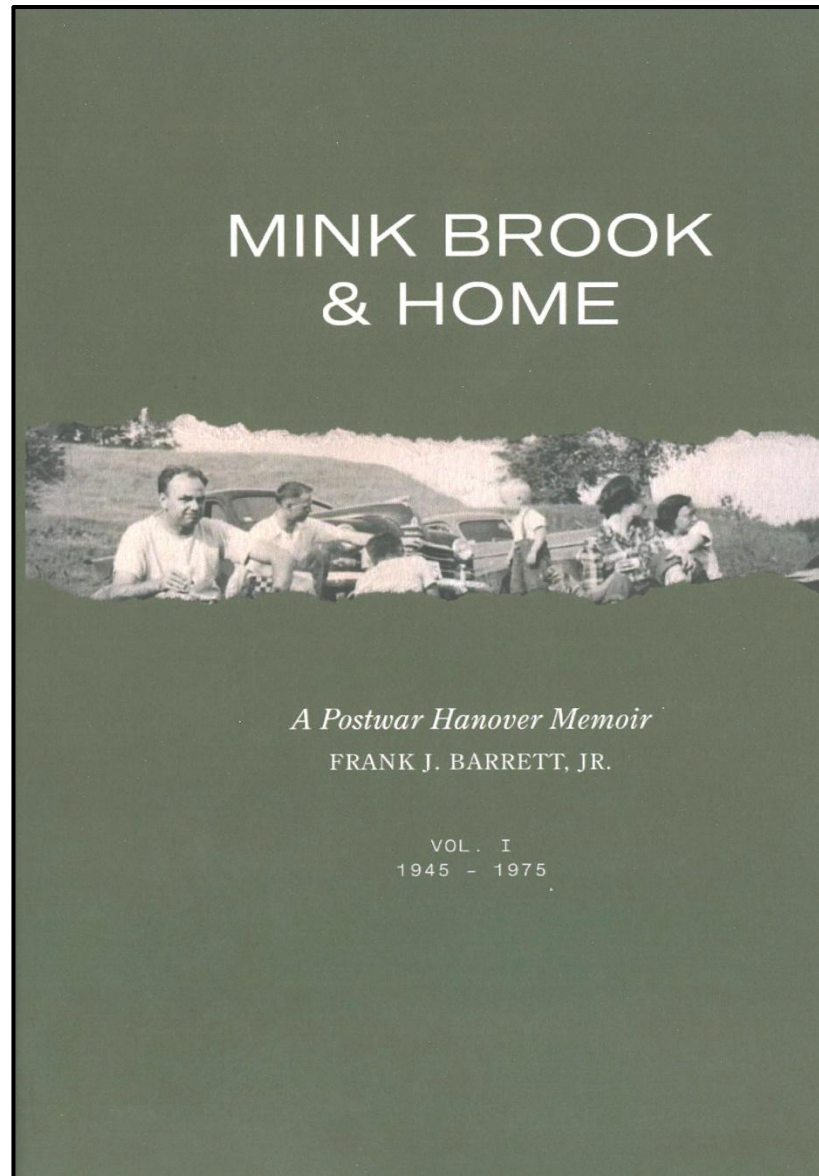


***-Mink Brook-
An Historic and Geologic
Overview***

***Etna Library
September 2, 2026***

***By
Frank J. Barrett, Jr., A.I.A.
Architect***



The book that inspired this Presentation.

