

Outlines of the Presentation

What is Weathering?

Weathering Processes

Agents of Mechanical Weathering

Agents of Chemical Weathering

What Affects the Rate of Weathering?

Products of Weathering

What is Erosion?

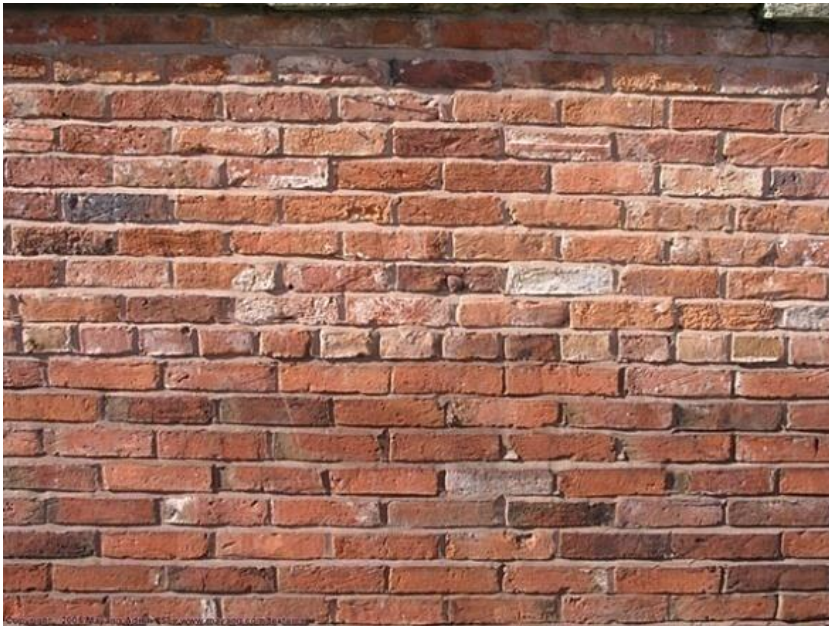
Agents of Erosion

What is Deposition?

What is Weathering?

- Weathering is a processes at or near Earth's surface that cause rocks and minerals to break down.

Weathering is a slow yet continuous process that, as a result, is hard to notice at times. But, peeling paint and the contrast between bright red, sharp edged bricks and dull red, smooth edged bricks are a few of the places where weathering is very noticeable and easy to pick out.



Weathering Processes

Weathering involves two processes that often work together to decompose or break down rocks.

➤ Physical/Mechanical Weathering is a processes by which rocks are broken down into smaller pieces by external conditions without a change in chemical composition.. At the beginning of the weathering process, the rocks are sharp and angular. Eventually the rocks become smooth and rounded as the weathering process continues. All of the different agents (causes) of weathering result in the breaking down of rocks.



➤ Chemical Weathering is the breakdown of rocks and minerals into smaller pieces by chemical action. The rocks breaks down at the same time as it changes chemical composition. The end result is different from the original rock. During chemical weathering, rocks are broken down in a process called decomposition (process where dead organisms are broken down), or minerals are added or taken away from rocks. Acid rain and pollution are two factors of chemical weathering that cause the most damage.

