

Glaciers and Glaciation

Geology 105

Chapter #12

Cryosphere-

- _____ of all freshwater is tied up in the glaciers
 - _____ of the Earth has been covered by glaciers- today
 - _____
 - Affects the geosphere
 - Influences the climate
 - Influences the ocean currents
 - Affects the biosphere
-

Glaciers-

□ Alpine glaciation-



Continental Glaciation-



Continental Glacier on Ellesmere Island

Formation of a glacier

□ 1) more snow must fall than melts

As snow accumulates it gets buried under additional snow and is compacted.

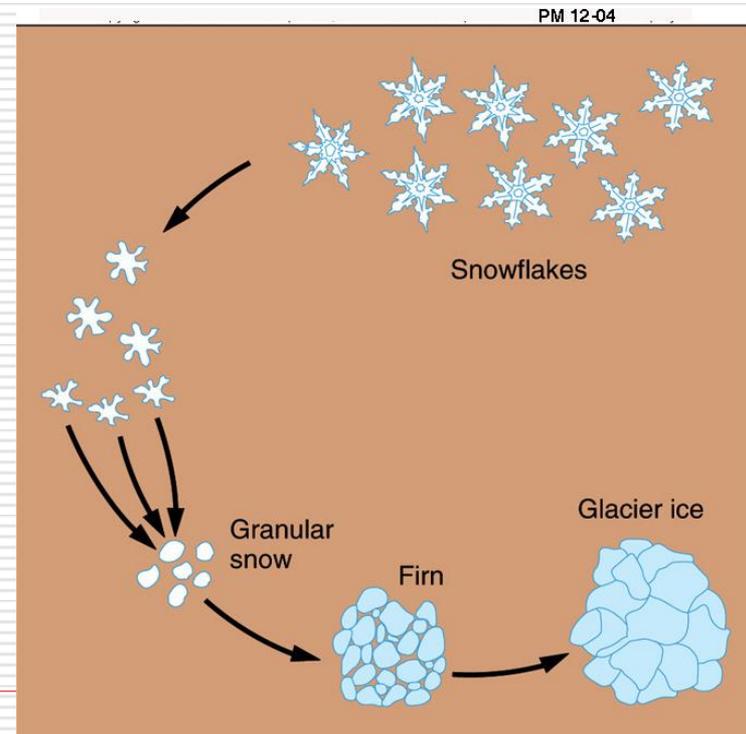
Fresh snow is about 5% water & 95% air.

1st stage of compaction is _____
about 50% water & 50% air.

2nd -Further burial- granular ice becomes
_____ about 25% air and 75% water.

final stage - _____, like a rock,
closely packed grains of ice & 5-20%
air.

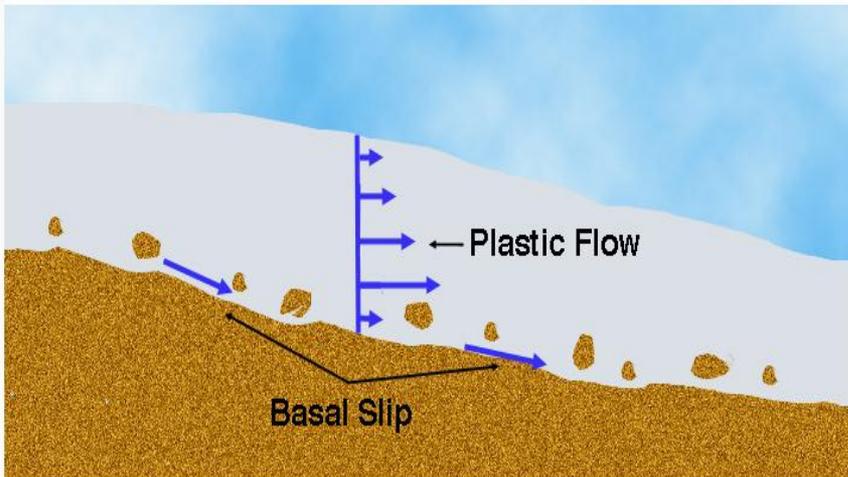
As snow compacts it loses about 80-90%
of its initial volume.



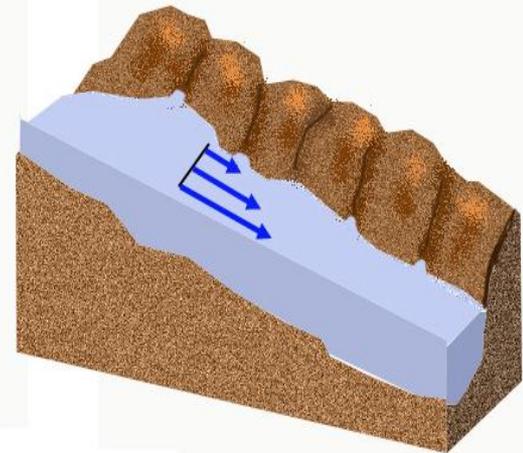
2) Gravity causes the ice to move

Glaciers move by _____ along the base of the glacier and by _____ within it.

Basal slip is the movement of ice along a layer of water between the bedrock & ice. The water is caused by the pressure on the ice along the base of glacier, causing a small amount of melting of the glacier.