-Part I-

***Some Human History
of the Land***

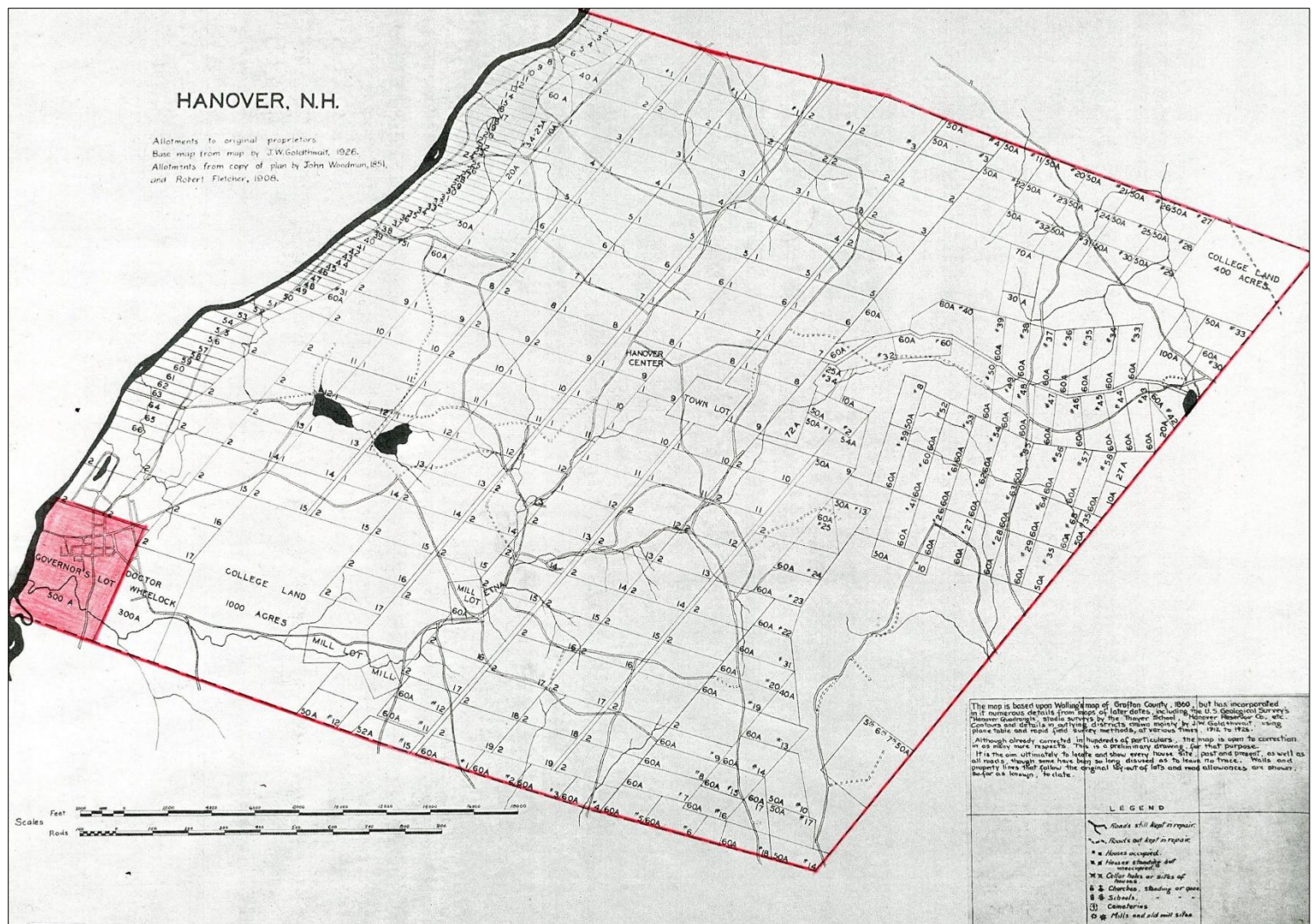


-Hanover Circa 1948-

**Hanover Hardware Store; Tanzi Brothers; Eastman's Drug Store; and the
Dartmouth Savings and National Bank.**



**New Hampshire
Governor Benning
Wentworth
1699 – 1770
In office 1741 - 1766**



The Town of Hanover Chartered July 4, 1761 Showing the Governor's Lot



Governor John Wentworth

1737 – 1820

In Office 1767 - 1775

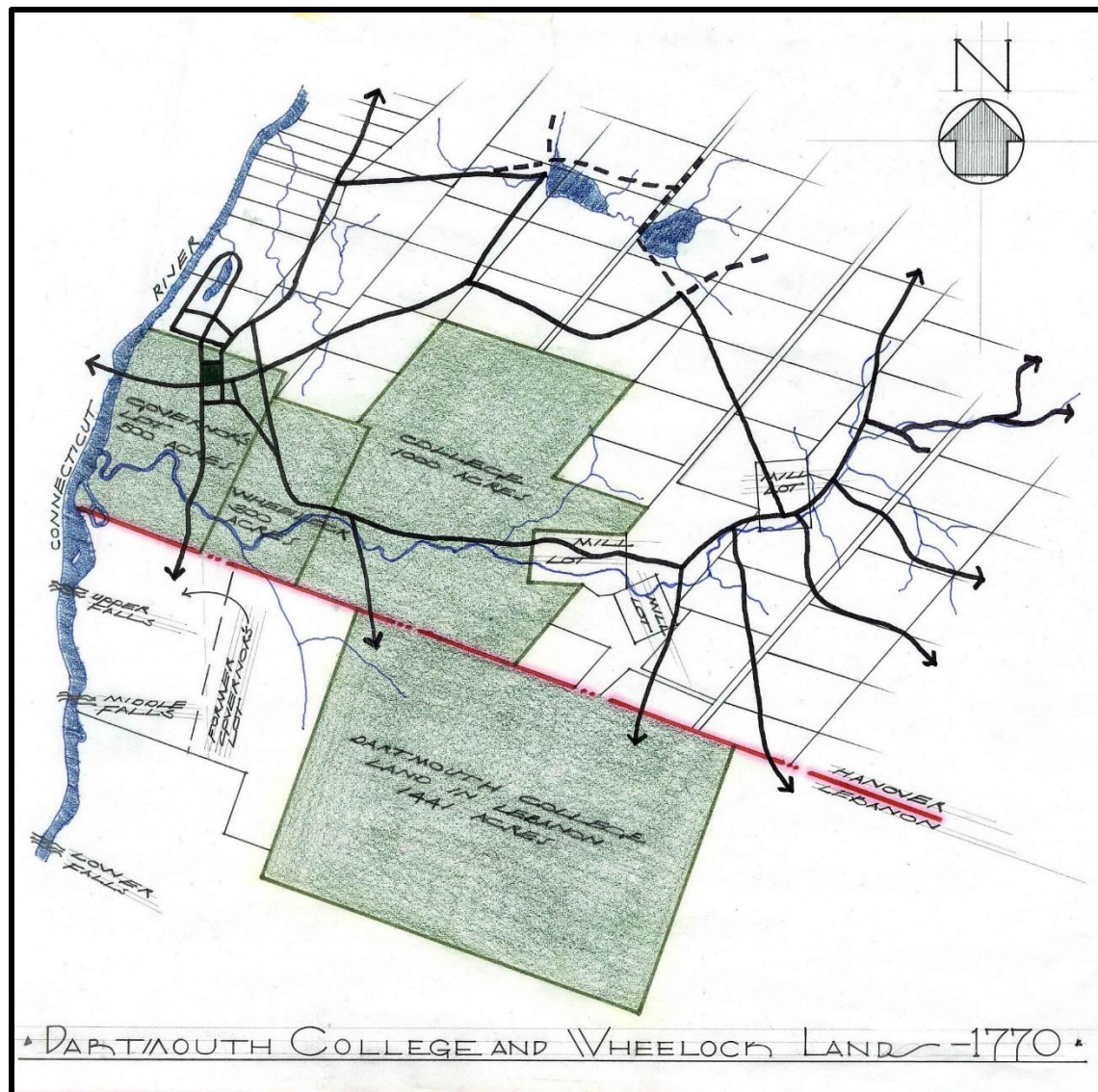


Rev. Eleazar Wheelock

1711 – 1779

President of Dartmouth College

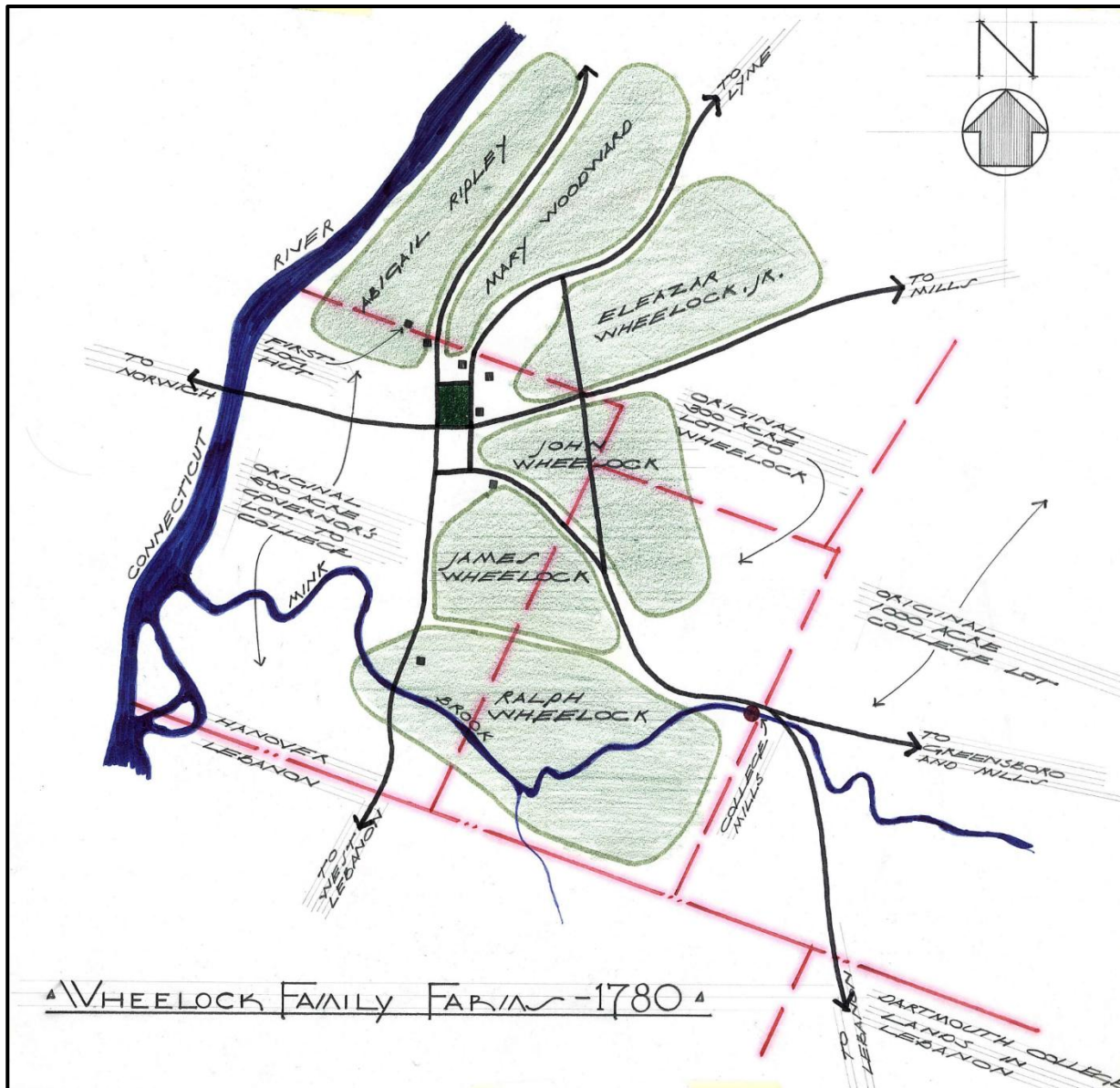
1769 - 1779



Map of land gifted to Rev. Eleazar Wheelock and Dartmouth College in 1770



**The remains of Wheelock's mills on Mink Brook
Lebanon Street is shown above**



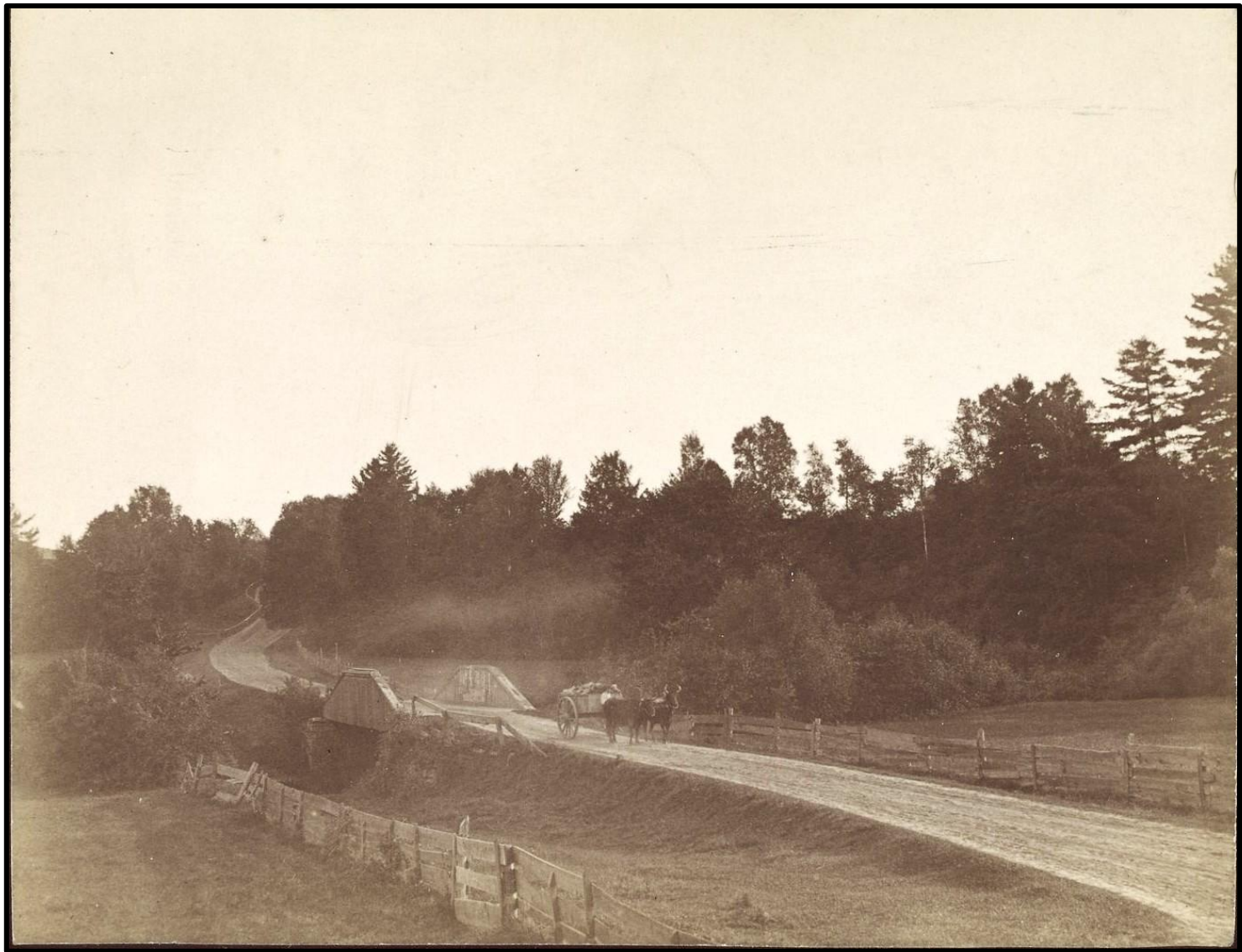
Wheelock Family Farms - 1780



**The Benton Farmhouse at 104 South Main Street
Constructed in 1840 by Reuben Benton**



The Benton Farm looking north, 1867



**Looking south along the West Lebanon Road showing the
Mink Brook bridge and Rueben Bentons meadows**



**The Mink Brook Bridge on the West Lebanon Road
Looking South**



Looking south down West Lebanon Road from South Main Street circa 1920.



The new highway bridge built in 1914 over Mink Brook on the West Lebanon Road.



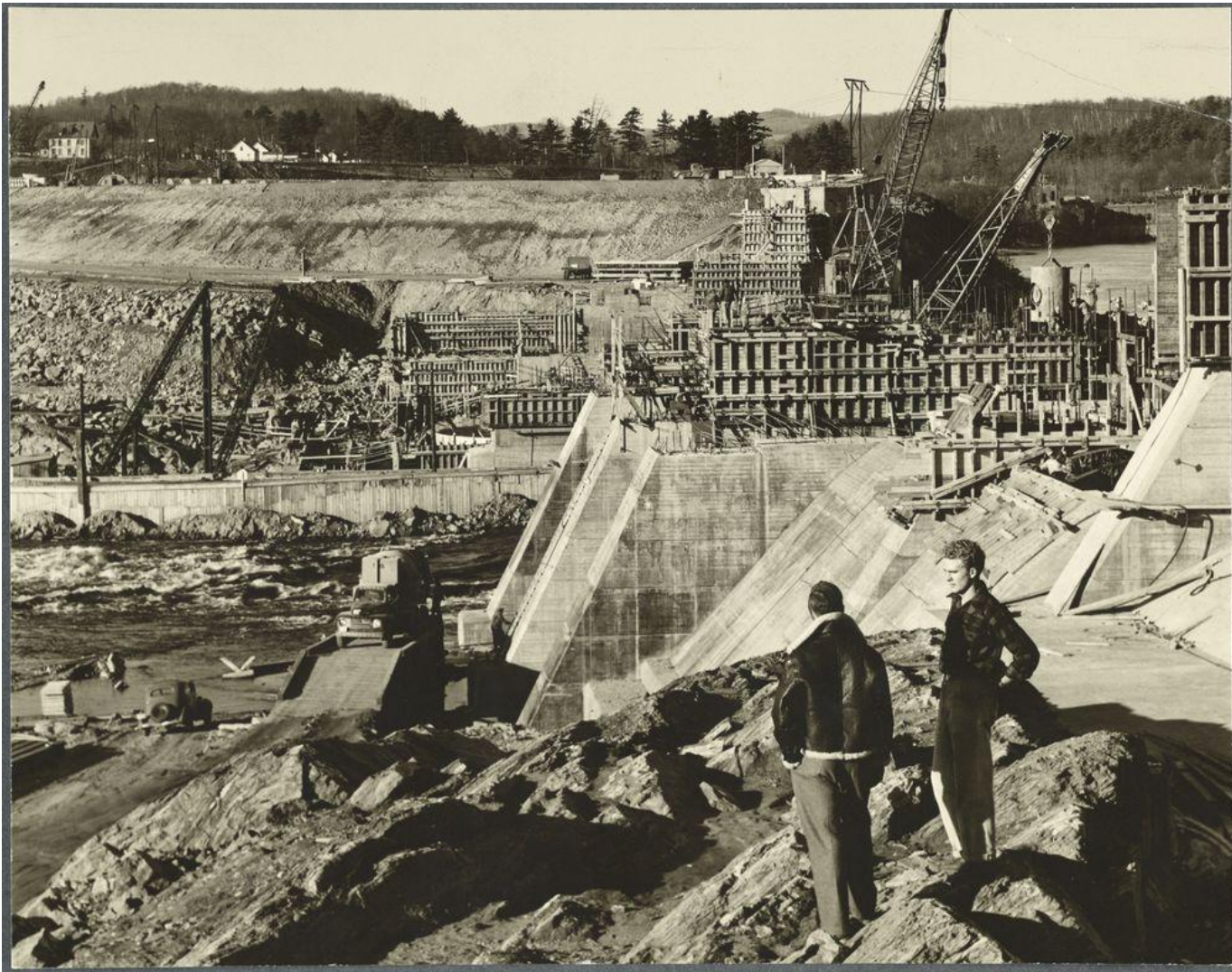
**Airial view of West Lebanon Road, Mink Brook,
and the Stone Farm, 1938.**



The relocated West Lebanon Road looking north - Summer 1940.



The work to realign the West Lebanon Road included construction of a new Mink Brook bridge and relocating Mink Brook - Summer 1940. The Stone Farm is in the background – looking northeasterly.



**Wilder Dam during construction 1948 to 1950
looking towards Vermont.**



Wilder Dam was completed November 1950 and raised the water level of the Connecticut River a total of 21-feet.



The mouth of Mink Brook at the Connecticut River looking northeasterly. For the first time there was a backwater on Mink Brook.



**William H. and George K. Barrett, with Susie, our collie dog,
boating on Mink Brook, 1959.**

-The Stone Farm-

1. The Wheelock Family

1770 to about 1826

Eleazar Wheelock

Ralph Wheelock

2. The Benton Family

About 1826 to 1898

Ruben Benton

Charles Benton

Charles F. Benton

3. Dartmouth College

1897 to 1903

4. The Stone Family

1903 to 1949

Charles W. Stone

Charles R. "Jim" Stone



-The Stone Farm-

Showing the Stone's Farmhouse at 106 South Main Street.

Photograph by Frank J. Barrett, July 1948.



-The Stone Farm-

The four story, 45' X 130', Barn built in 1852 by Reuben Benton.

Photograph taken by Frank J. Barrett, July 1948.



-The Stone Farm-

Looking westerly showing Mink Brook and the West Lebanon Road.

Photograph taken by Frank J. Barrett, July 1948.



-The Stone Farm-

**The area of the present-day Mitchell Lane Neighborhood
looking north-easterly.**

Photograph taken by Frank J. Barrett, July 1948.



-The Stone Farm-

**The area that is the present-day Brook Road neighbor
Looking easterly.**

Photograph taken by Frank J. Barrett, July 1948.



-The Stone Farm-

Looking westerly from present-day 10 Barrett Road toward the complex of farm buildings. Note the “Big Hill” to the left.

Photograph taken by Frank J. Barrett, July 1948.



-The Stone Farm-

**Looking westerly towards the West Lebanon Road from present-day
12 Brook Road.**

Photograph taken by Frank J. Barrett. July 1948.



-The Stone Farm-

**Looking southerly across the area of present-day Thompson Terrace
with George K. Barrett.**

Photograph taken by Frank J. Barrett, July 1948.



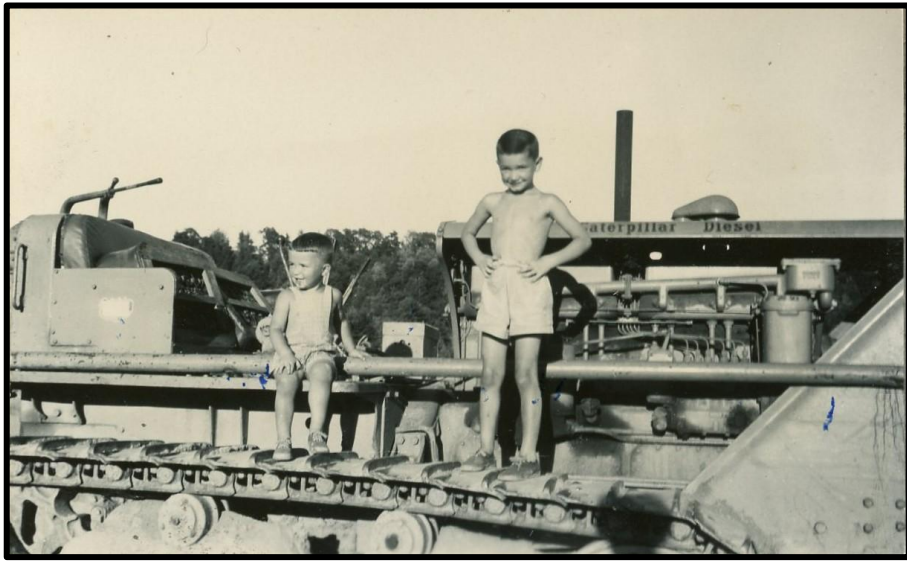
**The “Clay Bank” at the Stone Farm
Circa 1920
(Dartmouth College Special Collections)**



**Frank J. Barrett, Dorothy H. Barrett, George K. Barrett,
and William H. Barrett at the farm. April 1949.**



A picnic at the Stone Farm – Summer 1948
Barrett and Ransmeier Children playing in the tractor ford across
Mink Brook



**Bull- dozing over the “Big Hill” at the Stone Farm
William H. and George K. Barrett
Summer 1949**



**The project to construct 1 Mitchell Lane
April to November 1951**



**The Stone Farm looking westerly from 10 Brook Road
1948 and 1958**



The passive solar house at 1 Mitchell Lane and the 8-acre bird preserve donated by Barrett, Granger, & Ransmeier in 1962, looking from Mink Brook circa 1959.



**The passive solar house at 1 Mitchell Lane.
In 1951 the lagoon at Mink Brook was created.**



**The Fullington's guernsey yearling heifers at present day
6 Brook Road, circa 1959.**



The Red-Winged Blackbirds – the lagoon was their territory.



The Bank Swallows – the clay bank was their territory.



