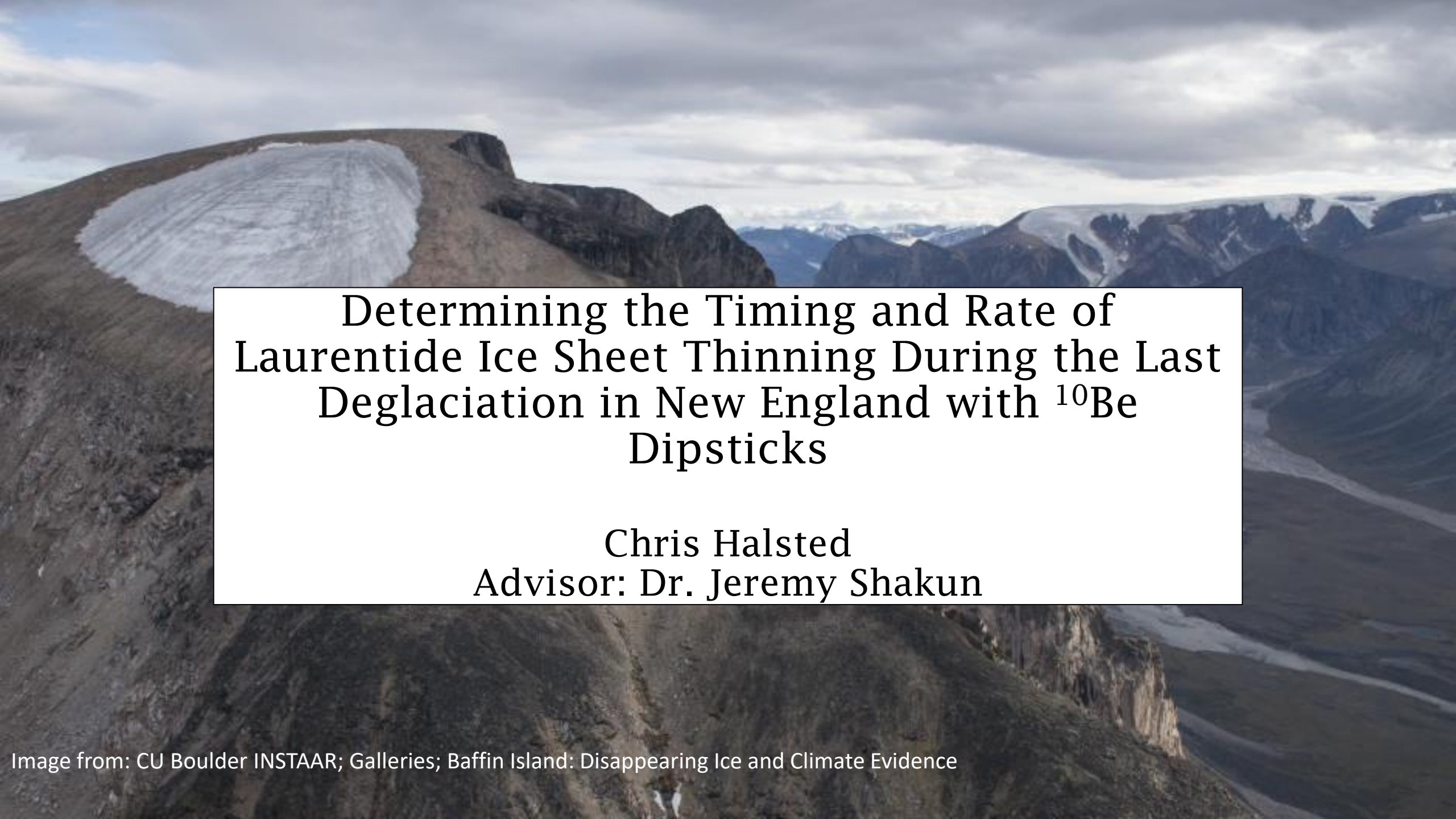
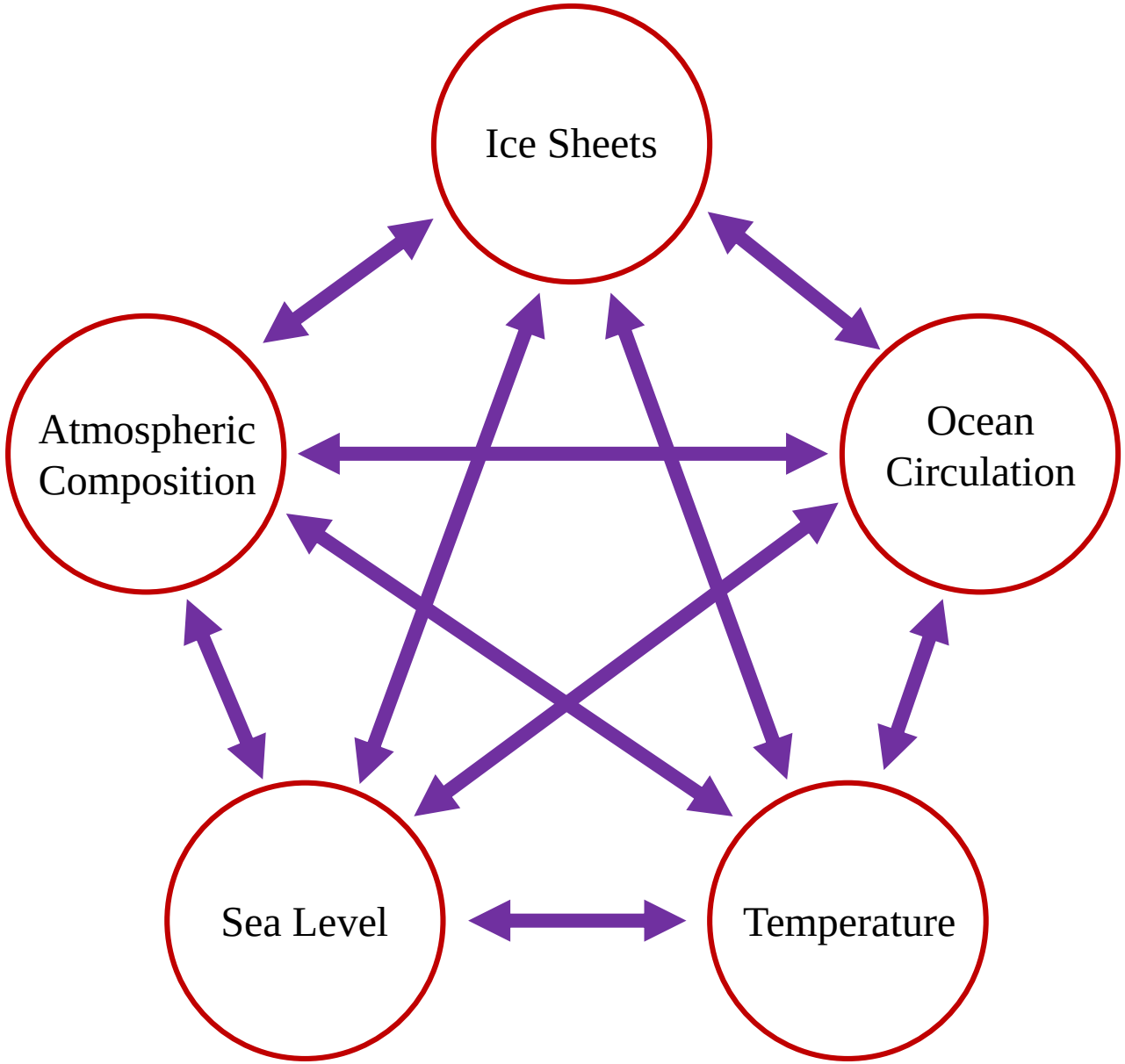


