Surface Processes

Unit Topics

- Topic 1: Weathering & Soils
- Topic 2: Erosion & Deposition
- Topic 3: Running Water
- Topic 4: Glaciers
- Topic 5: Mass Movement, Waves, & Wind

Topic 1: Weathering & Soils

- Essential Question: What surface processes shape our Earth?

Topic 1: Weathering & Soils

- Weathering: the breakdown of rock at or near the Earth's surface
- Sediments: smaller pieces of rock that have undergone weathering
- Weathering occurs when rocks are exposed to:
  - Air
  - Water
  - Actions of Living Things

Topic 1: Weathering & Soils

- <u>Chemical Weathering:</u> the breakdown of rock through changes in mineral or chemical compositions
  - The rate of chemical weathering increases in warm and moist climates

Topic 1: Weathering & Soils

- Oxidation: when iron combines with oxygen to make rust

Topic 1: Weathering & Soils

- Effects of Water on Rock
  - Sometimes called the universal solvent, because given enough time water can dissolve nearly everything
  - Water can combine with CO2 to form carbonic acid
  - Carbonic acid can dissolve most rock --- especially limestone

Topic 1: Weathering & Soils

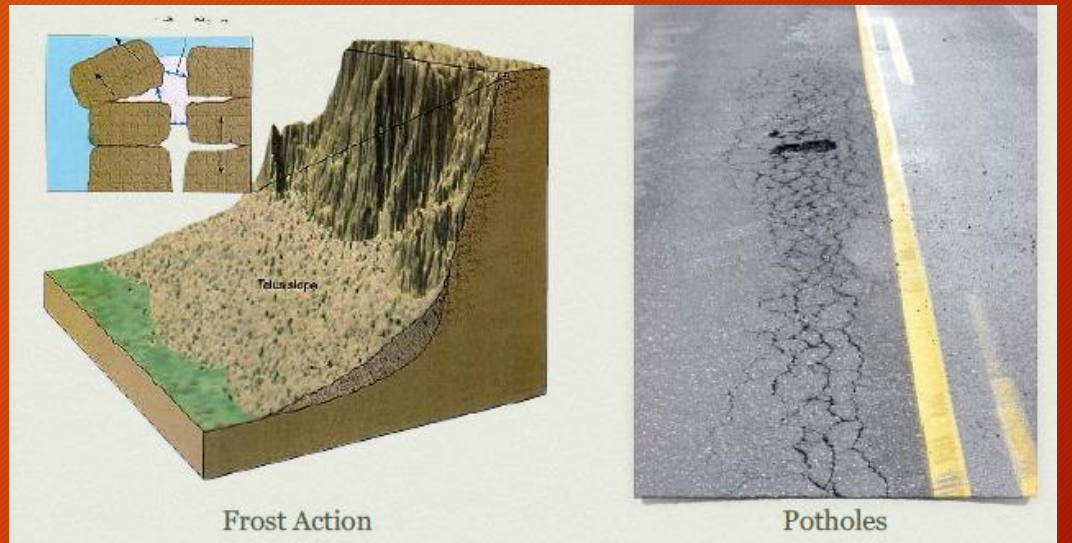
- Sinkhole: a natural depression in a land surface formed by the dissolution and collapse of a cavern roof

Topic 1: Weathering & Soils

- Physical Weathering: the breakdown of rock into smaller pieces without chemical change
- Abrasion: breakdown when rock particles grind against rock
  - Characteristics: round-shaped particles
  - Occurs as sediments are moved by ice, running water, gravity, or air

Topic 1: Weathering & Soils

- Frost Action: weathering process caused by cycles of freezing and thawing of water in rock openings
  - Water infiltrates cracks in the rock and when it freezes, it expands 10%, causing the rock to split apart
  - Infiltration: the process by which water moves into soil or rocks

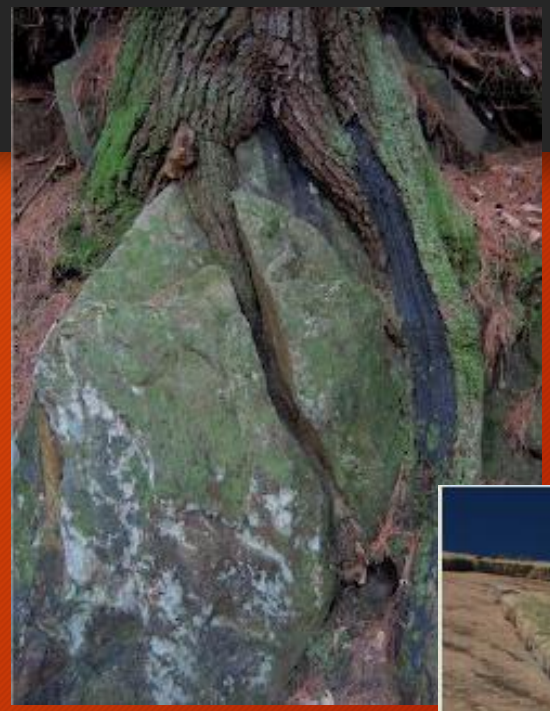


Frost Action

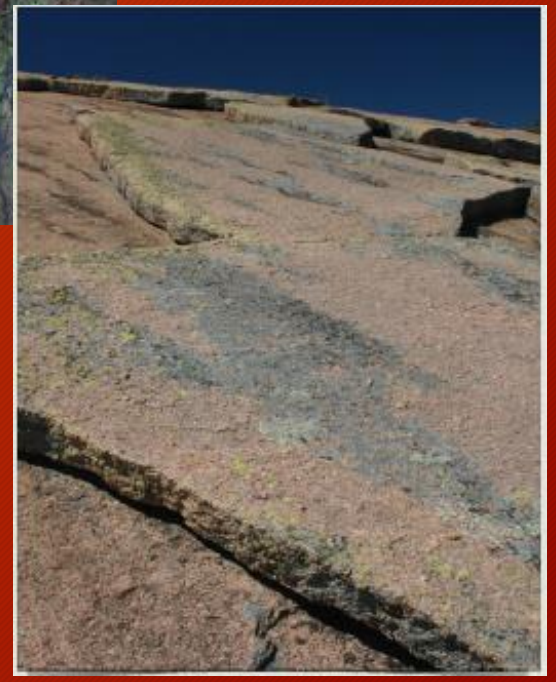
Potholes

Topic 1: Weathering & Soils

- Plant Root Growth: as plants grow, they can also spread cracks apart even further in rocks



- Abrupt Temperature Changes: as temperature increases, rocks expand and fracture (break)
  - Example: Bridges

