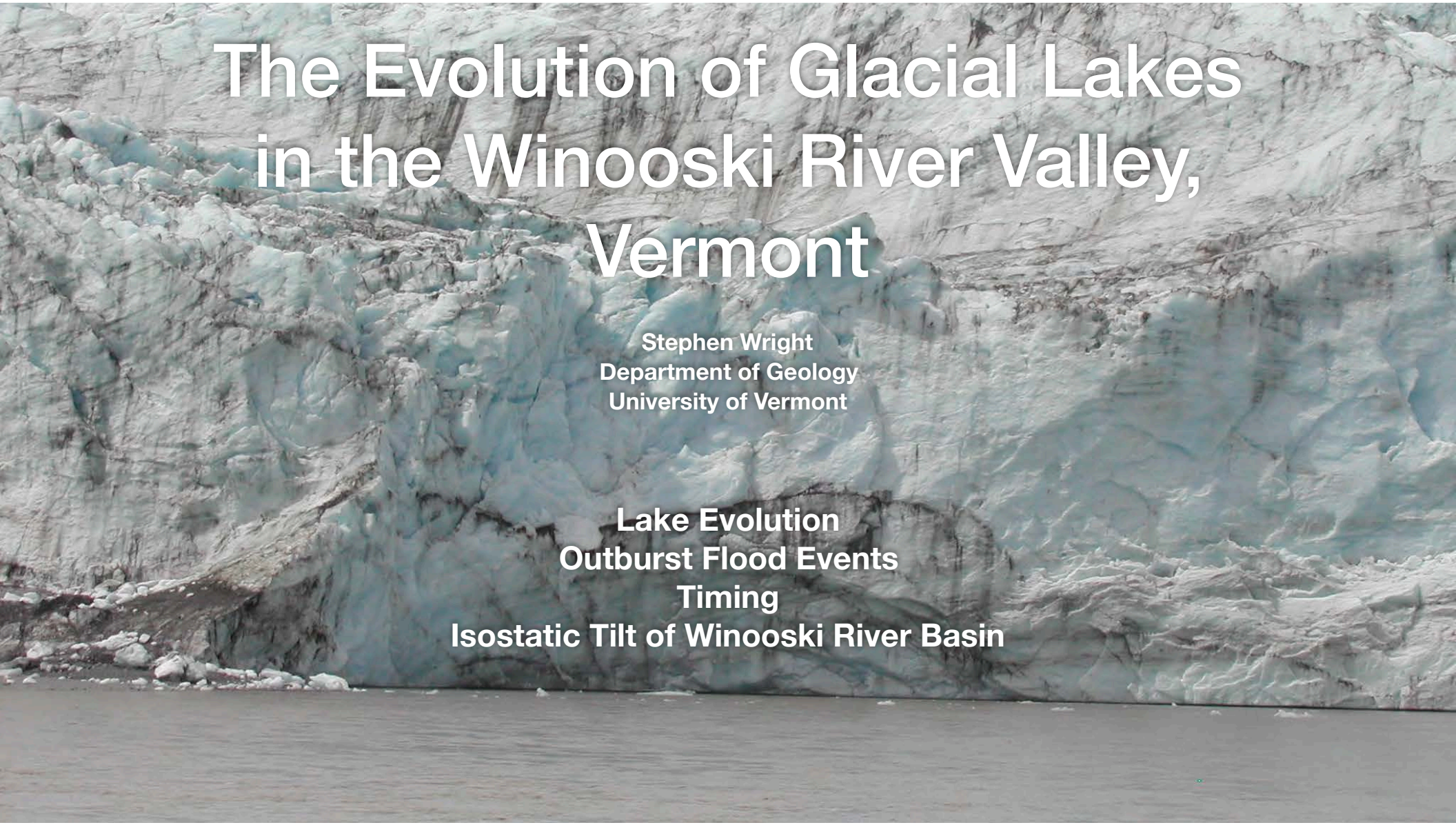
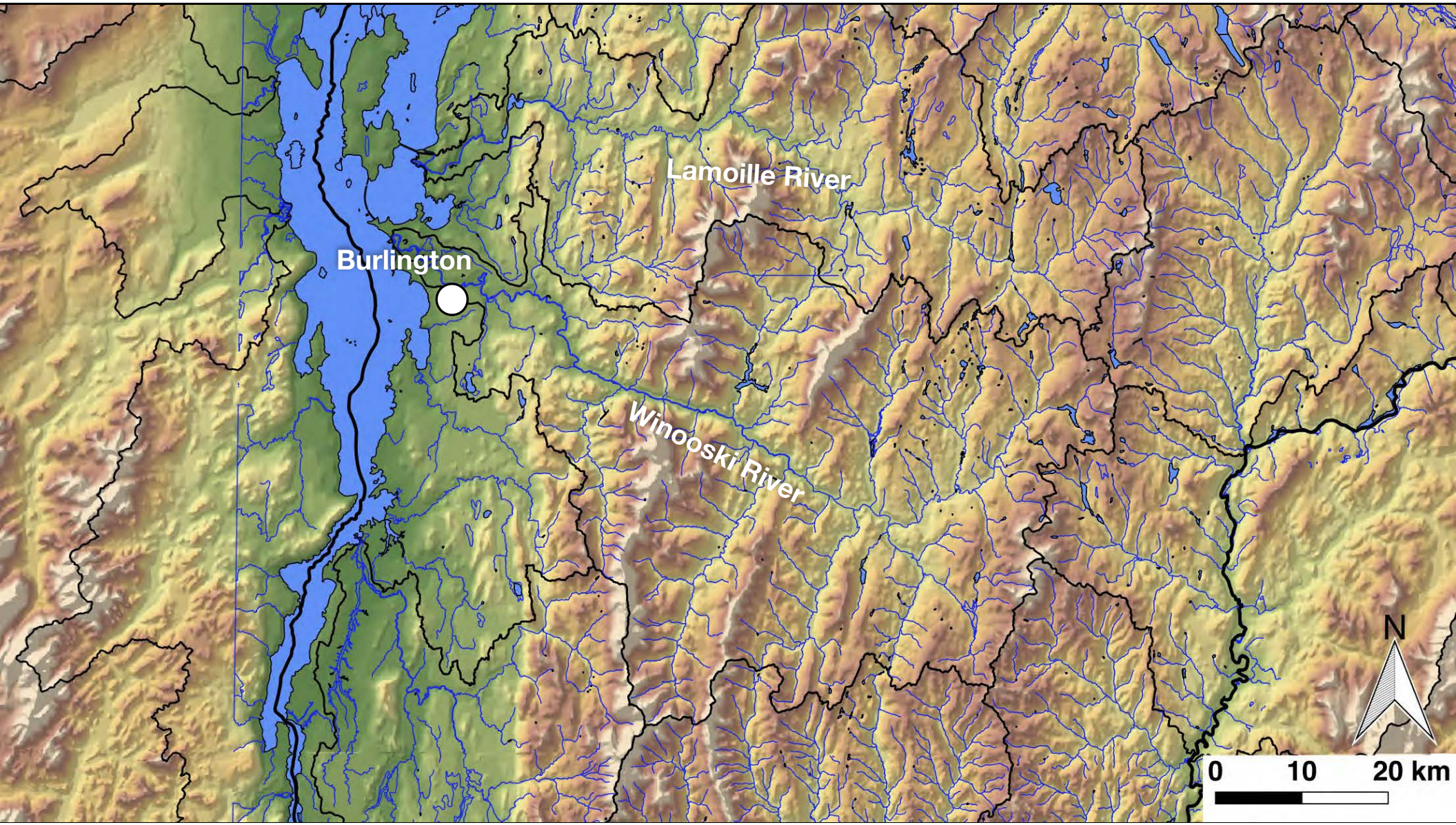
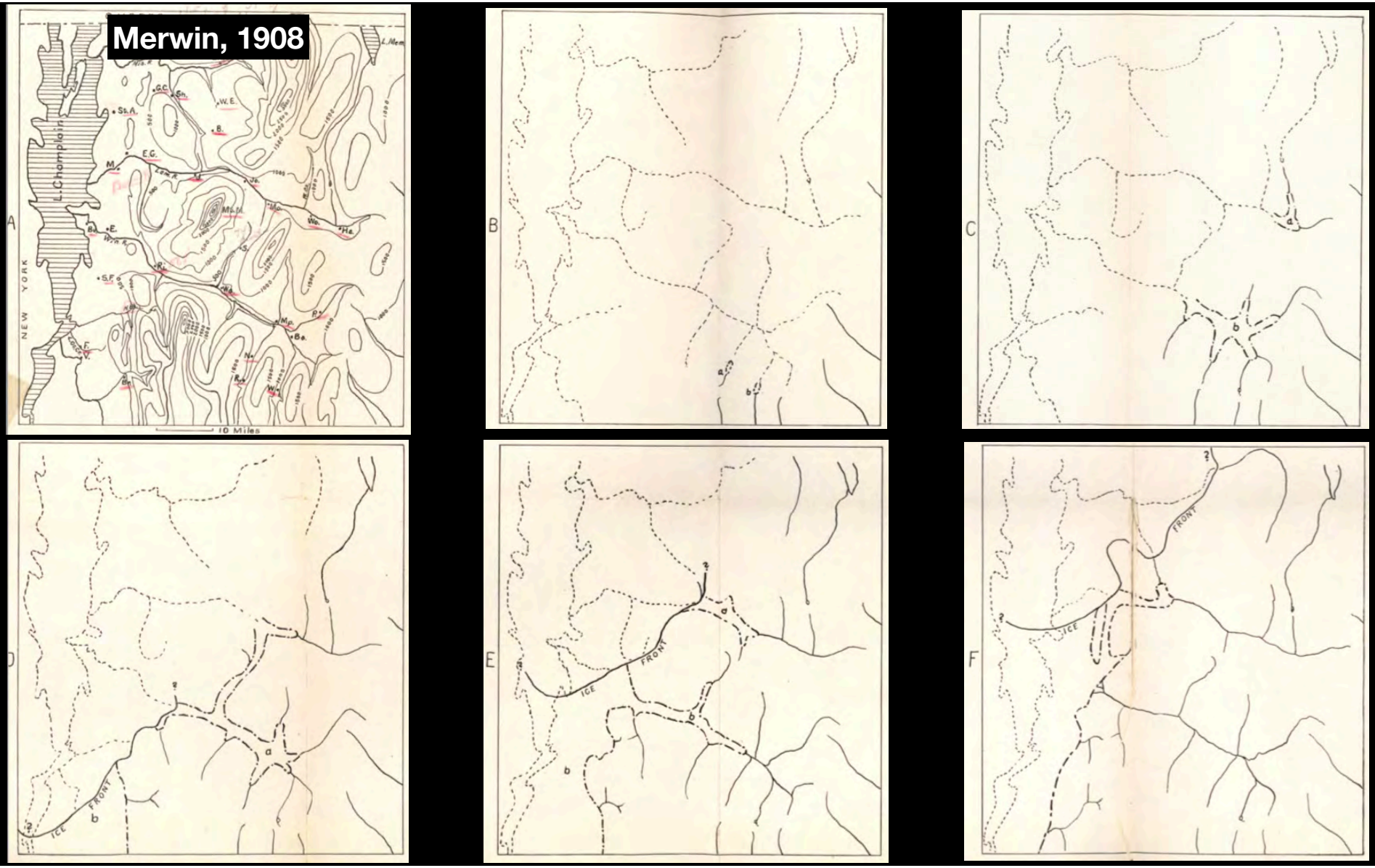


