Chapter Outlines

Today's continental glaciation of Greenland & Antarctica

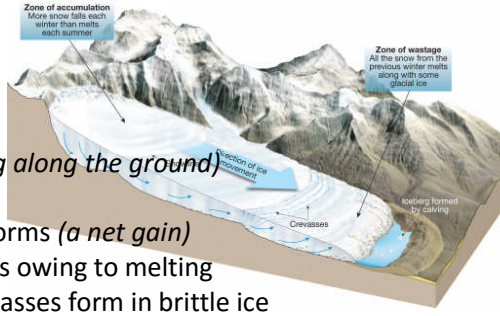
NOTE: This is intended to help students 'organize' their understanding of each topic. It is <u>not</u> a comprehensive study guide for quizzes or midterms, i.e. <u>study your text!</u>

Glaciers, Deserts, and Wind

Continental glaciation of North America during the last ice advance

I. Glaciers: a part of both the hydrologic cycle and rock cycle
- A. Glacier—a thick mass of ice that forms over land from the compaction and recrystallization of snow, and shows evidence of past or present flow
- B. Types of glaciers
  1. **Valley glaciers**, or alpine glaciers - form in mountainous areas
  2. Ice sheets, or **continental glaciers**– large scale such as over Greenland and Antarctica
  3. Other types
     - a. **Ice caps** *(covering only one mountain)*
     - b. **Piedmont glaciers** *(valley glacier that reaches flat land)*


A crevasse in the 'zone of fracture'



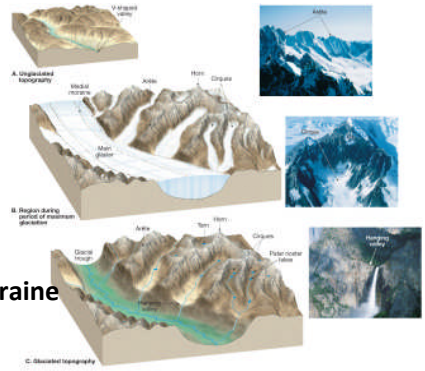
Glacial zones above & below the snow line (equilibrium line)

- C. Movement of glacial ice includes - **plastic flow** and **basal flow** *(slipping along the ground)*
- D. Parts of a glacier include:
  1. **Zone of accumulation**—the colder 'upland' area where a glacier forms *(a net gain)*
  2. **Zone of wastage**—the lower warmer area where there is a net loss owing to melting
  3. **Zone of fracture** - the uppermost surface *(±50 meters)* where crevasses form in brittle ice
- E. Erosion by glaciers
  1. **Plucking**—lifting of rock blocks
  2. **Abrasion** – resulting in rock flour *(pulverized rock)* and **striations** *(grooves in the bedrock)*

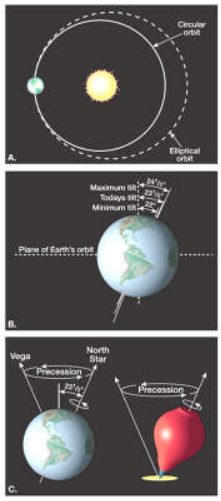

Glacial striations, and polishing

- F. Landforms created by glacial erosion - **glacial trough, hanging valley, cirque, arête, horn, fiord**