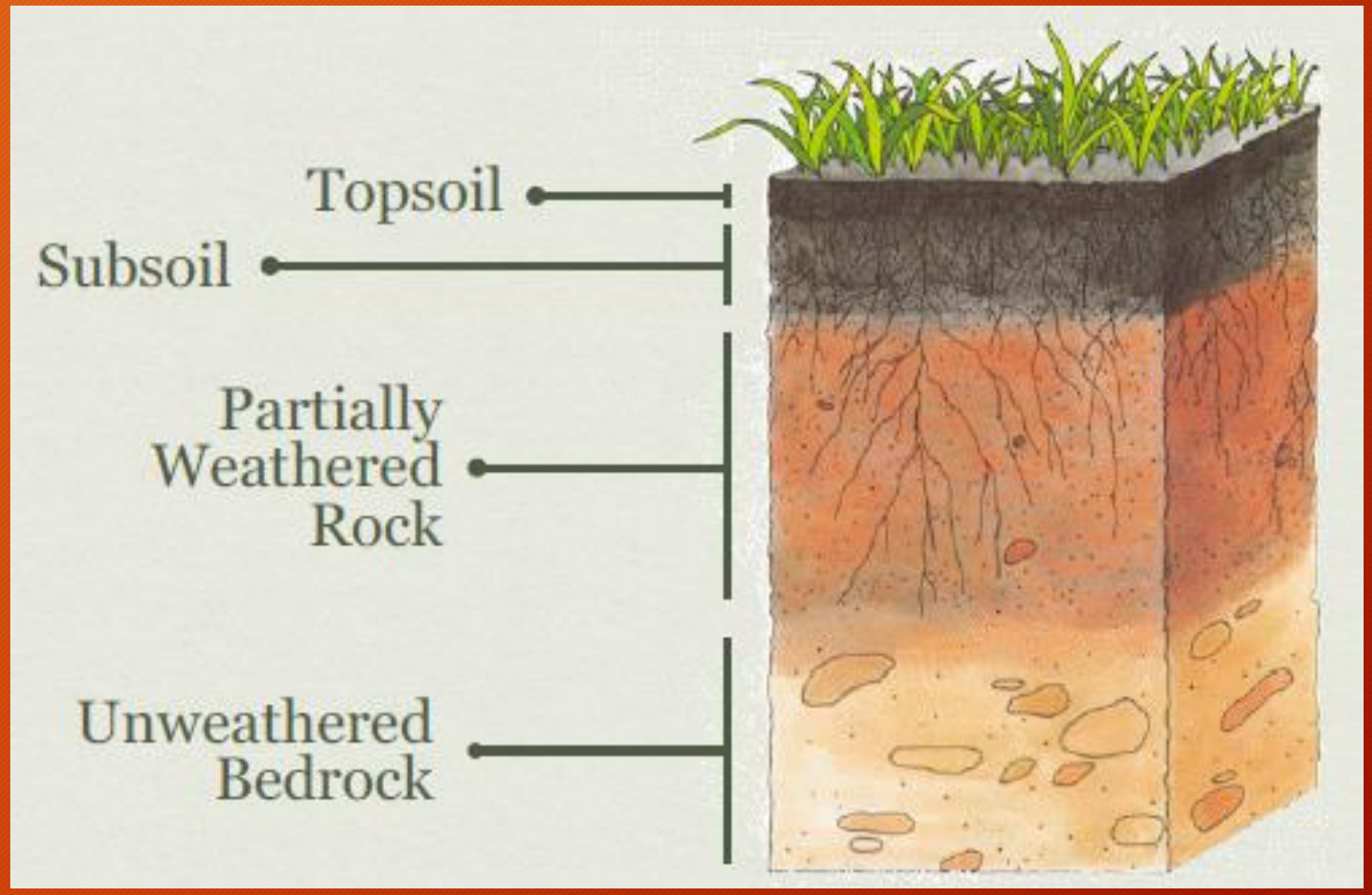


Topic 1: Weathering & Soils

- Physical and chemical weathering processes are important in the formation of soil
- Soil is a mixture of weathered rock particles and organic matter that supports rooted plants
- Humus: part of soil that serves as a source of plant nutrients

Topic 1: Weathering & Soils

- Soil Layers



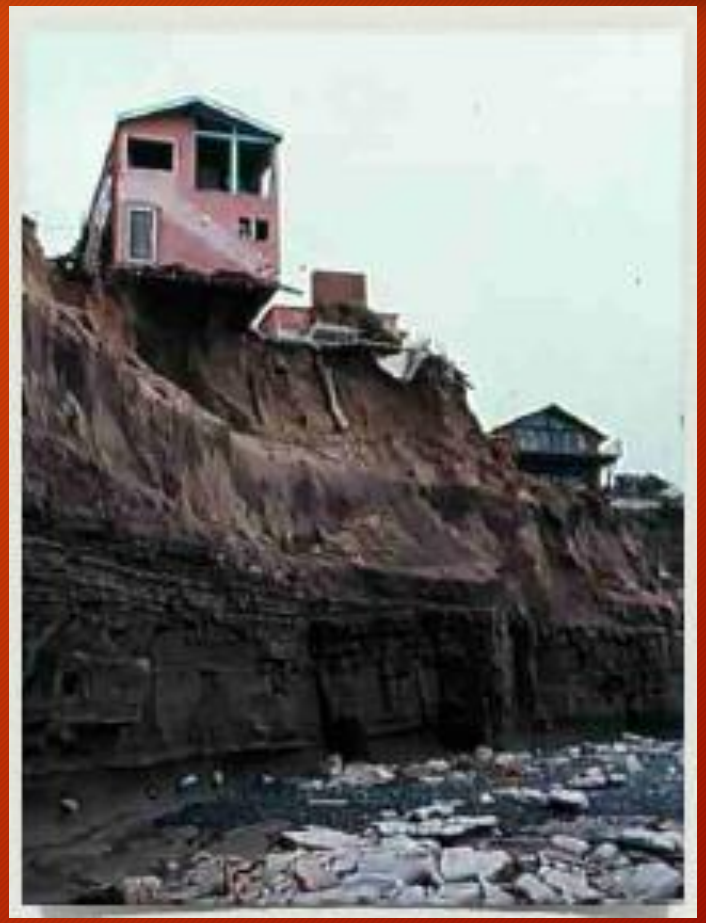
Questions?

Topic 2: Erosion & Deposition

- Essential Question: How are sediments moved & placed in a new location?

Topic 2: Erosion & Deposition

- After rocks are broken up from weathering, they need to be moved
- Erosion: process where particles are transported as sediment
  - Over time erosion helps shape and lower all surface features



Topic 2: Erosion & Deposition

- <u>Agents of Erosion:</u> forces set in motion by gravity that cause sediments to move
  - Examples of Agents of Erosion:
    - Streams

Topic 2: Erosion & Deposition

- Examples of Agents of Erosion:
  - Waves

Topic 2: Erosion & Deposition

- Examples of Agents of Erosion:
  - Glaciers

Topic 2: Erosion & Deposition

- Examples of Agents of Erosion:
  - Wind

Topic 2: Erosion & Deposition

- Examples of Agents of Erosion:
  - Mass Movement

Topic 2: Erosion & Deposition

- Gravity: Plays a DIRECT role!
  - Force behind most agents of erosion
  - Causes rivers to flow, ice to move, and rocks to slide

Topic 2: Erosion & Deposition

- The Sun: Plays an INDIRECT role!
  - Drives the water cycle which produces rain and ice
  - Fuels winds and drives ocean currents

Topic 2: Erosion & Deposition

- Deposition: process by which sediments are deposited after being eroded away
  - Sediments are deposited in locations where they form (horizontal) layers of sedimentary rocks

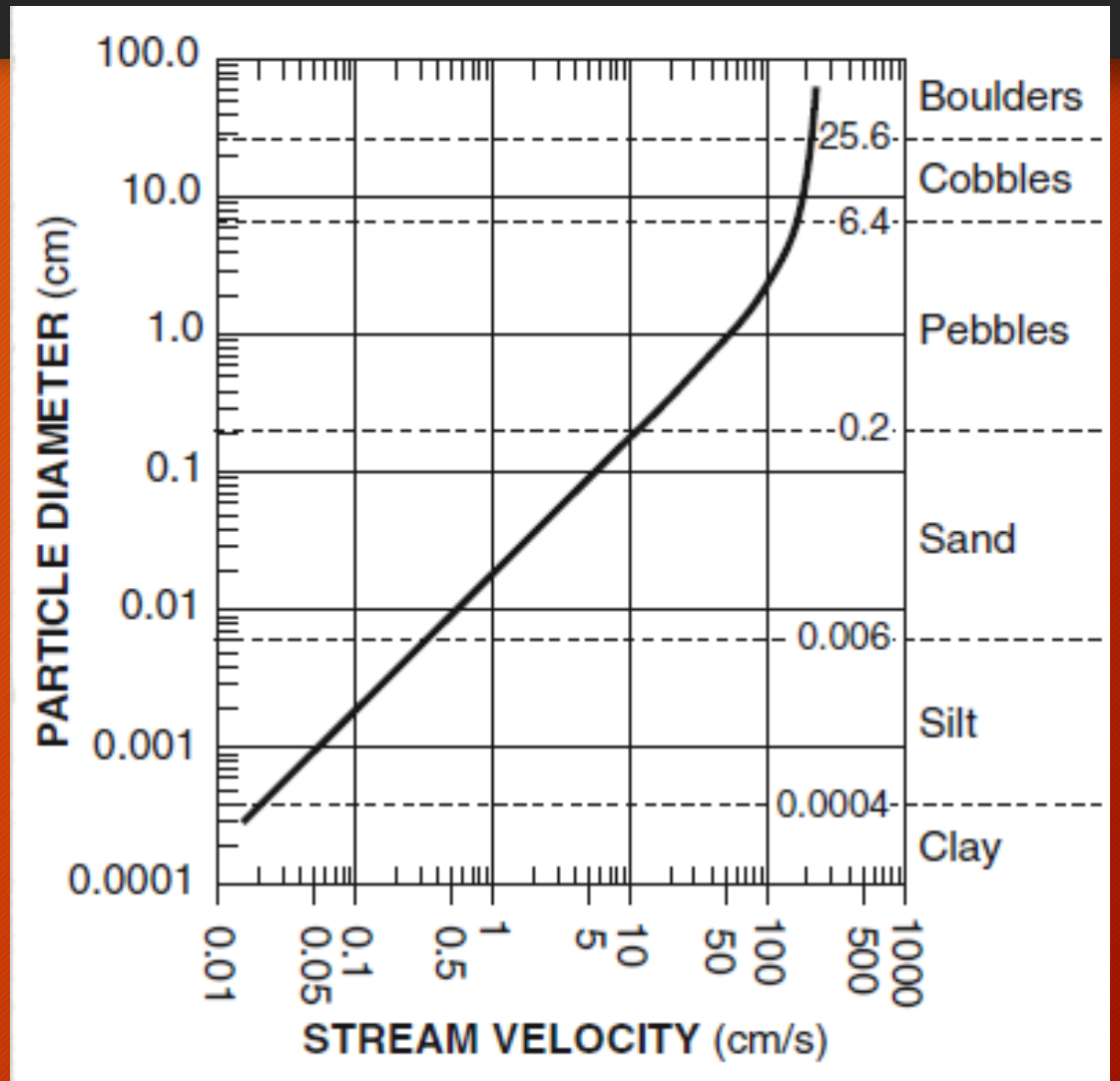
Topic 2: Erosion & Deposition

- The sediment determines how fast they are deposited
  - Size: larger sediments will settle faster
  - Shape: rounder sediments settle faster
  - Density: more dense sediments settle faster

