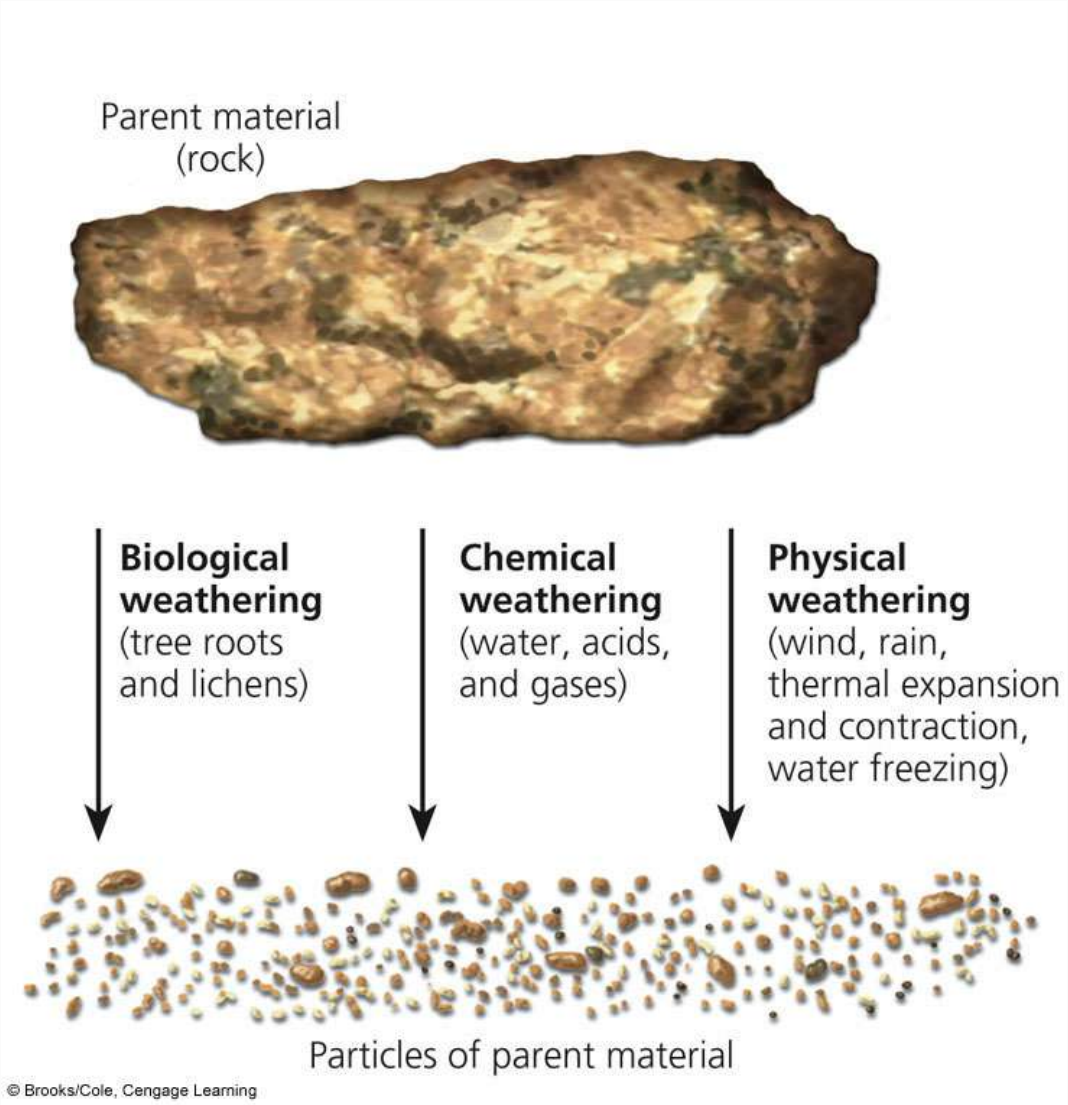
SOIL FORMATION

Soil Formation

- The Importance of Soil
  - All life depends on the thin top layer of soil covering the earth's surface.
  - Topsoil provides:
    - Support
    - Water
    - Air
    - Nutrients