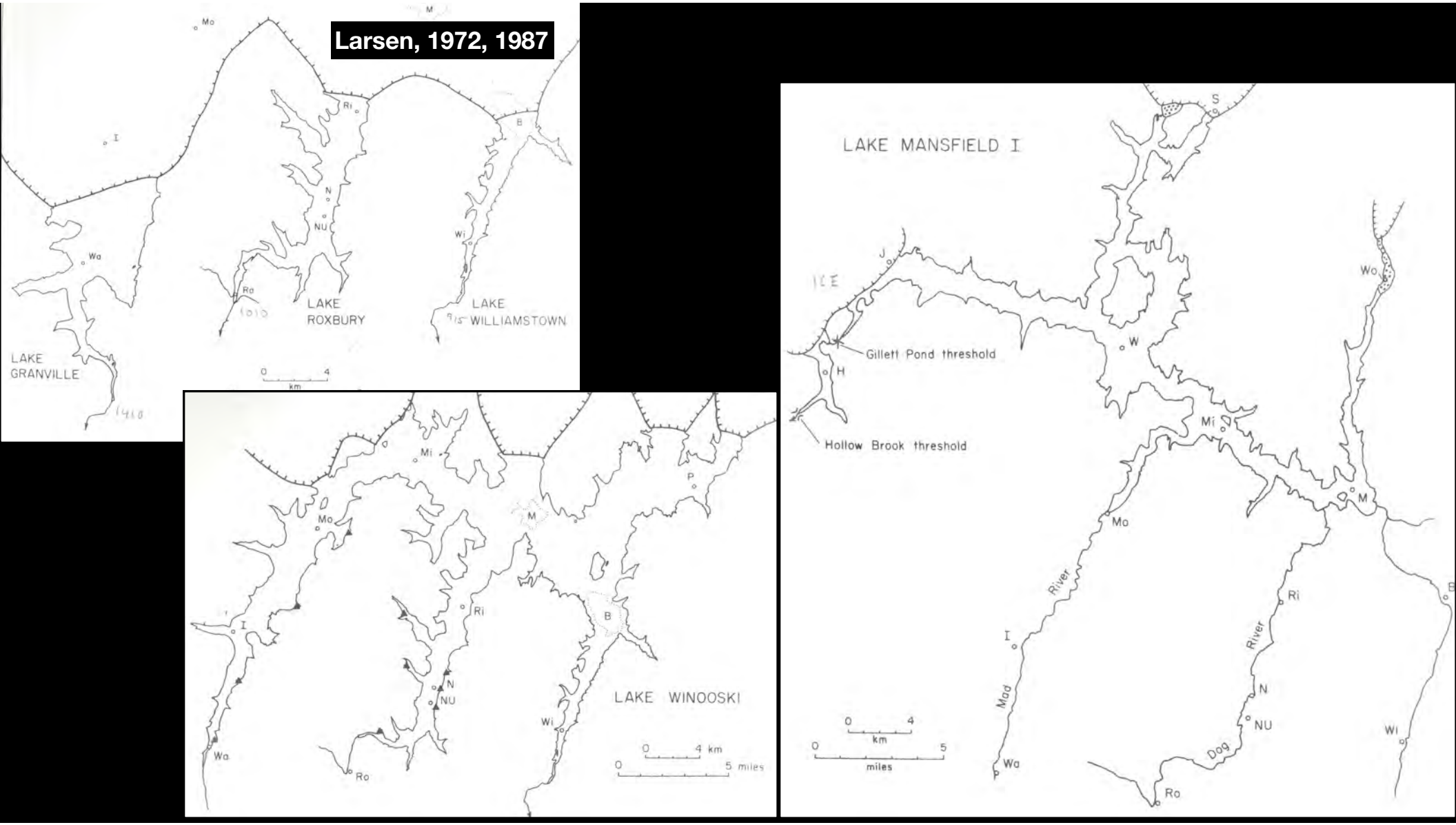
The Evolution of Glacial Lakes in the Winooski River Valley, Vermont

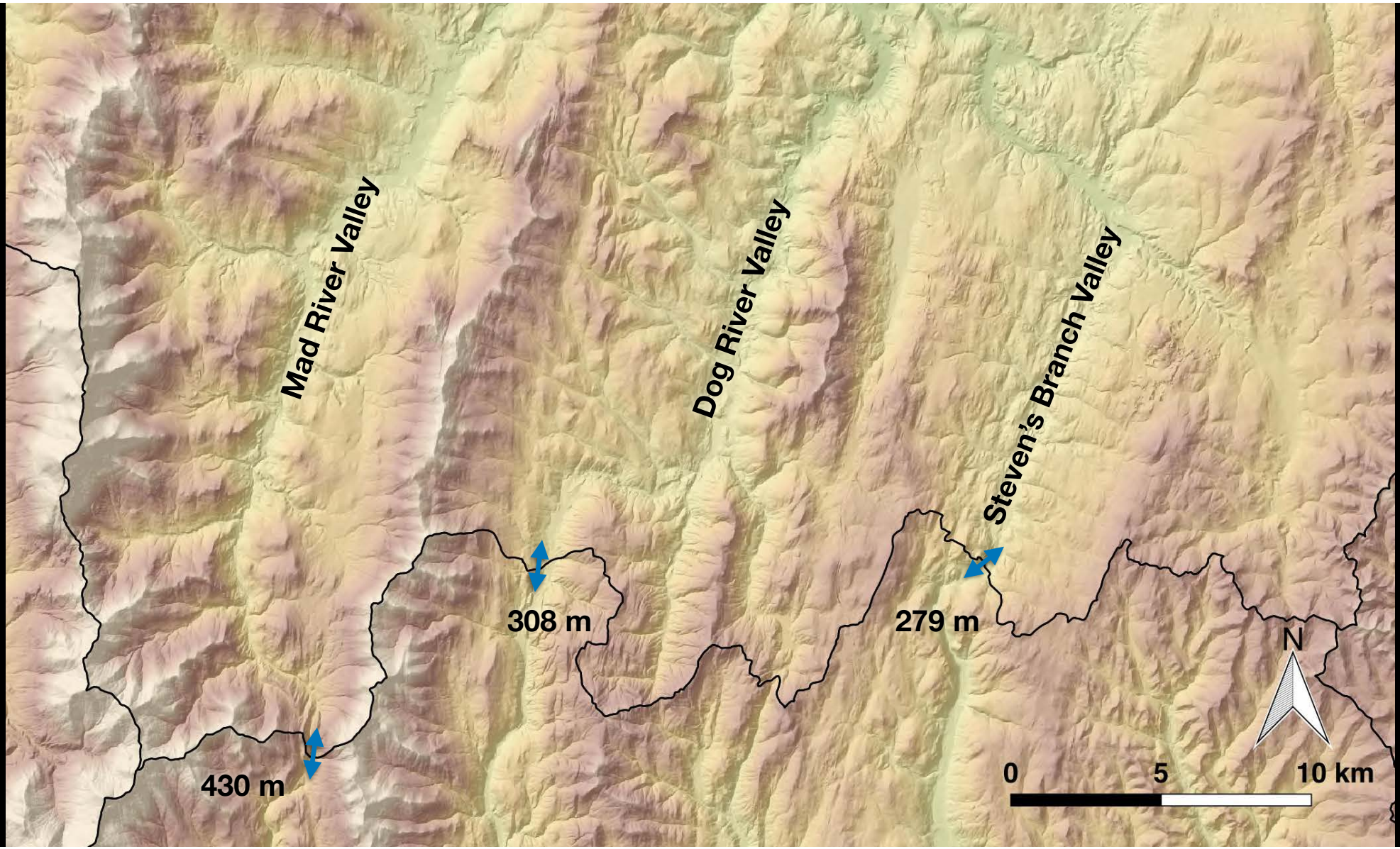
Stephen Wright
Department of Geology
University of Vermont

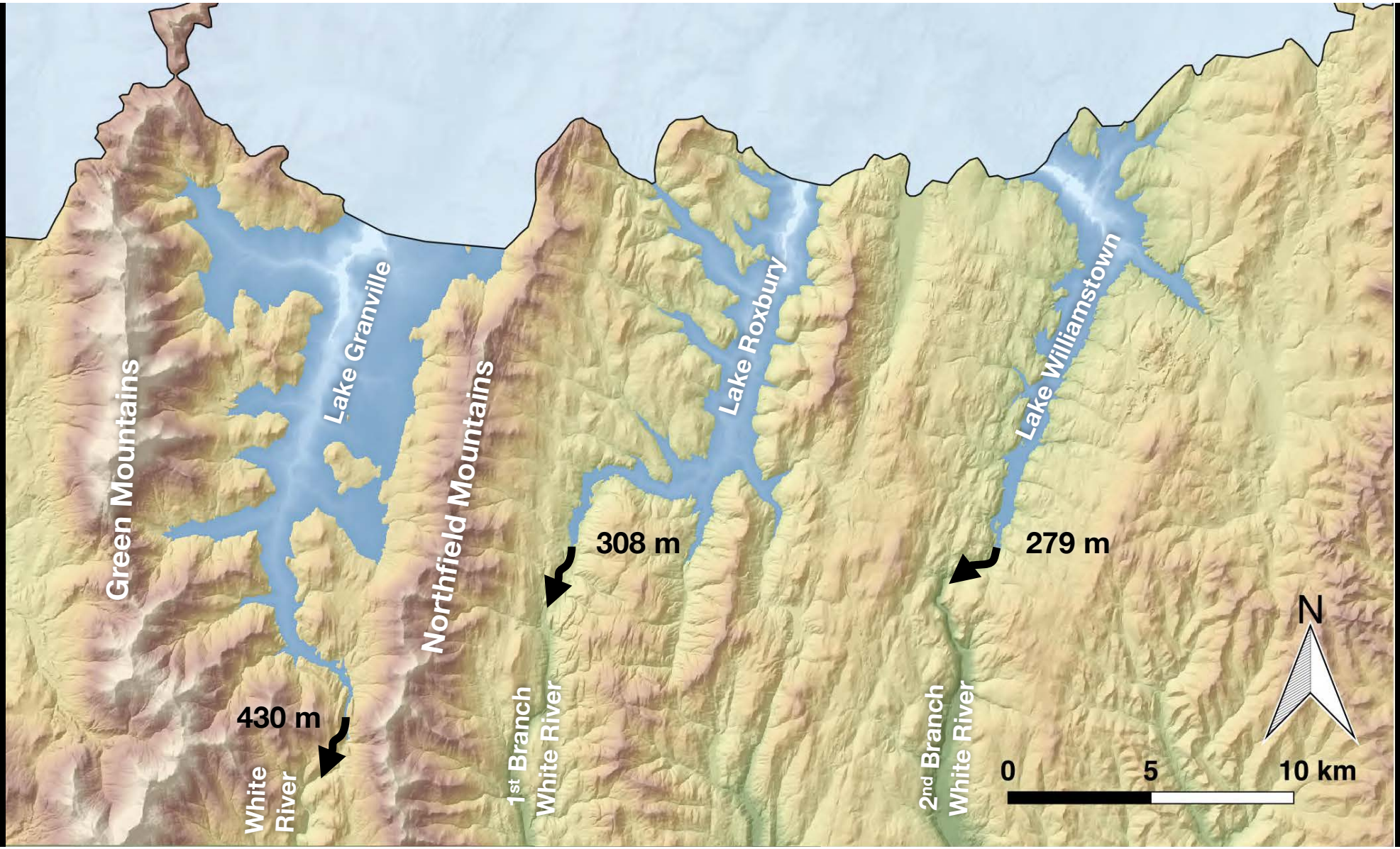
Lake Evolution
Outburst Flood Events
Timing
Isostatic Tilt of Winooski River Basin