Topic 2: Erosion & Deposition

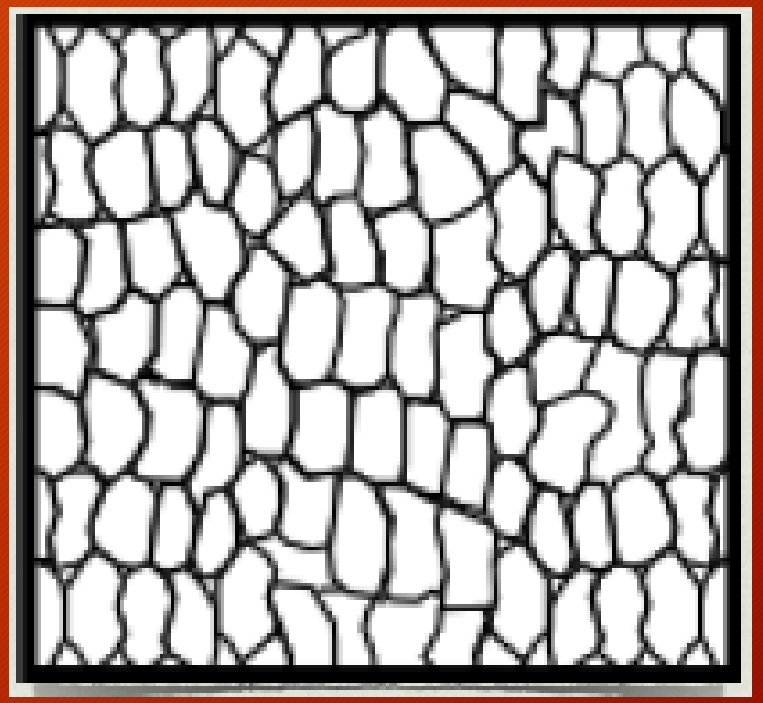
- ESRT Pg. 6:

How size & stream velocity affect deposition rate



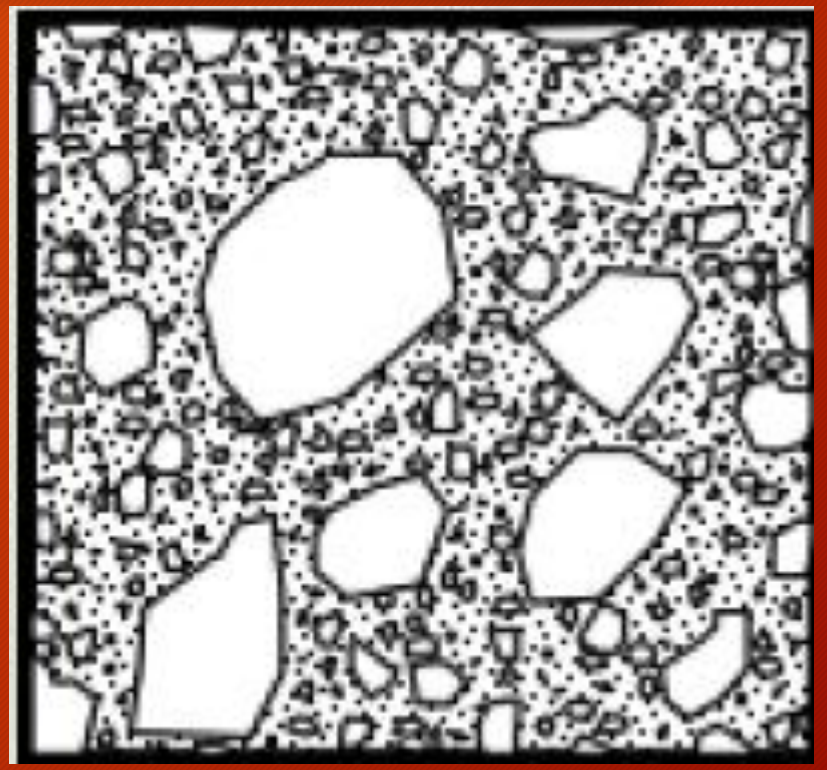
Topic 2: Erosion & Deposition

- Sorted Sediment: layers of sediment that are similar in size, shape or density
  - Example: deposition from a stream



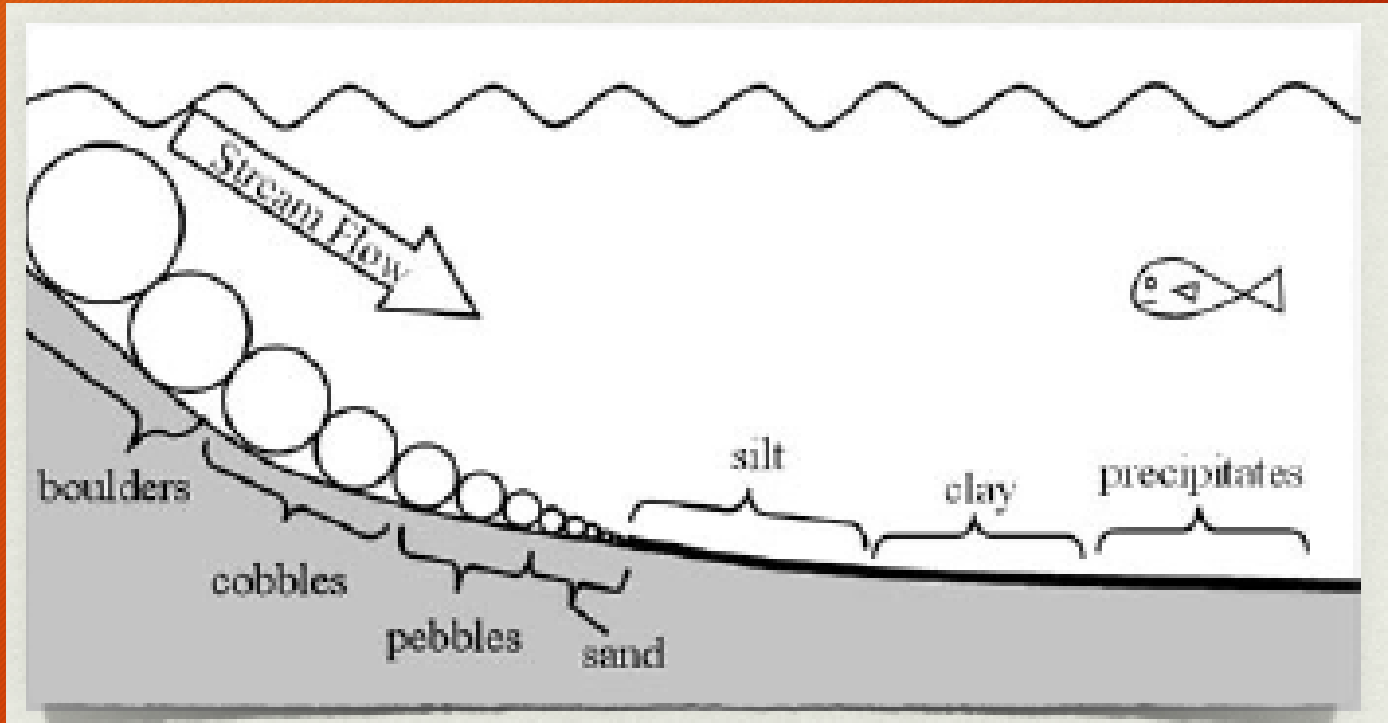
Topic 2: Erosion & Deposition

- Unsorted Sediment: layers of sediment that are mixed in size, shape or density
  - Example: deposition from a glacier



