

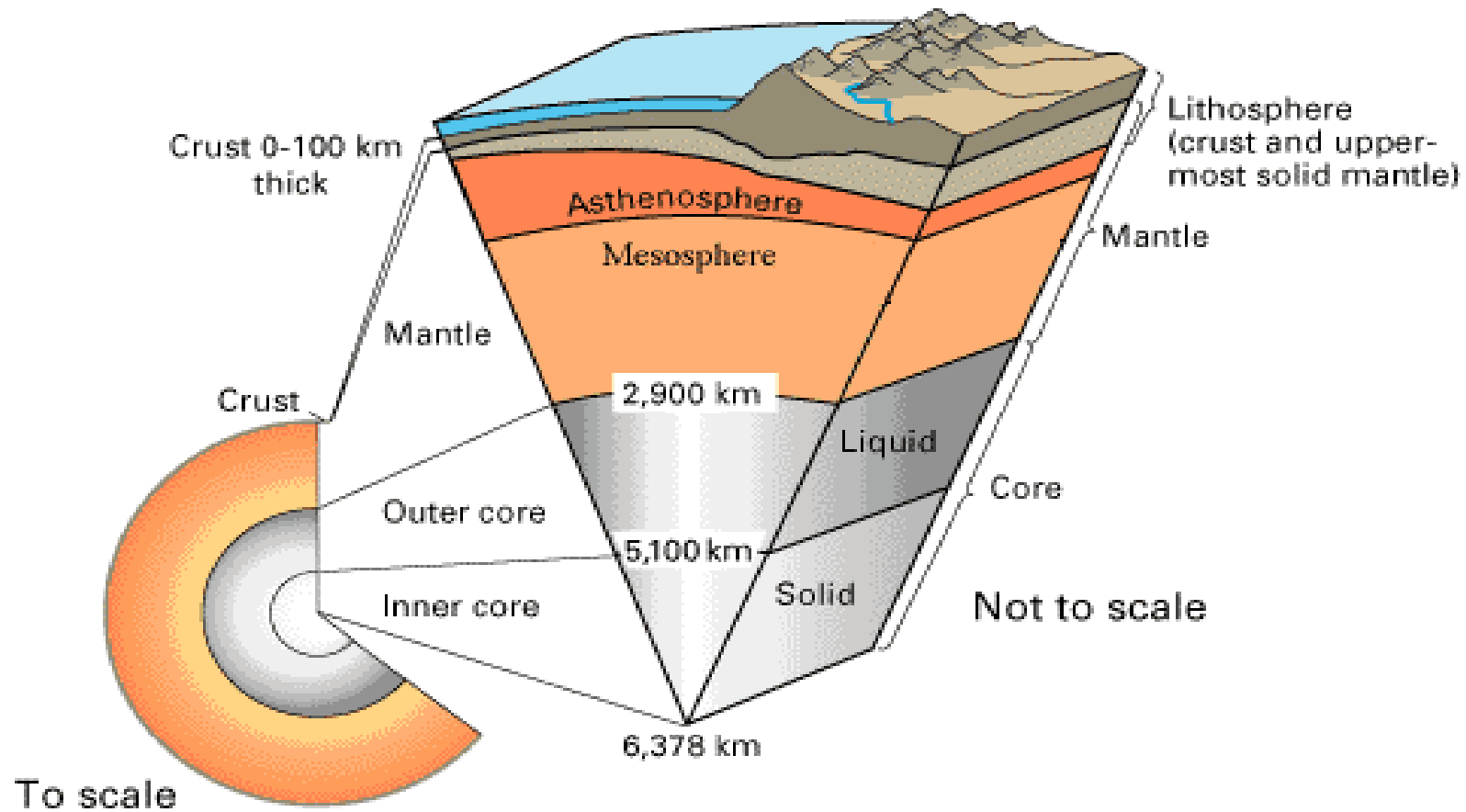
Chapter 10 - Geology

Earth's Structure, Geologic Hazards, and Soils

Plate Tectonics

- Earth crust (or lithosphere) is broken up into plates that shift and slide around
 - Asthenosphere (semi molten layer of earth) causes movement
- The majority of Earth's volcanic and earthquake activity occurs along plate boundaries

