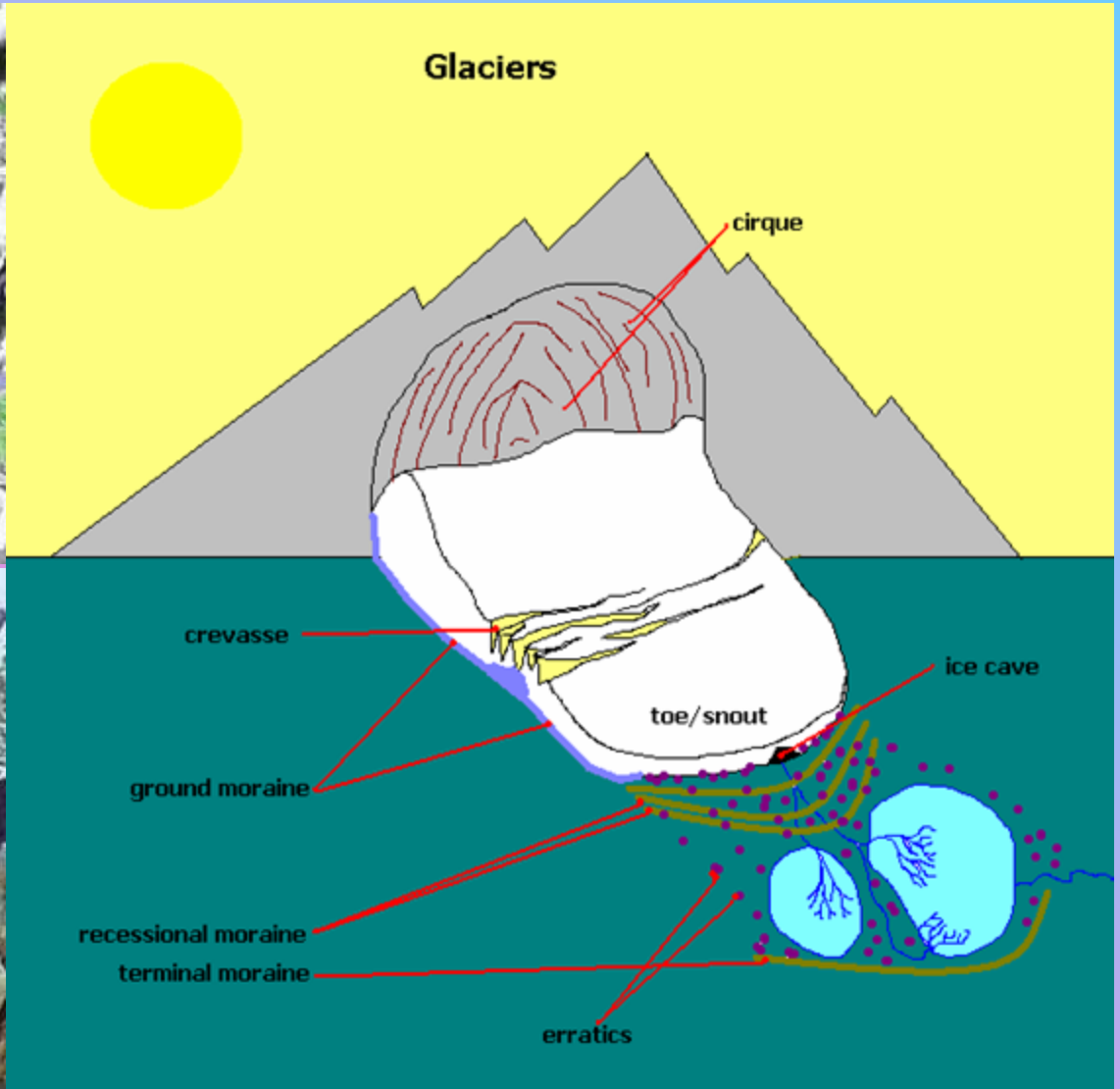


Alpine & Continental Glaciers: Alaska, Canada & New Jersey(?!)

John E.B. Baker: Mikrogeo.com

Alpine Glaciers





horns

aretes



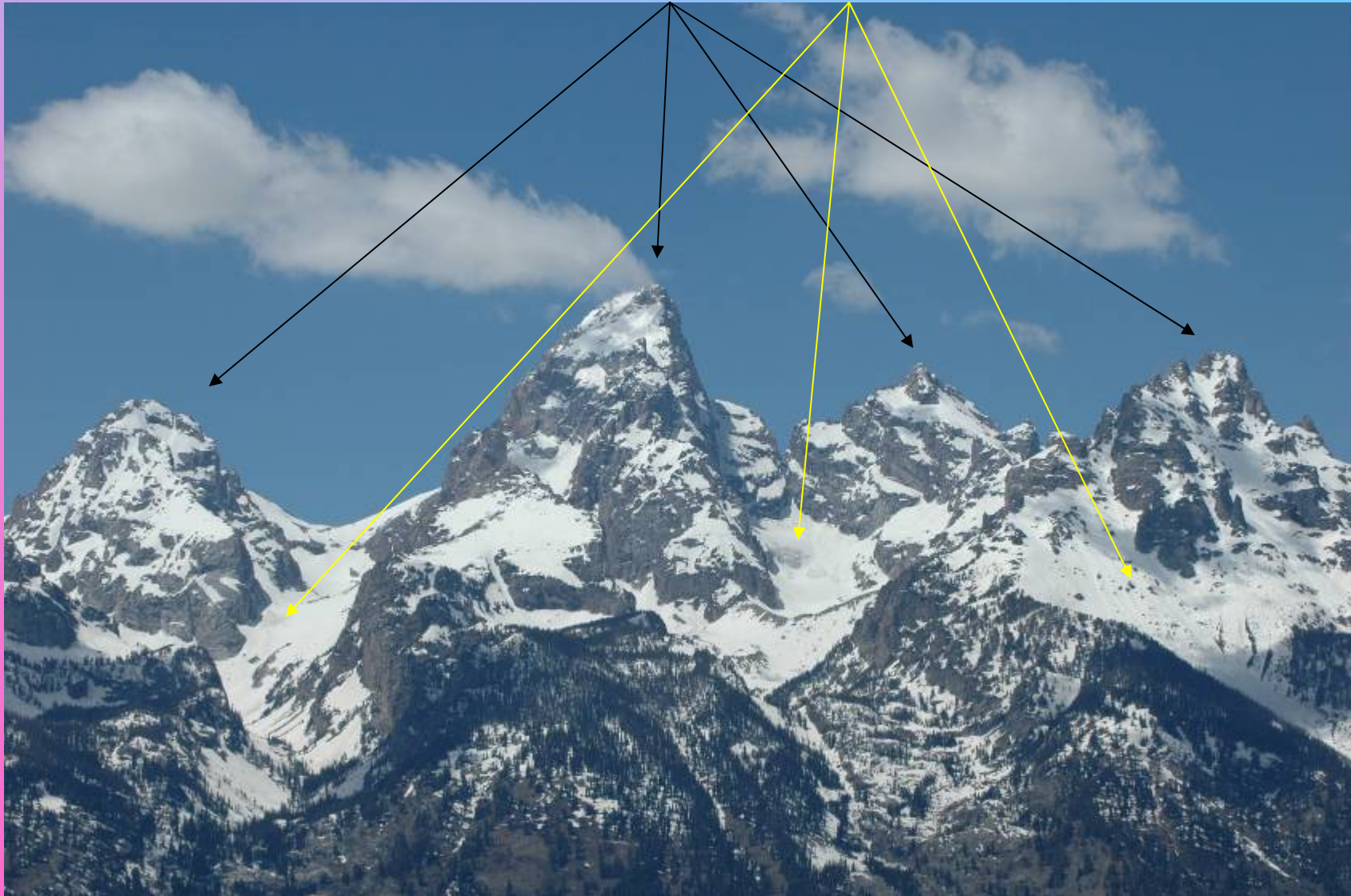
Grand Teton

Mt. Moran

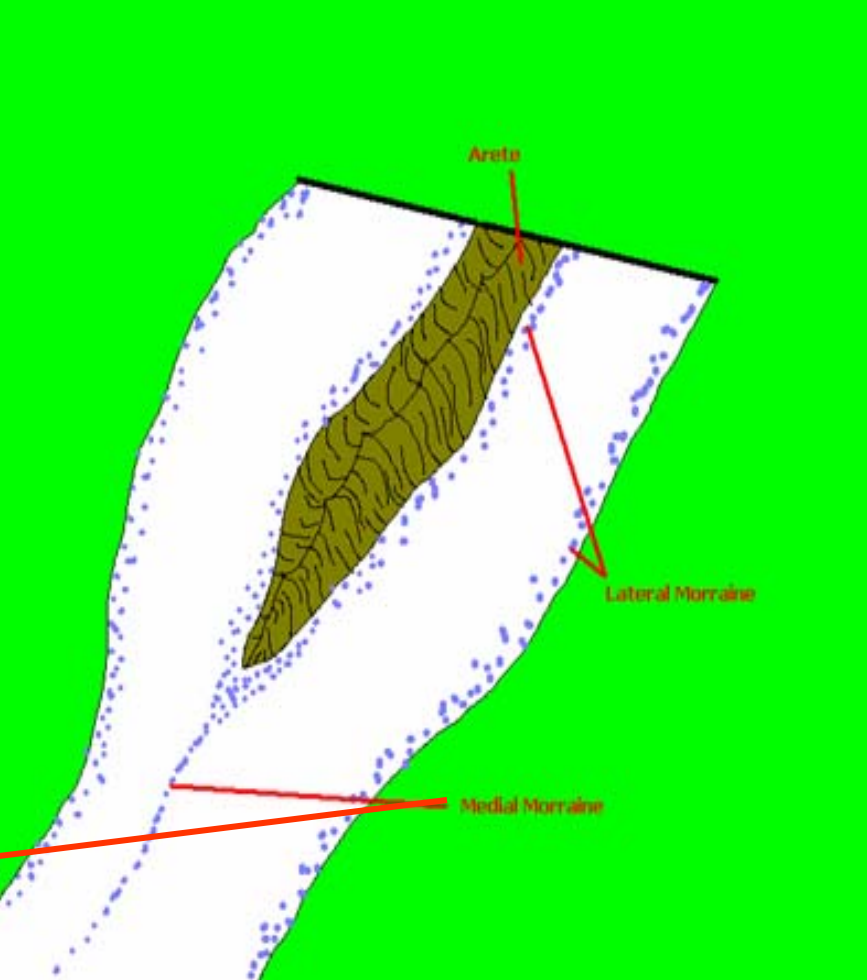
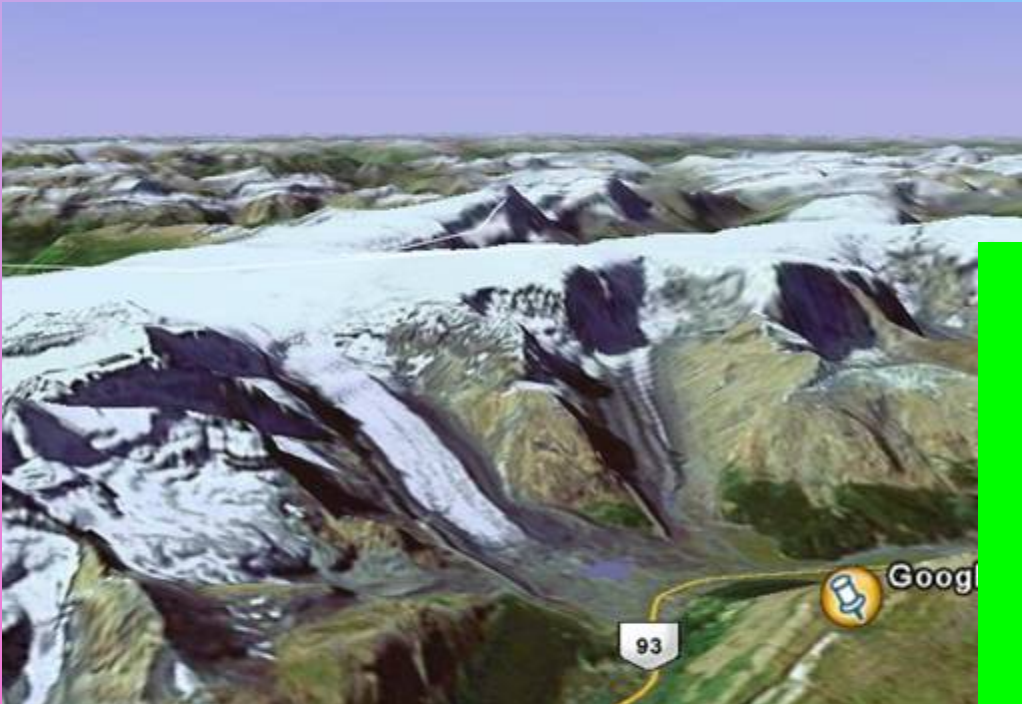