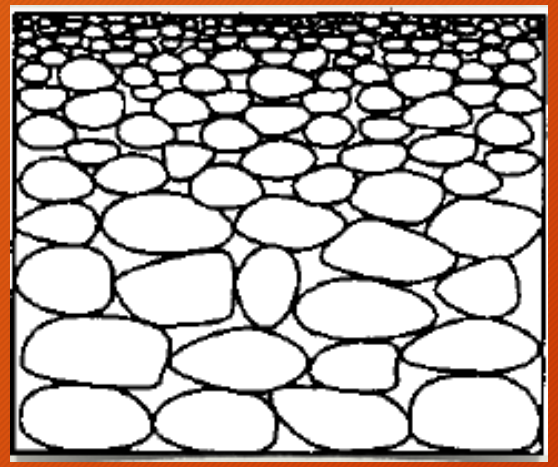
Topic 2: Erosion & Deposition

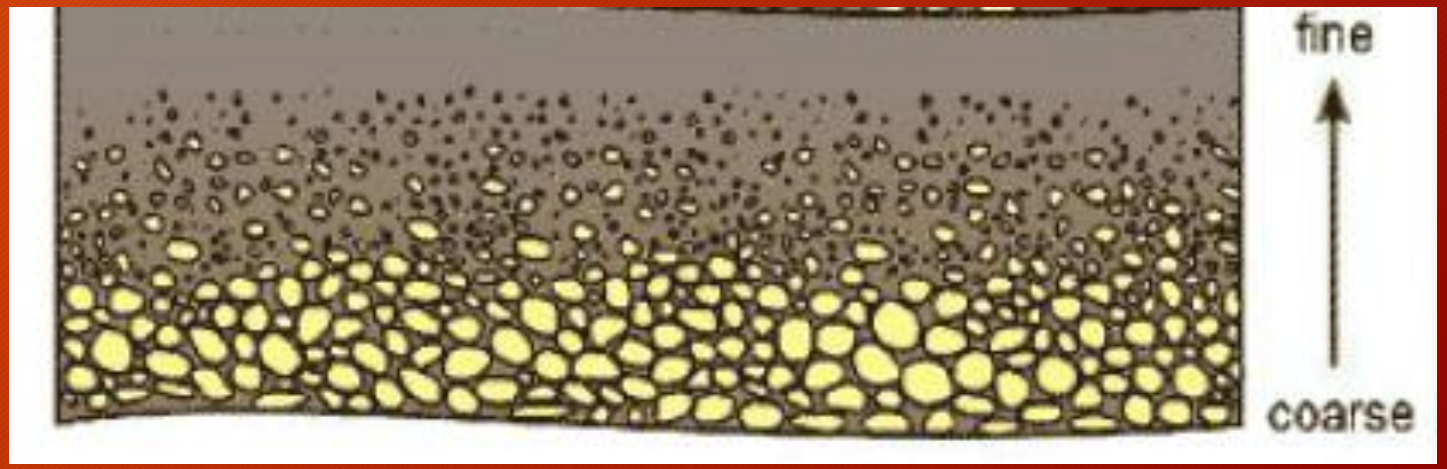
- Horizontal Sorting: when the velocity of wind or water gradually decreases, particle size, roundness, and density gradually decrease as you move farther away



Topic 2: Erosion & Deposition

- Vertical Sorting: larger or more dense sediments settle to the bottom first, followed by sediments with decreasing size and density
  - Example: as a stream slows down throughout the year, it can no longer transport larger material and begins to deposit the sediments according to size order





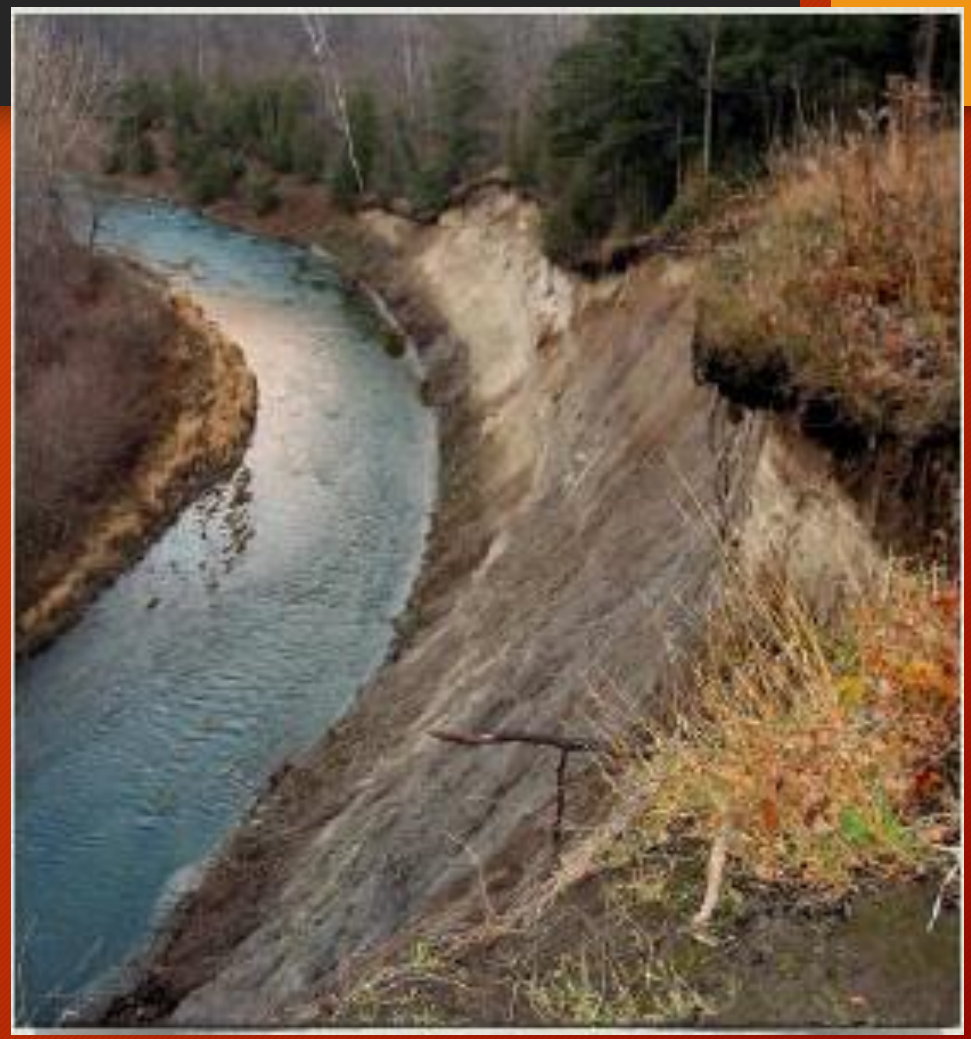
Questions?

Topic 3: Running Water

- Essential Question: How does running water help shape our Earth?

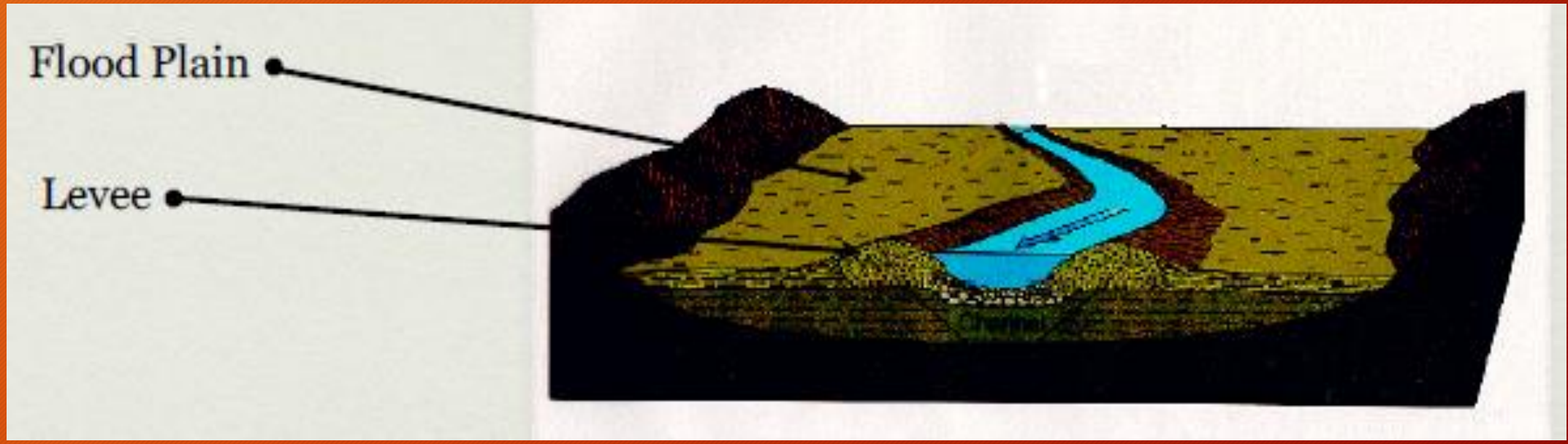
Topic 3: Running Water

- Running water is the most common agent of erosion
- Stream: running water that is confined to a channel
- Tributary: smaller streams that flow into a larger one



Topic 3: Running Water

- Flood Plain: nearly level plain that borders a river
- Levee: mound of sediment that runs parallel to a river & prevents flooding