Earth's Interior

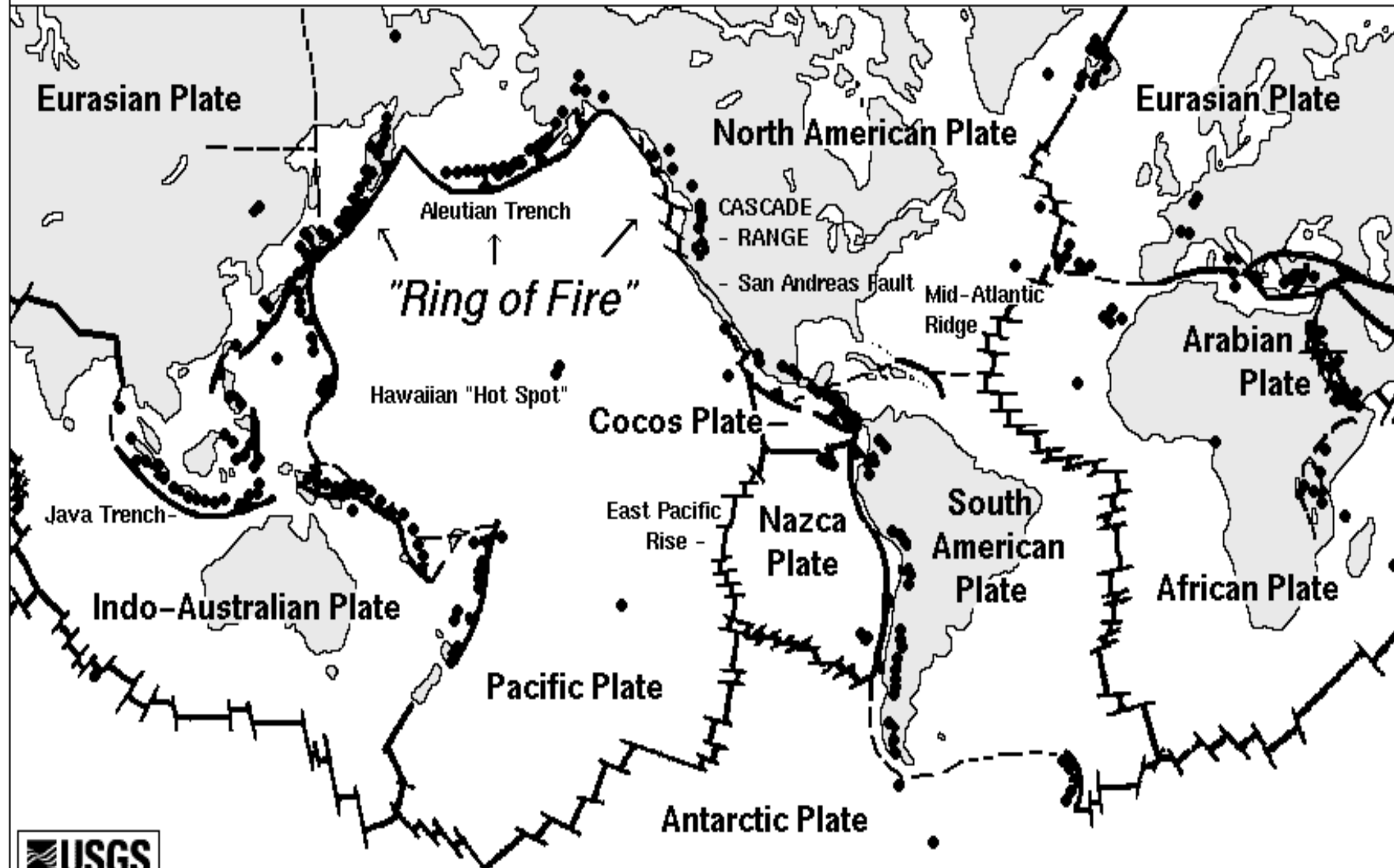


- Plate motion produces mountains, midocean ridges, trenches, volcanoes, earthquakes

Types of plate boundaries

- 3 types:
 - Divergent plate boundaries – create land when magma cools on Earth's surface
 - Plates move in opposite directions
 - Convergent plate boundaries – destroy land by pushing plate down into mantle when two plates come together
 - Mariana's trench, Aleutian Islands
 - Transform plate boundaries – two plates grind past on another
 - San Andreas Fault

Active Volcanoes, Plate Tectonics, and the "Ring of Fire"



Topinka, USGSICVD, 1997, Modified from: Tilling, Heliker, and Wright, 1987, and Hamilton, 1976

