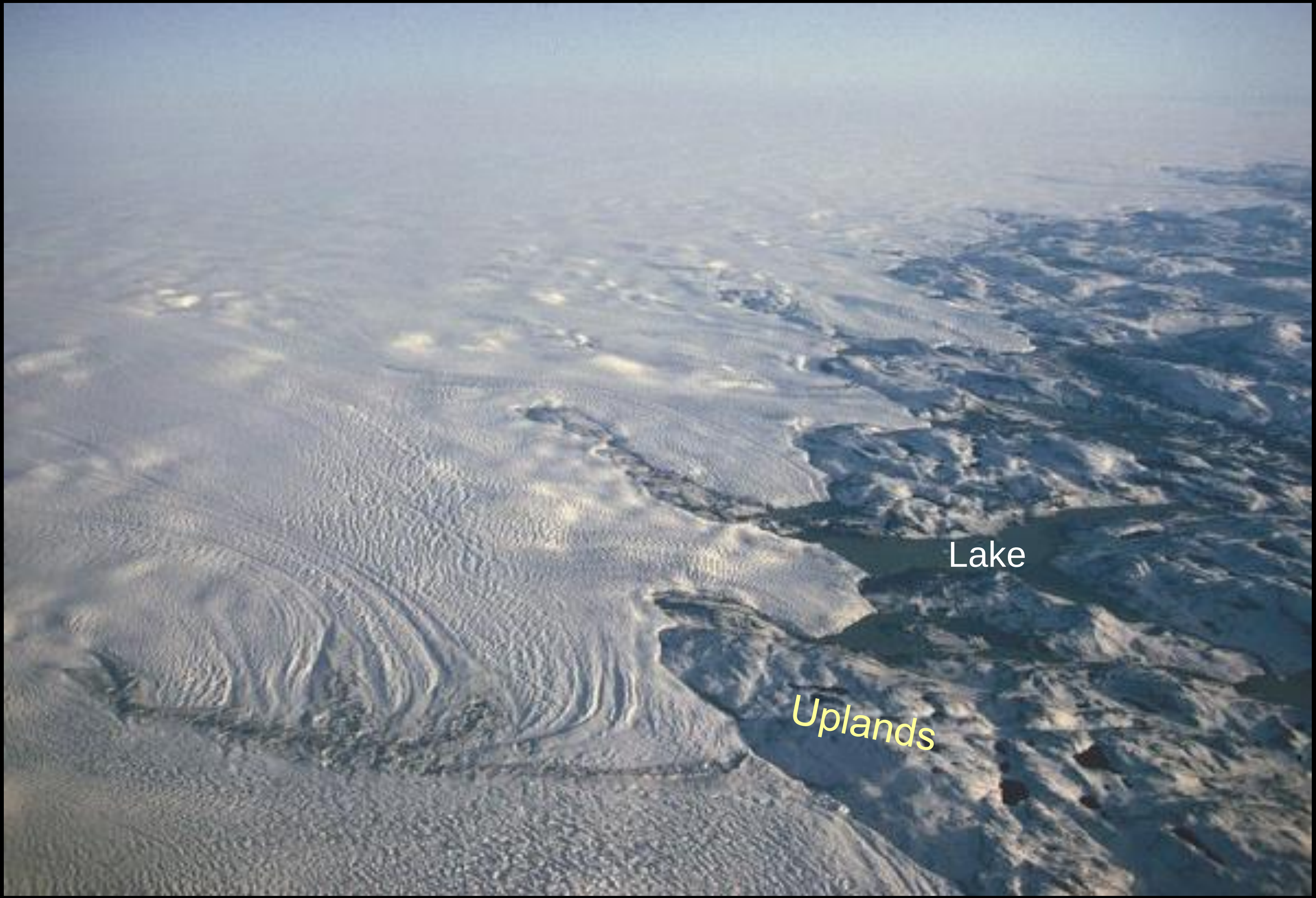




Bristol Valley
(peak of glaciation)

Antarctica - Kevin McMahon

Finger Lakes Region
(during advance and retreat)

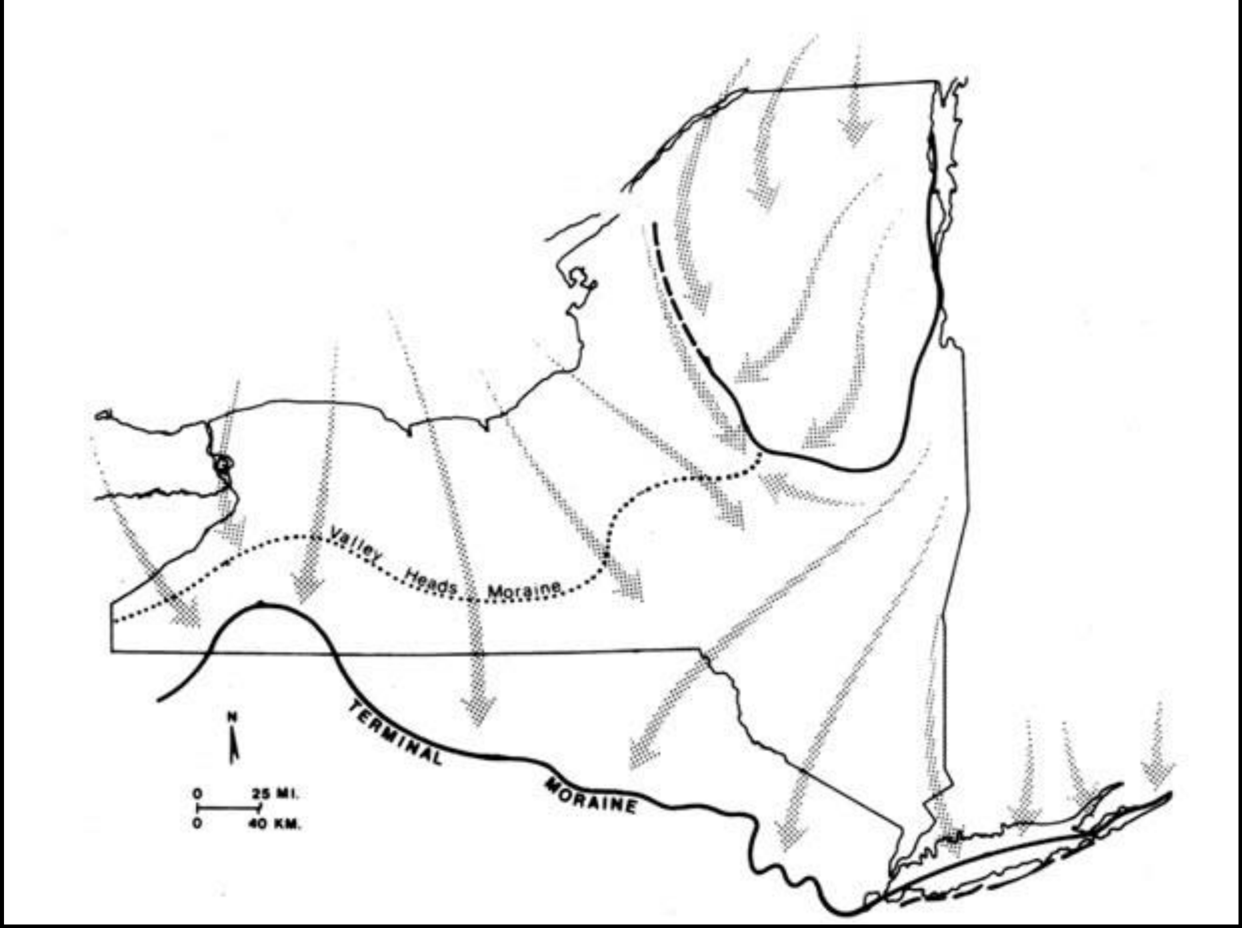


Selective Linear Erosion

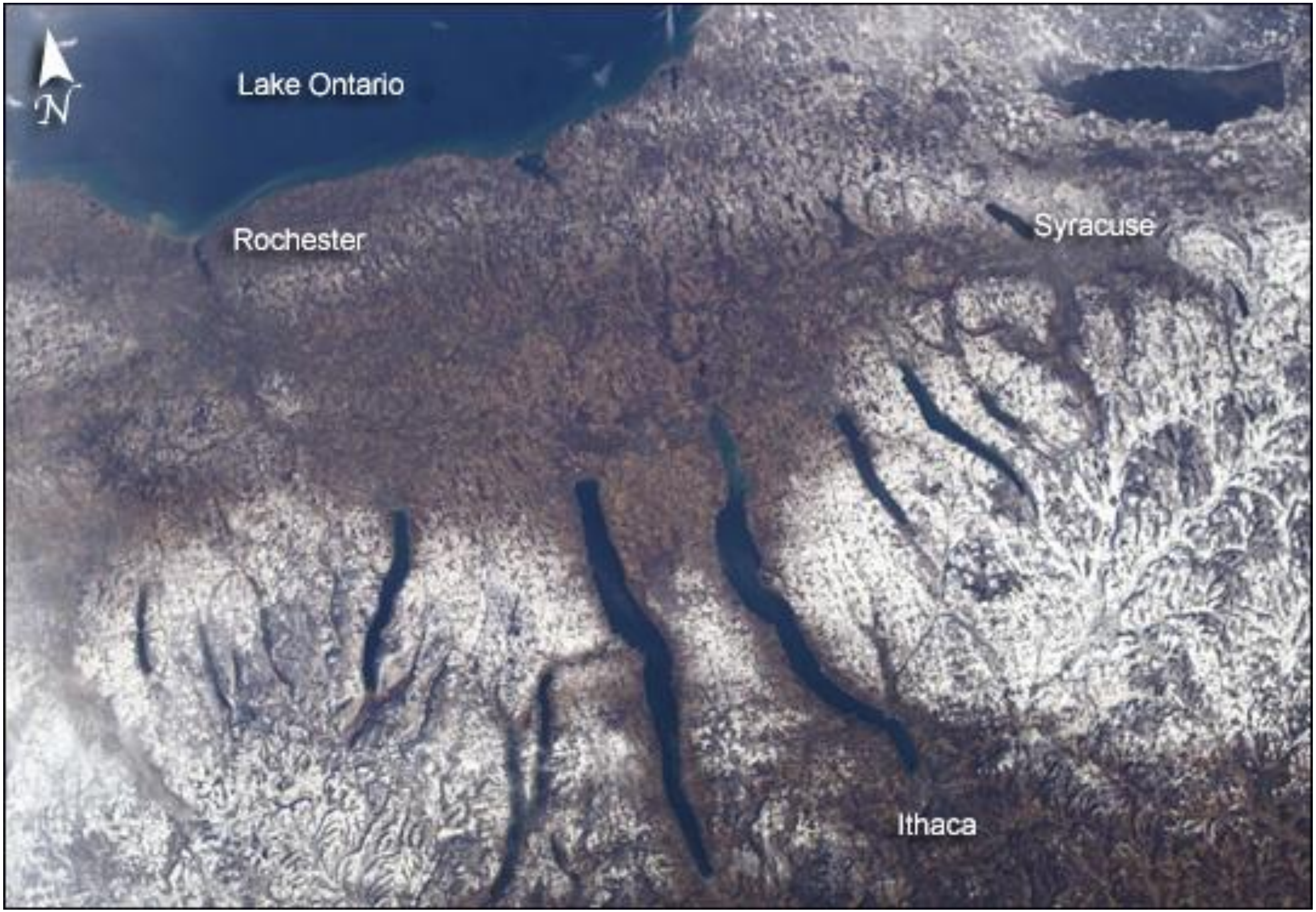
- Glacial ice has a preference to move in pre-existing stream valleys aligned with basal flow direction – why?

- Any meanders in the original stream flow pattern are straightened out – why?

