Glacio-Volcanic Landforms

Lecture 8

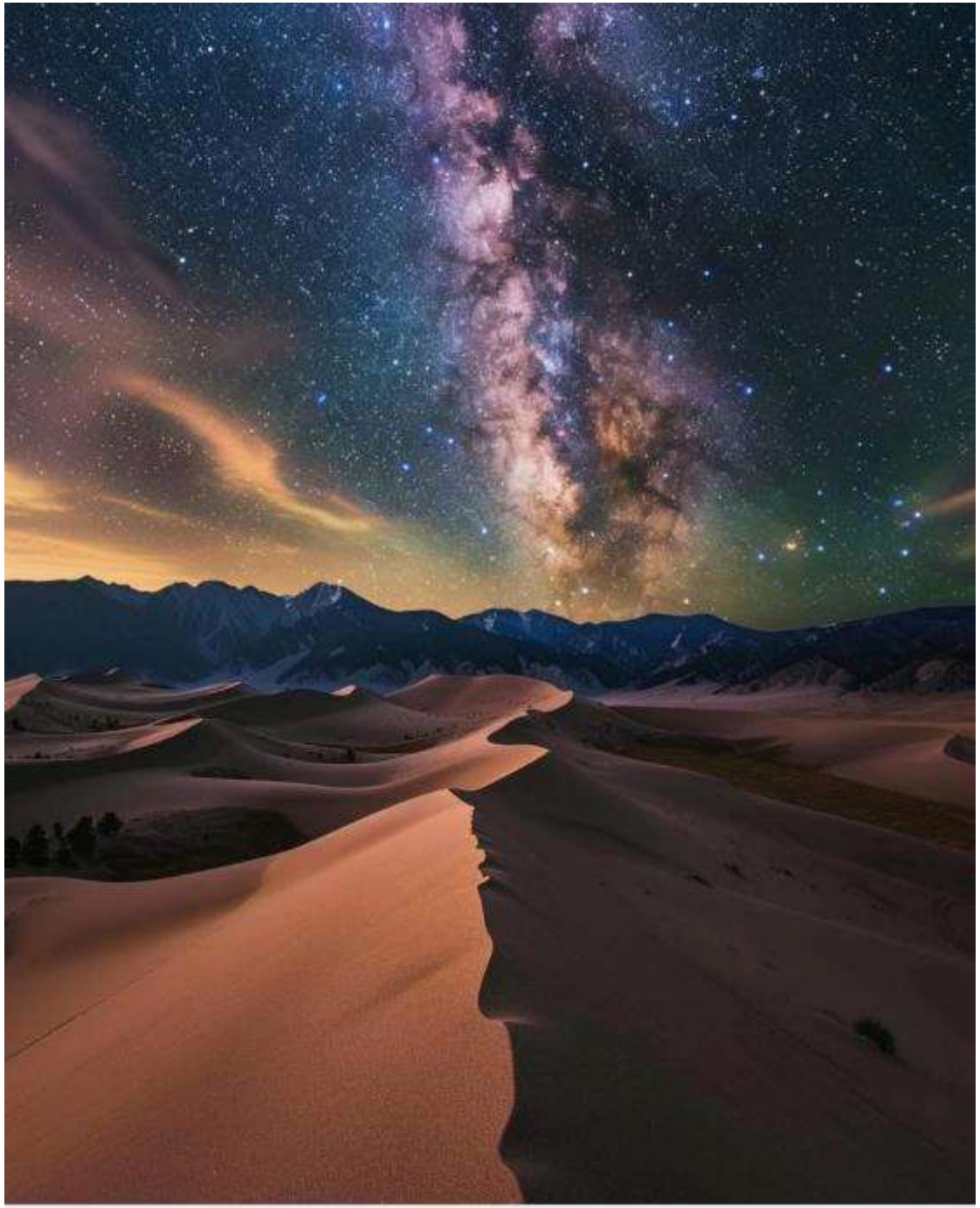
Skaftafelljokull (glacier)

Part 1

Social Media Pics

Glaciers (?) or snow fields
Cirques
Arêtes and Horns
dam probably not moraine
Cirque Lake

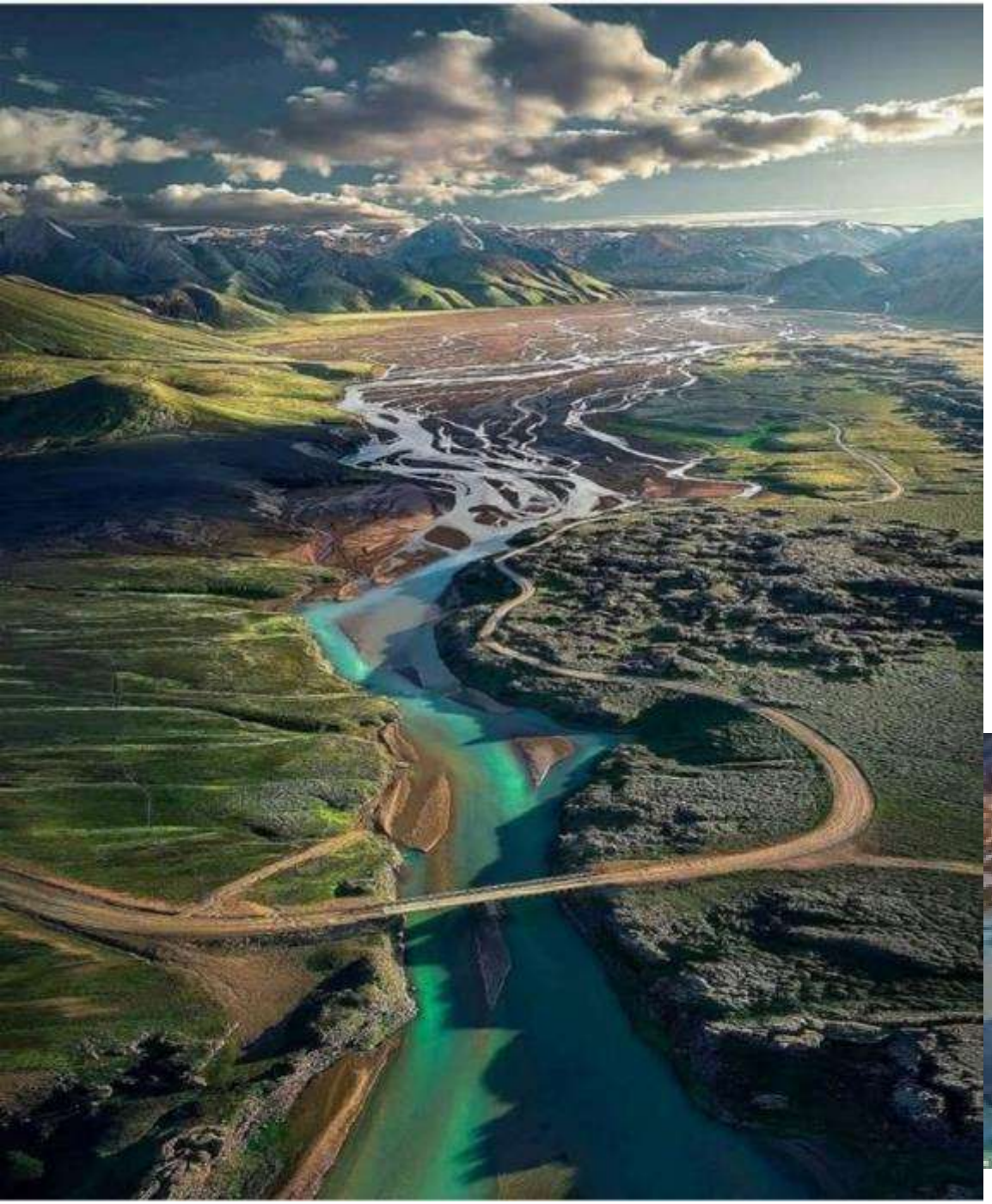
Cirque
Fjord
Arêtes
Horn



Not Glacial!

Not an Arête

What is it?



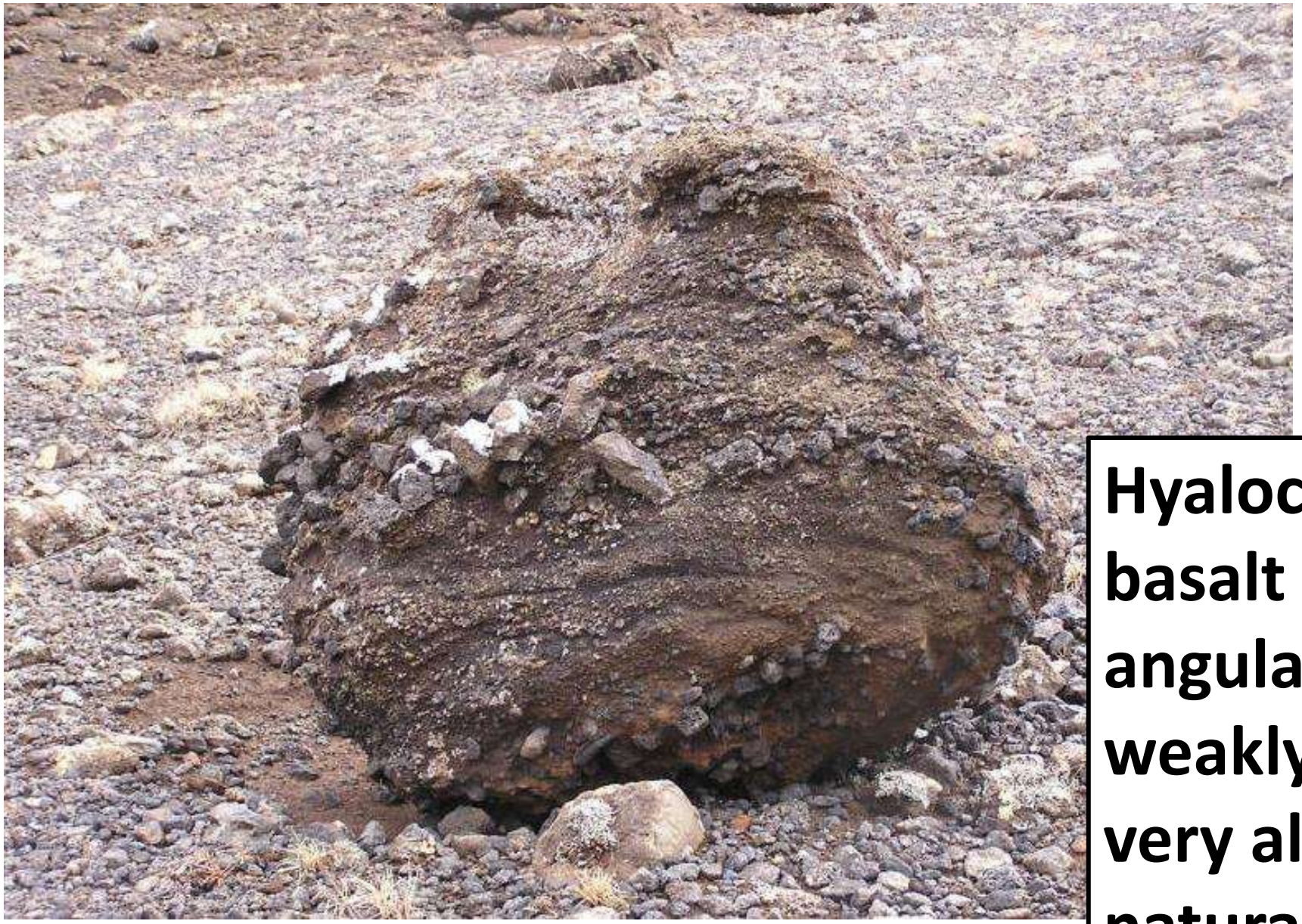
Glacial Valley
Braided Stream

What is hummocky terrain?

U-shaped Valley
Not particularly braided stream

Part 2

Hyaloclastite: Sub-glacial eruption material



Hyaloclastite
basalt erupted under ice
angular clasts
weakly stratified
very altered
naturally cemented

