WEATHERING AND SOILS

What are processes shape our Earth?
WEATHERING AND 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
Chemical Weathering - the breakdown of rock through a change in mineral or chemical composition

The rate of chemical weathering increases in warm moist climates
WEATHERING AND SOILS

Before

After
Oxidation - when iron combines with oxygen to make rust
Effects of Water on Rock:

- Sometimes called the universal solvent, because given enough time water can dissolve nearly anything
- Water can combine with CO$_2$ to form carbonic acid
- Carbonic acid can dissolve most rock --- especially limestone
Sinkhole - a natural depression in a land surface formed by the dissolution and collapse of a cavern roof
WEATHERING AND SOILS
• Physical Weathering - the breakdown of rock into smaller pieces without chemical change
WEATHERING AND SOILS

- **Abrasion** - occurs when rock particles grind against rock
  - **Characteristics**: round shaped rocks
  - **Occurs as sediments are moved by ice, running water, gravity, or air**
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% causes the rock to split apart

Infiltration - the process which water penetrates into soil or rock
WEATHERING AND SOILS

Frost Action

Potholes
Plant Root Growth - as plants grow they can also spread cracks apart even farther
WEATHERING AND SOILS

- Abrupt Temperature Changes - as temperature increases rocks expand and fracture
Physical Weathering
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 the soil that serves as a source of plant nutrients
Soil Layers

- Topsoil
- Subsoil
- Partially Weathered Rock
- Unweathered Bedrock
EROSION AND

How are sediments moved and placed in a new location?
EROSION AND DEPOSITION

The Time Machine
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.
Agents of Erosion - forces that are set in motion by gravity that causes sediments to move
Examples of Agents of Erosion:

- Streams
- Waves
- Glaciers
- Wind
- Mass Movement
EROSION AND DEPOSITION

Streams
EROSION AND DEPOSITION

Waves
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Glaciers
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Wind
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Mass Movement
Gravity --- Direct Role

- Force behind most agents of erosion
- Causes rivers to flow, ice to move, and rocks to slide
The Sun --- Indirect Role

- Drives the water cycle which produced rain and ice
- Fuels winds and drives ocean currents
Deposition - the process by which sediments are released from an erosional system

- Sediments are deposited in locations where they form layers of sedimentary rock
The sediments determine how fast they are deposited:

- **Size** - larger sediments will settle faster
- **Shape** - rounder sediments settle faster and flatter sediment will take longer
- **Density** - more dense sediment will settle faster
Sorted Sediment - layers of sediment that are similar in size, shape or density

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

Example: deposition from a glacier
Horizontal Sorting - when the velocity of a wind or water erosional system gradually decreases; the size, roundness, and density gradually decrease as you move farther out.
Vertical Sorting - larger or more dense sediments settle to the bottom first, followed by 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
• Vertical Sorting -
Vertical Sorting
RUNNING WATER

How does running water help shape our Earth?
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.
Flood Plain - nearly level plain that borders the river

Levee - mound of sediment that parallels the course of the river that prevents flooding
Streams carry sediment in various ways:

- Dissolved minerals in solution
- Solid particles are suspended in water
- Larger particles are usually carried by rolling, bouncing, or sliding along the stream bottom
**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
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
Variations in Stream Velocity:

- Deposition
- Erosion
Stream Characteristics:

- V-Shaped Valley - downcutting of a stream
Stream Characteristics:

- **Meanders** - as a stream gets older it begins to shift its course in a series of bends
RUNNING WATER

Meandering Stream
Meandering Stream (Oxbow Lake)
GLACIERS
How do glaciers help shape our Earth?
Glacier - naturally formed mass of ice and snow that moves downhill under the force of gravity
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.
Types of Glaciers:

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

Continental Glacier

Valley Glacier
Glacial Features:

- **U-Shaped Valleys** - shape of the valley walls from glacial erosion
Erratics - large deposited fragments that can be transported hundreds of miles inside or on top of the glacier
Drumlins - streamlined oval shaped mounds of unsorted sediment
Eskers - a long winding ridge of sands and gravels
Terminal Moraines - a mound of till deposited along the leading edge of a glacier

Till - unsorted sediments deposited by a glacier
Terminal Moraine
Glacial Grooves - long parallel scratches formed by sediment embedded in a glacier that has passed over the surface.

The grooves indicate the direction the glacier has traveled.
Kettle Lake - depression left in the ground that is filled with glacial melt water

Example: Lake Ronkonkoma
- Outwash Plain - broad glacial feature of smaller sediment carried from the melting water of a retreating glacier

- Example: Southern Long Island
Largest Glacier Calving
MASS MOVEMENT, WIND, & WAVES
How does mass movement, wind, and waves help shape Earth?
Mass Movement - the pulling of rock and sediment downhill by the force of gravity

Characteristics: unsorted Sediment
Examples:

- Avalanches
- Landslides
- Mudslides
Mass movement involves two forces:

- **Gravity** - the force of attraction where objects fall towards the center of the Earth

- **Friction** - the rubbing of one object against another

When rain weakens the force of friction gravity then pulls rock and sediment down a slope
MASS MOVEMENT, WIND, & WAVES

[Image: A photograph showing two cars stuck in a muddy area with a mountainous background, suggesting the effects of mass movements and possibly wind or waves in a natural environment.]
Wind - air that is moving horizontally

- Wind picks up loose sediments such as sand and silts and carries them to a new location
**Deflation** - wind readily blows away loose sediment lowering the land surface until there is no more loose sediment to erode
- Abrasion - wind picks up and blows smaller sediment against another surface wearing it down
Sand Dune - depositional feature when sand is deposited in layers or mounds

- Windward Side: gentle slope
- Leeward Side: steep slope
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”
Waves approach the shore at an angle, but retreat parallel to the shore, creating a zigzag pattern.
The zigzag pattern carries sand parallel to the shore.
Long Shore Current - ocean current that flows parallel and close to the shore
MASS MOVEMENT, WIND, & WAVES
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