Selective Linear Erosion at work in the Finger Lakes

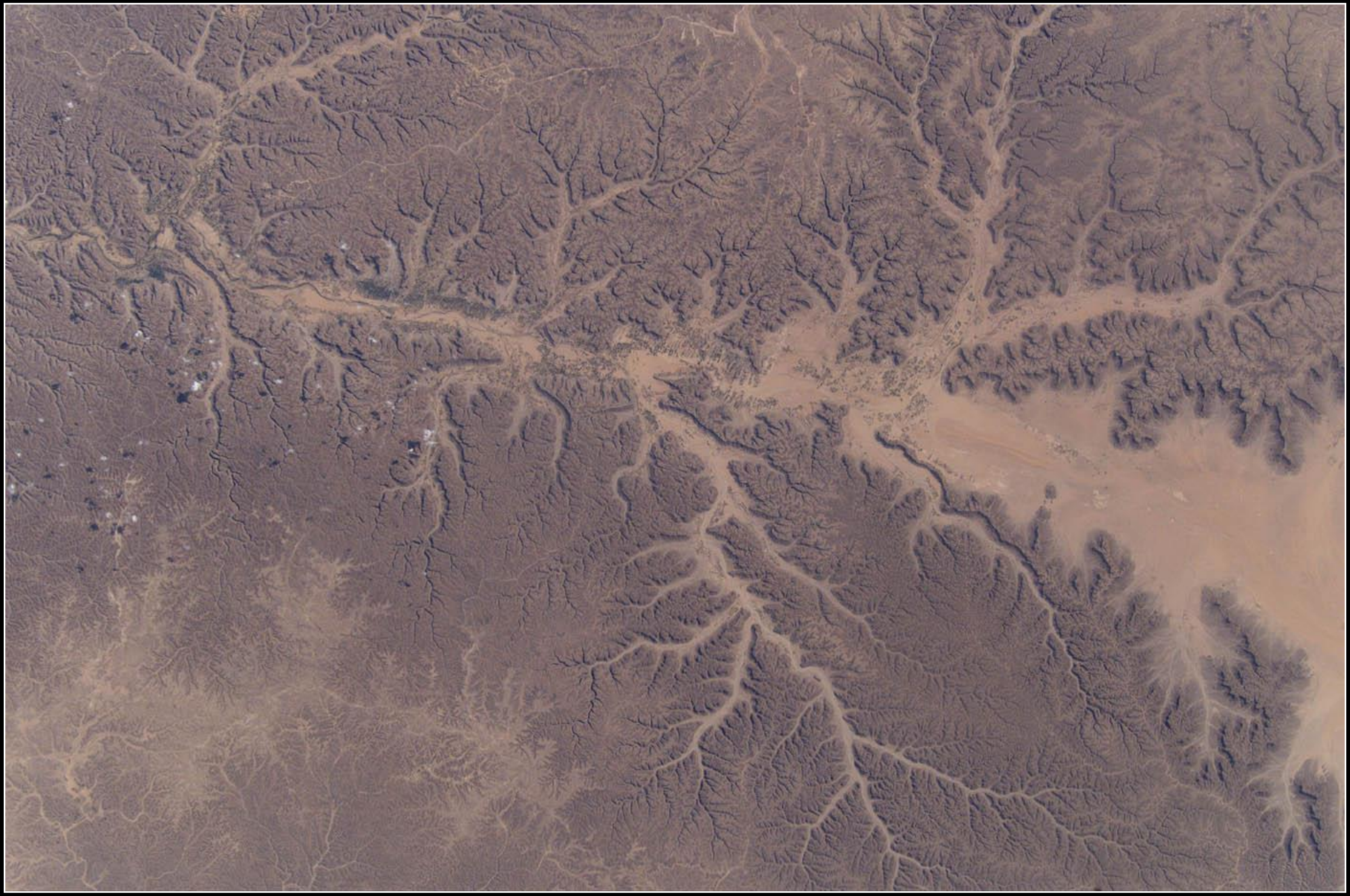


Formation of the Finger Lakes



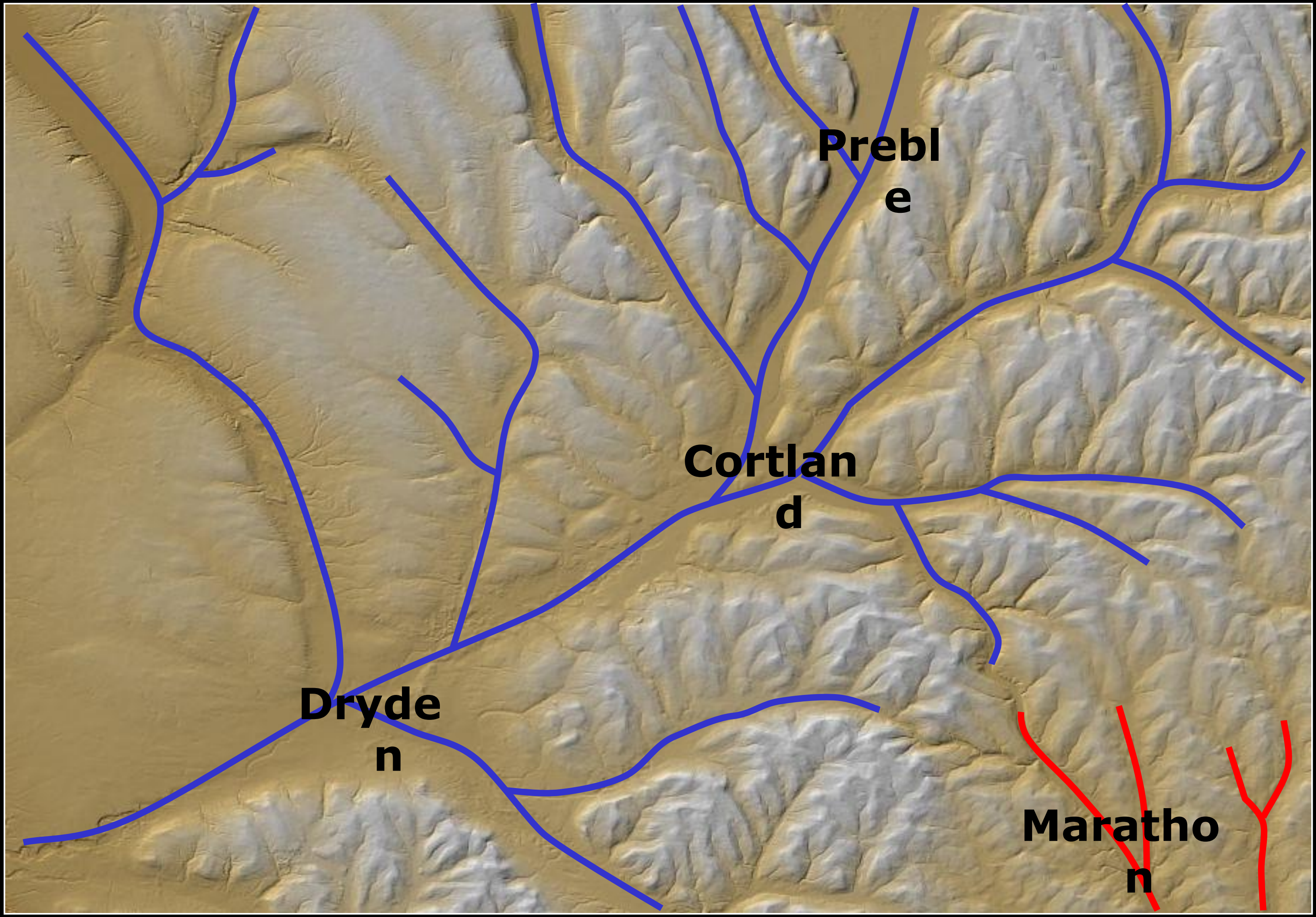
Finger Lakes - NASA

Finger Lakes Formation
(pre-existing dendritic river valleys)

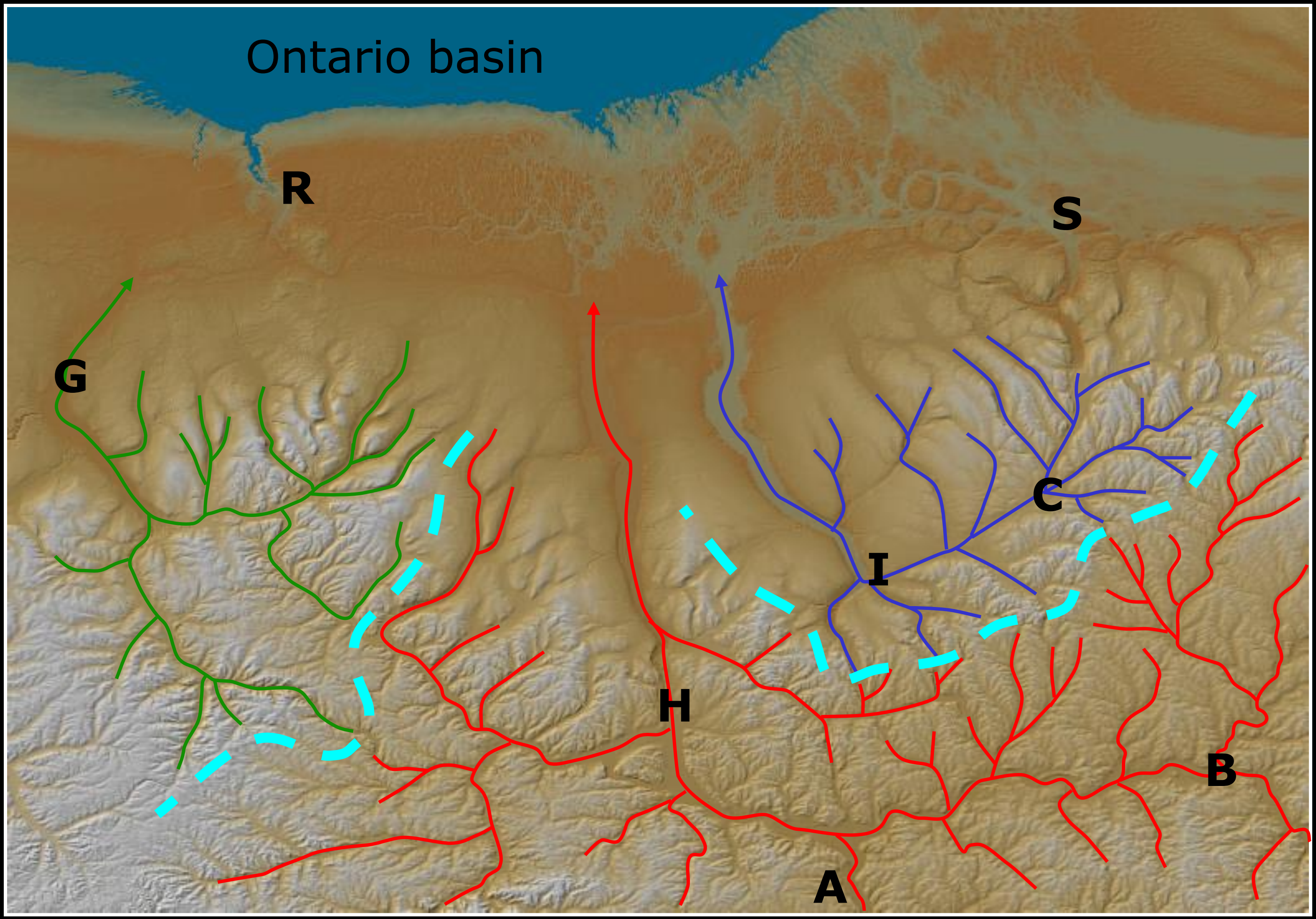


Yemen - SolarViews.com

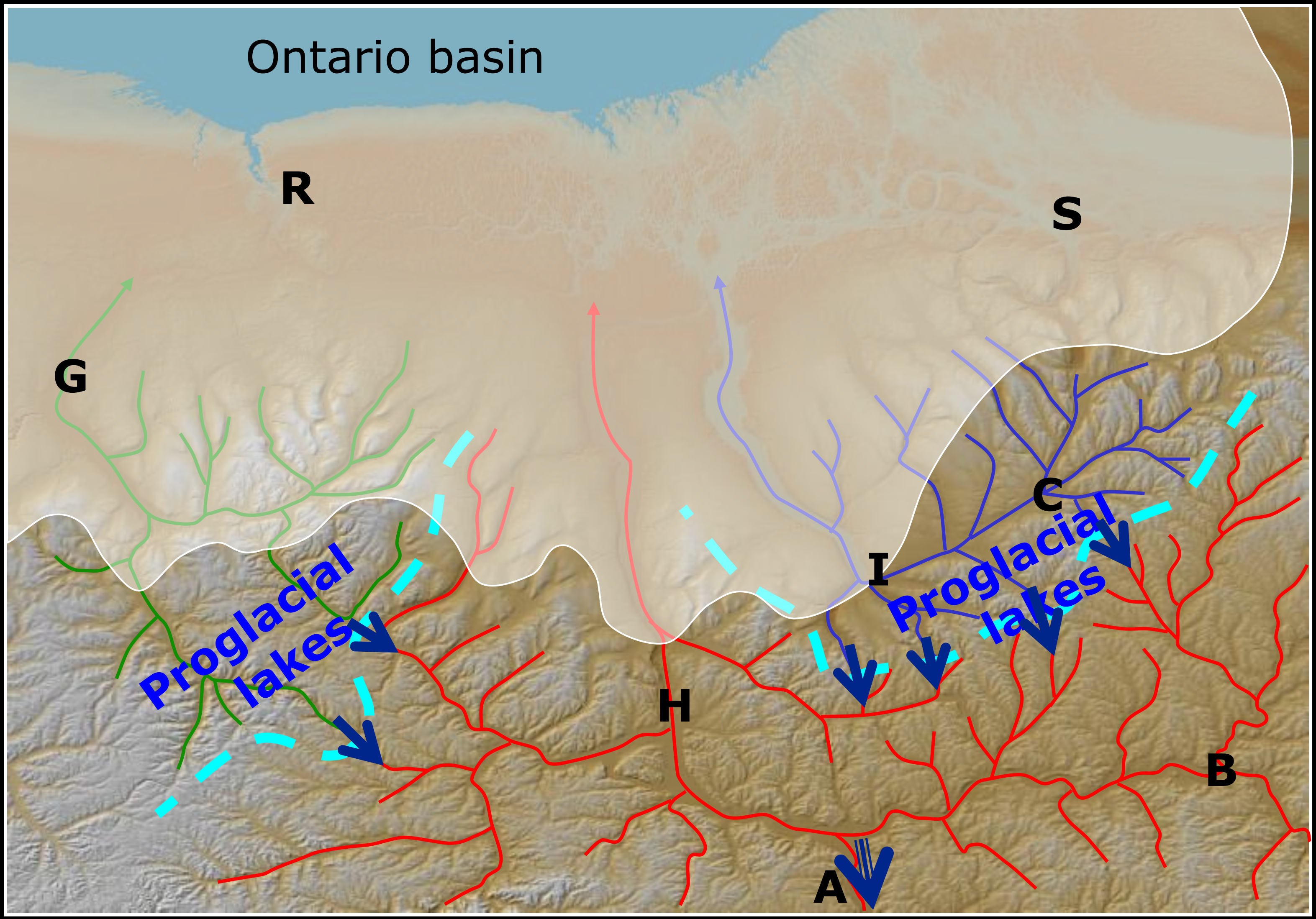
Finger Lake formation
(pre-glacial river valley network)