Volcanoes

- A volcano is an area where magma reaches earth's surface through a central vent
- When volcanoes erupt, they release debris and gases (H_2O , CO_2 , SO_2) into the atmosphere
 - Eruptions cause a global cooling (sunlight cannot penetrate particulates)

Benefits

- Beautiful scenery
- Highly fertile soils produced from the weathering of lava

Hazards

- Evacuation
- Debris release can prevent air travel and air quality
- Could completely destroy surrounding area, depending on size of eruption

Natural Hazards

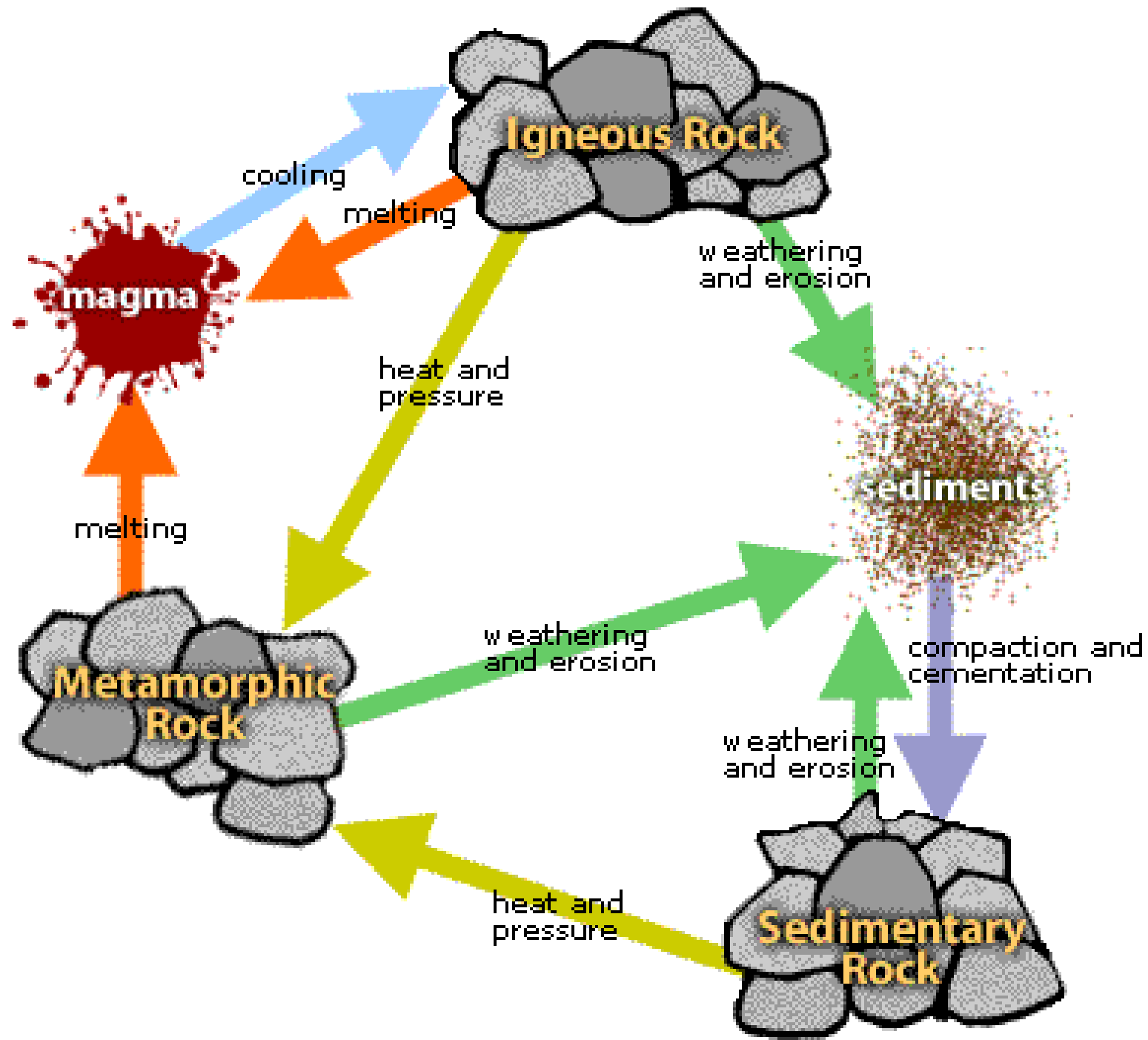
- Earthquakes!!
 - Rocks fracture, causing an earthquake usually at a fault,
 - When the earthquake occurs, energy is released as shock waves
 - Immediate hazard – violent ground shaking, buildings and structures collapse, break underground gas lines
 - Secondary hazards – rock slides, fire from broken gas lines, tsunami