Determining the Timing and Rate of Laurentide Ice Sheet Thinning During the Last Deglaciation in New England with ^{10}Be Dipsticks

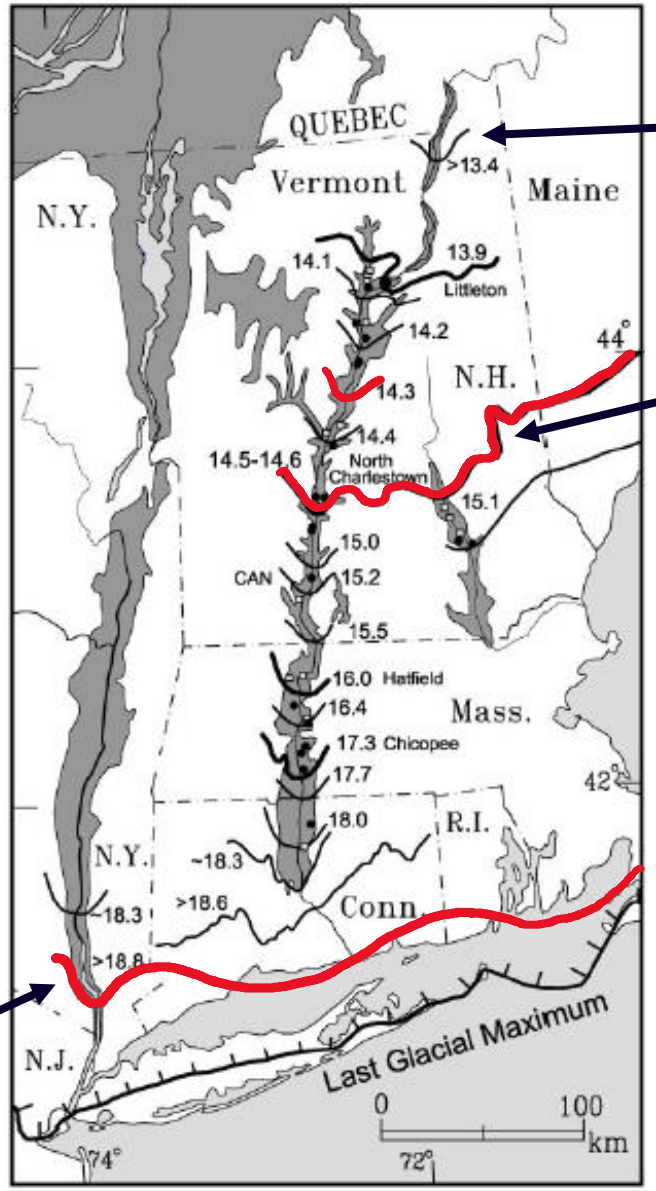
Chris Halsted
Advisor: Dr. Jeremy Shakun

Image from: CU Boulder INSTAAR; Galleries; Baffin Island: Disappearing Ice and Climate Evidence



Background Method Expected Results

Paleo Reconstructions



>13.4

14.5-14.6

>18.8

Figure modified from Ridge et al. (2012)

Background ● ● ● Method ● ● ● ● ● Expected Results ● ●

Research Objective:

- Construct ^{10}Be dipsticks using mountains throughout New England to constrain the timing and rate of ice thinning at these locations

Motivating Questions:

- Did thinning occur predominately during the Oldest Dryas/Heinrich Stadial I cold period or during the Bølling-Allerød warm period?

