Chapter 3 Landforms

Geomorphology

- Study of landforms and processes that create them
- Lithosphere
  - Rocks and soil
  - Surface landforms
    - Plains, hills, valleys, depressions

Landform Processes

- Exogenic
  - External forces
    - Erosion, water, wind, chemical
- Endogenic
  - Internal forces beneath or at Earth's surface
    - Mountain building
    - Earthquakes

Hasse's Geomorphology Rule #1

"The Earth Wants to Become Flat"

Exogenic Processes (the earth trying to become flat)

- Reduction of the land's surface
- Types
  - Weathering
  - Mass movement
  - Erosion

Weathering

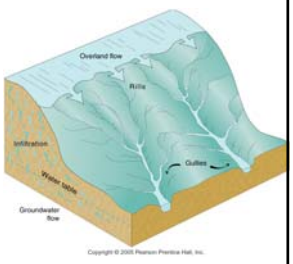
- Process of breaking rock into pieces
- First step in formation of soil
  - Chemical weathering,
    - Process of breaking down rock by:
      - Exposure to air and water
      - Acids released by decaying vegetation
      - Oxidation
      - Leaching
      - Decomposition of calcium carbonate
  - Mechanical weathering
    - Process of rocks breaking down by physical force

Movement of Weathered Material

- Mass movement
  - Slow gradual movement occurring near the surface, soil creep
  - Dramatic movements such as rock slides, landslides and mudflows
- Surface erosion
  - Caused mostly by rainfall

Stream Drainage

- 2 sources
  - Ground water
  - Overland flow
- Drainage basin
- Discharge
  - Volume of water carried per unit time
- Sediment transport
  - Movement of material



Erosion from Human Activity

- Faster than that which occurs geologically
- Sharply increase amount of sediment in streams
- Major contributors include:
  - Deforestation
  - Agricultural development
  - Urban development

Ice, Wind & Waves

- Glaciers
- Wind causes erosion
  - Deserts
  - Farmlands
  - Coastal areas
- Coastal areas
  - Active areas of erosion
  - Pounding waves and surf
  - Land lost or gained

Glaciers

- Rivers of ice flowing from colder to warmer regions
- Act like conveyor belts picking up sediment and dropping it in depositional areas
  - Moraines
    - Terminal moraines
    - Lateral moraines
    - Medial moraines

Glaciers

- Covered a large part of the planet only 10-15,000 years ago
- Large body of ice moving down a slope or spreading outward on a land surface
- Can move as much as 1 meter per day
- Northern New Jersey Covered by Glaciers

Impact of Past Glaciations

- Soils
  - Advance and retreat of glaciers leave behind highly fertile soil
- Water supply
  - Retreating glaciers left sand and gravel deposits yielding large supplies of ground water
- Transportation routes
  - Water transport is heavily influenced by glacial melt water channels left behind by receding glaciers

Effects of Wind on Landforms

- Significant shaper of landforms in dry regions and regions not well covered by vegetation
- Carries great quantity of fine grained sediment such as sand and loess

Coastal Erosion

- Waves
  - Form of energy traveling horizontally along the boundary between water and air
- Longshore currents
  - Currents traveling parallel to the shore, caused by repeated breaking of waves. Capable of carrying enormous amounts of sediment
- Sea-level change
  - Continuing to rise as seawater volume increases from glacial melting
  - Causes increased erosion as waves break closer to shore

Landforms

Hasse's Rule #2 :

"All Earth land features that are not flat are due to active geologic processes"

Mountain Building (Endogenic) Processes occur in particular geographic patterns throughout the world

- Chains of Mountains
- Pacific "Ring of Fire"
- Earthquakes often near mountain chains
- Volcanoes often adjacent to ocean trenches
- Different types and ages of rock found together
- Land Masses often have complementary shapes (Africa and South America)
- What can explain these patterns?

The Earth's Surface is Active

Geologic Time

- Earth formed 4.7 billion years ago
- Current landforms are often millions of years old
- Early 20th century work by geologist Alfred Wegener on continental drift helped to explain how landforms developed over time

Plate Tectonics

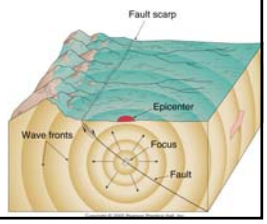
- Theory of the earth's crustal plate sections
- Plates – generally intact sections of lithosphere
- Two types of crust:
  - Ocean
  - Continent
- Boundaries of plates are areas of active geologic process
  - Earth quakes
  - Volcanoes
  - Mountain building
  - Deep sea trenches

Movements of the Continents

- Earth's crust is outer, lighter portion of the lithosphere
- Lithosphere broken into 12 large and numerous small plates that slide & drift over the asthenosphere
- Plate movement may be caused by convection

Earthquakes

- Focus
  - Place of actual movement
- Epicenter
  - Surface directly above focus
- Seismograph
  - Recording device for seismic waves
  - Richter Scale, 1935
- Seismic waves
  - Recordable vibrations



Faults

- Fractures in Earth's crust from stress
- Types
  - Normal
    - Divergent plate boundary
    - Stretching
  - Reverse
    - Convergent plate boundary
    - Compressed rock
    - Appalachian Mountains, Wasatch Range, Himalayas
  - Thrust
    - Horizontal movement

Plate Boundaries

- Divergent
  - Plates spreading apart
    - Seafloor spreading
    - Rift Valleys in Africa
- Convergent
  - Plates push together
    - Dense plates dive below
    - Volcanic eruptions
- Transform
  - Grinding of plates past each other
    - San Andreas Fault, CA

Volcanoes

- Magma
  - Molten rock
- Lava
  - Molten rock reaching Earth's surface
- Volcano
  - Surface vent for lava

Volcanism

- 2 Volcanic Types
1. Composite volcano
   - Also called "Strato"
   - Explosive forces
   - Steep sides
2. Shield volcano
   - Milder (oozing) forces
   - Gentle slopes
   - No explosion

- 4 Volcanic Conditions
  - Continental Rift
    - Mt Kilimanjaro
  - Continental Arc
    - Cascade Mountains
    - Mt St. Helens
  - Hot Spot
    - Yellow Stone
    - Hawaii
  - Island Arc
    - Japan

Rock Formation

- Igneous
  - Cooled molten crustal material
  - Basalt, granite
- Sedimentary
  - High pressure
  - Sandstone, shale, limestone
- Metamorphic
  - Compacted by heat, pressure
  - Marble from limestone
  - Slate from shale

Landform Regions

- A large section of the earth's surface where a great deal of homogeneity occurs
- Landscapes appear similar in these regions
- New Jersey has 5 regions (a lot for such a small state