

^{10}Be concentration in Greenland sediment indicates source and erosion history



March 19th, 2013



Alice Nelson¹, Paul Bierman¹, Jeremy Shakun², Dylan Rood³

¹University of Vermont, ²Harvard University, ³SUERC, University of Glasgow

Talk Outline

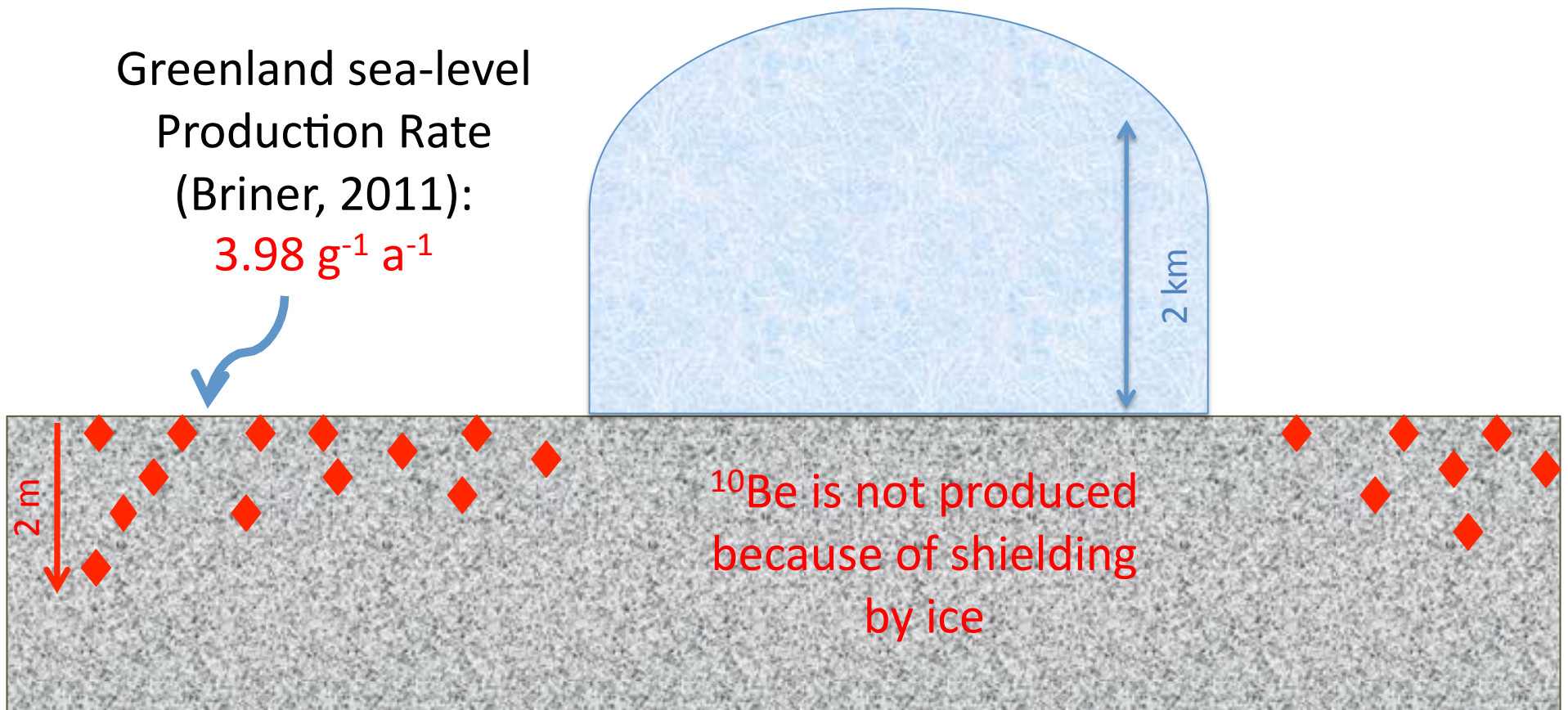
1. Background: cosmogenic ^{10}Be
2. Field work
3. Sediment Sources
4. Preliminary data
5. Conclusions

Cosmogenic Background

- ^{10}Be is produced in near surface rocks and sediments because of terrestrial exposure to cosmic rays

Greenland sea-level
Production Rate
(Briner, 2011):