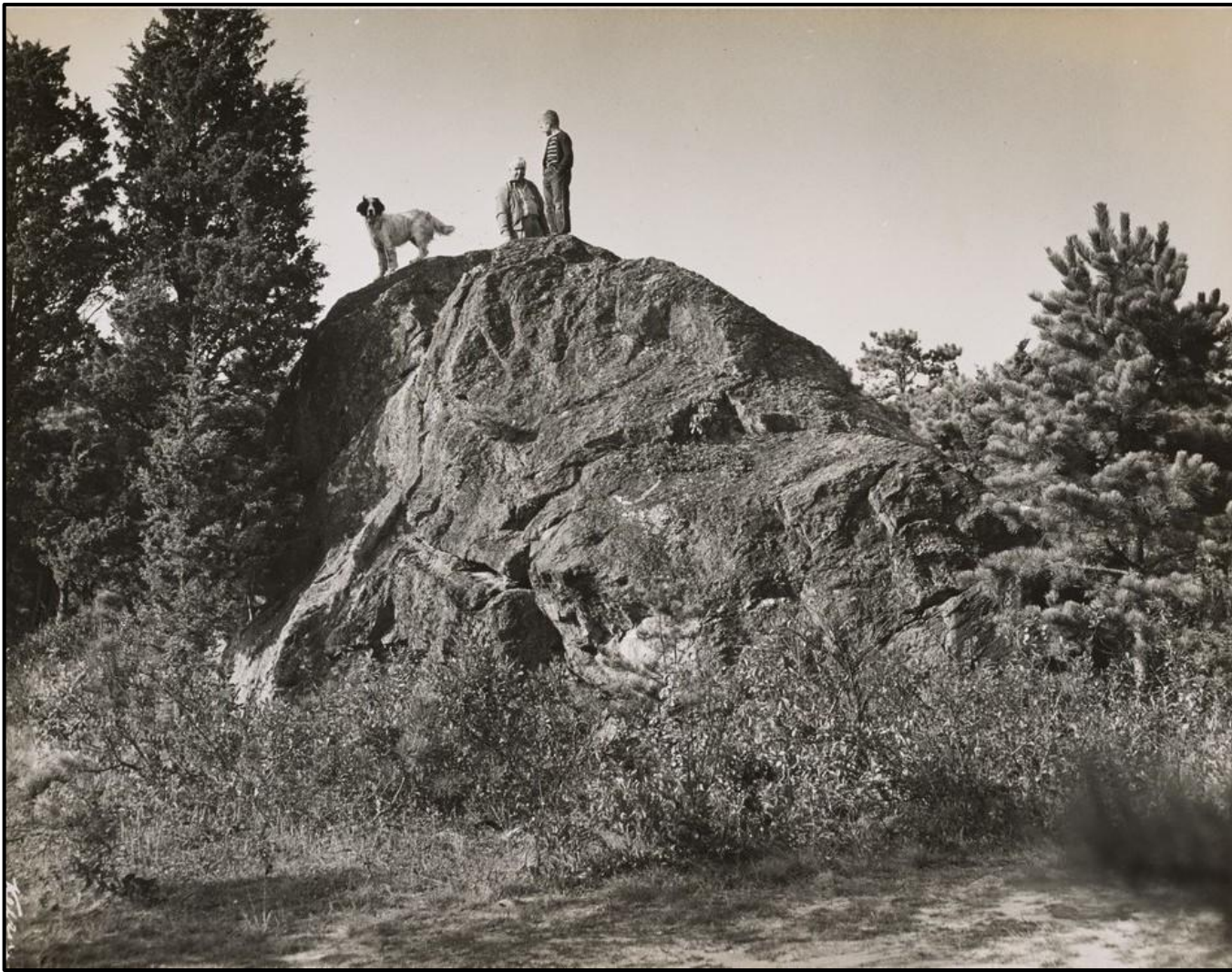
Wheelock Family early mill site on Mink Brook, circa 1960. Upper photo looking from Thompson Terrace.



**“The Milk House” in 1958.
The last remnant of the former Stone Farm.**

-Part II-

***Some Geologic History
of the Land***

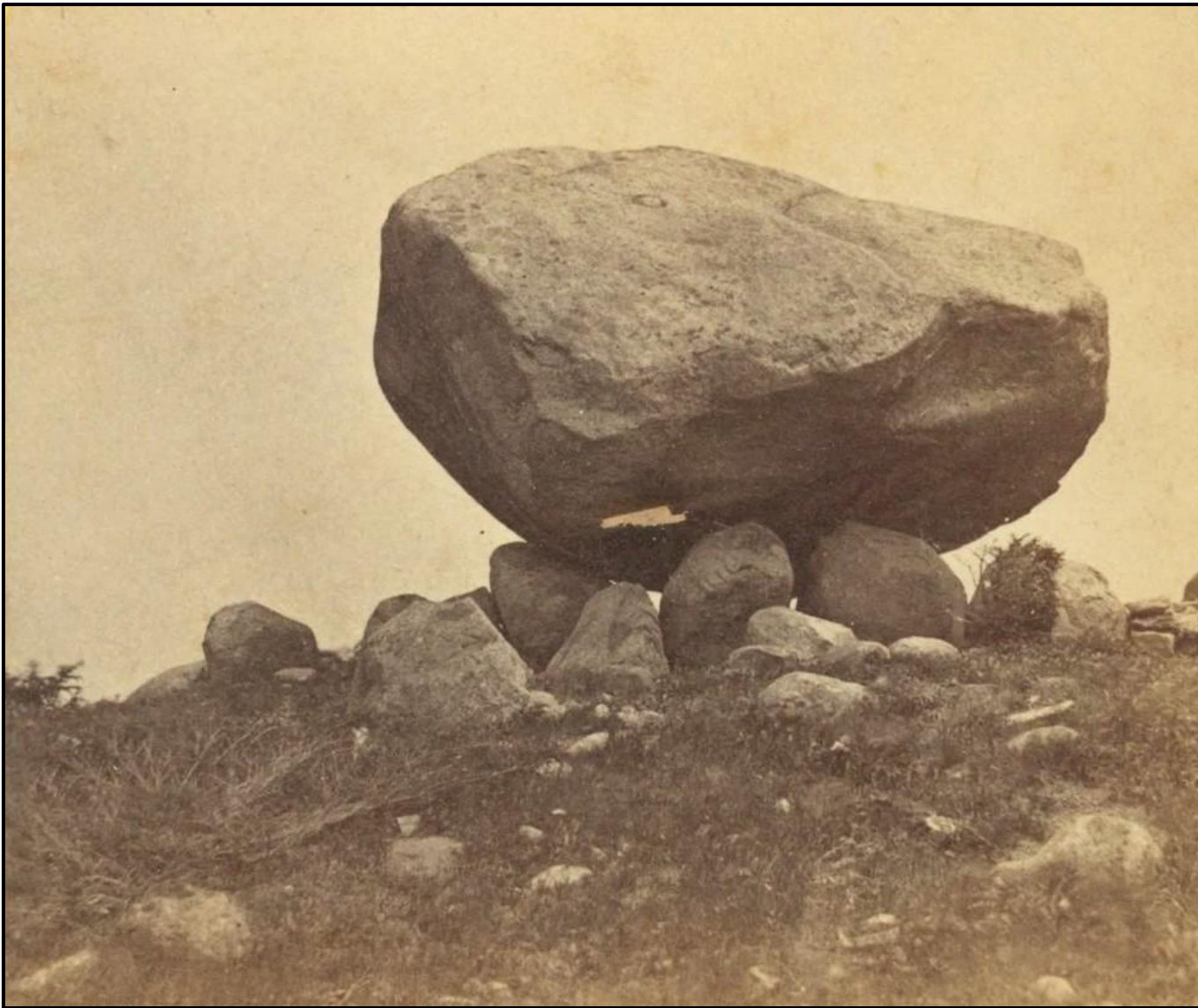


Doane Rock

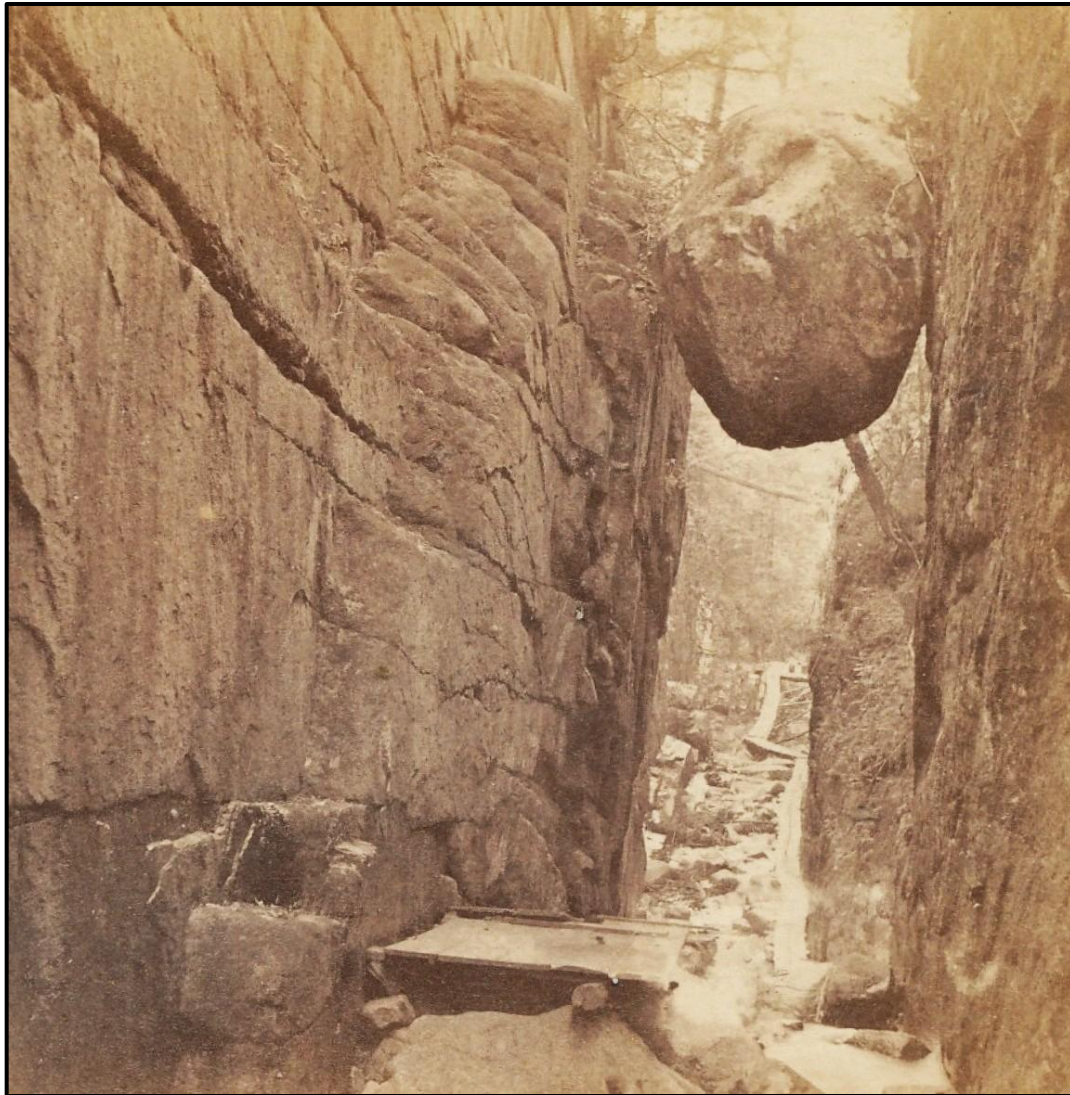
Eastham, Massachusetts

12-feet below ground; 18-feet above ground; 45-feet long.

Estimated weigh approximately 8000 tons.



The Bartlett Boulder
Bartlett, New Hampshire



The Flume Gorge
Franconia Notch State Park
Lincoln, New Hampshire



The Madison Boulder

Madison, New Hampshire

**83 feet long; 37 feet wide; 23 high above the ground; 12 feet below ground;
estimated weigh 7650 tons +/-.**

Where did these boulders come from?

And what about all the loose stone on and in the ground?

Many early New Englanders believed that it was:

- The work of giants, witches, the devil, an angry “Mother Nature”?
- Maybe it was from the tail of a comets?
- Maybe it was from ancient convulsions within the earth?
- Many in Europe believed the same.

By the early nineteenth century scientific reasoning believed:

- The Flood Theory.
- The Iceberg Theory.



Edward Hitchcock

Edward Hitchcock

1793 – 1864

Born:

Deerfield, MA.

Educated at:

Deerfield Academy
Amherst College

Professor of:

Chemistry and Natural History

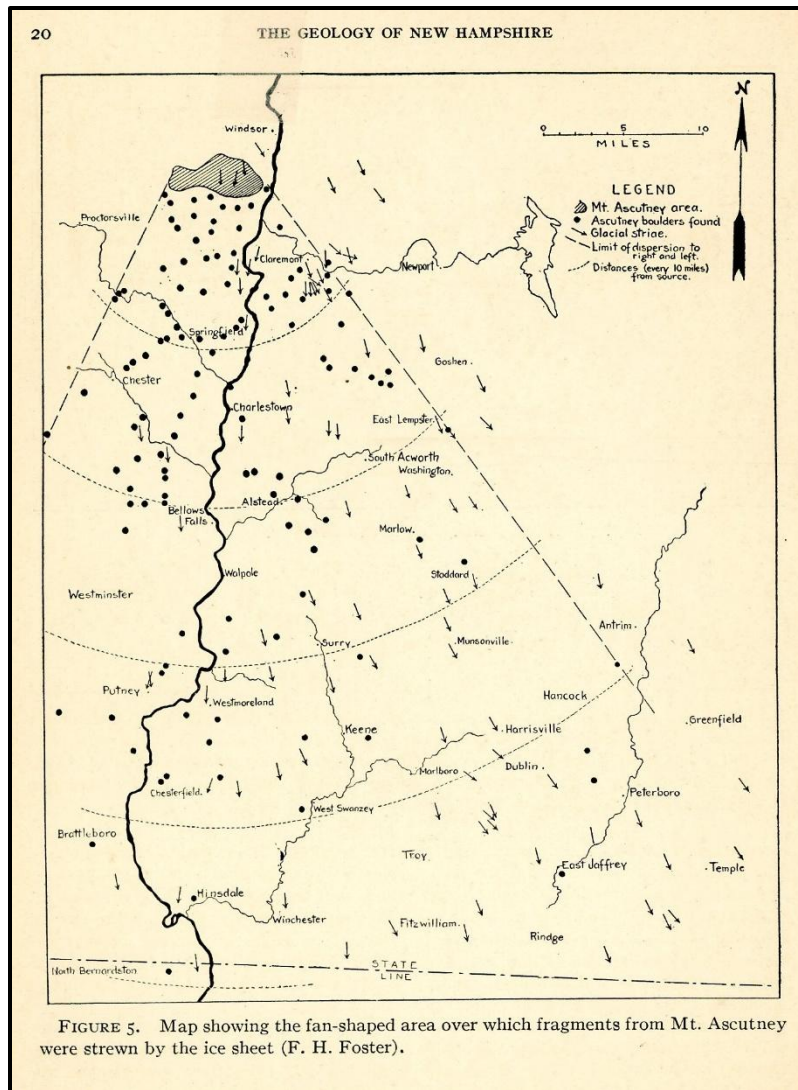
President of:

Deerfield Academy
Amherst College

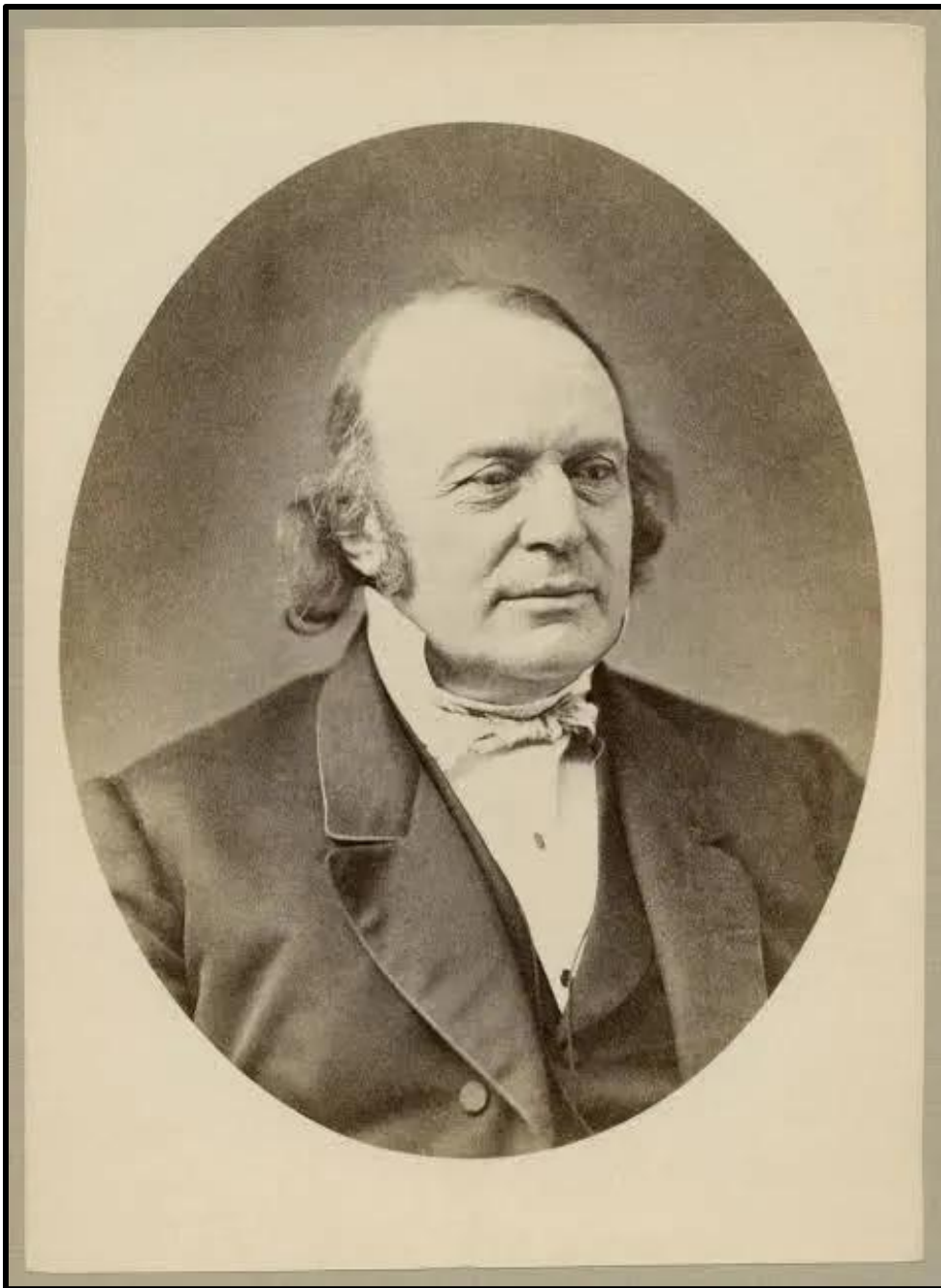


The Connecticut River at Amhurst, Massachusetts.

**Professor Hitchcock became curious about the terraced land along the river.
It was silt like material in flat horizontal layers without a stone in it.
It could only be lake bottom he reasoned.**



Professor Hitchcock also became curious about the way boulders of Mount Ascutney rock were strewn across the landscape south of the mountain.



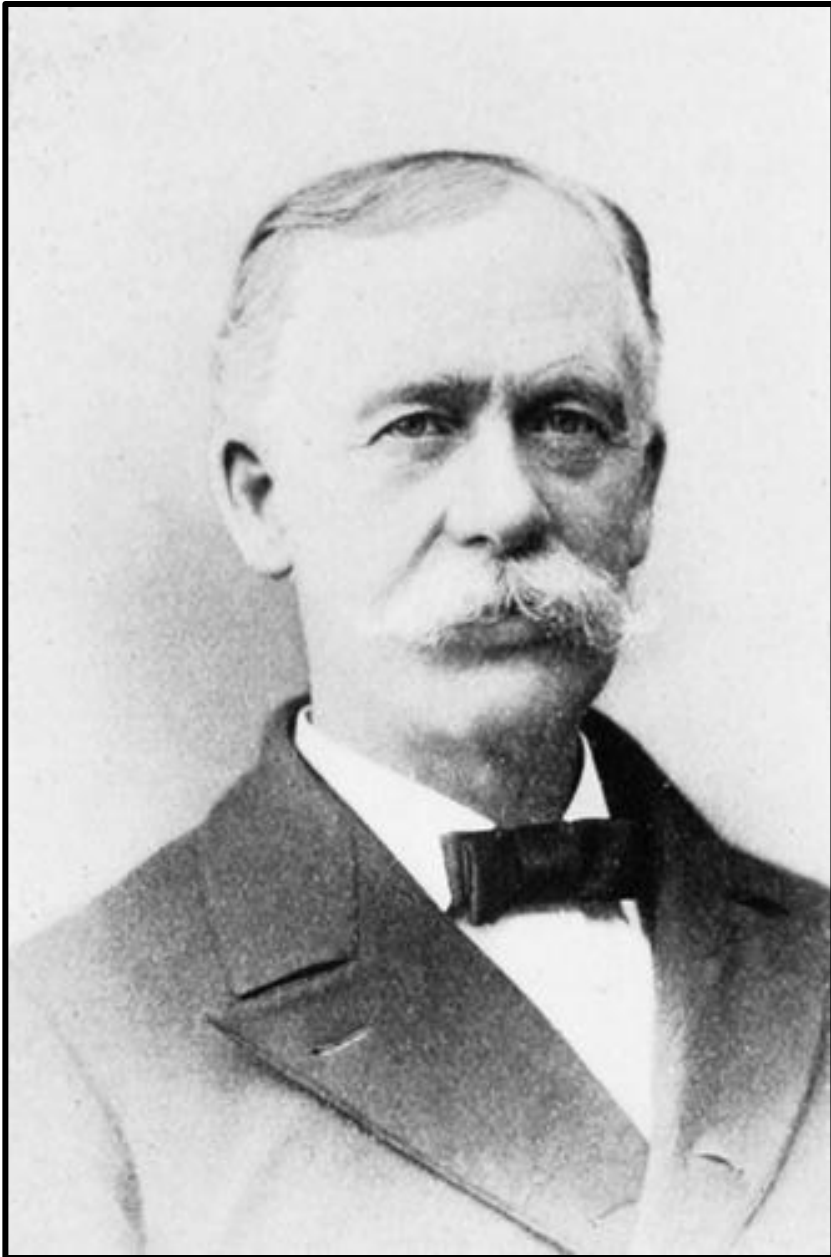
Louis Agassiz
1807-1873

**Born in Haut-Vully,
Switzerland; died in
Cambridge, Massachusetts.**

**Swiss-American zoologist,
glaciologist, and geologist.**

**In 1837 he first proposed
the scientific idea of past ice
ages.**

**In 1840 he published his
work *“Study on Glaciers”*.**



Charles Henry Hitchcock

1836 – 1919

(Son of Edward Hitchcock)

Born:

Amherst, MA.

Educated at:

Amherst College-Graduated 1856

**Professor at Dartmouth College
1868 – 1908**

**Vt. Assistant State Geologist
1851 – 1867**

**NH State Geologist
1868 – 1878**

Visited Glaciers in Switzerland.

Past Ice Ages

-The Pleistocene Epoch-

Four (4) repeated cycles of glacial advances and retreats.

1. The Nebraskan Glaciation:

2.1 to 1.4 million years ago.

2. The Kansan Glaciation:

700,000 to 600,000 years ago.

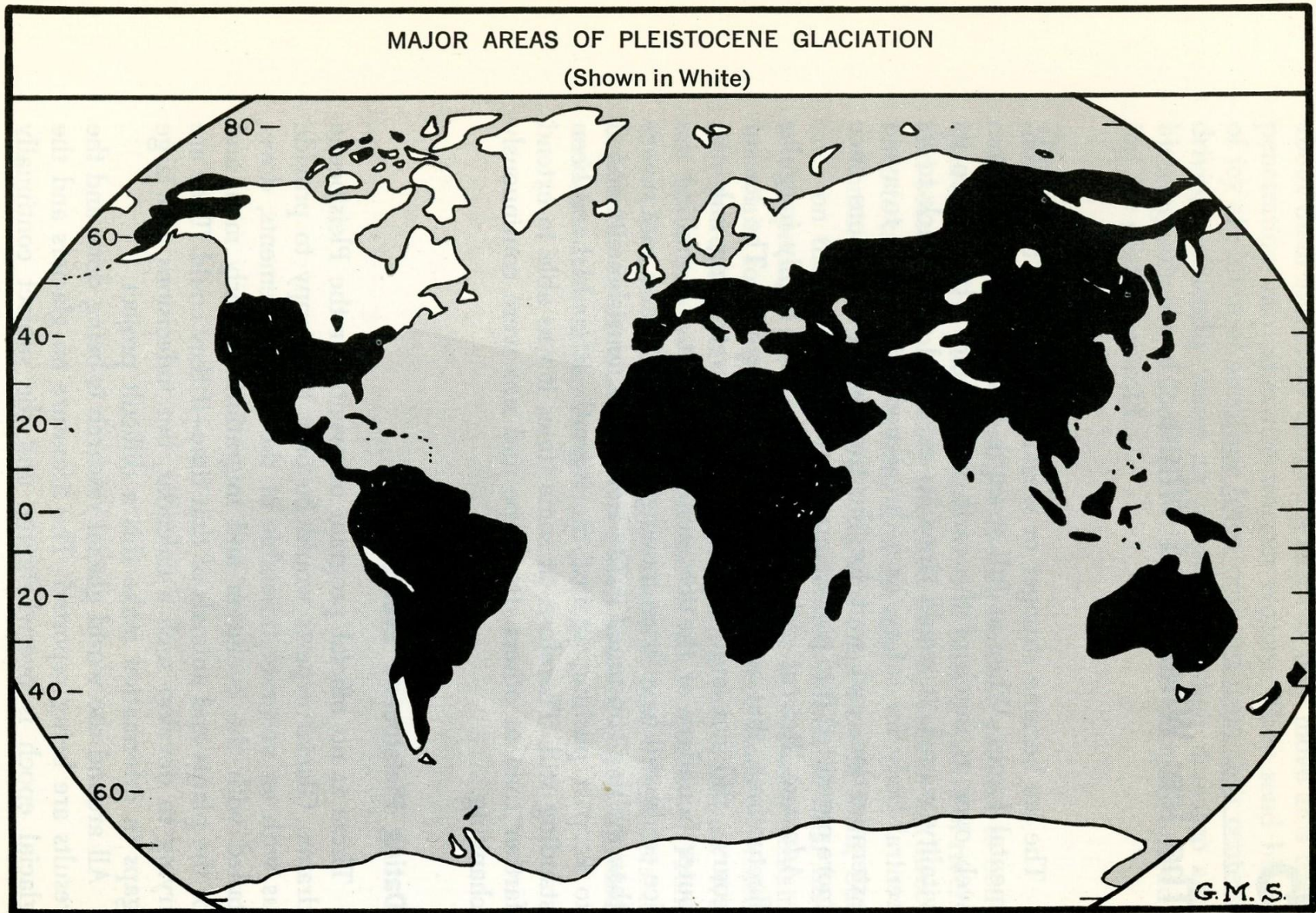
3. The Illinoisan Glaciation:

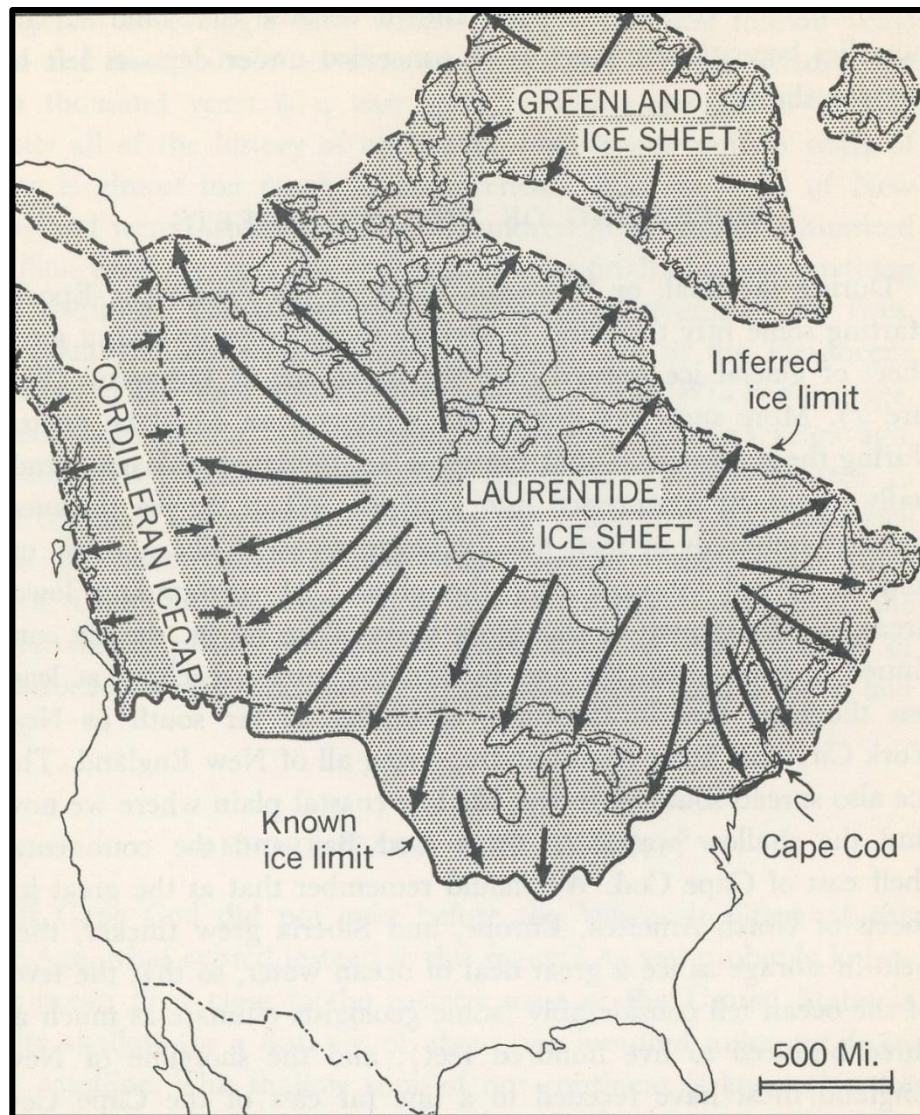
186,000 to 128,000 years ago.

