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

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Paleo Reconstructions

Figure modified from Ridge et al. (2012)

Background

Method

Expected Results

>13.4

>18.8

14.5-14.6

Figure modified from Ridge et al. (2012)
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

$^{10}$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$^{-1}$; $\lambda_{10}$)
- $4.99 \times 10^{-7}$ 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!!

Background  ●  ●  ●  ●  Method  ●  ●  ●  ●  ●  Expected Results  ●  ●
$^{10}\text{Be}$ Dipsticks: Concept and Creation

**Background**

Figure from von Blanckenburg and Willenbring (2014)

**Method**

Figure from Gosse and Phillips (2001)

**Expected Results**

Figure from von Blanckenburg and Willenbring (2014)
10Be Dipsticks: Concept and Creation

LGM

Deglaciation

Today

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.

Background

Method

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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

Elevation (m) vs. Age (yr)
Field Photos!

Sampling in Northern VT in November...

Glacially-deposited boulders
References Cited

• Davis, P.T., Bierman, P.R., Corbett, L.B., and Finkel, R.C., 2015, Cosmogenic exposure age evidence for rapid Laurentide deglaciation of the Katahdin area, west-central Maine, USA, 16 to 15 ka: Quaternary Science Reviews, v. 116, p. 95-105.