Tsunamis

- Seismic sea wave
- Caused by underwater earthquake or underwater land slide
- Displaces column of water above earthquake and wave goes in all directions
- Sends large volume of water rapidly, flooding inland quickly

The Rock Cycle

- Slowest of Earth's cyclic processes
- Responsible for concentrating Earth's nonrenewable resources



3 Major Types of Rocks

- 1. Igneous
 - Magma or lava solidifies on or beneath Earth's surface
- 2. Sedimentary
 - Form fossils and fossil fuels because creation doesn't destroy materials
- 3. Metamorphic
 - Forms when rock is put under heat and pressure
 - Anthracite coal forms (cleanest burning coal)

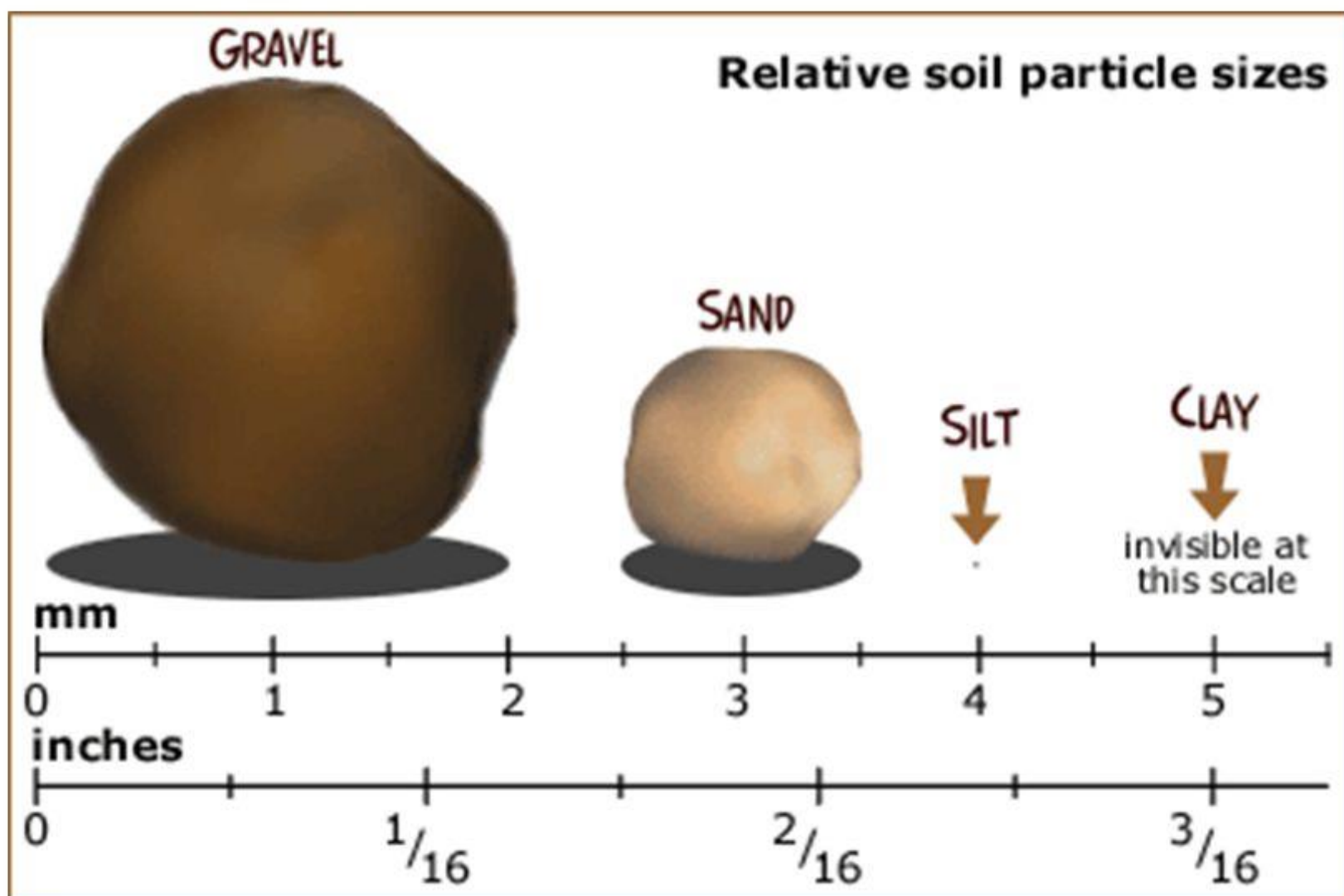
Soils

- What is soil?
 - Renewable resource made of eroded rock, mineral nutrients, decaying organic matter, water, air, and billions of living organisms
- Forms by:
 - Rocks weathering (breaking down)
 - Living organisms die or break down organic matter

The types of soil particles

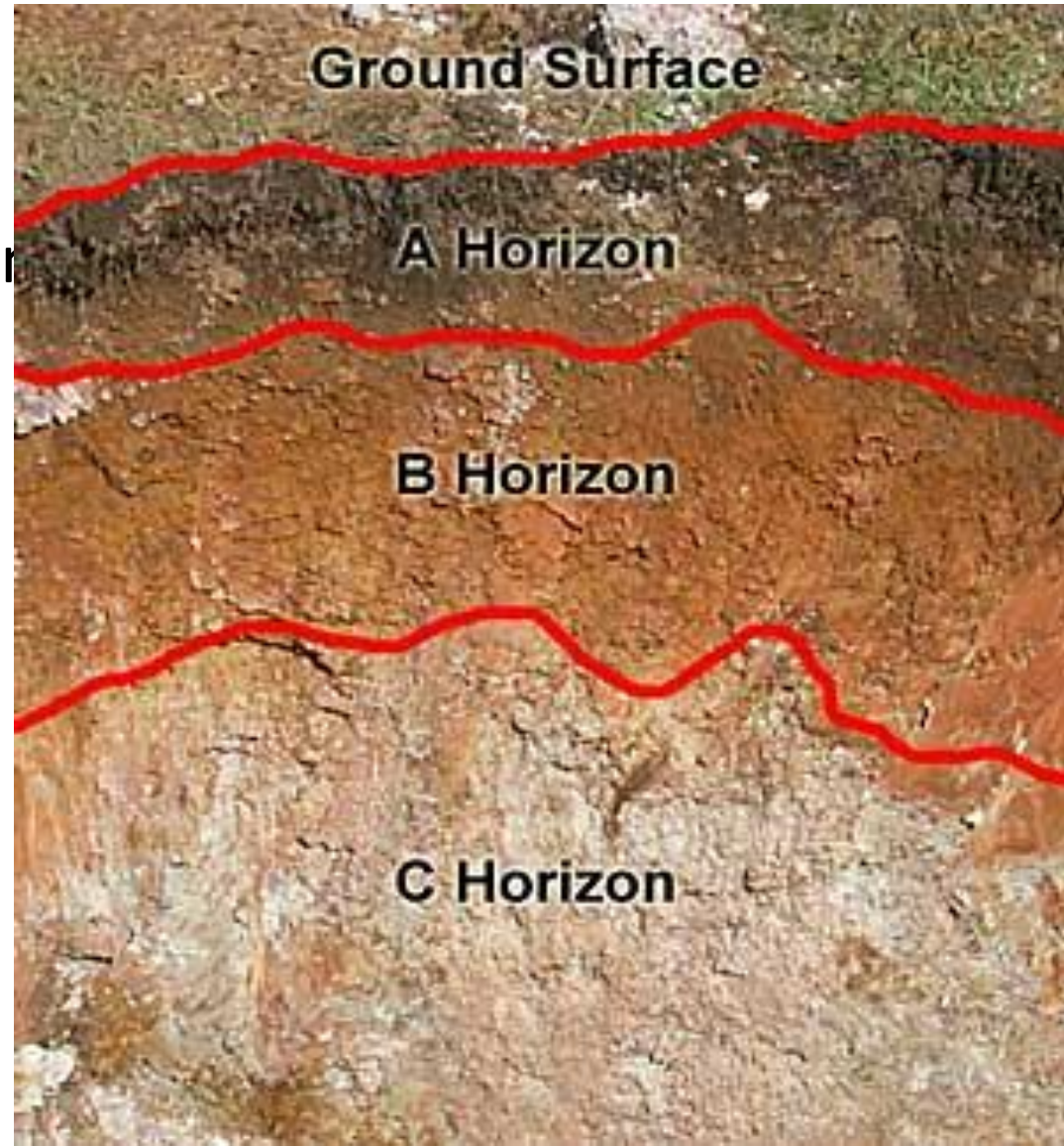
- Soils contain:
 - Sand – medium sized particles (largest of these 3)
 - Silt – fine particles
 - Clay – very fine particles
- Loams: soils with roughly equal mixtures of above
 - Ideal for growing

Particle Sizes



What major layers are found in mature soils?