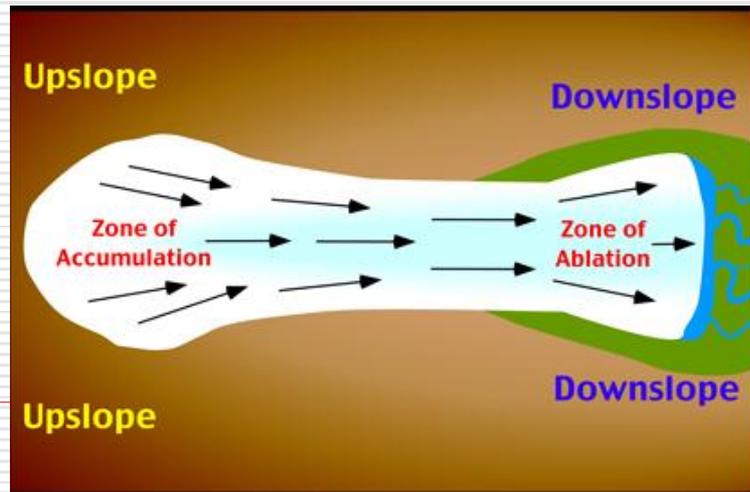
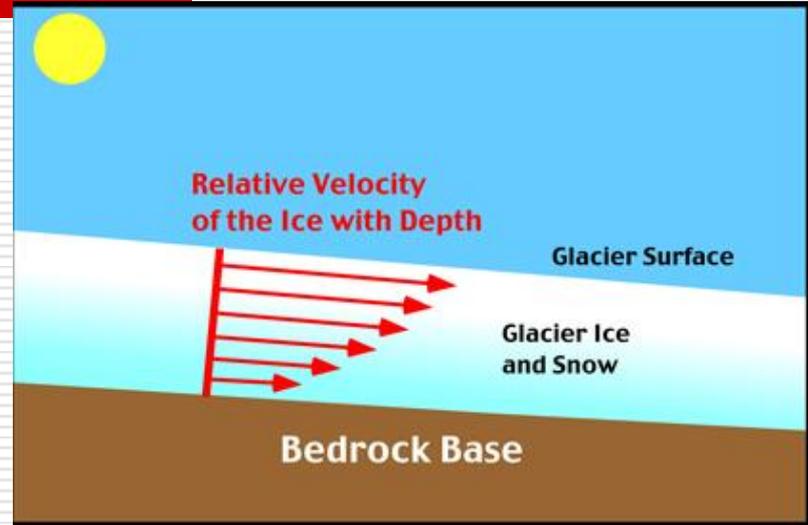
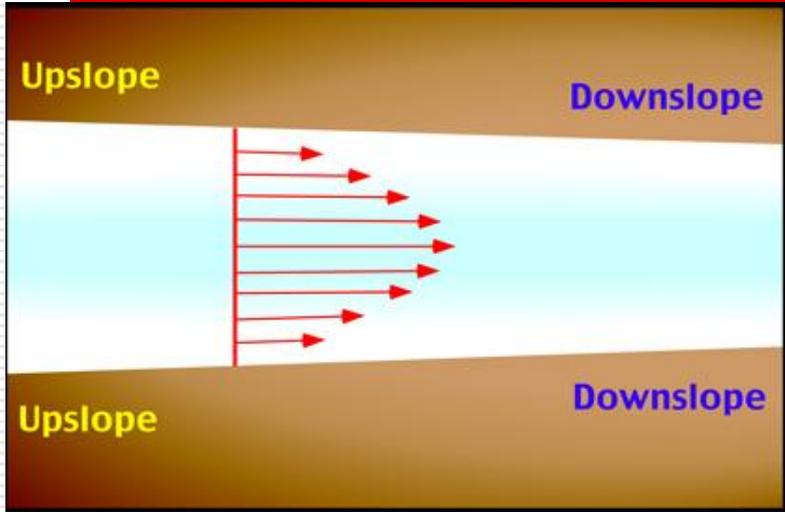


A



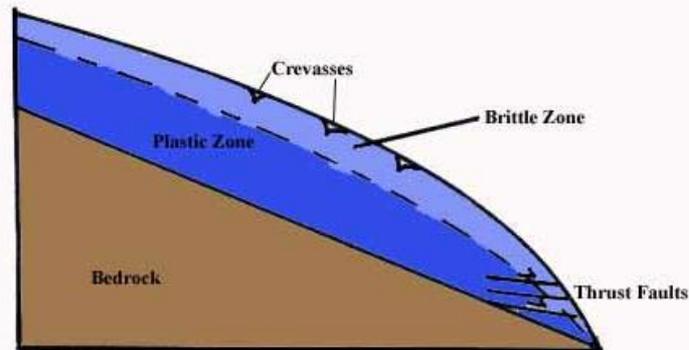
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Movement of a valley glacier



Zones within a glacier

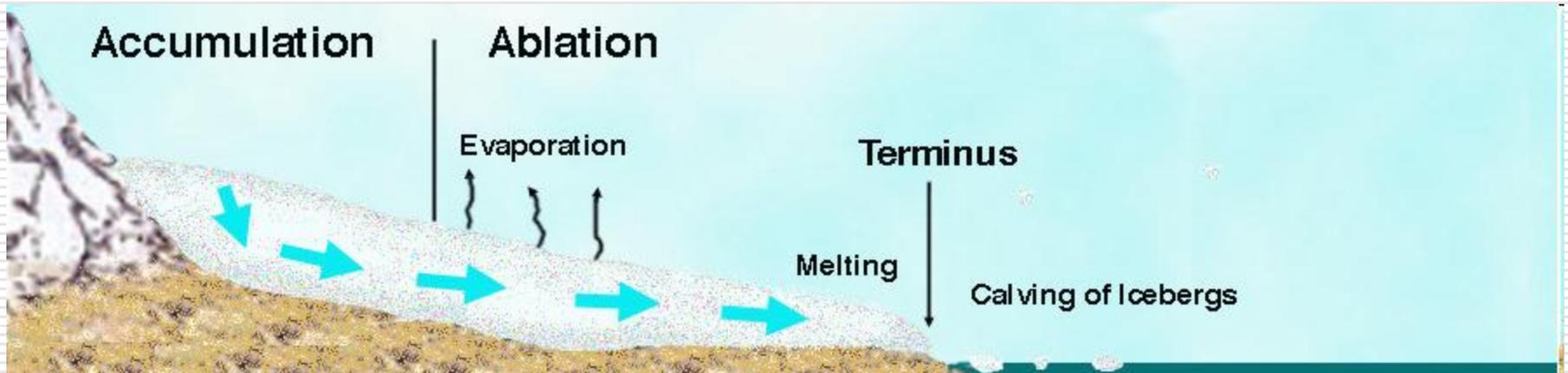
- _____ - ice grains deform & crystallize as they slide over each other.
- _____ - upper part of the glacier where the grains of ice do not move relative to each other



Crevasses-



Glacial Budgets



Glaciers advance or recede as a function of the balance between accumulation and ablation of snow and ice.