Hyaloclastite hill

Bill by Keilir

Sub-areal lava flow looks very different

Brandur by moss


Keilir
Vogar
SVEITARFÉLAGIÐ VOGAR
GRINDAVÍKURBÆR
Reykjanesfólkvangur
Kleifarvatn
GRINDAVÍKURBÆR
420
41
42
427
380
Layers
Terrain
View topography and elevation
Map data ©2025 Google
United States
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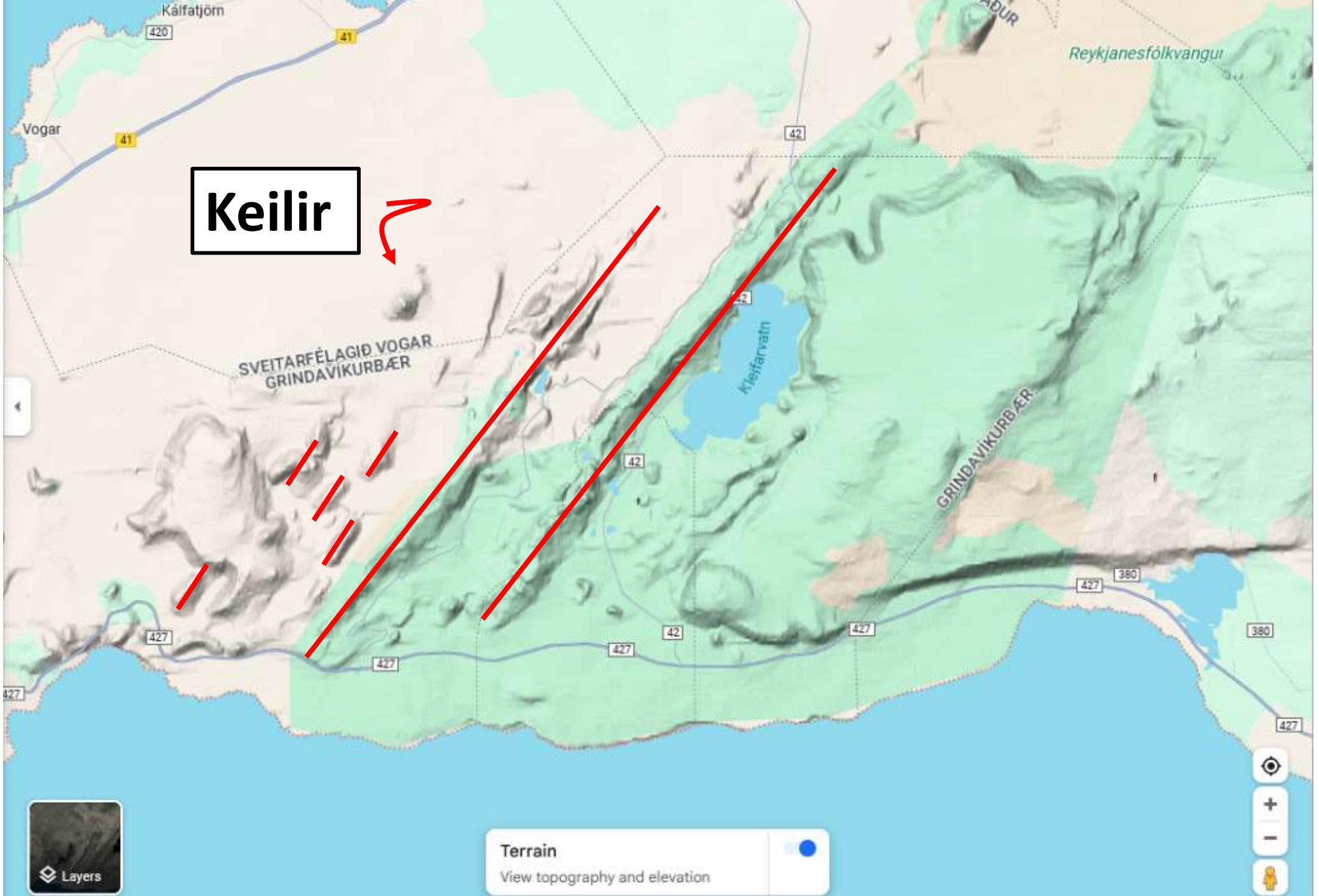
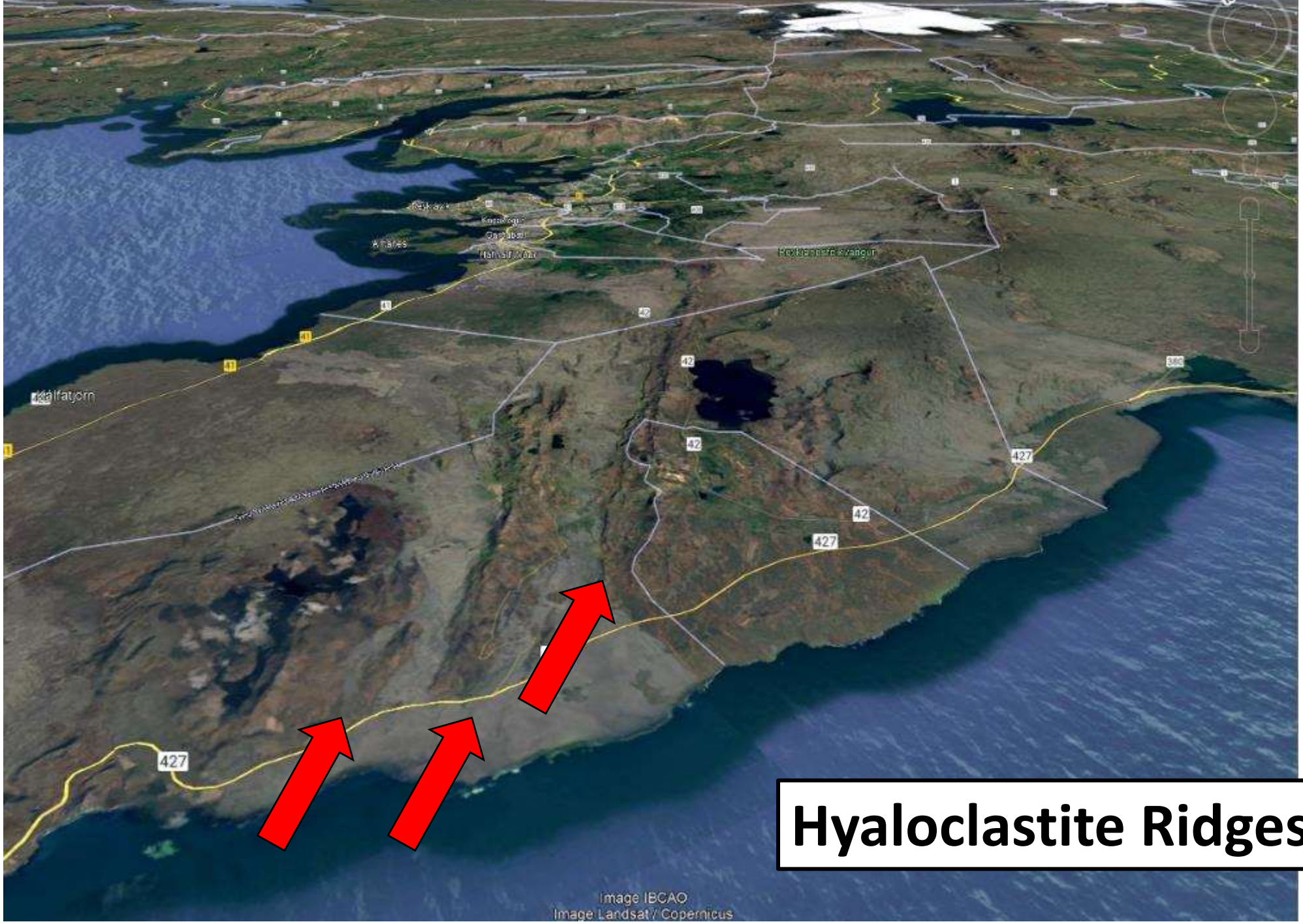
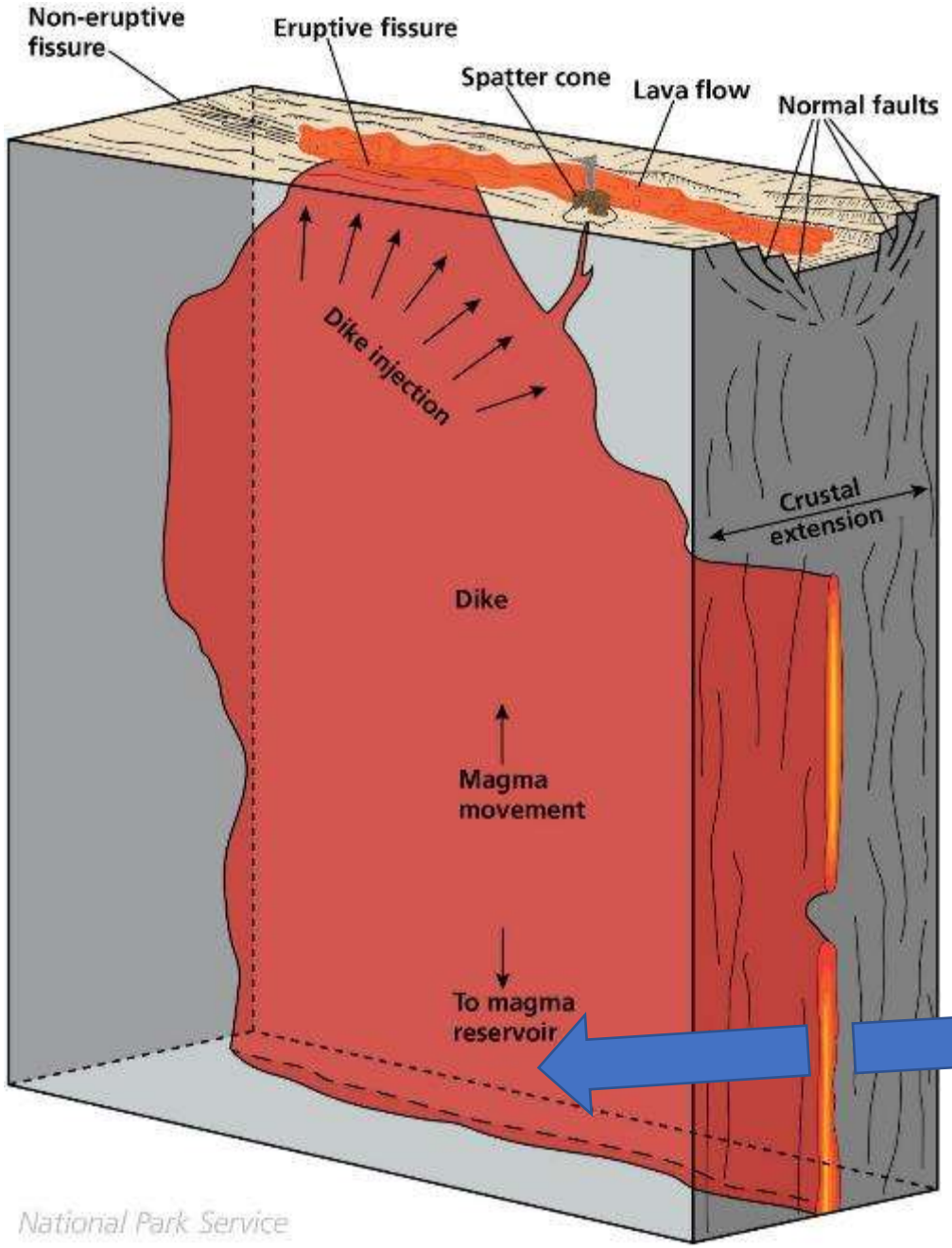

Keilir
Kálfatjörn
420
41
Vogar
42
Reykjanesfólkvangur
SVEITARFÉLAGIÐ VOGAR
GRINDAVÍKURBÆR
Kleifarvatn
GRINDAVÍKURBÆR
427
380
Layers
Terrain
View topography and elevation



Hyaloclastite Ridges


modern sub-areal
fissure eruption

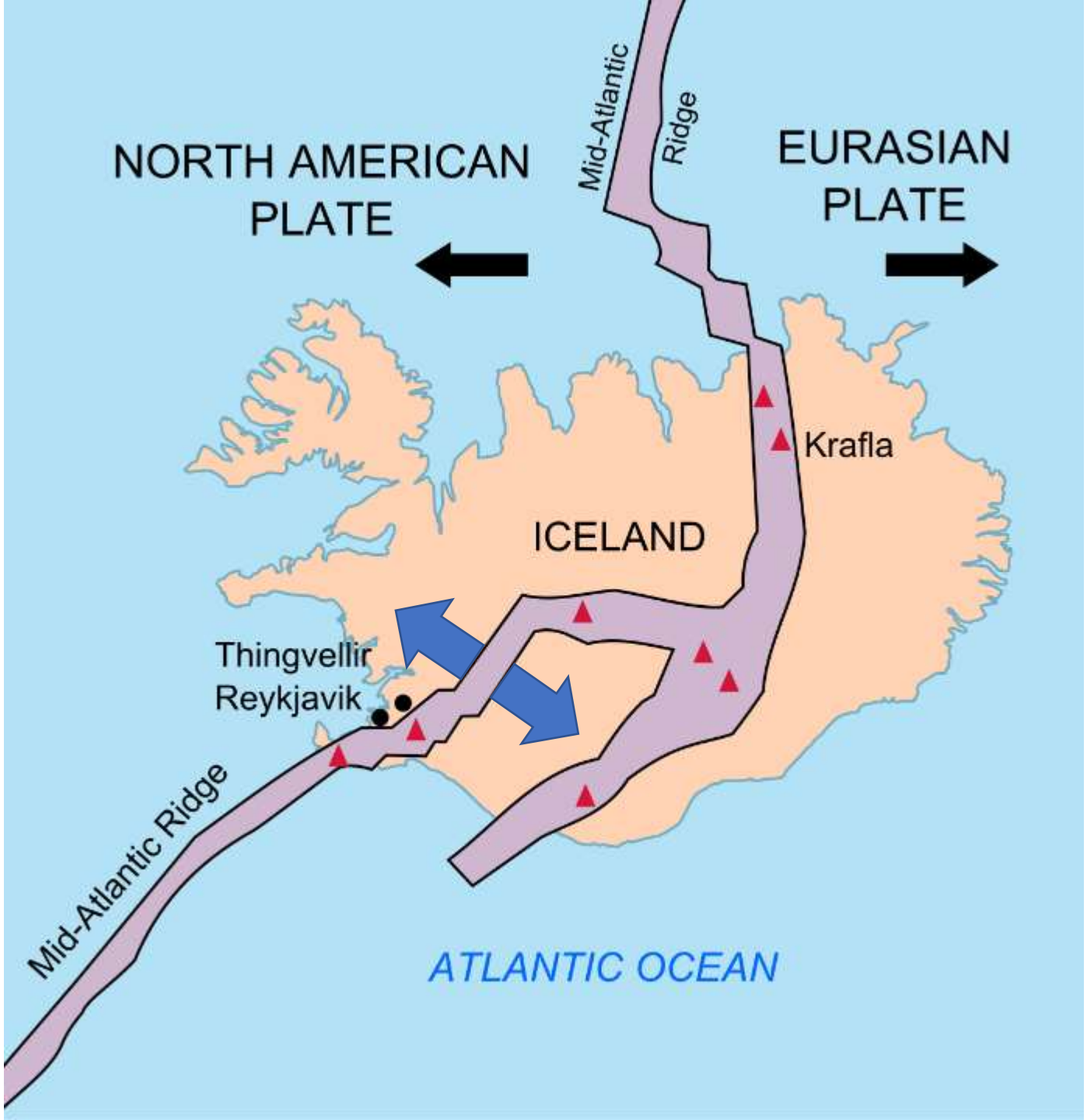


fissure eruption

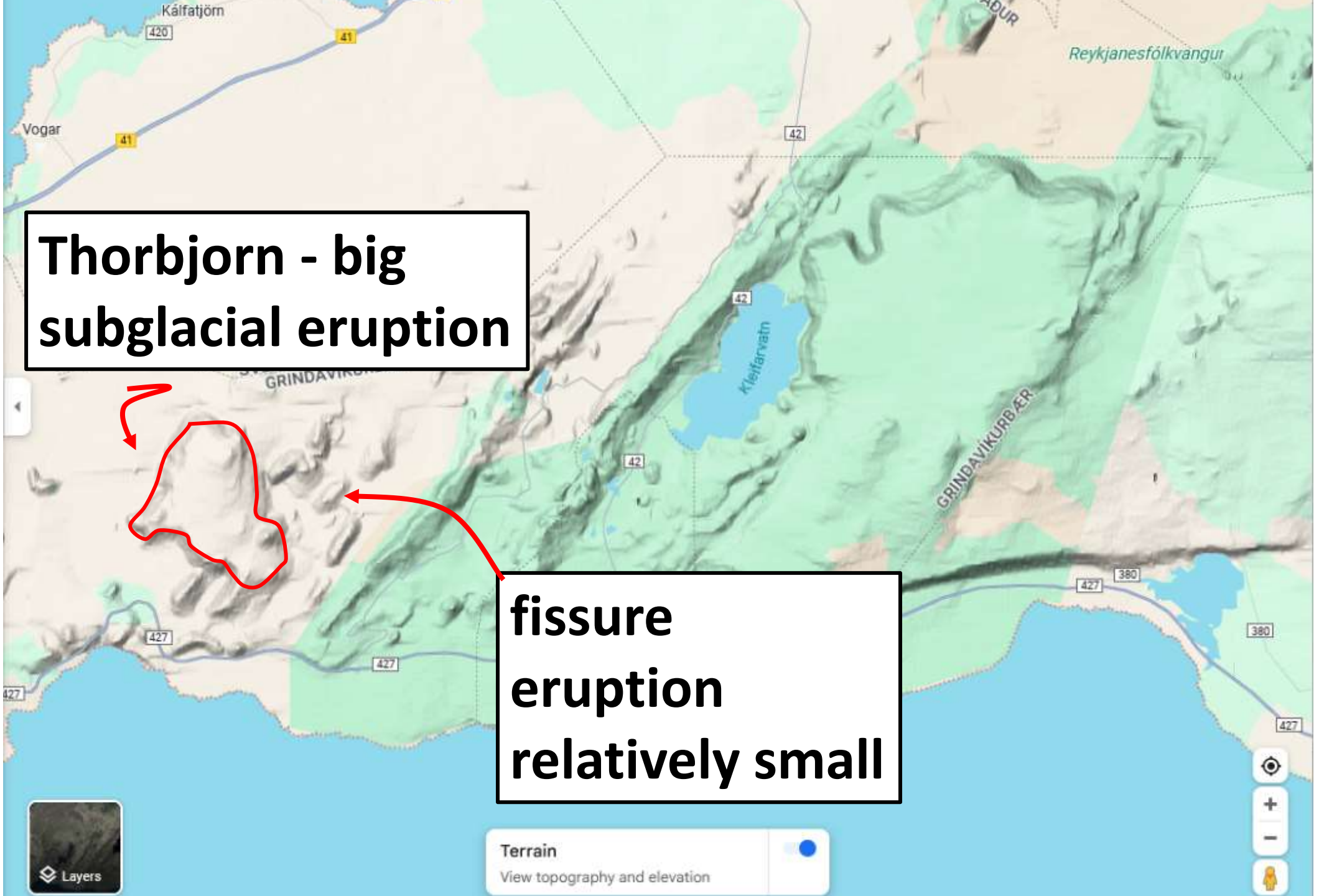
top of lava-filled vertical crack

opening direction is horizontal


Easy to judge opening diretion
Reykjanesfólkvangur
SVEITARFÉLAGIÐ VOGAR
GRINDAVÍKURBÆR
Kleifarvatn
GRINDAVÍKURBÆR
420
41
42
427
380
Layers
Terrain
View topography and elevation



opening direction controlled by plate tectonic extension


Thorbjorn - big subglacial eruption
fissure eruption relatively small
Kálfatjörn
420
41
Vogar
42
Reykjanesfólkvangur
Kleifarvatn
GRINDAVÍKURBÆR
427
380
Terrain
View topography and elevation
Layers