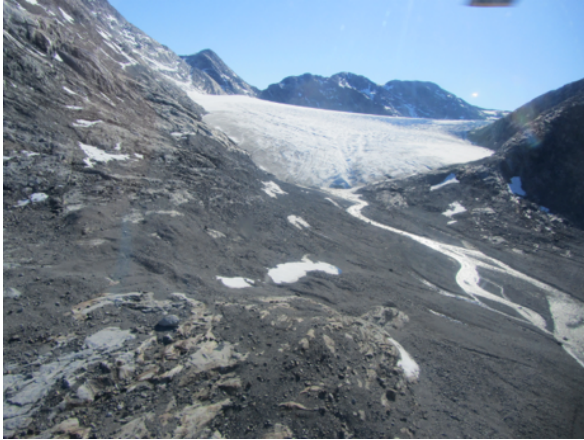
$3.98 \text{ g}^{-1} \text{ a}^{-1}$



Field Work



We collected sediment samples

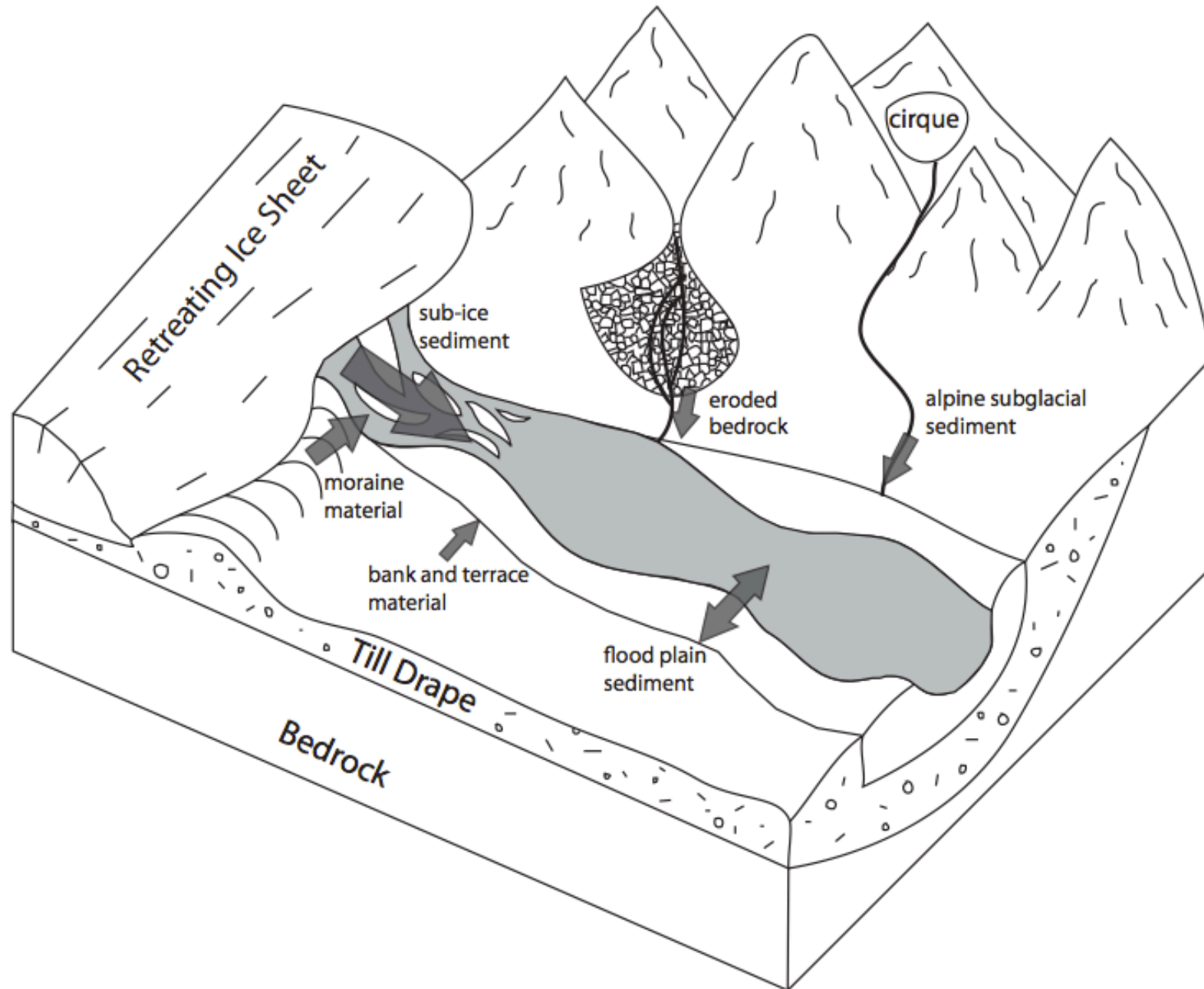


from ice sheet margins, in river transects to the fjord mouth,

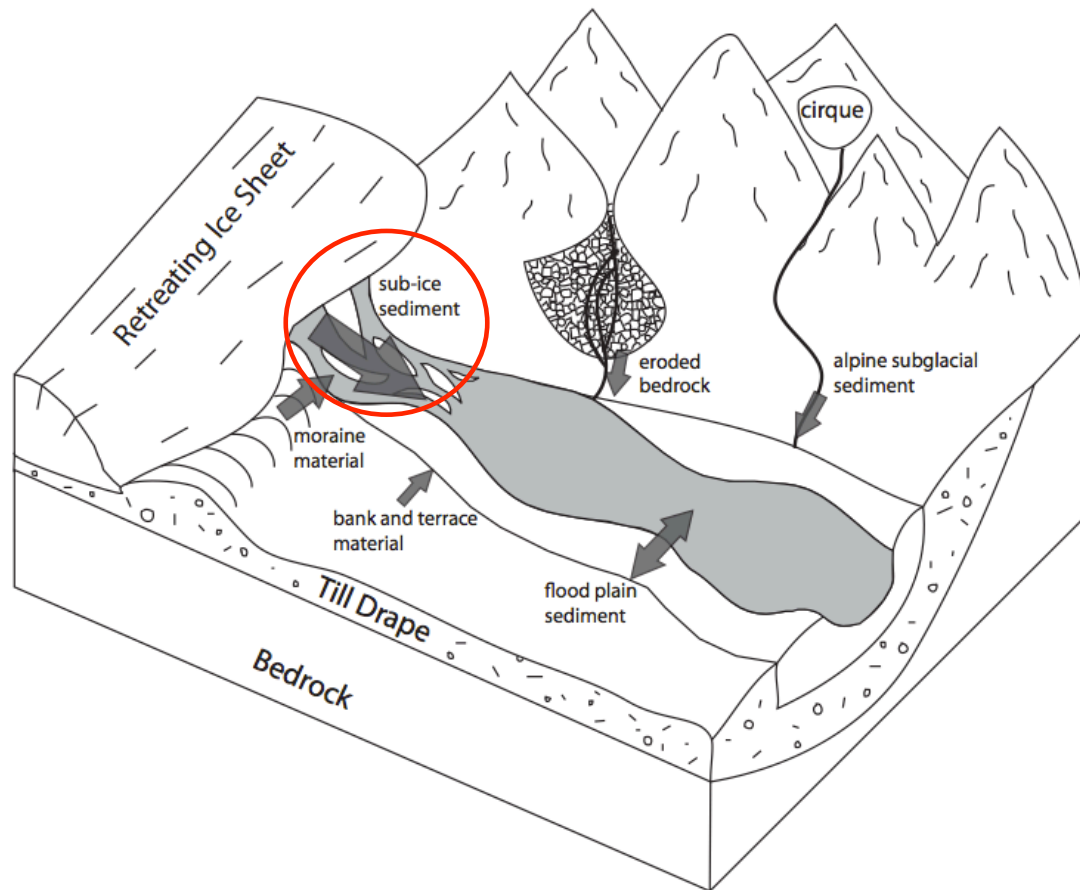


from ice-free tributary valleys, and from old deltas

Where does fluvial sediment come from?

