Weathering
Weathering

- *Weathering* is the process by which rocks on or near Earth’s surface break down and change

- Two types of weathering can occur:
  - (1) Mechanical (physical) weathering
  - (2) Chemical weathering
Mechanical Weathering

- **Mechanical weathering** is the process by which rocks and minerals break down into smaller pieces.
- Doesn’t involve any change in a rock’s composition, only in the size and shape of the rock.
Mechanical Weathering

- Three types of mechanical weathering:
  - (1) temperature
  - (2) pressure
  - (3) biological
Low temperatures can cause water to freeze.

When water is trapped in the cracks of rocks and rock layers, when it freezes it expands, put pressure on the rock and cause splitting.
Temperature

- Repeated freezing and thawing of water is called *frost wedging*
- **Frost wedging** is the cause of many potholes in roads
Pressure

- Remember that as layers of sediment are added, the pressure to bottom layers increases
- When weathering removes the top layers, the bottom layers are now able to expand
- Over time, outer layers of rock are able to be stripped off in succession, like an onion
- This process is called *exfoliation*
Biological Weathering

- Biological weathering occurs when rocks are broken down as a result of plant growth.
Chemical Weathering

- *Chemical weathering* is the process by which rocks and minerals undergo changes in their composition as a result of chemical reactions.
- These chemical reactions result in the formation of new minerals.
Chemical Weathering

- Four agents of chemical weathering
  - (1) water
  - (2) oxygen
  - (3) carbon dioxide
  - (4) acid rain
Water

- Water is important to chemical weathering because it can dissolve many kinds of minerals and rocks.
- The reaction of water with other substances is called hydrolysis.
Oxygen

- The chemical reaction of oxygen with other substances is called *oxidation*.
- Common weathering reaction is the formation of rust.

Creates reddish brown soil.
Carbon Dioxide

- Produced by living organisms
- When carbon dioxide combines with water in atmosphere, weak carbonic acid is created
Acid Rain

- Caused by emission of cars or burning of fossil fuels (Sulfur dioxide and nitrogen oxide)
- Measure acidity by using pH scale
- Lower pH value, more acidic
- Acid rain is precipitation that has a pH value below 5.6 (pH of normal rainfall)
Acid Rain Damage

Sandstone figure over the portal of a castle in Westphalia, Germany, photographed in 1908

Same statue photographed again, this time in 1968
Aquatic species are sensitive to changes in pH values, and as a result of acid rain, can be adversely affected.
What affects rate of weathering?

- The rate at which weathering occurs is affected by:
  - (1) Climate
  - (2) Rock type and composition
  - (3) Topography
Climate

- Climate can hugely impact chemical weathering rates.
- Remember that if temperature increases, the rate of the chemical reaction increases; therefore causing the rate of weathering to increase as well.
- Amount of rainfall also affects weathering; lots of rain = lots of weathering.
Rock Type and Composition

- How hard or resistant rocks are to being broken down will affect how easily they are weathered.
- Sedimentary rocks are easier to weather than metamorphic or igneous rocks.
Topography

- **Topography** refers to the shape of the land with regard to elevation.
- Topography greatly affects erosion and drainage.
- Steep slope = lots of water runoff and erosion; not much water can seep into plant roots
- Gentle/no slope = little water runoff and not as much erosion
Topography - Surface Area

- As rock is broken down into smaller pieces, its surface area increases.
- This means more surface area is available for weathering to occur.
Formation of Soil

- Soil is the result of weathering of rocks and includes weathered particles.
Formation of Soil – Parent Rock

1. Soils form from parent rock as the rock begins to breakdown and weather due to precipitation and heat.
Formation of Soil – Organic Materials

2. Organic (living) things begin to help breakdown the parent rock more by adding nutrients and aerating (creating pockets of air) the soil.
Formation of Soil - Horizons

3. Horizons begin to form in the soil, creating visible layers.
Soil Texture

- There are three main types of soil texture:
  - (1) sand
  - (2) silt
  - (3) clay
Sand

- These are large particles (2mm - 0.02mm) formed by the physical weathering of rocks.
- In a soil the sand particles affect the size of space (voids). They tend to increase the size of the space allowing more movement of water and air. Therefore, sandy soils are well drained and well aerated.
- Sand does not hold nutrients well.
- Little plant growth (think deserts and beaches)
Silt

- Particles range in size from 0.002 mm – 0.05 mm
- Silt soil is considered to be among the most fertile of soils. Silt is often found in river estuaries, because the fine particles are washed downstream and deposited when the water flows more slowly. It is also soft and smooth, and holds a lot of water.
Clay

- Particles range in size from 0.002 mm and smaller
- In clay-rich soil, there is little organic matter. Clay particles stick well together, making plant root growth difficult. Clay holds water extremely well, and is found in the piedmont region of NC.