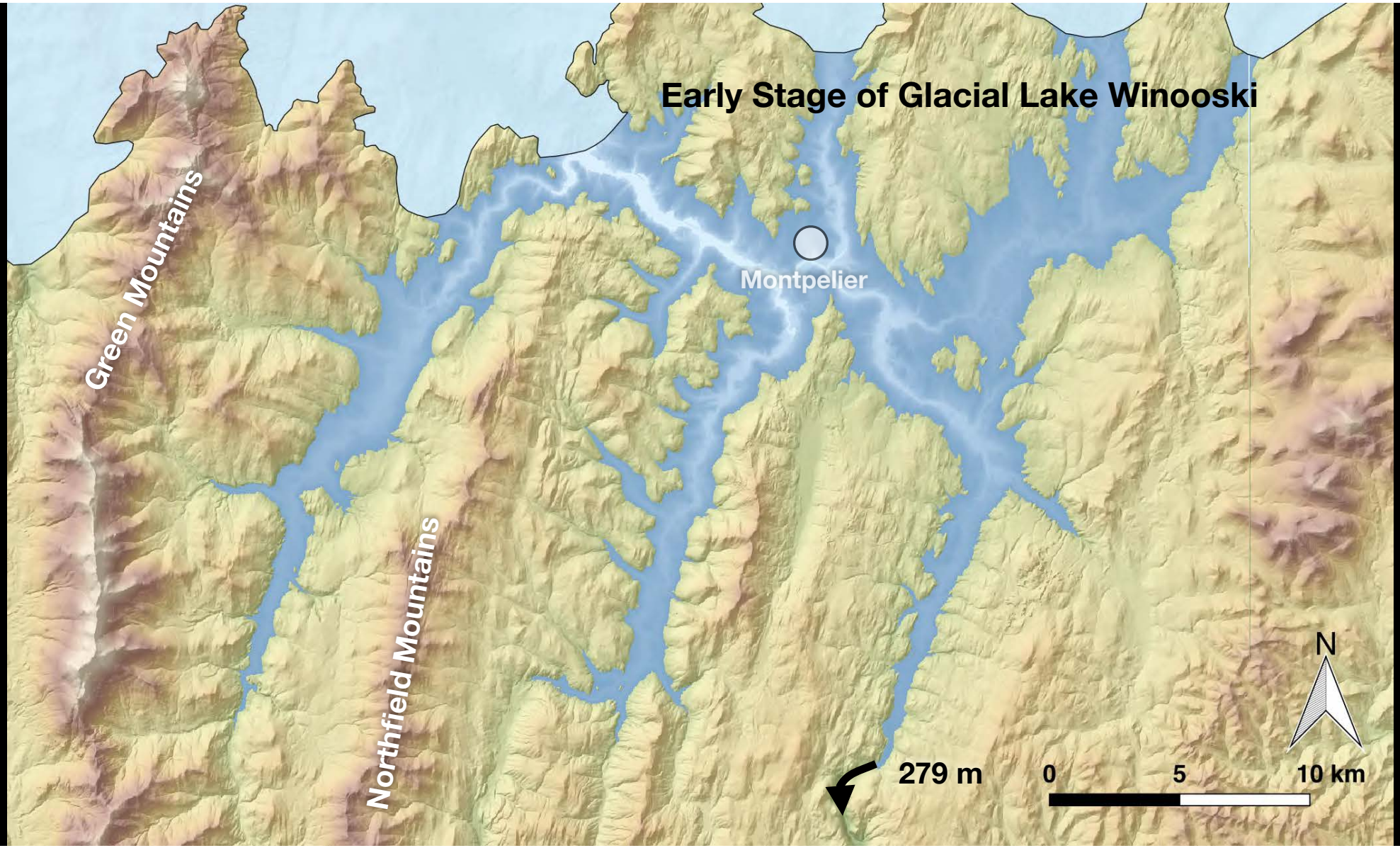

Burlington
Lamoille River
Winooski River
N
0
10
20 km


Merwin, 1908
A
B
C
D
E
F
L. Champlain
NEW YORK
10 Miles
ICE
FRONT


Larsen, 1972, 1987
LAKE GRANVILLE
LAKE ROXBURY
LAKE WILLIAMSTOWN
LAKE WINOOSKI
LAKE MANSFIELD I
Gillett Pond threshold
Hollow Brook threshold
Mad River
Dog River
0 4 km
0 5 miles

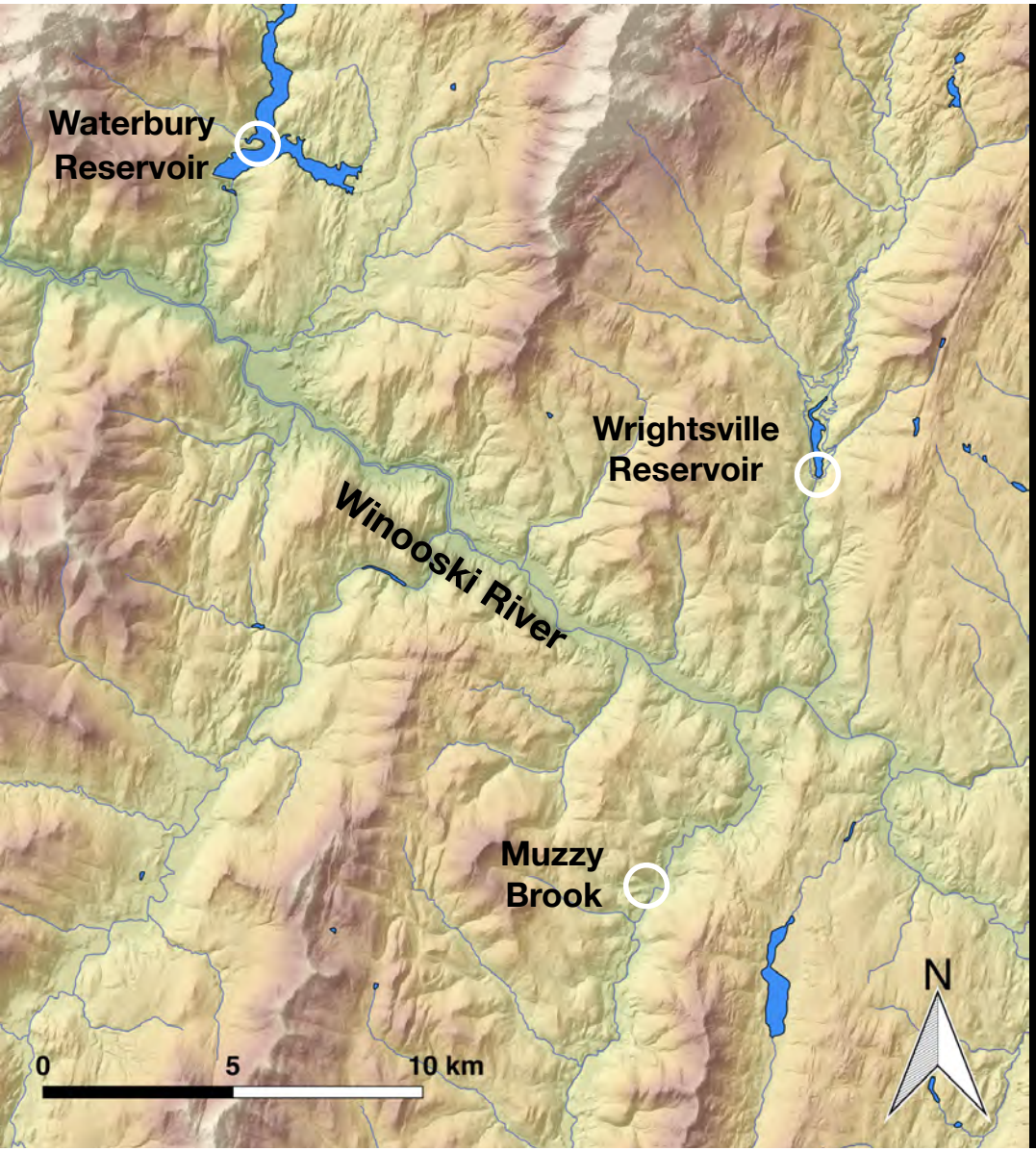

Mad River Valley
Dog River Valley
Steven's Branch Valley
430 m
308 m
279 m
N
0
5
10 km


Green Mountains
Lake Granville
Northfield Mountains
Lake Roxbury
Lake Williamstown
430 m
308 m
279 m
White River
1st Branch White River
2nd Branch White River
N
0
5
10 km


Early Stage of Glacial Lake Winooski
Green Mountains
Montpelier
Northfield Mountains
279 m
0
5
10 km
N

Maximum extent of Glacial Lake Winooski in the Winooski and Lamoille River Valleys

- Glacial Lake Winooski existed as long as the Winooski River Valley was dammed.
- Rapid northward growth of Glacial Lake Winooski east of the mountains indicates how quickly the ice sheet was retreating east of the mountains compared to ice in the Champlain Valley.