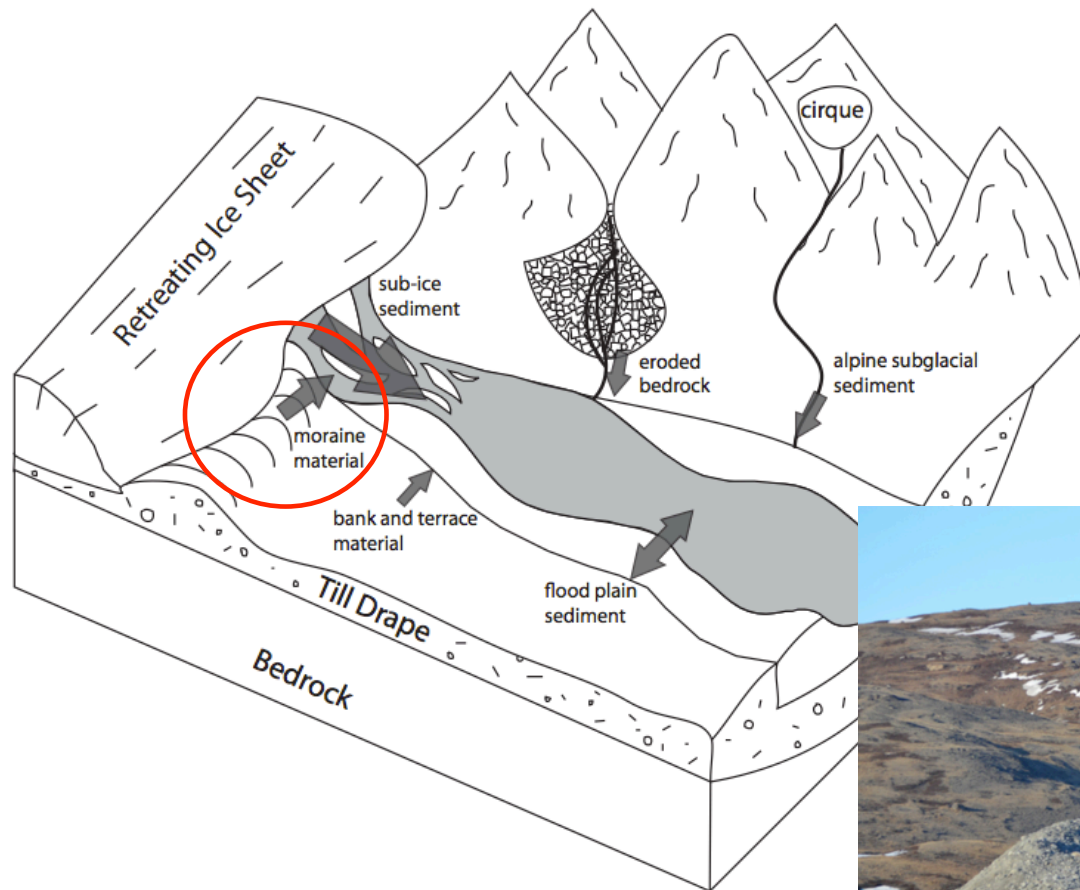


Where does fluvial sediment come from?