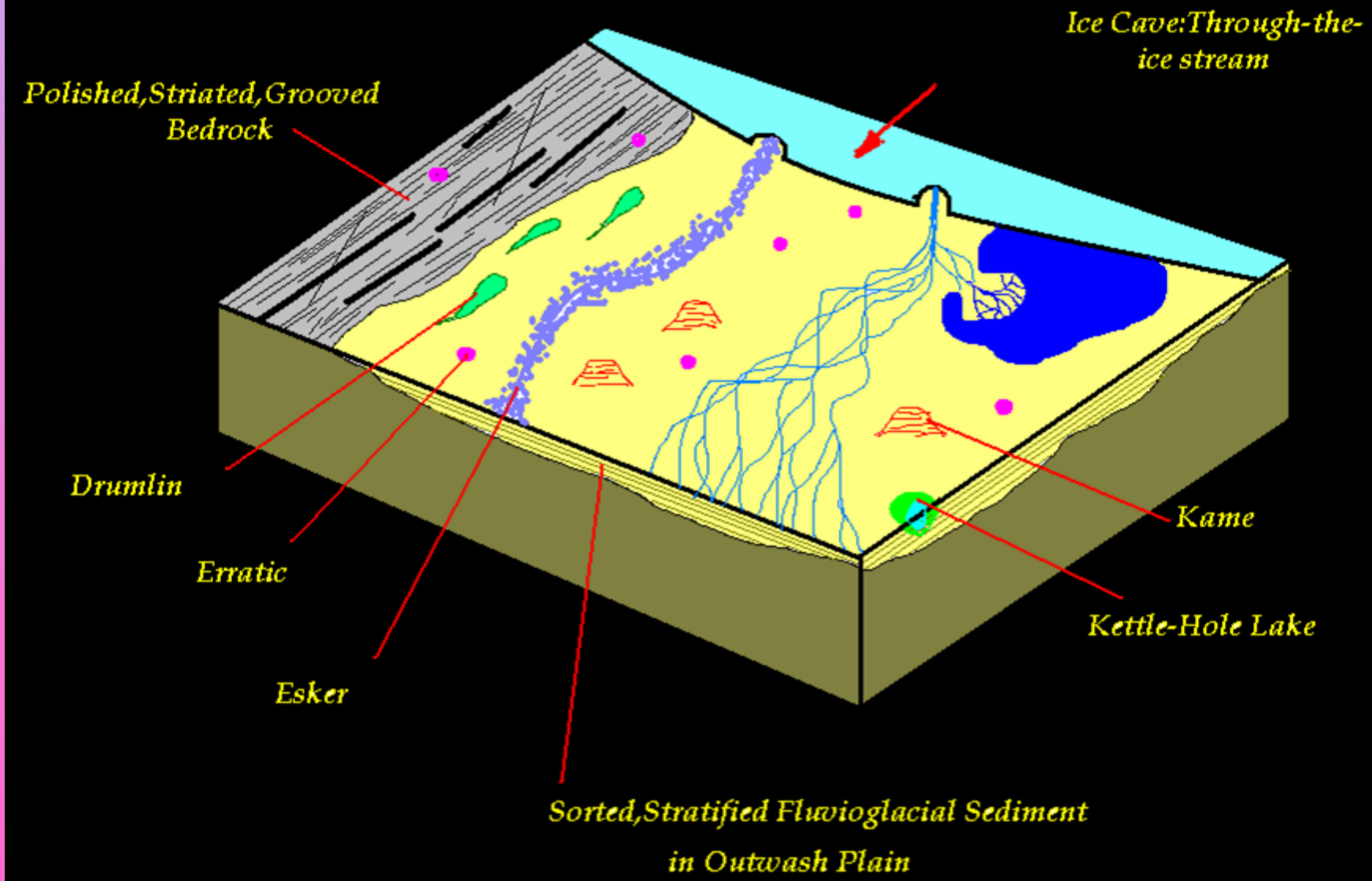
Grand Tetons Nat'l Pk -WY

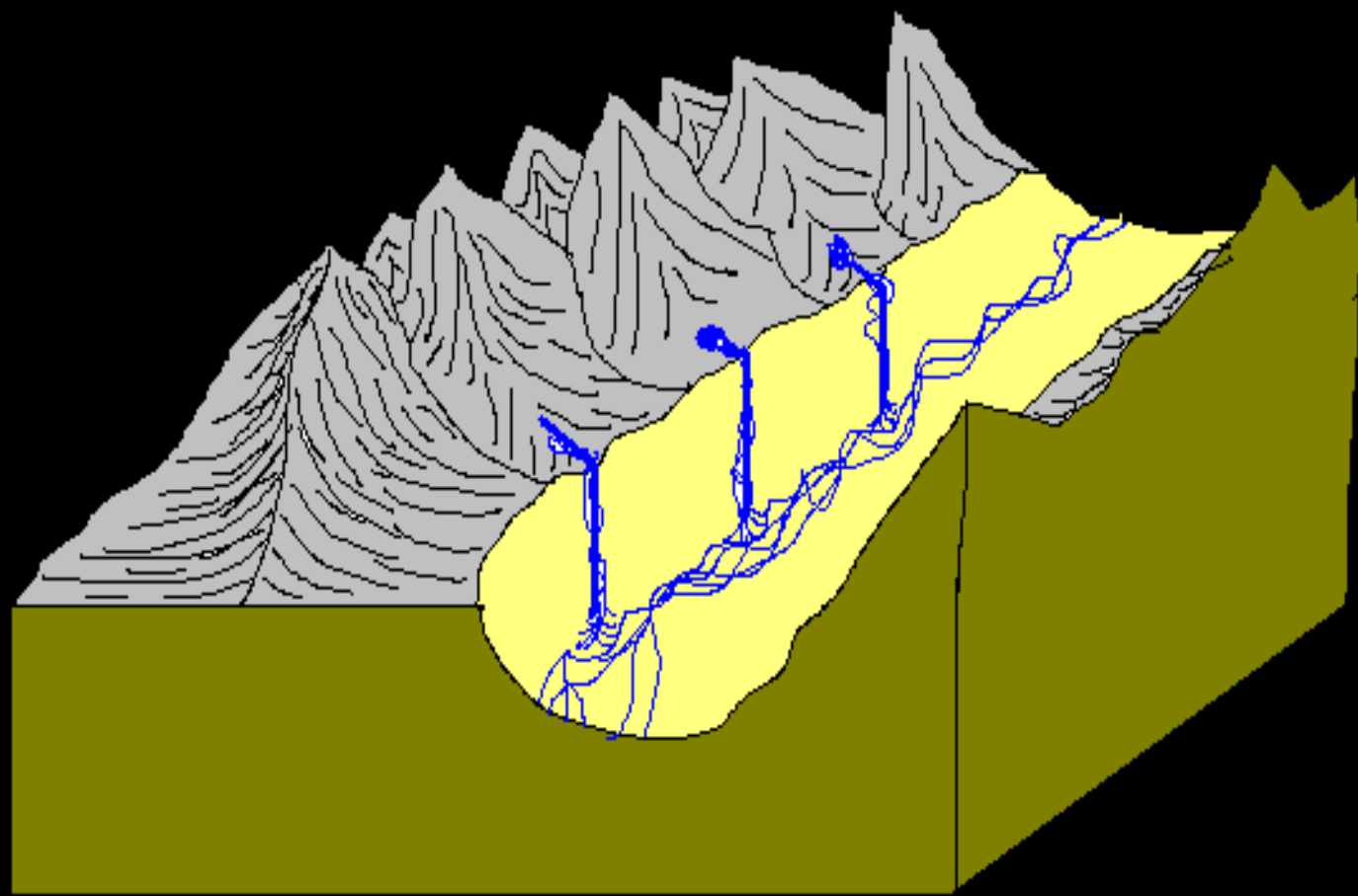
Grand Teton - Horns & Cirques



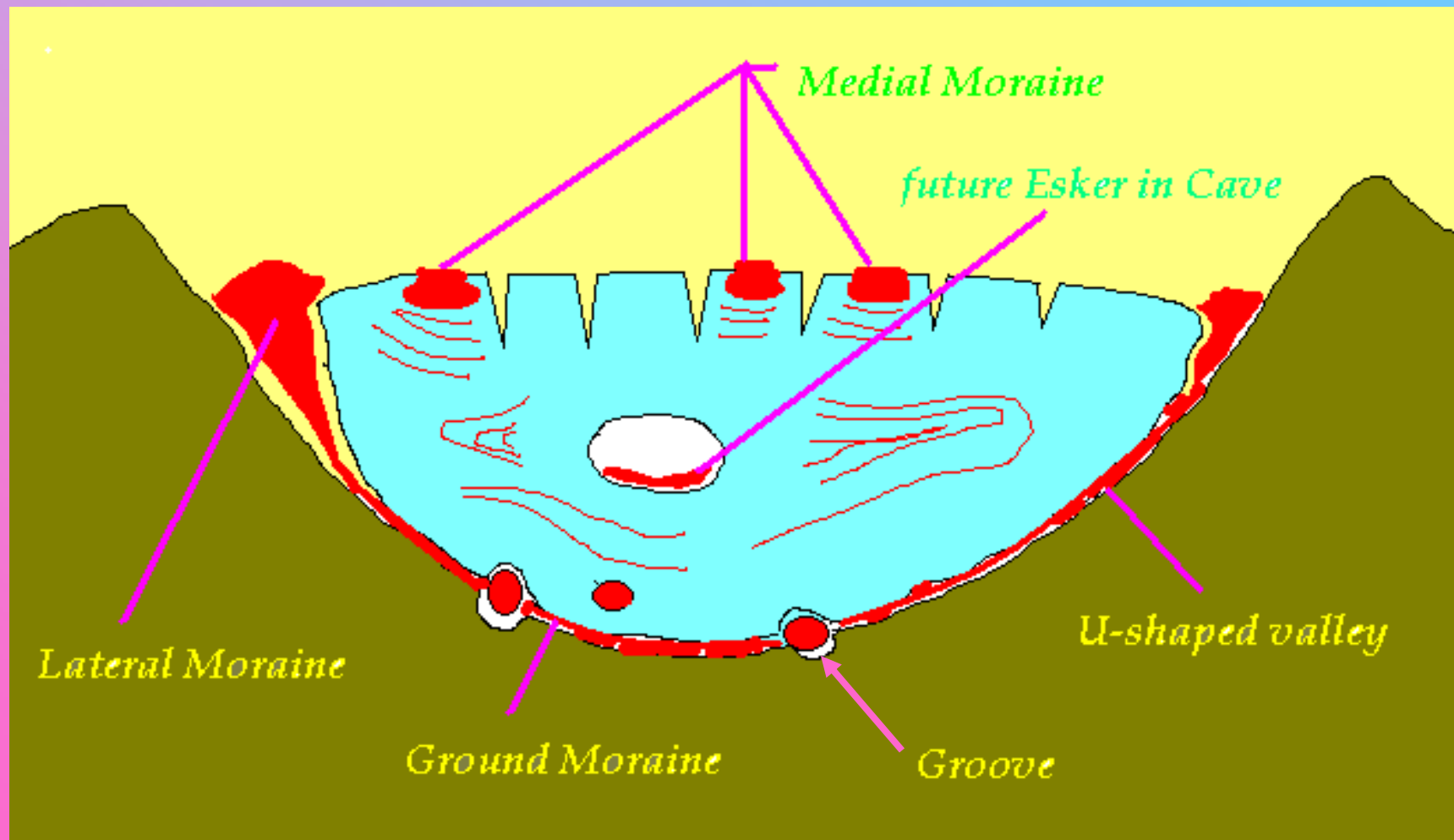
Merging lateral moraines produce a medial moraine