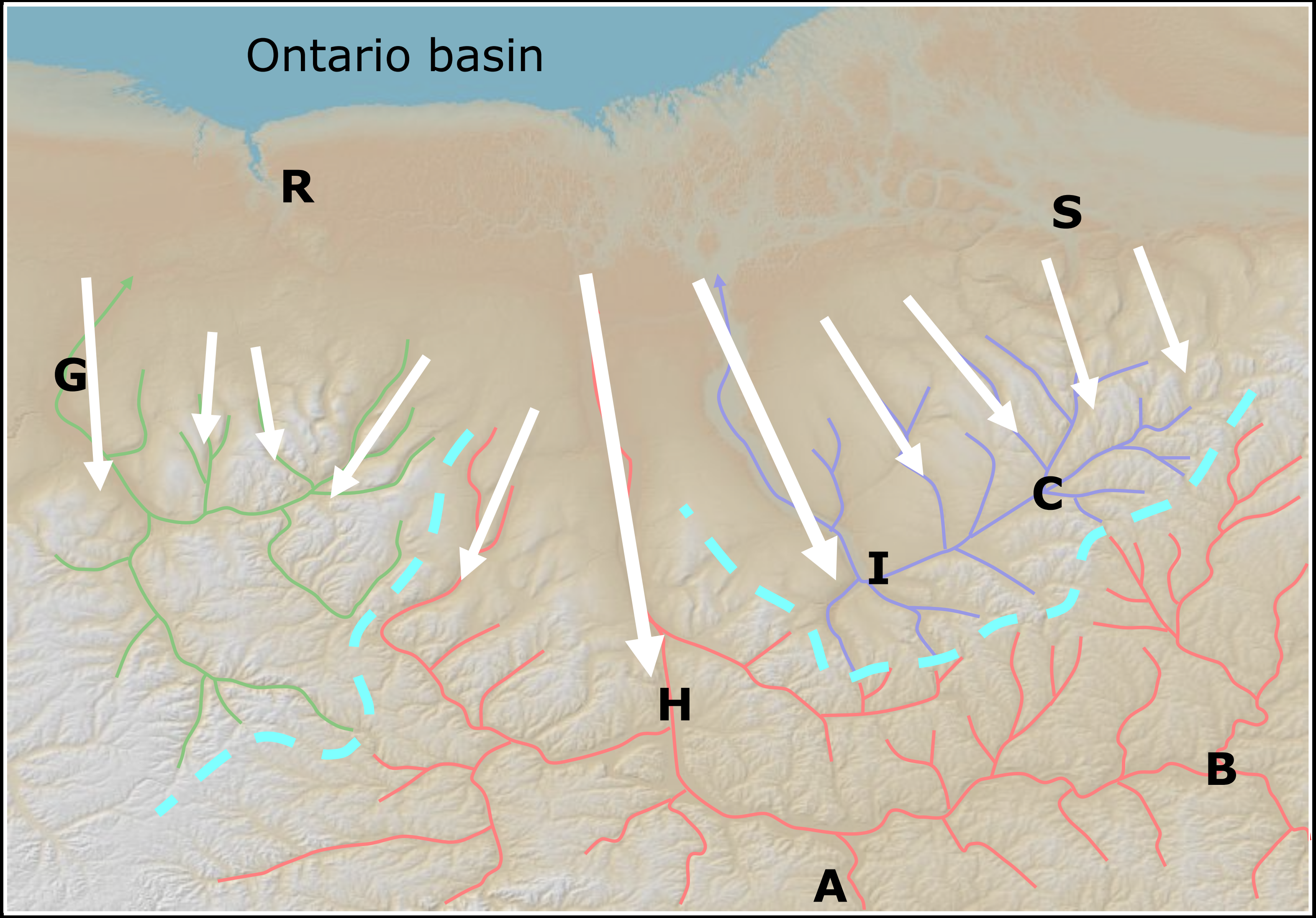
Finger Lakes Formation (pre-glaciation)



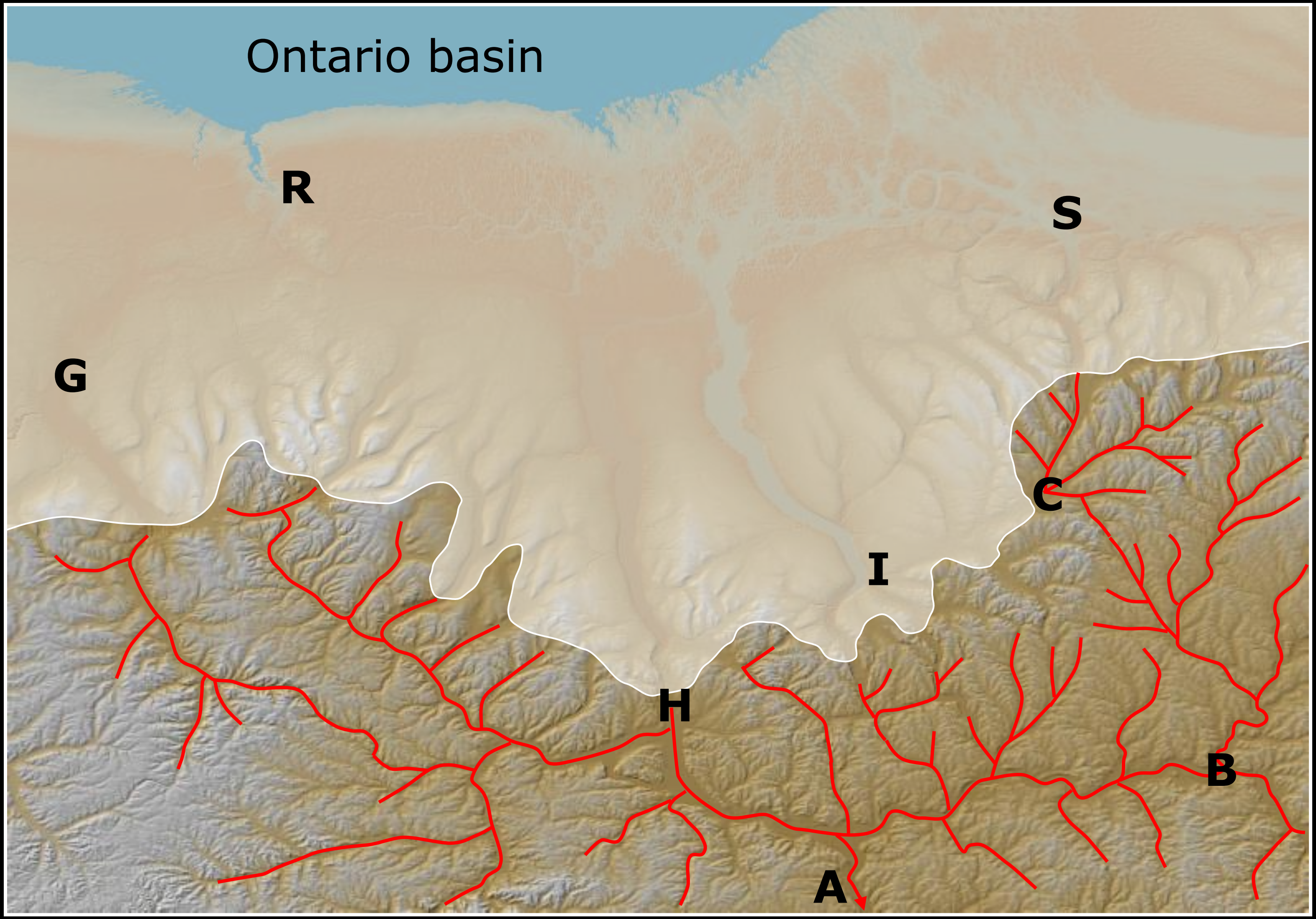
Finger Lakes Formation
(ice sheet advance)



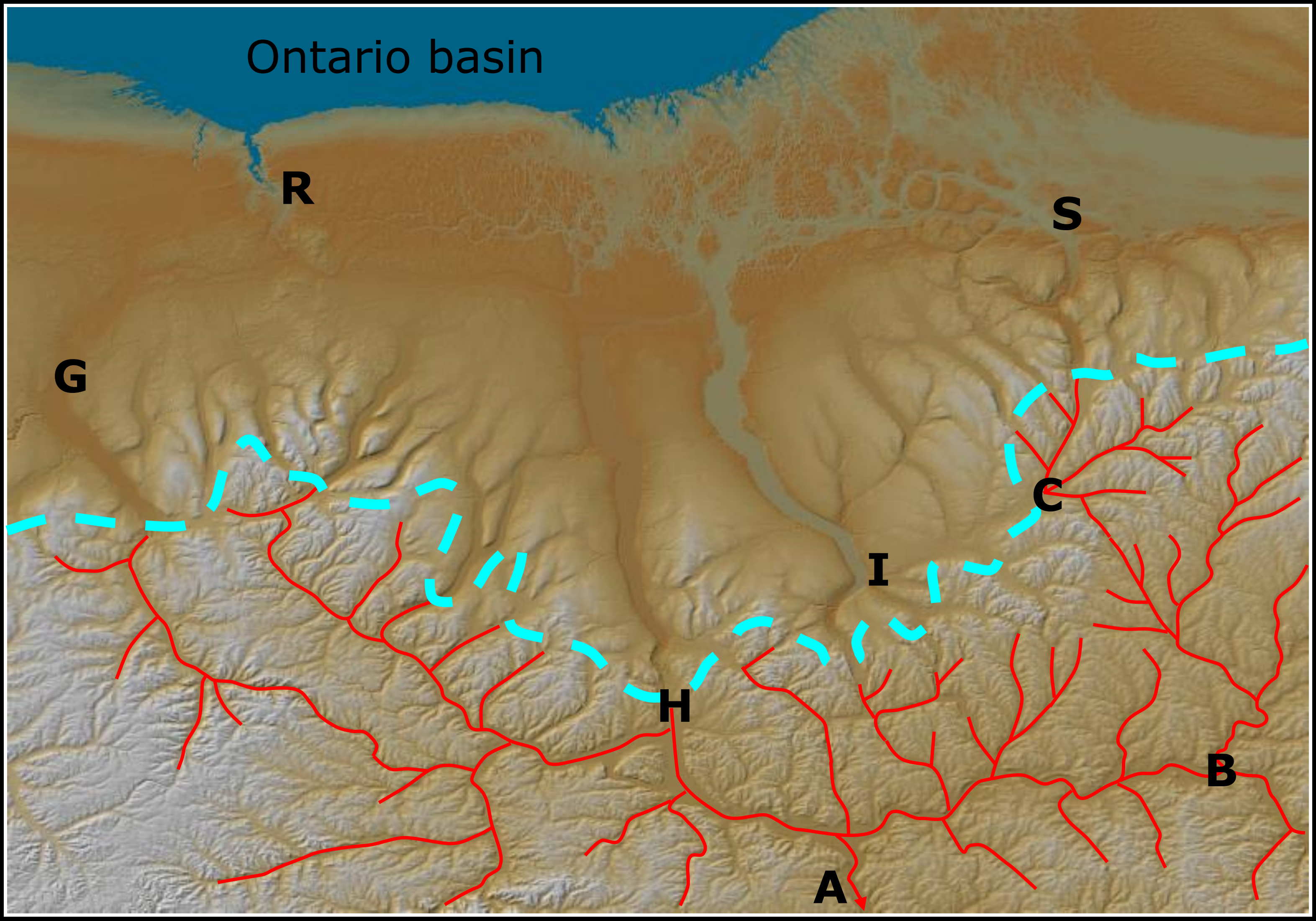
Finger Lakes Formation (ice sheet maximum)



Finger Lakes Formation
(Valley Heads re-advance)



