GeoBus

Supporting Earth Science education in schools

University of St Andrews

Glaciology

Glacier Dynamics

NERC SCIENCE OF THE ENVIRONMENT

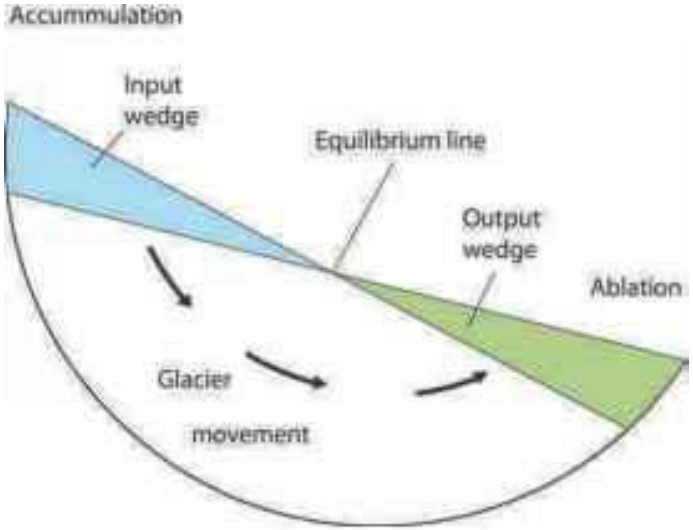
St Andrews Glaciology

Earth & Environmental Sciences

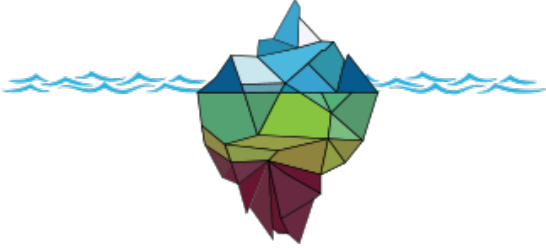
Glacier Motion

- Glaciers, like water, flow downhill due to gravity
- This flow transfers mass from the accumulation zone to the ablation zone of the glacier

uwcm-geog.wikispaces.com



Benn and Evans, 2010.



Flow Velocities

- This flow can take place at different rates

- Rates and patterns of glacier motion depend on the balance between driving and resisting forces
  - driving forces = the downslope component of gravity
  - resisting forces = drag at the bed and sides of the glacier

So, flow is the result of friction between the ice and the ground below it

Mechanisms of Glacier Flow

Three main mechanisms of glacier flow:

1. Internal deformation of Ice (creep)
2. Sliding at the glacier bed
3. Deformation of basal sediments

Conditions

Experiment

- We will be testing flow velocities under the following conditions:
  - A rough bed
  - A smooth bed
  - A steep bed
  - A shallow bed
  - A wet bed

Frictional Effects

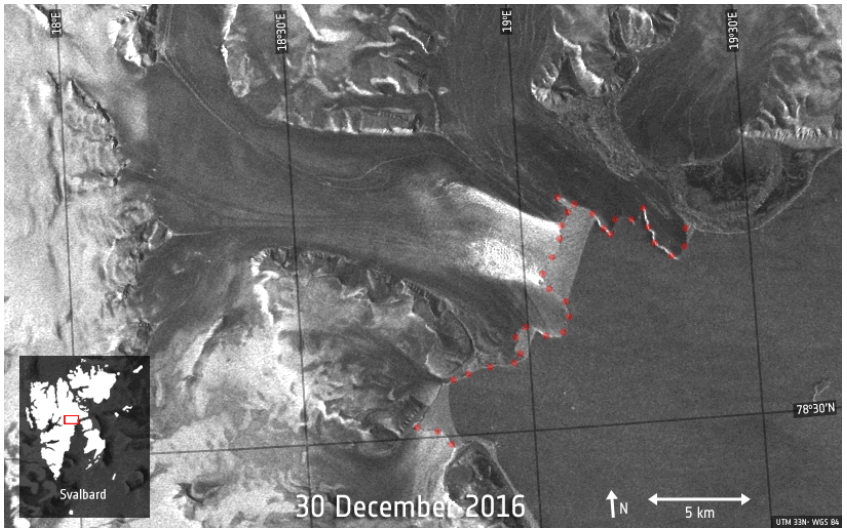
- Should get fastest flow with the 'wet' bed condition
  WHY?