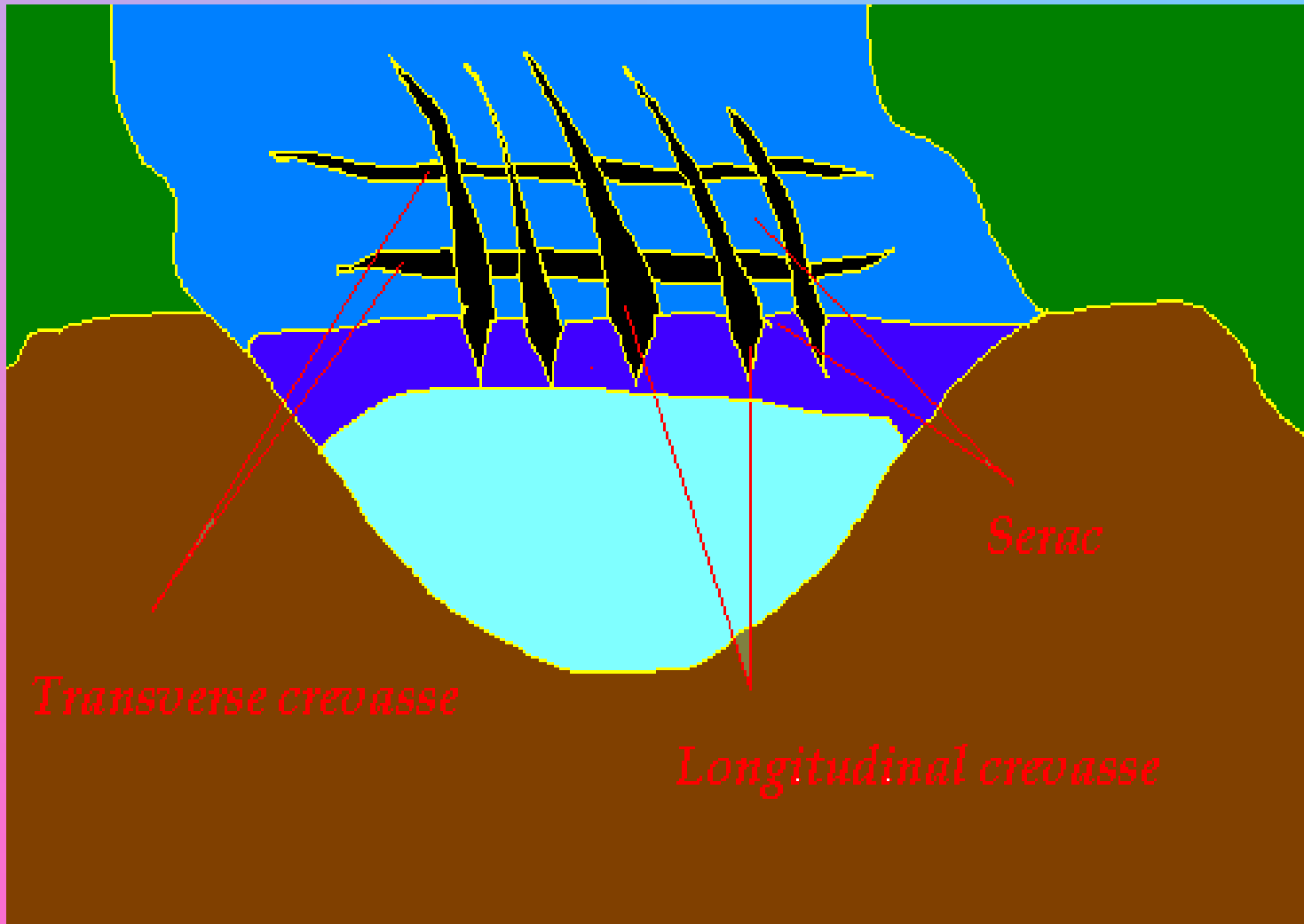






Hanging Valleys & Hanging Valley Waterfalls



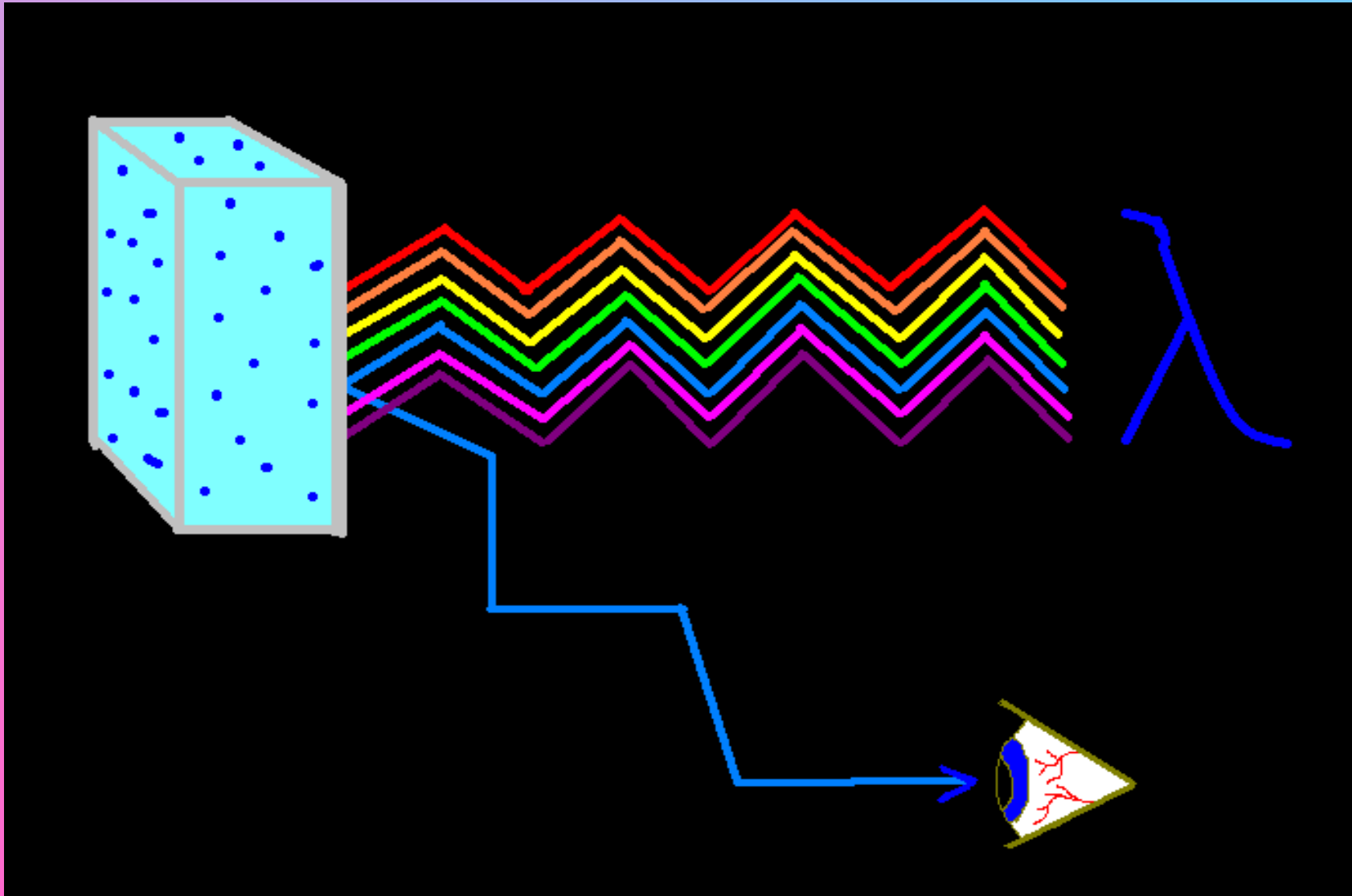


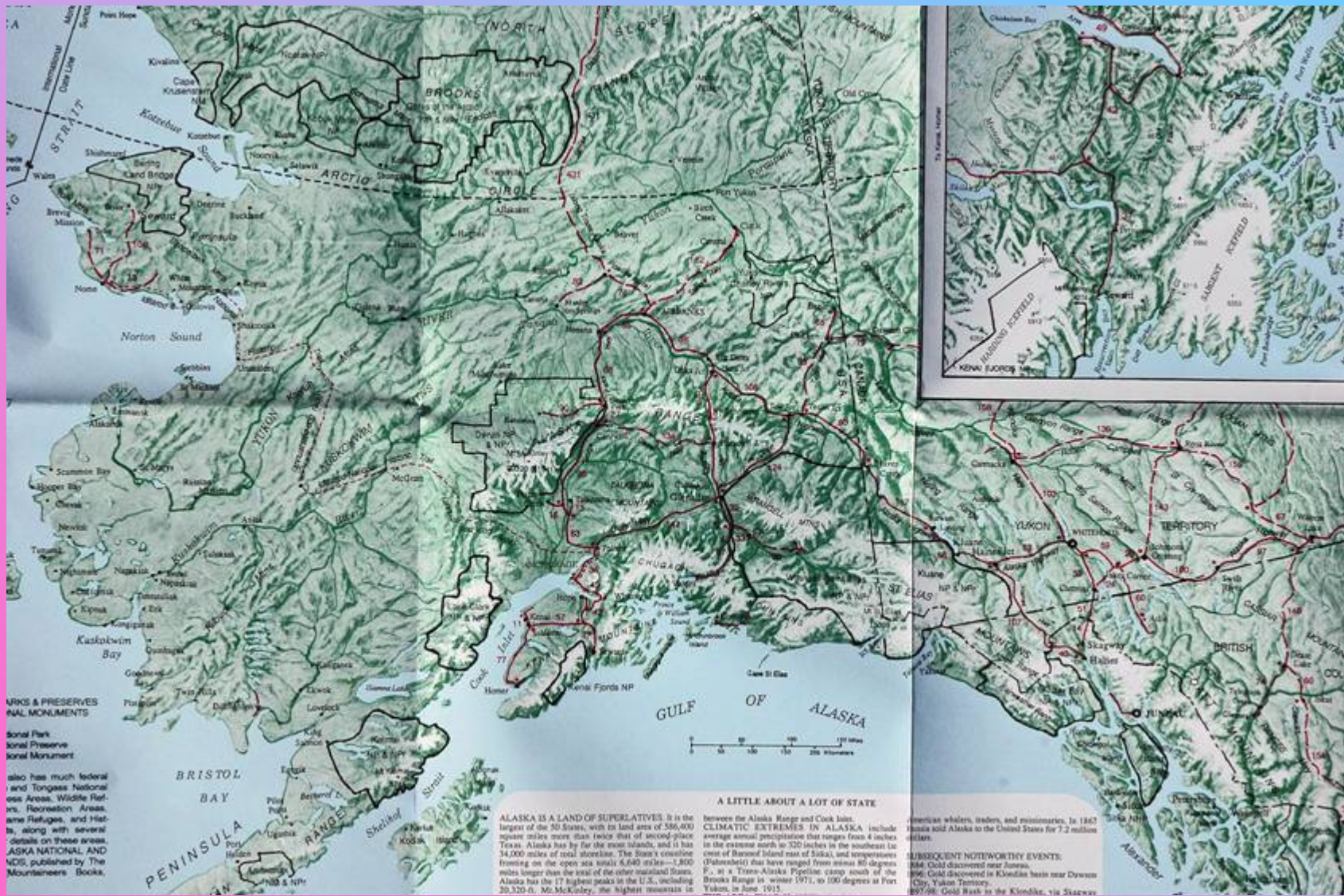




Ice flows like molten plastic=folds

Glacial ice is blue







Google Earth - New Placemark

Google Earth - New Place



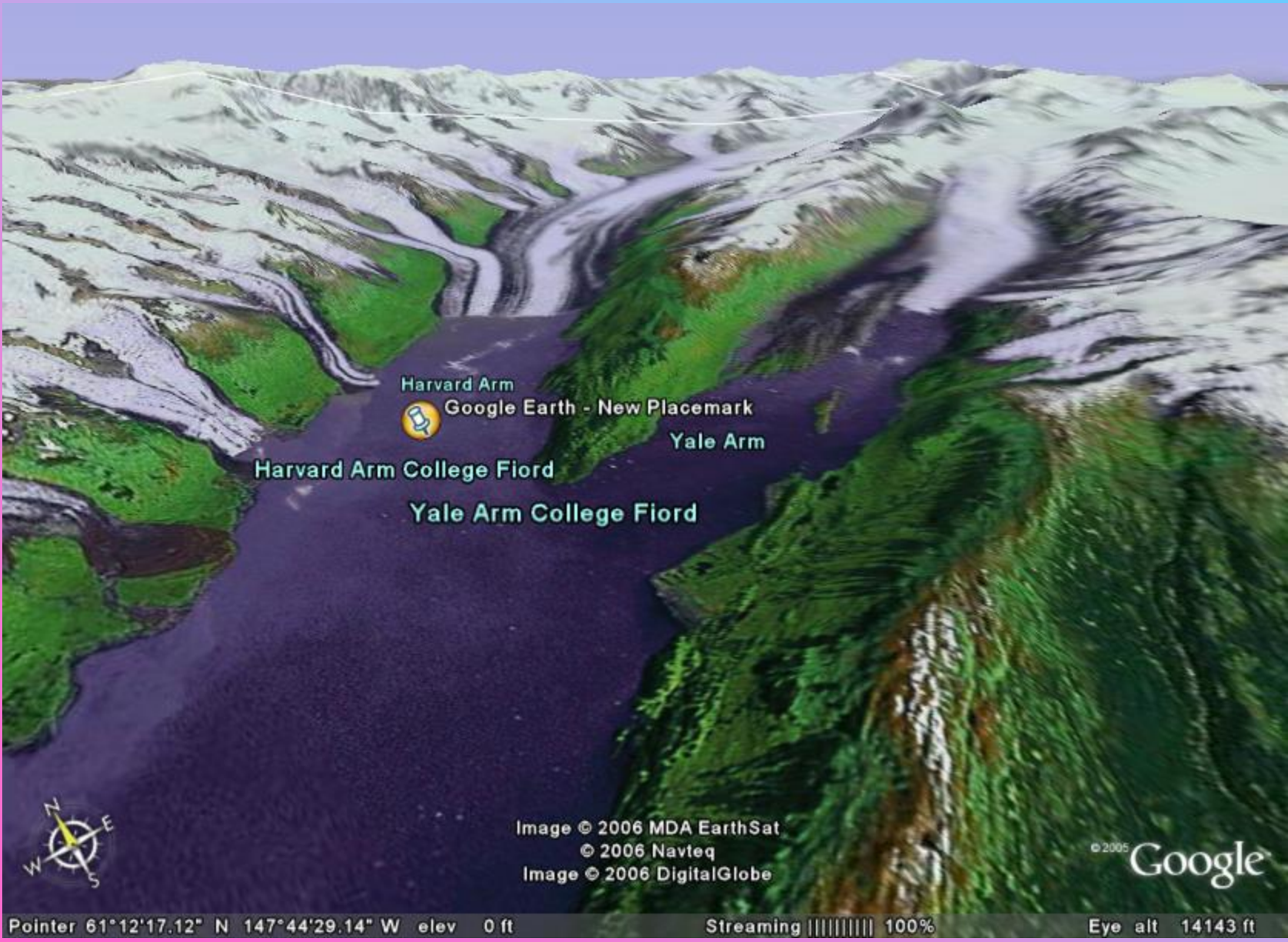
© 2006 Europa Technologies
Image © 2006 TerraMetrics
© 2006 Navteq

© 2005 Google

Pointer 60°57'46.55" N 148°25'36.20" W elev 536 ft

Streaming ||||| 100%

Eye alt 75.54 mi



Harvard Arm
Google Earth - New Placemark
Yale Arm

Harvard Arm College Fiord
Yale Arm College Fiord



Image © 2006 MDA EarthSat