- Soil horizons – zone (layer) with distinct texture and composition
- Soil Profile - Cross section of soil horizons



O horizon
Loose and partly
decayed
organic matter

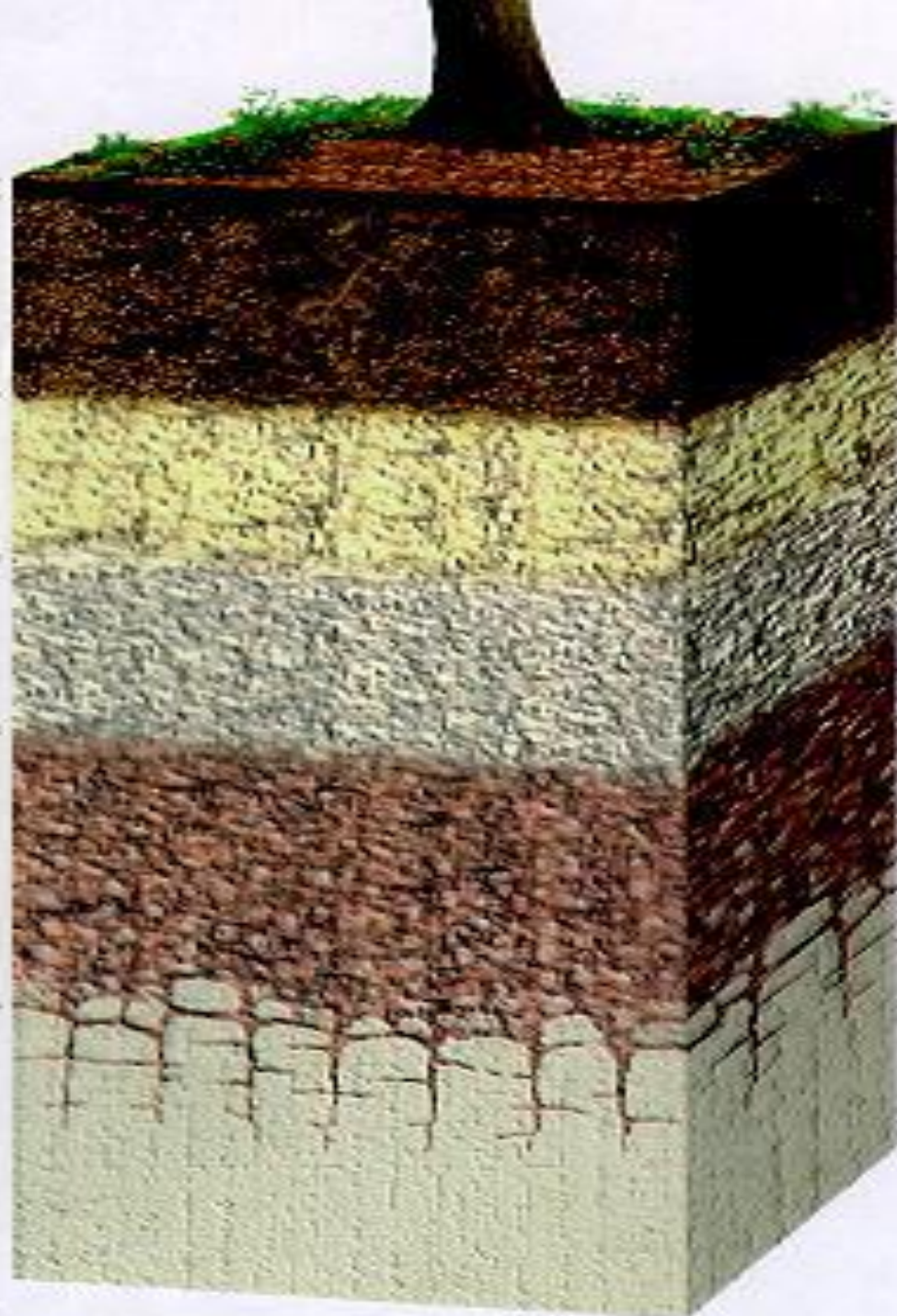
A horizon
Mineral matter
mixed with
some humus