_____ the part of the glacier with perennial snow cover

_____ ice is lost (ablated) by melting, evaporation or calving

_____ marks the highest point at which the glacier's winter snow cover is lost in the melt season

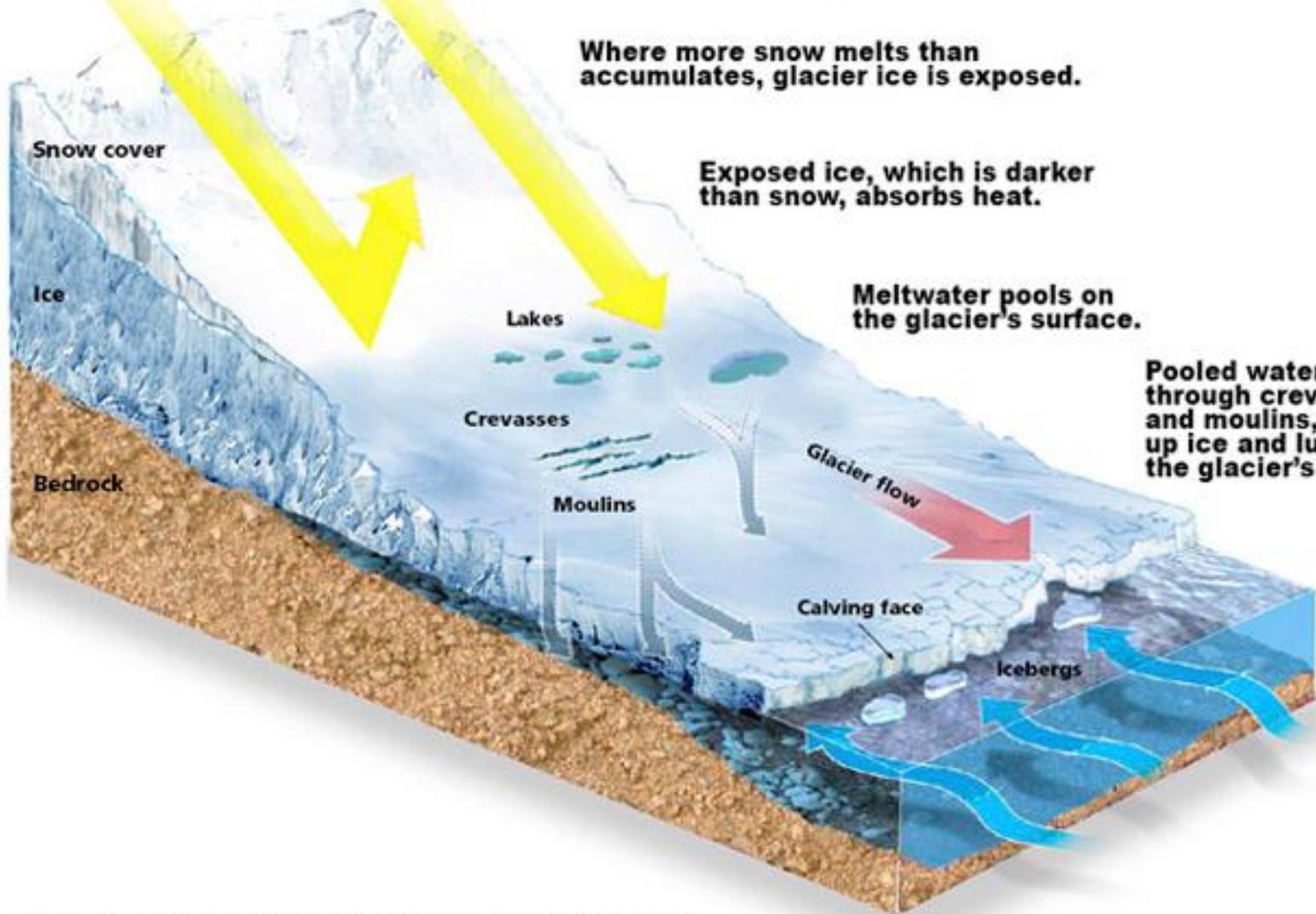
White snow cover usually reflects sunshine, protecting the ice below from melting.

Where more snow melts than accumulates, glacier ice is exposed.

Exposed ice, which is darker than snow, absorbs heat.

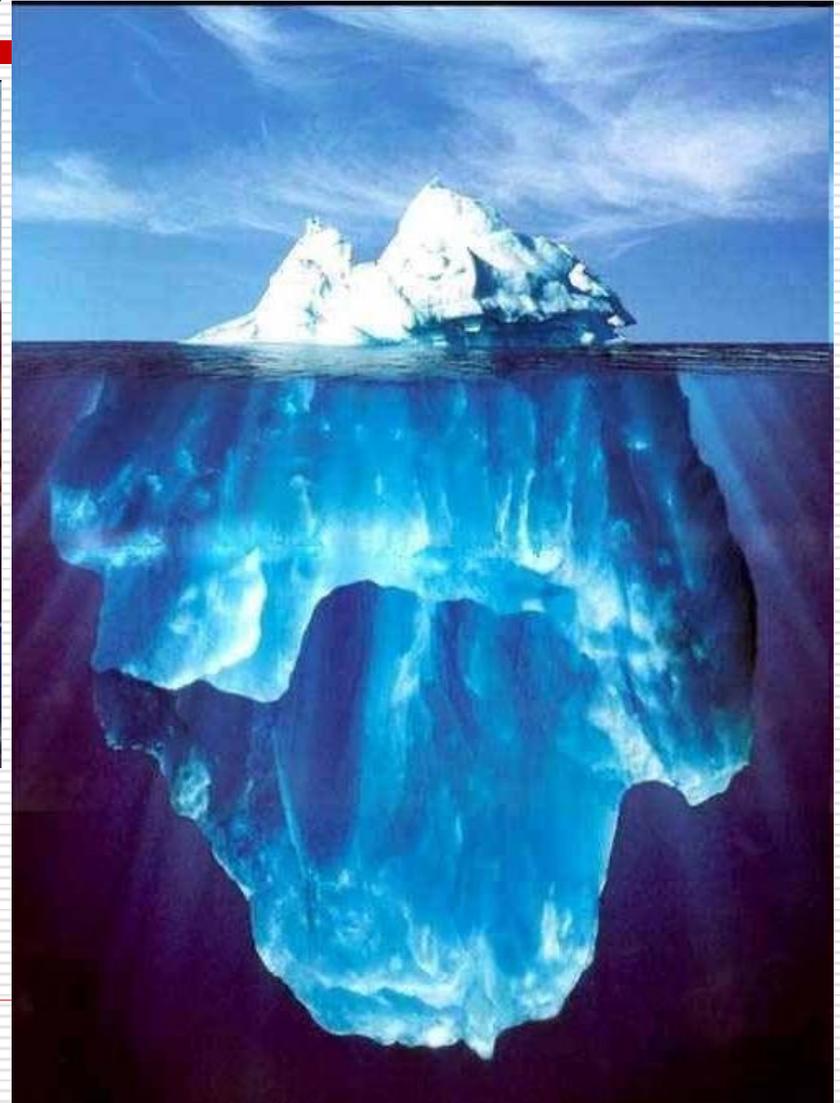
Meltwater pools on the glacier's surface.