- Do the timing and rate of southeastern Laurentide thinning indicate that this ice mass contributed to MWP-1A?
  - If not, did it respond to the abrupt warming after this event?

- How accurately do current deglacial models depict ice thinning in New England?

^{10}Be Dipsticks: Concept and Creation

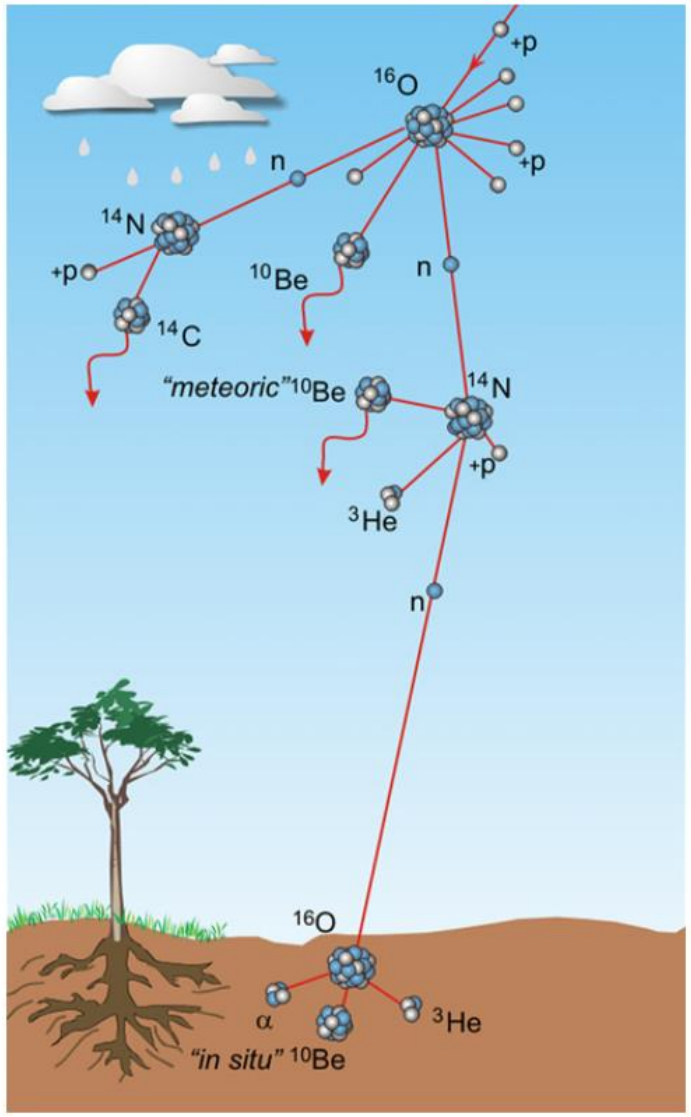


Figure from von Blanckenburg and Willenbring (2014)

^{10}Be concentration in quartz (atoms g^{-1}; N_{10})

^{10}Be production rate in quartz at the sample site (atoms g^{-1} yr^{-1}; P_{10})

^{10}Be decay constant (yr^{-1}; λ_{10})

- 4.99 x 10^{-7} yr^{-1}

$$N_{10} = \frac{P_{10}}{\lambda_{10}}\left[1 - e^{-\lambda_{10} t}\right]$$

From Balco (2011)

t = Amount of time that the surface has been exposed to cosmic rays!!