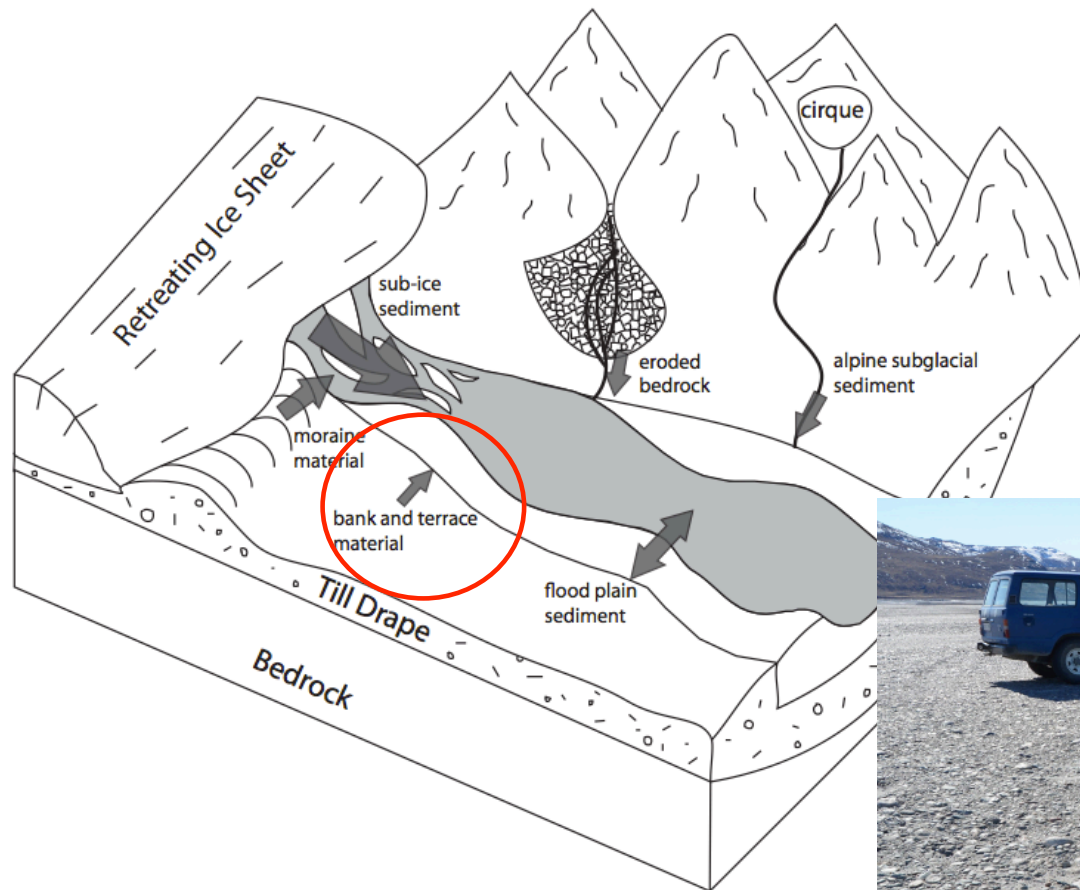
from beneath the ice

Where does fluvial sediment come from?



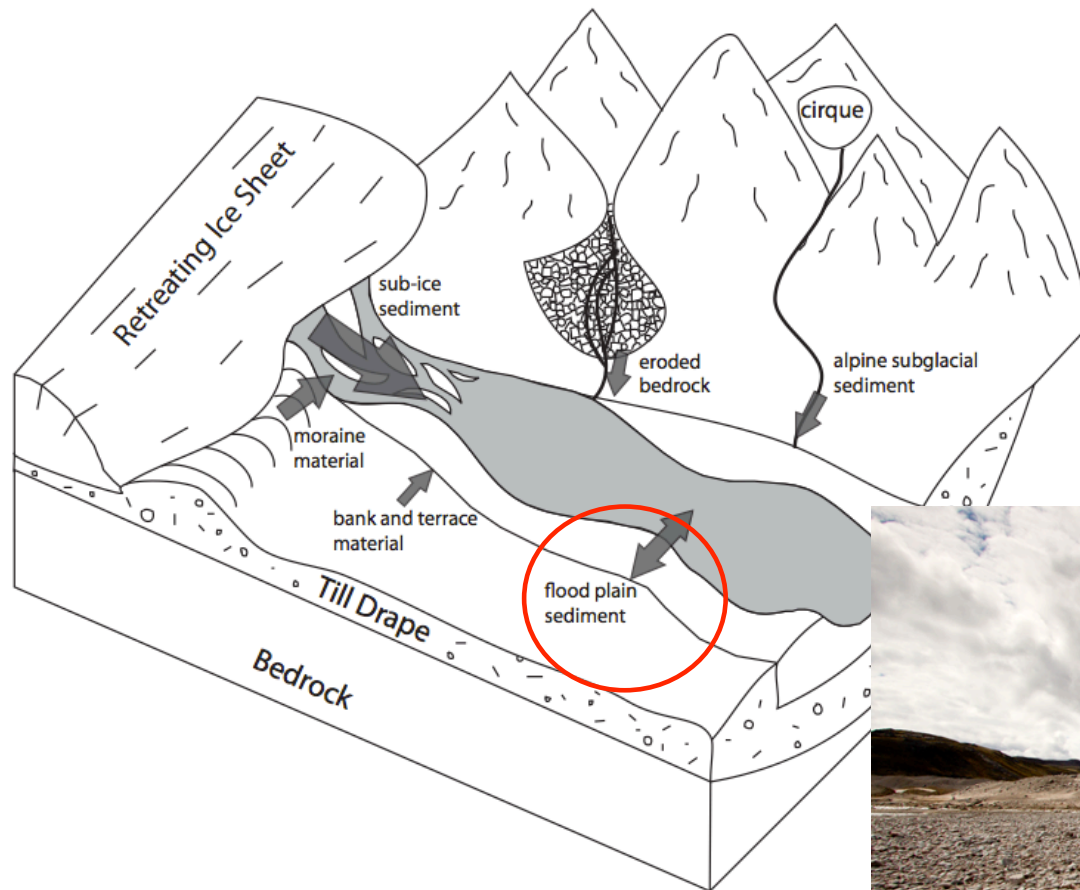
mobilized from moraines

Where does fluvial sediment come from?