Pooled water drains through crevasses and moulin, breaking up ice and lubricating the glacier's base.



Source: Denver Museum of Nature & Science

Iceberg formation



Terminus-



Calving of a glacier

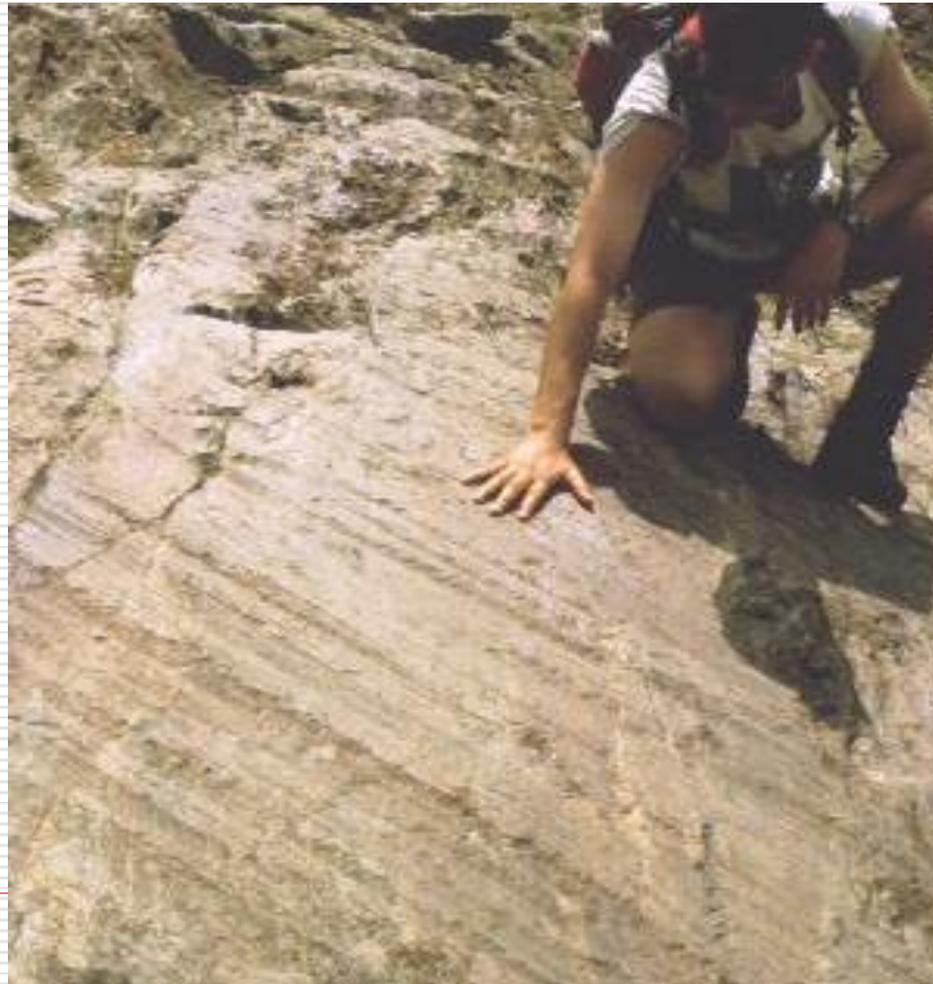
Honey comb glacier in the Cascades
Retreated over 2 km since 1977 →



Glacial erosion-

- - melt water works into cracks in bedrock & refreezing breaking loose rock which are carried along by the glacier.
 - - flat surface on rock caused when rocks are dragged by ice
 - powder produced by grinding rock
-