4. The Wisconsin Glaciation:

75,000 to 11,000 years ago.

-The Pleistocene Epoch Worldwide-

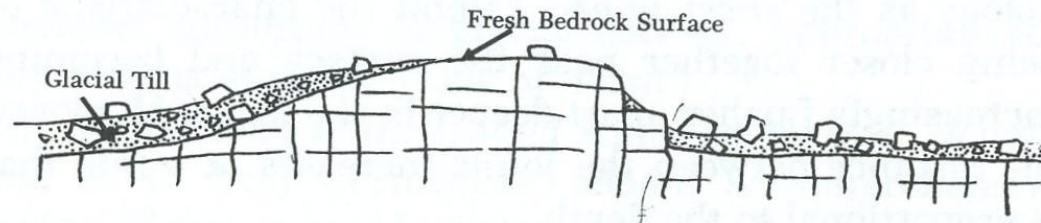
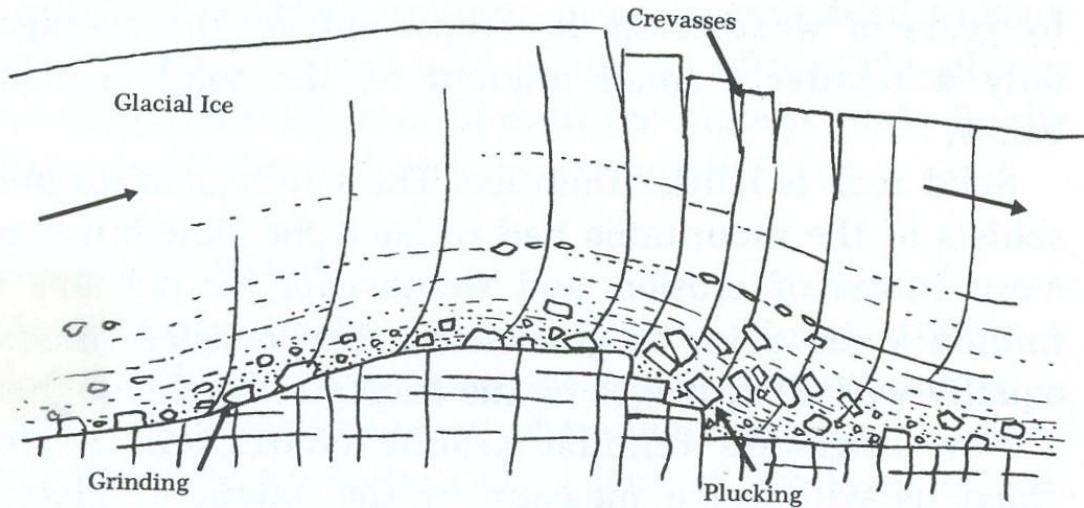
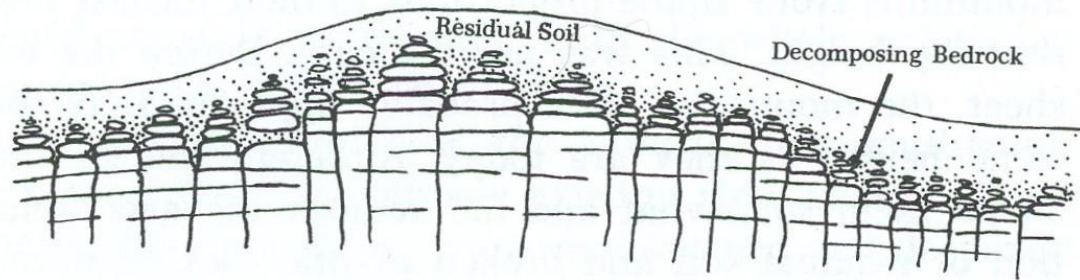




The Wisconsin Glaciation and the Laurentide Ice Sheet.

Lasted 75,000 to 11,000 years - Peaked 20,000 years ago.

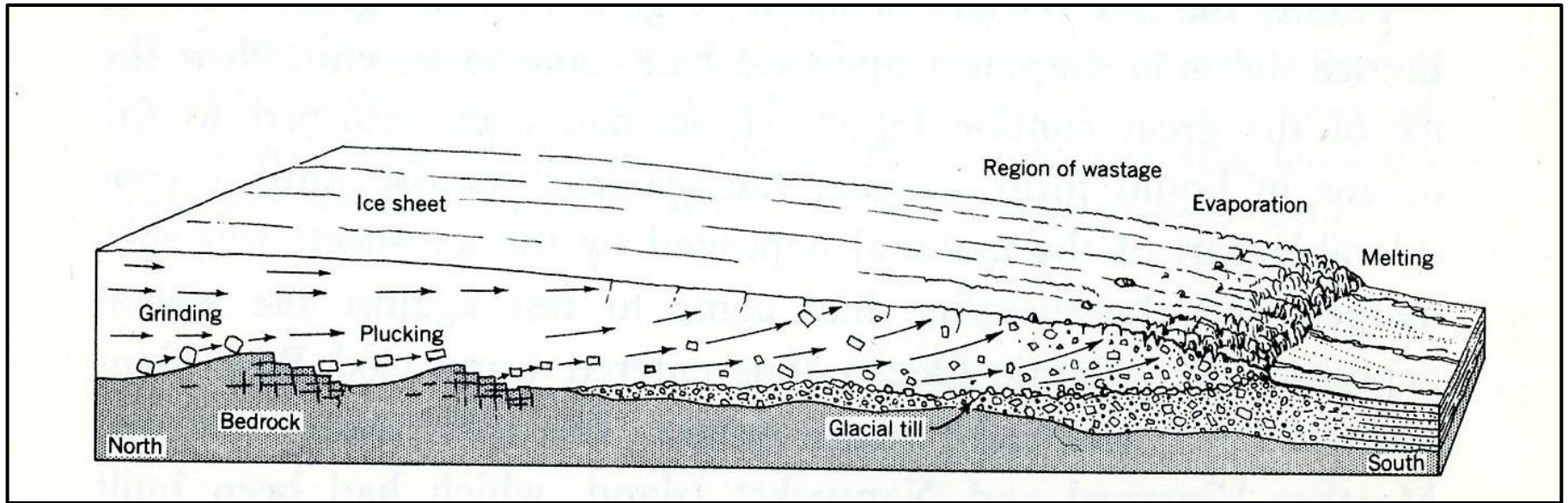
About 1 mile thick.



Glacial Action and the creation of Glacial Debris.

As an example,
locally scouring
the top of Moose
Mountain

Before and After.



The grinding, plucking, and dumping action of a glacier and the creation of glacial till.

-Glacial Till-

Basal Till:

Is formed under the glacier, this material is typically carried at the base of the glacier and laid down beneath it. Basal Till very dense and compact due to the great weight and pressure of the ice.

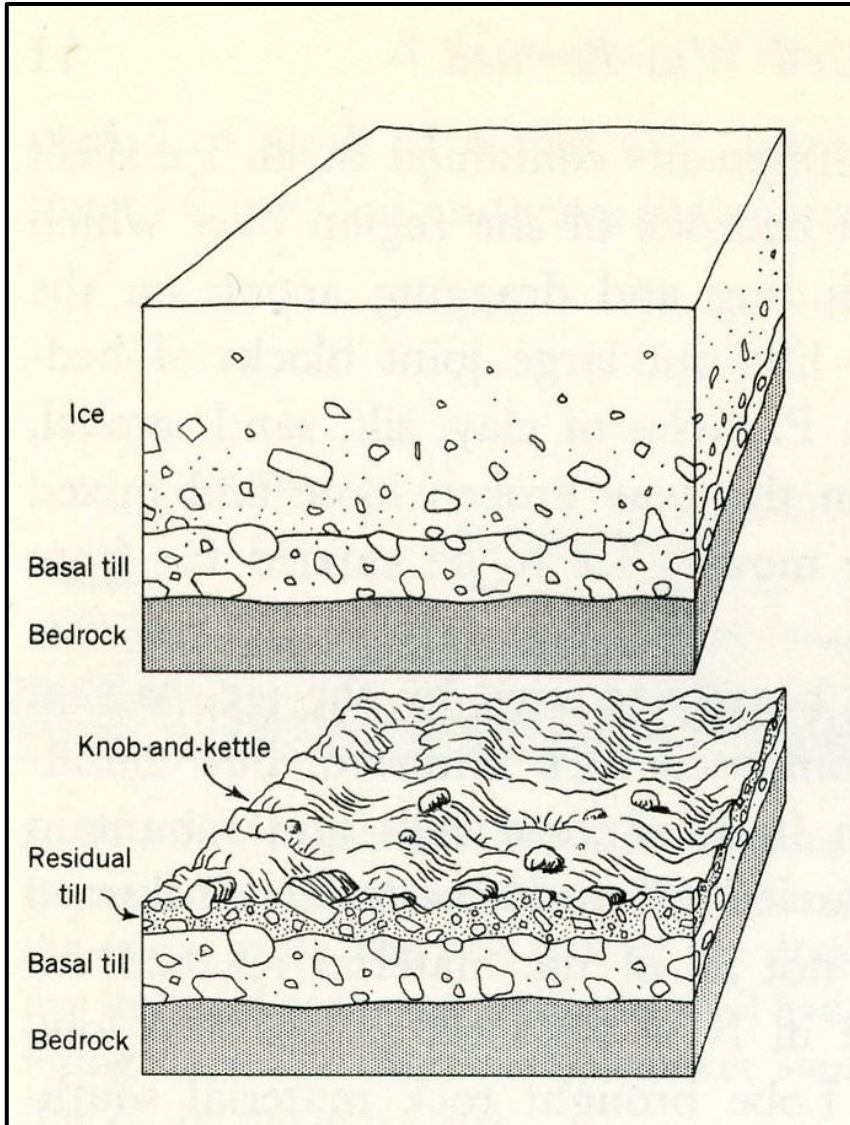
Residual Till:

Is carried on or near the glacier's surface. This type of deposit is often severely compressed and compacted, referred to as lodgment till.

knob-and-Kettle:

The landscape after the retreat of the glacier:

- Boulders, rocks, and dirt.
- Blocks of rotting ice.
- New ponds and lakes of water.



- Glacial Erratics -

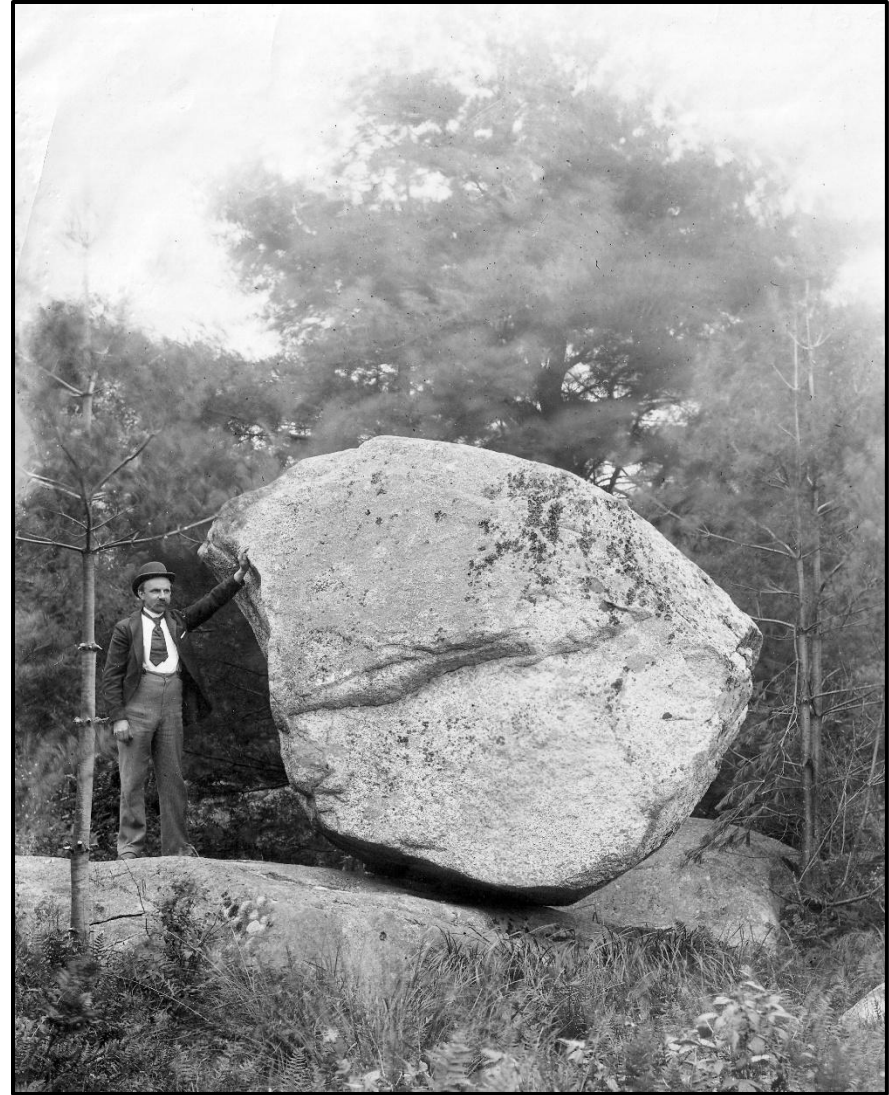
A glacial erratic is a glacially deposited rock differing from the type of rock native to the area in which it rests.