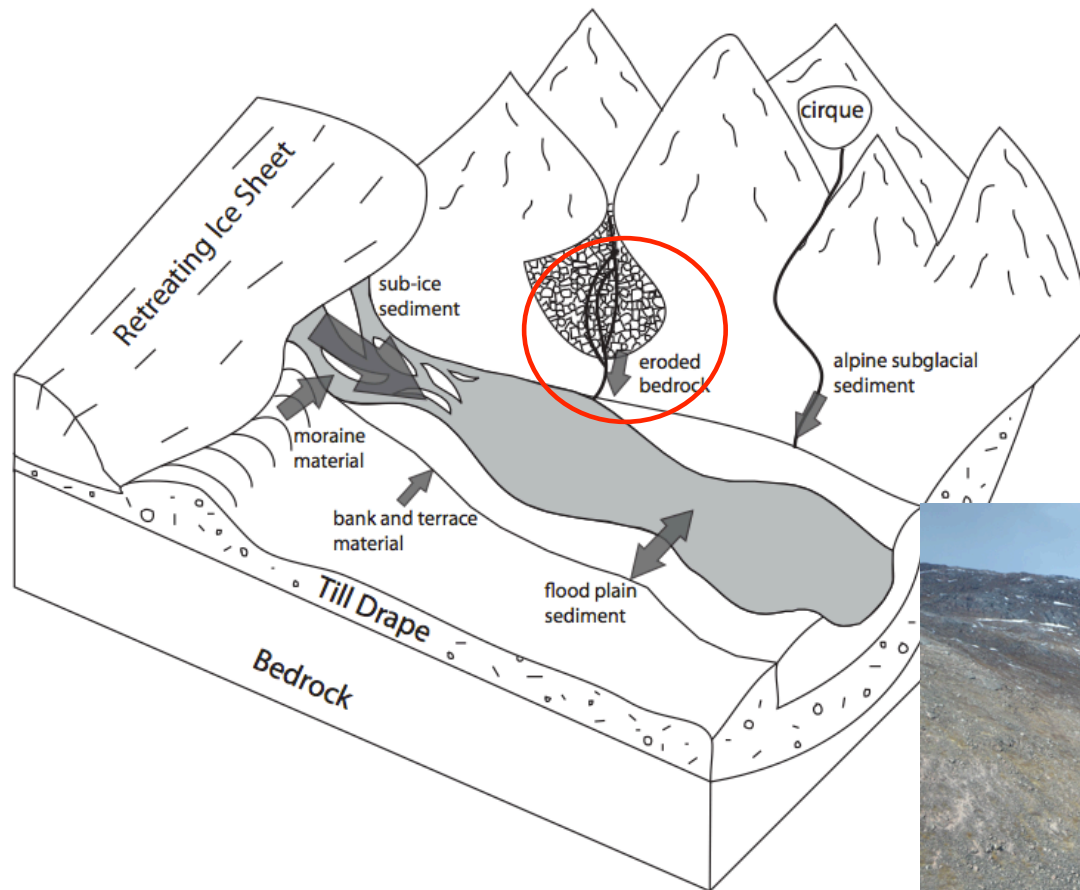
long-term storage in terraces

Where does fluvial sediment come from?



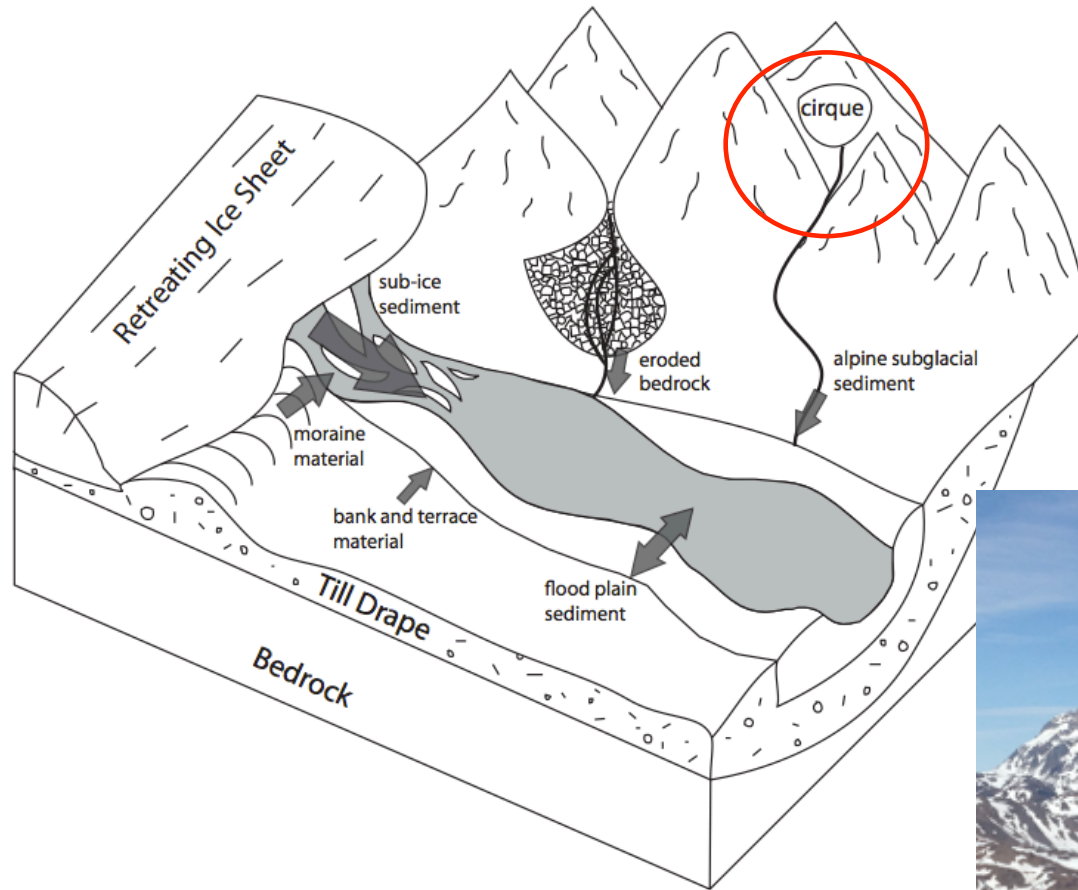
temporary storage in flood plains

Where does sediment come from?



eroded from exposed slopes

Where does sediment come from?