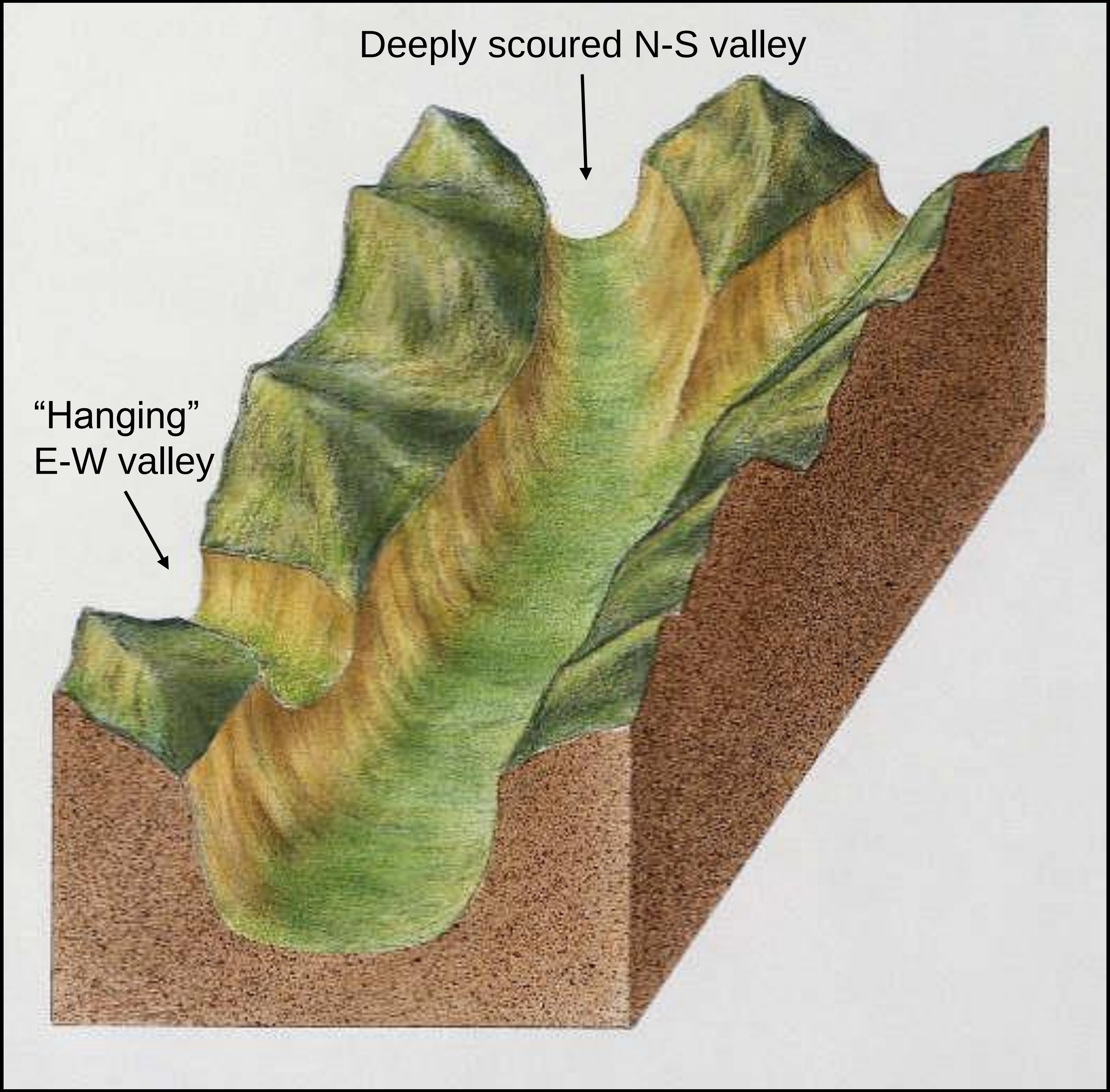
Finger Lakes Formation
(new drainage divide today)



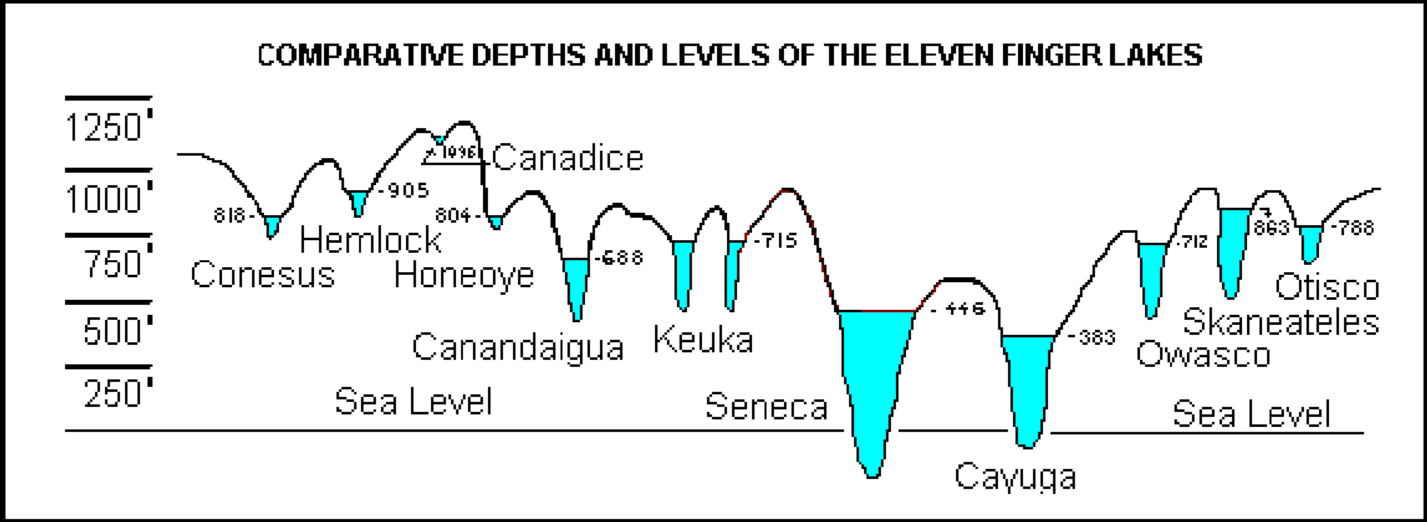
Valley Heads Moraine

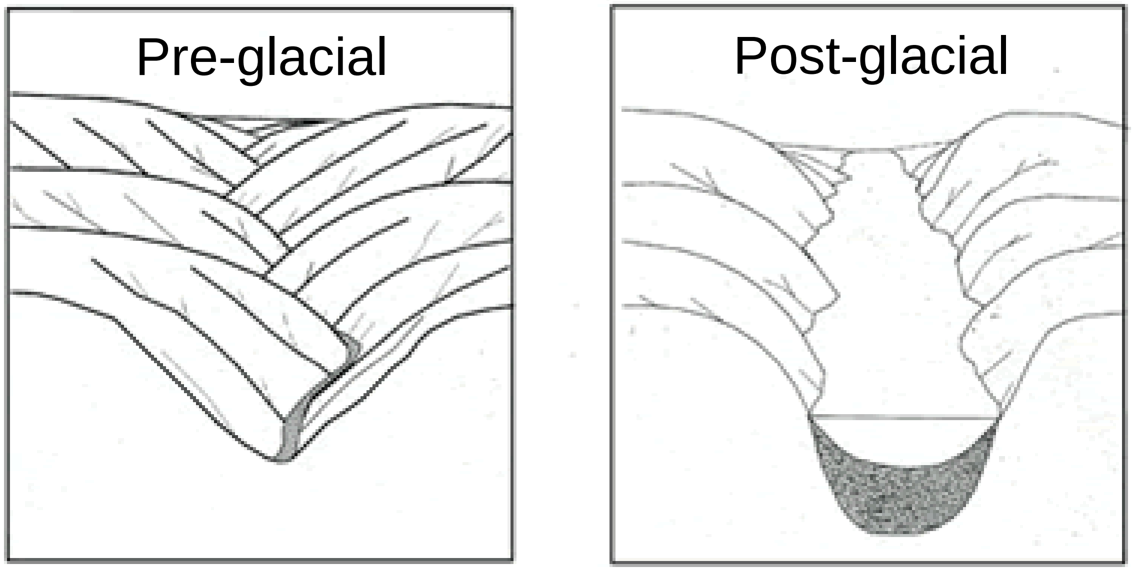
North Cohocton, New York

Figure 108. PHYSIOGRAPHY OF CENTRAL NEW YORK.


Deeply scoured N-S valley
“Hanging”
E-W valley

Post-Glacial Gorge Development (Burning Springs, Bristol Valley)





The streams and rivers of the Finger Lakes region were scoured by advancing glacier, creating characteristic U-shaped glacial valleys. Today the Finger Lakes exist in those valleys.

<u>Water Erosion</u>

V-shaped

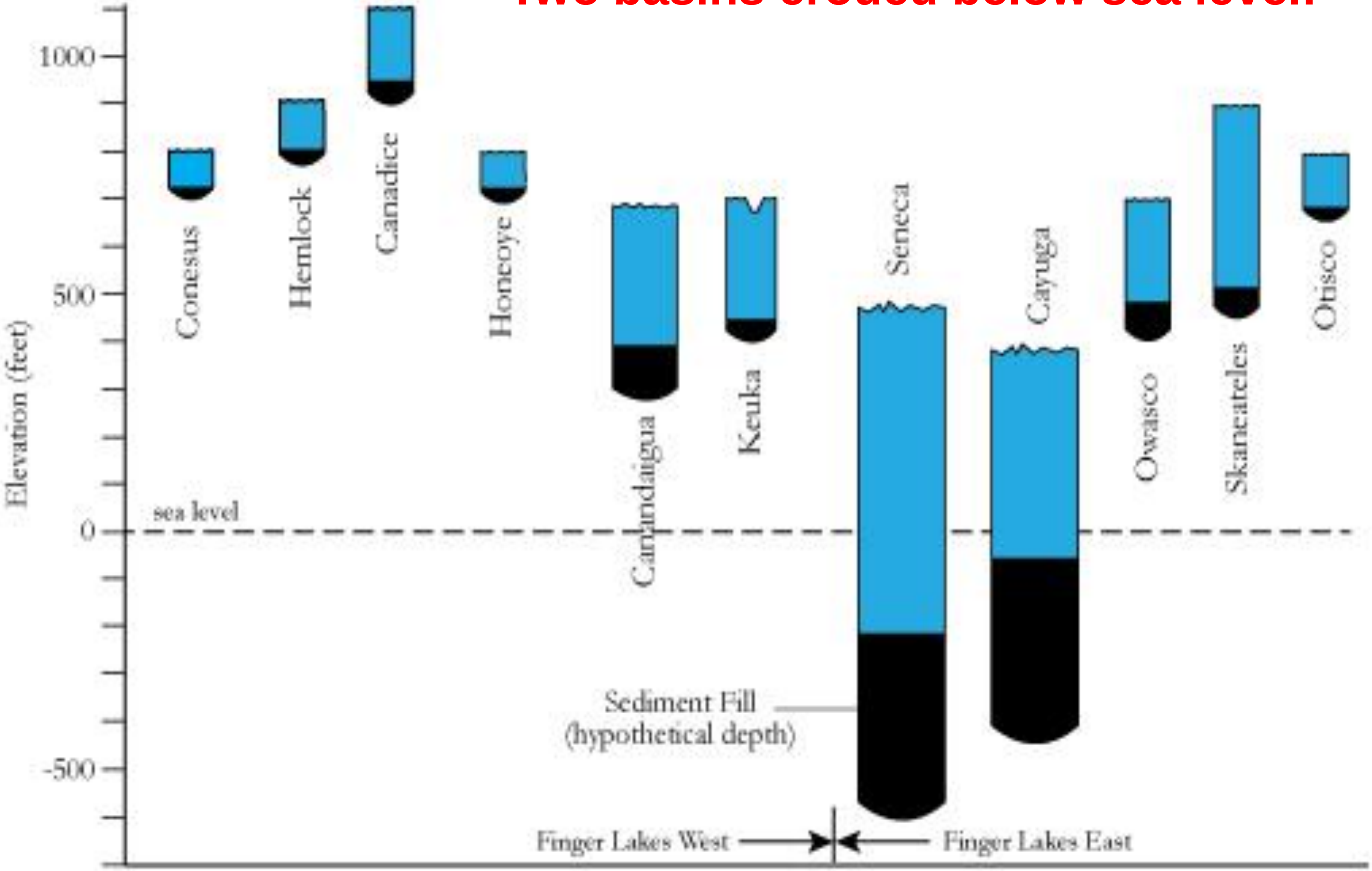
rocky stream bed

<u>Ice Erosion</u>

U-shaped

glacial sediment fill

Two basins eroded below sea level!



Schematic cross-sections of the Finger Lakes, with greatly exaggerated vertical scale.
Each shows actual maximum depth of water.

Keuka Lake – Connections of Central New York

Hemlock and Canadice Lakes

The Finger Lakes Region contains 28 broad U-shaped glacial troughs,

11 of these valleys are <u>doubly</u> dammed and contain water!

At the end of the Pleistocene, the retreating ice margin could dam the <u>north end</u> of a valley, while glacial moraines would dam the <u>south end</u>.

What is the evidence for a large proglacial lake?