Weathering: Biological, Chemical, and Physical Processes



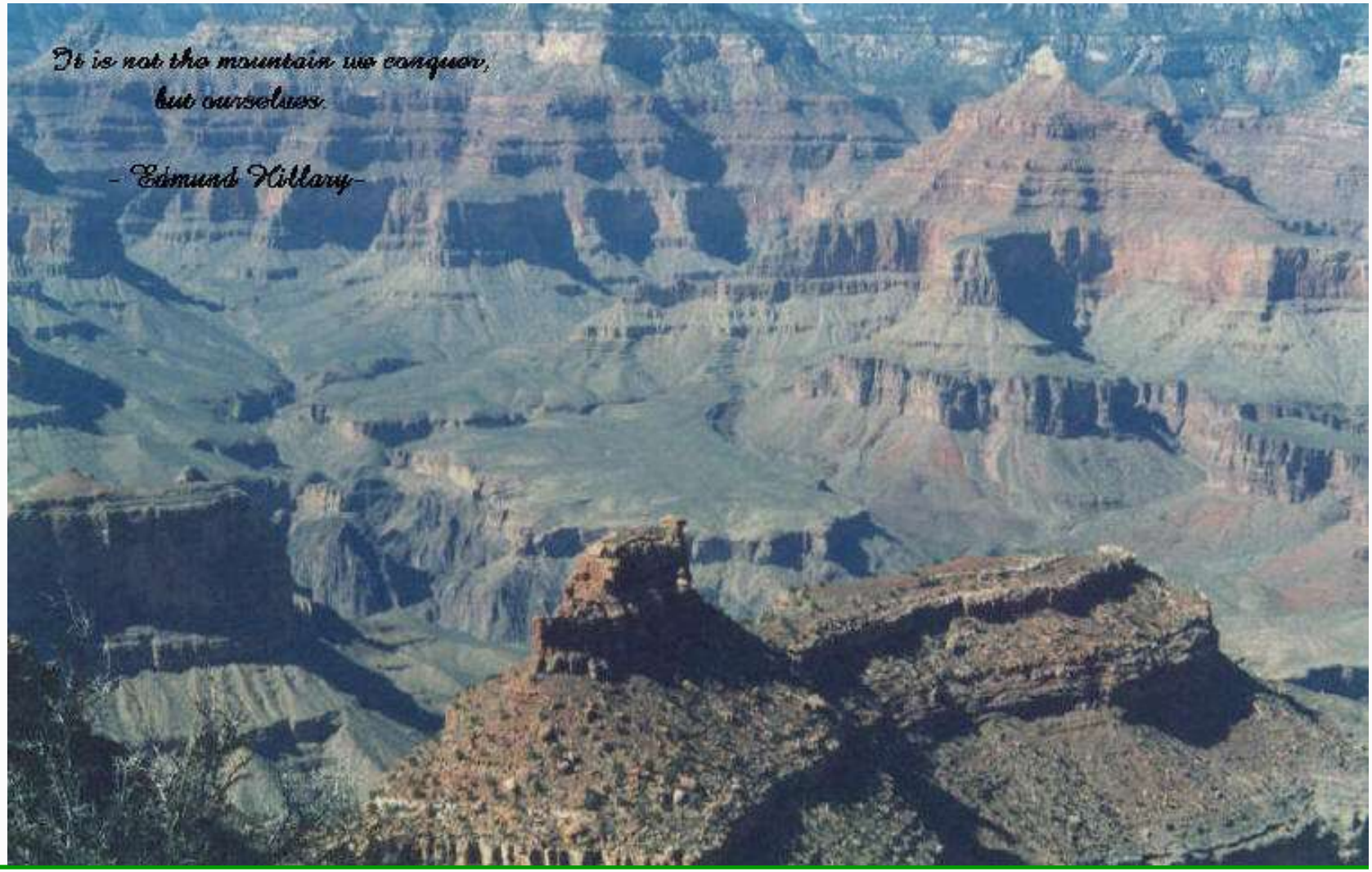
Weathering: Breakdown of Rock near the Surface

Mechanical

- Geological Activity – abrasion
  - often occurs to rocks in rivers, beaches, or desert areas
- Glacial Activity
- Expansion of ice
- Effects of Temperature

Erosion – by wind

Erosion – by water



Glacier Receding

Wedging - Frost

Weathering: Breakdown of Rock near the Surface

Chemical Alteration

- Carbon dioxide, sulfur dioxide and various nitrogen compounds from the air form acids when dissolved in water. These acids may react with the rock and increase breakdown.