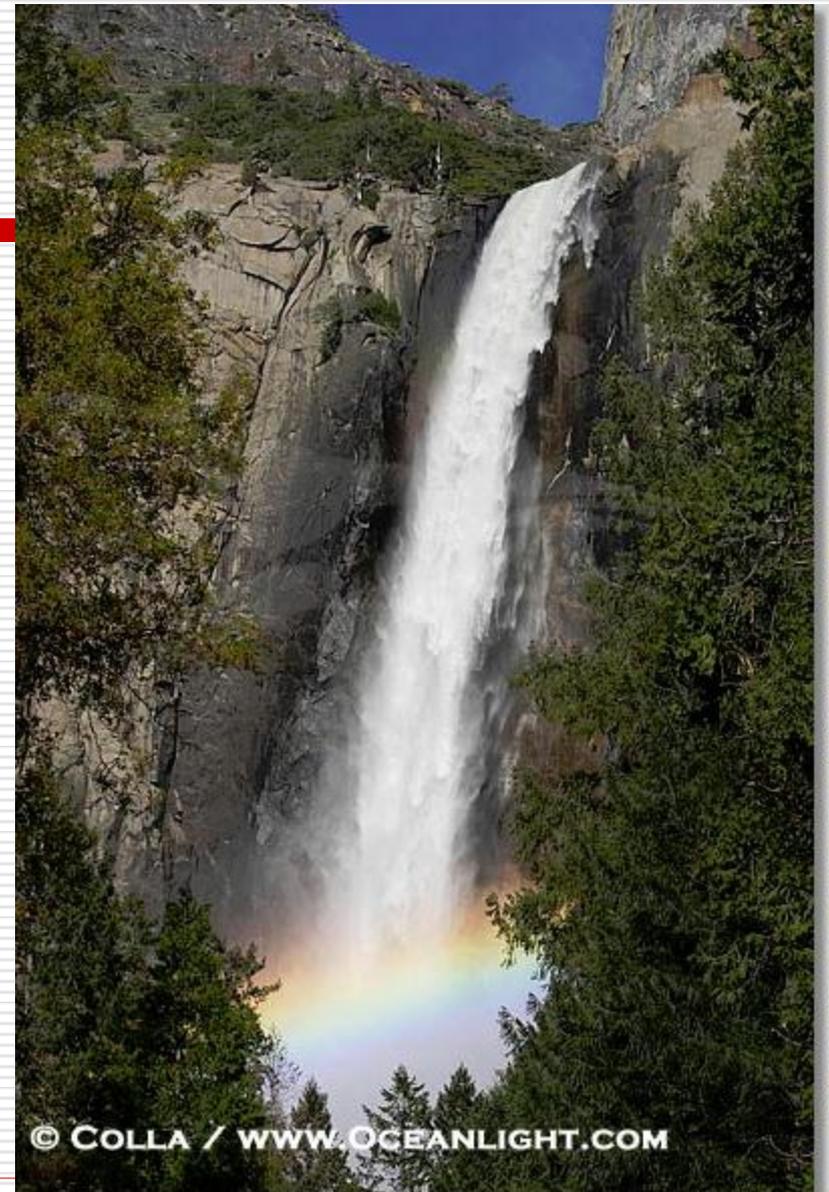
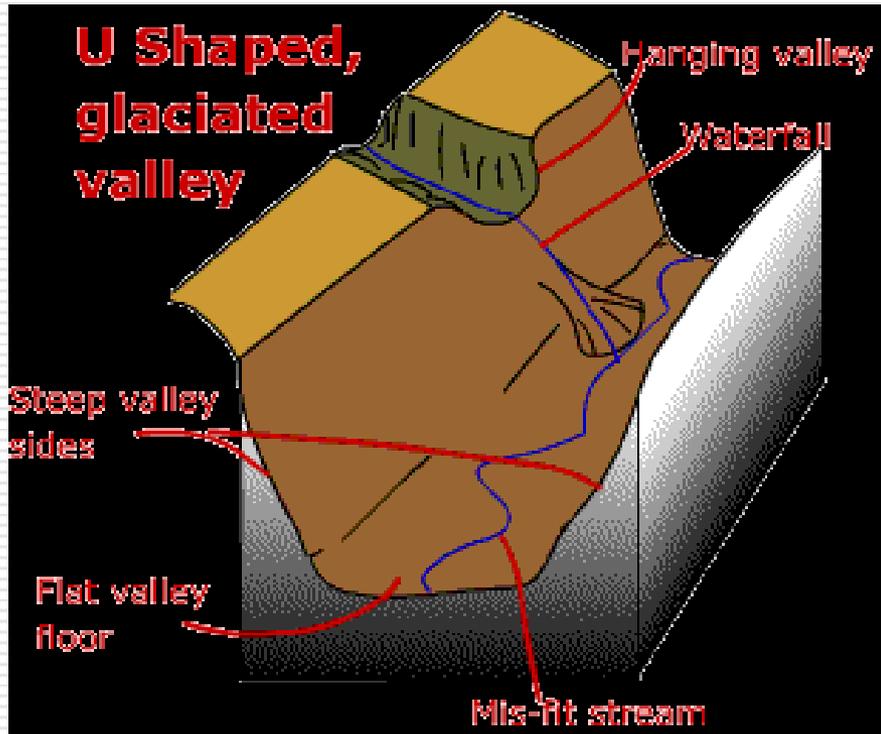
Bedrock underlying a glacier is _____ and _____.



3) U-shaped valley-

- 4) _____ - sharp peak that remain after cirques cut back a mountain on several sides
 - 5) _____ - sharp ridges separate glacial valleys
 - 6) _____ tributary valley entering a main valley at a much higher level because of a deepening of the main valley by glacial erosion
-