Thorbjorn (note that it is cut by fissures)

hyaloclastite ridges and hills common in iceland

Stream, with Efstadalsfjall (mountain) in the distance

Raudafell (mountain), at sunrise

Blafell (mountain) as seen from Bjarnafell (mountain)

Part 3

Table Mountains

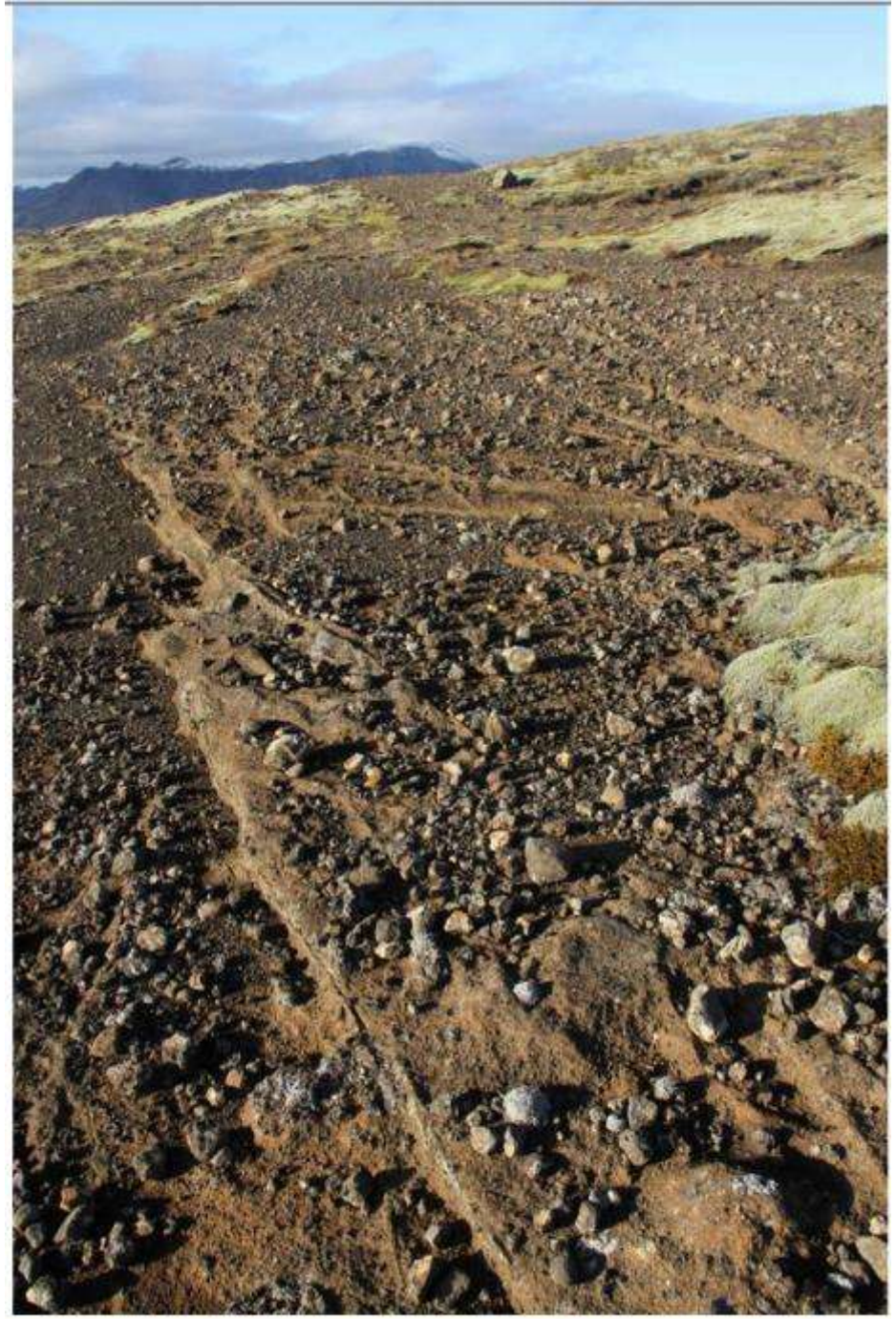
Bjarnafell, as seen from along the hiking route

flat layers on top

by the way, Iceland is the most ecologically-damaged country in Europe. Why?

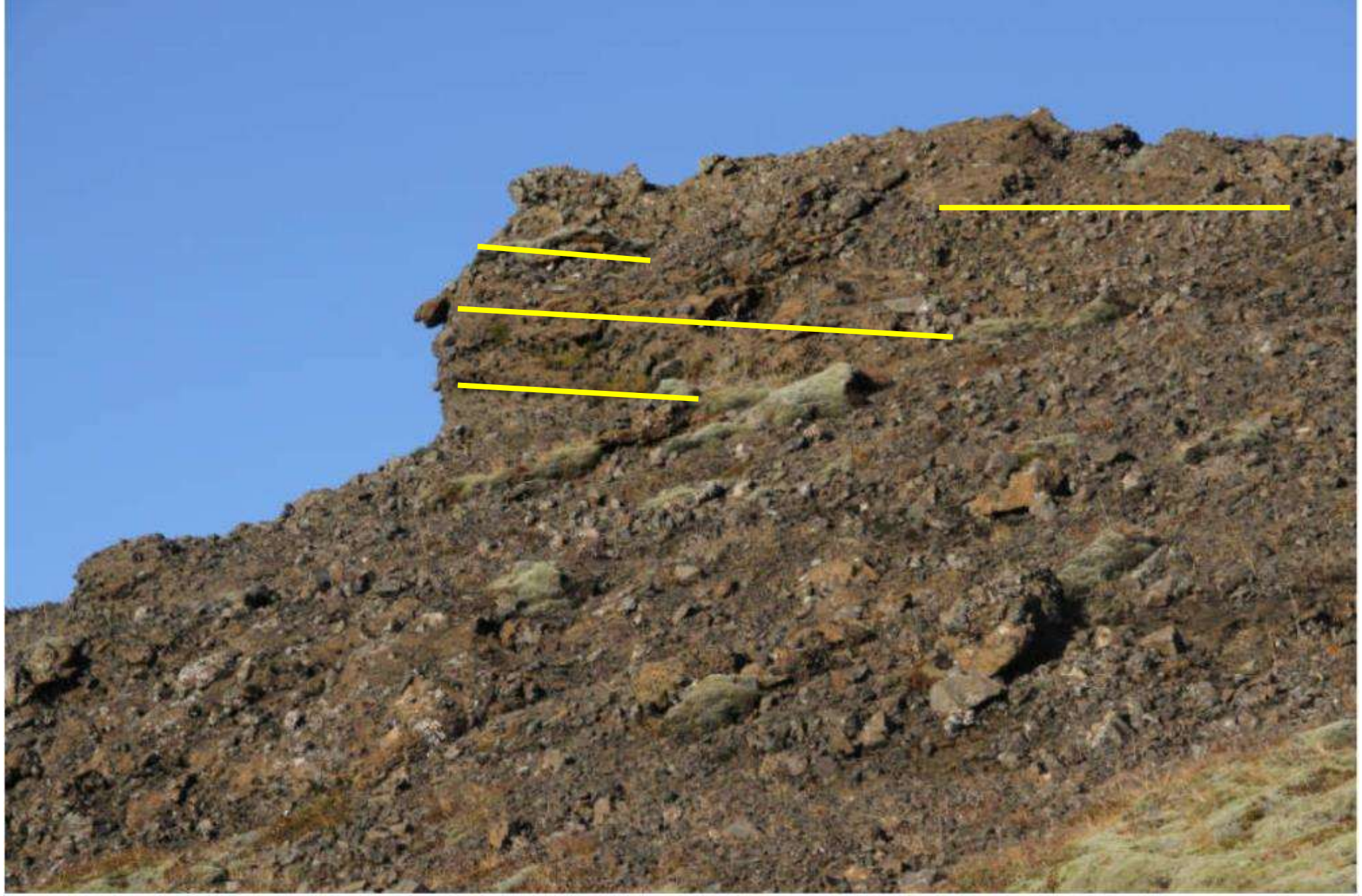
Soil erosion

Glacial striae on a boulder



Hyaloclastite strata on the flank of Bjarnafell

Hyaloclastite outcrop on the flank of Bjarnafell



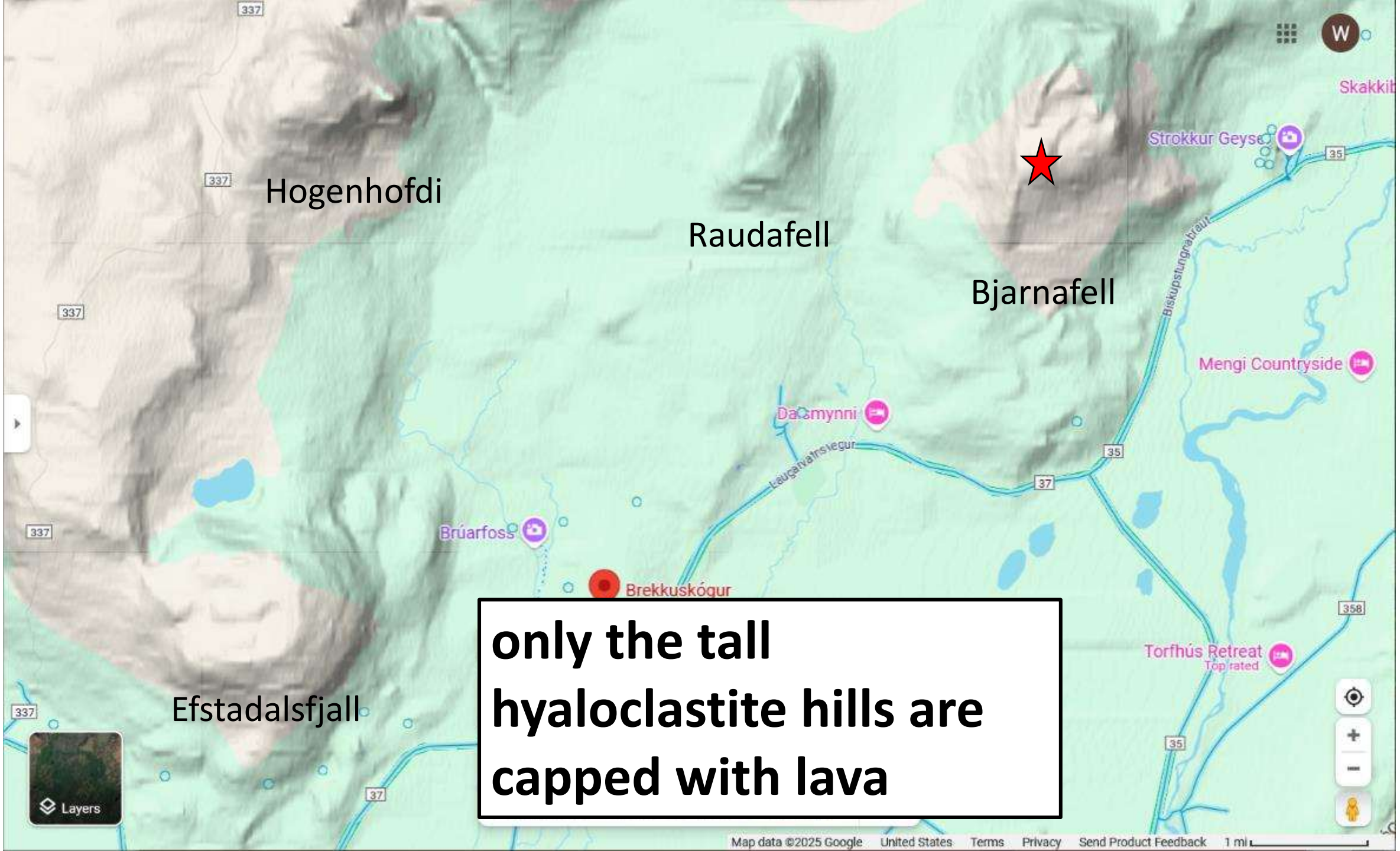
Hyaloclastite outcrop on the flank of Bjarnafell

Hyaloclastite boulder containing large clasts


Next

Basalt outcrop on summit plateau of Bjarnafell

Dallas, on the summit plateau of Bjarnafell


Hogenhofdi
Raudafell
Bjarnafell
Efstadalsfjall
Strokkur Geyser
Mengi Countryside
Brúarfoss
Brekkuskógur
Torfhús Retreat
Top rated
Layers
only the tall hyaloclastite hills are capped with lava
Map data ©2025 Google
United States
Terms
Privacy
Send Product Feedback
1 mi

Gaesafjoll


Gaesafjoll
Krafla
Leirhnjúkur
Krafla
Terrain
View topography and elevation
Images