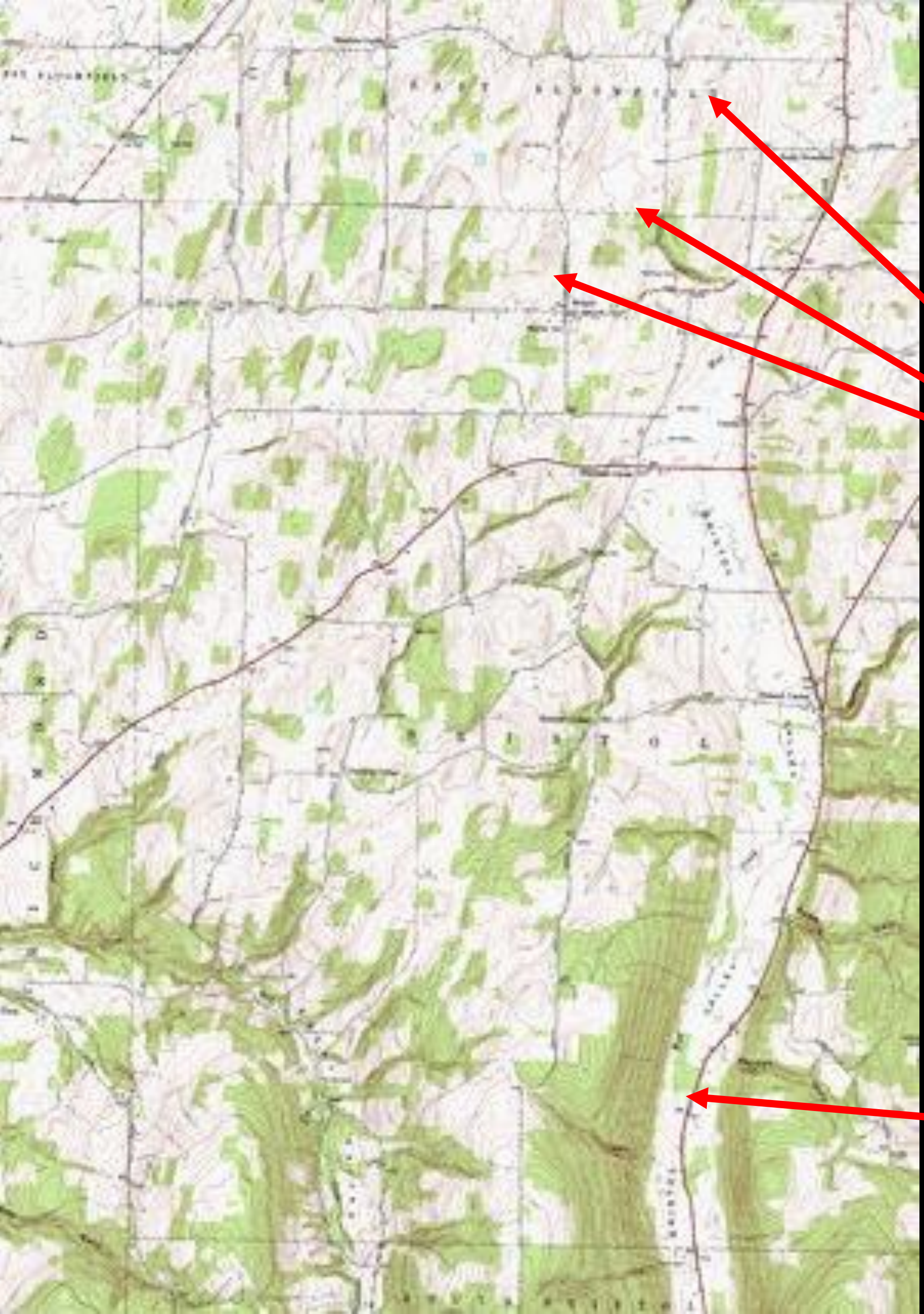
- abandoned shorelines on the valley walls

- lake bottom deposits on the valley floor

varves and dropstones

Varves from the bottom of Glacial Lake Honeoye, southern Honeoye Valley

Bruce Gilman



Northern Bristol Valley

Lateral moraines formed along sides of an ice lobe extending south into the narrowing valley

Glacial erratics sloughed off on upper valley walls and hilltop summits

Valley floor with varves, dropstones and muck

<u>Southern Bristol Valley</u>

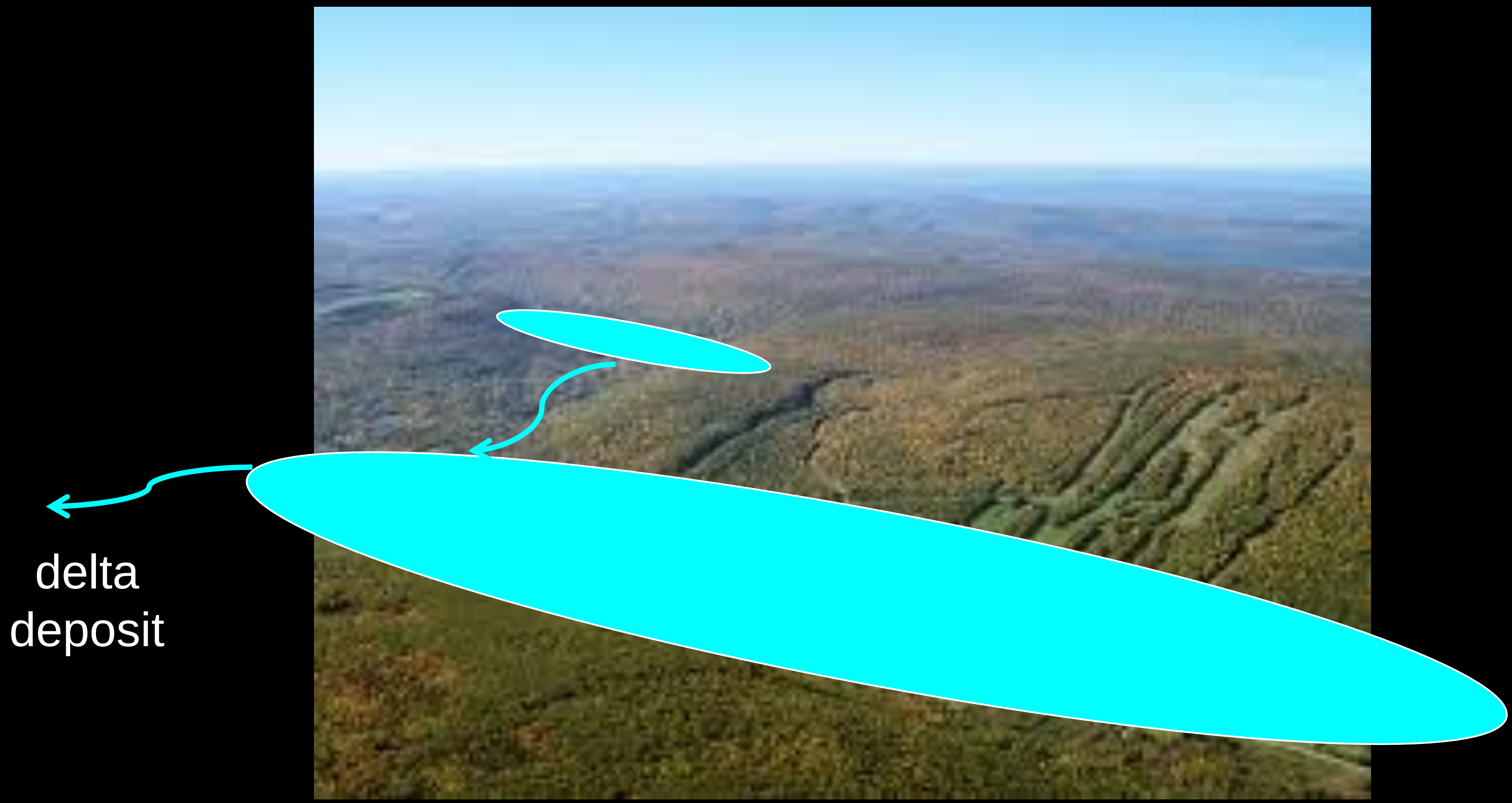
Steep valley walls with large vertical drops in elevation

Strandlines, that is, abandoned shorelines

Valley floor with varves, dropstones and muck

Proglacial lake outlets with alluvial fans and outwash

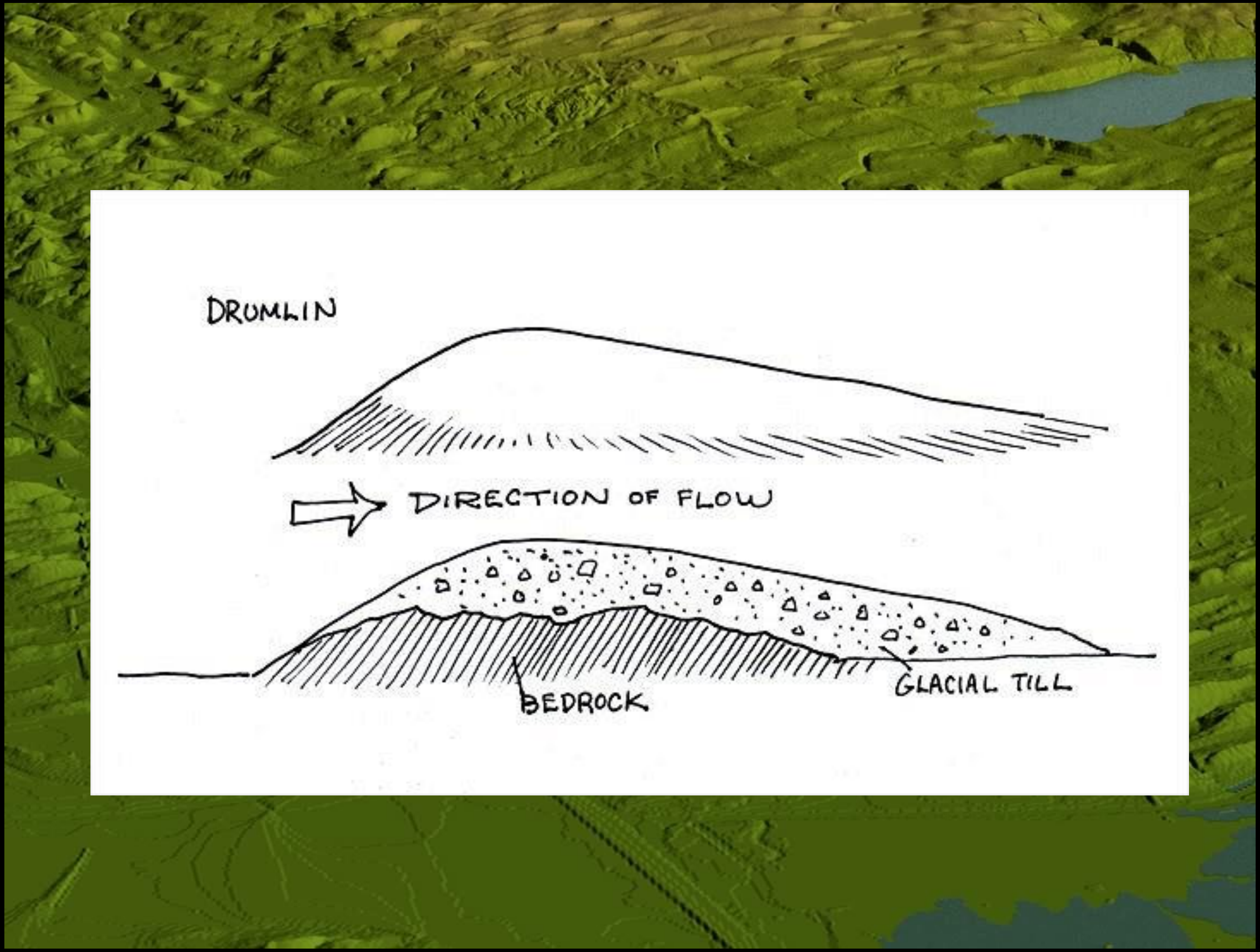
Proglacial Lakes in the Bristol Valley Region