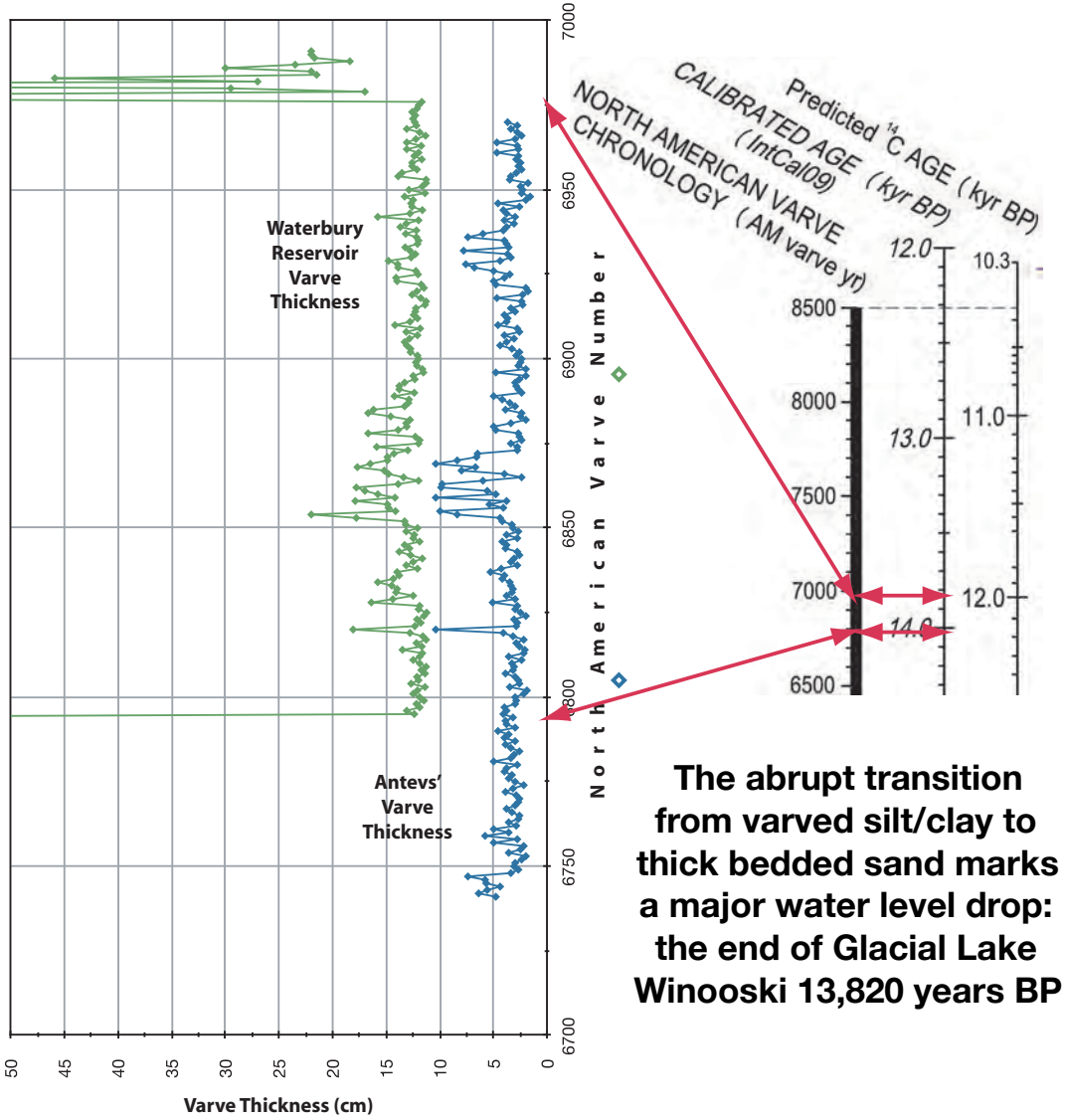


Measured Varve Sections

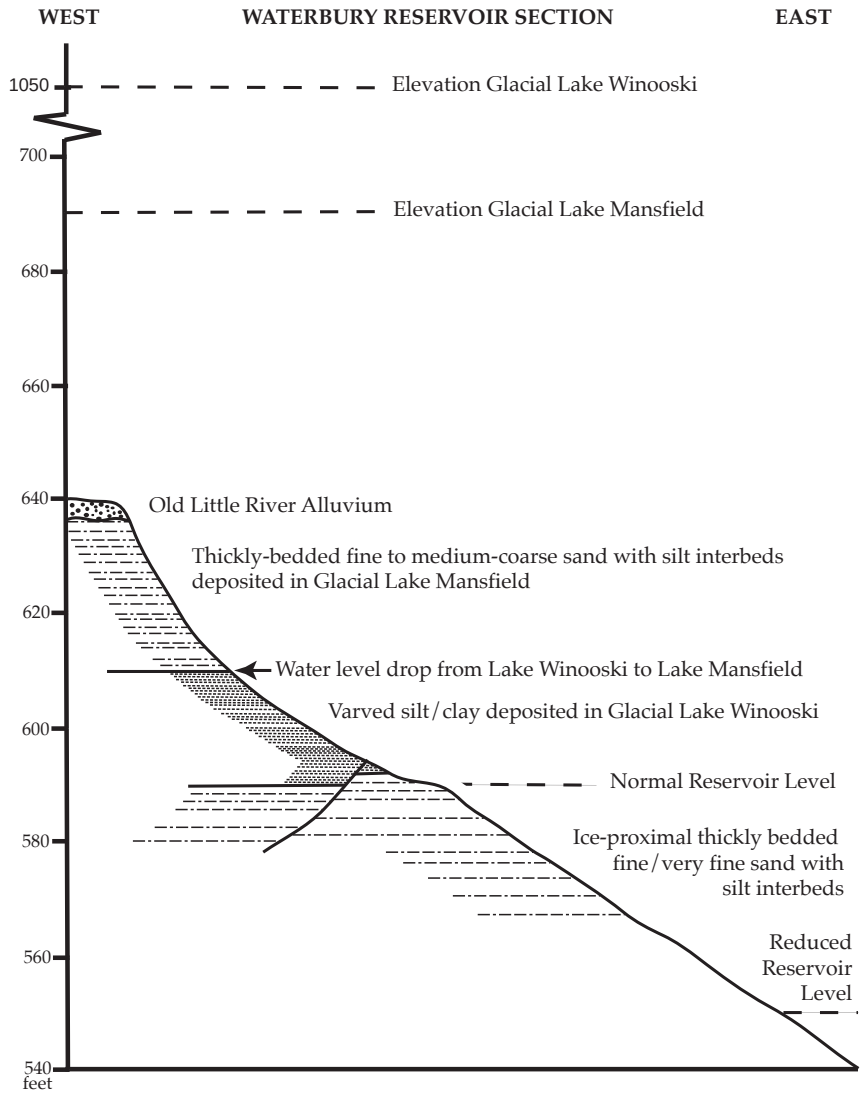
- Three good measured varve sections
- Timing of Glacial Lake Winooski
  - Varve sections correlated to the North American Varve Chronology
  - Ice-Proximal varves deposited at Muzzy Brook ~14,100 years BP
  - Glacial Lake Winooski partially drains ~13,820 years BP
  - Lake duration ~280 years
- Ice Sheet Retreat Rate
  - Muzzy Brook to Wrightsville Reservoir
  - 11,700 m/132 years
  - ~89 m/year
- Ice Sheet Retreat Rate
  - Muzzy Brook to Waterbury Reservoir
  - ~125 years
- Conclusion
  - Wrightsville and Waterbury Reservoirs deglaciated at about the same time
  - The ice sheet east of the mountains retreated rapidly northward up these tributary valleys