Topic 3: Running Water

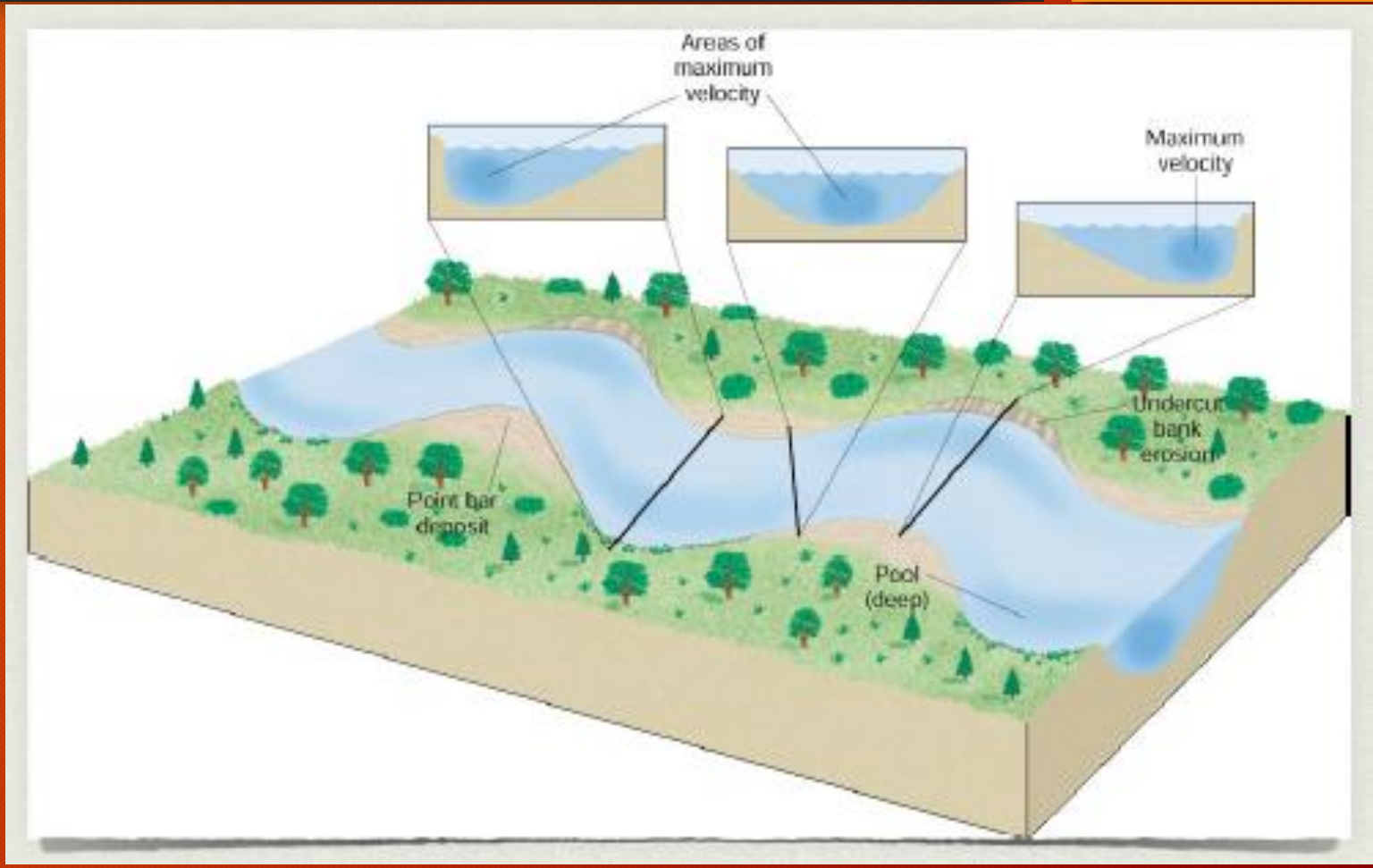
- Streams carry sediments in various ways:
  - As dissolved minerals in solution
  - As solid particles suspended in water
  - Larger particles are usually carried by rolling, bouncing, or sliding along the stream bottom

Topic 3: Running Water

- Stream Velocity: the speed of the stream
  - Gradient: slope of the stream
  - Discharge: amount of water that flows past a given point at a given time
  - Channel Shape: shape of the bed where the running water is confined

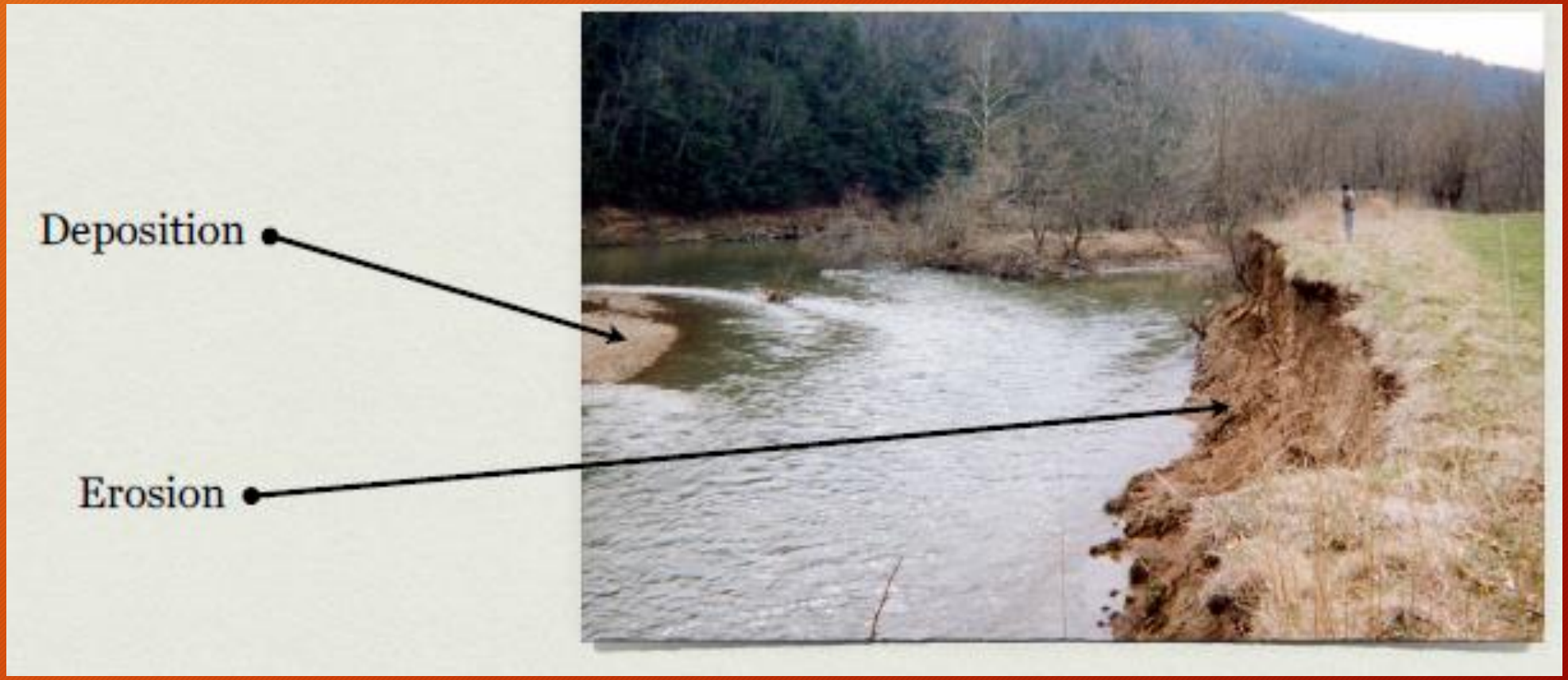
Topic 3: Running Water

- Variations in Stream Velocity:
  - When a stream channel is straight, the greatest velocity is in the middle
  - When a stream channel curves, the greatest velocity is on the outside of the curve



Topic 3: Running Water

- Variations in Stream Velocity:



Topic 3: Running Water

- Stream Characteristics
  - V-shaped Valley: created by the down-cutting of a stream
  - Meanders: a series of bends created as a stream gets older; may also create oxbow lakes

Topic 3: Running Water

- Stream Characteristics

Meandering Stream (Oxbow Lake)

Questions?

Topic 4: Glaciers

- Essential Question: How do glaciers help shape our Earth?

Topic 4: Glaciers

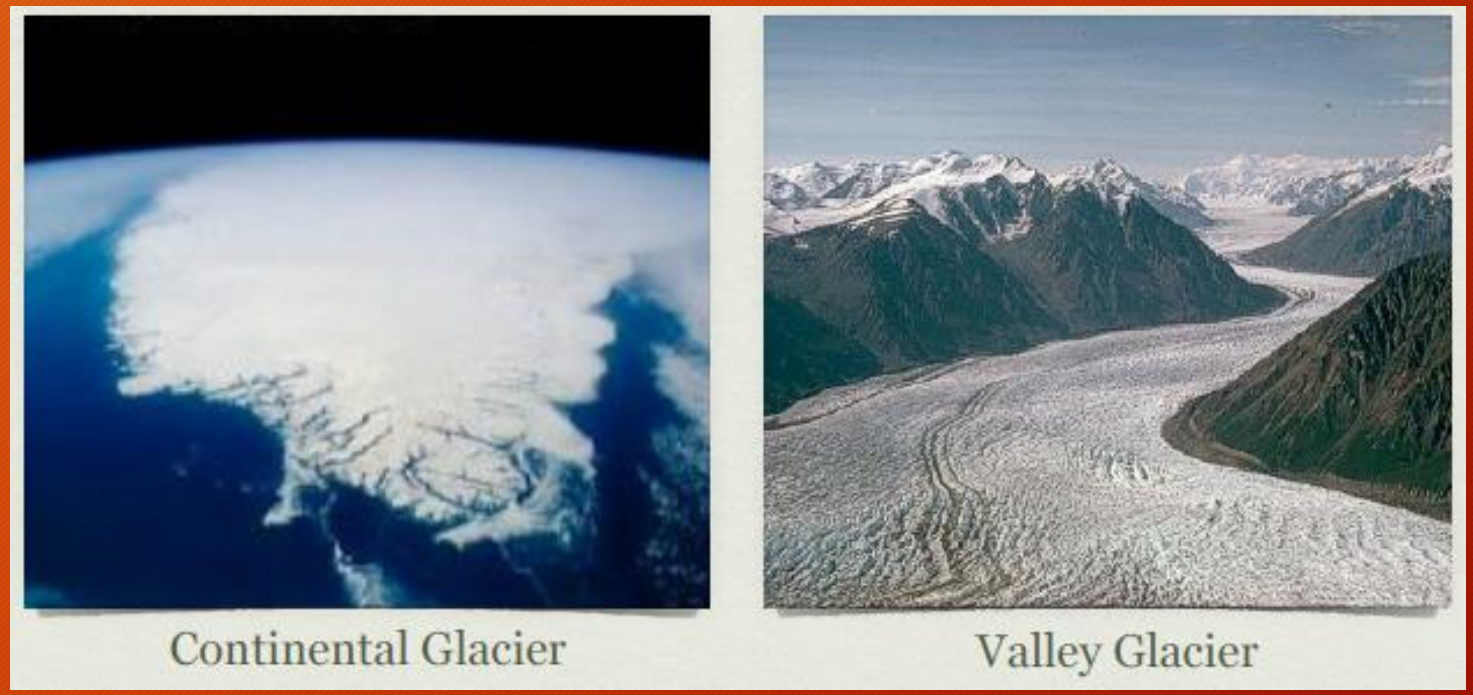
- Glacier: naturally-formed mass of ice and snow that moves downhill due to gravity