- Water reduces the friction between the ice and the rock and so the glacier is able to slide downhill faster

keysigns.co.uk

Frictional Effects

- Some glaciers move very quickly
  - this is known as ‘surging’
- Causes
  - water at the bed of the glacier
  - Still not 100% known why

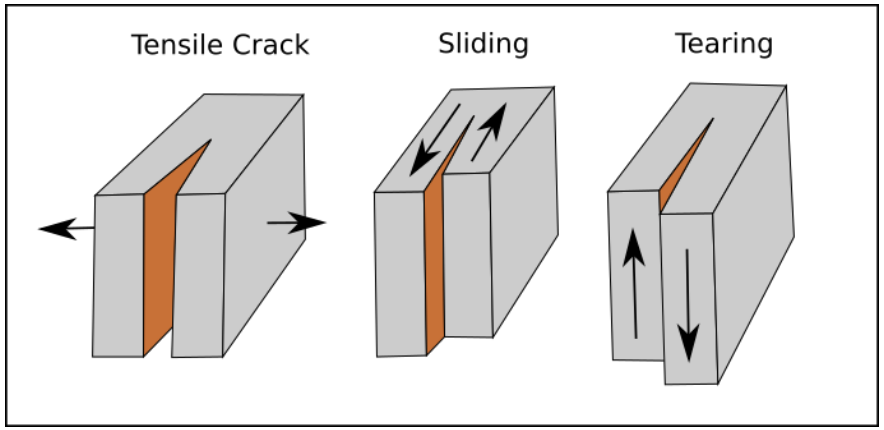


Negribreen, Svalbard. esa.int

Frictional Effects

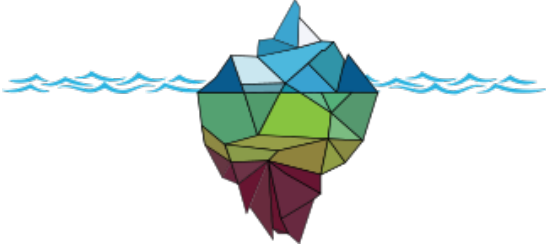
- Crevasses
  - *crevasses open up when the forces pulling ice apart are greater than the strength of the ice*

- Develop in 3 ways:



Adapted by R.Jones from: Benn and Evans, 2010

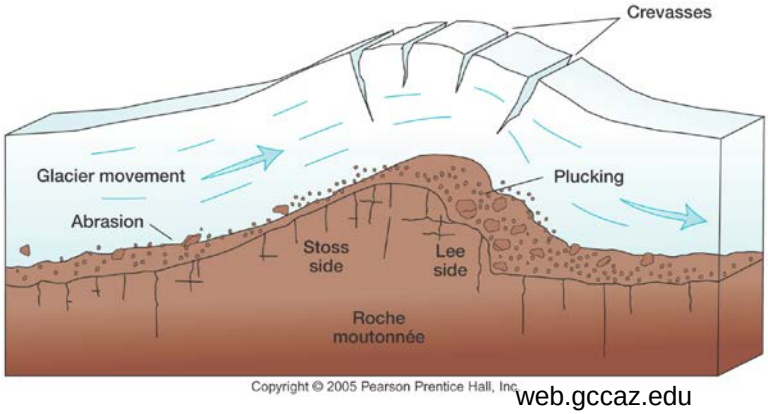
dreamstime.com



Erosion

- Glaciers are very powerful ice masses which have the ability to ‘shape’ the land

- Processes
  - Plucking or quarrying
    - glacier removes rocks from its bed
  - Abrasion
    - rock particles held in basal ice are dragged over the glacier bed
    - this scratches the grounds surface



web.gccaz.edu

Erosional Features

limestonebarrens.ca

Glacial Striations

bbc.co.uk

U-Shaped Valley:
Glen Fee, Scotland

fjordnorway.com

Corrie:
Corrie Brandy, Scotland

Deposition

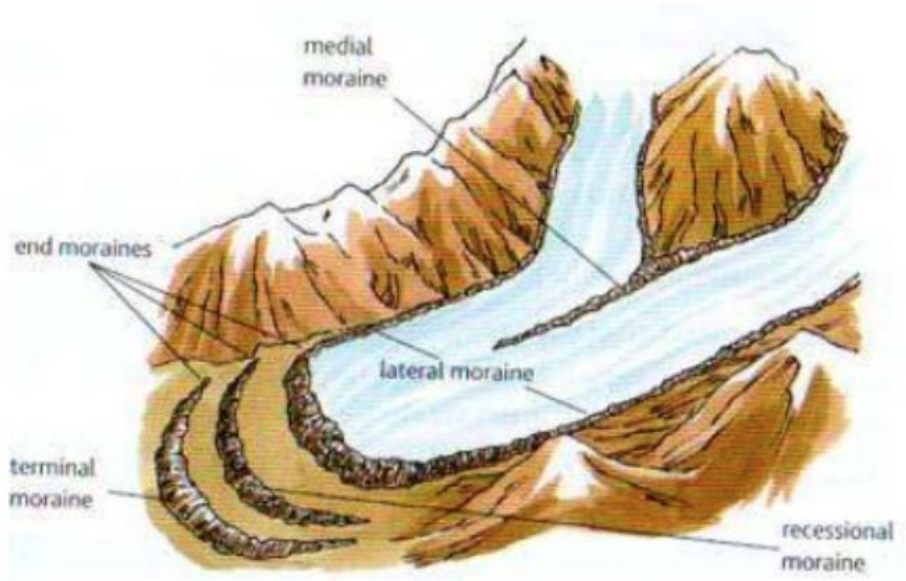
- Landforms
  - Moraines
    - Lateral
    - Terminal (end)
    - Recessional