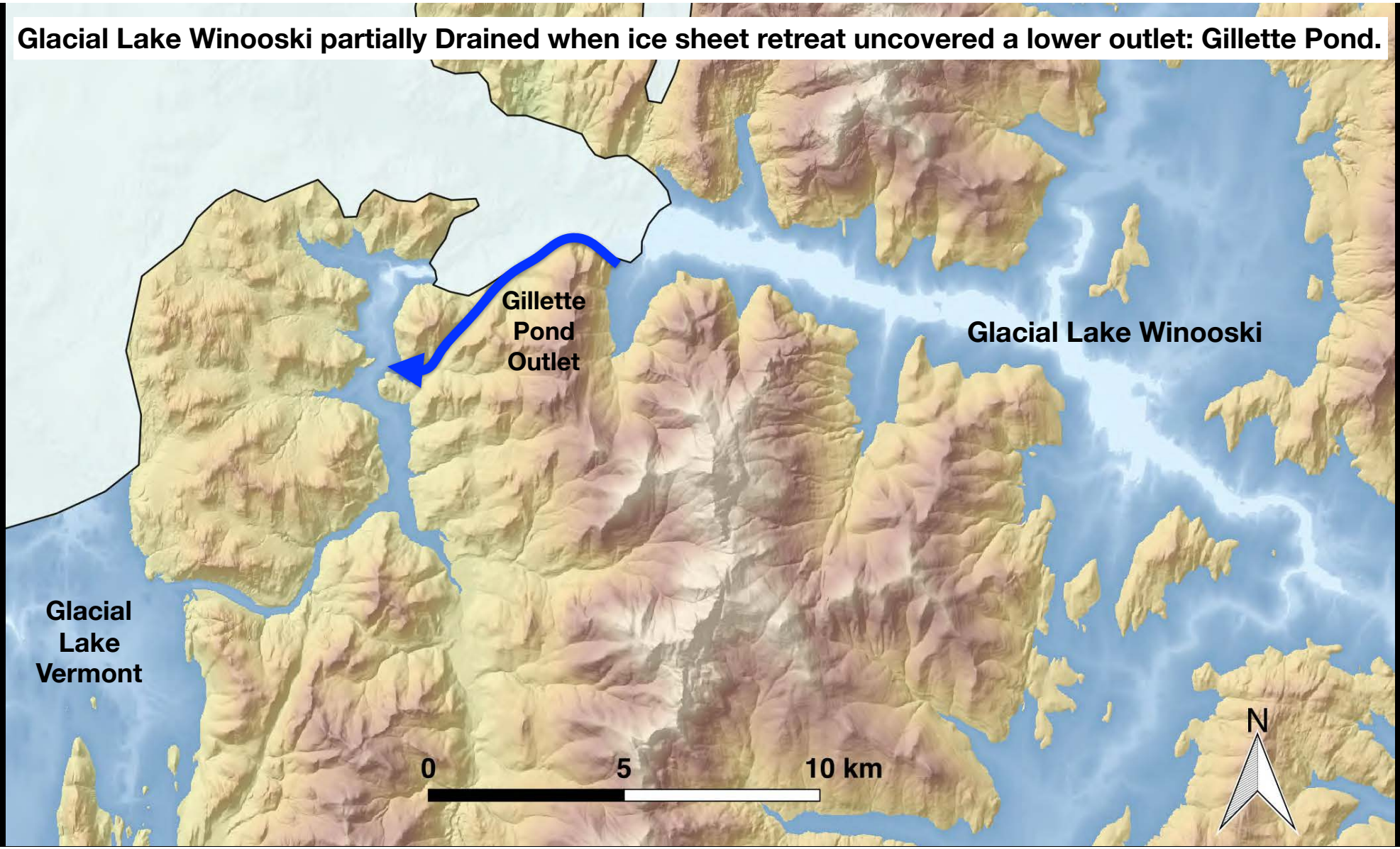

Measured
Section

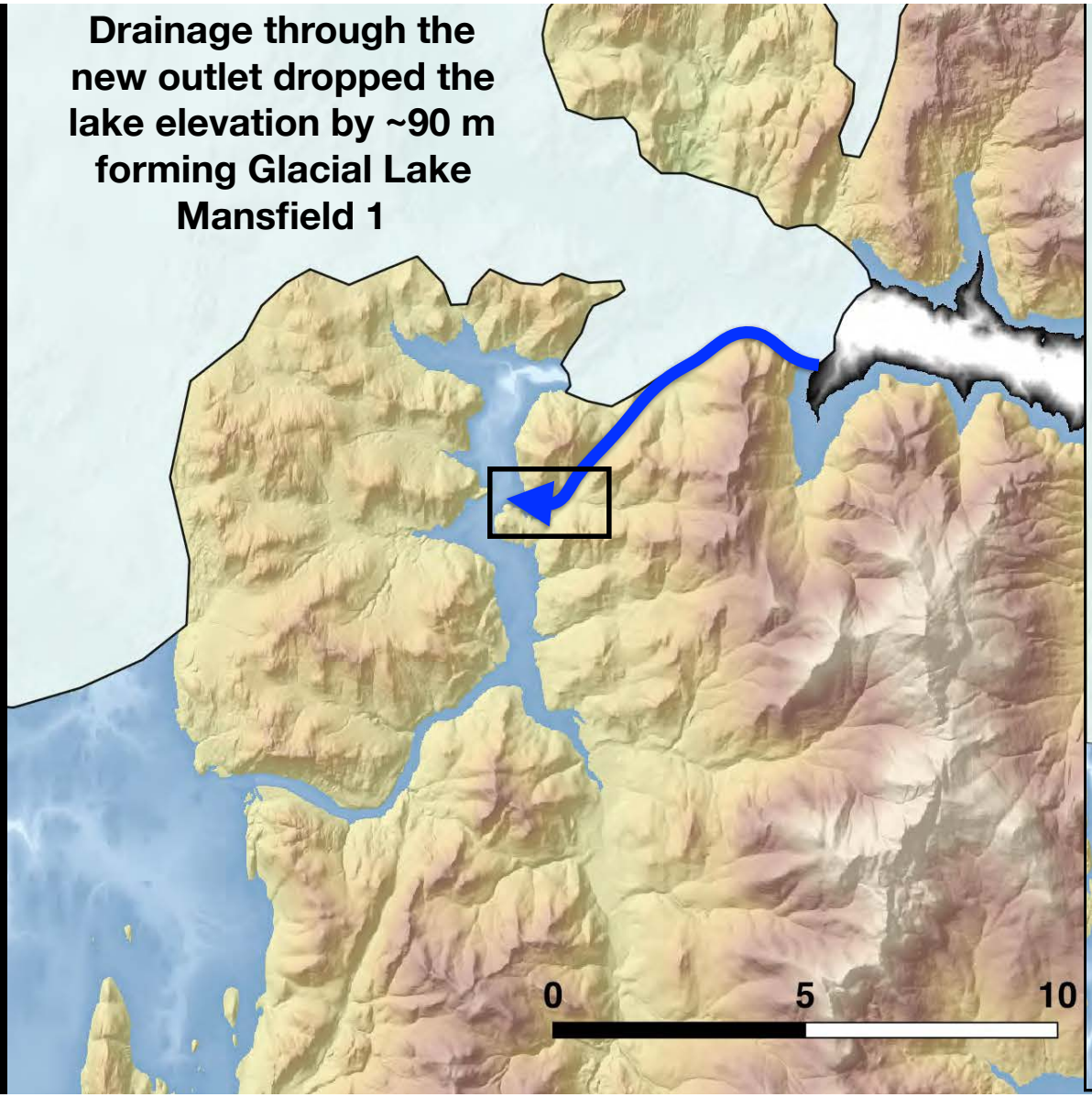
Correlation of Waterbury Reservoir Varves with the North American Varve Chronology

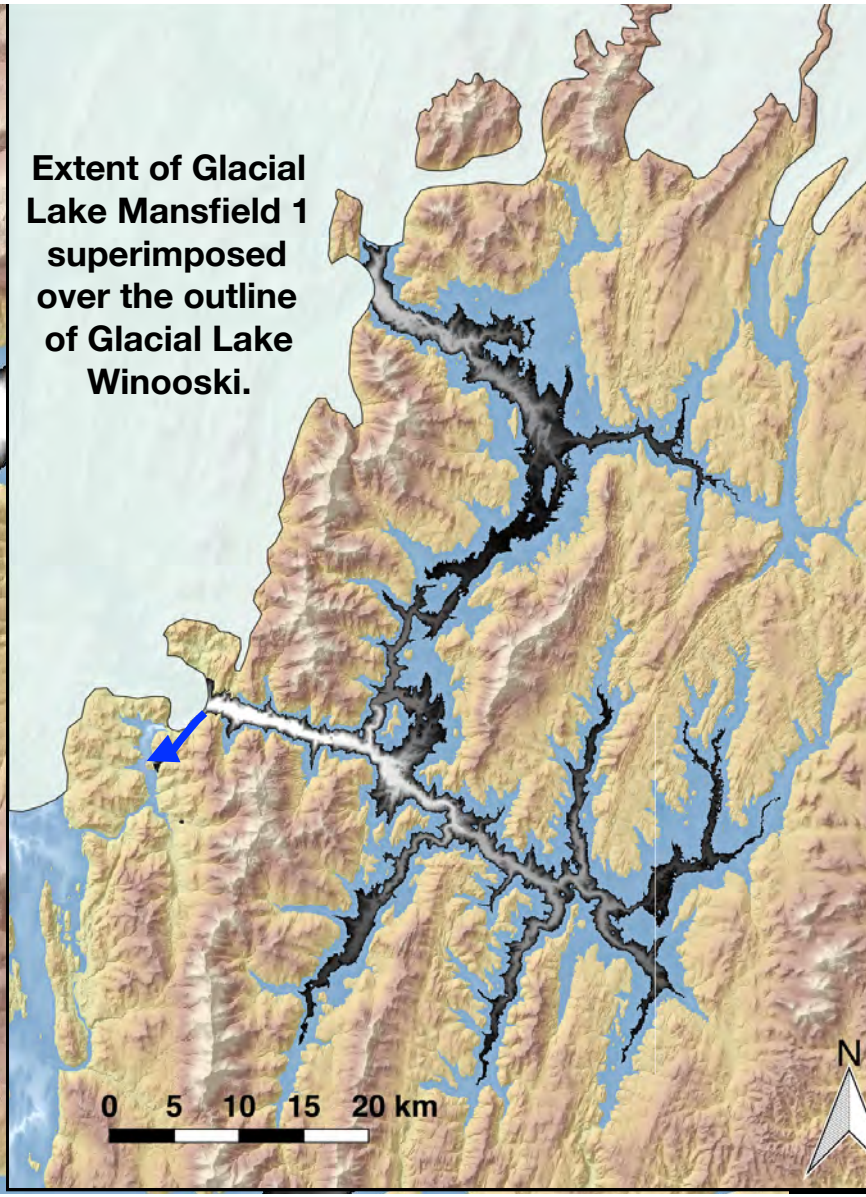


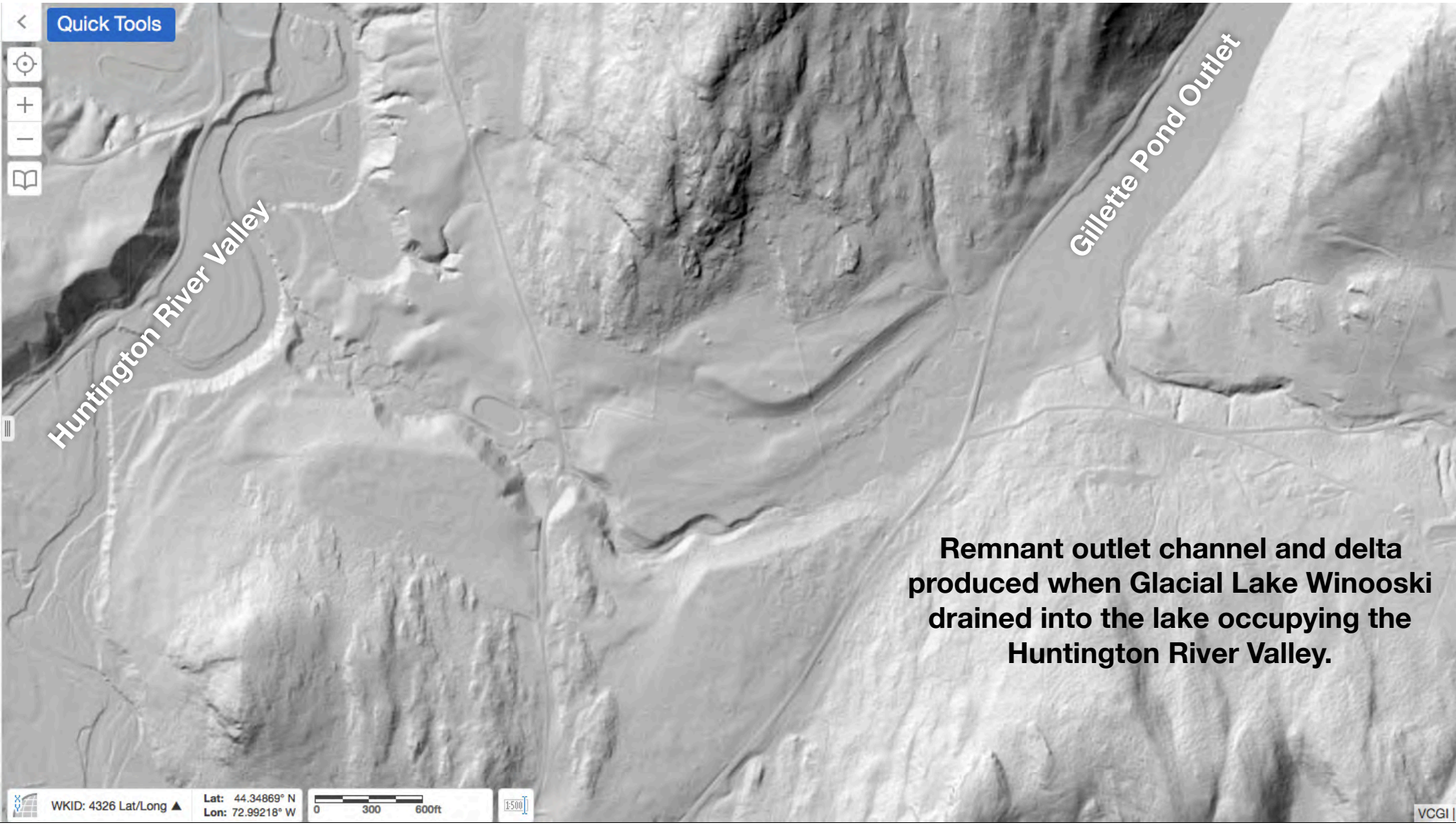
The abrupt transition from varved silt/clay to thick bedded sand marks a major water level drop: the end of Glacial Lake Winooski 13,820 years BP




Glacial Lake Winooski partially Drained when ice sheet retreat uncovered a lower outlet: Gillette Pond.
Gillette
Pond
Outlet
Glacial Lake Winooski
Glacial
Lake
Vermont
0
5
10 km
N


Drainage through the new outlet dropped the lake elevation by ~90 m forming Glacial Lake Mansfield 1
0
5
10

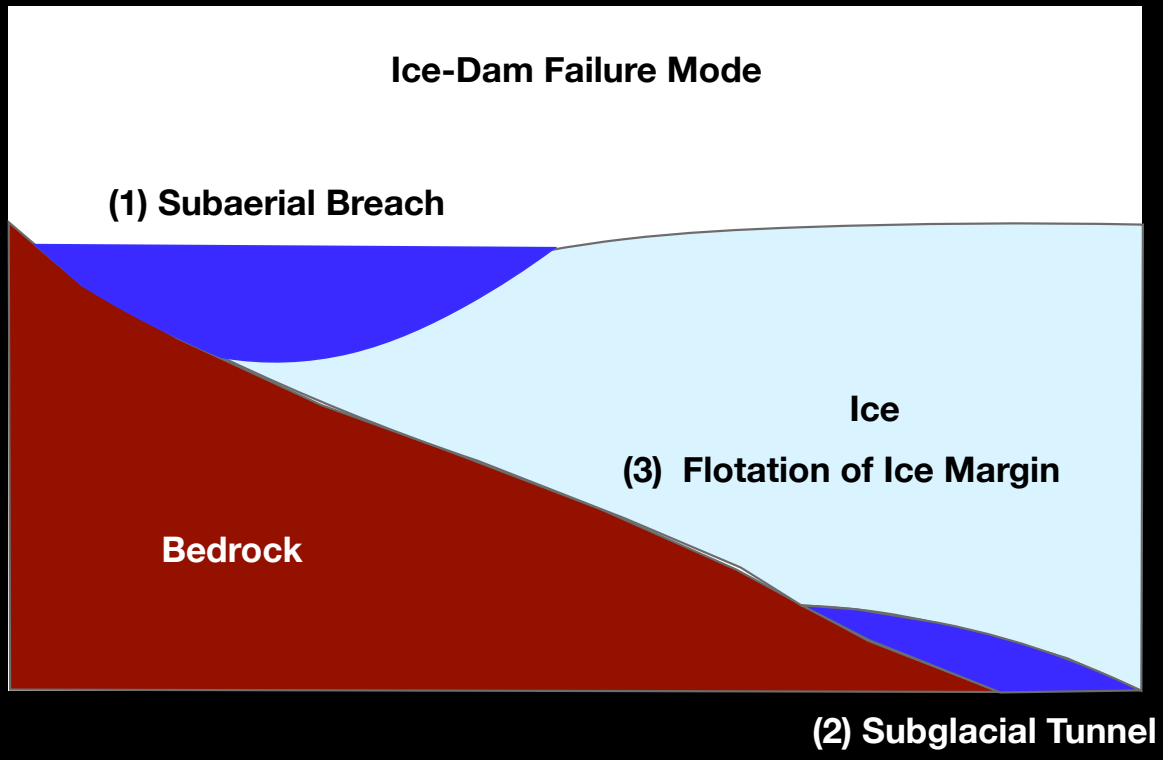

Extent of Glacial Lake Mansfield 1 superimposed over the outline of Glacial Lake Winooski.
0 5 10 15 20 km
N



Remnant outlet channel and delta produced when Glacial Lake Winooski drained into the lake occupying the Huntington River Valley.