Chemical Weathering

Weathering
Breakdown of Rock near the Surface

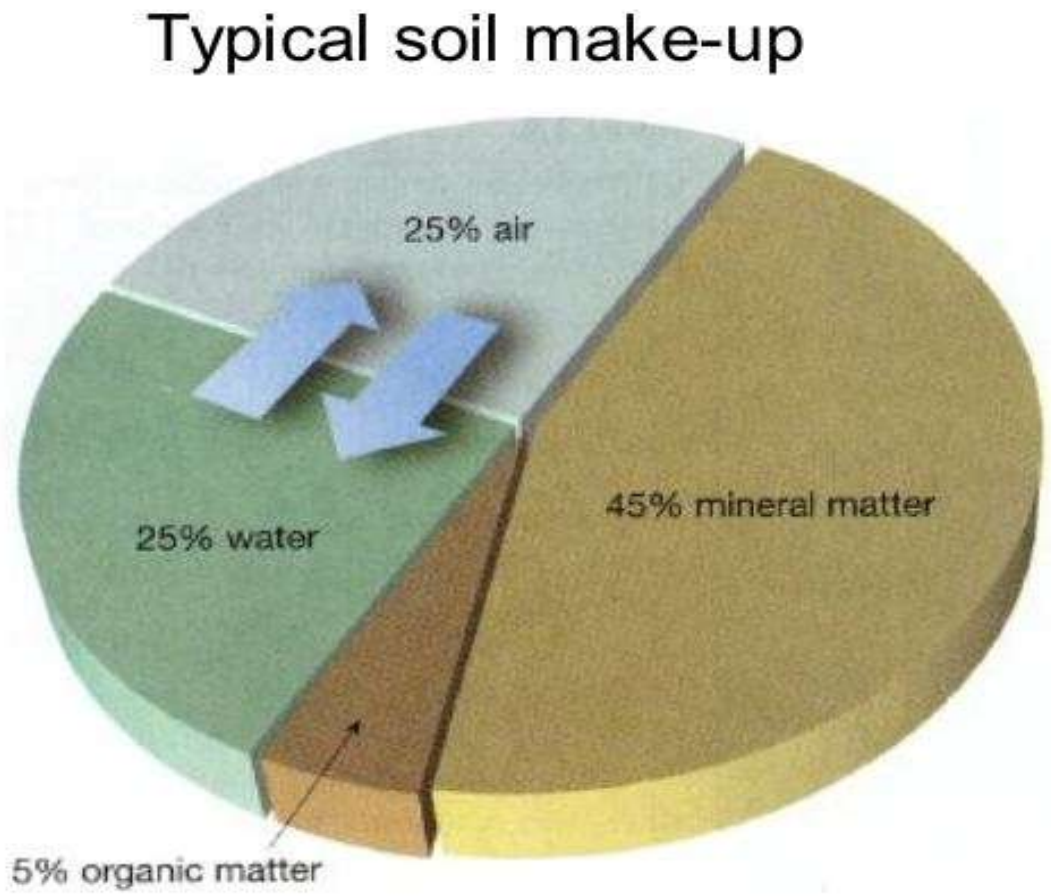
- Organic Processes
  - Wedging – Plant Roots

Wedging - Roots

What Determines Soil Type

- Climate
- Vegetation
- Drainage
- Time
- Parent Material
  - Residual - Transported
  - Least Important Factor for Mature Soils

Soil Composition



What determines soil type?