sourced from alpine glaciers

Legend

$^{10}\text{Be} \times 10^3 \text{ atoms/g}$
2011/2012 value

■ ice margin

■ ice-free

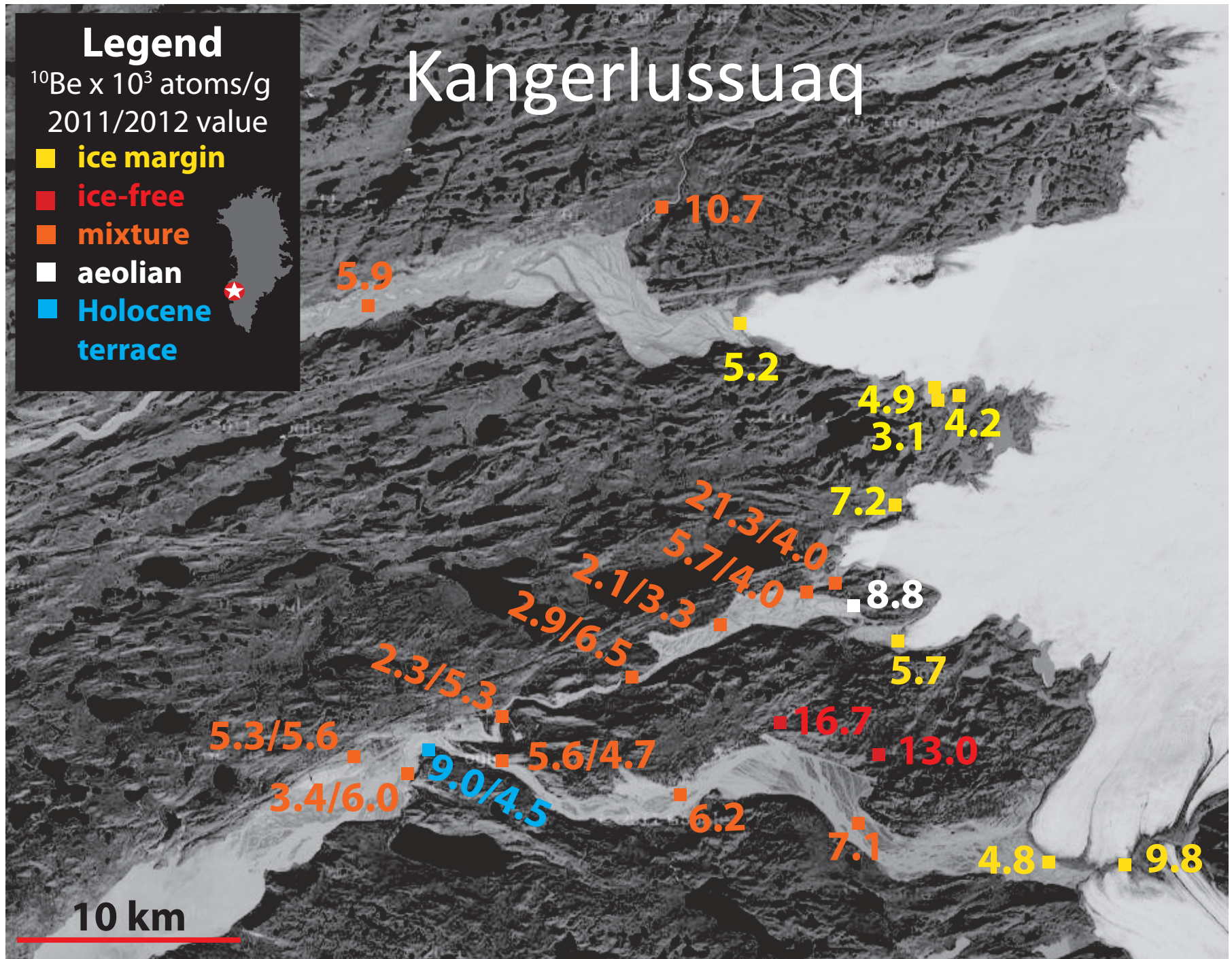
■ mixture

■ aeolian

■ Holocene
terrace



Kangerlussuaq



Narsarsuaq

19.2*

12.6*

24.9

34.7

8.6

10.2

14.3

2.2

2.1

5.1

3.9

3.5

6.4

5.2

4.8

Legend

$^{10}\text{Be} \times 10^3 \text{ atoms/g}$

■ ice margin
(* high elevation)