Flood Volume Estimate

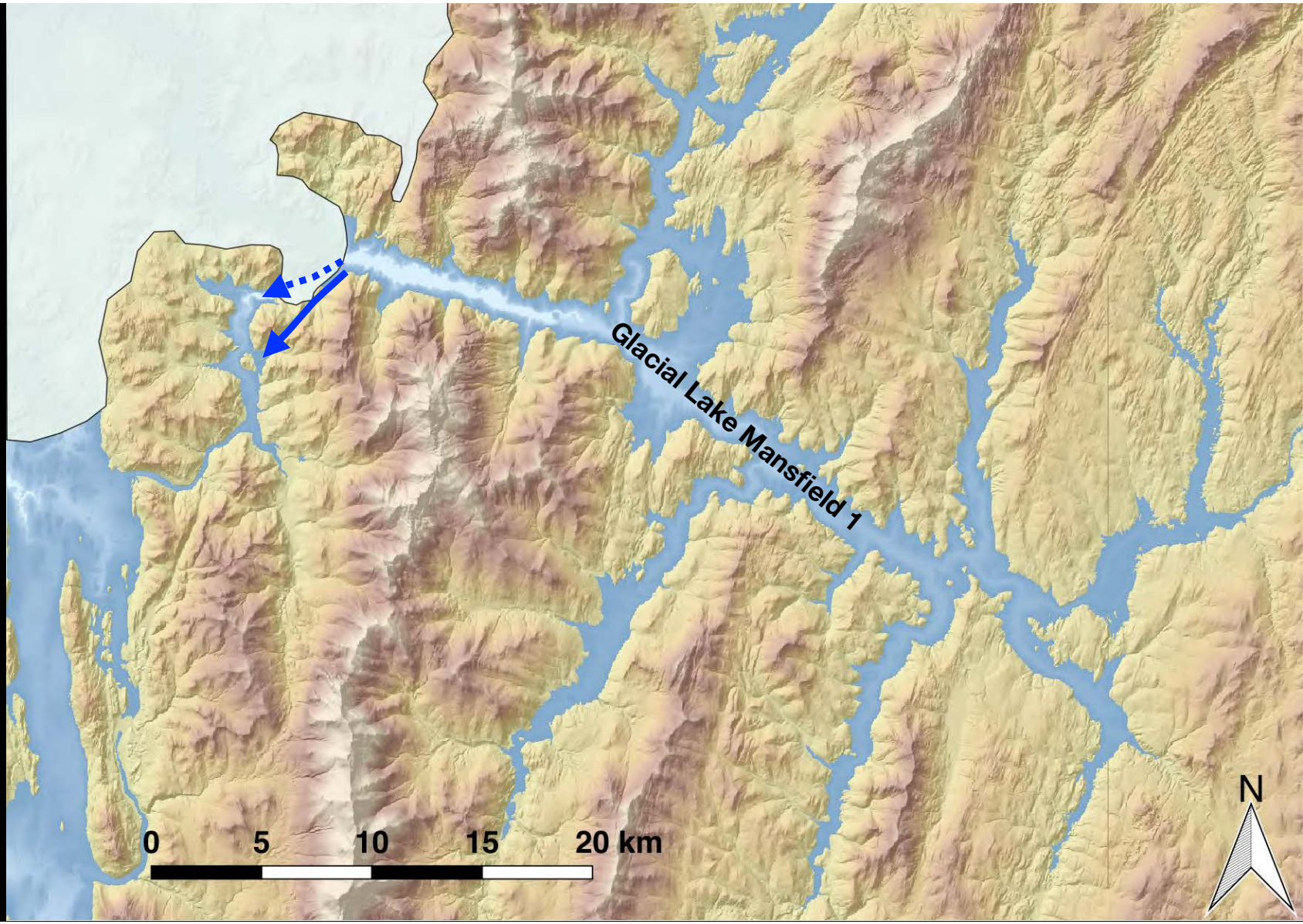
- Volume of Glacial Lake Winooski
  - 1,206 km^3
- Volume of Glacial Lake Mansfield 1
  - 829 km^3
- Flood Volume
  - 377 km^3