Bulldozer Effect…

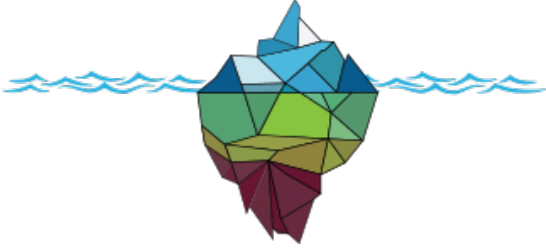
bear-viewing-in-alaska.info

Recessional Moraines

- Form as the glacier retreats
- Parallel to terminal moraines



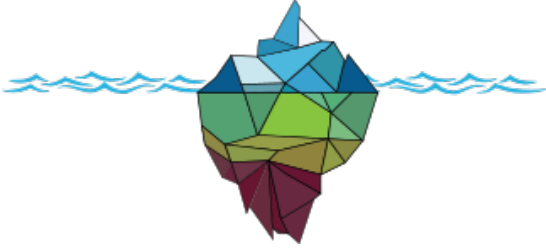
slideshare.net



True or False

Glaciers that flow over rough beds flow more quickly than glaciers over smooth beds.

True or False



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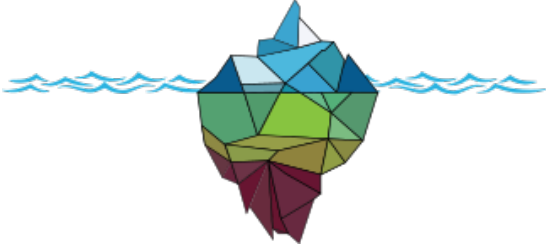
Glaciers that flow over rough beds flow more quickly than glaciers over smooth beds.

~~True~~ or False

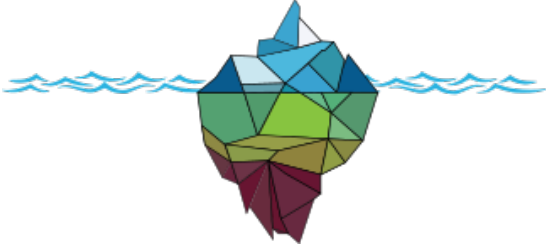
False! Rough beds have more friction and more drag on the glacier than smooth beds, meaning the glacier flows slower.



True or False

Wet based glaciers flow more quickly because of reduced friction between the glacier and the bed.

True or False



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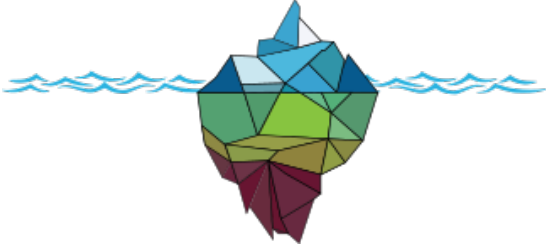
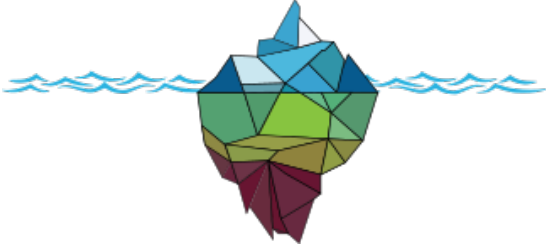


True or False

Glaciers have dramatically impacted the landscapes we see today.

True or False



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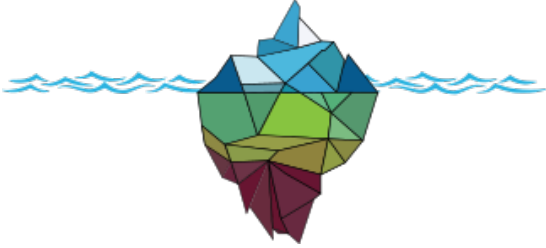

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Moraines can only form at the front of a glacier.

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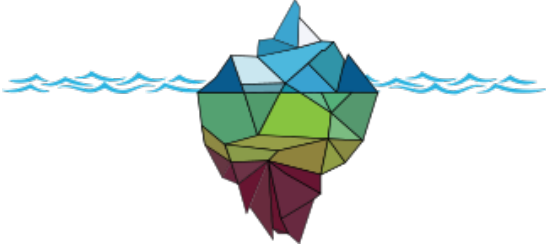

True or False

Moraines can only form at the front of a glacier.

~~True~~ or False

False! Moraines form at the front of a glacier (Terminal Moraines) or the sides of a glacier (Lateral Moraines).

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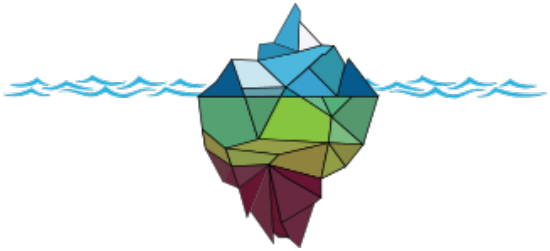

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