© 2006 Navteq
Image © 2006 DigitalGlobe

©2005 Google

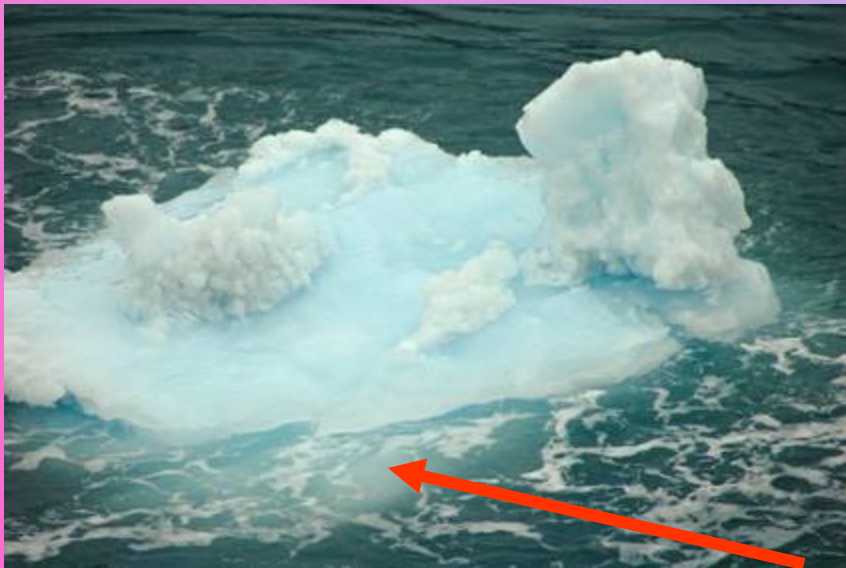
Pointer 61°12'17.12" N 147°44'29.14" W elev 0 ft Streaming ||||| 100% Eye alt 14143 ft

Tributary Gl. Enters **FJORD** or drowned Valley Gl.



Tributary Gl. Enters **FJORD** or drowned Valley Gl.





Calved icebergs – 90% underwater and full of rock debris
(*ice rafted* sediment will sink to the bottom- even out in the
deep ocean)



Bald eagles love fish in the same water and rest on icebergs

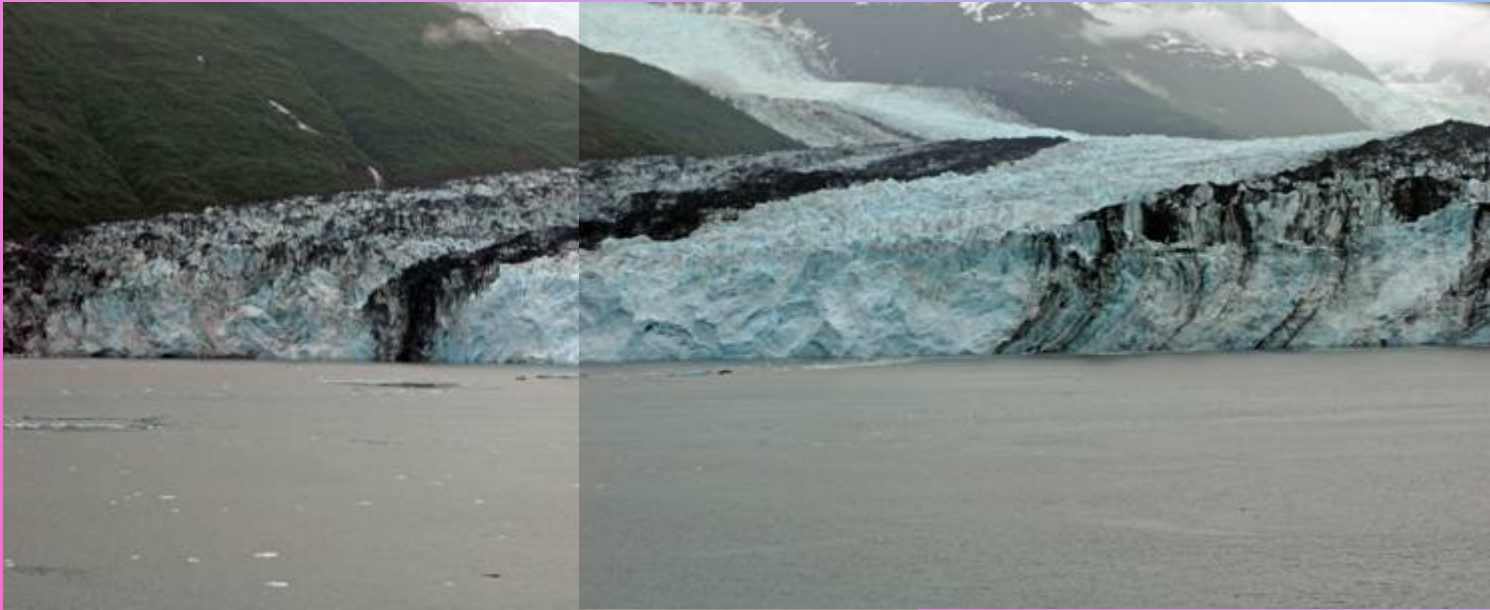
Humpback whales love krill that flourish in the mineral & phytoplankton-rich waters at the terminus of calving ice