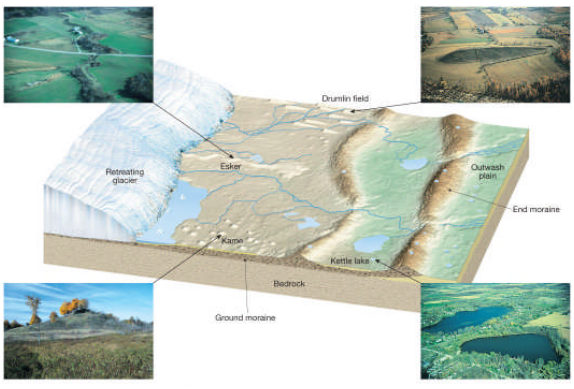
Glacial erosional features



- G. Glacial deposits
  1. **Glacial drift** - all sediments of glacial origin including:
     - a. **Till** – unsorted material deposited directly by the ice
     - b. Glacial **erratics** *(boulders embedded in till)*
     - c. Stratified **drift** – sorted sediment deposited by glacial meltwater
  2. Depositional features
     - a. **Moraines** - layers or ridges of till. Types include:
       lateral, medial, ground, terminal end moraine, recessional end moraine
     - b. Other features - **outwash plain, kettles, drumlins, eskers, kames**
- H. Glaciers of the past
  1. **Ice Age (the Pleistocene epoch)** – began 2 to 3 million years ago…
     Ice covered 30 percent of Earth's land area
  2. Indirect effects of Ice Age glaciers
     - a. Migration of animals and plants
     - b. Rebounding upward of the crust *(after melting)*
     - c. Worldwide change in sea level
     - d. Climatic changes
- I. Causes of glaciations *(not fully understood)*
  1. A successful theory must account for:
     cooling of Earth and short-term climatic changes
  2. Proposed possible causes
     - a. Plate tectonics
       - i. Continents were arranged differently
       - ii. Changes in oceanic circulation



Earth's changes that may affect climate



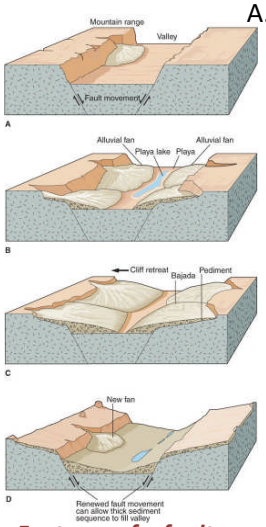
Glacial depositional features

b. Variations in Earth's orbit
i. Milankovitch hypothesis
a. Shape *(eccentricity)* of Earth's orbit varies
b. Angle of Earth's axis *(obliquity)* changes
c. Axis wobbles *(precession)*
ii. Changes in climate over the past several hundred thousand years are closely associated with variations in Earth's orbit

'Buttes' in Monument Valley

II. Deserts

A. Geologic processes in arid climates



Features of a fault-block region

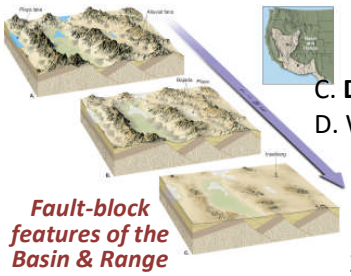
1. Weathering
a. Not as effective as in humid regions
b. Mechanical weathering forms unaltered rock and mineral fragments
c. Some chemical weathering does occur – clays and thin soils form

Desert features

2. Role of water in arid climates
a. Streams are dry most of the time
b. Desert streams are **ephemeral** *(exist for short periods)*
i. Flow only during periods of rainfall
ii. Nomenclature for desert streams
- **Wash, Arroyo**, *(also called wadi, donga, or nullah)*
- Desert rainfall - most erosion in a desert is caused by running water *(albeit very little)…*
  Rain often occurs as heavy showers causing **flash floods** in poorly integrated drainage

Arroyo – site of occasional flash floods

B. **Basin and range** – a region of uplifted crustal fault blocks
1. Interior drainage into basins produce:
alluvial fans, **bajadas**, **playas** and **playa lakes**
2. Erosion of mountain mass causes local relief to continually diminish
3. Eventually mountains are reduced to a few large bedrock knobs called ***inselbergs*** projecting above a sediment-filled basin



Fault-block features of the Basin & Range province

C. **Desertification** – result of poor management of arid land and/or diversion of rivers

Desertification of the Aral Sea

D. Wind erosion
1. By **deflation** *(primarily the midwest)*
a. Lifting of loose material
b. Production of **blowouts**

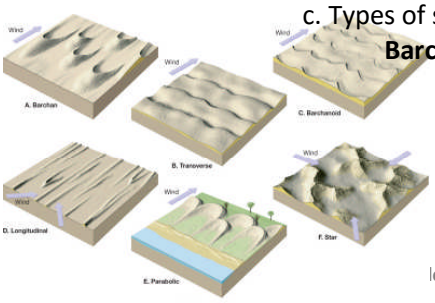
The center of this 'blowout' remains standing

2. By abrasion

E. Types of wind deposits
1. **Loess** *(primarily the midwest)*
a. Deposits of windblown silt
b. Extensive blanket deposits
c. Primary source is glacial stratified drift

Dust storm, in the 'dust bowl'

2. **Desert pavement** – a veneer of coarse pebbles
3. **Sand dunes**
a. Mounds and ridges of sand formed from the wind's bed load
b. Characteristic features
i. **Slip face**—the leeward slope of the dune
ii. **Cross beds**—sloping layers of sand within the dune
c. Types of sand dunes include:
Barchan dunes, Transverse dunes, Longitudinal dunes, Parabolic dunes, Star dunes



Types of sand dunes

Sand dunes, and cross-bedding formation