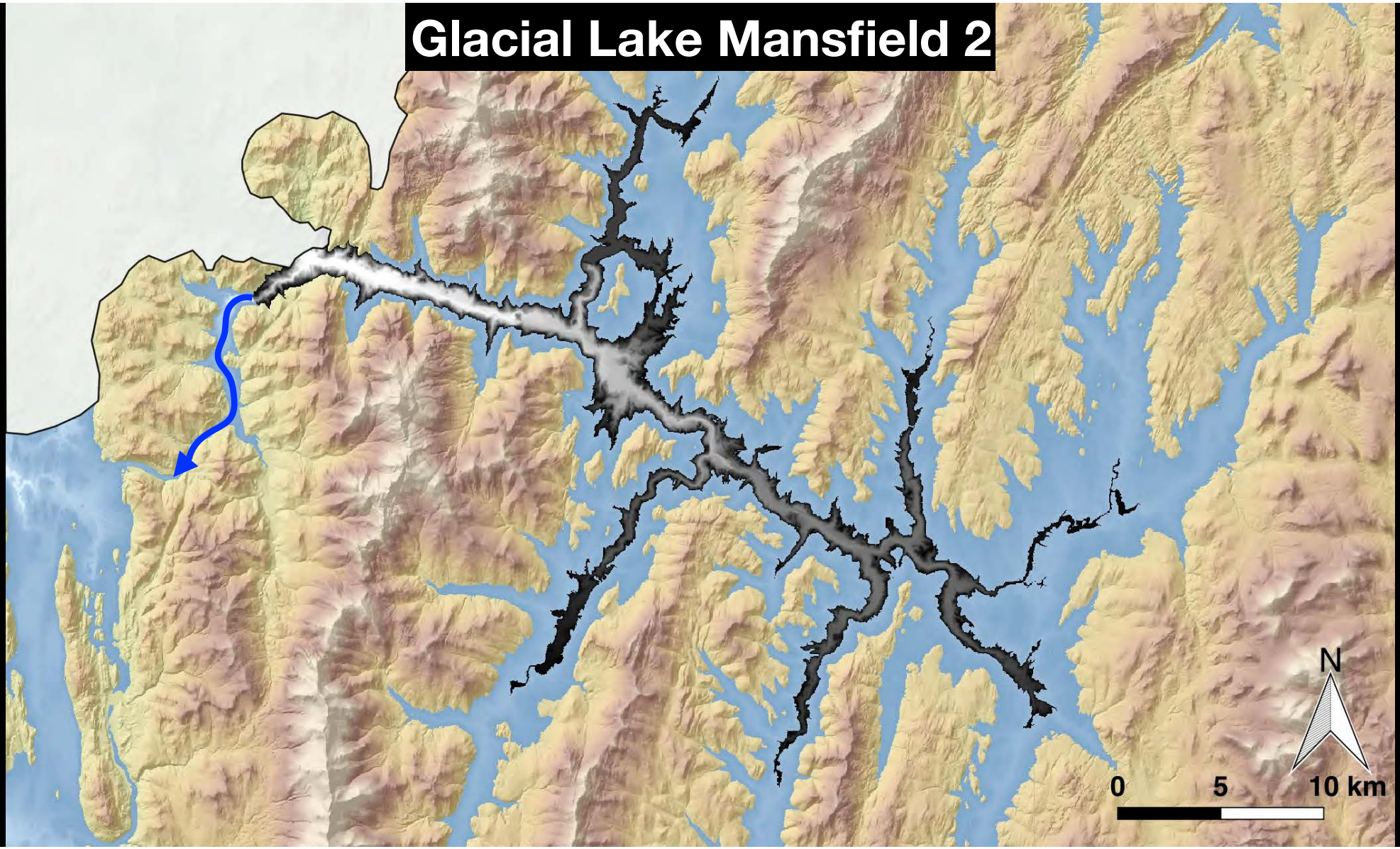


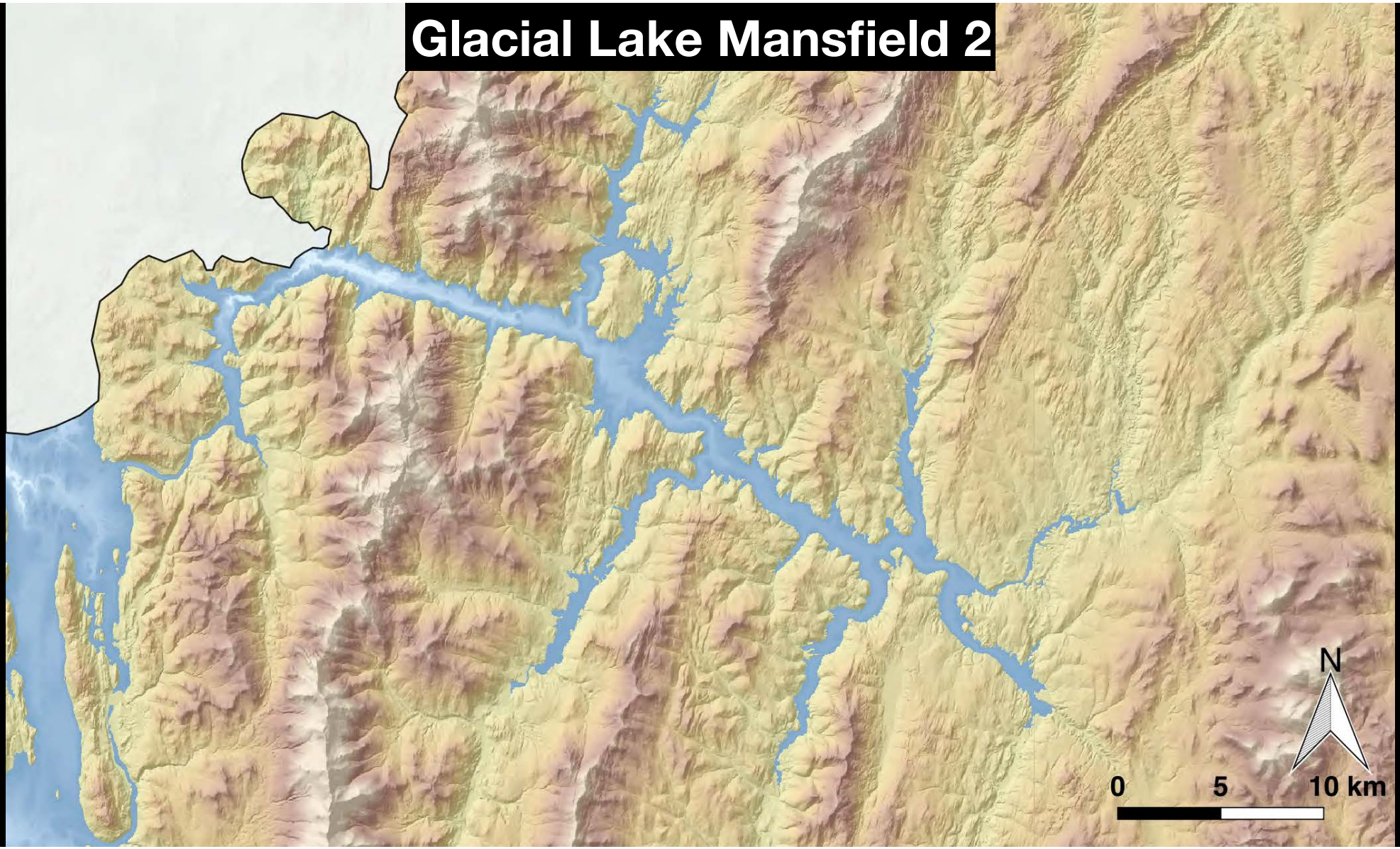
Transition from Glacial Lake Mansfield 1 to Glacial Lake Mansfield 2

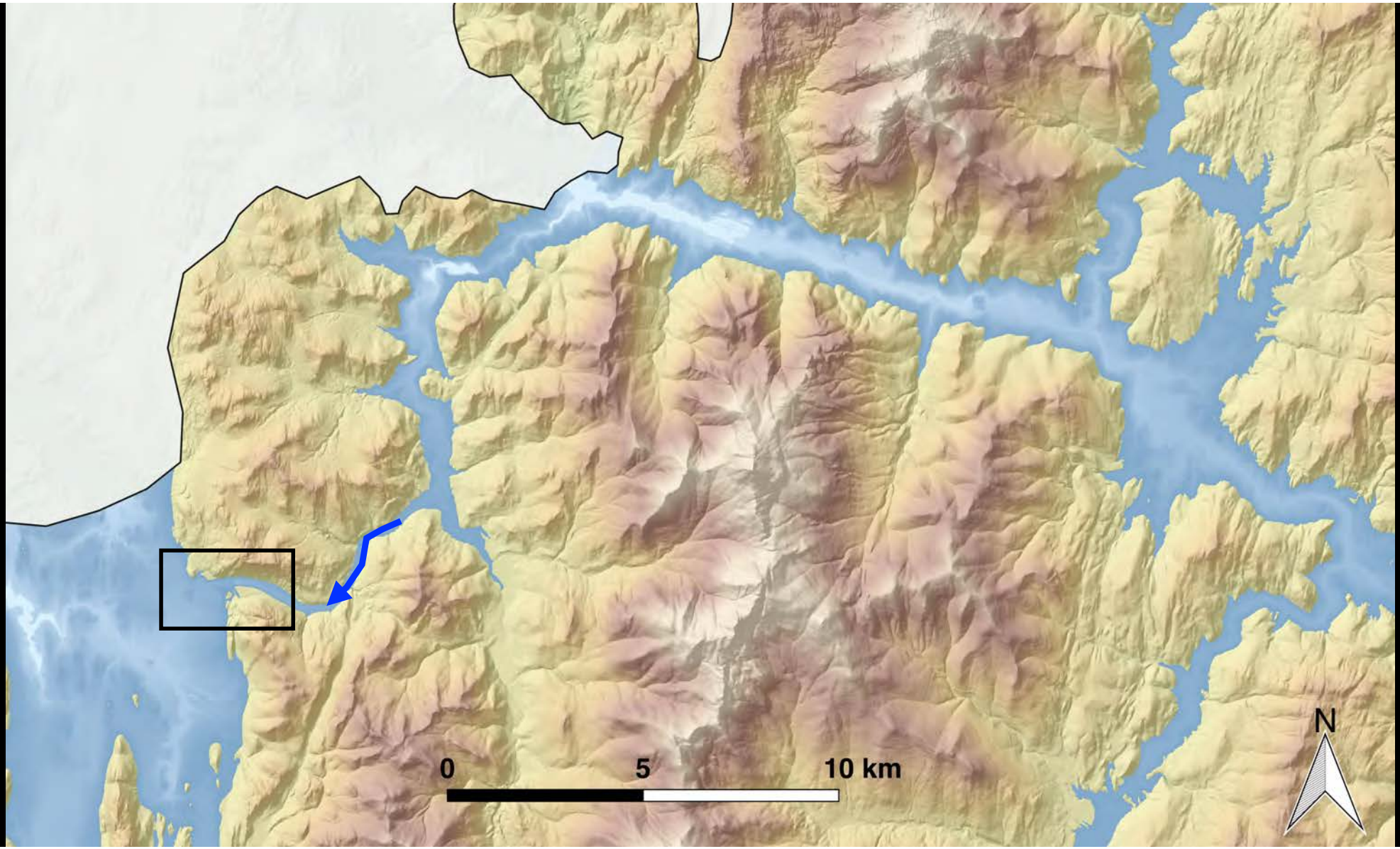
Relatively little additional retreat of the ice sheet uncovers a lower outlet through the Huntington River Valley.

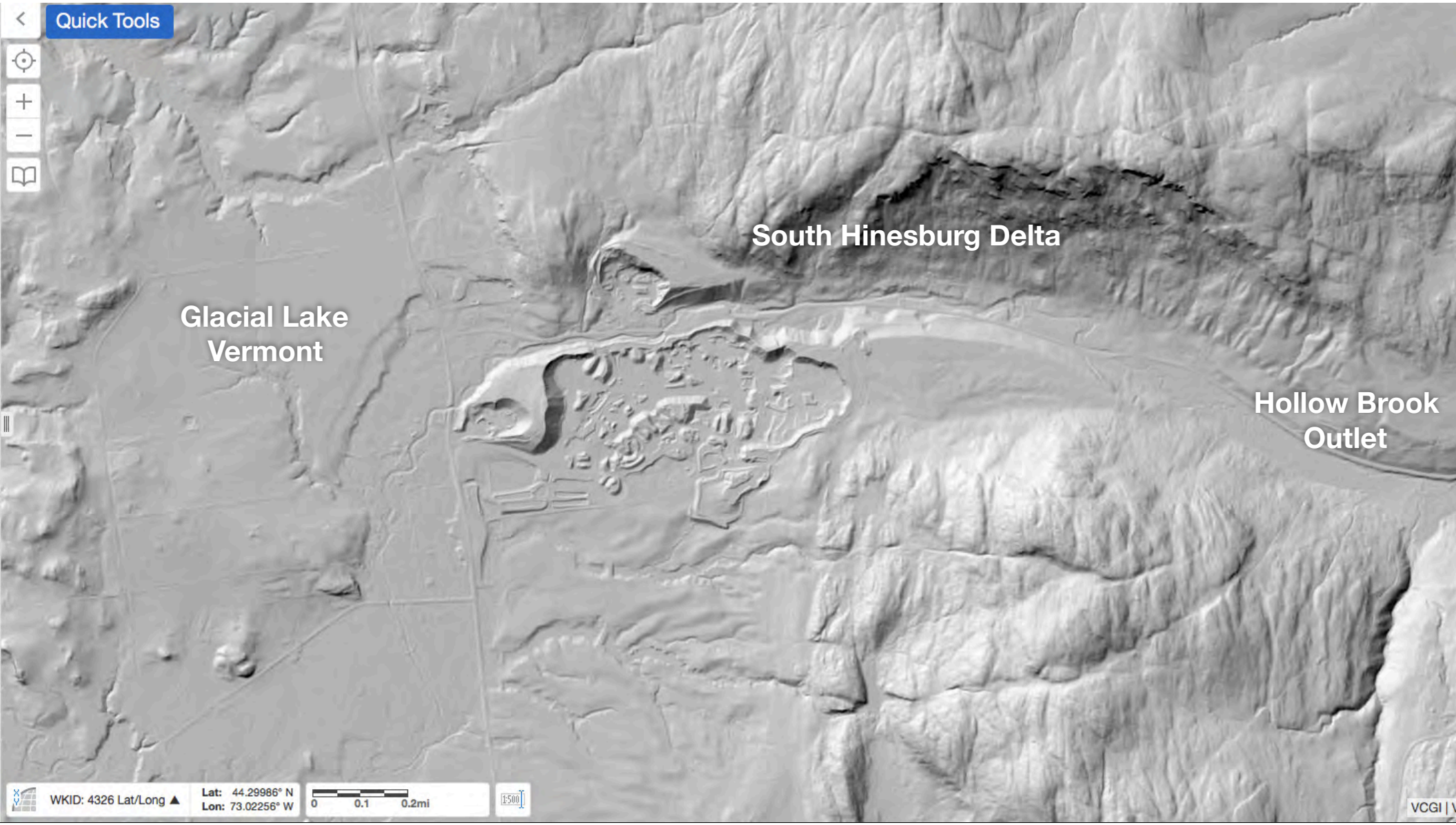
Lake level drops another 26 m.