■ ice-free

■ mixture

■ Holocene
terrace



10 km

Legend

$^{10}\text{Be} \times 10^3 \text{ atoms/g}$

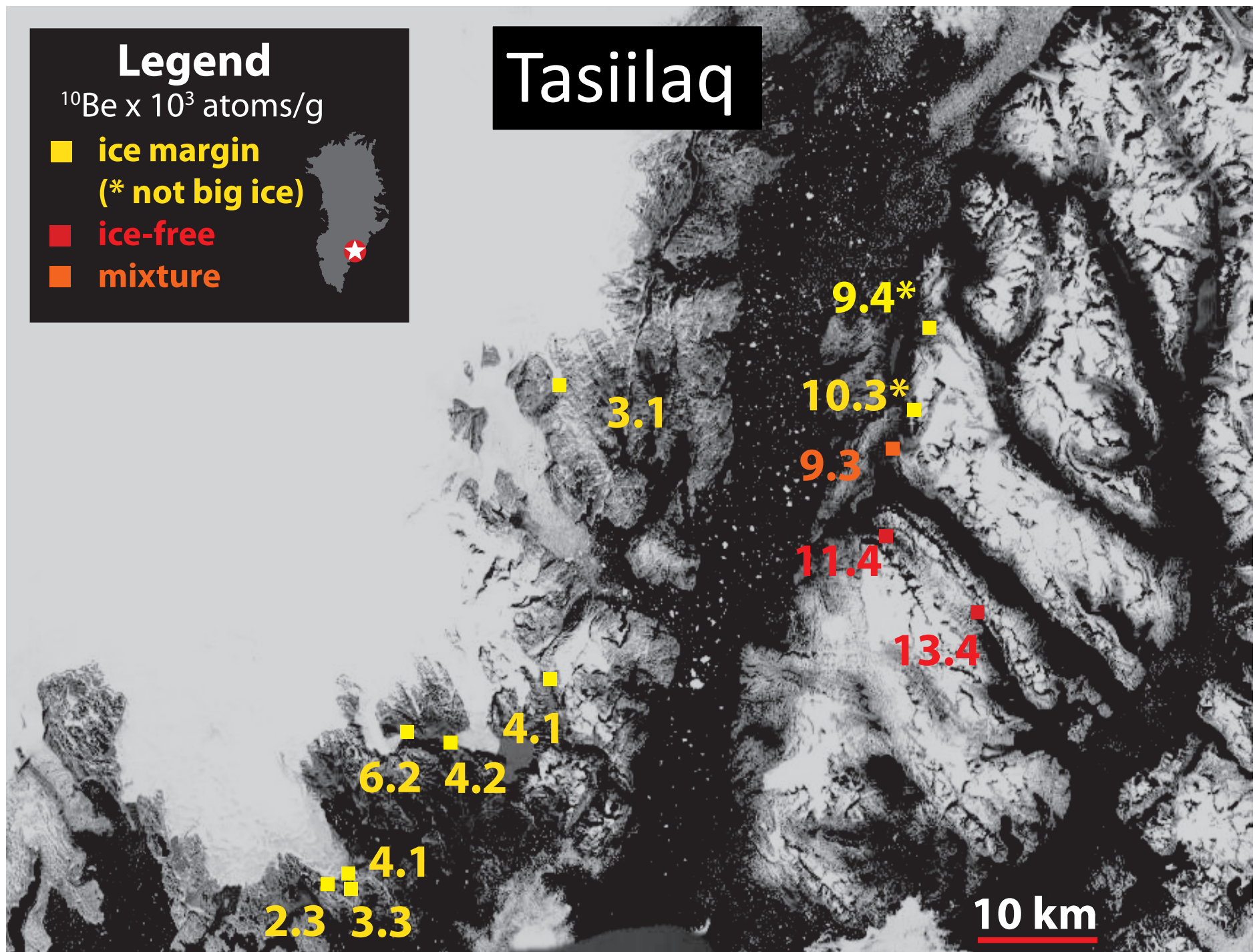
■ ice margin
(* not big ice)

■ ice-free

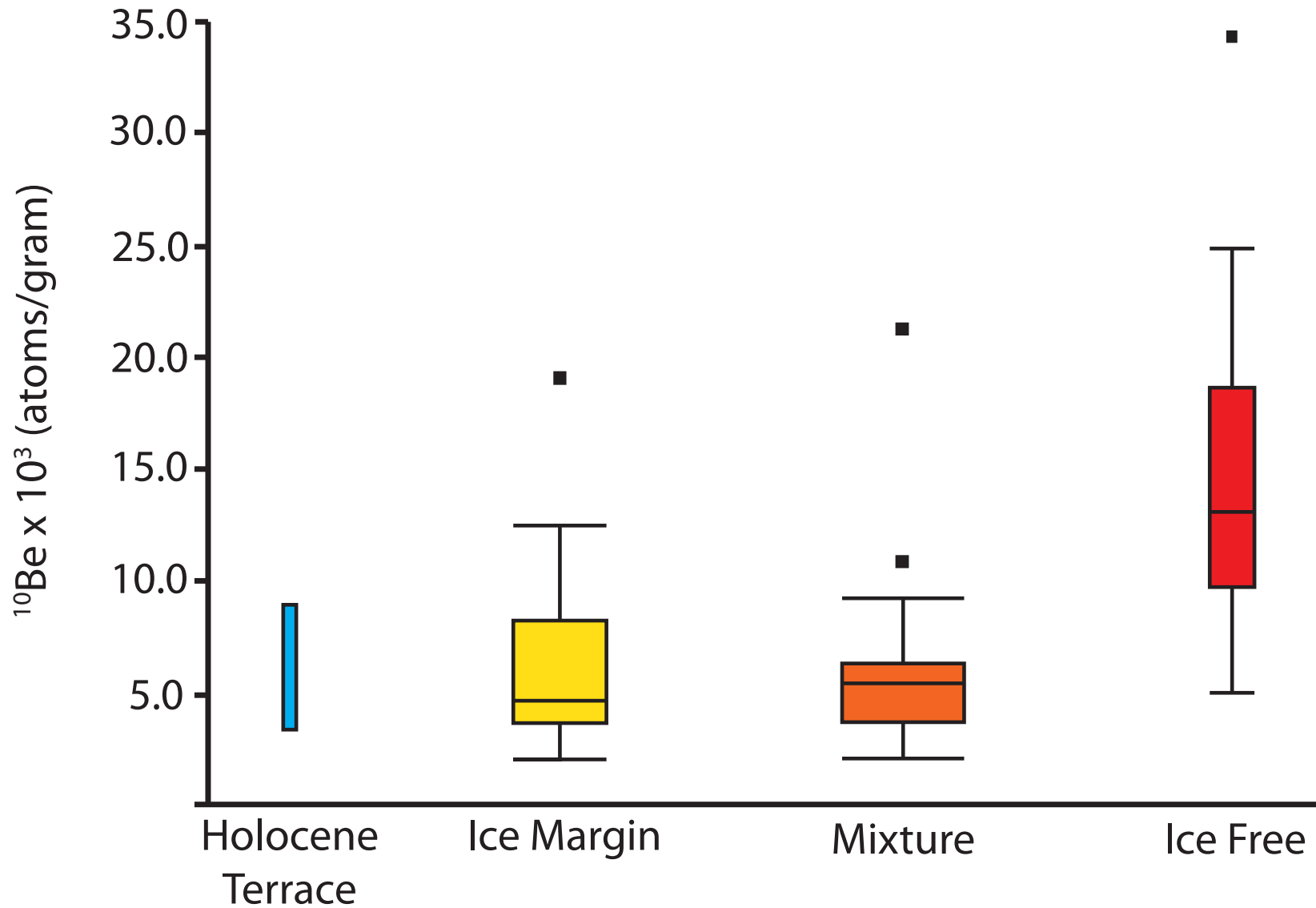
■ mixture



Tasiilaq



^{10}Be Concentration by Category



Conclusions

- Temporal and spatial variability in sediment ^{10}Be concentration

Conclusions

- Temporal and spatial variability in sediment ^{10}Be concentration
- ^{10}Be concentration in ice marginal samples is lower than in exposed hill slope samples