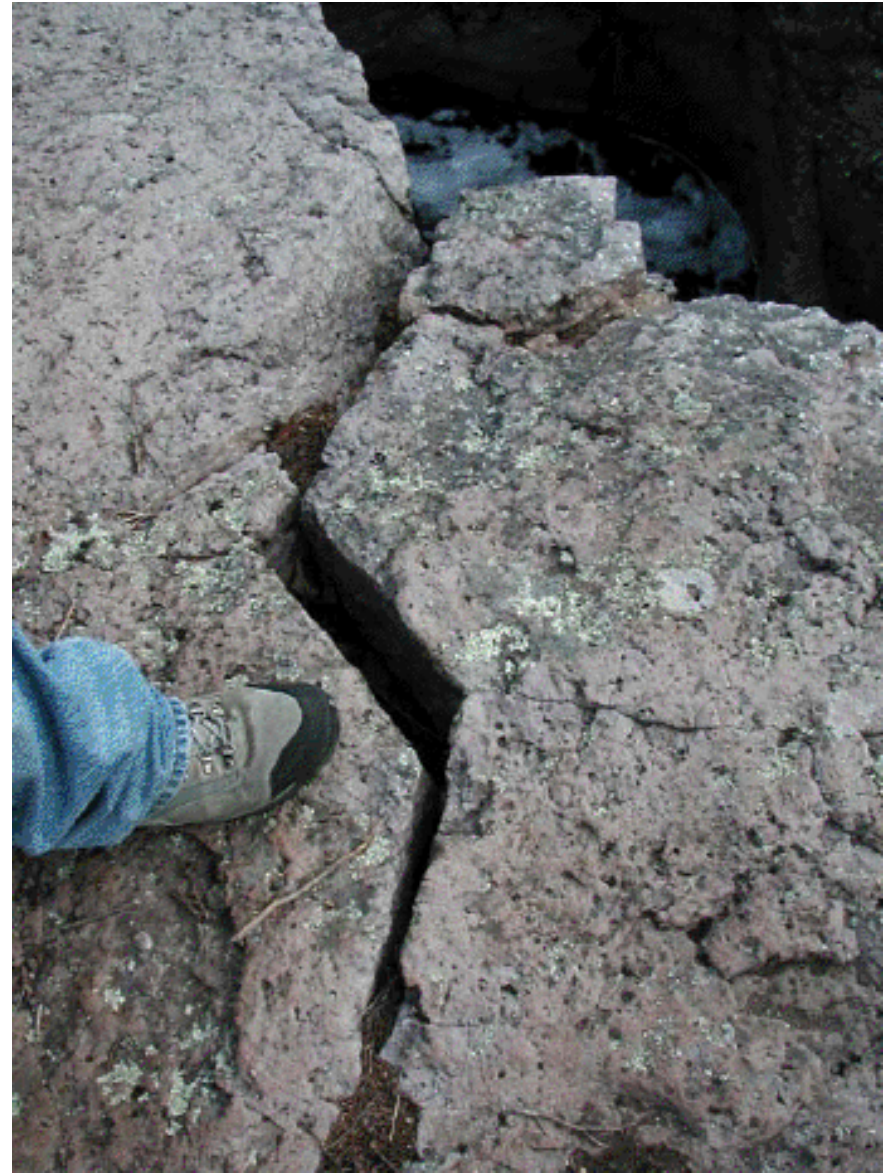
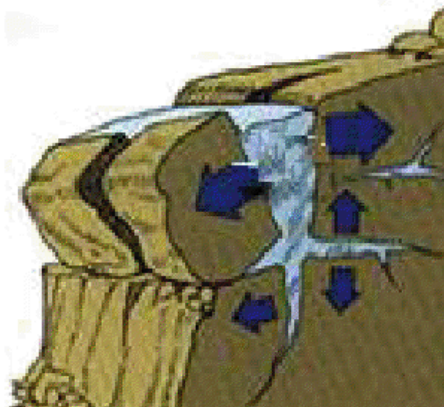


Agents of Mechanical Weathering

Frost Wedging/Frost Action

Frost Wedging is the freezing and thawing of water in cracks.

Water will go into cracks in rocks and when it gets cold enough outside (32 degrees F or 0 degrees C), the water inside the rocks will freeze. That will cause the water, and then the rock to expand, causing the rock to eventually break into pieces.