87
87
Leirhnjukur

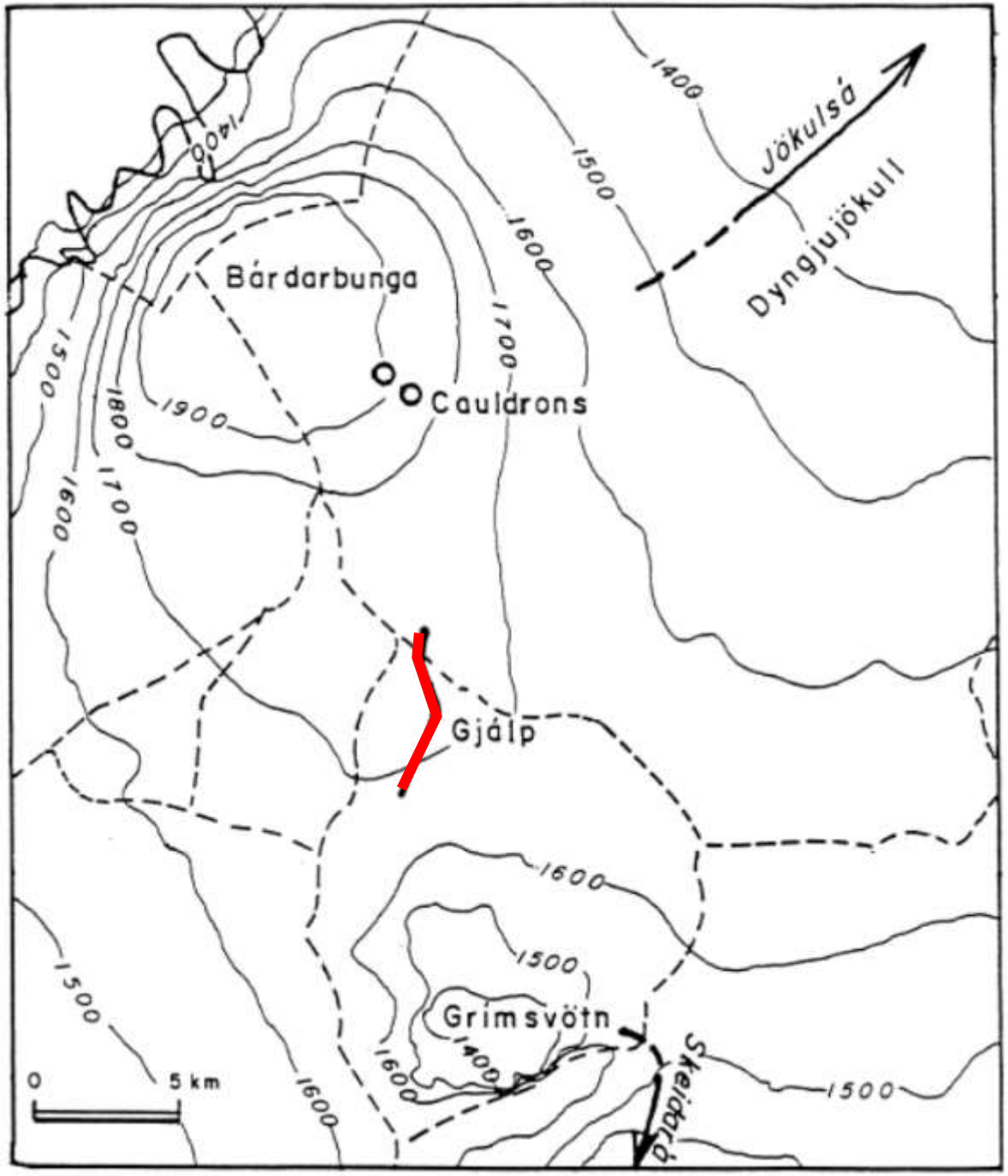
Volcanic Crater

Basalt at top

Herðubreið

Volcanic Crater

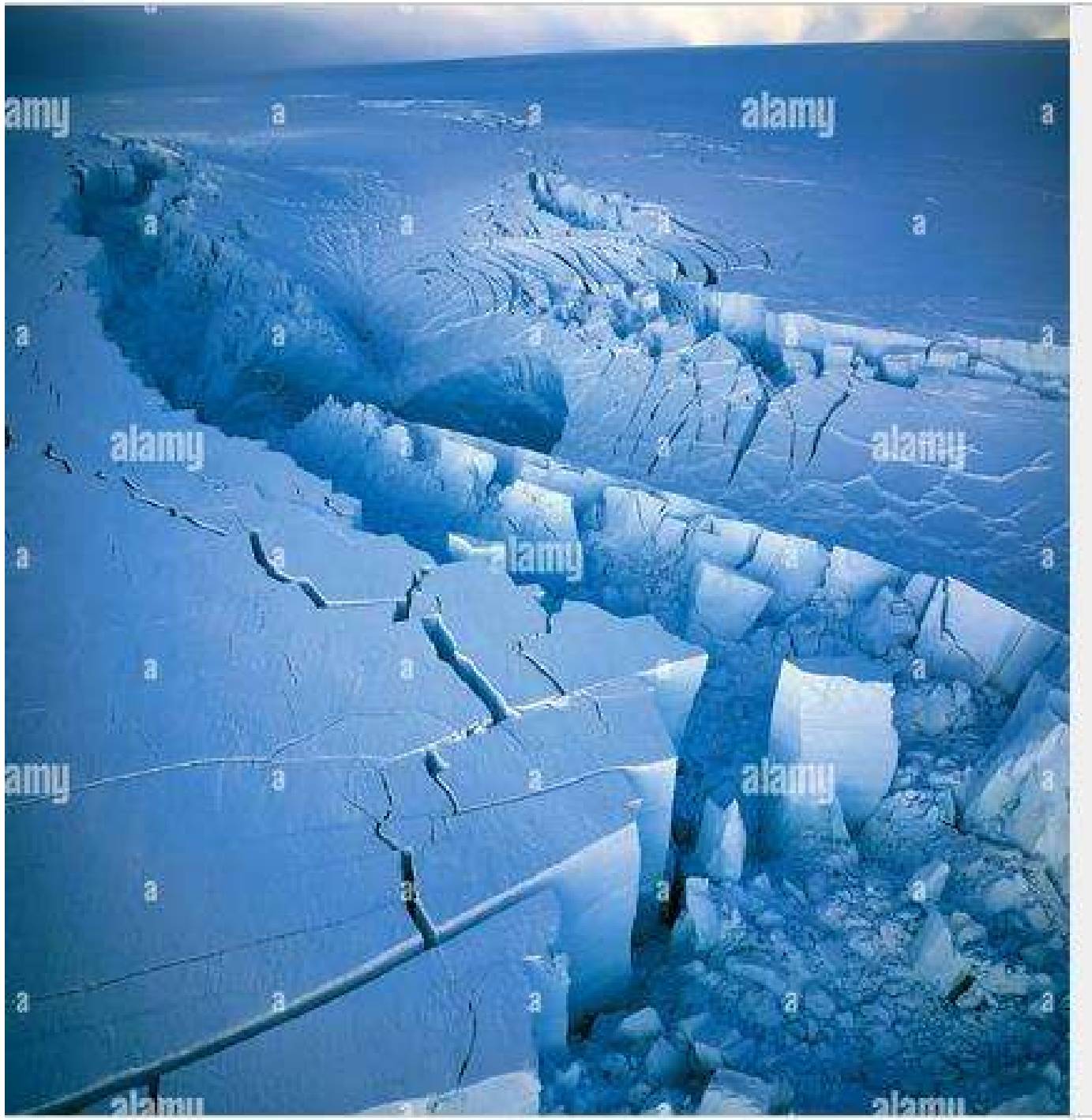
Herðubreið



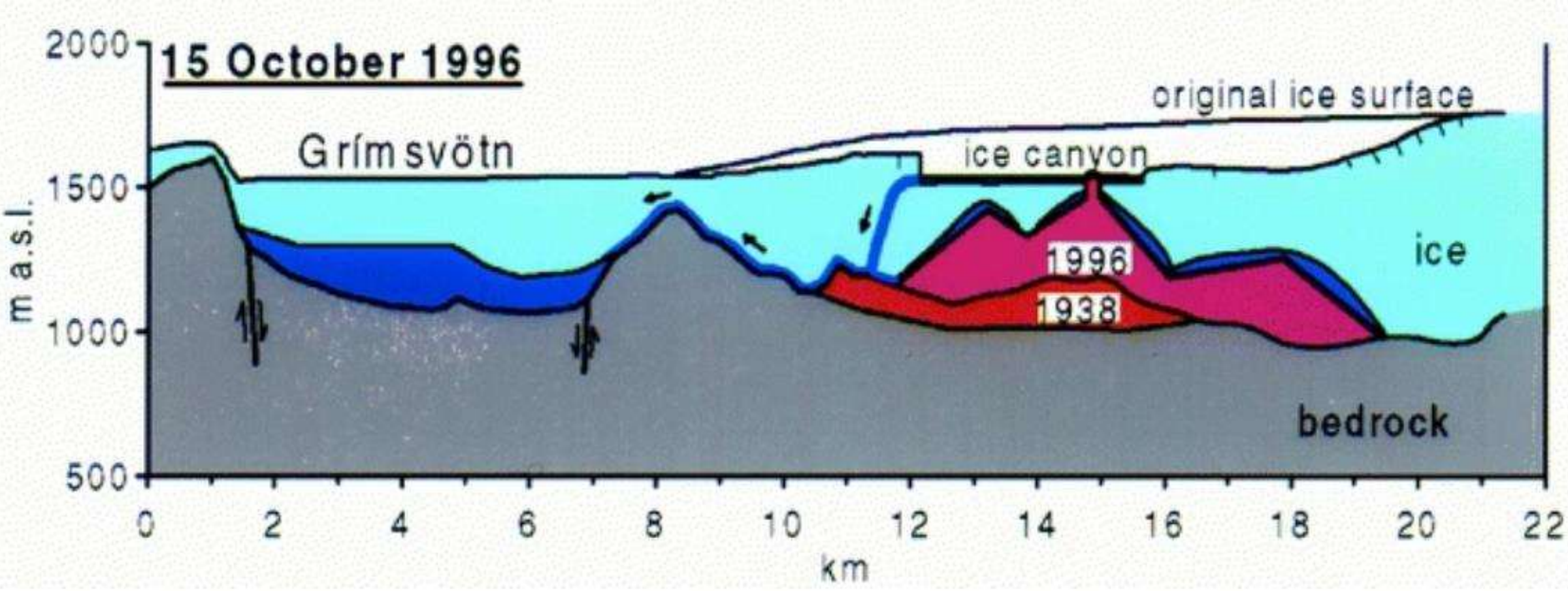
1996 subglacial eruption

Subglacial Gjalp eruption in 1996. Páll Stefánsson, Iceland Geological Survey, CC BY

tephra-covered glacier

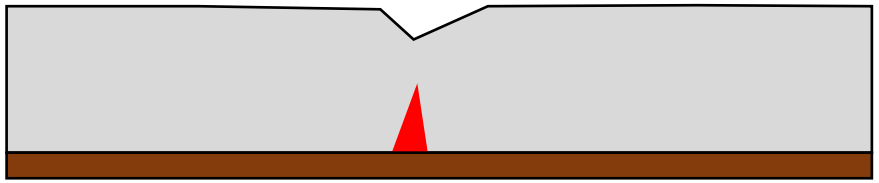


giant slot melted in ice

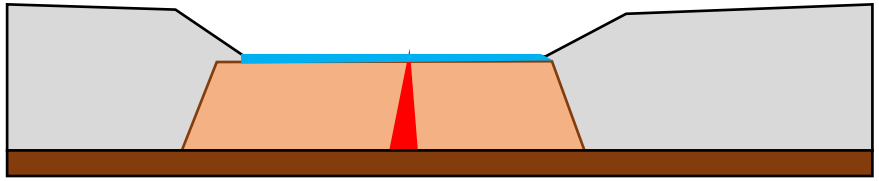

15 October 1996
Grímsvötn
original ice surface
ice canyon
1996
1938
ice
bedrock
2000
1500
1000
500
m a.s.l.
0
2
4
6
8
10
12
14
16
18
20
22
km

formation of table mountain

1



2



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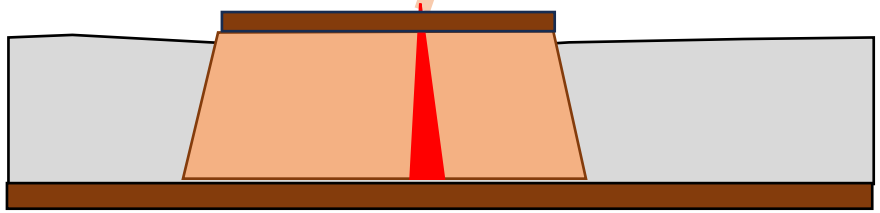
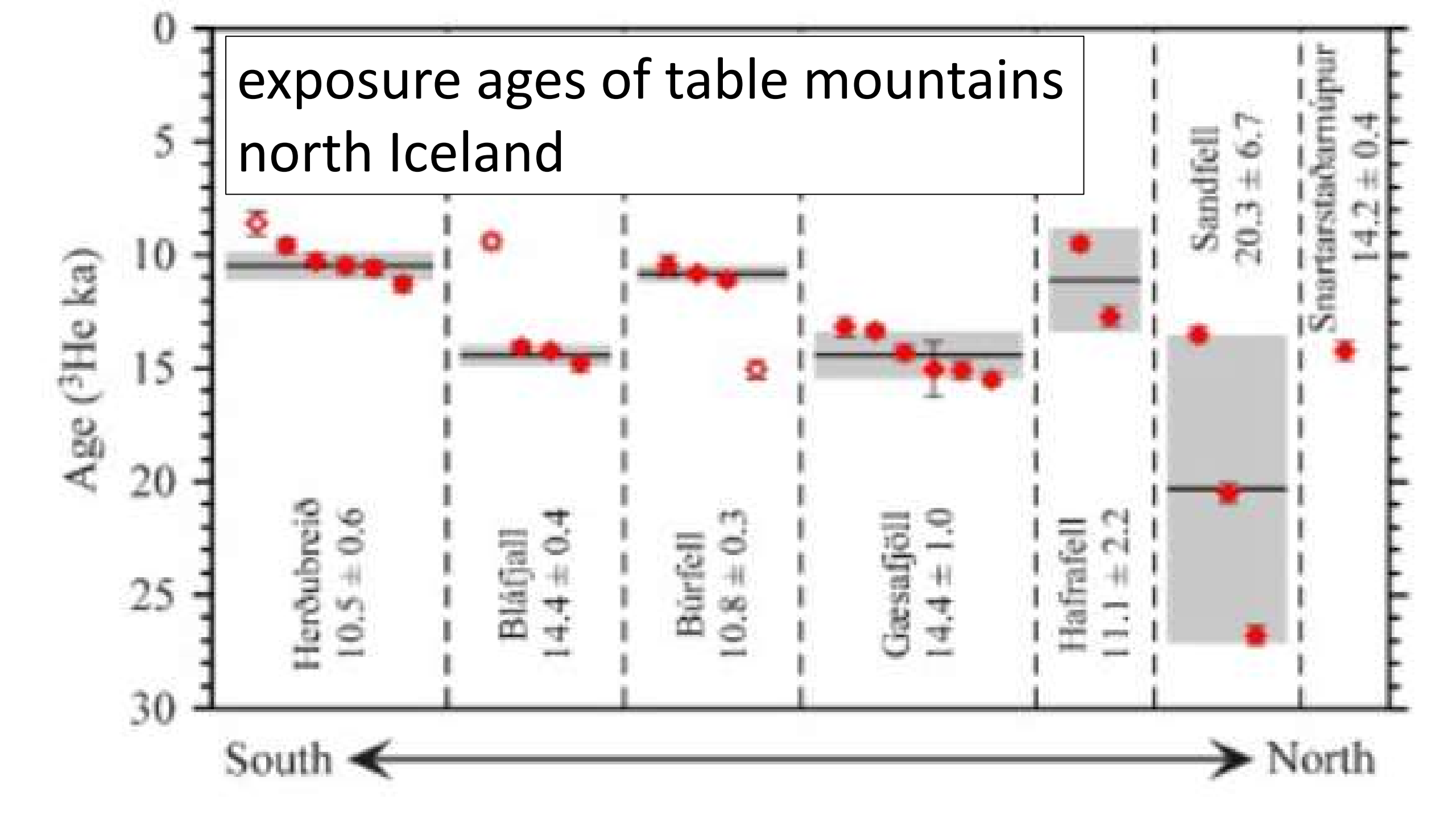