^{10}Be Dipsticks: Concept and Creation

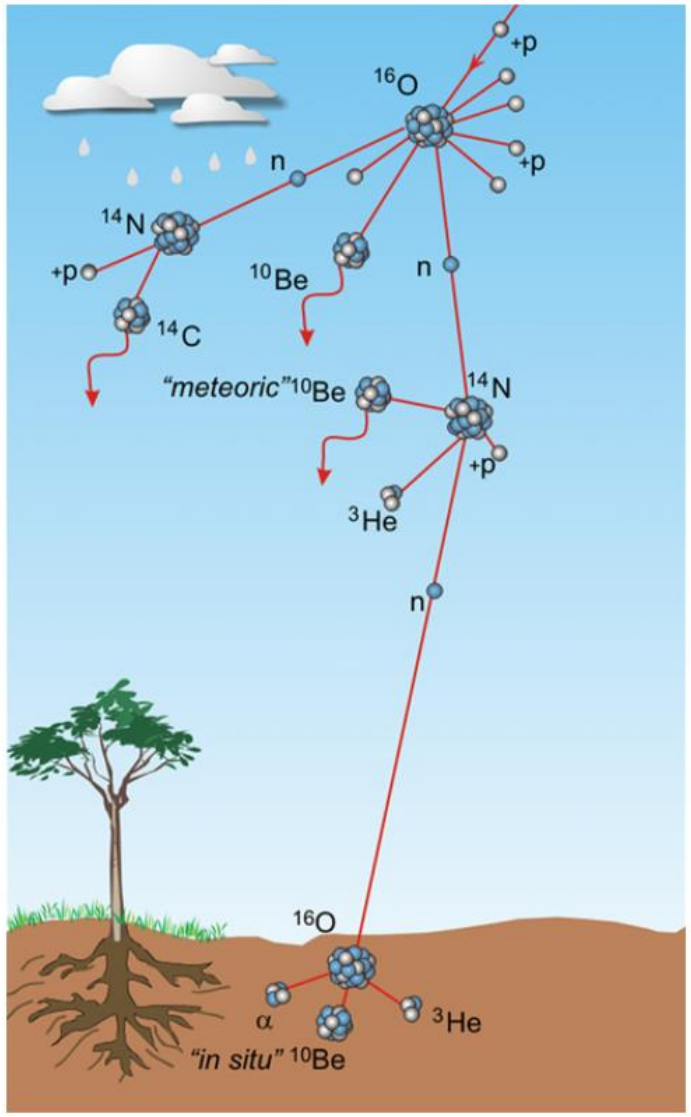


Figure from von Blanckenburg