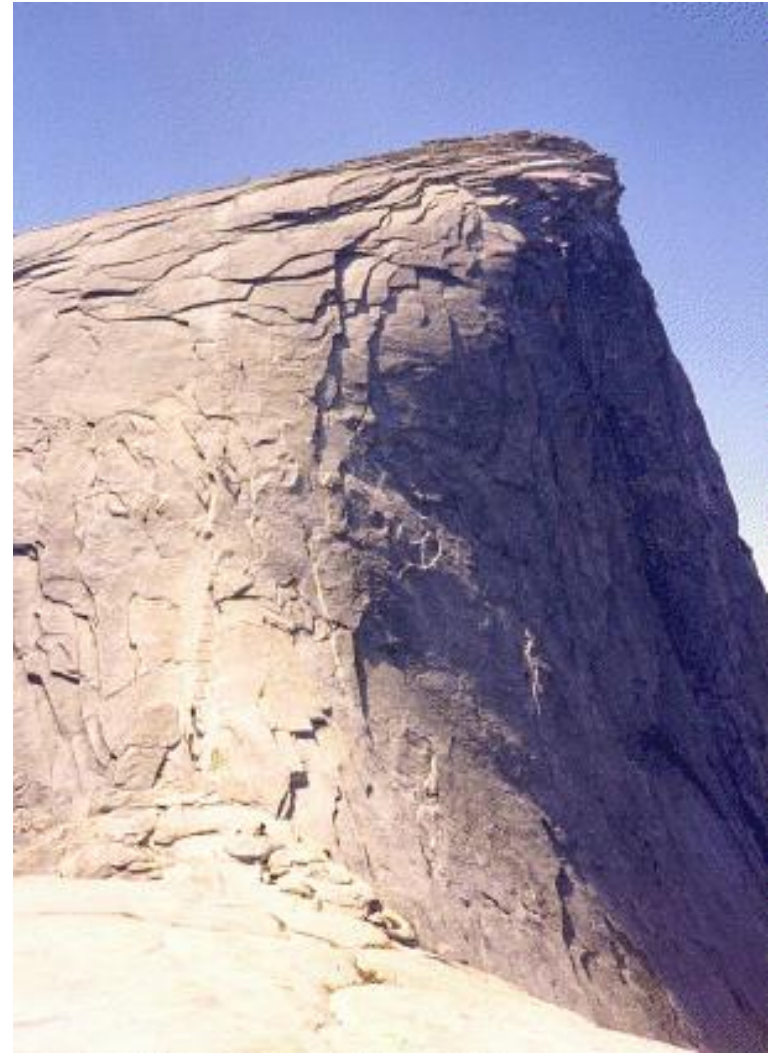


Agents of Mechanical Weathering

Mechanical Exfoliation

Mechanical Exfoliation is the peeling off of sheets of rock as they expand and crack.

During the day when the Sun is out, rocks become hotter and expand. During the night when the Sun is no longer out, the rocks will become cooler and contract. This continuous process of heating and cooling causes small pieces of the rocks to flake off.



Agents of Mechanical Weathering

Thermal Expansion and Contraction

Repeated heating and cooling of materials cause rigid substances to crack and separate.



Agents of Mechanical Weathering

Plant Wedging

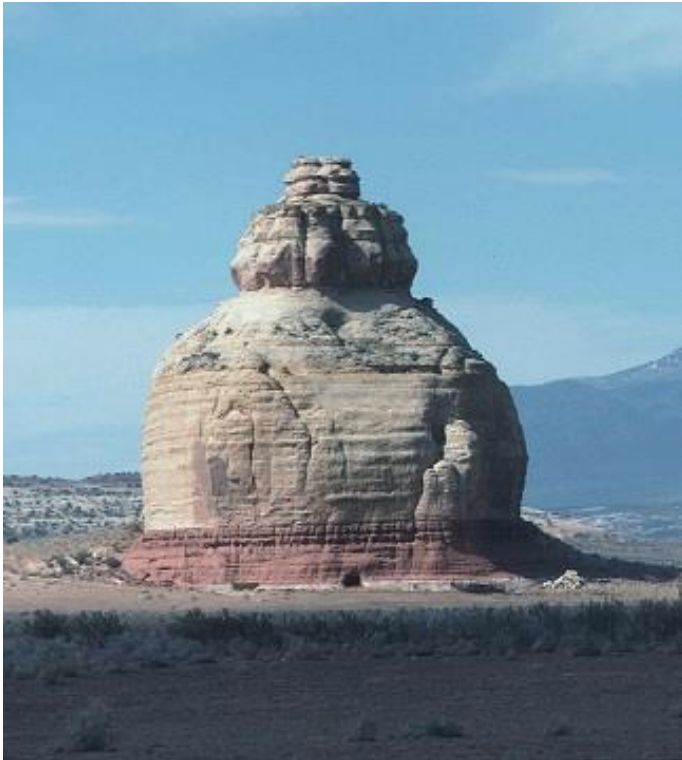
Tiny root hairs seek out small cracks and pits in rock. Once the root hairs find a place they grow and expand. The expansion causes great pressure and cracks the rock.