4

5

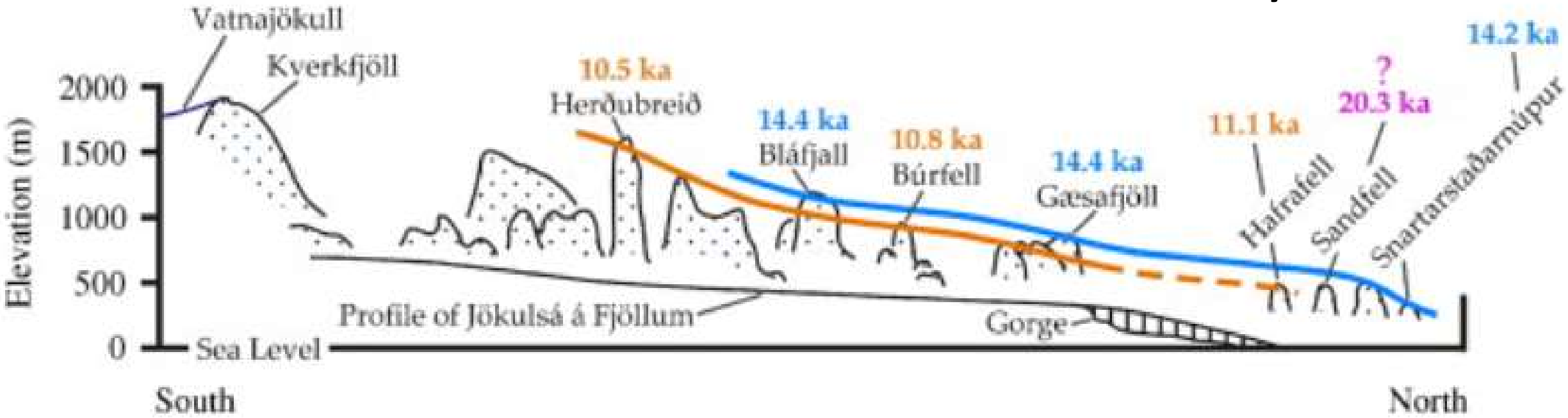

exposure ages of table mountains north Iceland
Age (^{3}He ka)
0
5
10
15
20
25
30
Herðubreið
10.5 ± 0.6
Bláfjall
14.4 ± 0.4
Búrfell
10.8 ± 0.3
Gæsafjöll
14.4 ± 1.0
Hafrafell
11.1 ± 2.2
Sandfell
20.3 ± 6.7
Snartarstaðarnúpur
14.2 ± 0.4
South
North

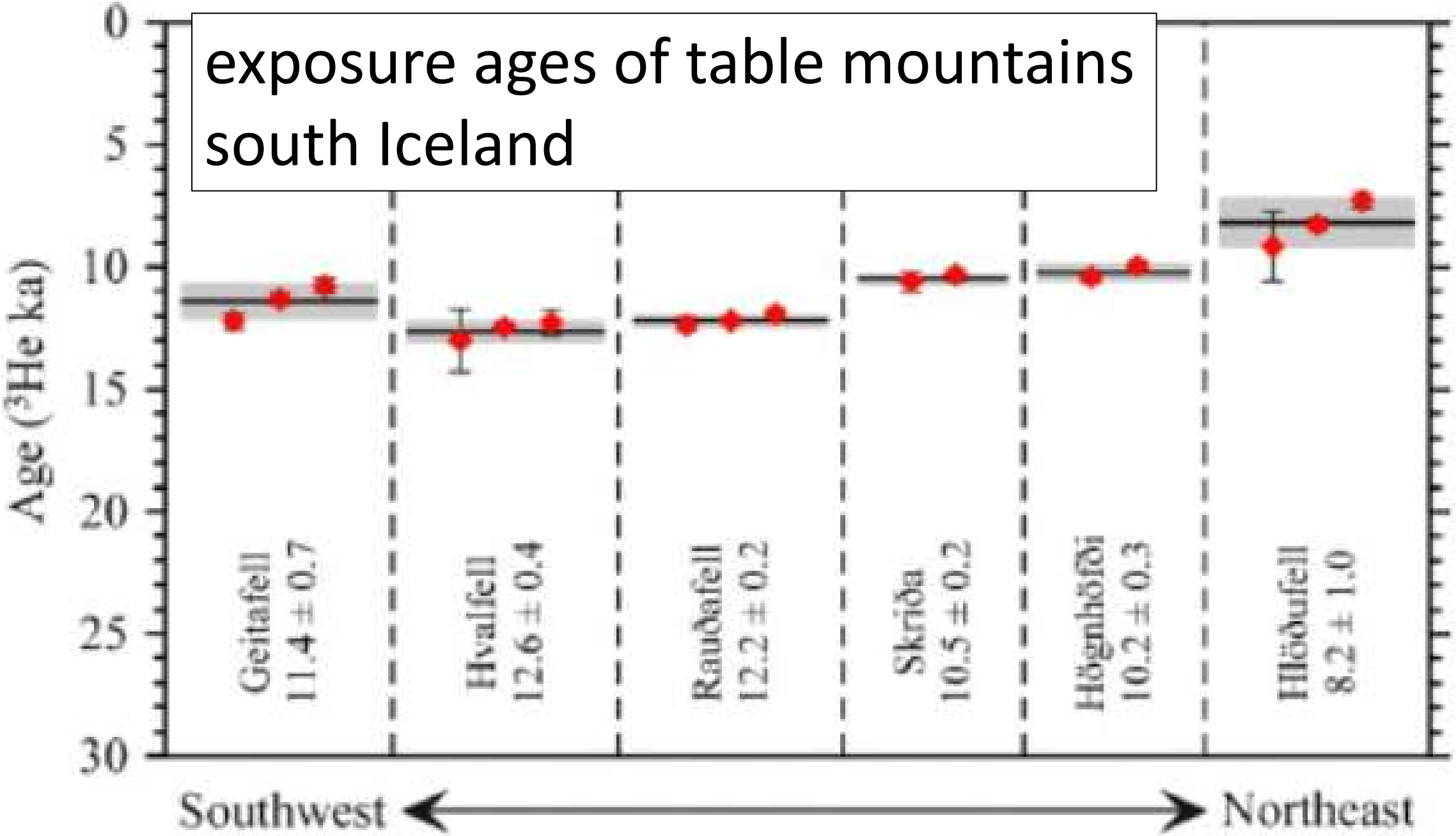
height and exposure ages of table mountains

North Iceland

14,400 yrs

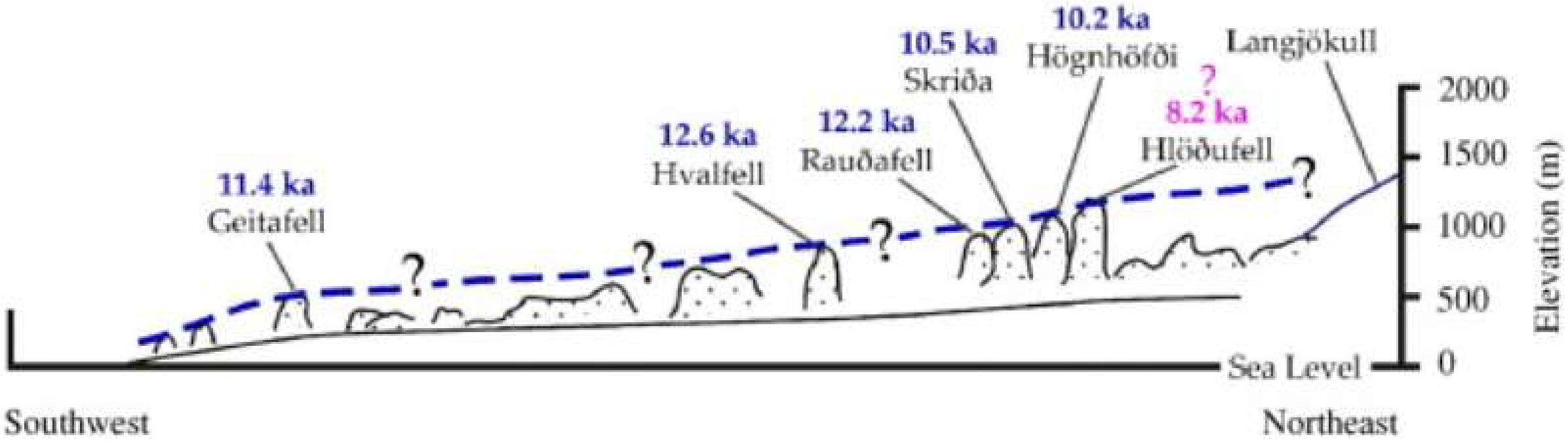
10,500 yrs




exposure ages of table mountains south Iceland
Age (^{3}He ka)
0
5
10
15
20
25
30
Geitafell
11.4 ± 0.7
Hvalfell
12.6 ± 0.4
Raudafell
12.2 ± 0.2
Skriða
10.5 ± 0.2
Högnhöfði
10.2 ± 0.3
Hlöðufell
8.2 ± 1.0
Southwest
Northeast

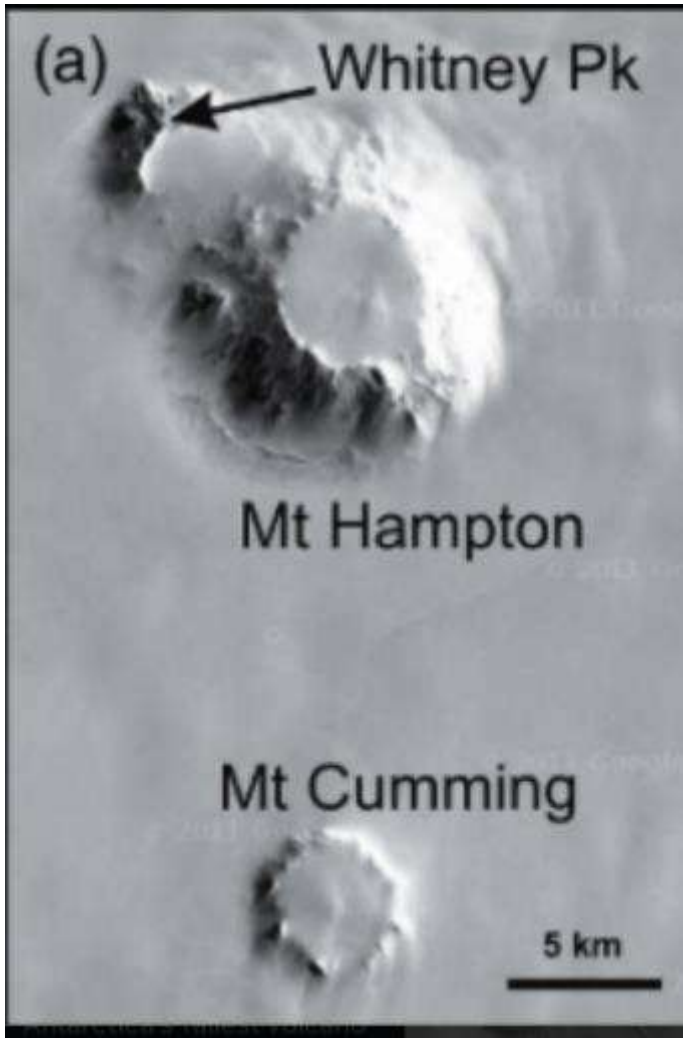
height and exposure ages of table mountains