Hanging valley



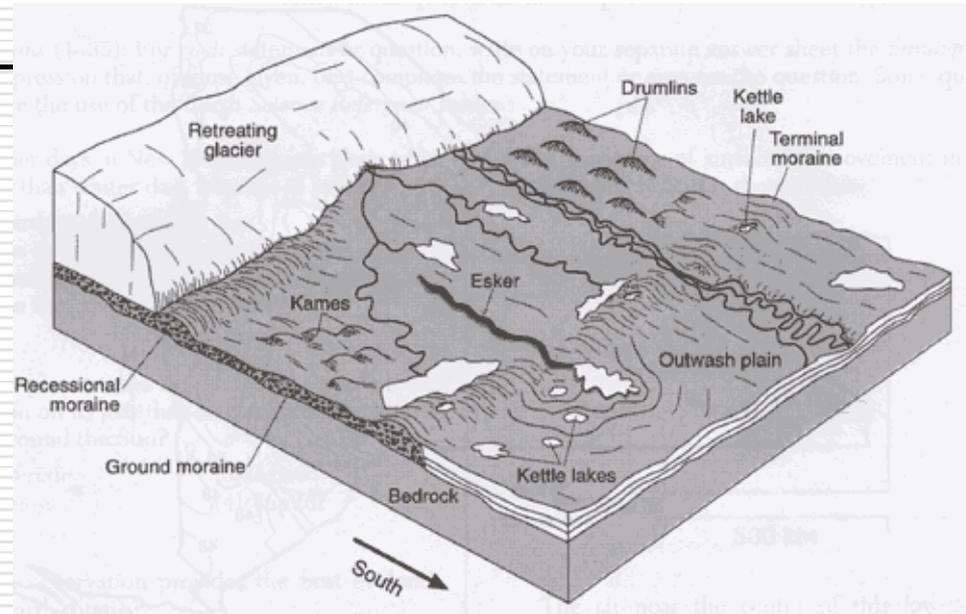
Landforms of a continental glacier

□ Tend to produce a more _____

□ Rounded knobs-

□ Striated bedrock

□ Glacial deposition features

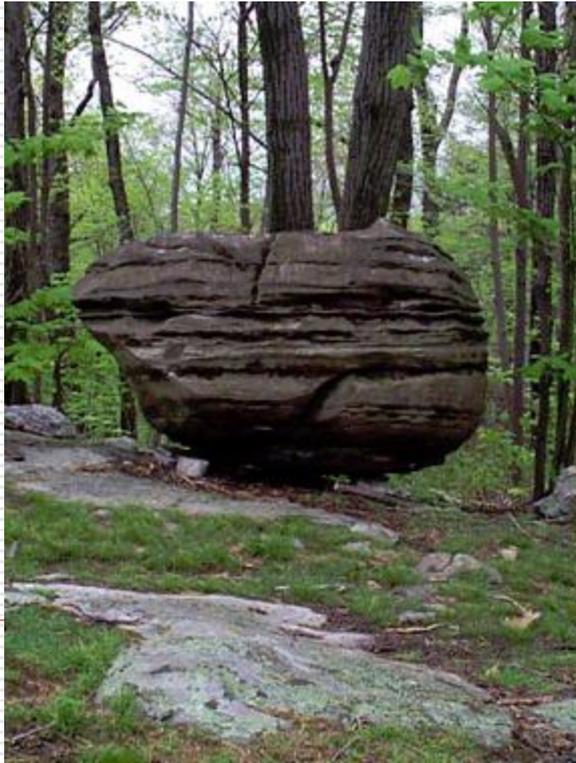


Fjord-



Glacial depositional features

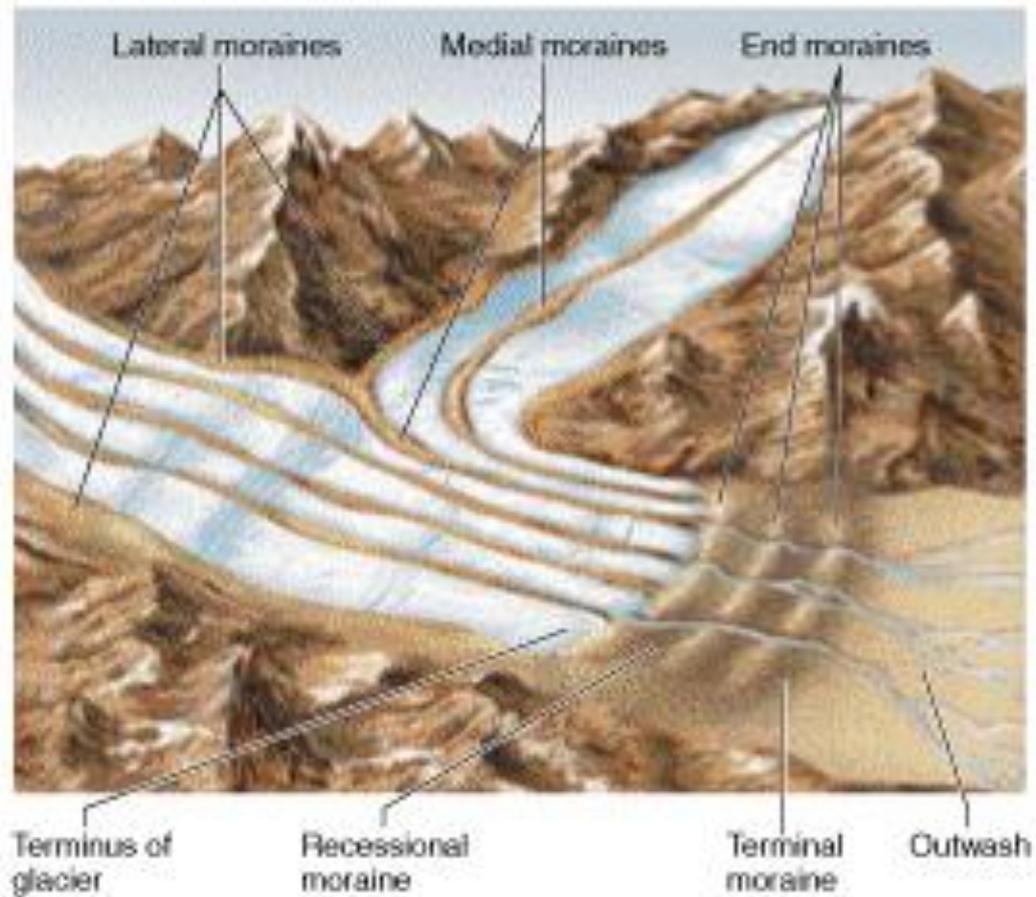
- _____ - unsorted and unlayered rock debris carried by a glacier
- _____ - boulder transported by a glacie



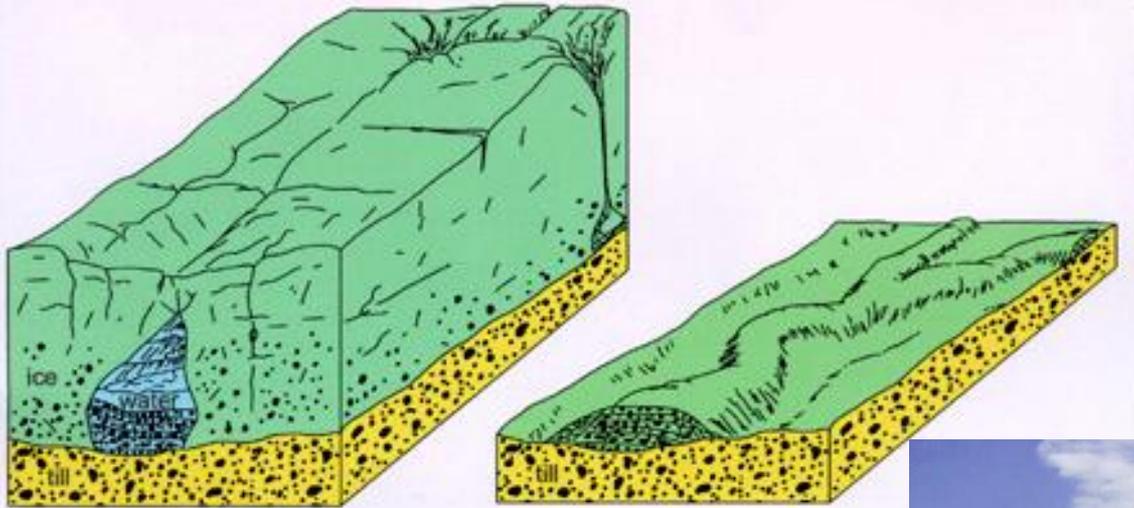
- mound of unsorted debris on or left behind a glacier