Agents of Mechanical Weathering

Abrasion

Abrasion is a gradual wearing down of bedrock by the constant battering of loose particles transported by wind, water or ice. Both wind and water can cause abrasion as rock fragments bounce off each other.



Agents of Mechanical Weathering

Gravity

Gravity will pull loose rocks and soil down a slope, causing a landslide where the tumbling rocks will bump into other rocks on the way down and break into smaller pieces.



Agents of Chemical Weathering

Water

Water can do three main things: dissolve the crucial minerals in rocks that hold them together (dissolution), speed up the decomposition process using acids, and create a completely different material when water is combined with certain minerals (hydrolysis).



Feldspar

Hydrolysis



Kaolinite (clay)

Agents of Chemical Weathering

Oxidation

Oxidation is when oxygen combines chemically with some other substance, eventually creating a new substance. Oxidation can actually create rust. For example, the iron-containing mineral pyrite forms a rusty-colored mineral called limonite.

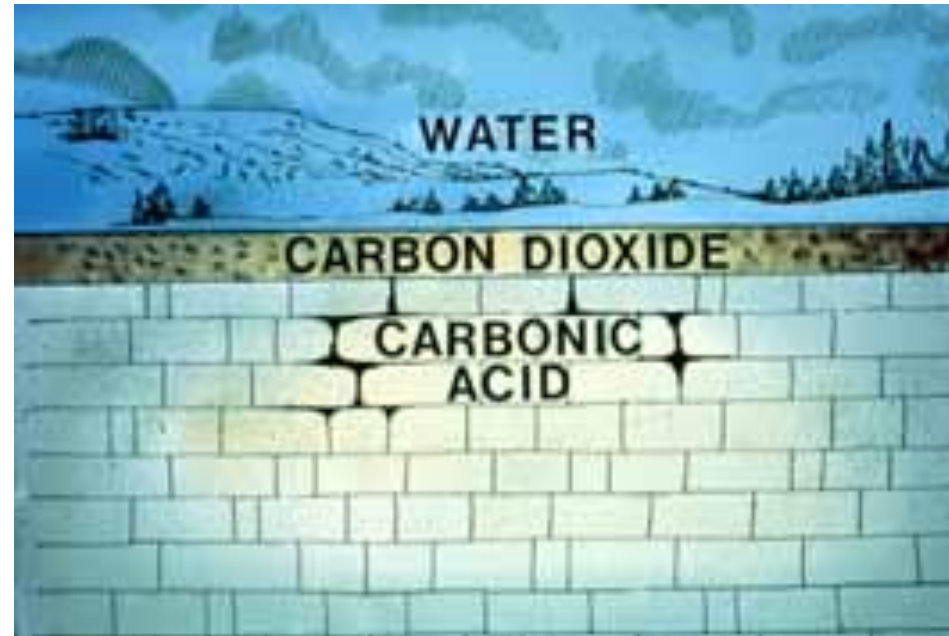


Oxidation

Agents of Chemical Weathering

Carbonation

Carbonation is when chemical reactions occur between certain substances and carbonic acid, which is an acid that comes from carbon dioxide when it dissolves in water. Carbonic acid can be found in rain, that will seep into rocks on the ground and won't actually do too much damage, but it does slowly decompose certain rocks like limestone and feldspar.