and Willenbring (2014)

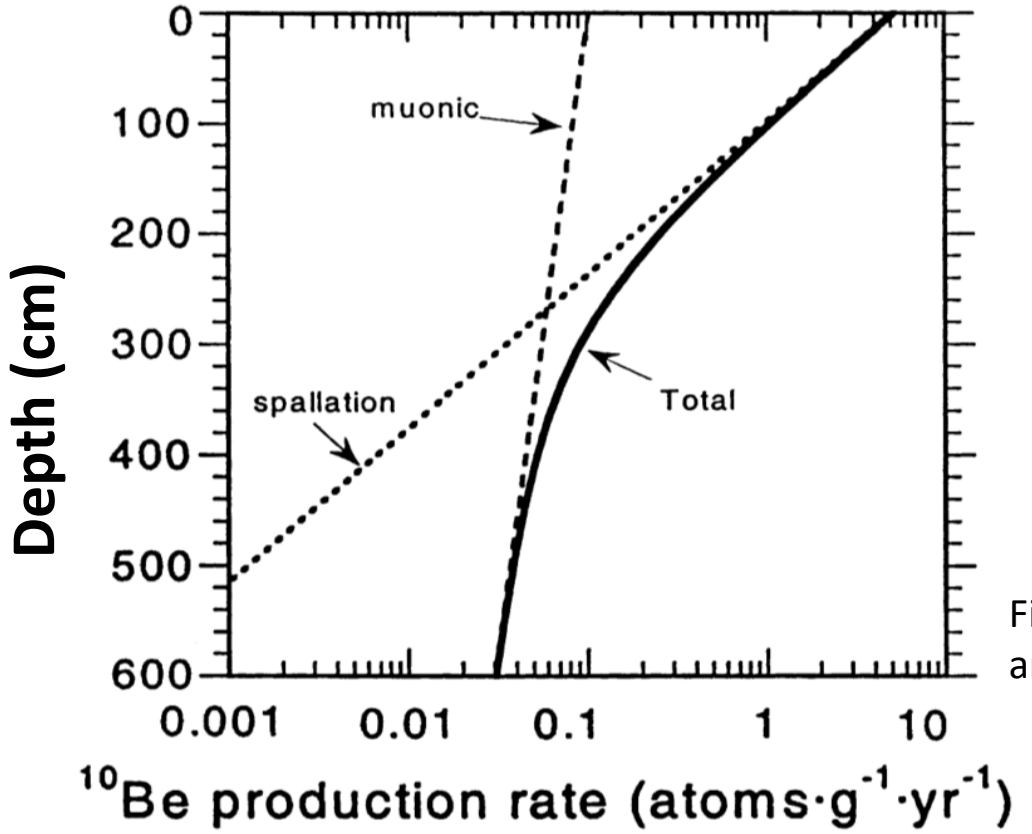
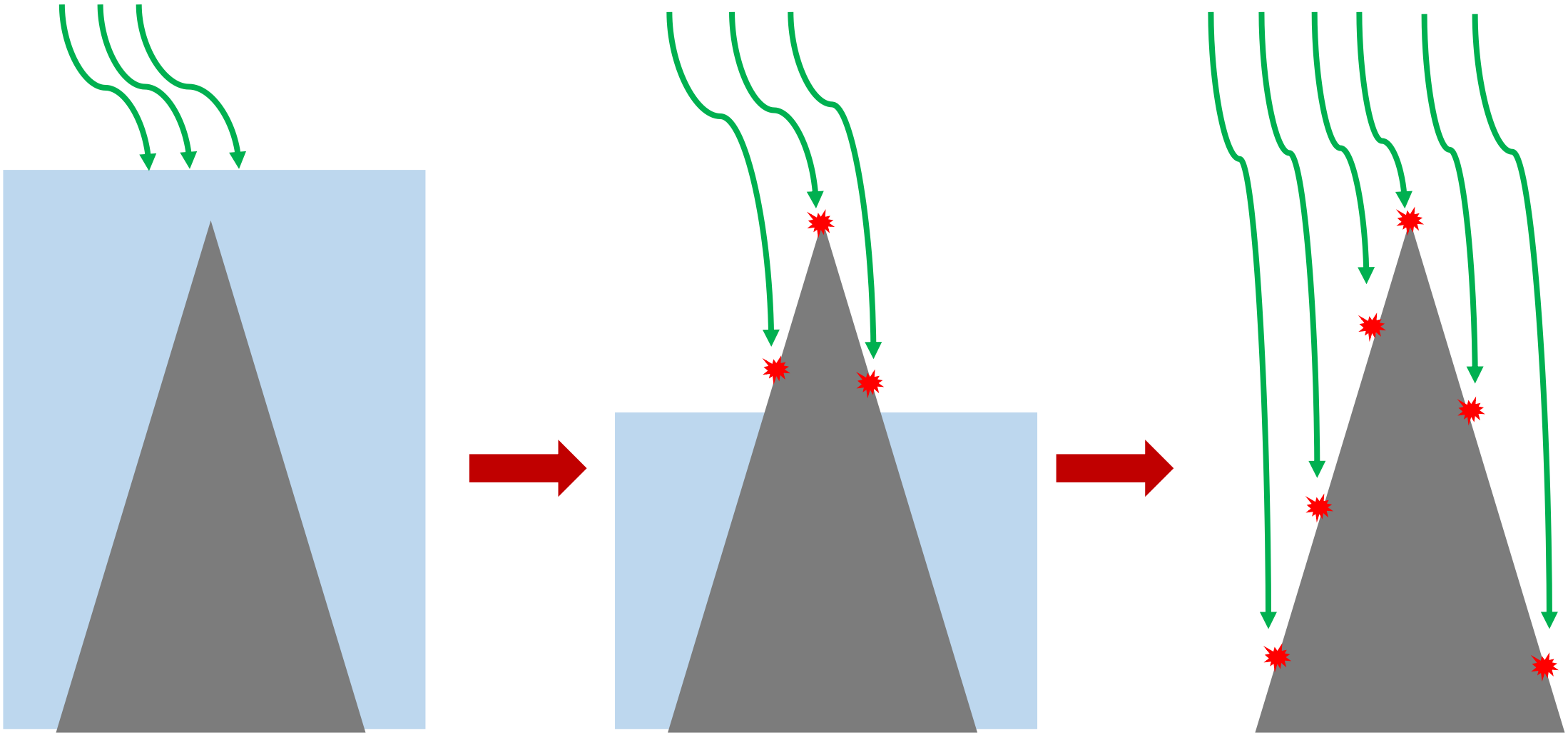