Topic 4: Glaciers

- Glacier Movement:
  - As snow and ice accumulate, the glacier moves forward under its own mass and the pull of gravity
  - Sometimes called a "river of ice," glaciers act like fluids and flow in a plastic-like motion

Topic 4: Glaciers

- Types of Glaciers:
  - Continental Glacier: huge sheets of ice that cover entire land masses
  - Valley Glacier: glaciers that form in high elevations in mountain valleys



Topic 4: Glaciers

- Glacial Features:
  - U-Shaped Valleys: shape of valley walls created from glacial erosion

  - Erratics: large deposited pieces that can be transported hundreds of miles inside or on top of a glacier

Topic 4: Glaciers

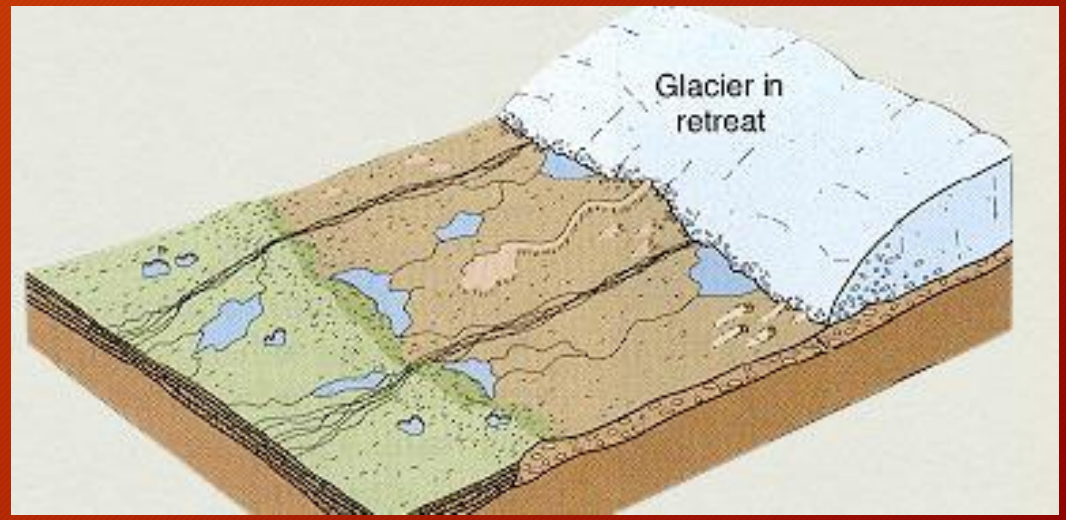
- Glacial Features:
  - Drumlins: oval-shaped mounds of unsorted sediment
  - Eskers: long winding ridge of sands and gravels

Topic 4: Glaciers

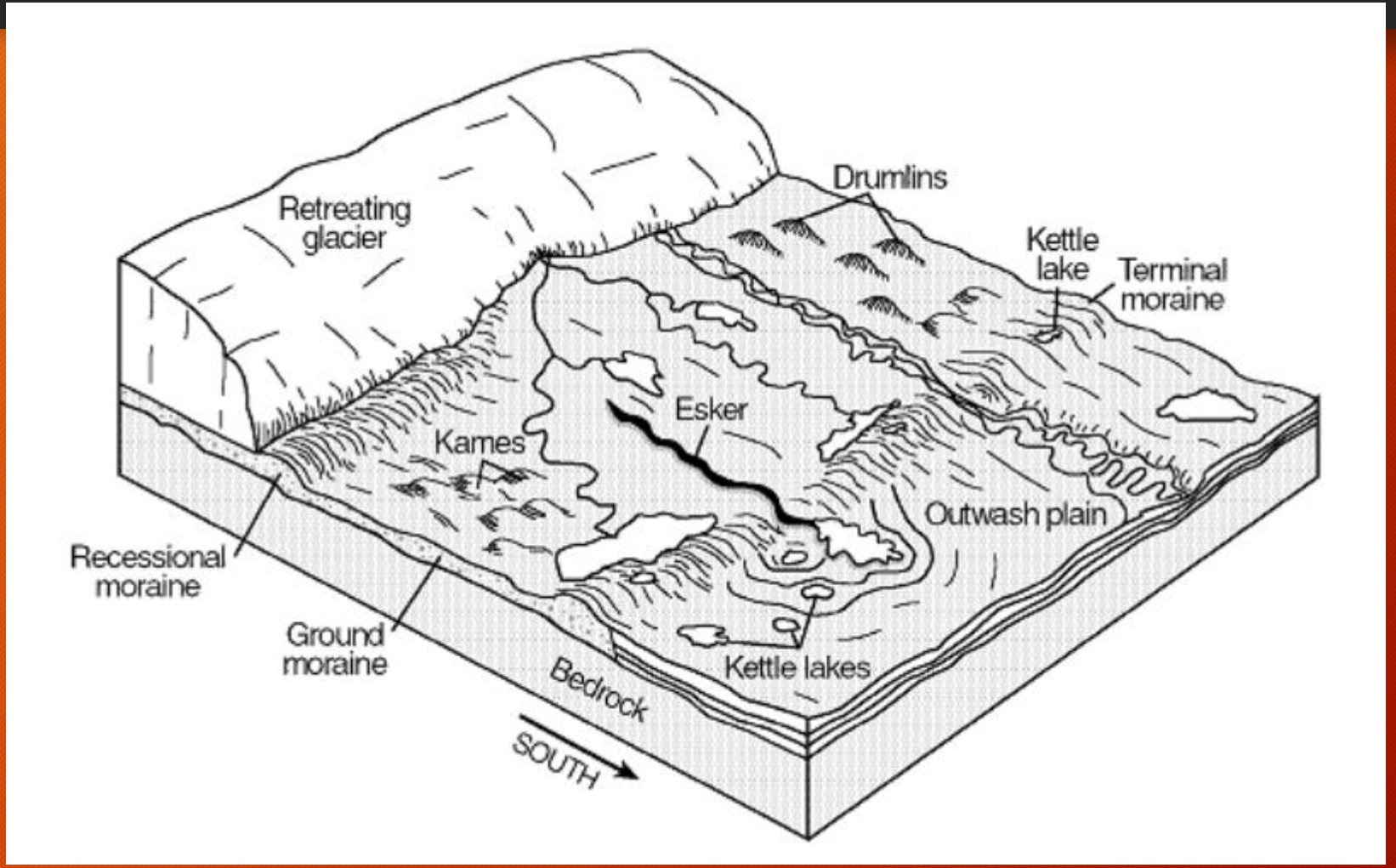
- Glacial Features:
  - Terminal Moraines: mound of till deposited along the leading edge of a glacier
    - Till: unsorted sediments deposited by a glacier
  - Glacial Grooves: long, parallel scratches created by sediments “trapped” in the glacier that pass over the surface
    - The grooves indicate (show) the direction the glacier has traveled

Topic 4: Glaciers

- Glacial Features:
  - Kettle Lake: lake that is created by and filled with glacial meltwater
    - Example: Lake Ronkonkoma (Long Island's largest freshwater lake)
  - Outwash Plain: widespread small sediment carried from the melting water of a retreating glacier
    - Example: Southern Long Island



Topic 4: Glaciers



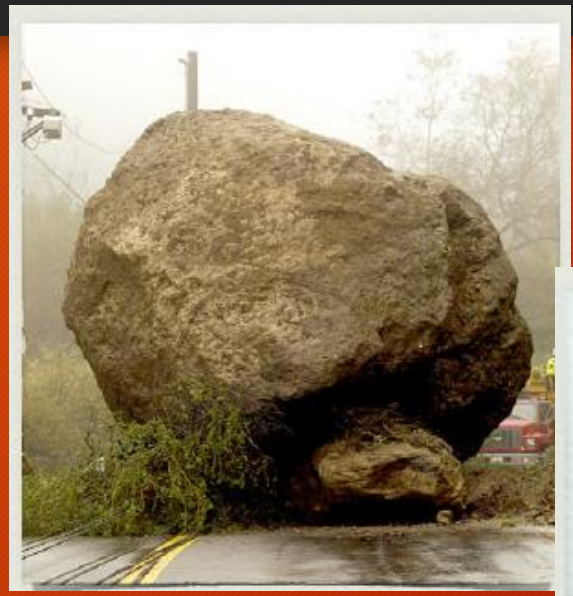
Questions?