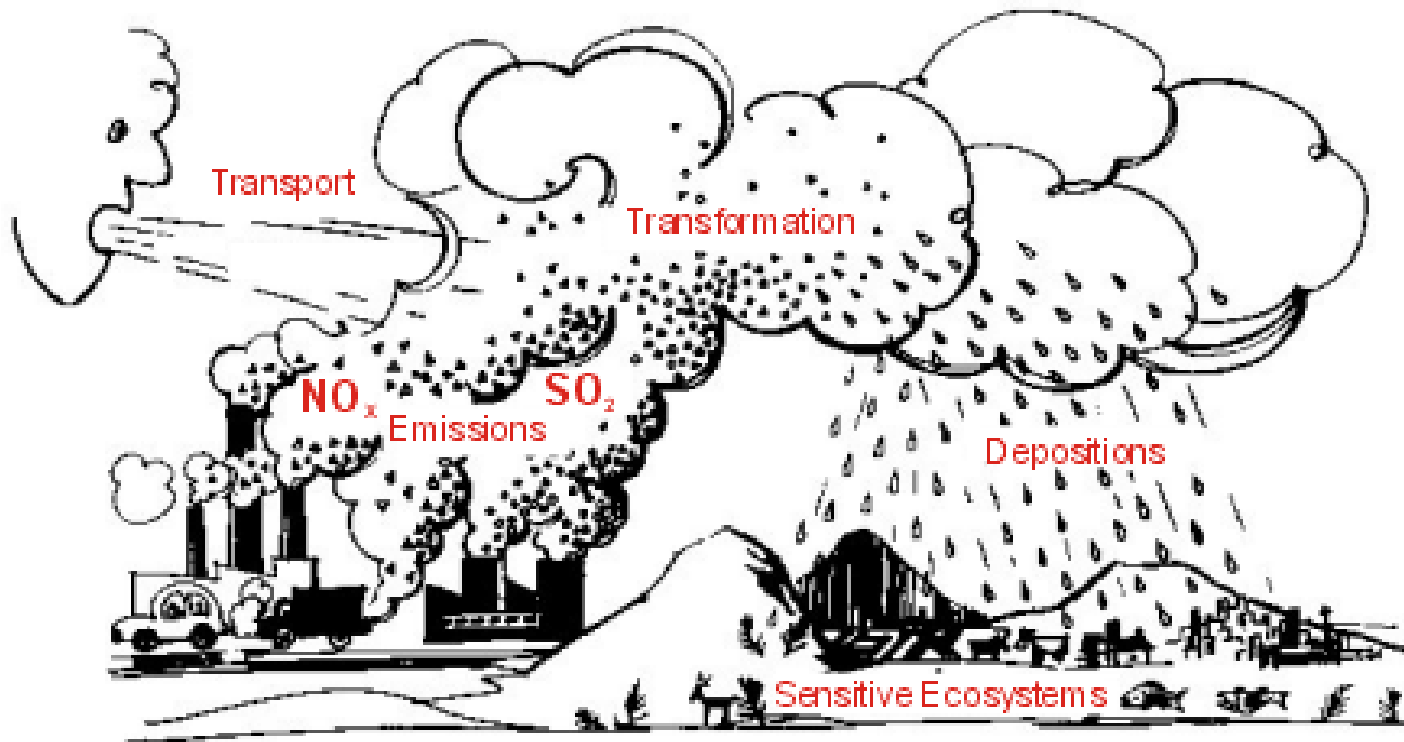


Carbonation

Agents of Chemical Weathering

Sulfuric Acid

Along with carbonic acid, sulfuric acid can be found in acid rain. But, unlike carbonic acid that is a relatively weak acid, sulfuric acid is very strong and can wear down rocks and even metal at a quick rate. Sulfuric acid is created from burning coal.



