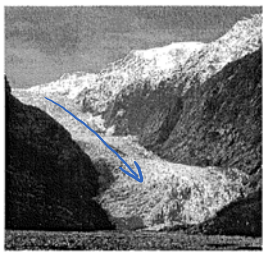
Glaciers

Glacier Terms



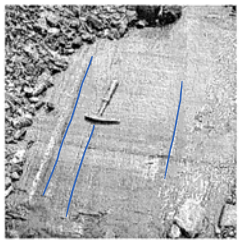
1. Glaciers – rivers of ice
   a. How do glaciers form?

      snow accumulates over years, compresses into ice crystals called "firn"

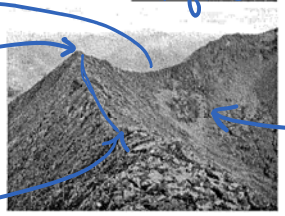
   b. snow line - lowest level that permanent snow reaches in the summer.
   c. How do glaciers erode the bed rock?

      rocks imbedded into the bottom and sides scratches bedrock

2. Glacier Types
   a. Alpine or Valley glacier Wedge-shaped stream of ice found in mountains. → forms U-shaped valleys
   b. Continental glacier -Moves outward from center as gravity squishes. Covers large areas. Also called Ice Sheet.
   c. Hanging Valley -Small (tributary) glacial valley cut off by larger glacier. (Often have waterfalls when glacier melts.)



3. Erosional Features – formed by glacier removing material
   a. Striations -Long parallel scratches left by course sand, pebbles, sharp boulders that are imbedded in the ice and dragged over other rocks (bedrock).
   b. Cirque -Semicircular basin formed at the head of a glacial valley.
   c. Arête -Knife edge ridge between 2 cirques on a peak or between 2 U-shaped valleys.
   d. Horn -formed by 3 or more glaciers sliding down from the peak of a mountain.



4. Depositional Features – formed by glacier depositing material (usually as it melts)
   a. drift - all deposits of glacial origin are called this
   b. till or ground moraine - large buildups of rock pieces carried in the bottom of the glacier – deposits under the glacier — can become "tillite" if lithified
   c. outwash - deposits made by streams of glacial meltwater (outwash plane)
   d. moraines - long lines of rock. There are various types:
      i. Lateral moraine As a glacial moves down a valley, rocks from the valley walls fall onto the glacier. When the glacier melts, the rocks are deposited (dumped) along the sides of the valley.
         └ unsorted, angular

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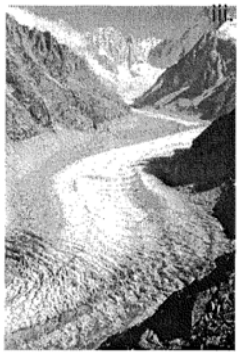
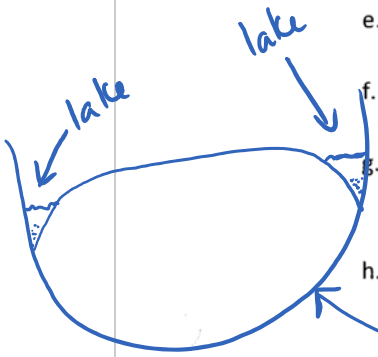
ii. Medial Moraine - If two glaciers from separate valleys join into one valley, the two central lateral moraines join to become one. When the glacier melts, the rocks are deposited in the middle of the valley.

iii. end moraines-Formed at the end of a glacier. There are two types:



1. terminal - as a glacier moves it bulldozes material in front of it, making a line of rock at the toe.
2. recessional - As a glacier retreats (melts faster than it moves forward) it temporarily stops (melts at the same rate as it is moving forward) and all the rocks in the ice that is melting at the toe are deposited at that one spot.

moraines are angular, unsorted deposits



e. erratic - Large boulders that have been transported to an area by a glacier but don't belong there.

f. outwash plain - glacial meltwater forms streams, from end of glacier – alluvial fans (deltas out of water) formed, overlap and form plains. – rounded, sorted sediments

g. esker - Meandering stream tunnels in/under glacier become partly filled with rocks. When glacier melts material is deposited in stratified s-shaped curves. These streams erode up since ice is softer than rocks below!

rounded, sorted, layered sediments

h. Kame - Cone-shaped hill formed when streams on top of glacier deposit rocks in lakes on top of glacier. When glacier melts, rocks deposited in stratified cone.

Kames terrace - formed by lakes at side of glacier

i. delta -When streams empty into still water (lakes/oceans), alluvial fan in water.

← esker

5. Other Features
   a. drumlin -Long, smooth, canoe-shaped hills made of till formed when advancing glacier runs over earlier deposited moraine.
   b. _____-Circular hollows on terminal moraines and out washed plains- large lump of ice left imbedded in out washed material then ice melts, leaving a hole.
6. Glacial Lakes
   a. _____- Formed when water fills the cirque basin left by alpine glaciers, also called tarns. Ex. Lake Louise
   b. _____- Formed when water fills kettles
   c. _____- River valley (used to be glacial valley) blocked by moraines EX. Moraine dammed lake on $20 bill.

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3. Hypotheses regarding the origin of ice ages/global warming

External

a) significant changes in sun's energy output.
- cycles of sunspot activity cause fluctuations but would have to be 10 times larger and way longer than what we see in the current 11 year cycle.
- lack of evidence, can't prove or disprove

b) variation in the tilt of Earth's axis.
- polar region might become cold enough for large ice sheet to develop
- for Pleistocene there seems to be a correlation but tests can't be done for earlier ones.

Earth-based

a) when Pangaea broke up the ocean circulation was blocked so warm equatorial water couldn't get to the poles.
- accounts for Pleistocene but not ice ages prior to break up of Pangaea
- can't explain glacial advance and retreat in one ice age.

b) blocking of incoming solar radiation by something in atmosphere.
- I.E. volcanic ash - in past Earth was more active volcanically so maybe enough dust for long enough led to cold enough temperatures to cause ice sheets to form.

None of the above accounts for all ice ages. It is an incomplete list too; human activity may have an effect but not much (especially not for previous ice ages). Something larger is at work.

Comparing Sediments:

	round?	Sorted?	chem erosion?	max size	other	sedimentary features
Stream	round	well sorted	Yes	med.	smooth	meanders, deltas, ripple marks
Glacier	*angular	not	no	large	←normal	moraines, erratic,
	round	well sorted	yes	med	←streams involved	Kame, esker, outwash
Wind	round	very well sorted	no	small	pitted	dunes

abrasion - sand blasting, grinds rocks