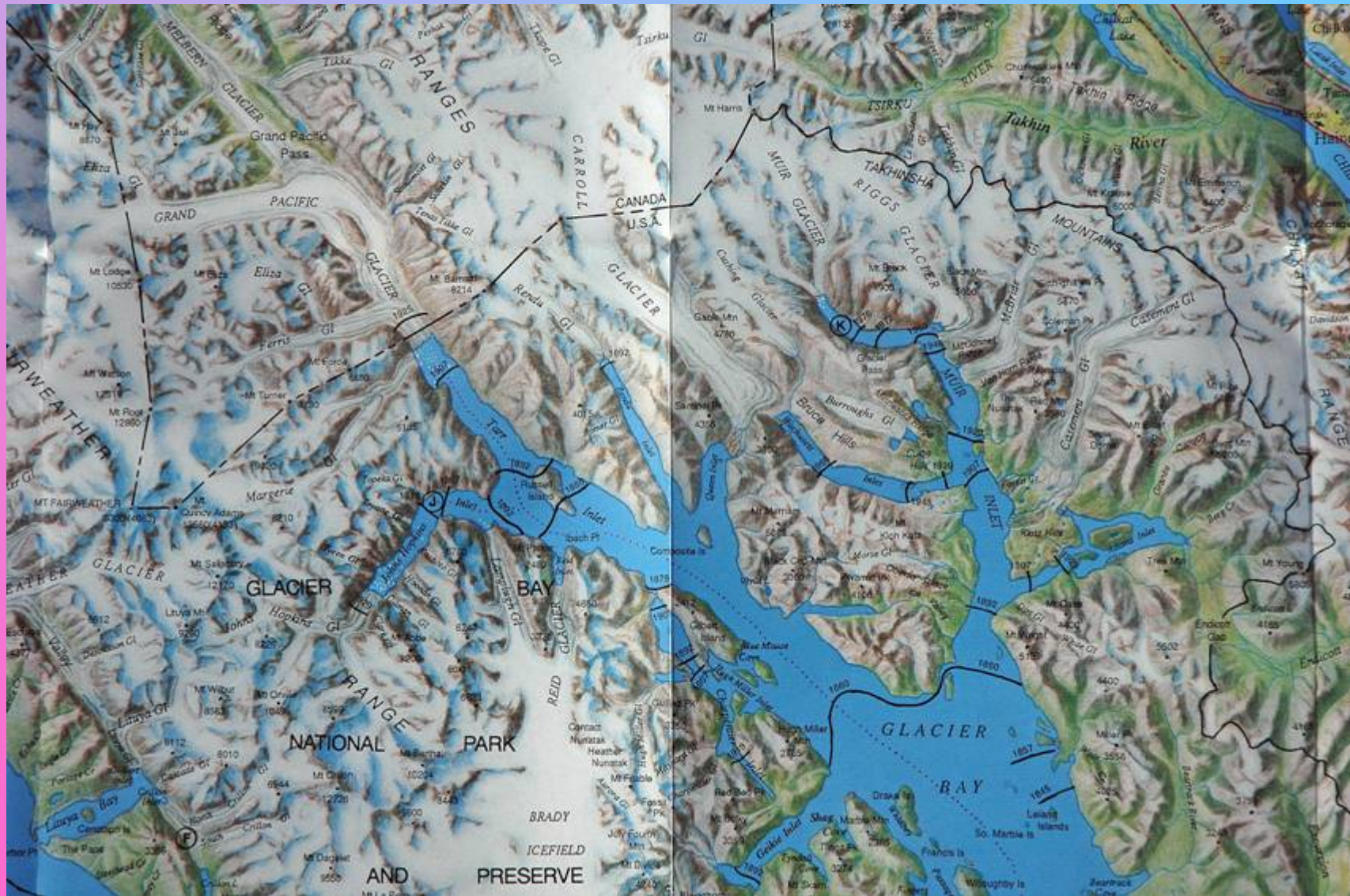
Tributary Gl. Enters **FJORD** or drowned Valley Gl.





More folds in ice – outlined by trapped glacial sediment







Google Earth - New Placemark



Image © 2006 TerraMetrics

© 2005 Google

Pointer 58°56'10.80" N 136°51'33.06" W elev 62 ft

Streaming ||||| 100%

Eye alt 26.33 mi



Google Earth - NewPlacemark

Image © 2006 TerraMetrics

© 2005 Google

Pointer 58°54'47.27" N 136°57'18.04" W elev 16 ft

Streaming ||||| 100%

Eye alt 37359 ft



Google Earth - New Placemark

Image © 2006 TerraMetrics

© 2005 Google

Pointer 59°02'09.05" N 137°01'23.75" W elev 8 ft

Streaming ||||| 100%

Eye alt 29964 ft



Image © 2006 TerraMetrics

©2006 Google

Pointer 58°51'47.93" N 136°56'49.28" W elev 1965 ft

Streaming ||||| 100%

Eye alt 46664 ft



Note medial and lateral moraines







Hanging-valley waterfall





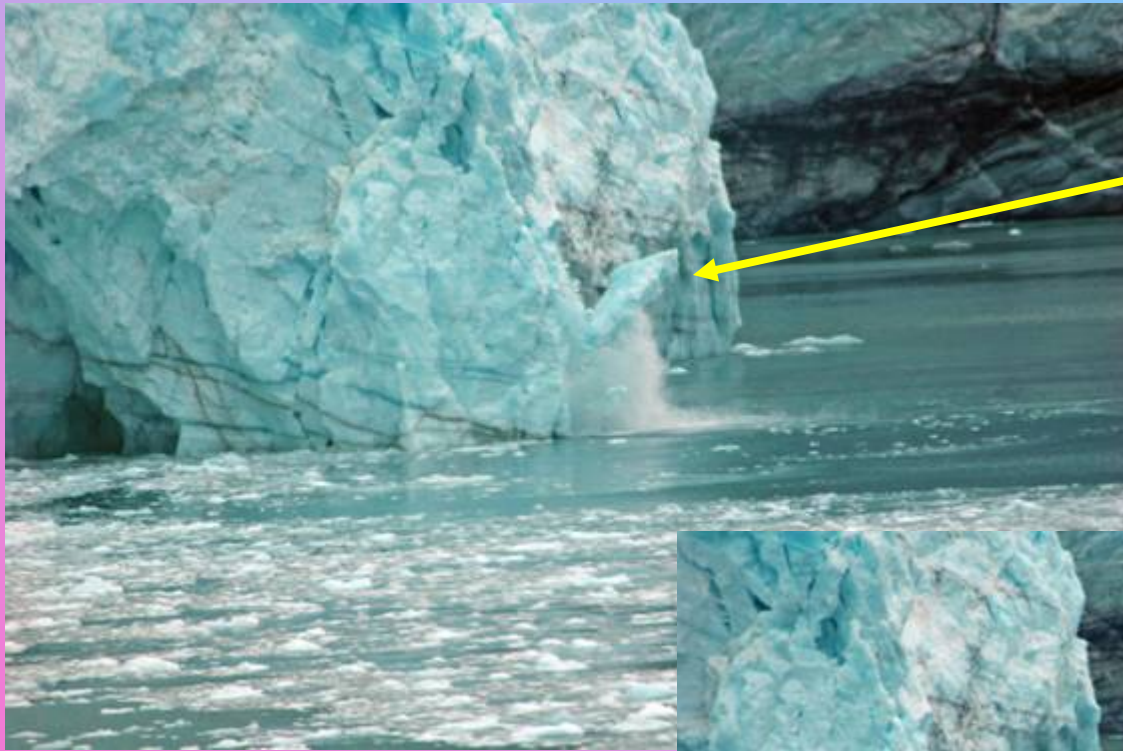
Sediment from scour of bedrock choaks ice

Sediment-rich meltwater shoots up & out of the underwater mouth of an ice cave



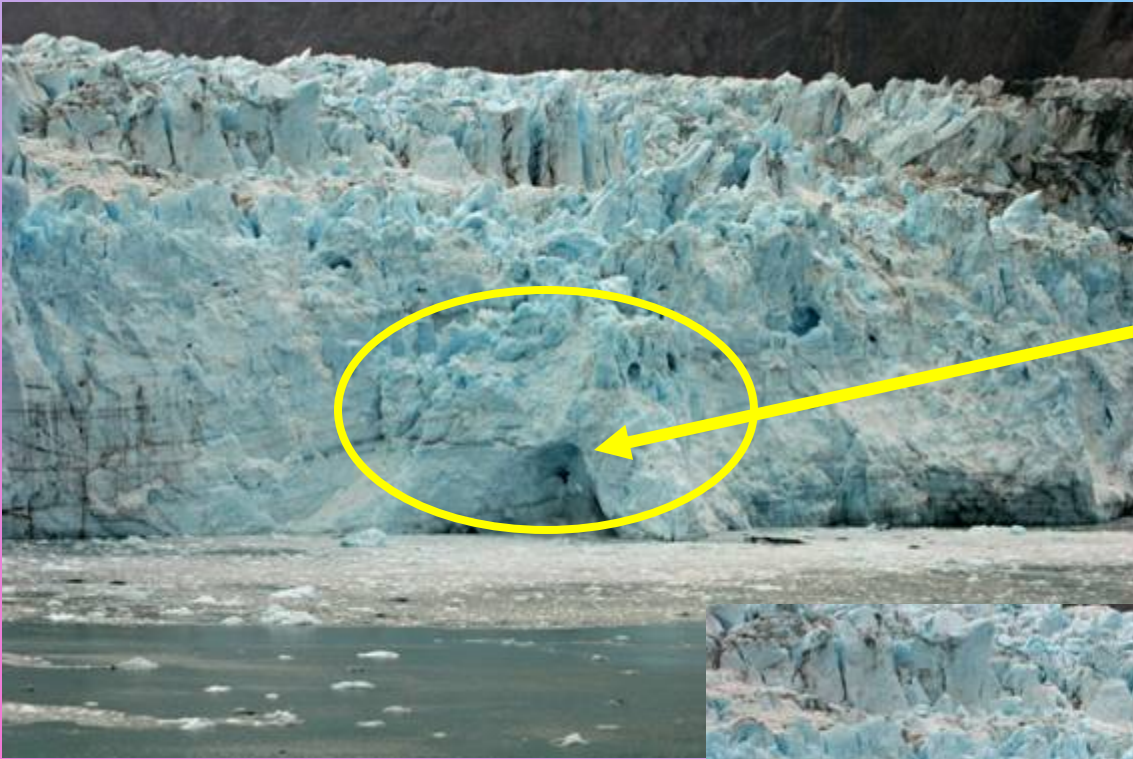
Sediment-rich meltwater from ice cave meets clearer water of Glacier Bay





Calving





Calving





Calving





Outwash Plain and large
erratics

Old Lateral Moraines left at the side of an abandoned U-shaped Gl. Valley

**U-shaped Glacial Valley – Rivers
cut V-shaped valleys**



**Hanging Valley Waterfalls-
a deeper cutting valley
glacier truncates a smaller
tributary cirque above**



Johns Hopkins Gl.- Glacier Bay



Johns Hopkins Gl.- Glacier Bay



Johns Hopkins Gl.- Glacier Bay-note many medial moraines from many tributary glaciers





MENDENHALL, Juneau

Mendenhall Glacier - Juneau



Mendenhall Glacier - Juneau



Model of ice field that feeds Mendenhall Gl.