Agents of Chemical Weathering

Plant Acid

The plants can not only be an agent of mechanical weathering, but can also be an agent of chemical weathering. Plants actually do produce acids, but not similar to sulfuric acid, plant acids are very weak. But, they do dissolve some minerals in rocks causing the rock to break into pieces over time.

Lichens that grow on rocks produce weak acids that chemically weather rock.



Products of Weathering

Clay

Tiny mineral particles of any kind that have physical properties like those of the clay minerals. Clays are hydrous alumino-silicate minerals.

Sand

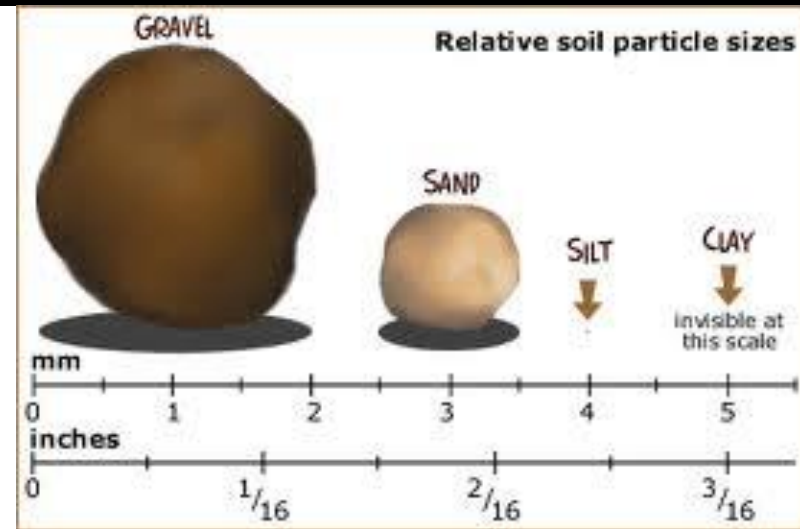
A sediment made of relatively coarse mineral grains.

Soil

Mixture of minerals with different grain sizes, along with some materials of biologic origin known as Humus. So the soil contains partially decayed organic matter.

Regolith

Regolith is the blanket of soil, broken rocks, dust, and other tiny objects that sits atop a layer of bedrock.



What Affects the Rate of Weathering?

➤ **Mineral composition**

Mineral composition- some minerals are more resistant than others. Quartz is resistant to chemical and physical weathering.

➤ **Climate**

Cold and/or dry climates favor physical weathering.

Warm and wet climates favor chemical weathering. Limestone ok in warm/dry climate; when wet-weak acids weather.

Frost action works best in areas where the temperature fluctuates wildly.

➤ **Time exposed on surface**

Old unexposed rocks-no big changes

New exposed rocks-weather quickly

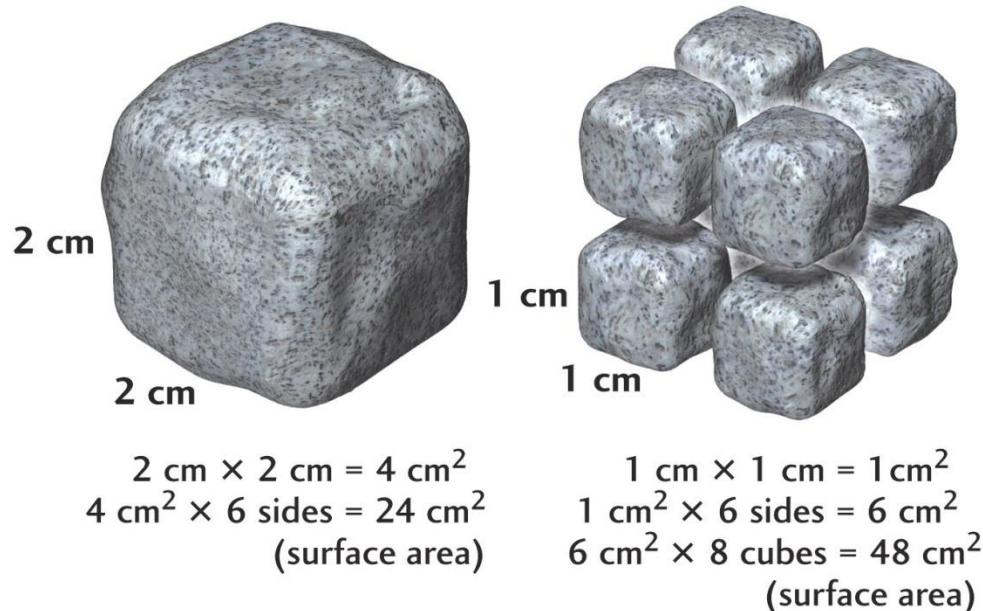
What Affects the Rate of Weathering?