The name derives from the Latin word *errare* (“to wander”).

Erratics are carried by glacial ice, often distances of many miles.

“Tipping Rock” in Lebanon, New Hampshire - Boston Lot Forest - with George Leavitt in 1896.

(Courtesy of the Lebanon Historical Society)



- Formation of Glacial Erratics -

By Abrasion / Scouring: Debris in the ice sheet scrapes along the bed, polishing and grinding the underlying rocks.

By Plucking: Pieces of bedrock are cracked off by glaciers producing larger erratics.

By Ice Thrusting: The glacier freezes to its bed, moving large sheets of frozen sediment at its base along with it.

By Glacially Induced Spalling: Layers of rock are spalled off the rocks below the glacier during ice lens formation. This provides smaller debris. which is ground into the glacial basal material to become till.

“Amackassin Boulder”

Located near Route 120 Lebanon, New Hampshire

A 500-ton Erratic





**Large erratic at Peabody and Mascoma Streets in Lebanon.
Note the adjacent smaller boulders.
(Author's Collection)**



An erratic behind the Etna Fire Station and the Etna Library.

- Glacial Melt Water -

At the peak of the last Wisconsin ice age, about 20,000 years ago, the ice sheets in North America and globally elsewhere locked up so much water that the global ocean level dropped by approximately 300-feet.

In New England, the Laurentide Ice Sheet was more than a mile thick.

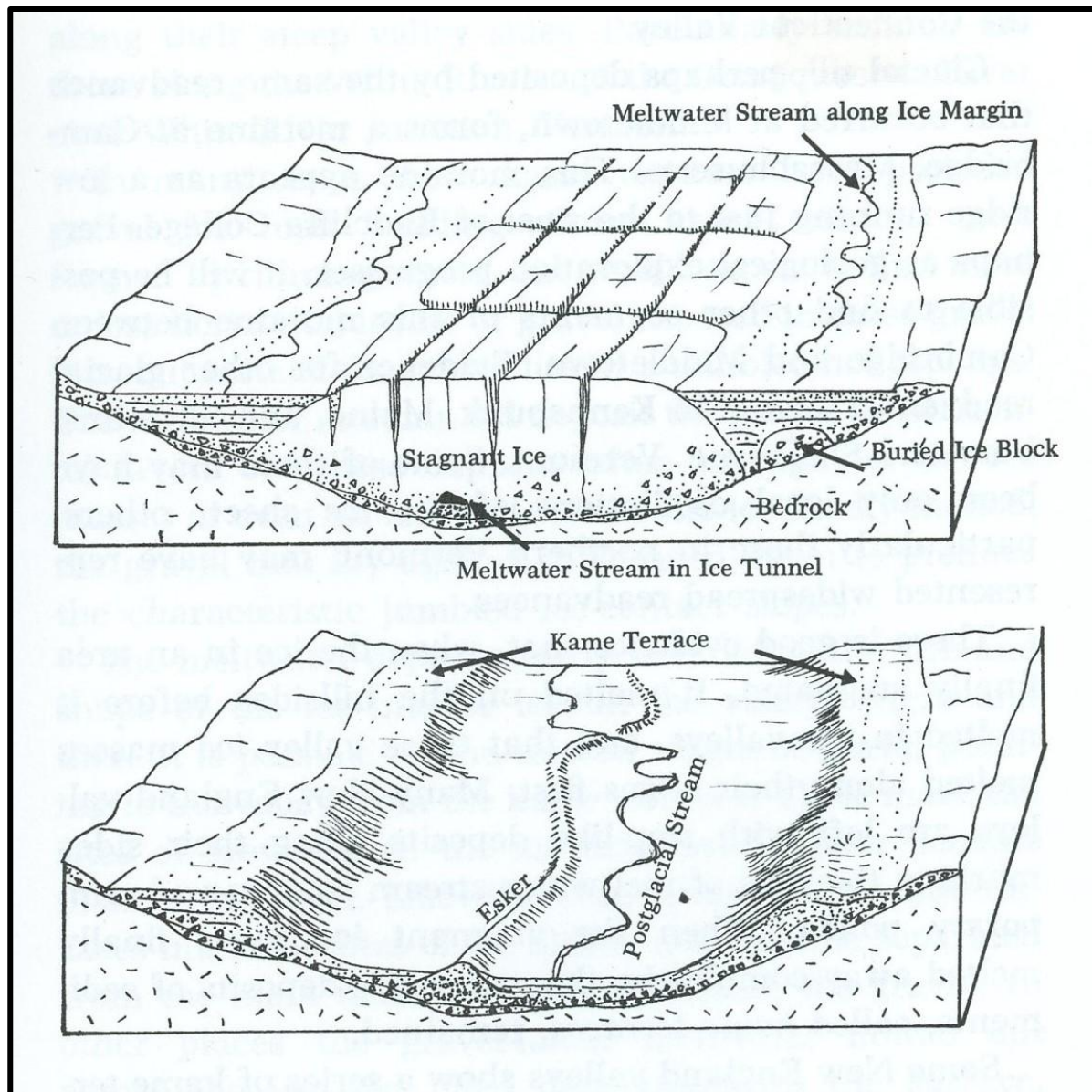
The ice sheet over-topped 6,285 feet high Mount Washington in northern New Hampshire.

The seasonal melting of the ice sheet released vast amounts of water.

- Eskers -

An esker is a long winding ridge of stratified sand and gravel deposited by glacial meltwater streams flowing within or beneath a melting glacier.

In the upper valley there is an esker that starts in North Thetford beside the Connecticut River and extends south to Norwich, jumps the River to Hanover just north of Kendal and Camp Brook, extends south beside the River to about the location of Wilder Dam, then runs beside the River through White River Junction to Windsor, Vermont. The total length of this esker is about twenty-four miles long.



-The Creation of an Esker-



Warren Upham

1850 – 1934

Born:

Amherst, NH

Educated at:

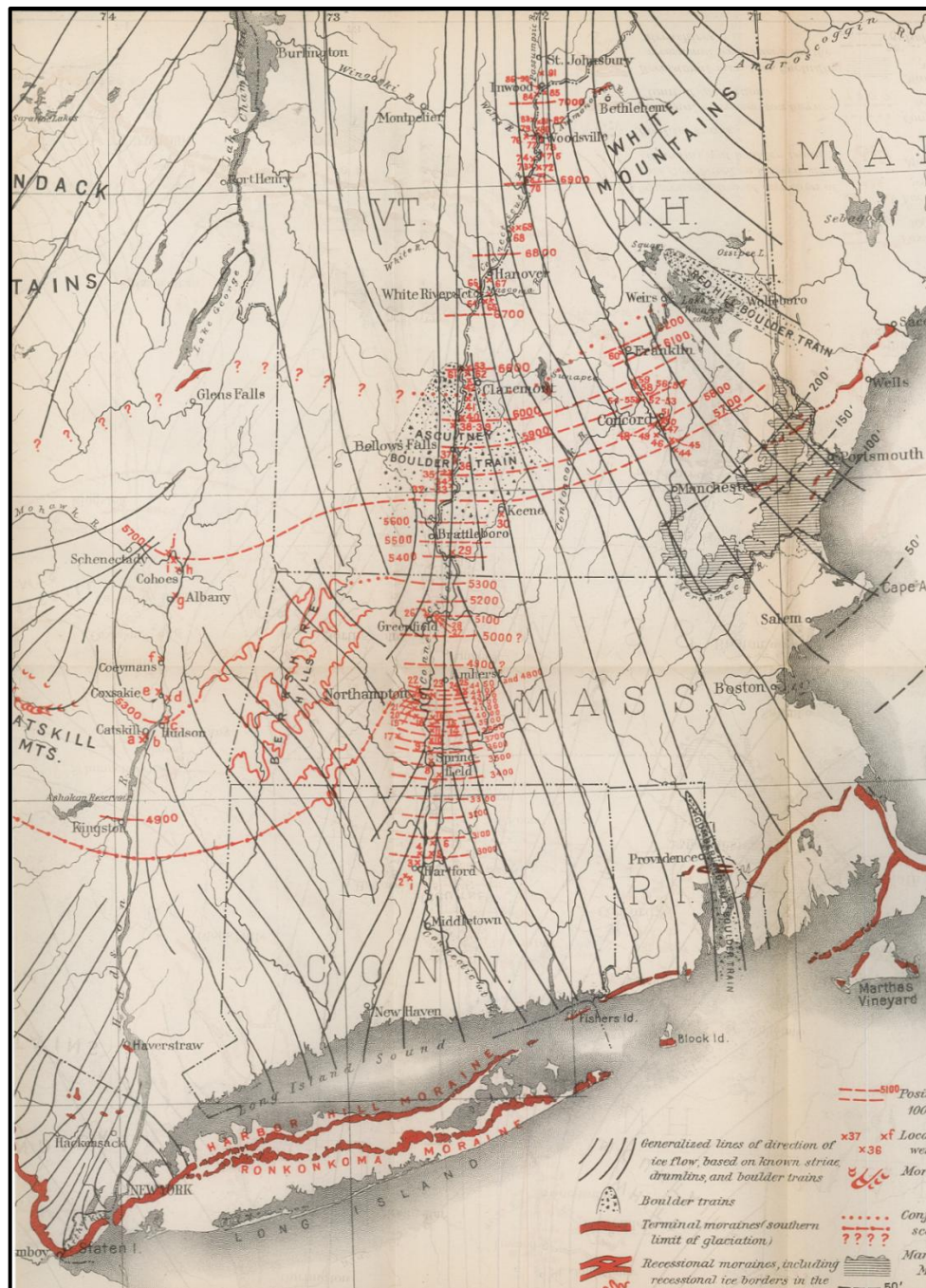
Dartmouth College Class of 1871

**Student at Dartmouth of Professor Charles
Henry Hitchcock.**

**Upham did a lot of early mapping of the
terraces along the Connecticut River.**

**He discovered the existence of the 24-mile-
long Connecticut River valley esker that
runs from North Thetford to Windsor,
Vermont.**

**One of the great minds of
glaciological research in
America.**

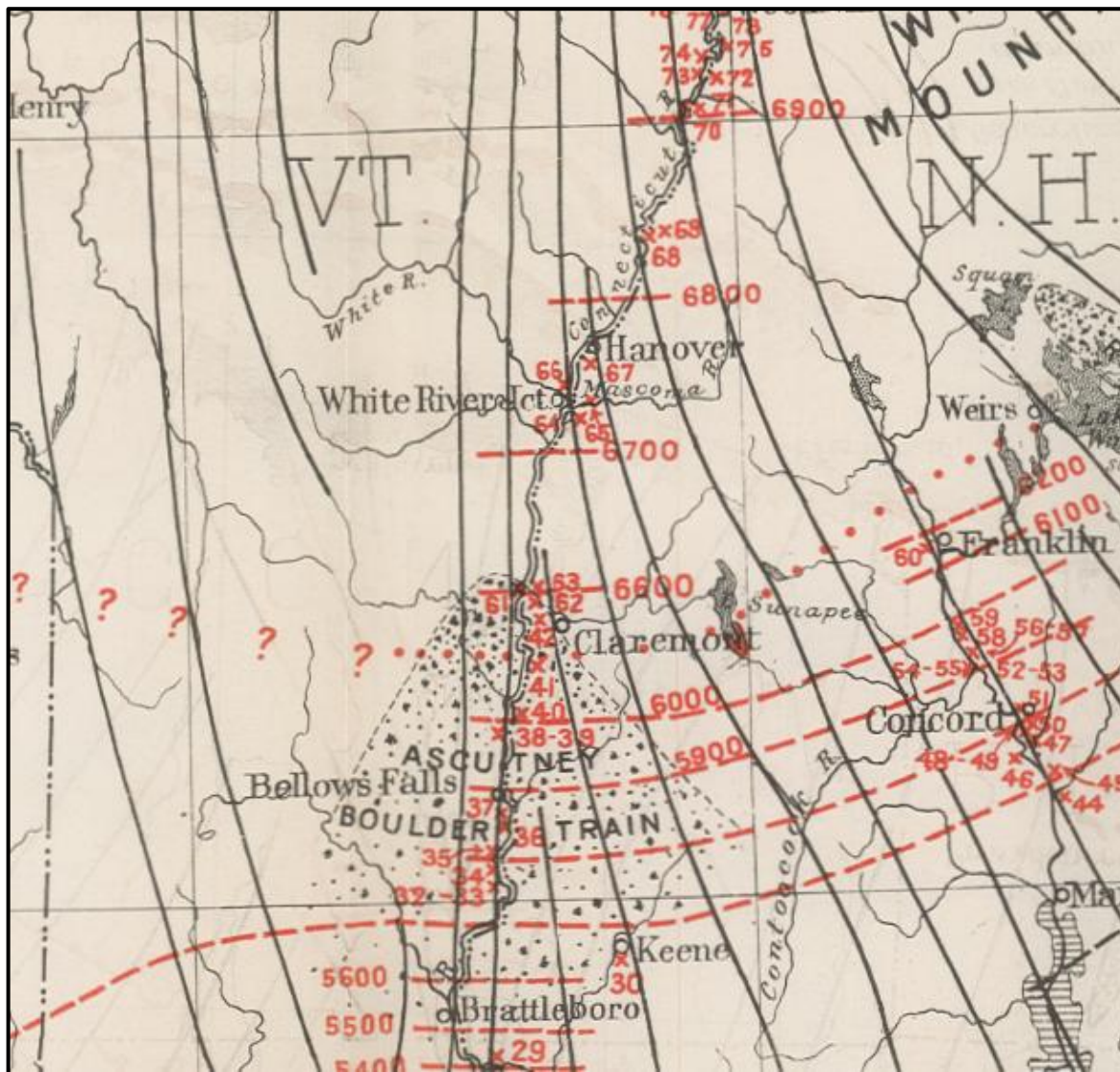


A Portion of a Map Titled:

Map Illustrating the Recession of the Last Ice Sheet from New England and New York

Compiled by J. W. Goldthwait
1922

It took about 7,000 years for
the ice sheet to melt from
Long Island, New York to St.
Johnsbury, Vermont.