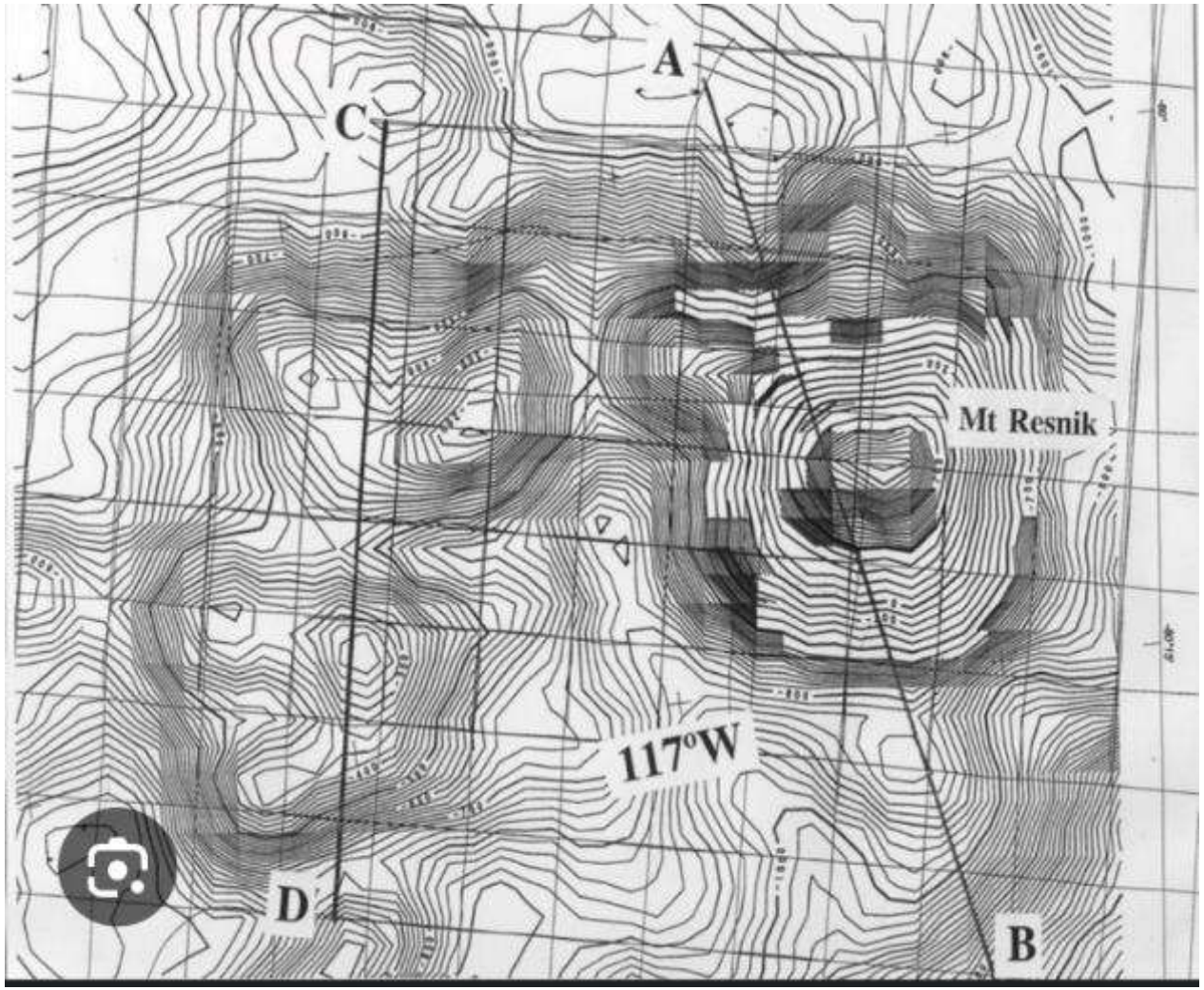
south Iceland ——— 14,000 – 12,600 yrs



Volcanoes in West Antarctica

Volcanoes in West Antarctica





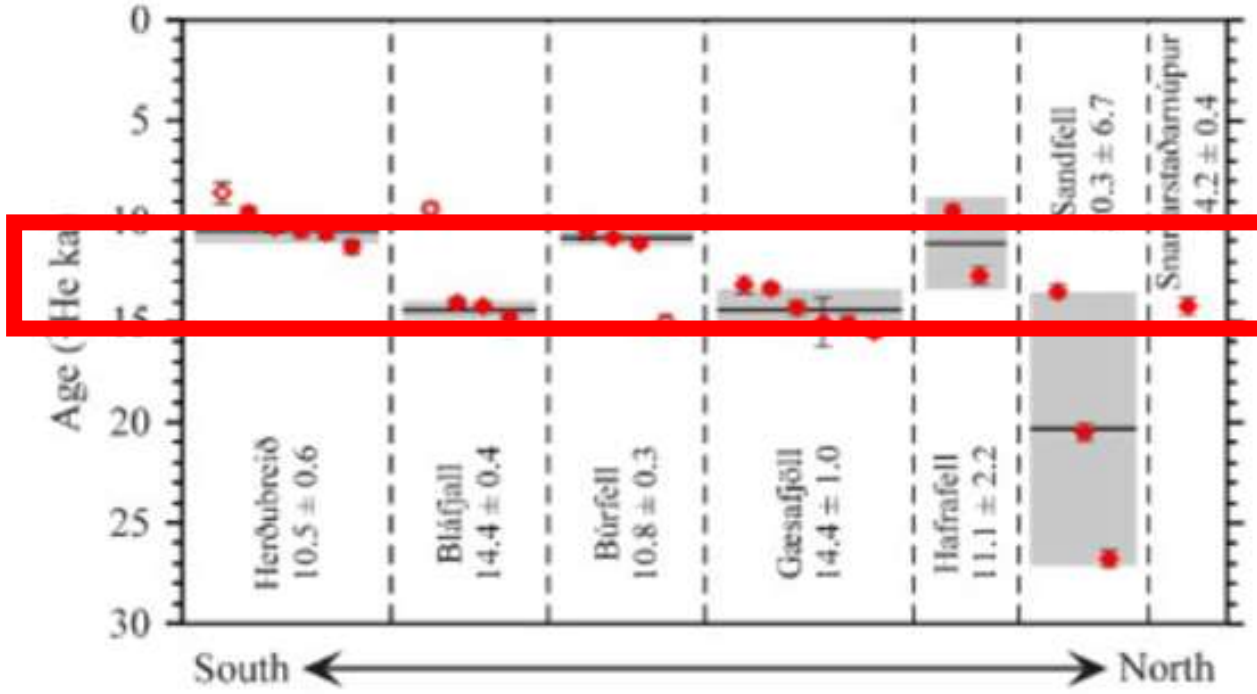
sub-areal

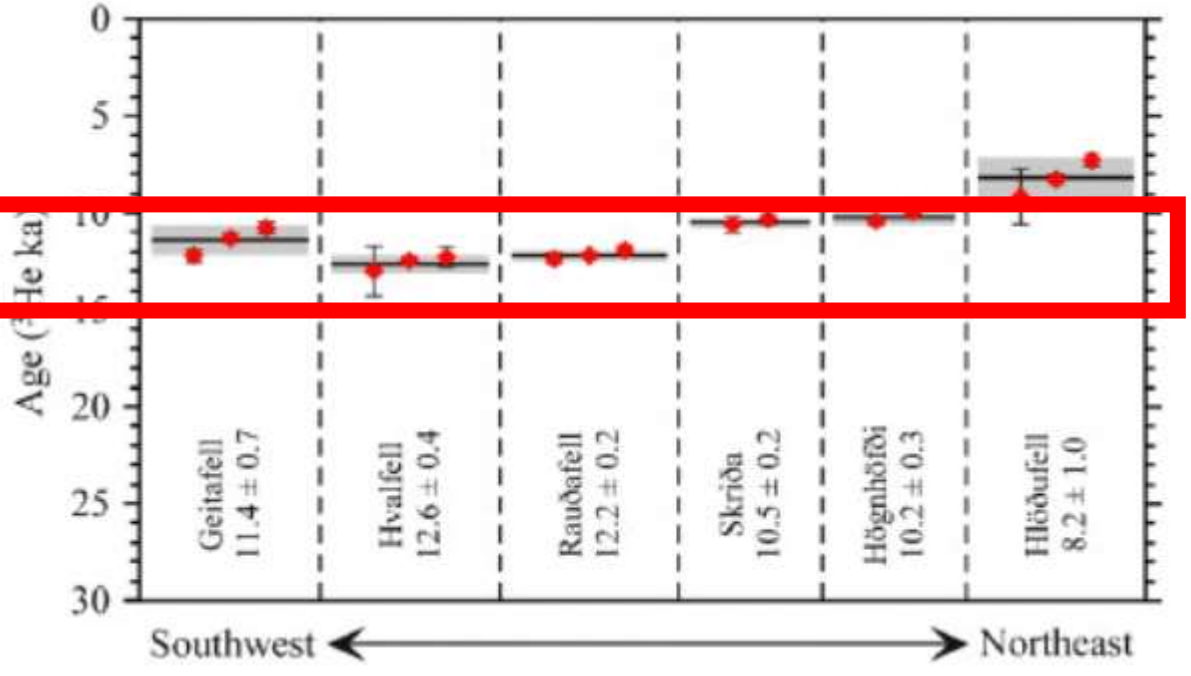
sub-glacial

Part 4

Glacial Rebound and accelerated volcanism

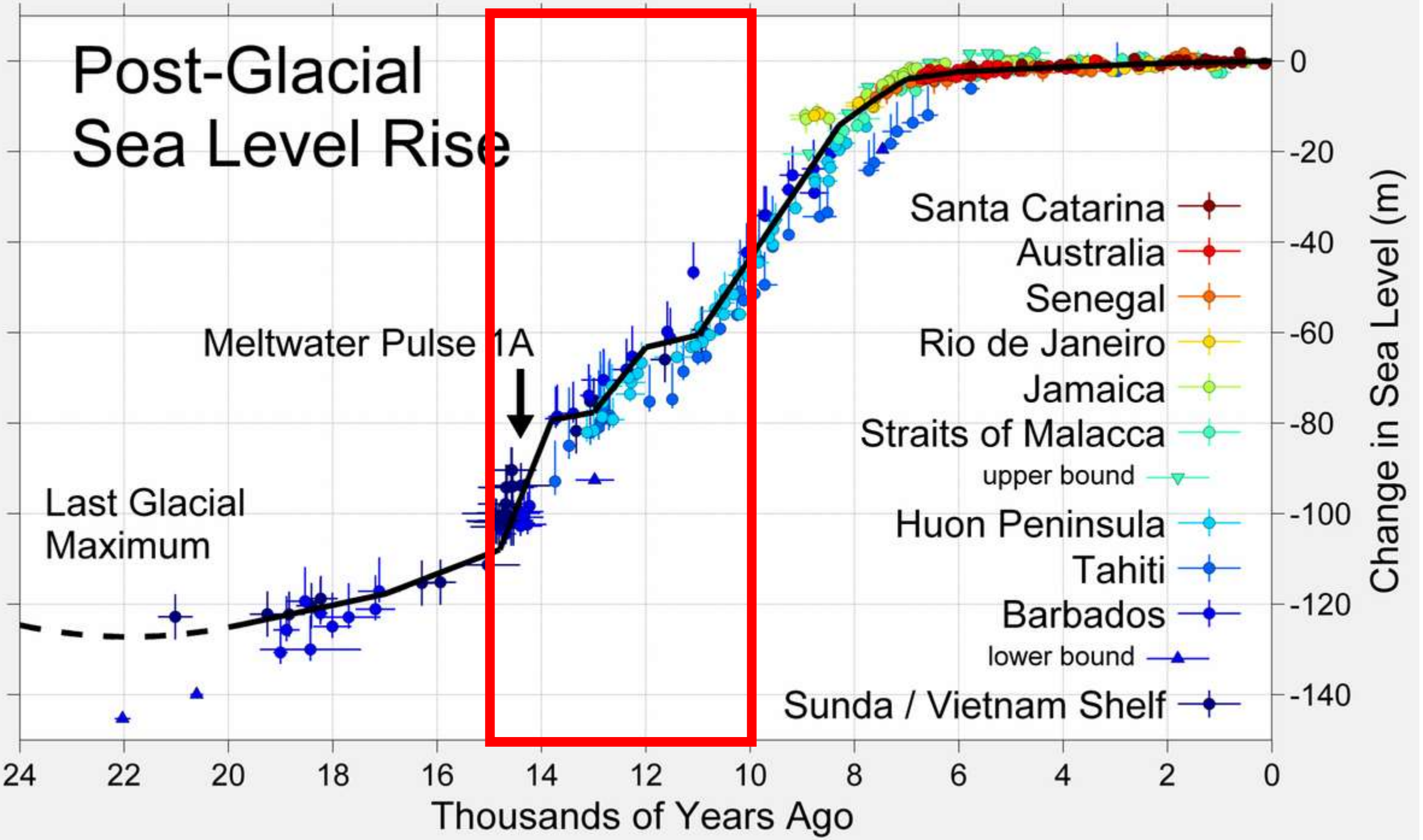
most table mountains date in the 10,000-15,000 yr range





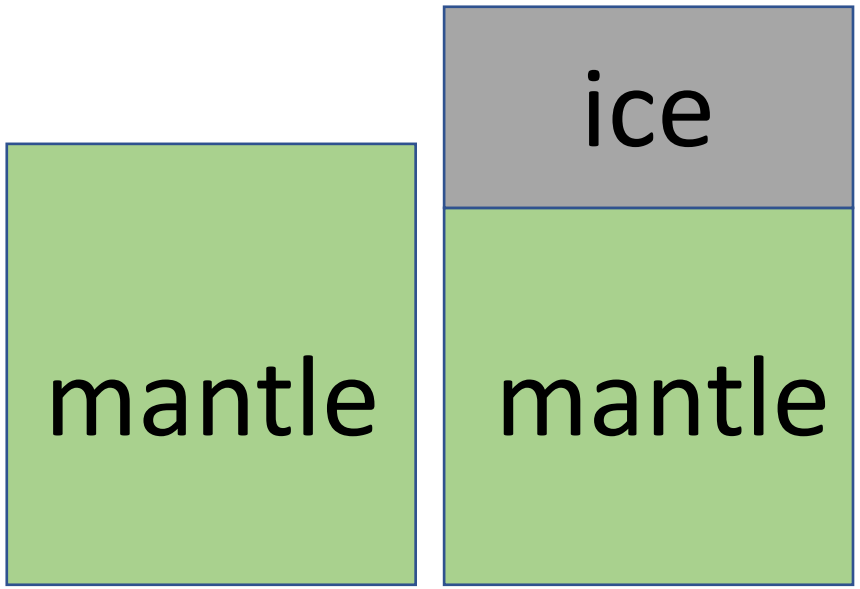
south Iceland

north Iceland

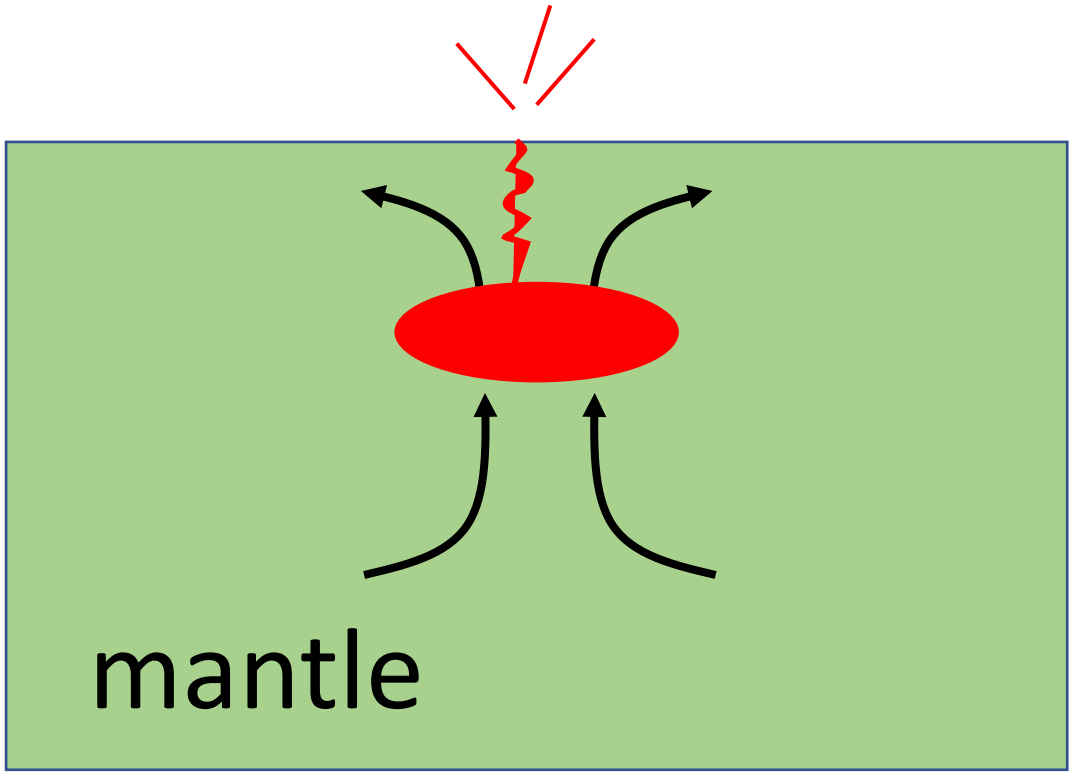

Post-Glacial
Sea Level Rise
Meltwater Pulse 1A
Last Glacial
Maximum
Santa Catarina
Australia
Senegal
Rio de Janeiro
Jamaica
Straits of Malacca
upper bound
Huon Peninsula
Tahiti
Barbados
lower bound
Sunda / Vietnam Shelf
0
-20
-40
-60
-80
-100
-120
-140
Change in Sea Level (m)
24
22
20
18
16
14
12
10
8
6
4
2
0
Thousands of Years Ago