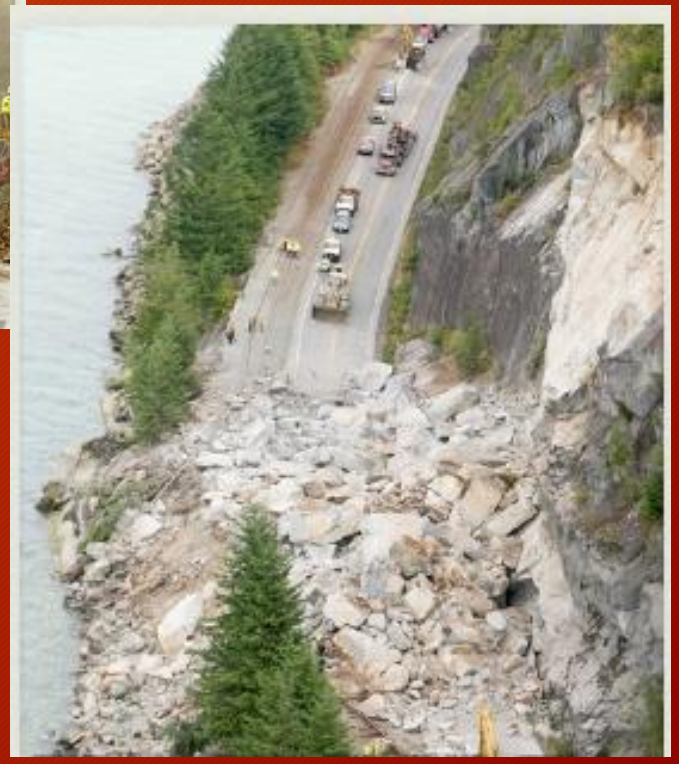
Topic 5: Mass Movement, Wind & Waves

- Essential Question: How does mass movement, wind & waves help shape our Earth?

Topic 5: Mass Movement, Wind & Waves

- Mass Movement: the pulling of rock and sediment downhill by gravity
  - Characteristics: unsorted sediment
  - Mass Movement Examples:
    - Avalanches
    - Landslides
    - Mudslides





Topic 5: Mass Movement, Wind & Waves

- Mass movement involves 2 forces:
  - Gravity: the force of attraction causing objects to fall towards the center of Earth
  - Friction: the rubbing of one object against another

  - For example: When rain weakens the force of friction, gravity then pulls rock & sediment down a slope

Topic 5: Mass Movement, Wind & Waves

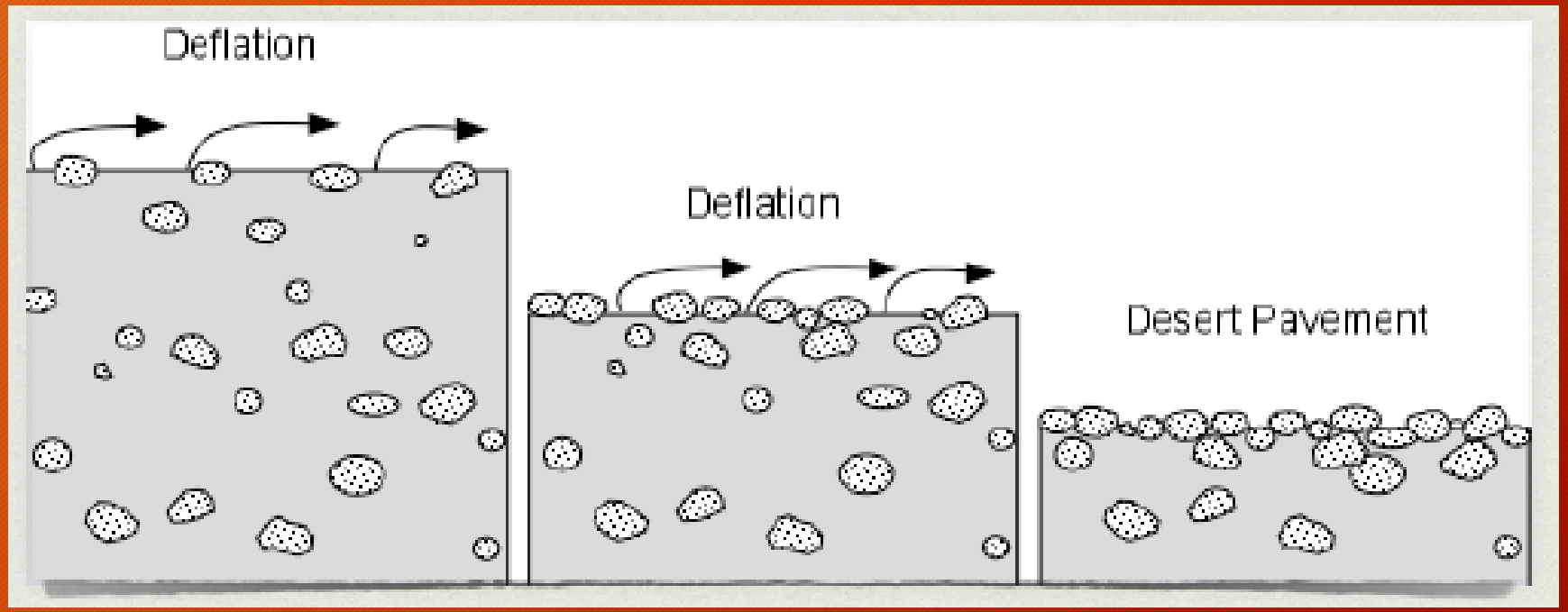
Topic 5: Mass Movement, Wind & Waves

Topic 5: Mass Movement, Wind & Waves

- Wind: air that is moving horizontally
  - Wind picks up loose sediment such as sand & silts and carries them to a new location

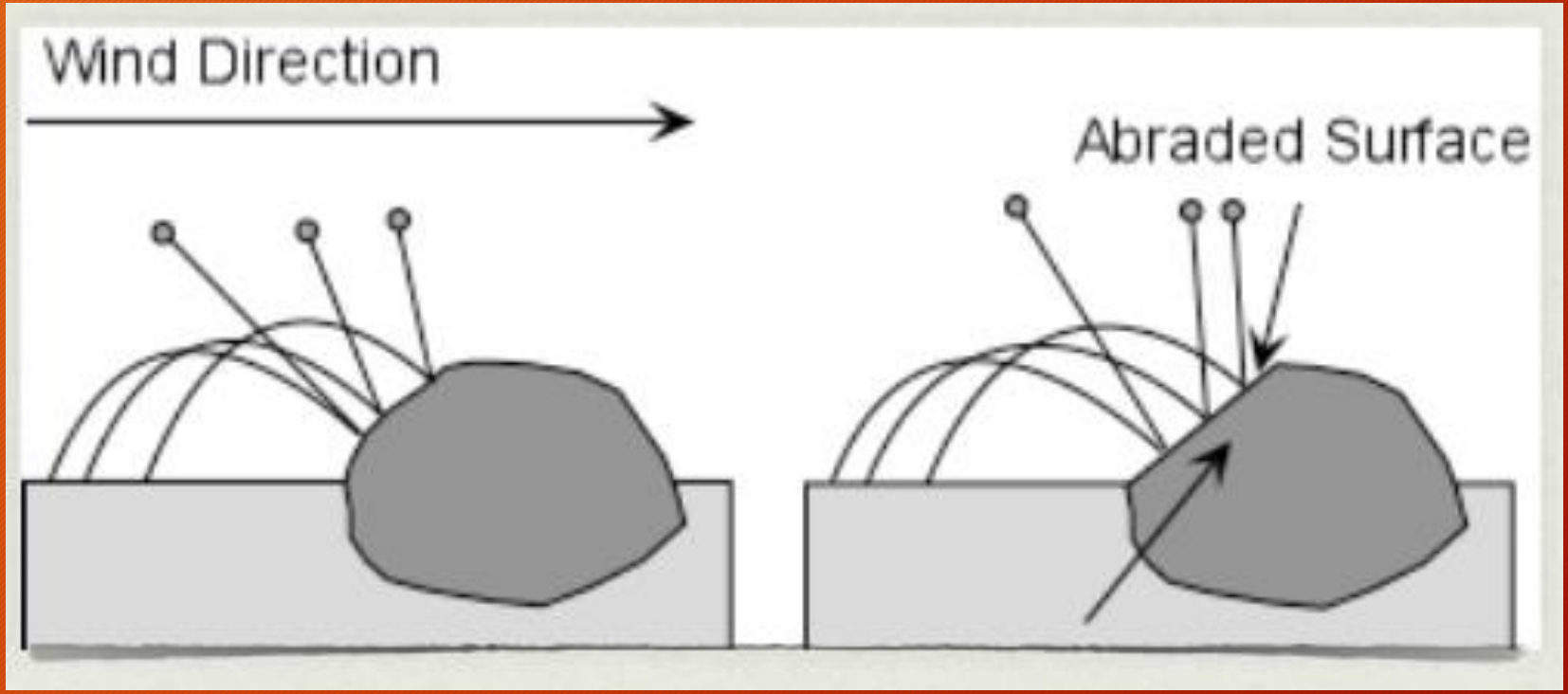
Topic 5: Mass Movement, Wind & Waves

- Deflation: wind blowing away loose sediment causes the land surface to lower until there is no more loose sediment to erode (move)