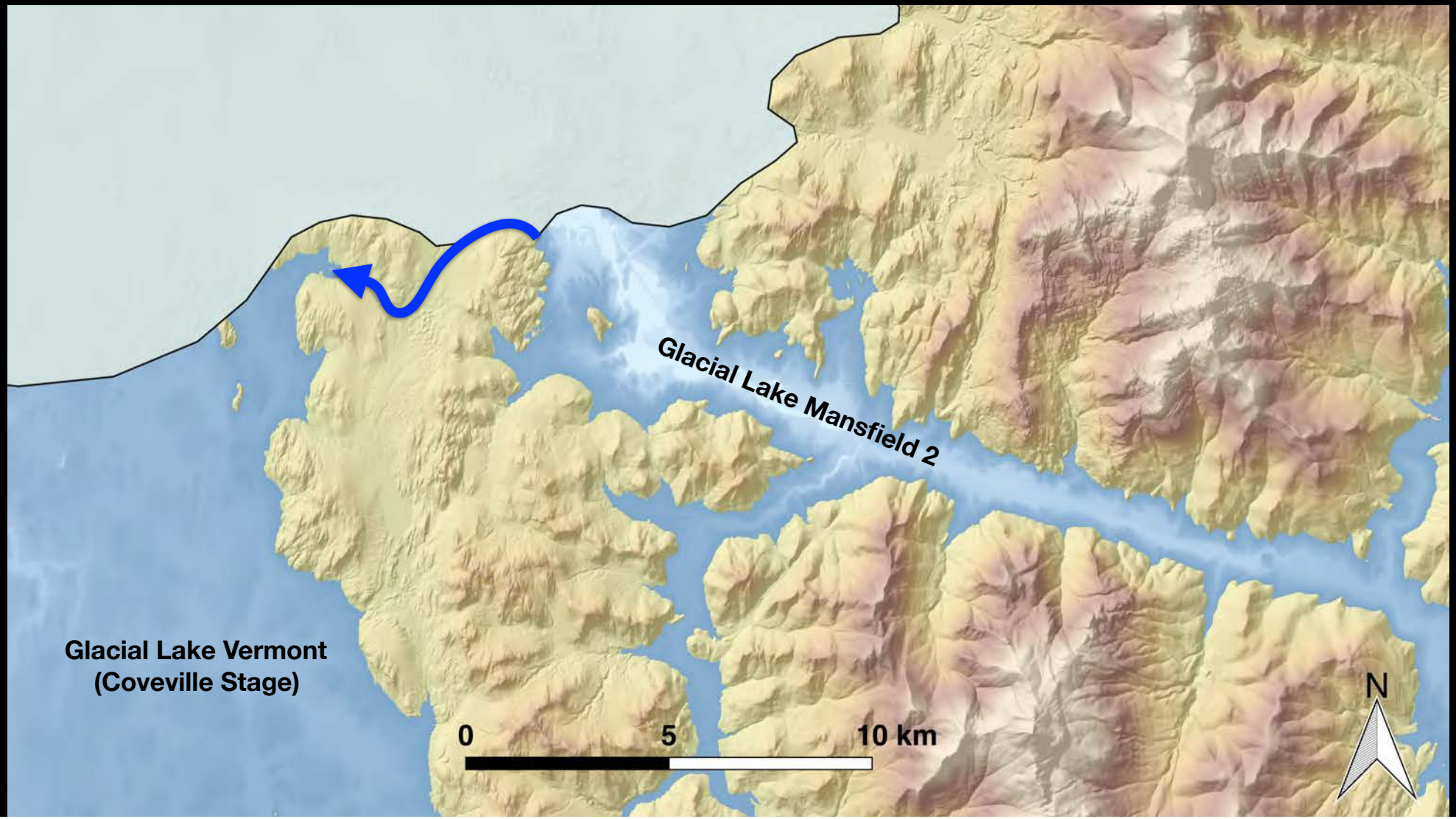

Glacial Lake Mansfield 2
N
0
5
10 km

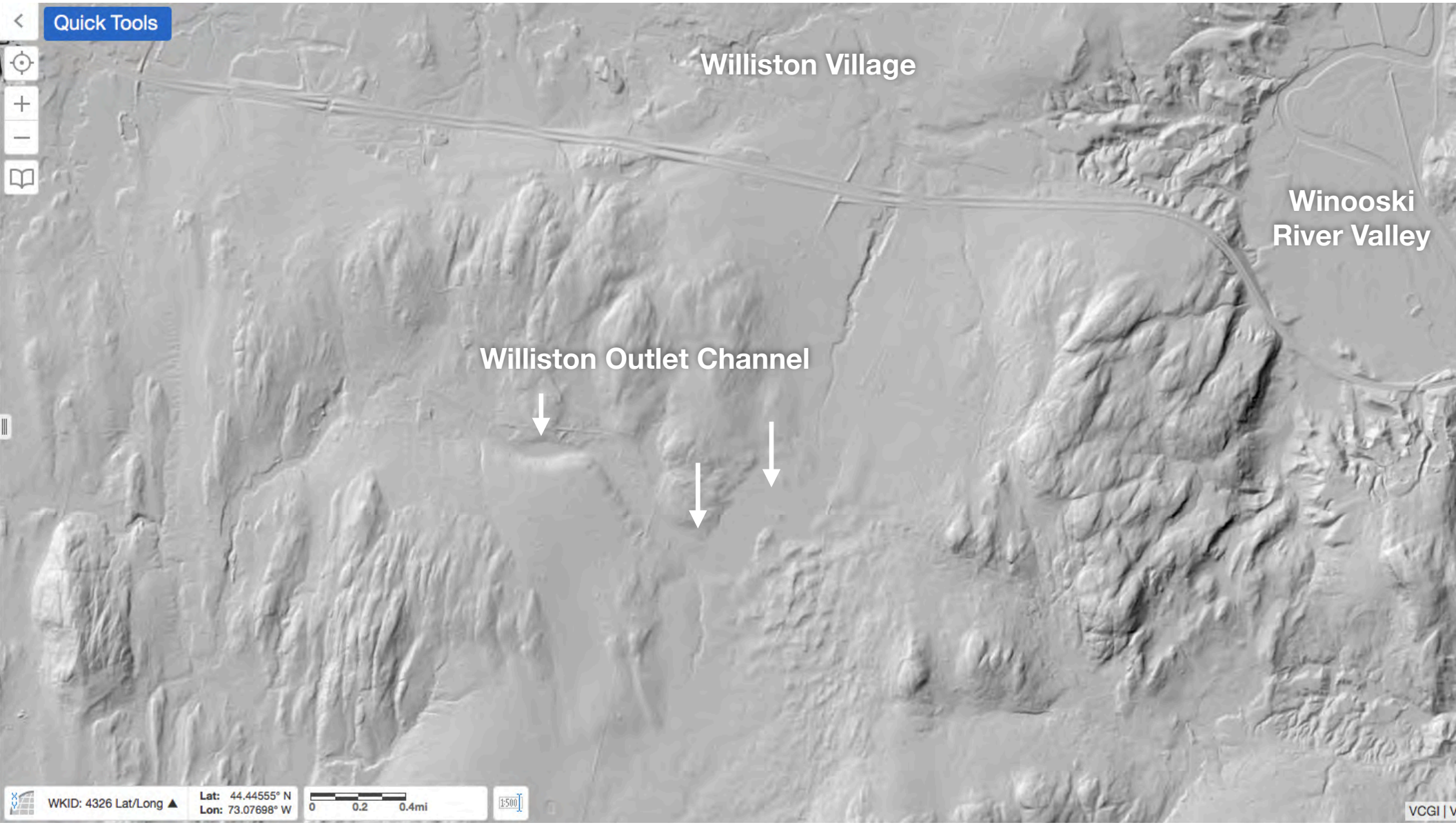

Glacial Lake Mansfield 2
N
0
5
10 km

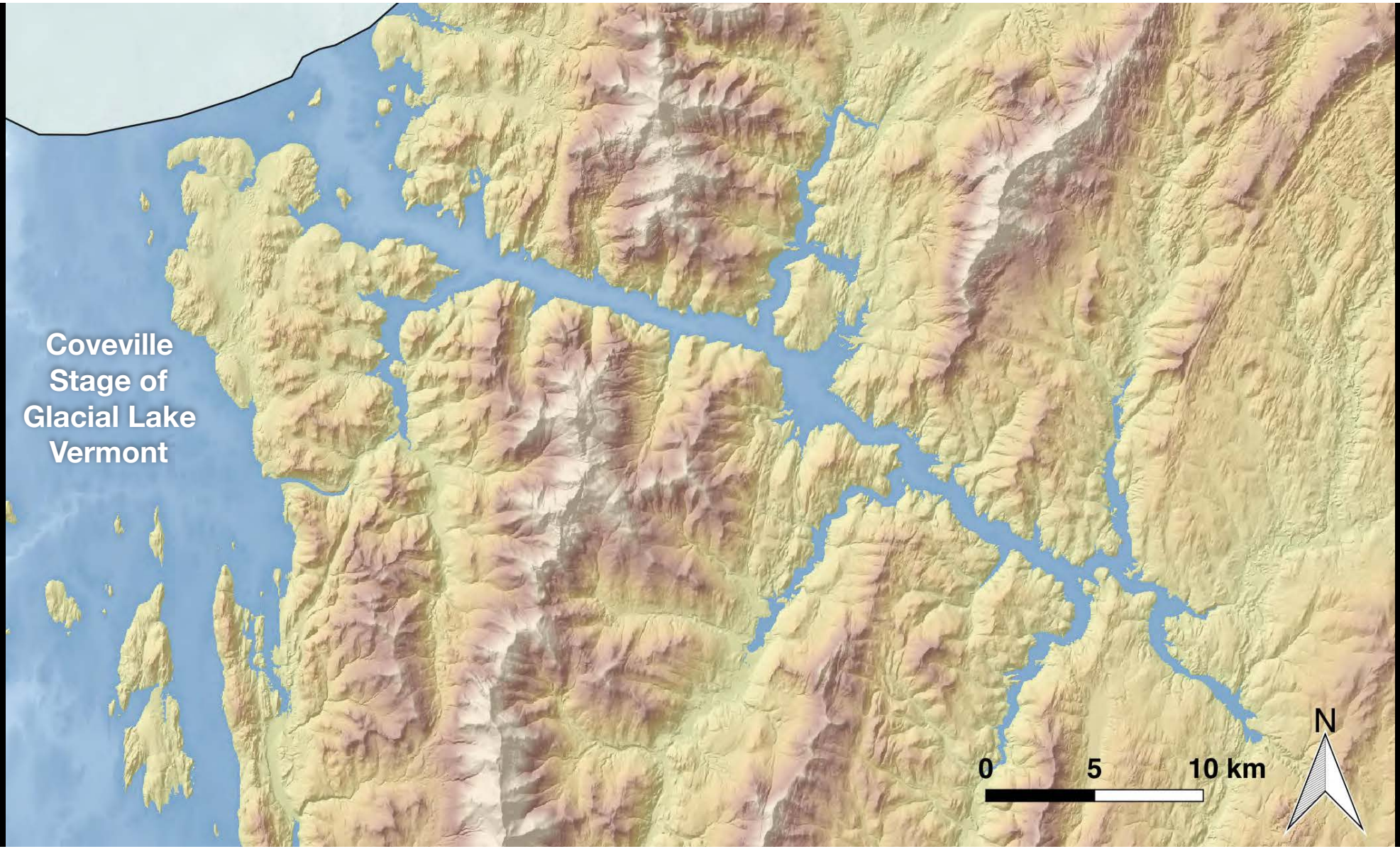

0
5
10 km
N


Quick Tools
South Hinesburg Delta
Glacial Lake
Vermont
Hollow Brook
Outlet
WKID: 4326 Lat/Long
Lat: 44.29986° N
Lon: 73.02256° W
0 0.1 0.2mi
1:500
VCGI

Transition from Glacial Lake Mansfield 2 to Glacial Lake Vermont




Quick Tools
Williston Village
Winooski
River Valley
Williston Outlet Channel
WKID: 4326 Lat/Long
Lat: 44.44555° N
Lon: 73.07698° W
0
0.2
0.4mi
VCGI


Coveville
Stage of
Glacial Lake
Vermont
0
5
10 km
N

Isostatic Tilt of Glacial Lake Winooski

- Preliminary best-fit plane based on 11 LiDAR-derived delta elevations and outlet elevation.
- 1.15 m/km to N17W (343)
- 0.90 m/km to N21.5W (Koteff and Larsen, 1989) Glacial Lake Hitchcock
- 1.2 m/km to N19 W (Parent and Occhietti, 1999) Glacial Lakes Memphremagog and Candona
- 0.7 m/km (Rayburn, 2004) Glacial Lake Vermont