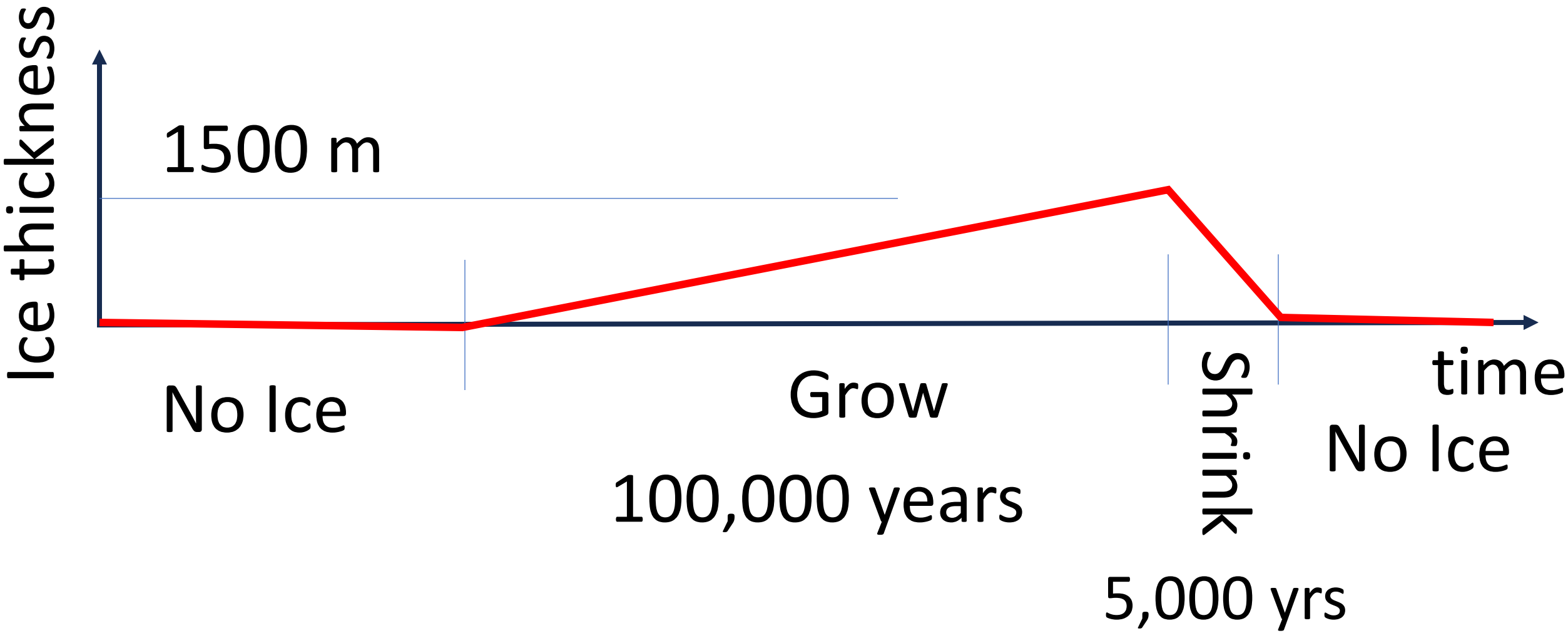
Two things you need to know

(1) 1500 m of ice depresses mantle by 500 m

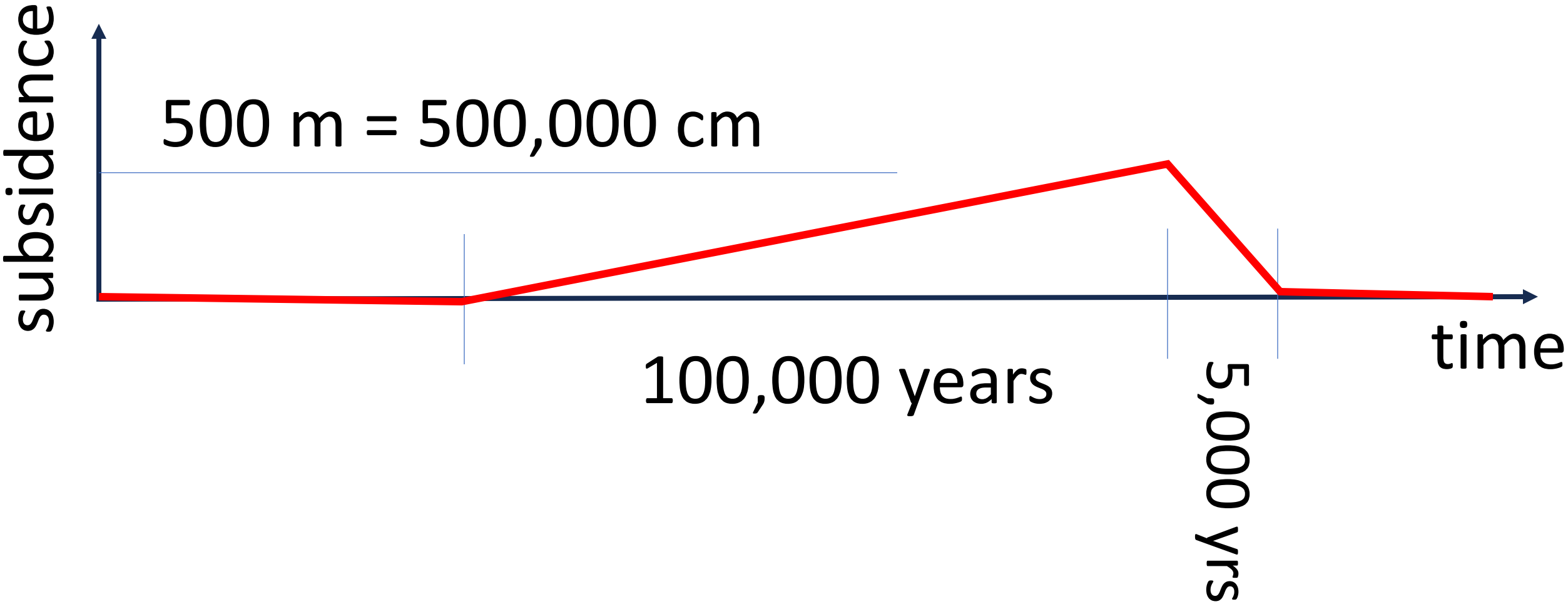


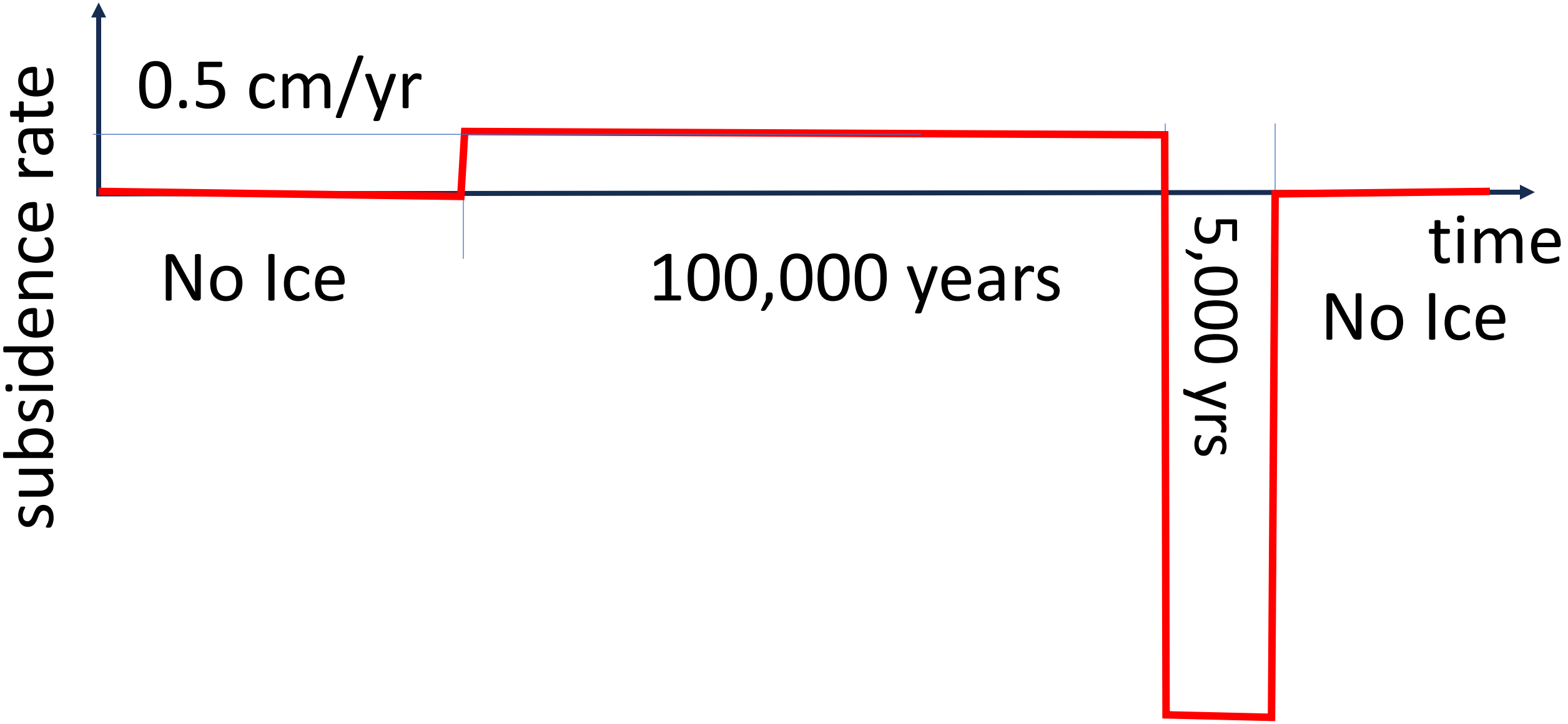
(2) mantle melts when it upwells to make magma