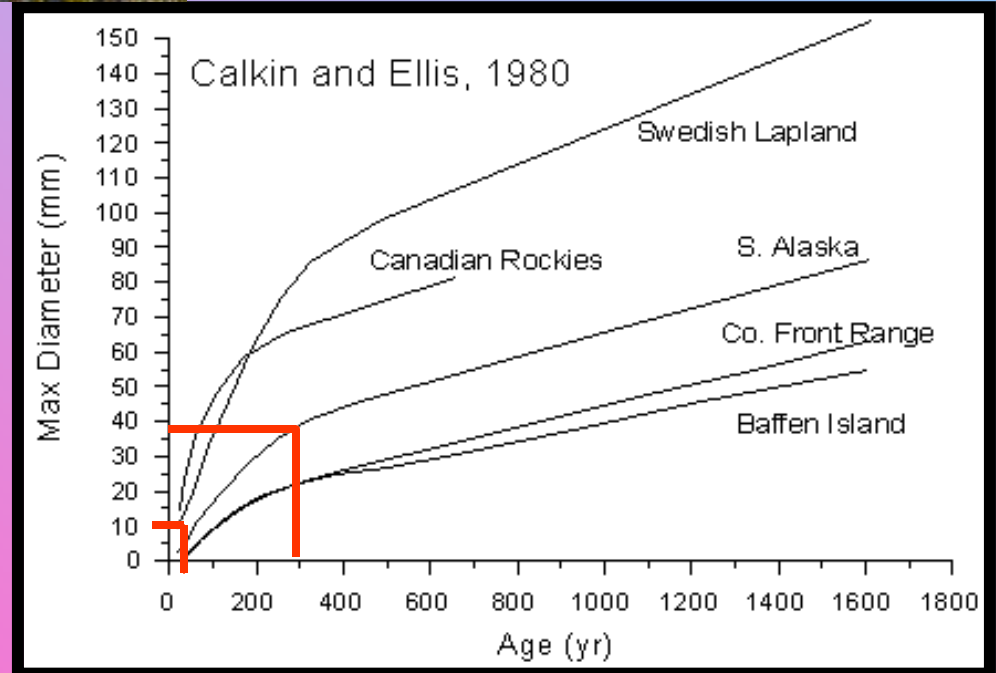


Lichenometry

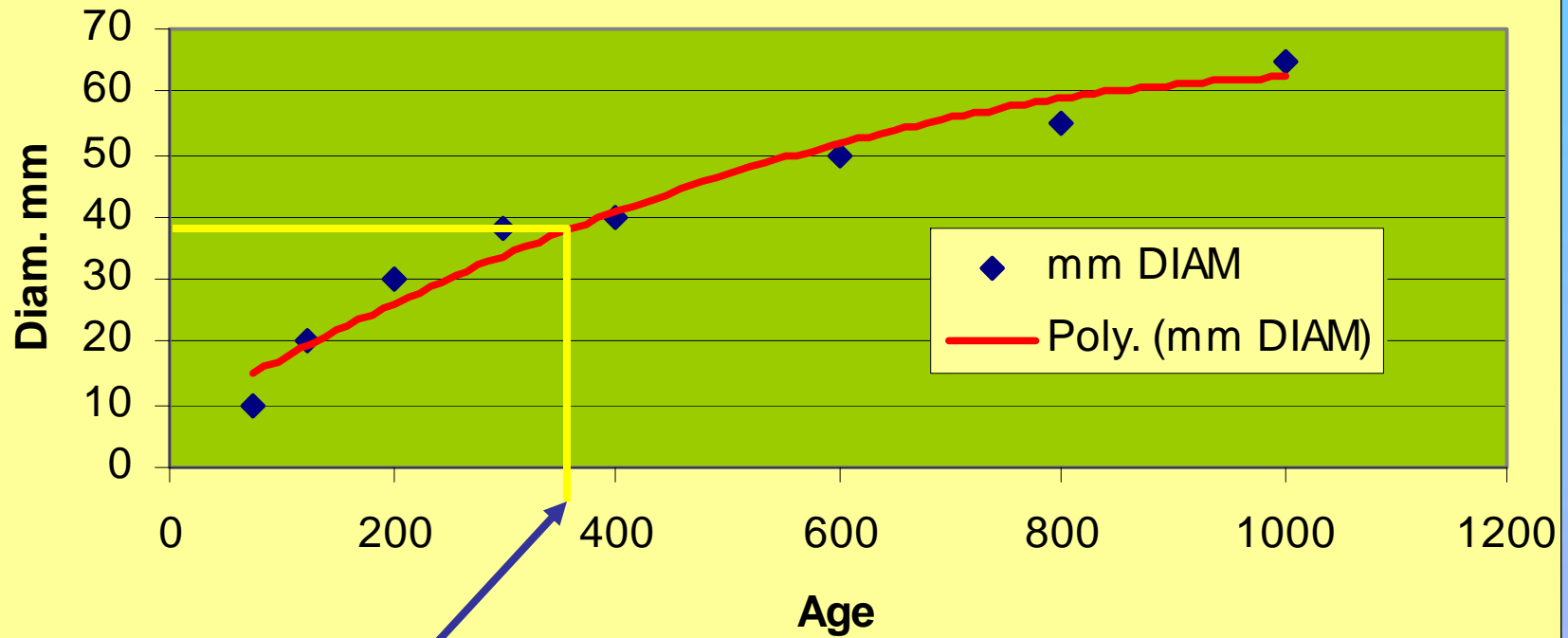


Placopsis sp.

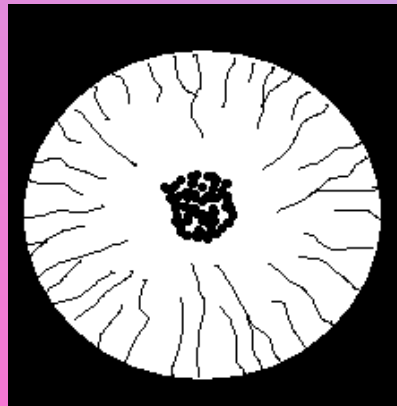
**Bull's eye lichen on
recent glacial
polish
38 mm = 300 yrs**



Lichenometry



**350 yrs since
ice left**



38 mm

Mendenhall Glacier - Juneau



Mendenhall Glacier - Juneau



Mendenhall Glacier - Juneau





Young black bear (cinnamon phase)