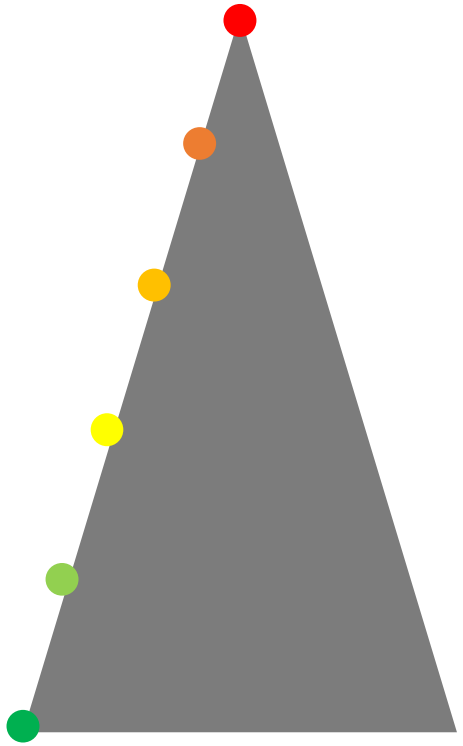
Figure from Gosse and Phillips (2001)

^{10}Be Dipsticks: Concept and Creation

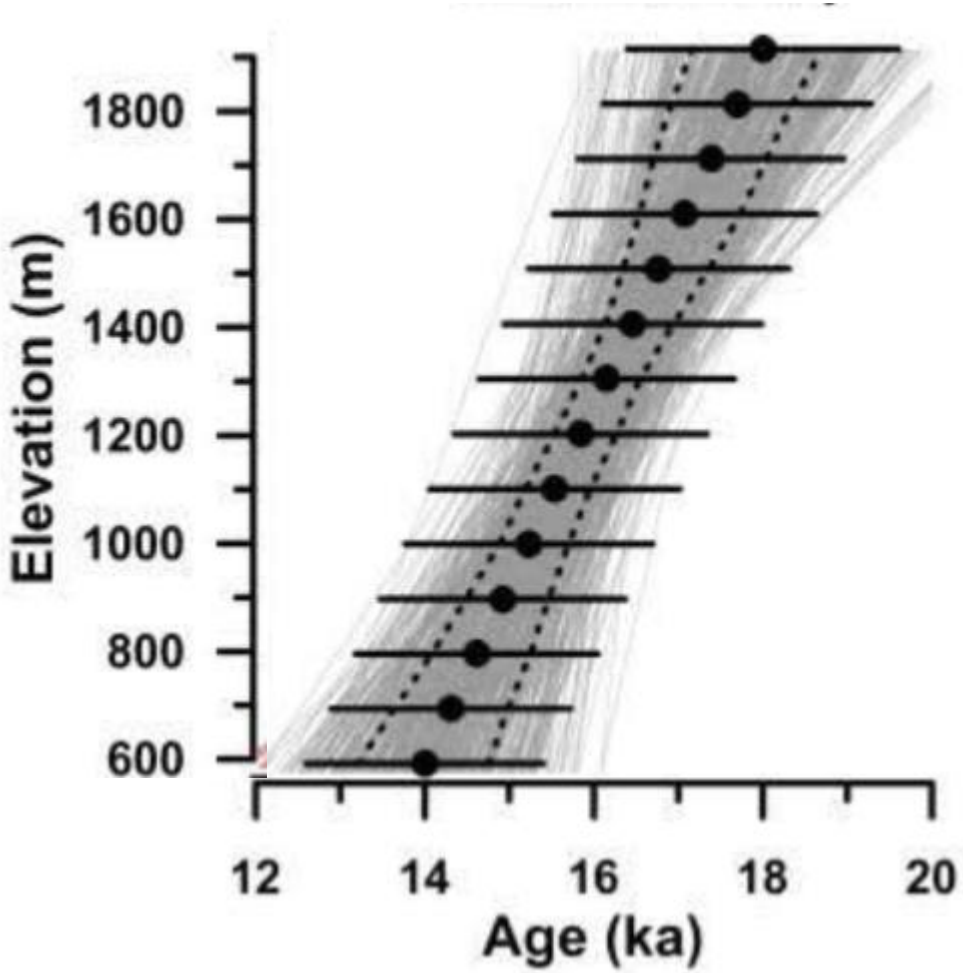


Background Method Expected Results

^{10}Be Dipsticks: Concept and Creation



Exposure Age

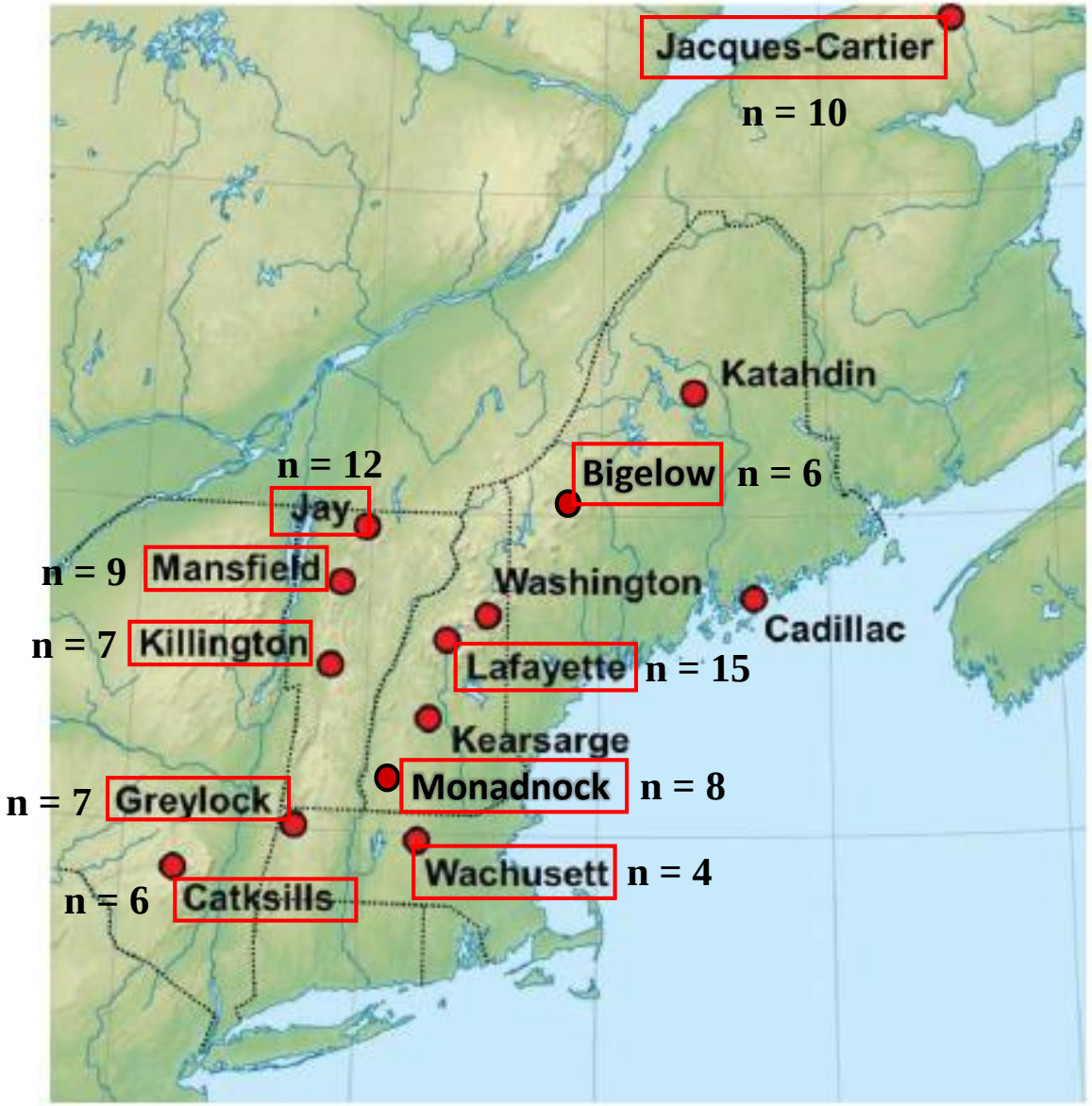