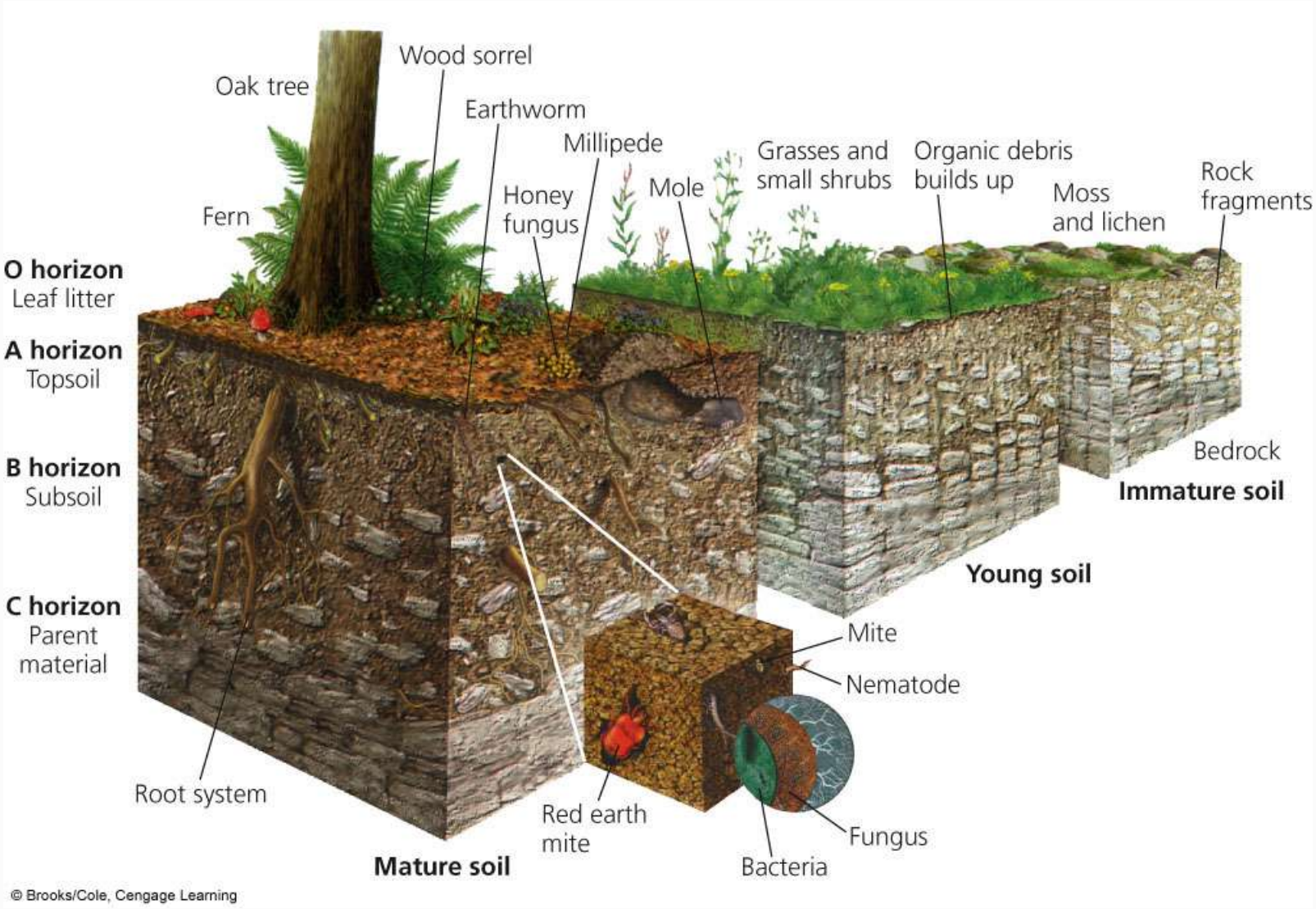
Young Soils/Immature Soils

- Strongest Influence Is Parent Material

Mature Soils

- Strongest Influences: Climate, Vegetation, Drainage

Soil Formation and Generalized Soil Profile



Soil Horizons and Profiles

Soil Profile

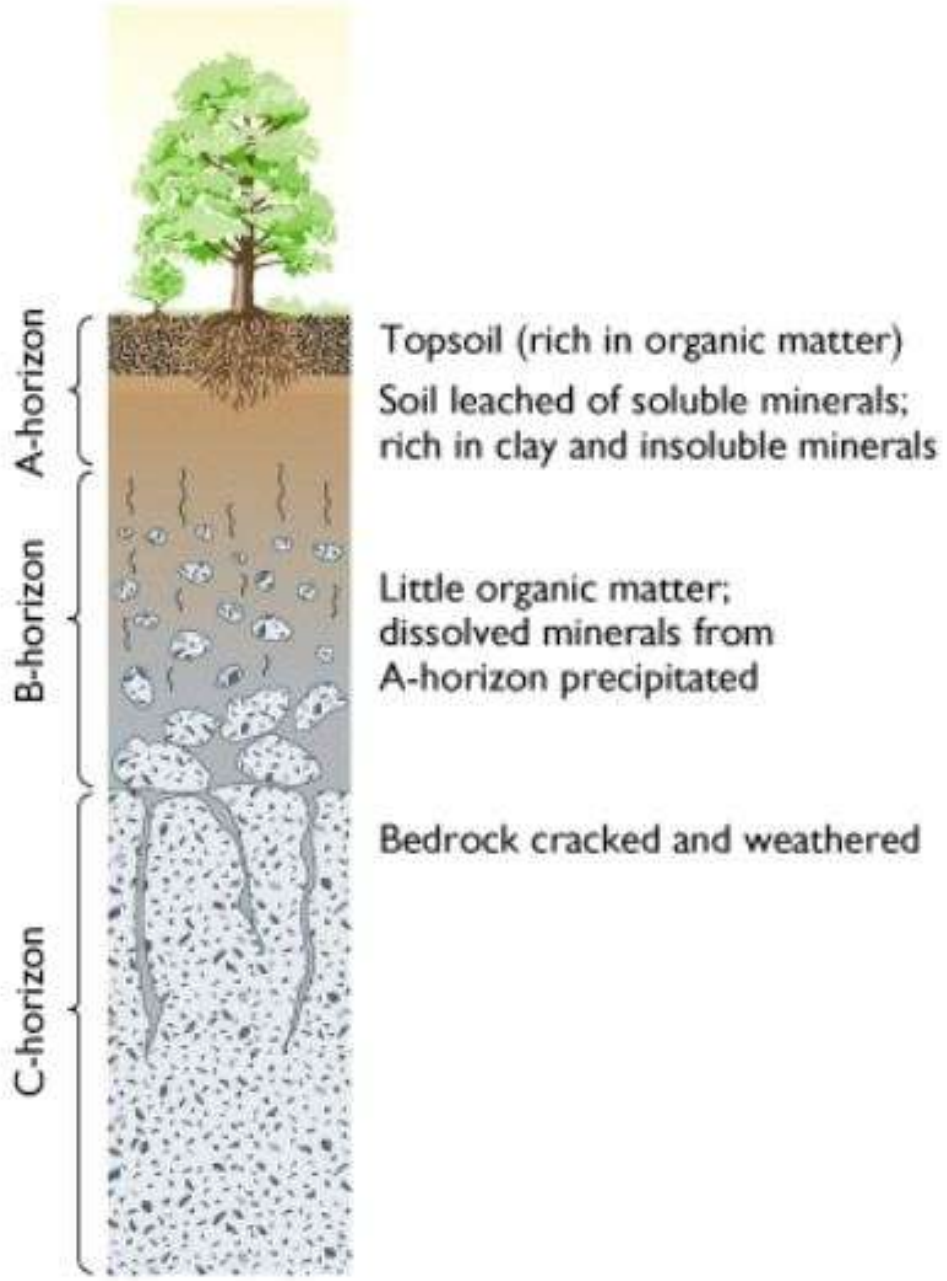