Glacial polish and striae

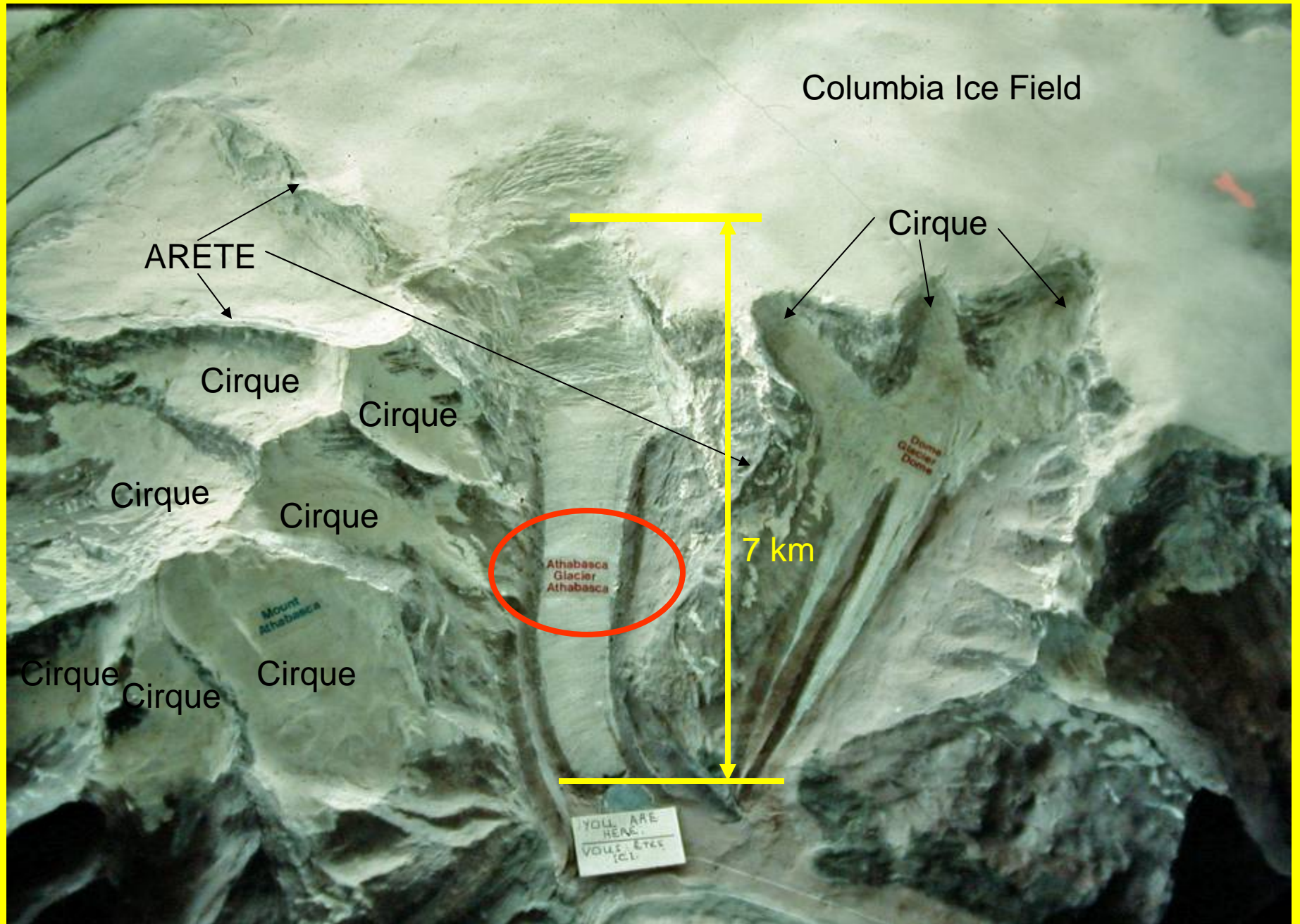


Glacial polish and striae





**Athabasca Glacier in Alberta, Canada:
one of many outflow valley glaciers of
the Columbia Ice Field or Ice Cap**





© 2004 Google
Image © 2004 DigitalGlobe

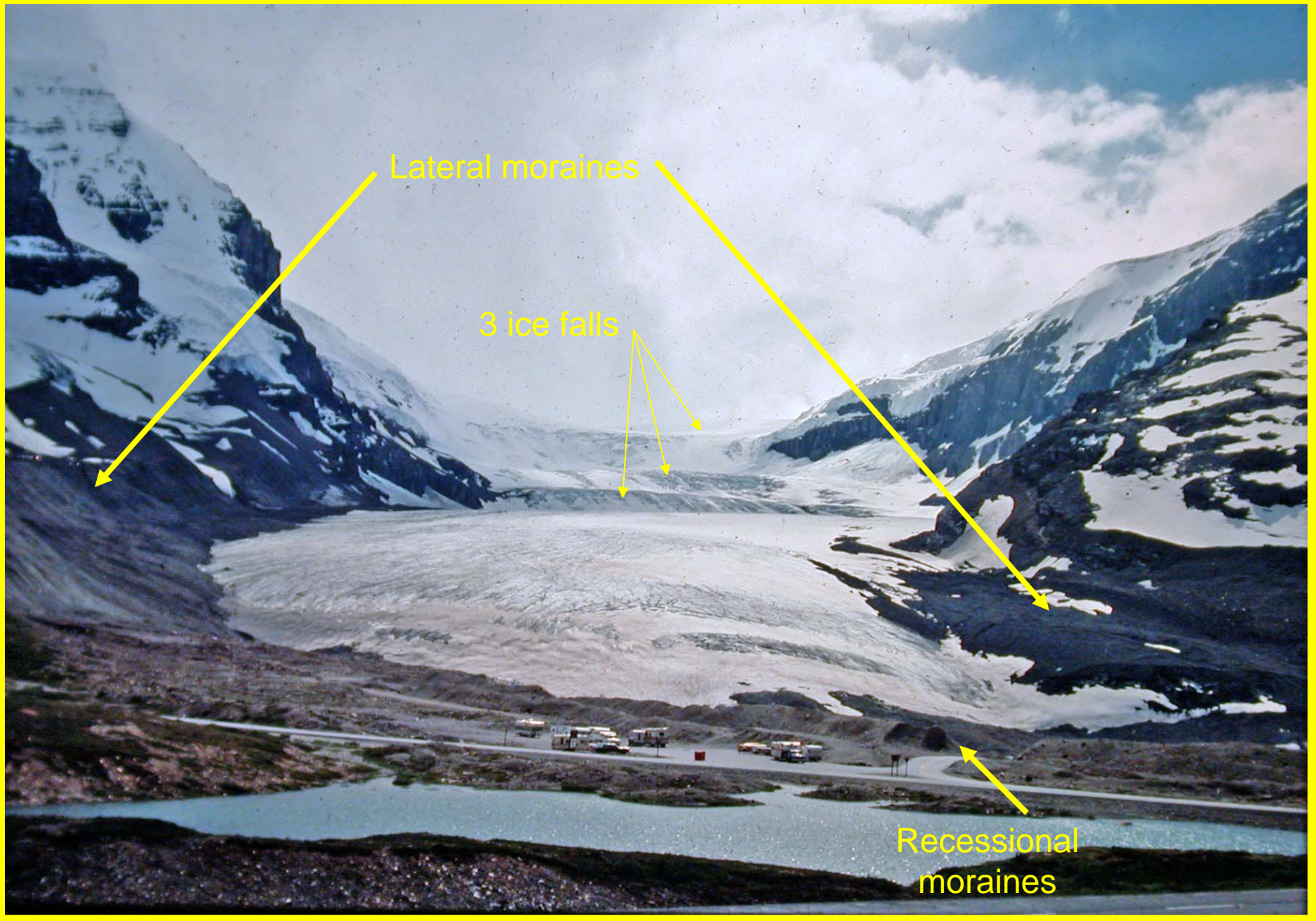
Google

Point: 32°11'48.05" N, 111°14'55.03" W, elev: 508.11

© 2004 Google

Feb 20, 2004





Lateral moraines

3 ice falls

Recessional moraines



**Recessional Moraines
mark time**



**Snout or toe of glacier with
meltwater stream ('valley train')
coming from moraine dammed
lake**





Moraine of **TILL** – unsorted & unstratified glacial sediment

Glacial Flour (Rock Flour-angular, silt-sized product of abrasion) suspended in cold meltwater is '**Glacial Milk**')

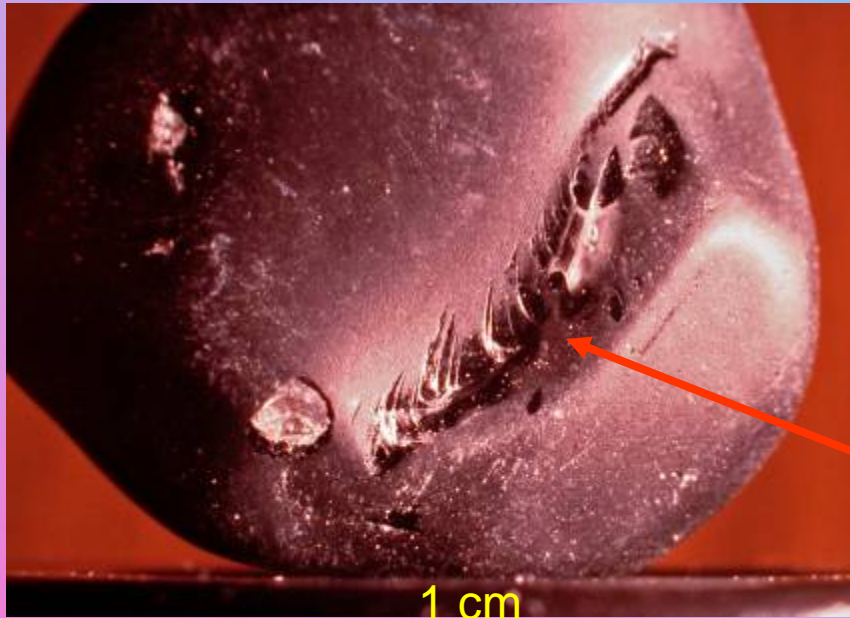
The 'flour' stays in suspension causing this turquoise color in a periglacial lake



OUTWASH PLAIN with Braided Stream



Ground Moraine (the sediment trapped in the bottom of the ice) polishes, gouges, grooves, scratches & striates the bedrock of the glacial floor



Pebbles, cobbles & boulders (Erratics) are themselves scoured, scratched & pulverized into flour by the end of the trip from being plucked to the terminus of the glacier.

Note chert (Cambrian Ls.) pebble with chevron shaped chatter marks & pluck marks (NJ)



10 cm, Cambrian slate (Ath)



30 cm, Cambrian slate (Ath.)

All different sizes = unsorted

This is how glaciers scour U-shaped Valleys



Glacial polish ,grooves & striae on bedrock in
Pequannock, NJ



When piled up or bulldozed into position as MORAINE the sediment is TILL

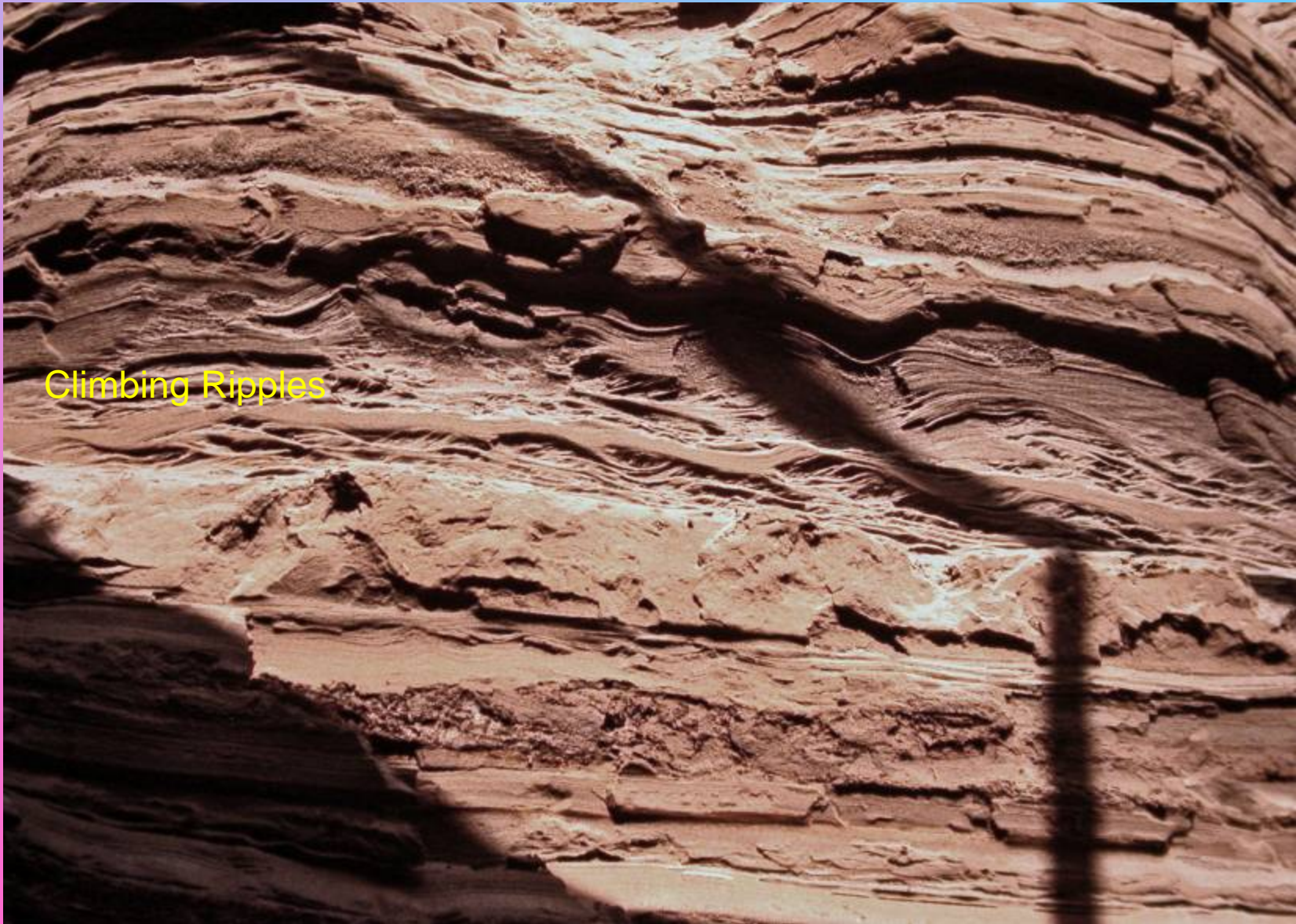


Continental glacial moraine left by
the Wisconsin Age ice sheet in
Sussex, NJ



Moulins are where surface meltwater and sediment enter *crevasses* or tensional surface fractures in the top of the glacier; note blue color if ice below granular dirty *neve* (*firn*)