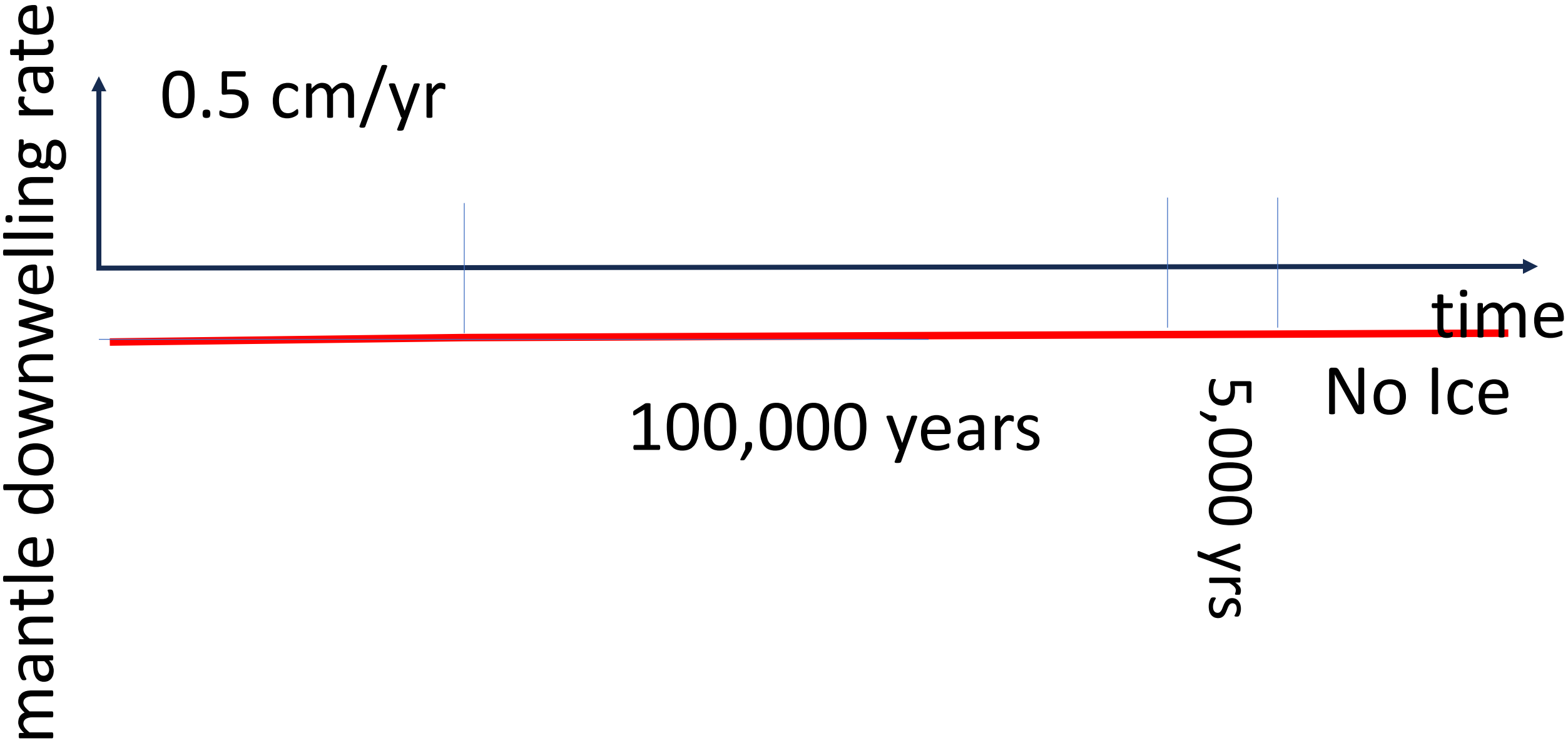


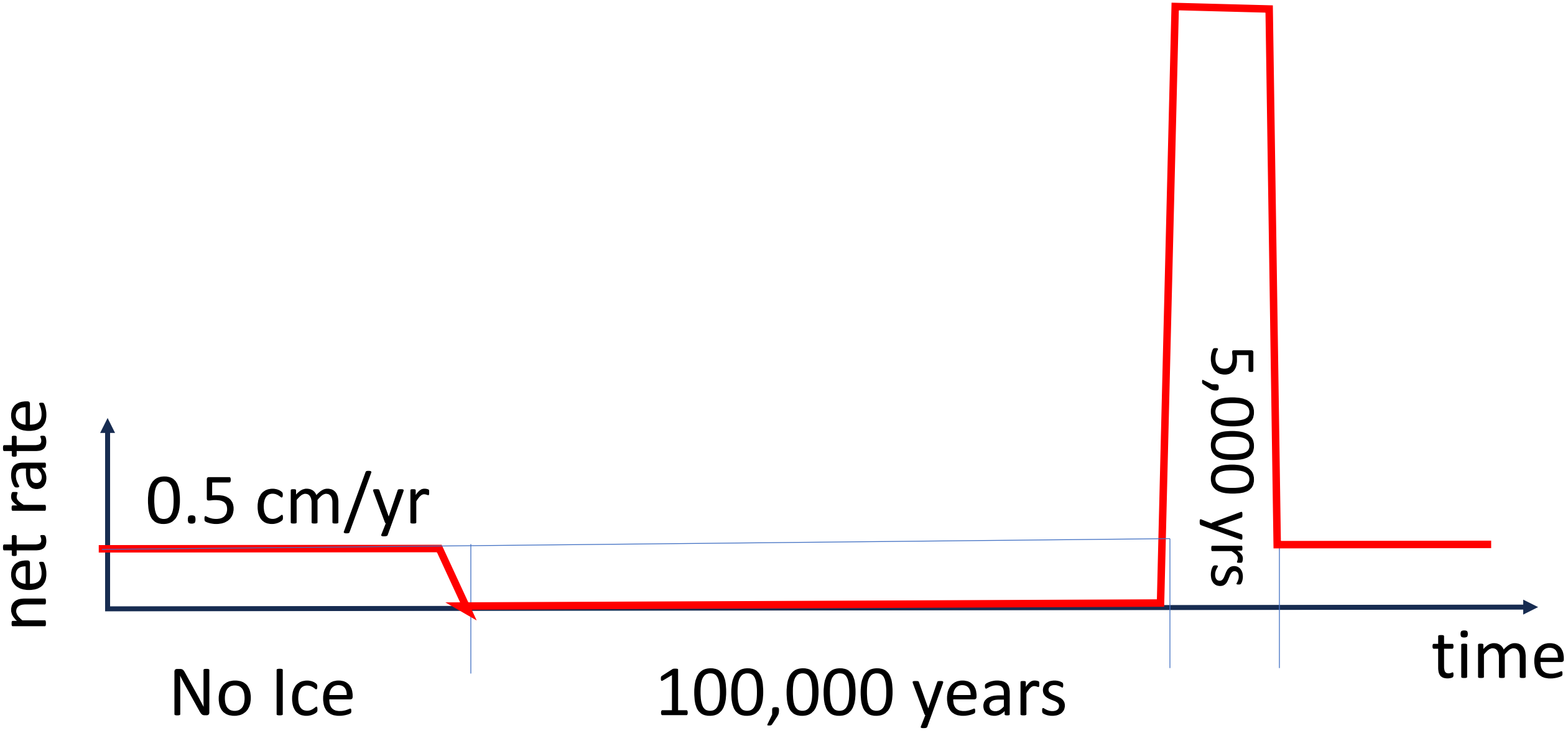

Ice thickness
1500 m
No Ice
Grow
100,000 years
Shrink
5,000 yrs
time
No Ice

ice 1/3 of density of mantle




subsidence rate
0.5 cm/yr
No Ice
100,000 years
5,000 yrs
time
No Ice


mantle downwelling rate
0.5 cm/yr
time
100,000 years
5,000 yrs
No Ice


net rate
0.5 cm/yr
5,000 yrs
time
No Ice
100,000 years

suppose the mantle upwelling rate is 0.5 cm/yr

(a reasonable number)

subsidence cancels mantle upwelling for 100,000 yrs

no decompression melting of mantle occurs

no volcanism occurs until the ice melts

then 100,000 years of volcanism

are compressed into 5,000 year

Part 5

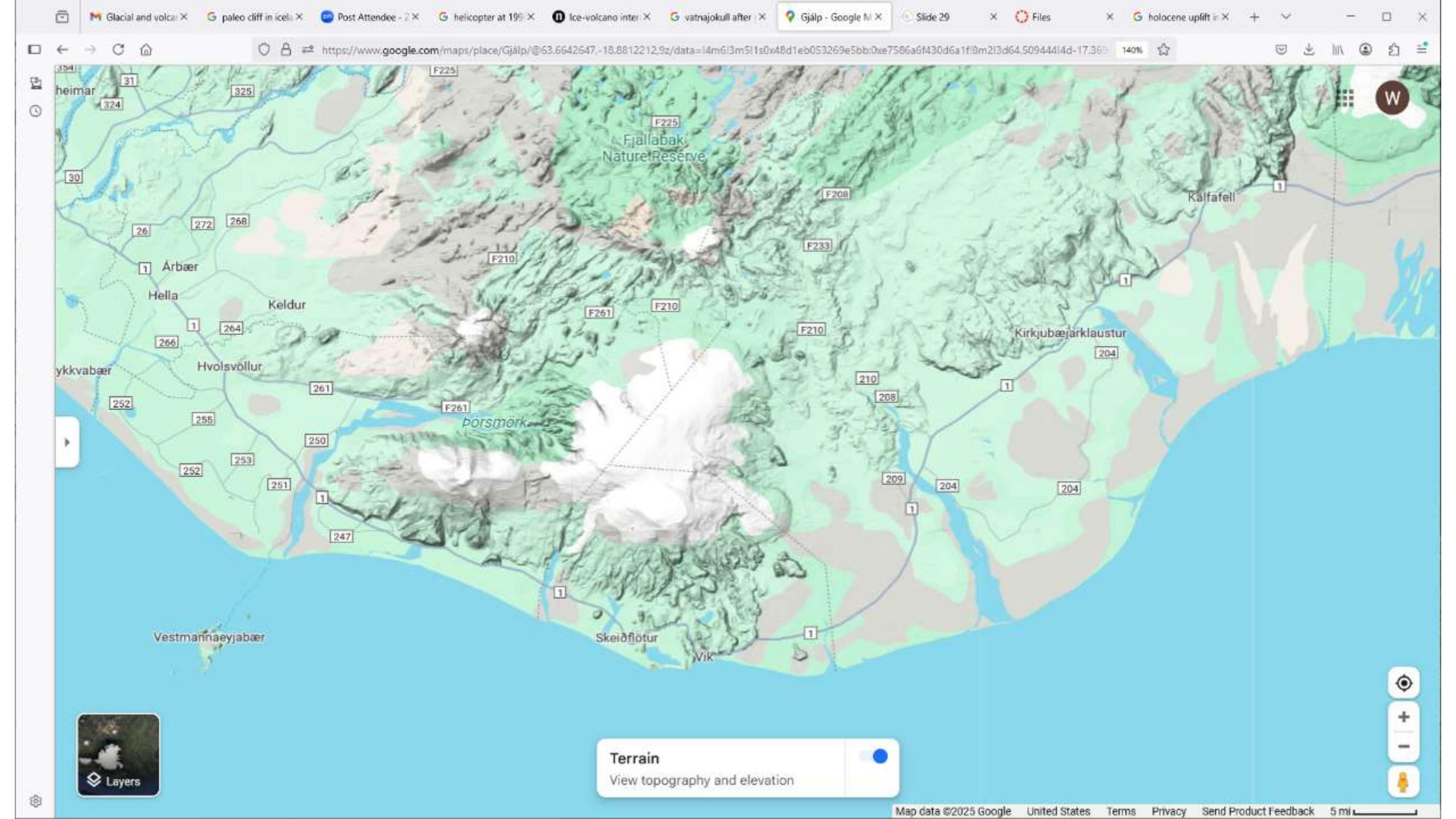
Glacial subsidence and ancient shorelines

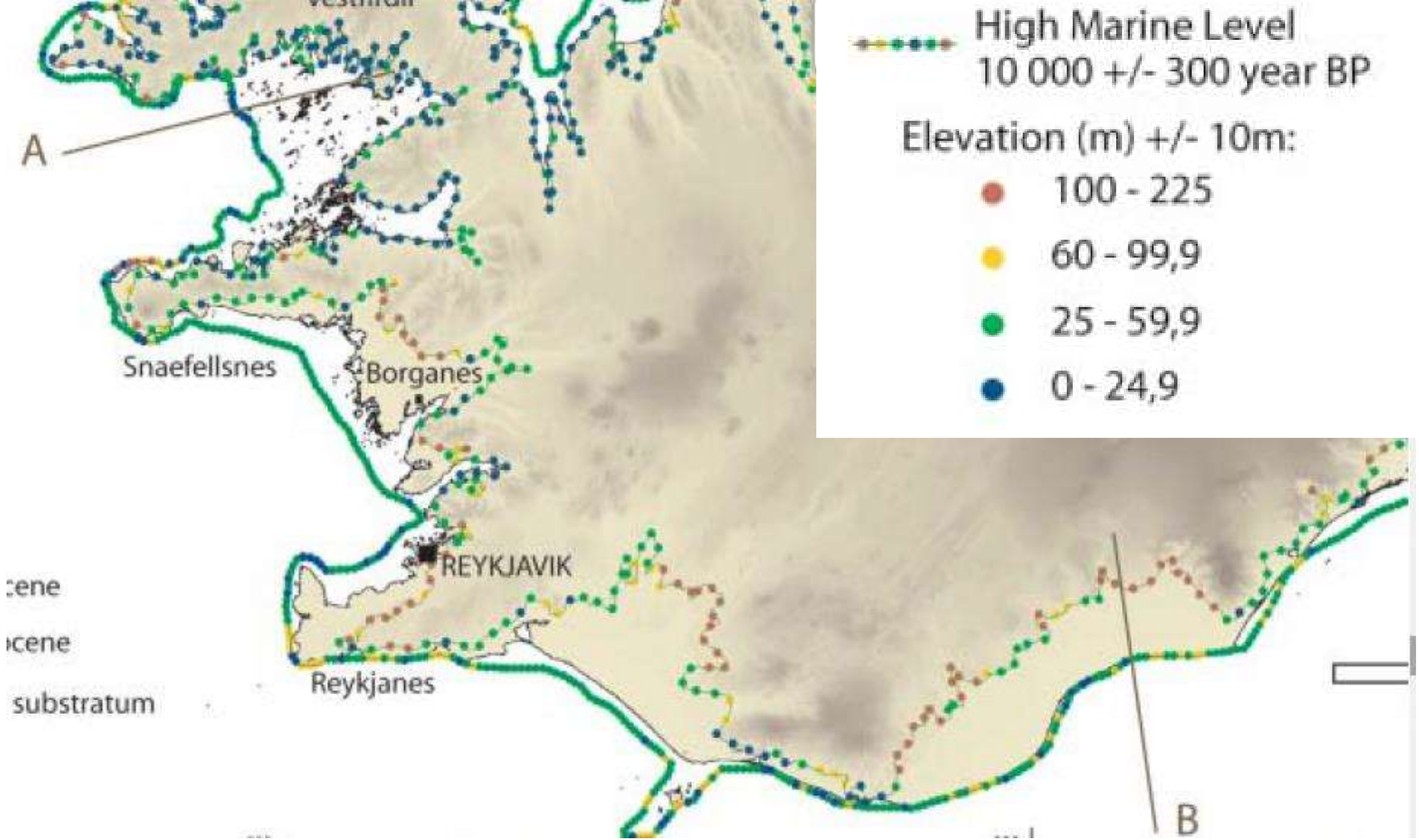
Stream from Skogarfoss

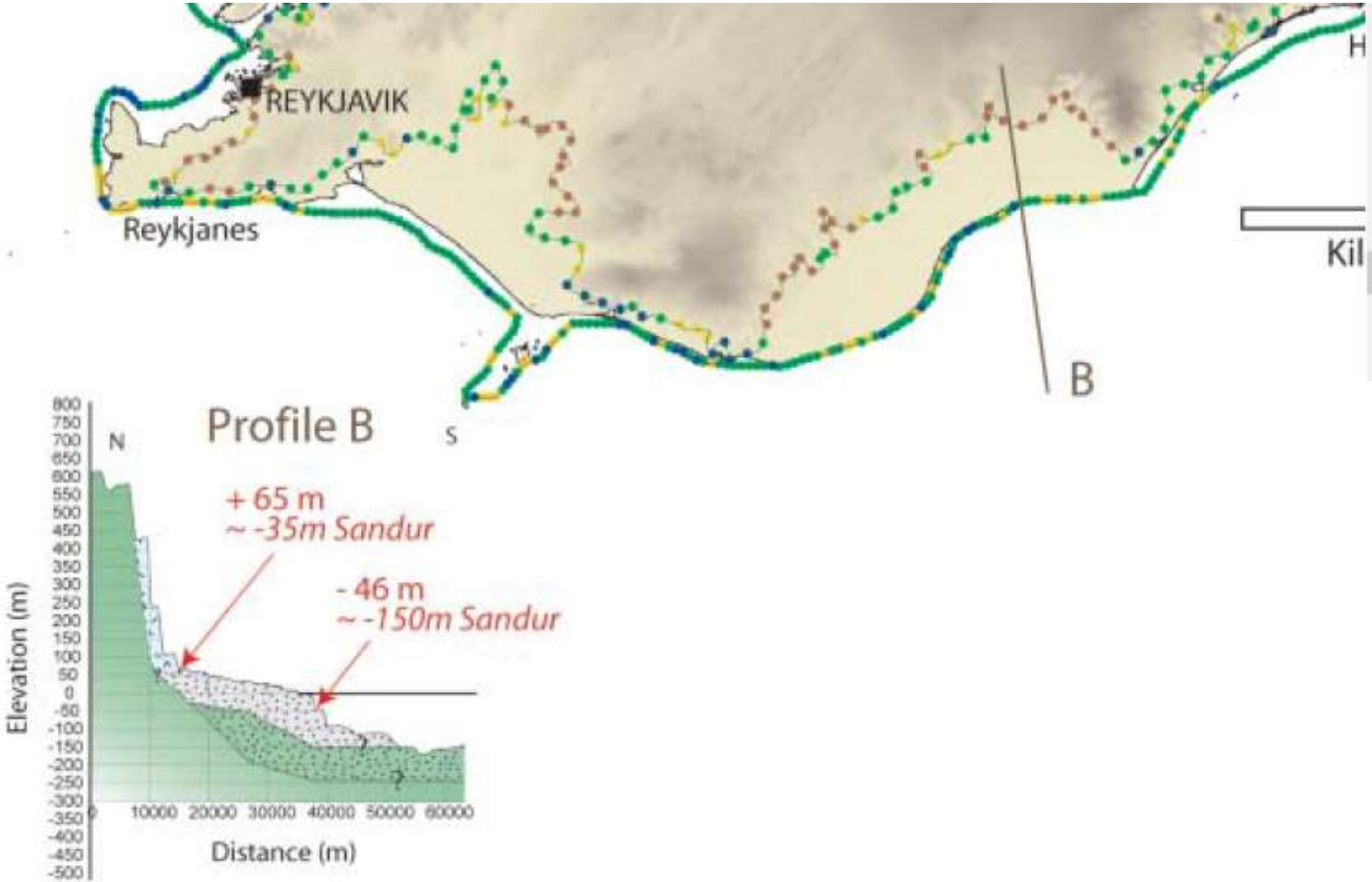
Eyjafjallajokull (glacier) as seen from Route 1 west of Skogar

Skogafoss (waterfall)

Waterfall near the Kirkjubaejarklastur Municpal Swimming Pool


Fjallabak Nature Reserve
Árbær
Hella
Keldur
Hvolsvöllur
Þorsmörk
Kirkjubæjarklaustur
Kálfafell
Skeiðflötur
Vik
Vestmannaeyjabær
Terrain
View topography and elevation
Layers
Map data ©2025 Google
United States
Terms
Privacy
Send Product Feedback
5 mi


High Marine Level
10 000 +/- 300 year BP
Elevation (m) +/- 10m:
100 - 225
60 - 99,9
25 - 59,9
0 - 24,9
A
B
Snaefellsnes
Borganes
REYKJAVIK
Reykjanes
substratum


REYKJAVIK
Reykjanes
B
Profile B
N
S
+ 65 m
~ -35m Sandur
- 46 m
~ -150m Sandur
Elevation (m)
Distance (m)
10000 20000 30000 40000 50000 60000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