- Suite of Layers at a Given Locality

Soil Horizons

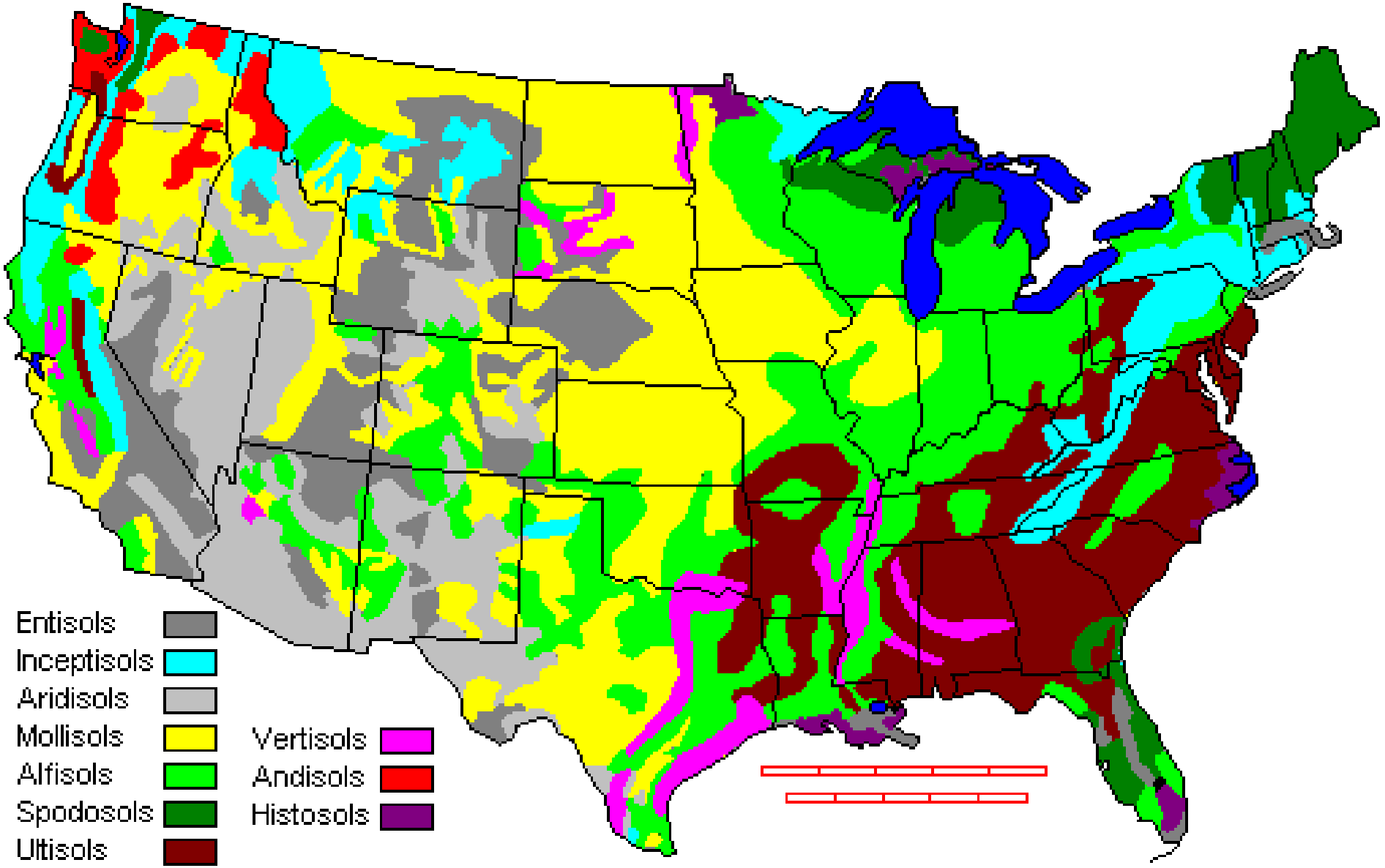
- Layers in Soil
- Not Deposited, they are Zones of Chemical Action
- Layers **(horizons)** of mature soils
  - O horizon: leaf litter
  - A horizon: topsoil
  - B horizon: subsoil
  - C horizon: parent material, often bedrock

Principal Soil Horizons

- **O** - Organic (Humus) Often Absent
- **A** – Leaching
  - K, Mg, Na, Clay Removed
- **B** – Accumulation
  - Absent in Young Soils
  - Distinct in Old Soils
  - Al, Fe, Clay (Moist)
  - Si, Ca (Arid)
- **C** - Parent Material



Soils of the U.S.