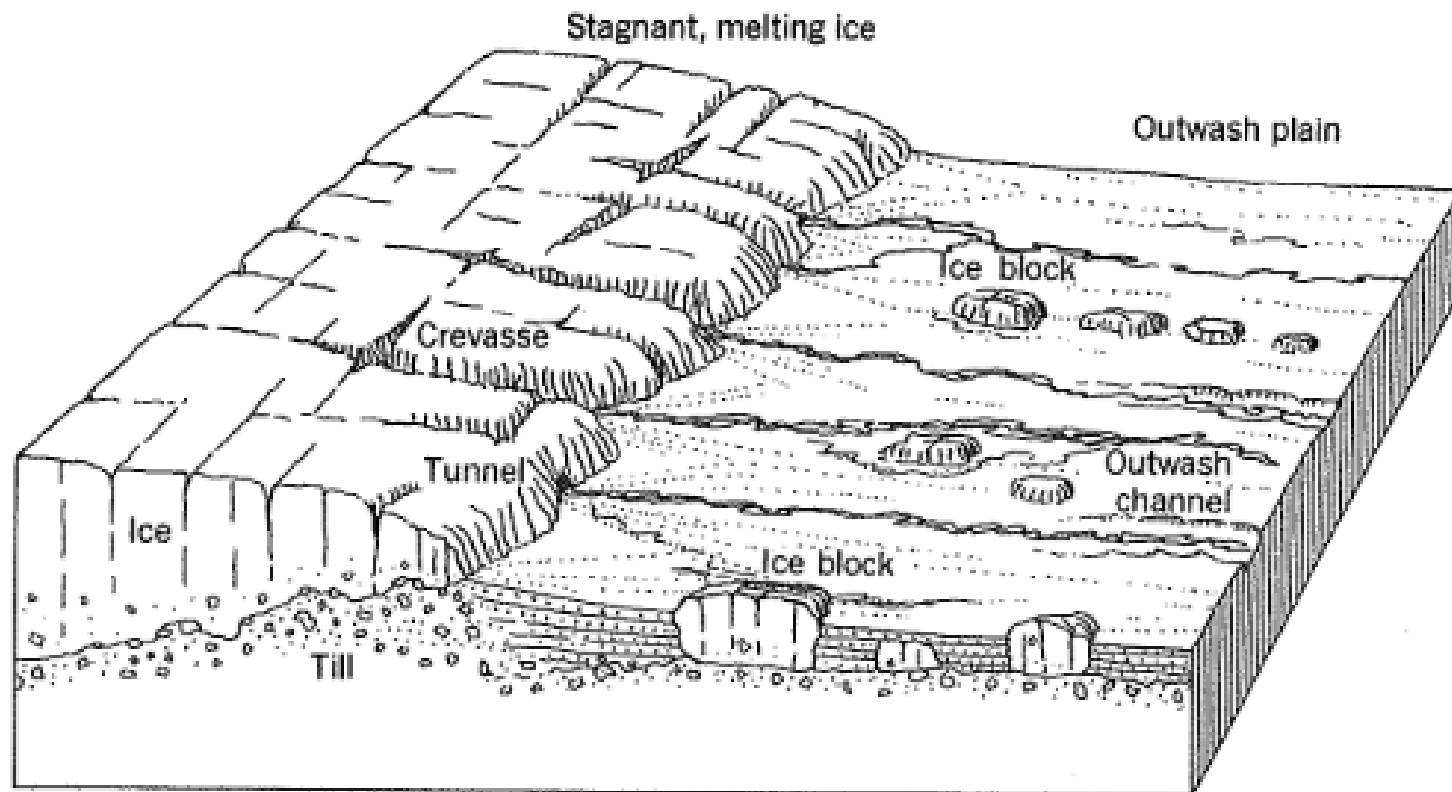


- The Retreat of the Glacier from Brattleboro to Bradford -
About 1400 Years

Retreat of the glacier within the Upper Connecticut River Upper Valley

- From about Mt. Ascutney to about the Plainfield – Lebanon town line = about 15.5 miles = 615 feet per year = 133 years.
- From about the Plainfield –Lebanon town line to the mouth of Mink Brook in Hanover = about 4 miles = 812 feet per year = 26 years.
- From the mouth of Mink Brook in Hanover to 21 miles north = about 21 miles = 786 feet per year = about 141 years.
- At Mink Brook about 6,500 years of retreat from Long Island, New York.

-A Retreating Glacier-



Glacial Outwash Deltas

A glacial outwash delta is a landform created where a meltwater stream from a retreating glacier flows into a standing body of water.

As the water's velocity drops, it dumps its sediment load, forming distinct layers of sorted sand and gravel.

Along Mink Brook there are four (4) delta areas:

- 1. Sand Hill at the top of Lebanon Street.**
- 2. At about Mink Drive, Martin Lane, and Greensboro Road.**
- 3. At about 100 Greensboro Road.**
- 4. At the intersection of Greensboro, Etna, and Great Hollow Roads, at "Cutting's Corner". This was the first mouth of Mink Brook into Lake Hitchcock.**

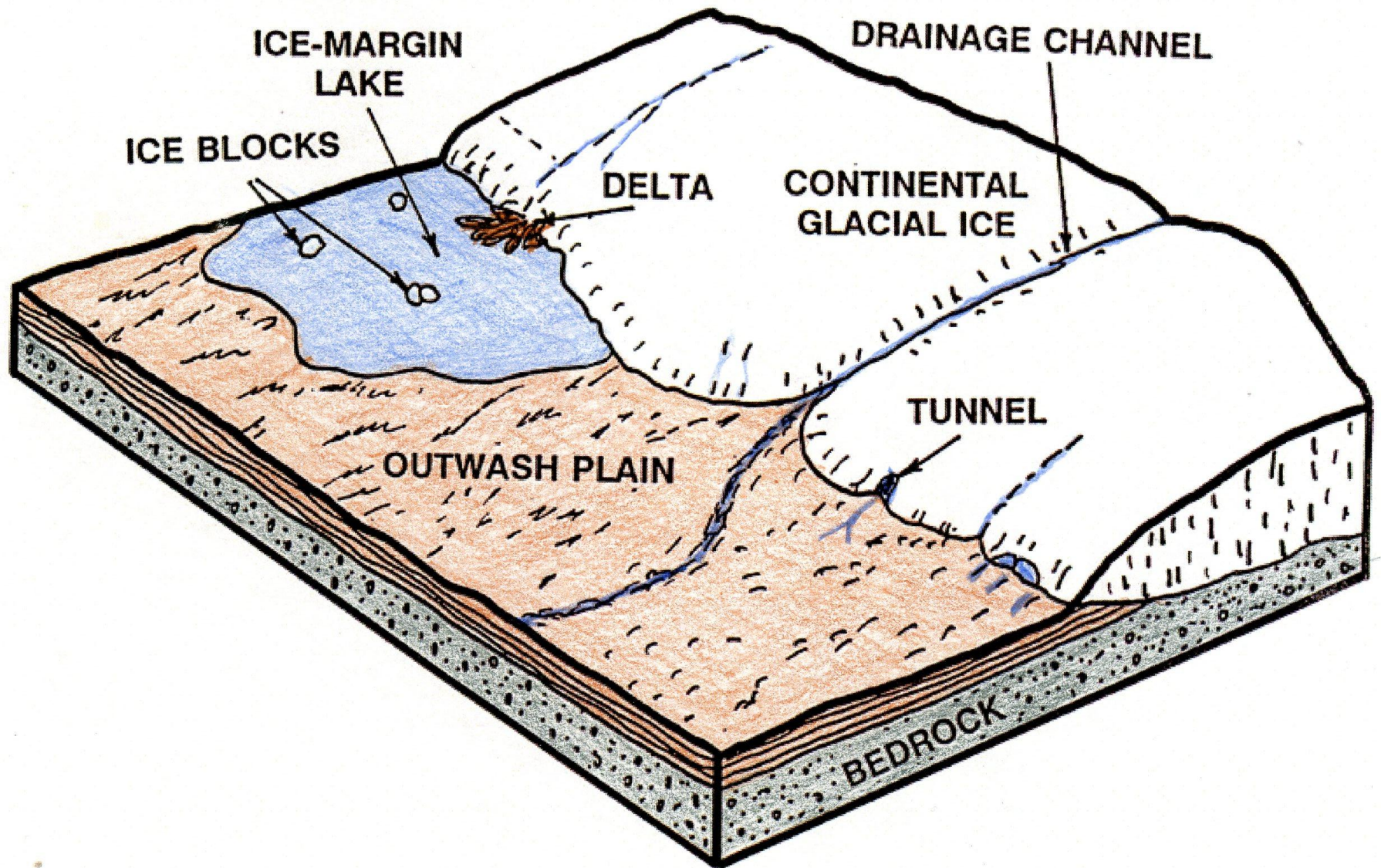
Lakes Hitchcock and Upham

Lake Hitchcock:

- Formed beginning about 15,000-14,000 years ago.
- Extended from about Rocky Hill, CT. to about St. Johnsbury, VT.
- Was about 2 to 3 miles at its widest in New Hampshire and Vermont.
- The lake elevation in Hanover was at about elevation 657 feet above modern-day sea level.
- Lasted for about 3,000 years.
- Drained in stages about 12,500 to 13,000 years ago.

Lake Upham:

- Formed out of the remains of Lake Hitchcock.
- About 90-feet lower than Lake Hitchcock.
- Existed about 600 years at Hanover.
- Existed about 1,600 years at Woodsville, New Hampshire.



At the edge of a melting glacier.



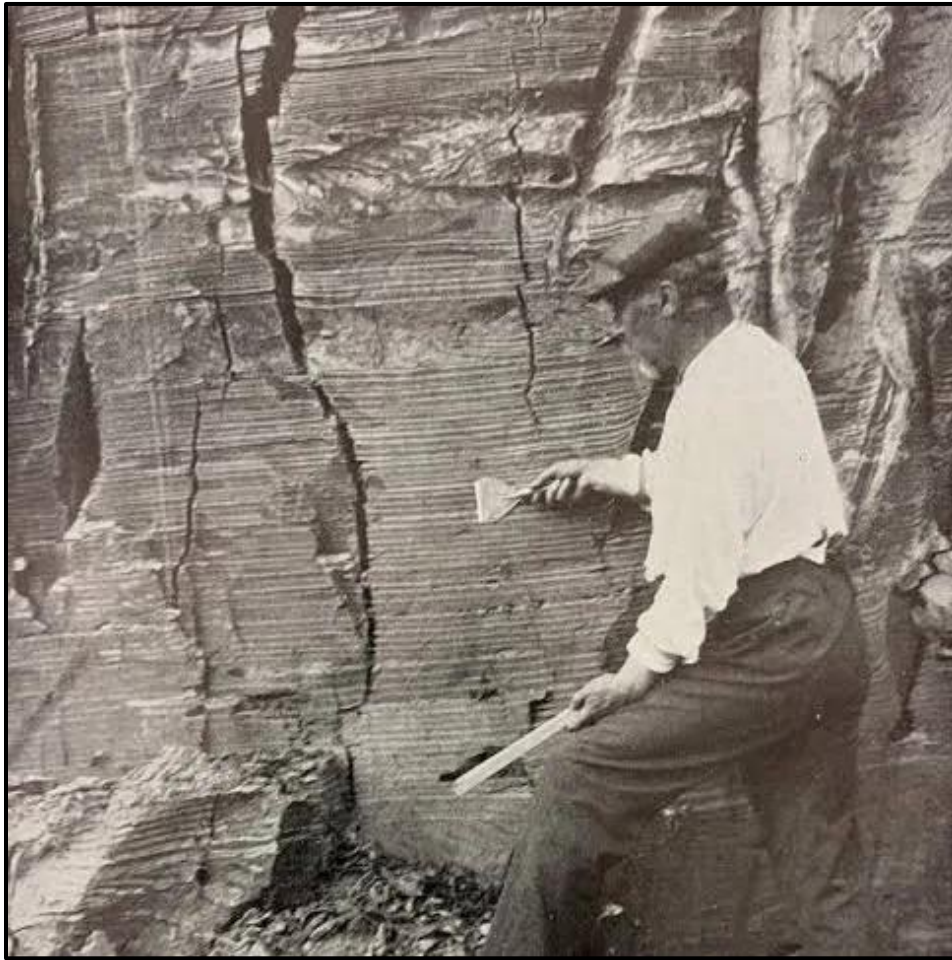
- Lake Hitchcock -

Existed for about 3,000 years, from about 15,600 to 12,400 years ago.

Scale ~

0 2000 4000
FEET





Gerard De Geer
1858-1943

Born Stockholm, Sweden.

Educated at Uppsala University.

**A brilliant Scandinavian
geologist.**

**Noticed how laminated
sediments found in glacial lakes
were like tree rings, indicating
passing years of growth.**

**Developed the theory of Varve
Chronology and Varved
sediments.**



Ernest V. Antevs

1888-1974

Born Vartofta, Sweden

**Educated at Stockholm
University**

Student of Gerard De Geer

**Further developed Varve
Geochronology**

**Studied the geology of the
Connecticut River Valley in
1921.**

**Published *"The Recession of
the Last Ice Sheet in New
England"* with James W.
Goldthwait in 1922.**



James Walter Goldthwait
1880-1947

Born Lynn, Massachusetts.

**Educated at Harvard: A.B. in 1902;
A.M. 1903; Ph.D. 1906.**

**He became Assistant Professor of
Geology at Dartmouth in 1908.**

**In 1911 he received an M. A.
honorary degree from Dartmouth
1911.**

**In 1925 he published *“The Geology
of New Hampshire”*.**

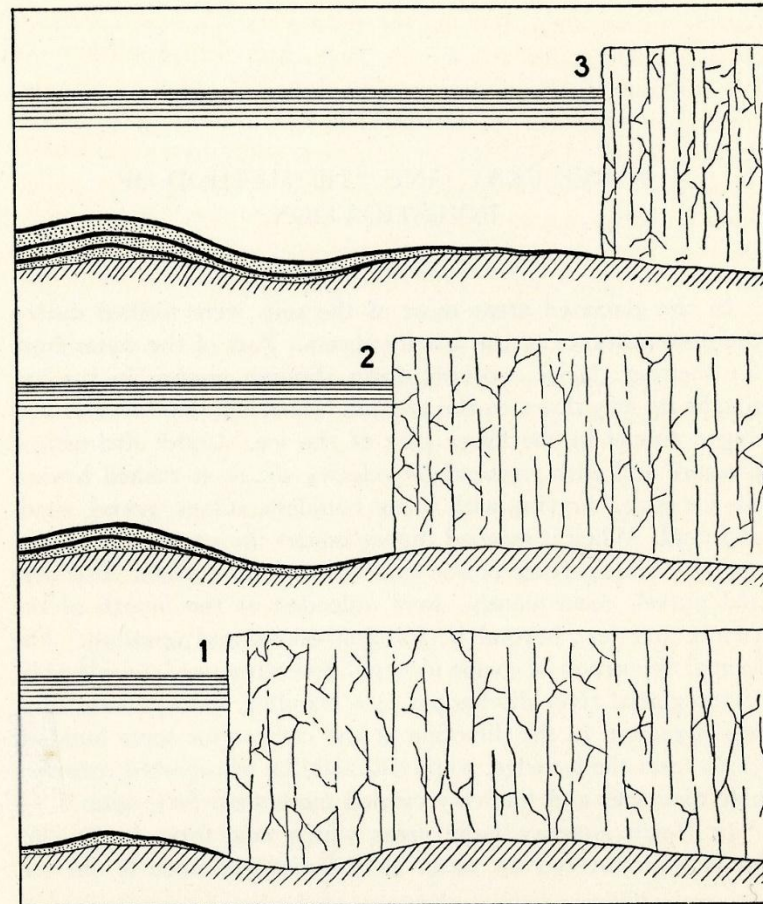


FIG. 1—Figure showing manner of deposition of varve clay in fresh water off the receding ice front during three successive years.