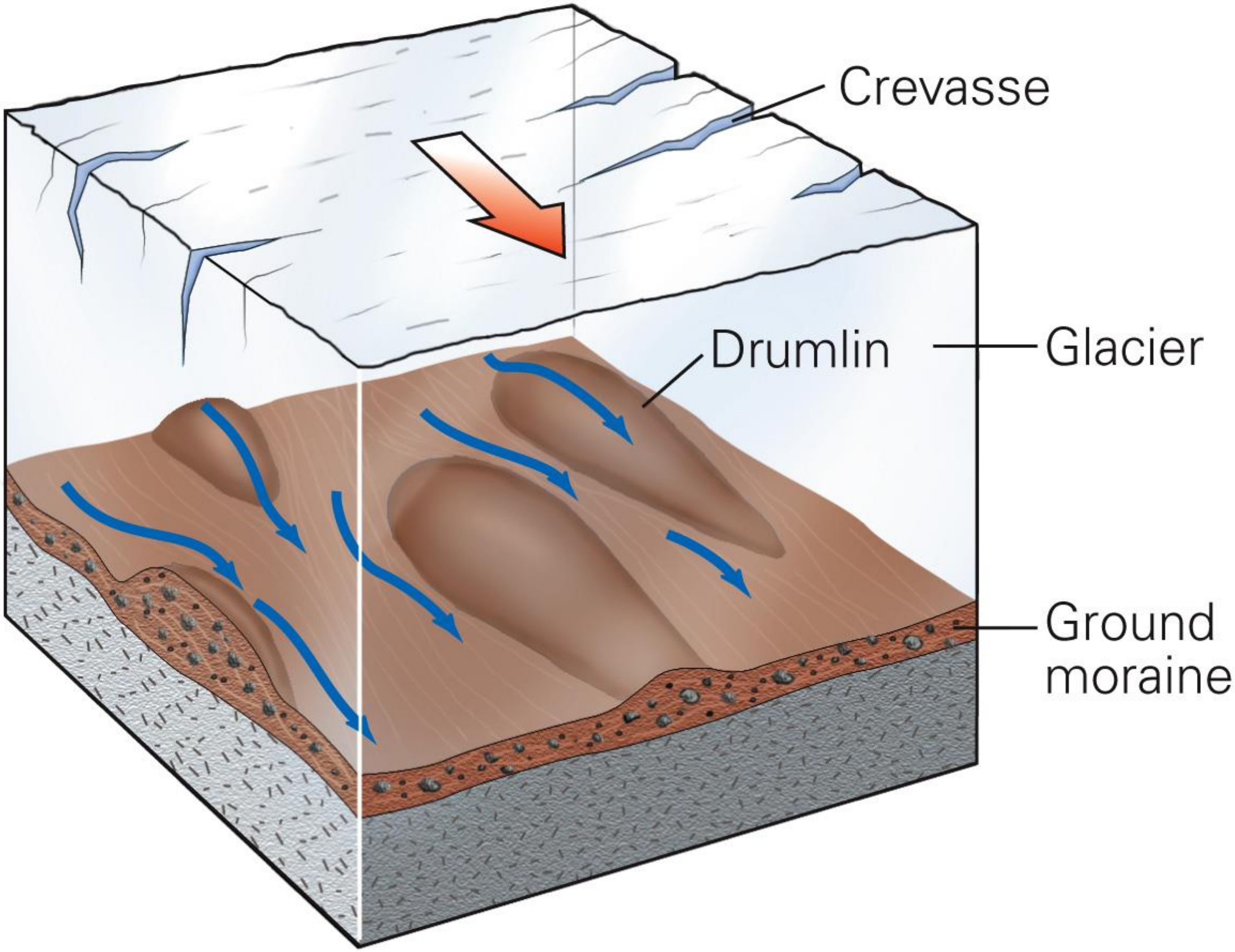


Glacial Lake Egypt & Glacial Lake Bristol

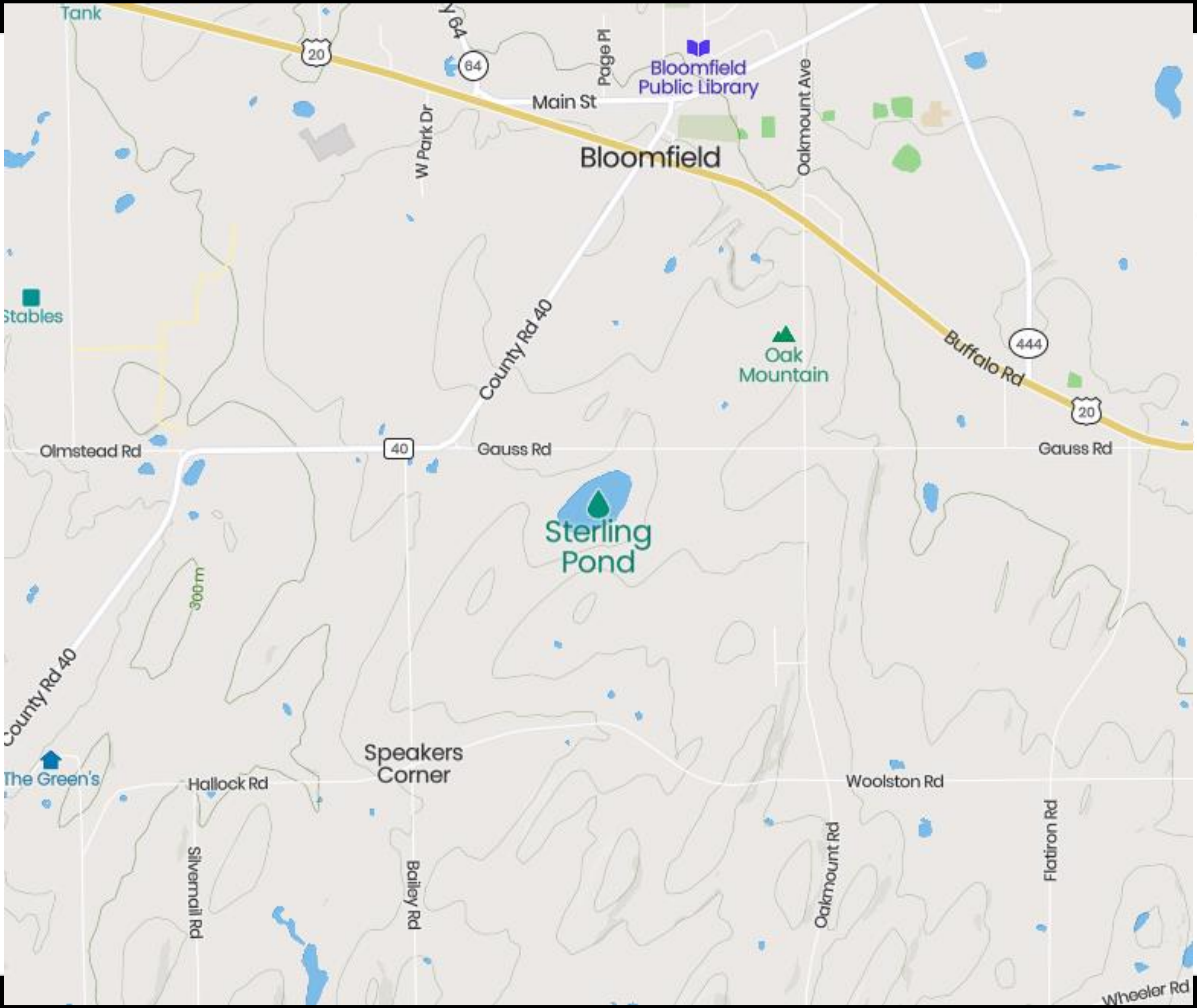
Abandoned Shorelines stranded on hillside east of Naples

Drumlin Formation (erosional or depositional?)




Crevasse
Drumlin
Glacier
Ground
moraine

Chimney Bluffs State Park
(along Lake Ontario)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20
64
Page Pl
Bloomfield
Public Library
Main St
Oakmount Ave
W Park Dr
Bloomfield
Stables
County Rd 40
Oak
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Buffalo Rd
20
Olmstead Rd
40
Gauss Rd
Gauss Rd
Sterling
Pond
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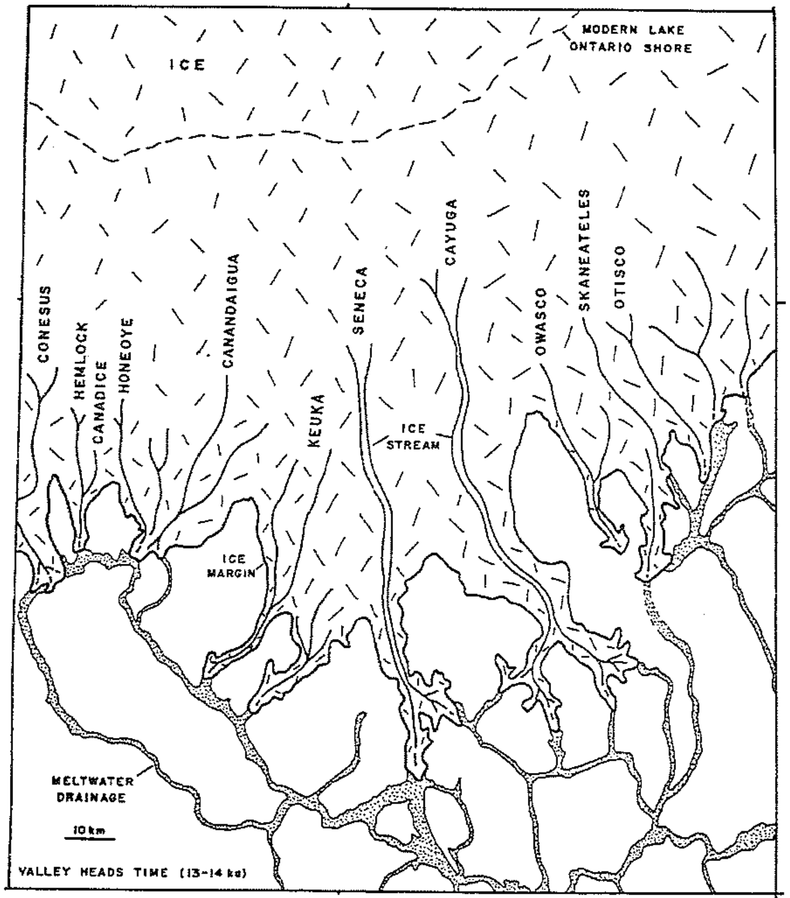
Corner
Woolston Rd
Silvermail Rd
Bailey Rd
Oakmount Rd
Flatiron Rd
Wheeler Rd



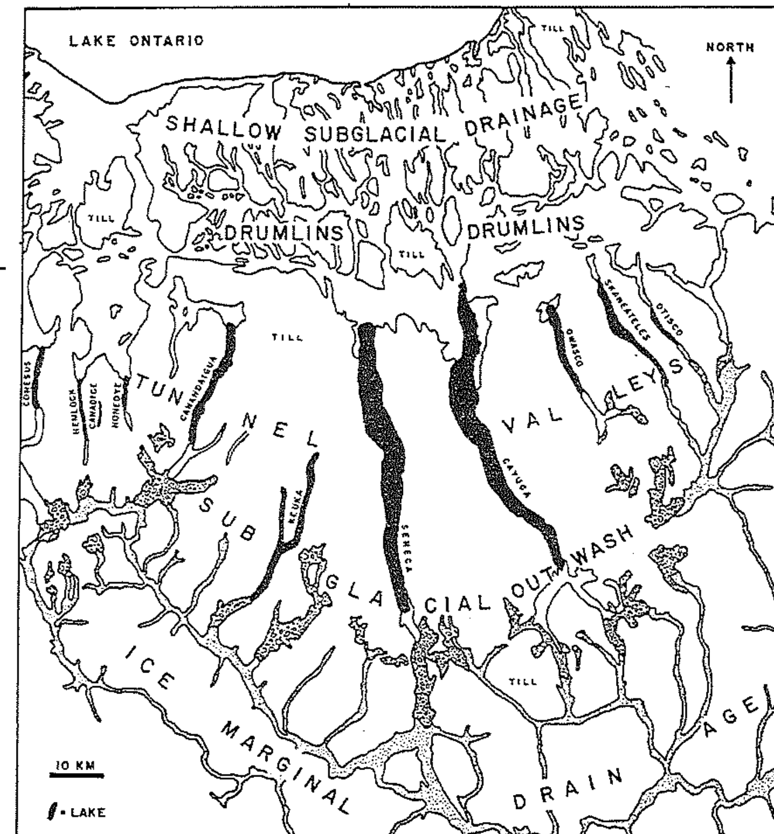


Fig. 40 - (Left) Schematic reconstruction of southern margin of Laurentide Ice Sheet in Finger Lakes region at Valley Heads time (13-14 ka). (Right) Regional interpretation of major glacial features in Finger Lakes region.

Muller et al. 1991

Now,
Imagine the
return of life
to the Finger
Lakes region
at the end of
the
Pleistocene
Ice Age…

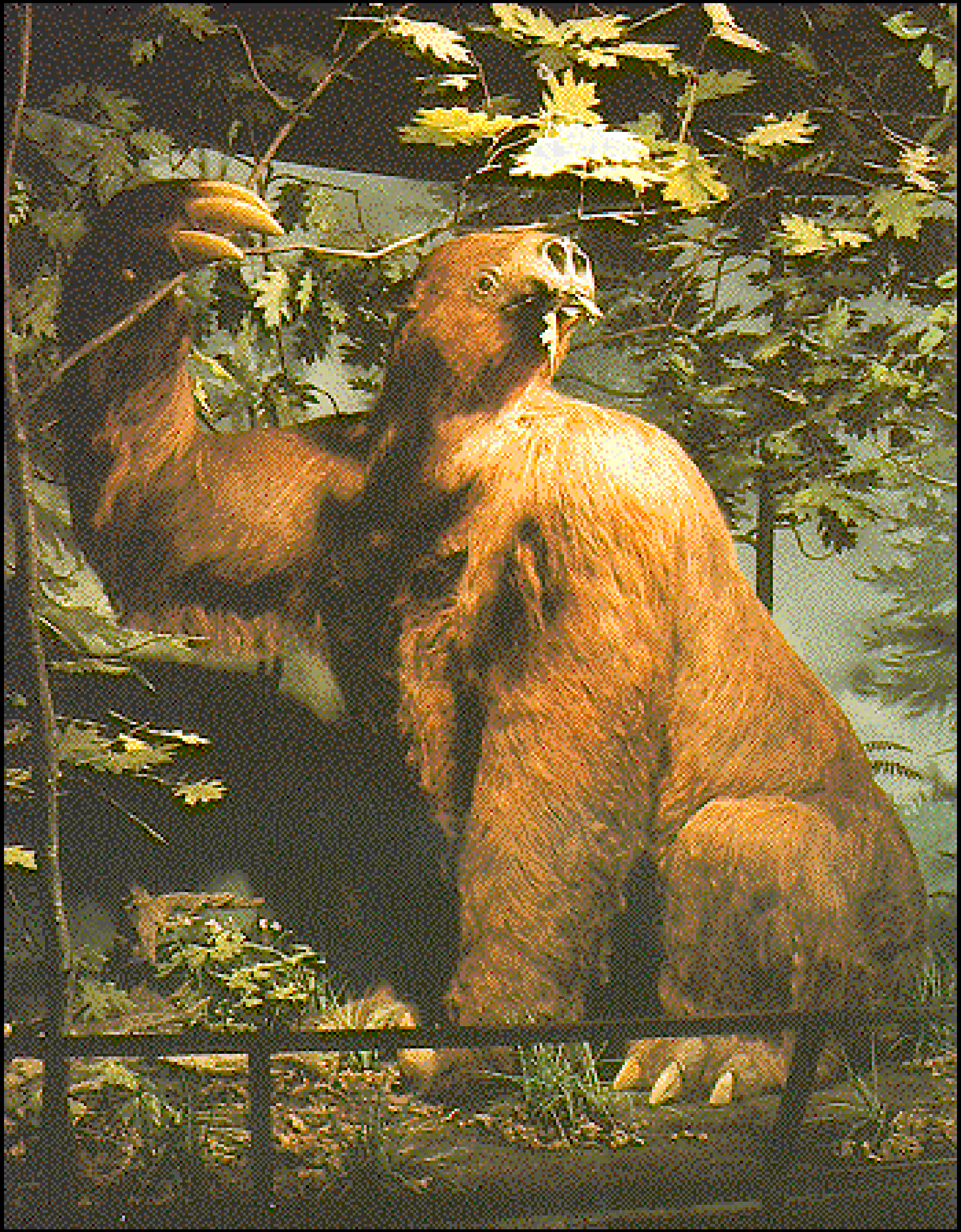
A greatly altered landscape was revealed as the ice disappeared