Modified from NSF proposal #1602280

Background ● ● ● Method ● ● ● ● Expected Results ● ●

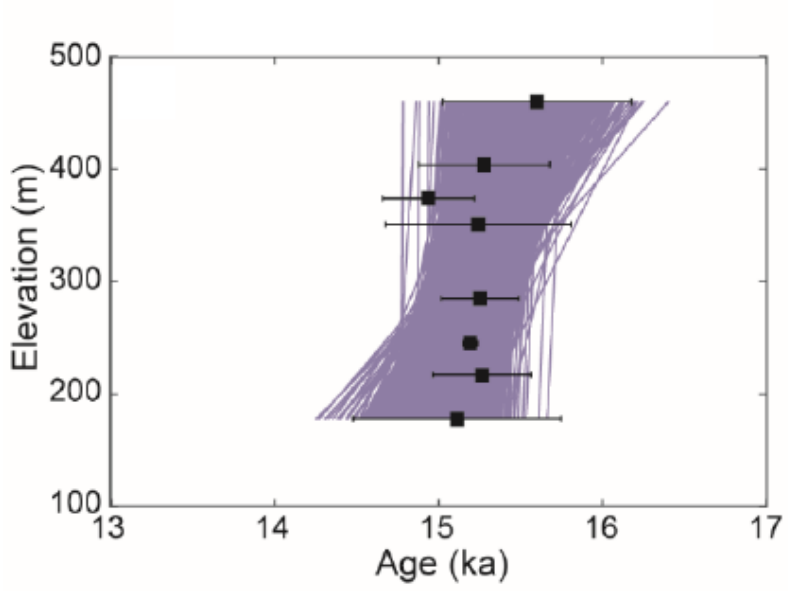
More Data = Better Histories

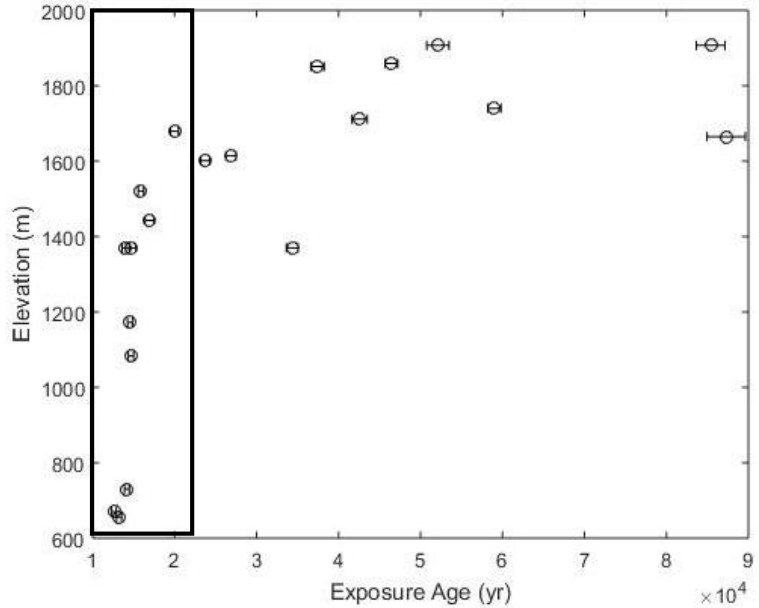
Goal is to create dipsticks at locations shown to constrain the timing and rate of Laurentide thinning at each location