Conclusions

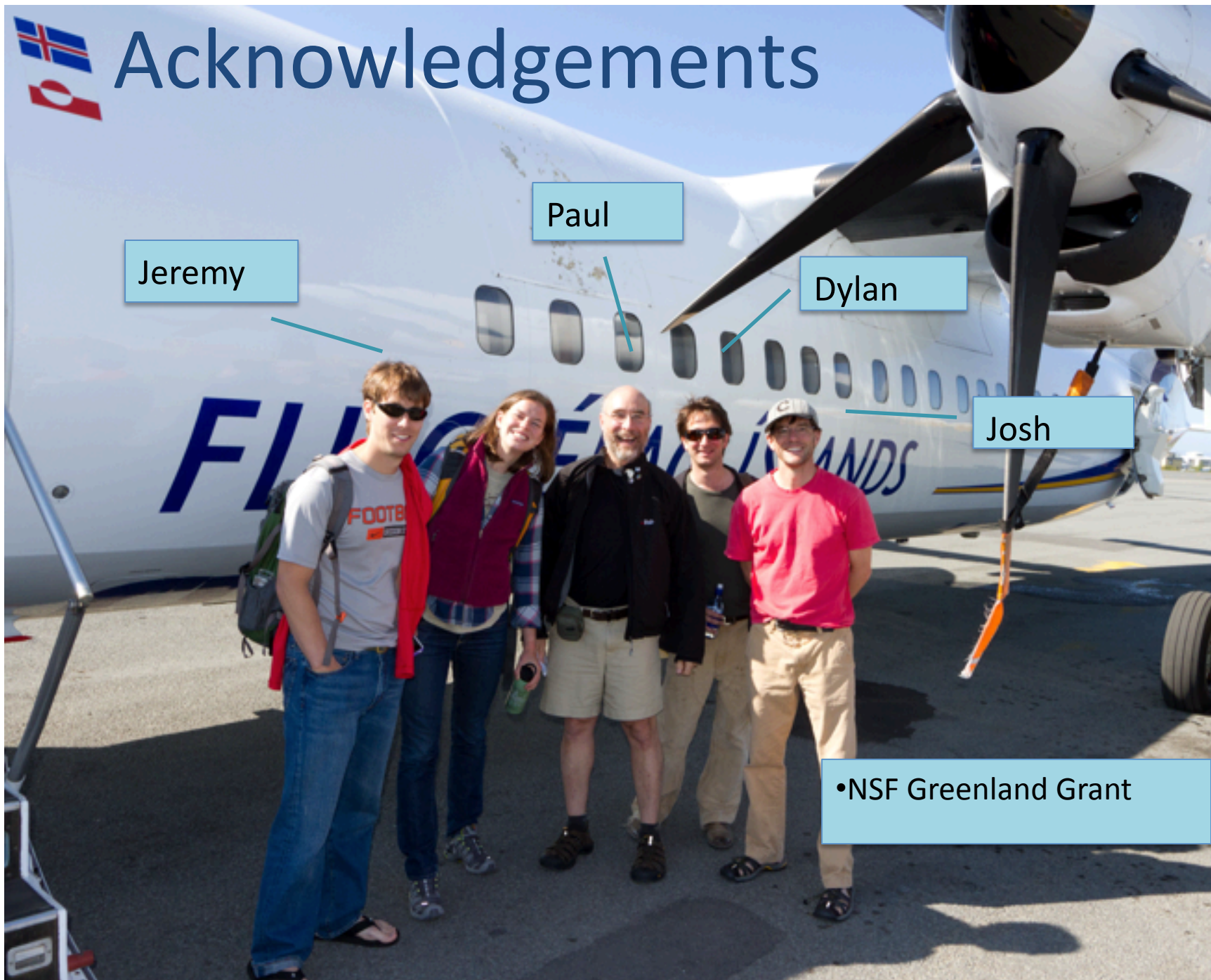
- Temporal and spatial variability in sediment ^{10}Be concentration
- ^{10}Be concentration in ice marginal samples is lower than in exposed hill slope samples
- Alpine glaciers and high elevation lobes of the ice sheet produce sediment with higher ^{10}Be than the other ice margins, possibly because ice extent is more dynamic here

Conclusions

- Temporal and spatial variability in sediment ^{10}Be concentration
- ^{10}Be concentration in ice marginal samples is lower than in exposed hill slope samples
- Alpine glaciers and high elevation lobes of the ice sheet produce sediment with higher ^{10}Be than the other ice margins, possibly because ice extent is more dynamic here
- “Mixed” stream concentration is similar to ice margin concentration, so most of the sediment entering the fjords is coming from the ice, rather than the hill slopes

Conclusions

- Temporal and spatial variability in sediment ^{10}Be concentration
- ^{10}Be concentration in ice marginal samples is lower than in exposed hill slope samples
- Alpine glaciers and high elevation lobes of the ice sheet produce sediment with higher ^{10}Be than the other ice margins, possibly because ice extent is more dynamic here
- “Mixed” stream concentration is similar to ice margin concentration, so most of the sediment entering the fjords is coming from the ice, rather than the hill slopes
- Holocene concentration and variability is similar to what is coming out of the ice today



Acknowledgements

Jeremy

Paul

Dylan

Josh

•NSF Greenland Grant

Questions?