- long low mounds of till that form along the sides of a glacier
 - - mounds of till that form when glaciers join
 - - mounds of till that form at the end of a glacier
 - - rock debris carried by a glacier is deposited beneath the glacier
 - material deposited by the debris-laden meltwater
-

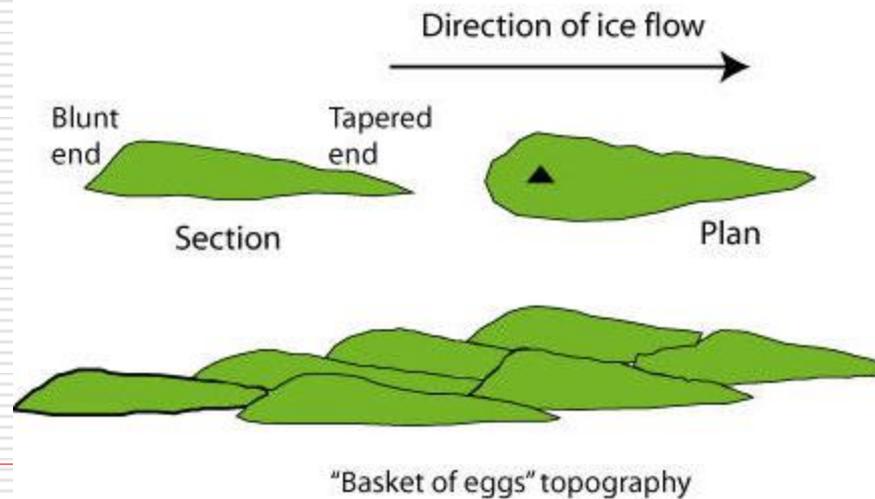
moraines



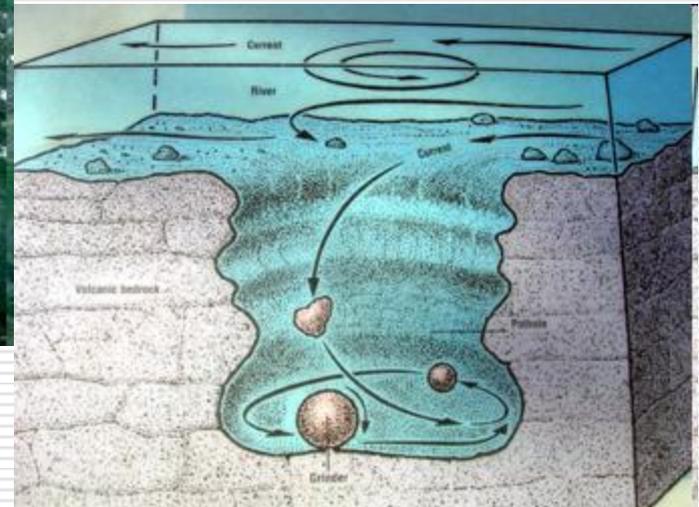
Esker-



Drumlins-



Kettles-



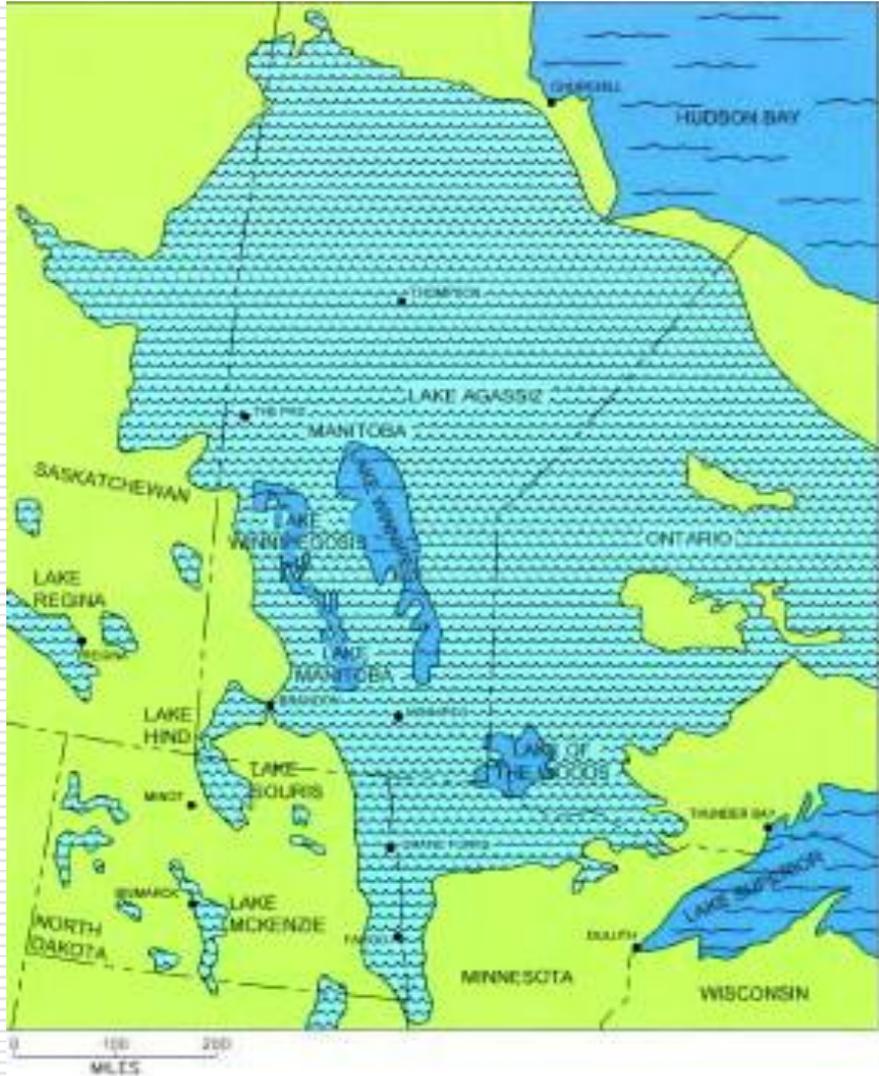
Kame-



Glacial lakes-

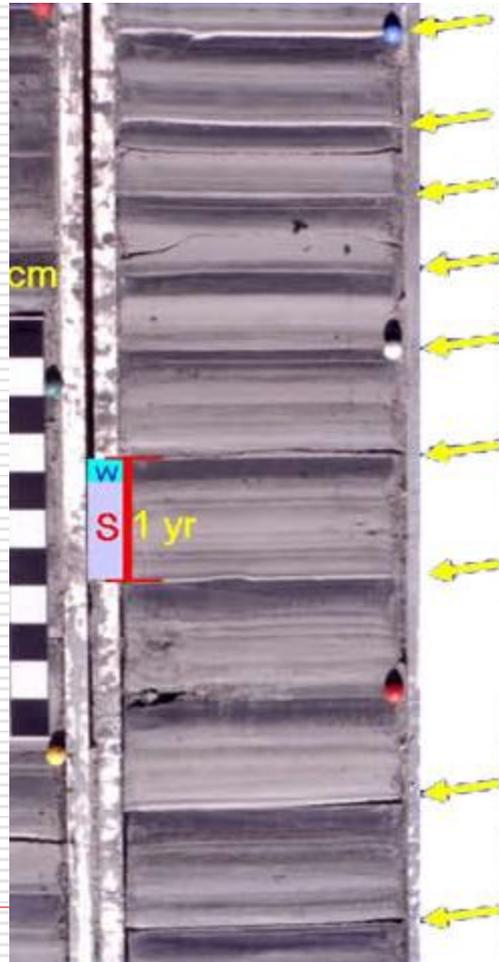