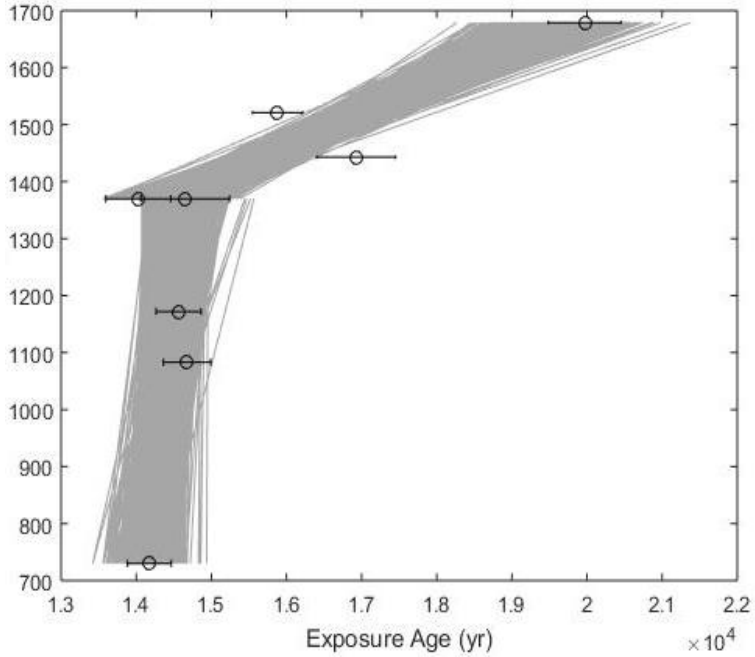


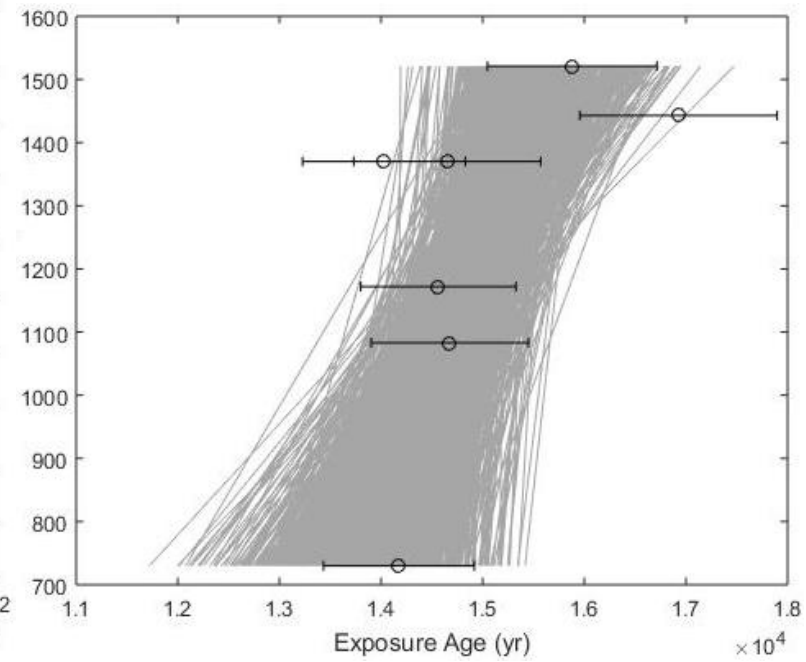
Existing New England Dipsticks:

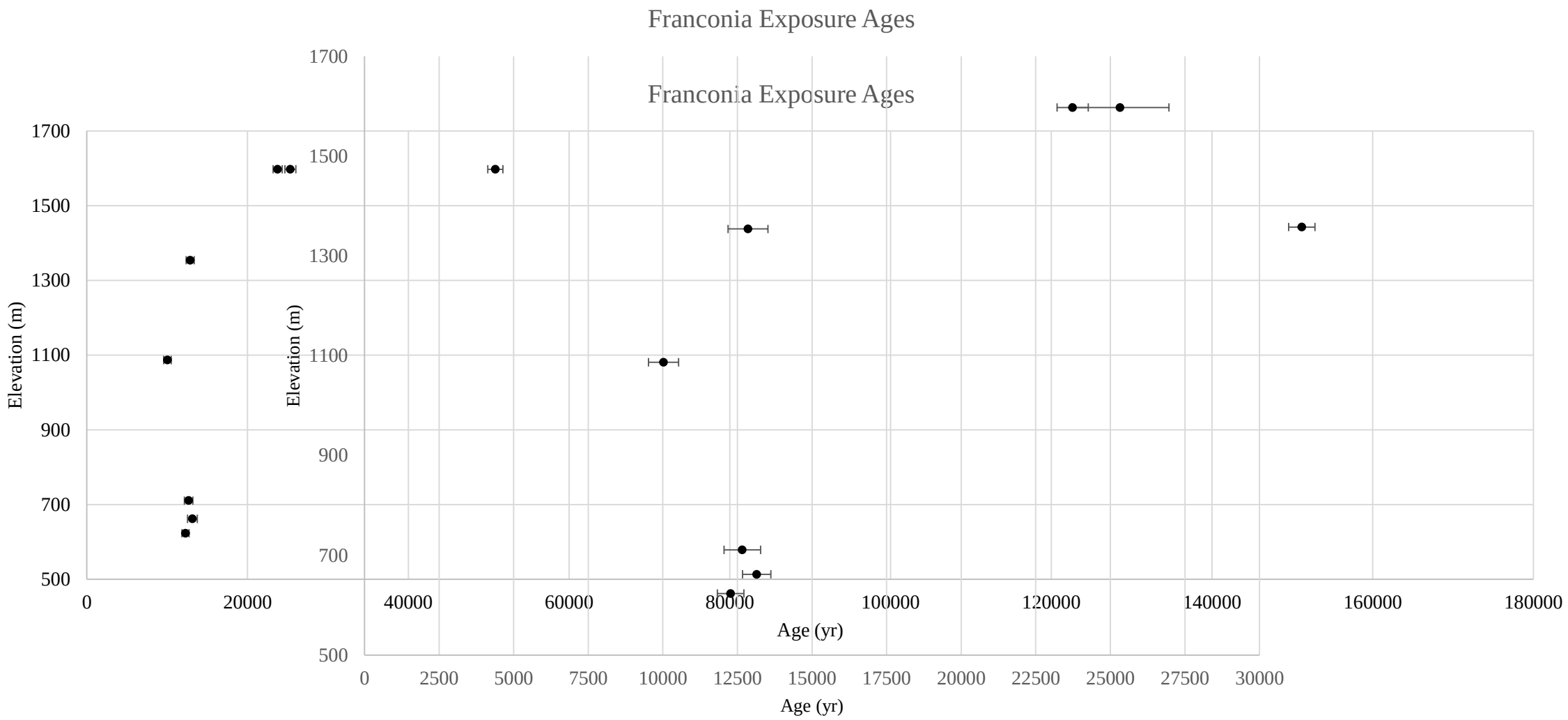
- Central Maine (Mt. Katahdin): Rapid thinning between 16-15 ka (Davis et al., 2015)
- Coastal Maine (Acadia): Rapid thinning around 15.2 ± 0.7 ka (Koester et al., 2017a)
- Mt. Washington, NH (Koester et al., 2017b): Difficult to fully assess










Franconia Exposure Ages
Franconia Exposure Ages
Elevation (m)
1700
1500
1300
1100
900
700
500
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
Age (yr)
Elevation (m)
1700
1500
1300
1100
900
700
500
0
2500
5000
7500
10000
12500
15000
17500
20000
22500
25000
27500
30000
Age (yr)

Field Photos!

Sampling in Northern VT in November…

Glacially-deposited boulders

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