- Scratched, grooved and polished rocks
- Broad, U-shaped valleys
- Hanging valleys and newly forming gorges
- Landforms composed of glacial till
- Scattered large erratic boulders
- Lakes, lakes, and more lakes
- Re-establishing vegetation and habitats

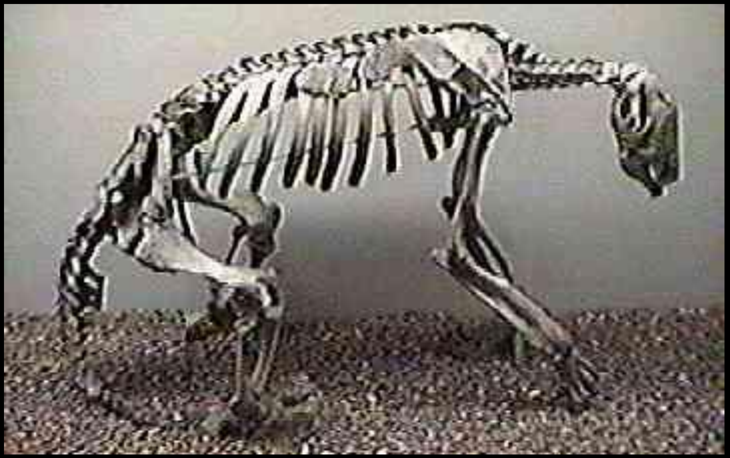
Alaska – Ice Park Campground

Bristol Valley may have resembled arctic tundra…

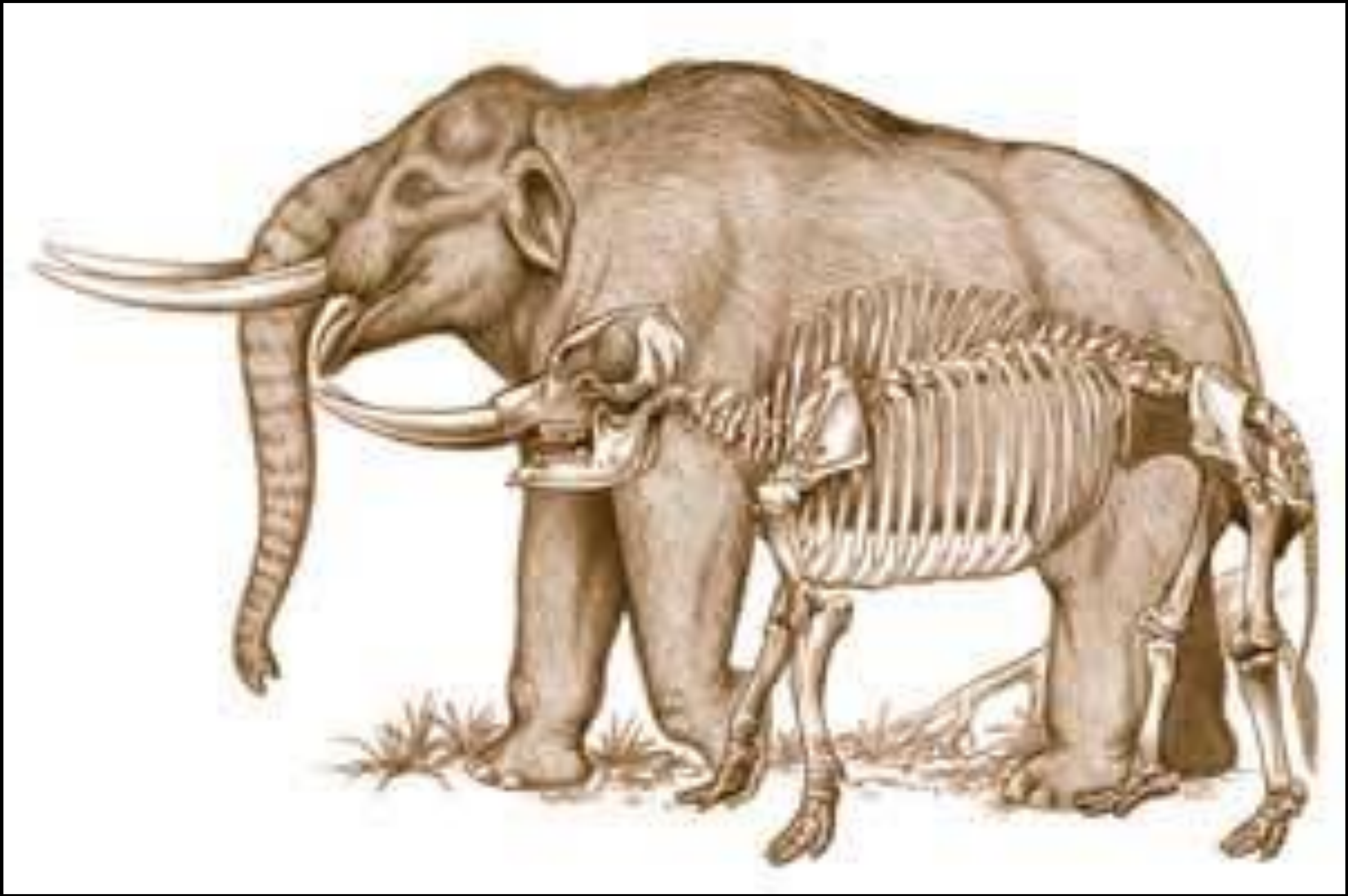
Giant Beaver



Ground Sloth



Wooly Mammoth



American Mastodon

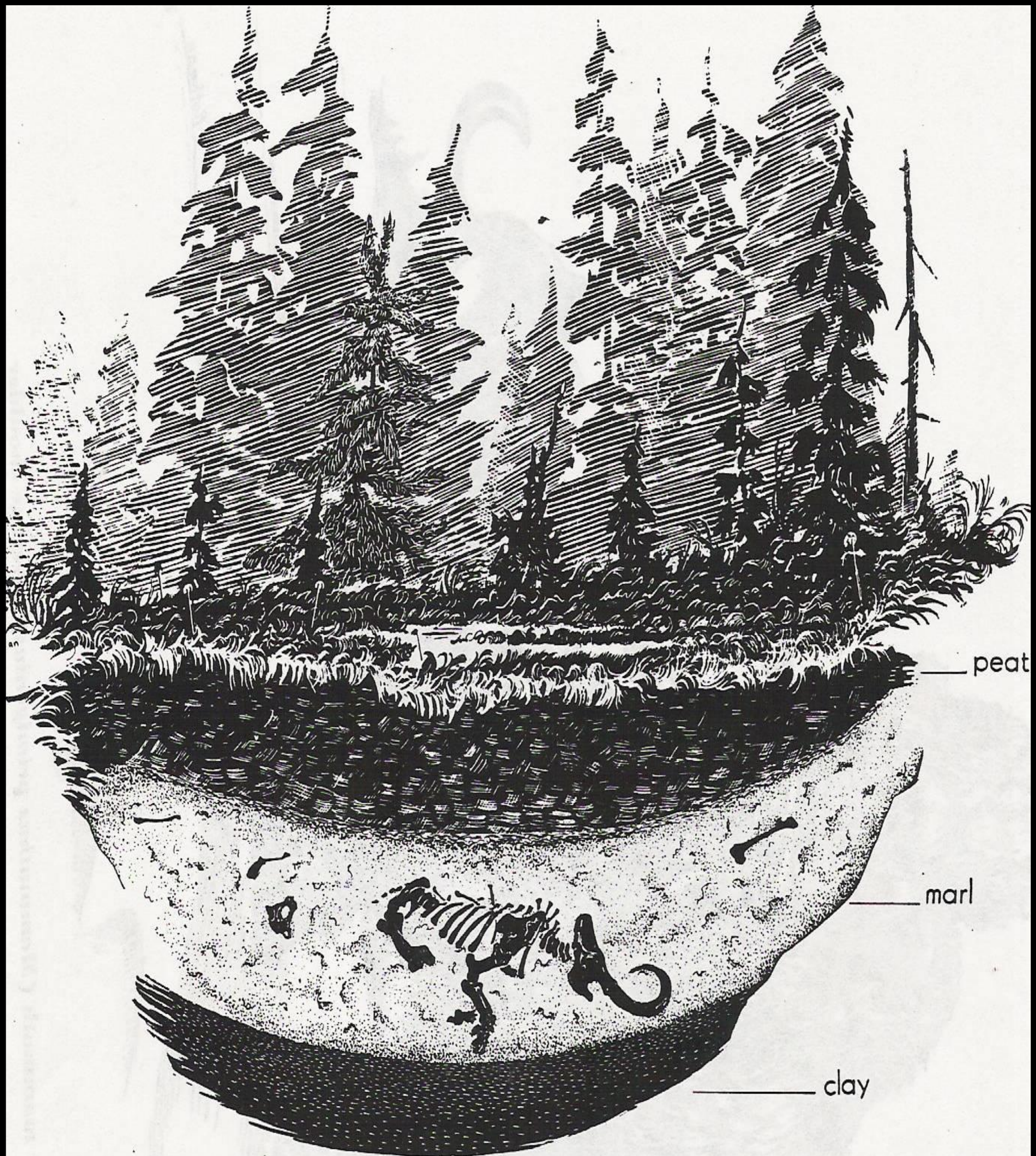
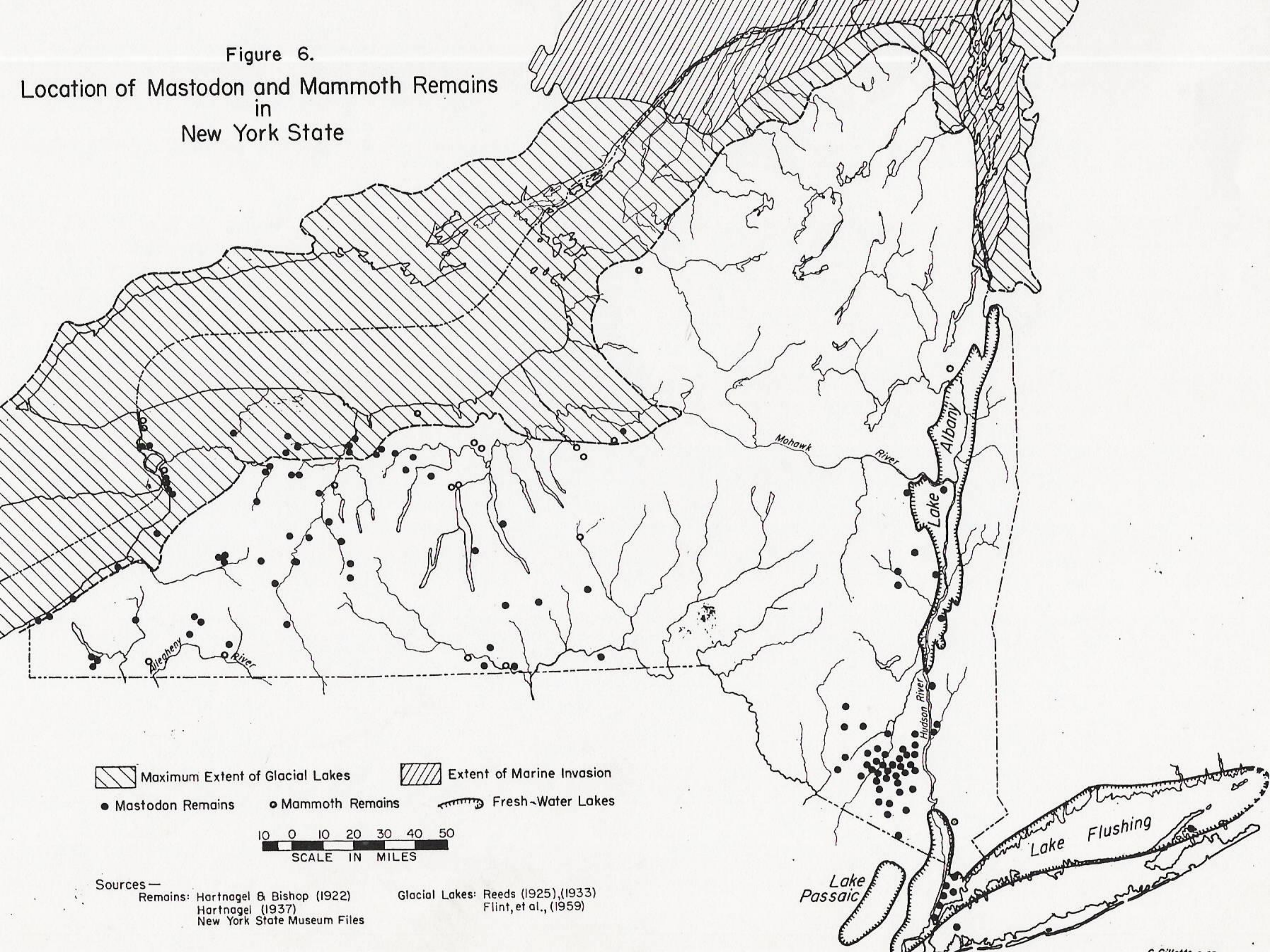
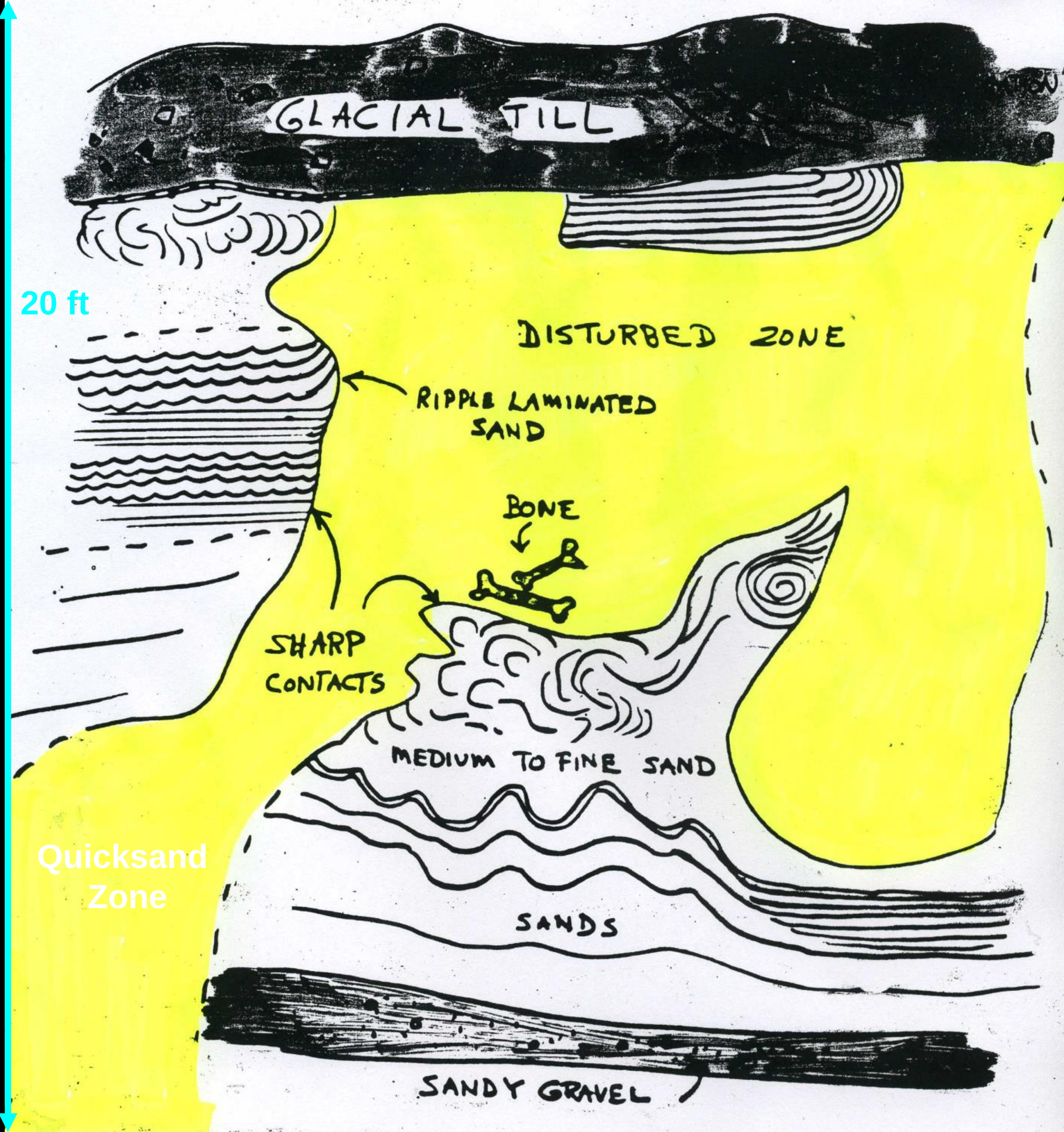