- The history of _____ in North Dakota covers approximately 2,700 years, from 11,700 years ago until 9,000 years ago. The lake began to form in the _____ when the glacier retreated north of the drainage divide between the Hudson Bay and Mississippi River drainage basins; this is near Browns Valley, Minnesota. North-draining rivers were _____
-

Glacial lake Agassiz

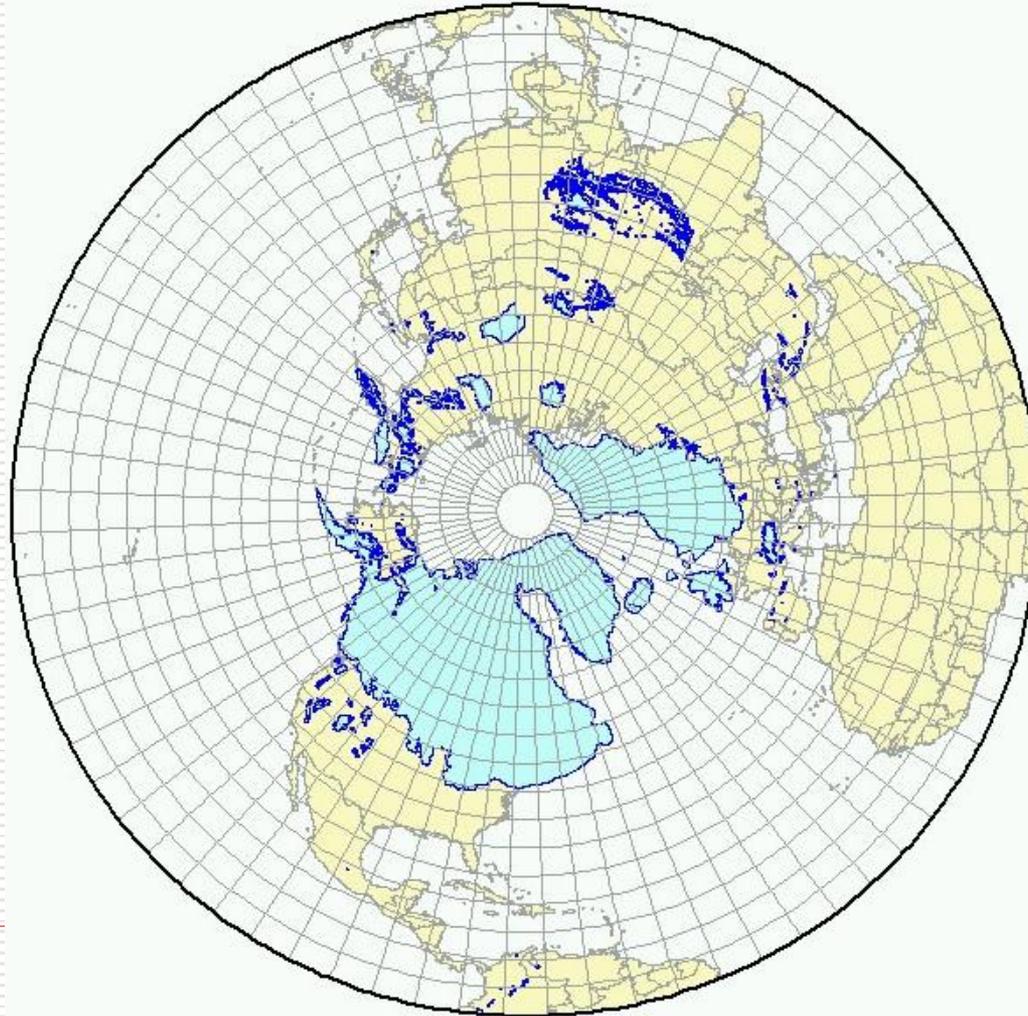


Lake Agassiz plain from the Pembina Escarpment looking east toward Mountain, North Dakota

Varves-



“Theory of Glacial Ages”-



Possible Causes of Glacial Ages

- 1.
 - 2.
 - 3.
-