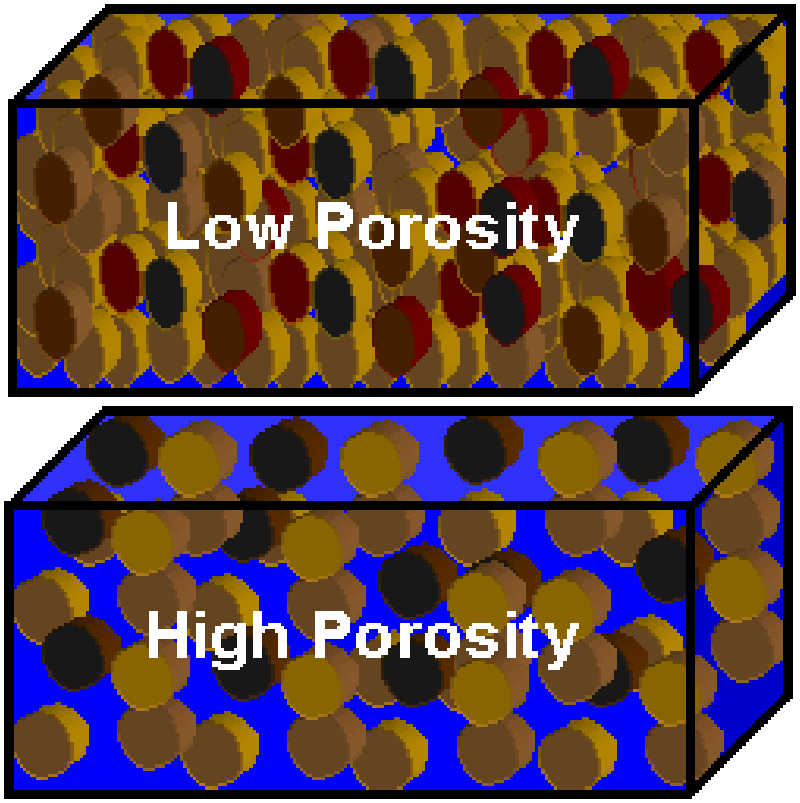


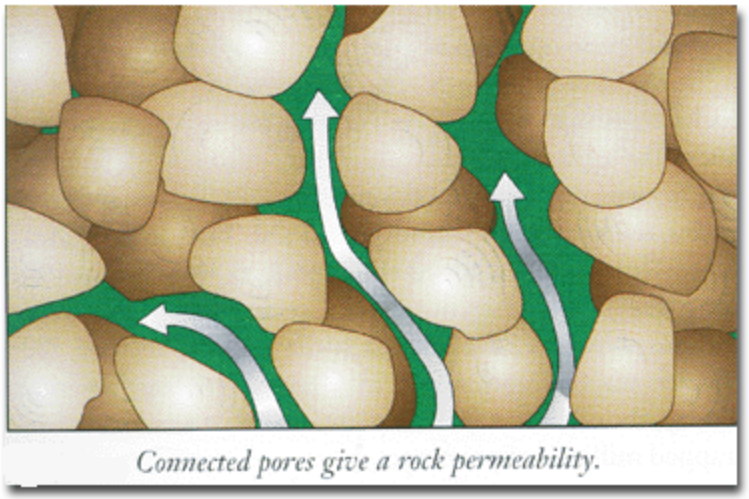
Typical Soil Profile (Spodosol)

Ultisols – Georgia Clay

Soil Characteristics

- Physical
  - Texture
  - Porosity
  - Permeability
  - Humus
- Chemical
  - pH
    - *You need to know how to fix pH problems
  - Nitrogen
  - Phosphorous
  - Potassium





- Porosity - the percentage of interconnected space in rock and soil that can contain water

Permeability – the degree to which the pores in the rock or soil are connected together so that water can move freely

Main Soil Textures

Soil Type	*Texture*	*Permeability*	*Porosity*
Sand	*Gritty*	*High*	*Low*
Silt	*Smooth & Slippery*	*Med*	*Med*
Clay	*Sticky*	*Low*	*High*

Soil Formation vs. Soil Erosion

- Soil formation
  - Takes hundreds of years to form 1 cm (0.4 inches) of soil
- Soil erosion
  - Blown away in weeks or months from plowing and clearing forests – any time we leave the topsoil unprotected