peat
marl
clay

Figure 6.
Location of Mastodon and Mammoth Remains in New York State



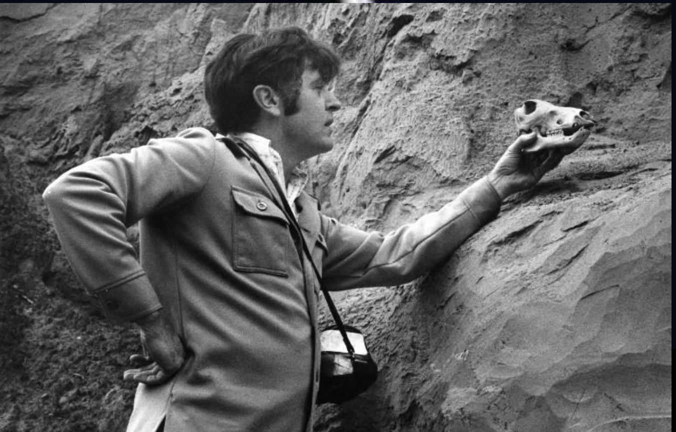
Original Field Sketch of Peccary Site at Moraine in Genesee Valley

R. A. Young
1978

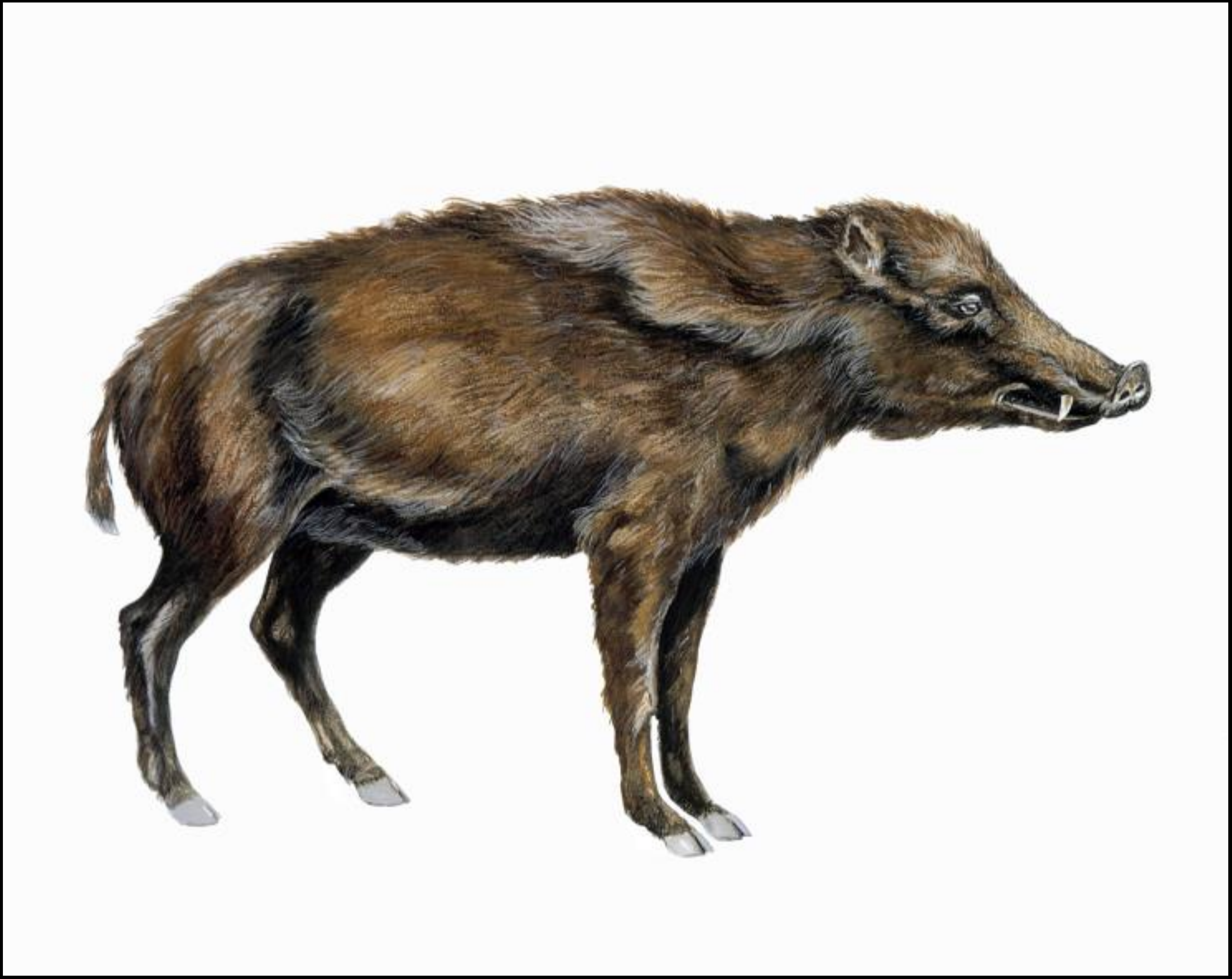


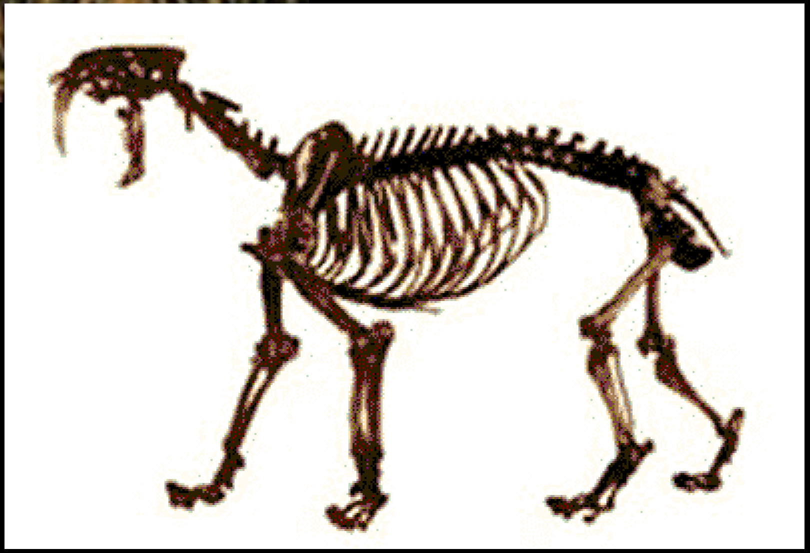
Peccary
Platygonus compressus

Univ. of Chicago



Ice Age Peccary





Saber-Tooth Cat

Giant Short-faced Bear

Then 12,000 years ago, the Great Ice Age was over...

Virtual Tour of Local Features

Special Thanks to Student Photographers

Egypt Valley Glacial Trough

South Bristol, New York

Glacial Lake Naples
(bottom sediment: varves and dropstones)

Cohocton, New York

Mastodon Bones Found at Pond Excavation in Bloomfield, New York

By THE ASSOCIATED PRESS
(reported in NY TIMES, August 1994)

Vaughn and Rebecca Buchholz ran into a snag with the pond they were digging in their yard this week. There was a mastodon at the bottom. "In the back of my mind, I said: ‘This is it. I finally dug up a dinosaur’," said Gary Phillips, who was operating an excavation bucket that struck the mastodon's bones on the Buchholz's property here, 25 miles southeast of Rochester. What he found was a yard-long rib of a mastodon that experts believe had been there for 11,000 years.

George McIntosh, curator of geology for the Rochester Museum and Science Center, said the 94 bones recovered from the animal were in excellent shape. Included in the discovery were about 20 rib bones, vertebrae, hip bones and the skull, which required four men to lift.
Mr. McIntosh said about 80 nearly complete mastodon skeletons have been unearthed in New York. The animals grazed in the region after the last Ice Age.

The Buchholzes donated the skeleton to the museum, which took the bones back to Rochester on Thursday for carbon-dating to determine their exact age. Museum researchers said they would continue poking through the excavation site for a few weeks to look for more bones.

High Tor WMA - Bill Hecht