E horizon
Light colored
mineral particles.
Zone of eluviation
and leaching

B horizon
Accumulation of
clay transported
from above

C horizon
Partially altered
parent material

Unweathered
parent material

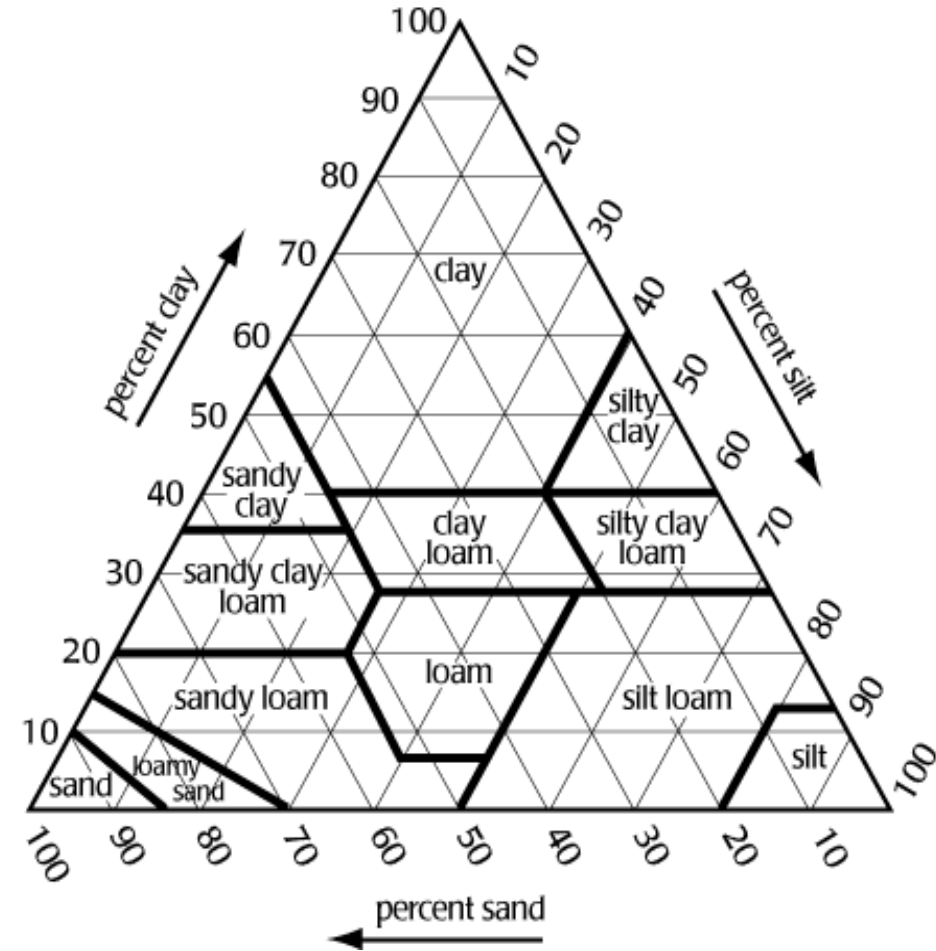


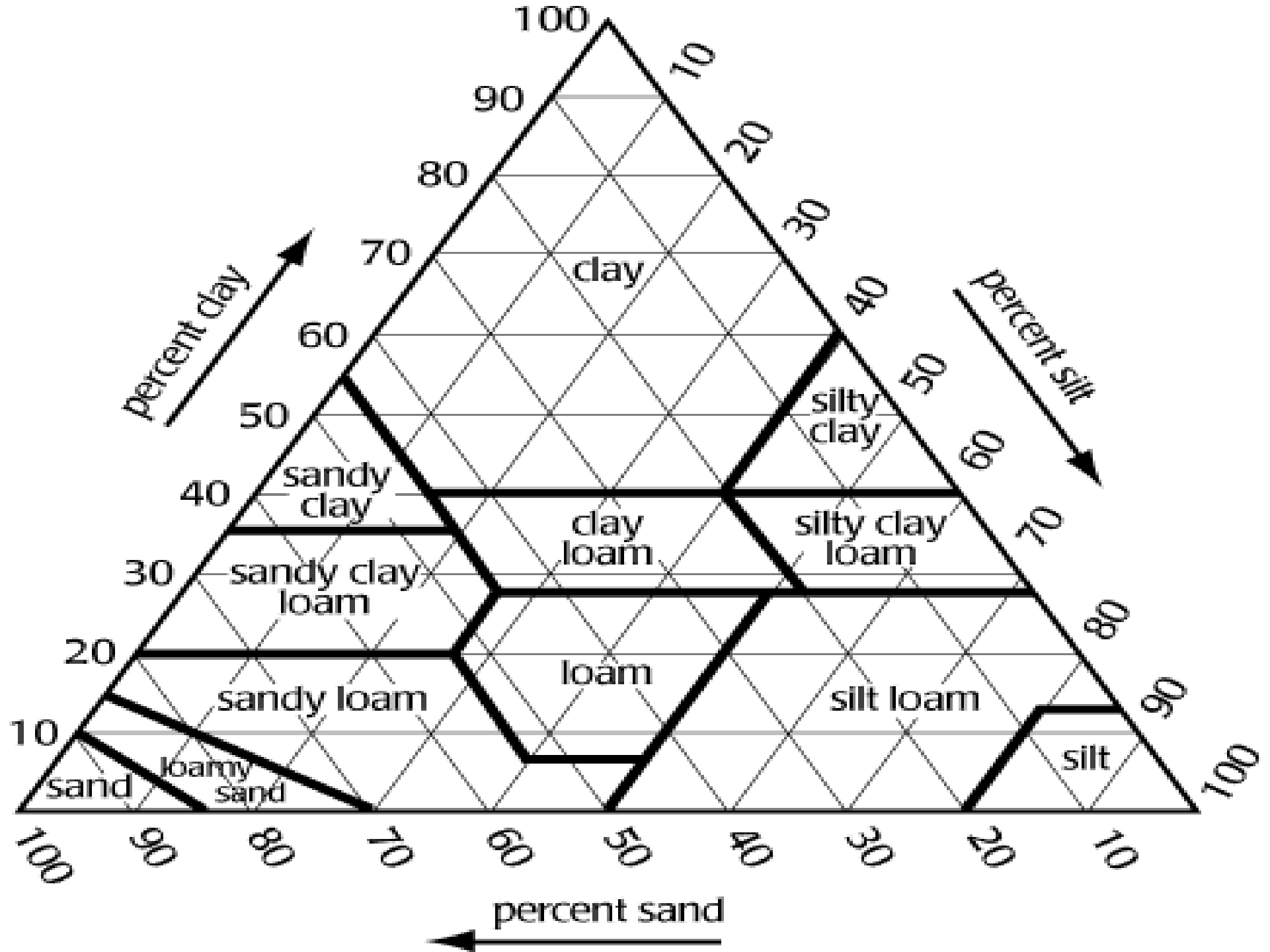
Major Soil Horizons

- O layer:
 - Top layer with freshly fallen and decomposed leaves, twigs, animal waste, fungi, organic matter; normally brown or black
- A layer:
 - Topsoil layer; made up of humus and inorganic minerals; helps plants grow; full of microorganisms
- E horizon – made up of mostly minerals
- B layer:
 - Subsoil
- C layer: has large rock pieces that have not undergone much weathering
- R layer – parent bedrock

Soil Textural Triangle

- Used to determine soil texture
- Can either be:
 - Sand - largest
 - Silt - middle
 - Clay - smallest
- Read by tracing the respective line in the direction the arrow is pointing
- Where all 3 points meet is what classification you have





Physical properties of soil

- Porosity:
 - Measure of volume of pore spaces per volume of soil; more pores can hold more water; helps in cellular respiration
- Permeability:
 - Average size of the spaces or pores in a soil; determines rate water moves downward
- Soil texture:
 - Relative amount of each particle in soil makeup

Other physical properties to test

- Particle density
- Soil structure
 - How soil particles are organized and clumped together
- Color

Chemical Properties of Soil

- pH– influences nutrient uptake by plants
- Humus content – amount of organic material
- Ion exchange – degree at which soil can absorb and exchange cations
 - How minerals make their way into soil – once there, not easily lost
 - Increases with pH of soil

- Salinity
 - Salt content in soil
 - Can prevent water uptake
- Carbon to nitrogen ratio
 - Carbon provides energy while nitrogen helps build tissues in plants