From Ernest Antevs'
The Recession of the Last Ice Sheet in New England
Diagram showing a three-year recession

-Clastic Varves-

Formed in Proglacial Lakes – Geology's Tree Rings



Varves are Cyclical

Spring–Summer:

- Light, coarse Layer.
- Increased seasonal runoff.
- Coarser, heavier material.
- Fine particles remain suspended in the water.

Winter:

- Dark , fine layer.
- Minimal runoff and water flow.
- Calm water allows fine suspended material to settle to the lake bottom.



James Walter Goldthwait
1880-1947

Born Lynn, Massachusetts.

**Educated at Harvard: A.B. in 1902;
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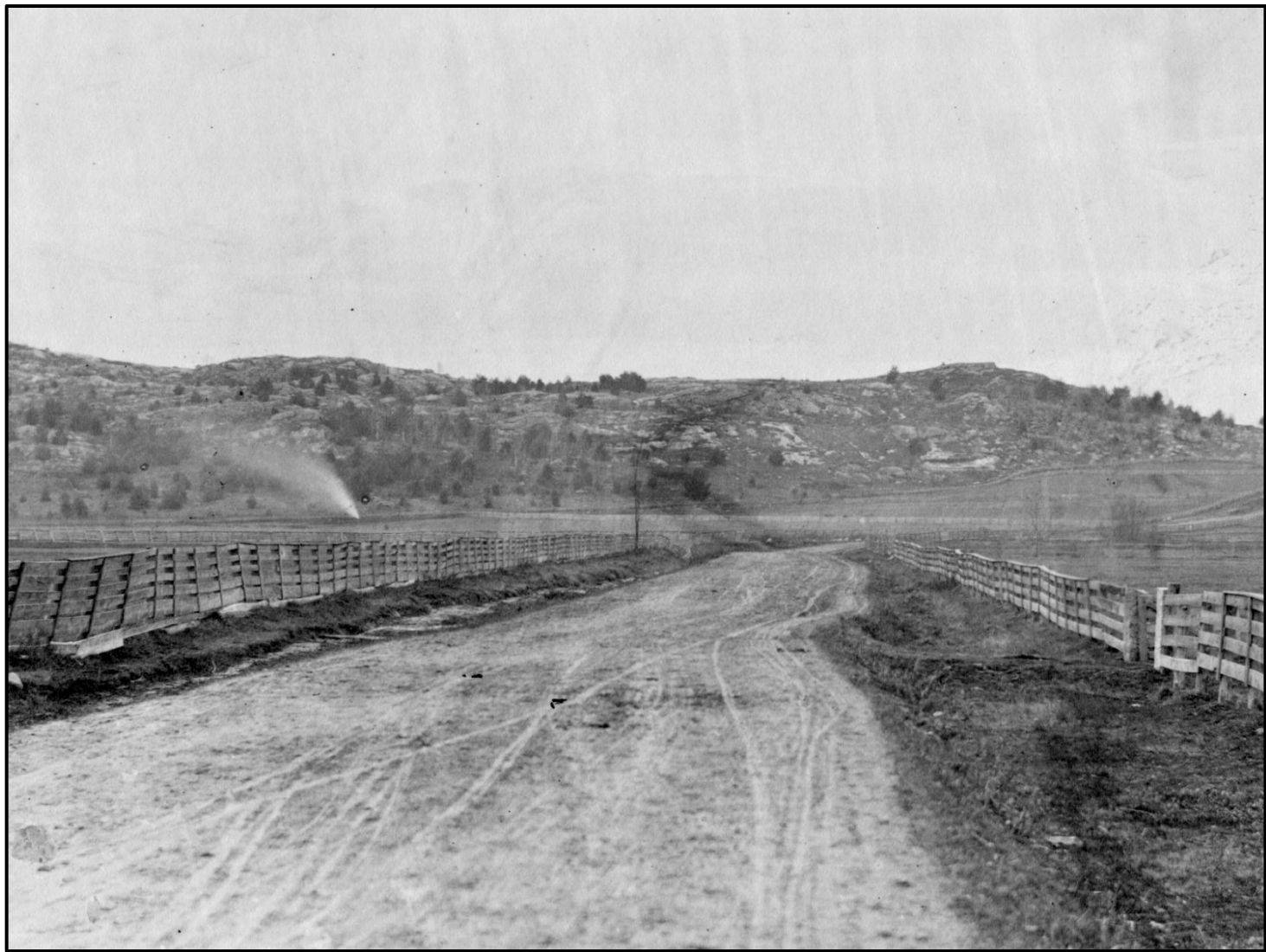
**He became Assistant Professor of
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**In 1925 he published *“The Geology
of New Hampshire”*.**



Looking south from the Bema across the Hanover Plain showing in the fore-ground lake bottom of Lakes Hitchcock and Upham, and the delta Sand Hill in the mid-ground.



**Looking south along Lebanon Street towards velvet rocks and
sand Hill, 1867.**

(Dartmouth College Special Collections)



**Looking from the top of Lebanon Street, 1867.
In the fore-ground is the gravel delta. In the background is the
Hanover Plain.
(Dartmouth College Special Collections)**



Looking easterly up West Wheelock Street, 1876.

At an earlier time, the esker had been breached when the glacial lakes drained.

(Dartmouth College Special Collections)

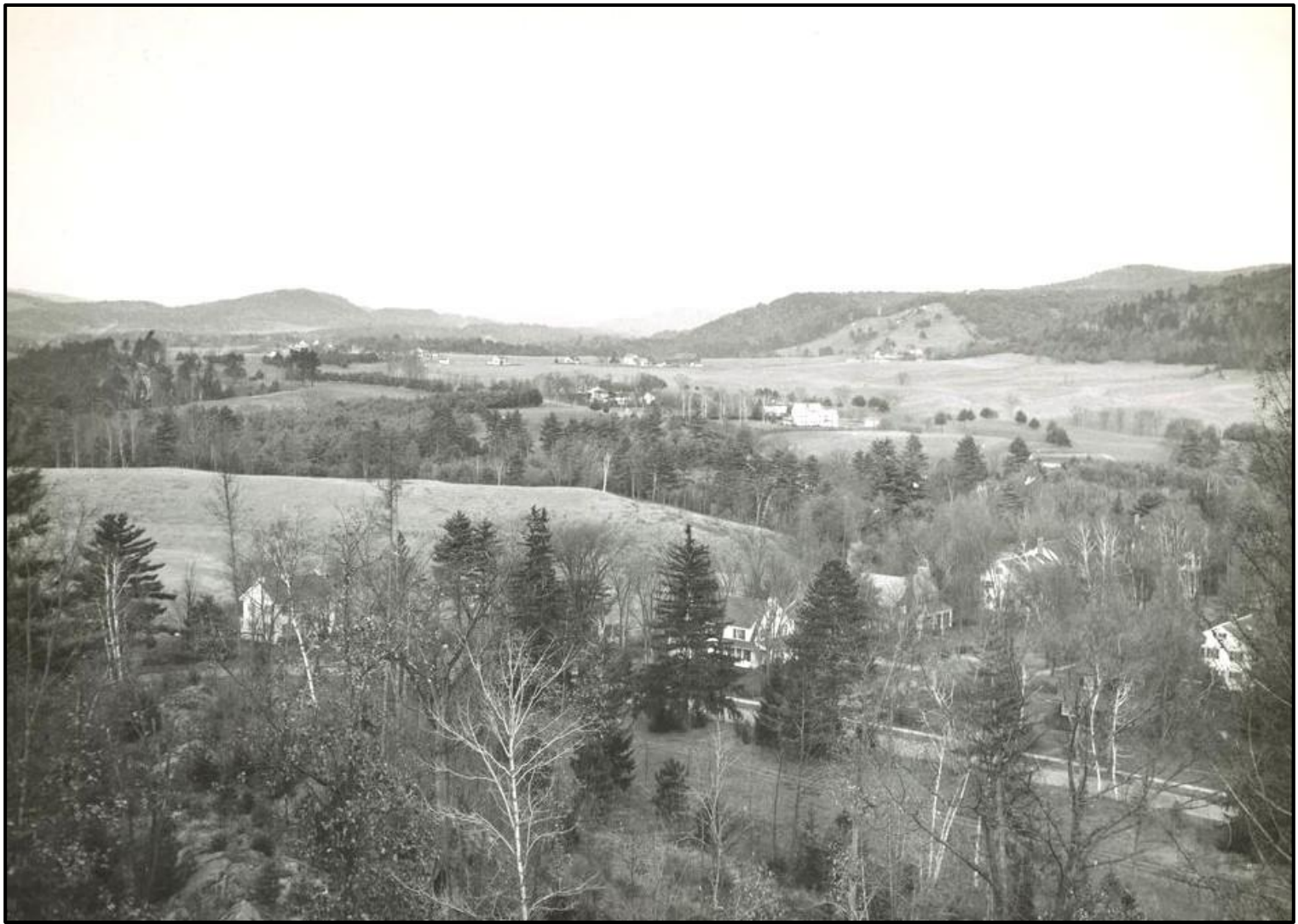


Mink Brook looking from Pleasant Street circa 1870.

Note the breached esker in the background.

An estimated 60 million cubic yards of silt and sand was washed away.

(Dartmouth College Special Collections)



Looking north from Bartlett Tower showing the sculpturing of the land by the erosion of Girl Brook.
(Dartmouth College Special Collections)



The Glenn at Mink Brook circa 1880 #1.
(Dartmouth College Special Collections)



The Glenn at Mink Brook circa 1880 #2.
(Dartmouth College Special Collections)



The Glenn at Mink Brook circa 1880 #3.
(Dartmouth College Special Collections)



The Glenn at Mink Brook circa 1880 #4.
(Dartmouth College Special Collections)



The “Clay Bank” at the Stone Farm circa 1920.
(Dartmouth College Special Collections)

Page 5
From Ernest Antevs'
"The Recession of the
Last Ice Sheet in
New England"

Detail photograph of the Clay
Bank at the Stone Farm
Circa 1920
Site # 67

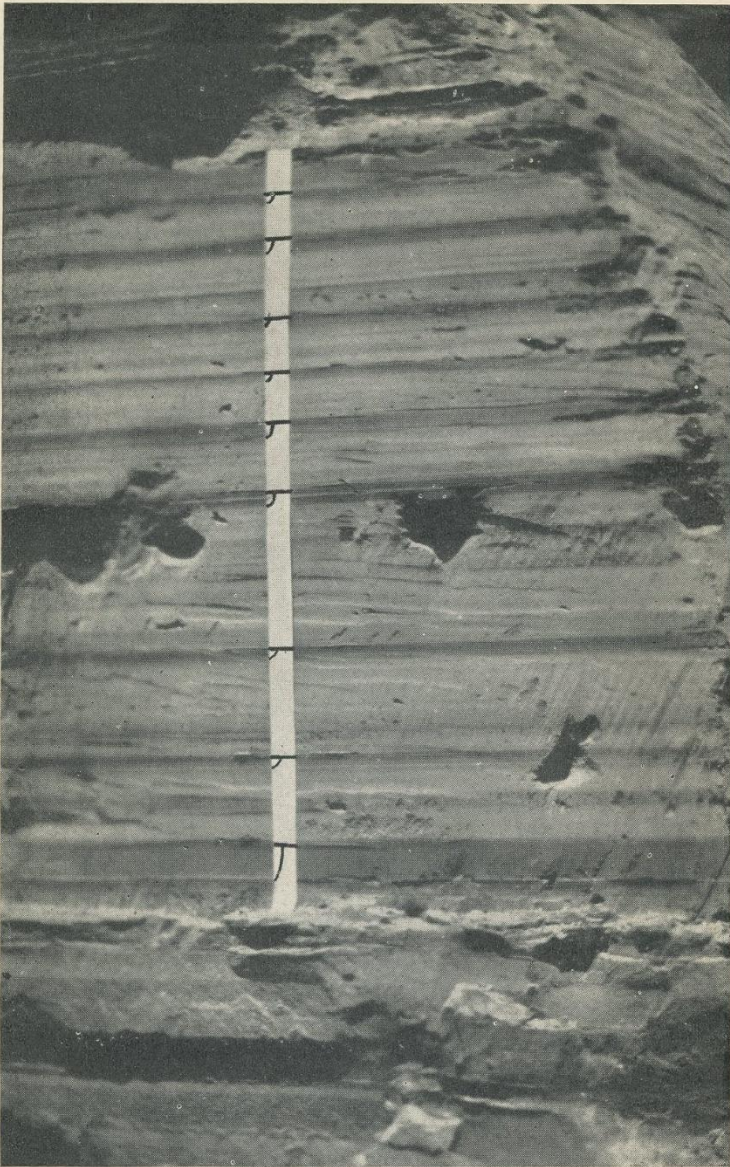


FIG. 3—View showing the method of measuring the clay layers on a strip of paper.
Locality 67, Hanover, N. H.



“The Clay Bank”

Photographs taken by Frank J. “Jay” Barrett, Jr. winter 1966.



**Looking westerly from just below the ledges at the old farm.
12,000 years ago, this was about the edge of Lake Hitchcock.**

Photograph by Frank J. Barrett, circa 1965.



Frank J. Barrett, Jr. and Susie returning from the upper millet fields. The lower clay bank is in the background.

Photograph taken by Frank J. Barrett, circa 1965.

- Suggested Reading -