Topic 5: Mass Movement, Wind & Waves

- Abrasion: wearing down of a surface caused by wind picking up and blowing smaller sediments against that surface



Topic 5: Mass Movement, Wind & Waves

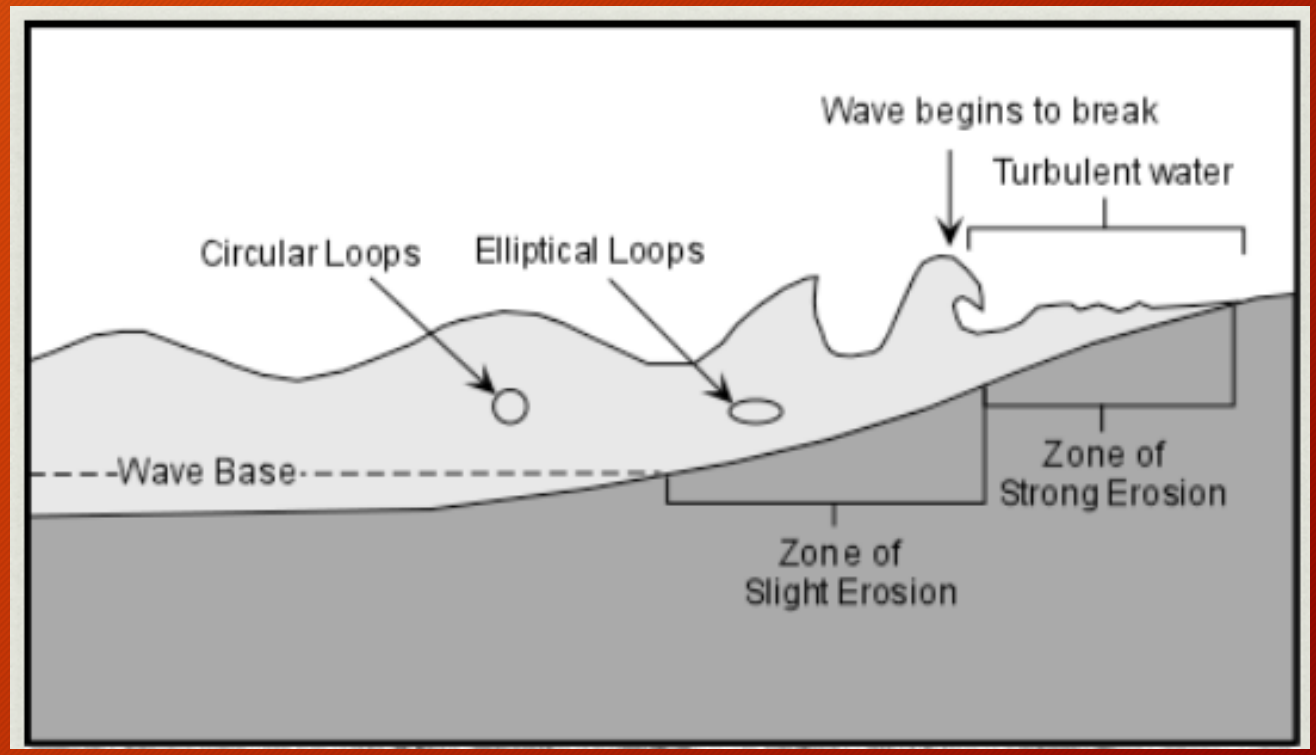
- Abrasion:

Topic 5: Mass Movement, Wind & Waves

- Sand Dune: sand deposited in layers or mounds
  - Windward Side: gentle slope
  - Leeward Side: steep slope

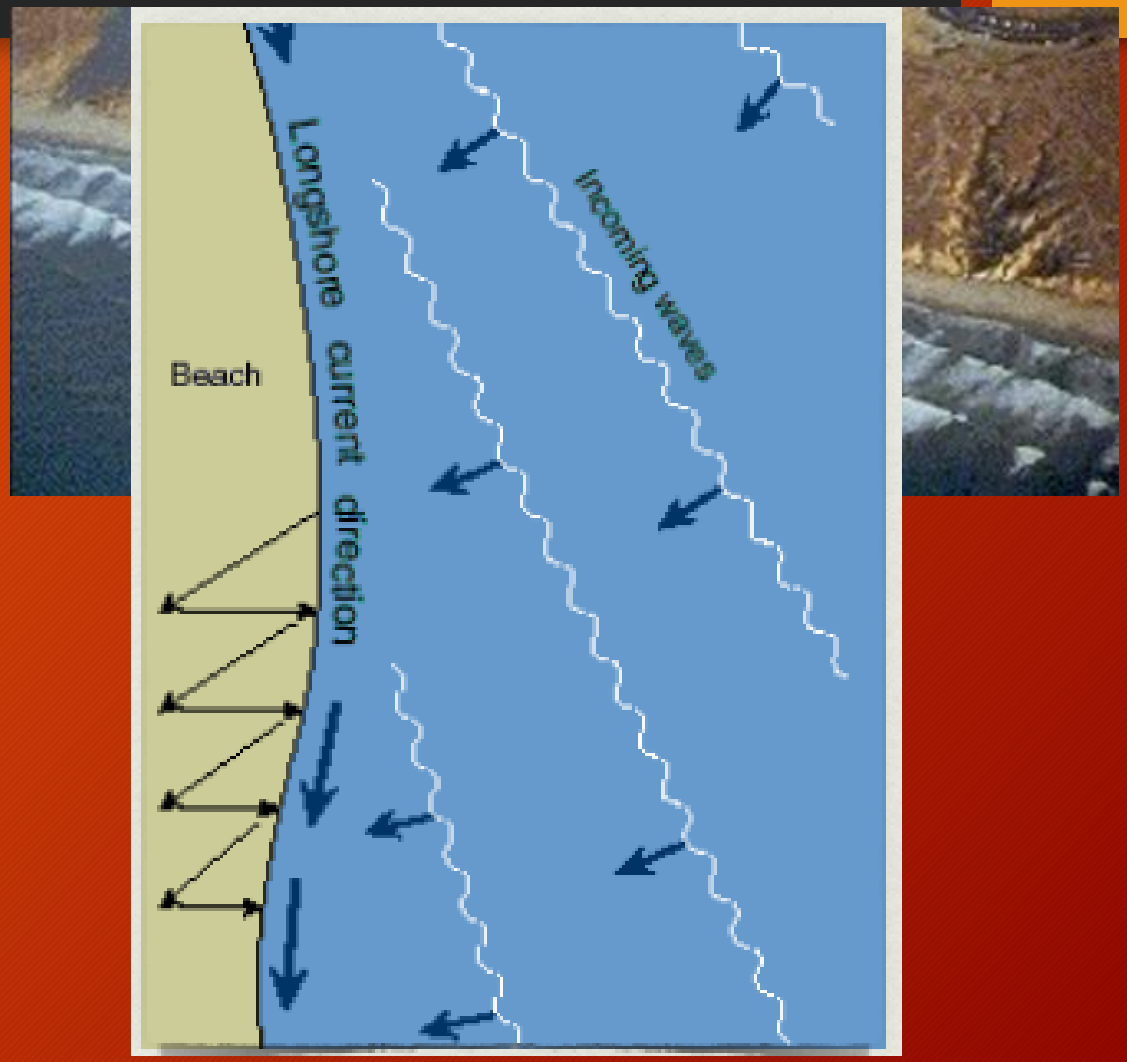
Topic 5: Mass Movement, Wind & Waves

- Waves: the up-and-down motion of water in the ocean or lake; usually caused by wind
  - As wind pushes a wave towards the shore, it drags along the bottom of the ocean floor
  - The dragging slows the bottom of the wave, but the top continues at the same speed
  - Eventually the wave becomes unstable and "breaks"



Topic 5: Mass Movement, Wind & Waves

- Waves approach the shore at an angle, but retreat parallel to the shore, creating a zigzag pattern



- Long Shore Current: ocean current that flows parallel and close to the shore

Questions?