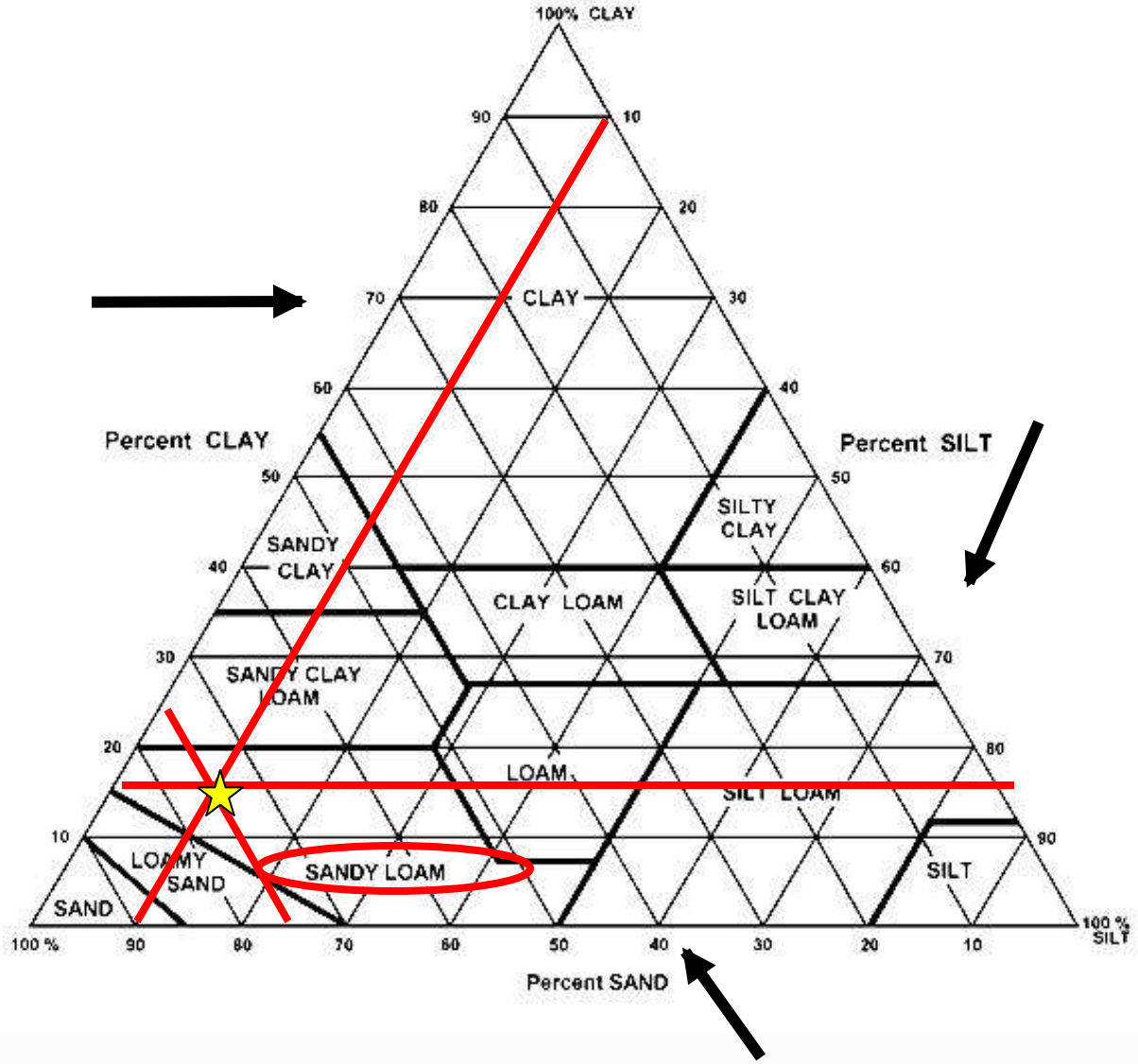
Topsoil Erosion Is a Serious Problem in Parts of the World

- **Soil erosion**
- Two major harmful effects of soil erosion
  - Loss of soil fertility through depletion of plant nutrients in topsoil
  - Water pollution in nearby surface waters where eroded soil ends up as sediment
    - Kills fish, shellfish
    - Clogs irrigation ditches, reservoirs, lakes, and boat channels
  - Eroded soil may also be polluted with pesticides and fertilizers

Dust Bowl of the 1930's

China’s Dust Storms - 2006

Soil Textural Triangle Practice Exercises



% Sand	% Silt	% Clay	Texture Name
75	10	15	sandy loam
10	83	7	