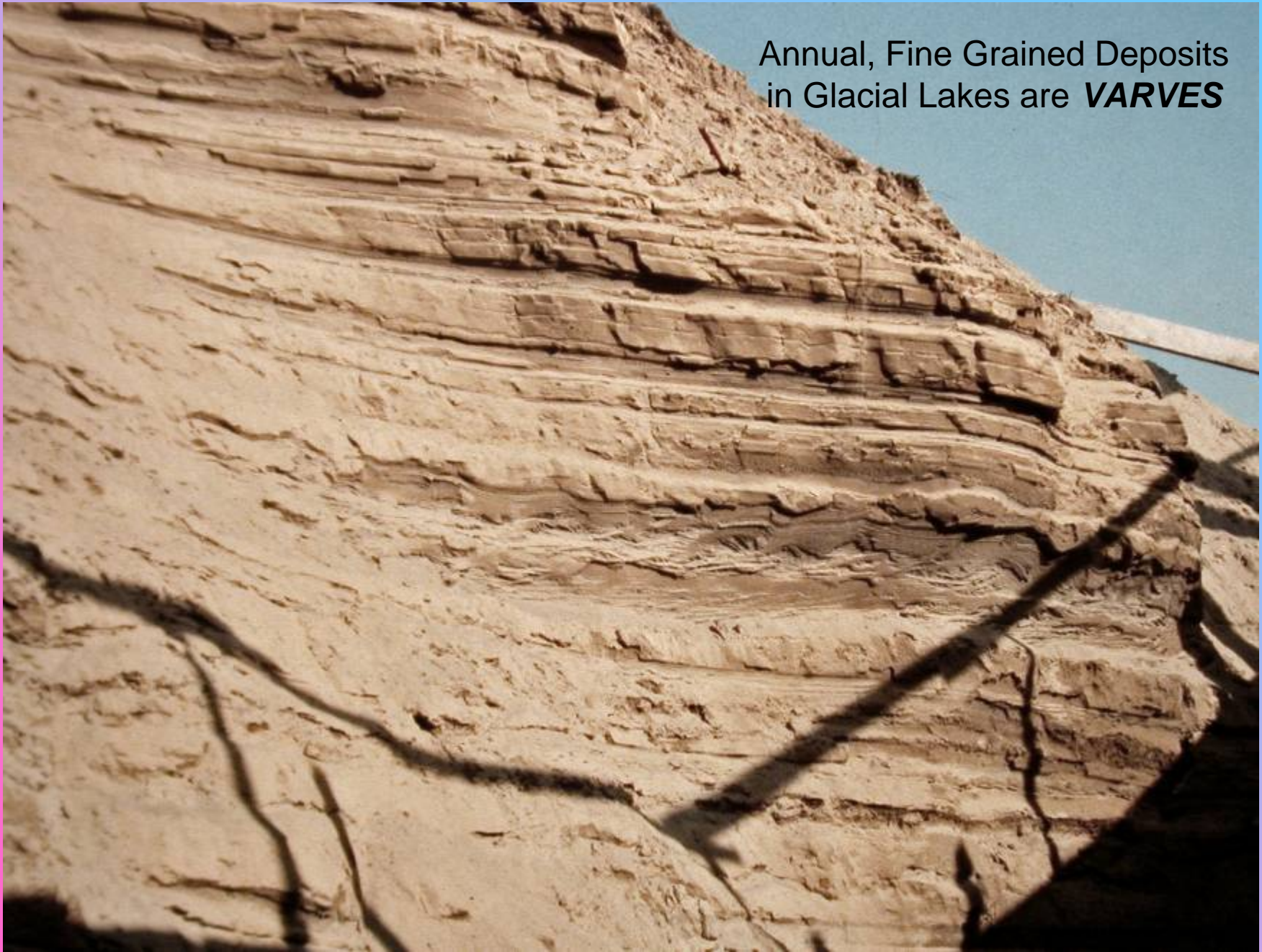


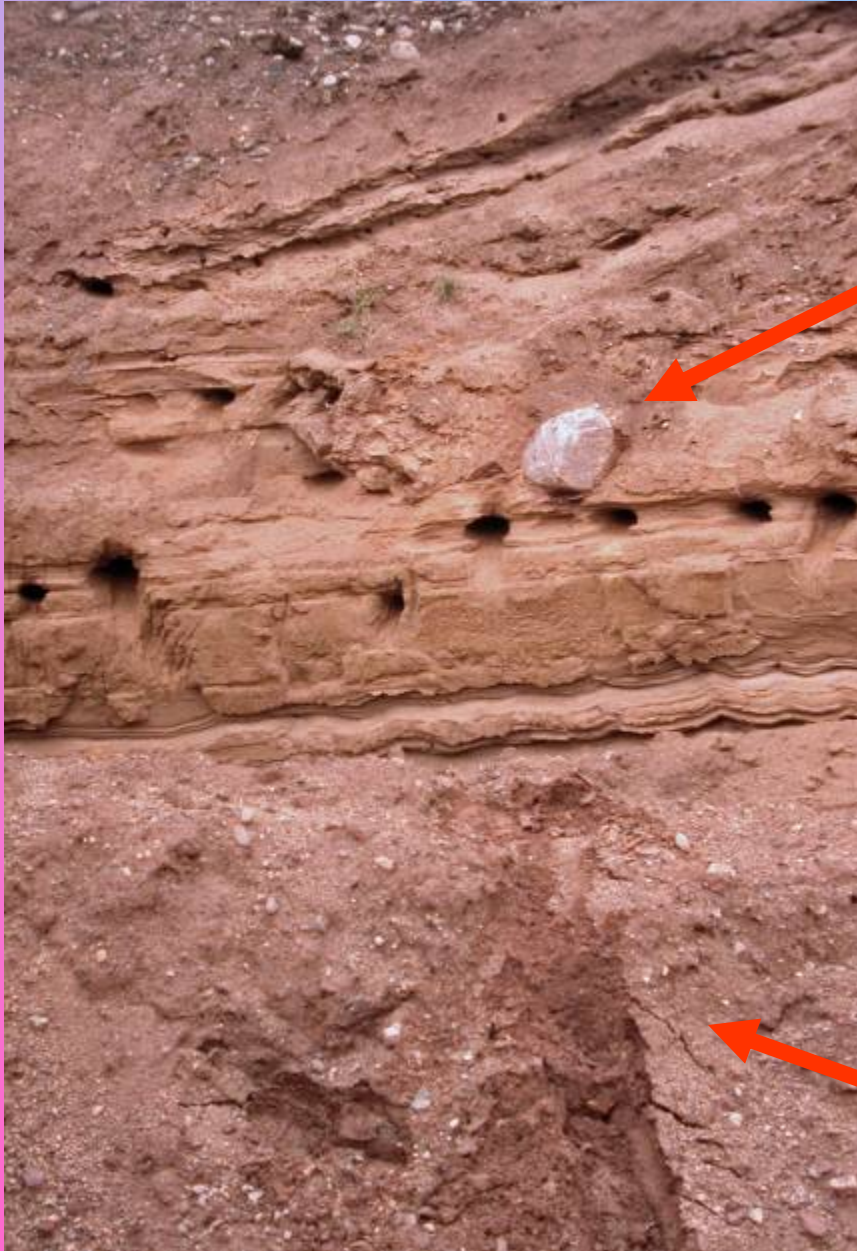


Climbing Ripples

Sorted & stratified meltwater sediment (fluvioglacial) left at the sides (*Kame Terraces*), in front of, or within Ice wells - *KAME Deposits* – also form Glacial Lake Deltas like this one in 'Glacial Lake Passaic' at Pequannock, NJ

Annual, Fine Grained Deposits
in Glacial Lakes are **VARVES**





Kame Deposit in a Glacial 'Well' bottom, filled with water; became a periglacial lake & a DROPSTONE in an iceberg was dumped on the fine sediment. Holes are swallow nests.

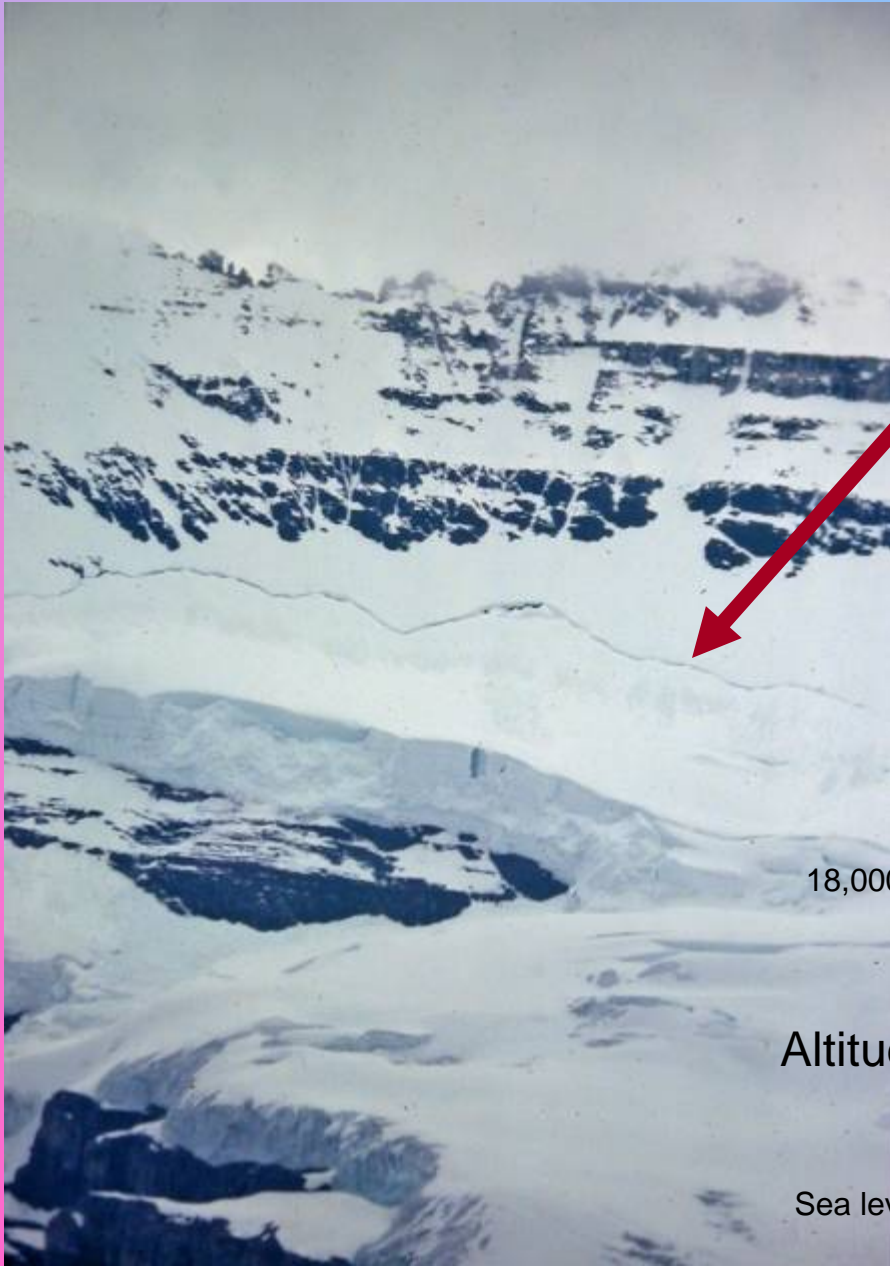
Note TILL unconformably overlain by younger fluvio-glacial sediment and overlying the same above



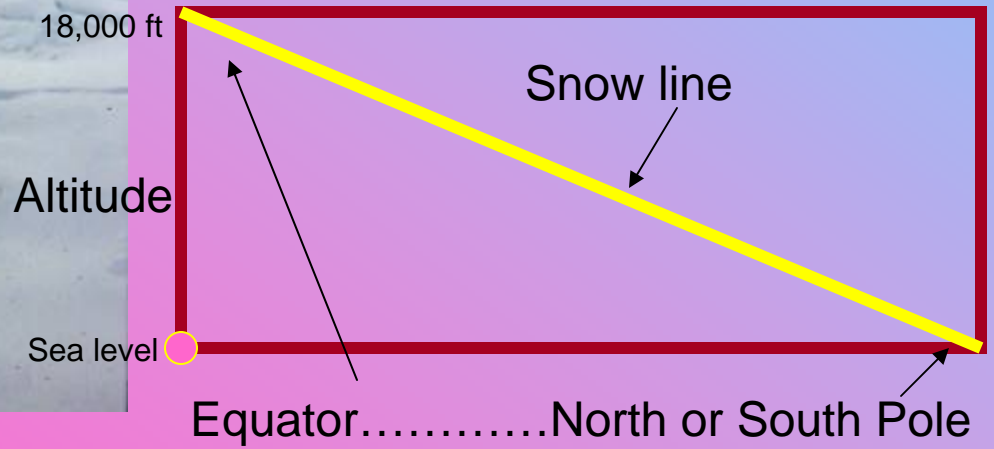
ICE CAVES at toe, where Meltwater streams exit glacier - note glacial milk: sediment in *ice stream's bed* will be deposited on bedrock as an **esker**



Braided meltwater streams outflow as *distributaries* on the surface of a DELTA, of their own creation, in Sunwapta glacial lake at Athabasca Gl.



BERGSCHRUND, a large crack in the ice where a cirque glacier pulls away from the bedrock to instigate glacial plastic flow under gravity; glaciers form where more snow falls than can melt- above the SNOW LINE, depending on altitude & latitude plus global climate





Continental Glaciers deposit winding hills of sand & gravel from the beds of through-the-ice streams: **ESKERS**



Boulders of melting *continental glacier ice*, trapped by rising fluvioglacial sediment, will eventually melt to form *Kettles* or *Kettle-hole Lakes*



ROCHE MOUTONEES: resistant bedrock is plucked on downstream side & gently sloping on upstream – ‘sleeping sheep rocks’