➤ Surface area exposed

Exposing more surface area will increase the rate of weathering. When rock is in small pieces, more surface area is available for weathering.

➤ Topography, other variables

Materials on slopes are more likely to move due to gravity. This exposes underlying rock, providing more opportunities for weathering.



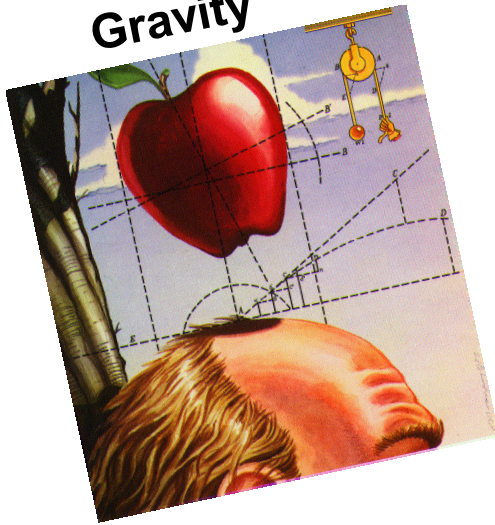
What is Erosion?

- Erosion is the process where weathered rocks and particles of soil are moved over land. After the rocks are broken down from weathering, erosion carries that sediment and deposits it in a new location.



Agents of Erosion

Gravity



Wind



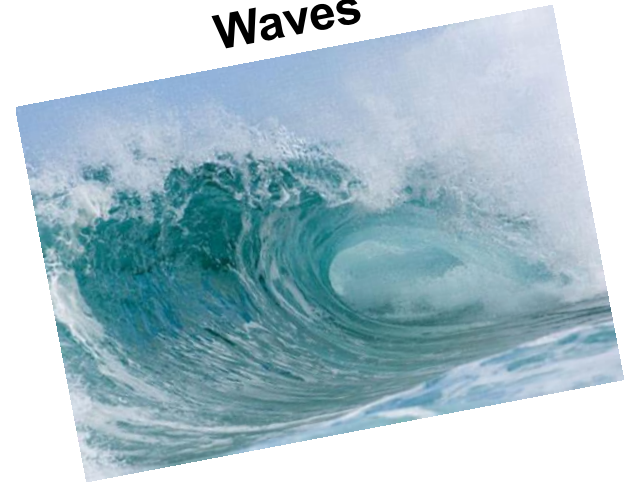
Glaciers



Running Water

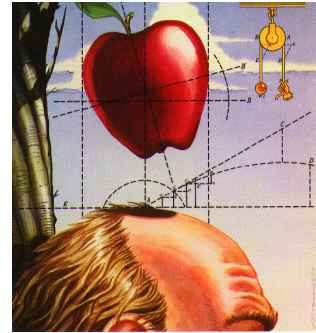


Waves



Agents of Erosion

Gravity



Gravity is what pulls down rocks and soil (sediment) down slopes.

That process is called mass wasting and it can happen quickly or slowly. Landslides and mudslides are examples of mass wasting.

A landslide happens due to an earthquake or volcanic eruption, and is when soil, rocks, and boulders fall down a slope. It causes a lot of damage in the end, as it moves anything in its path.

A mudslide happens after heavy rain when rain turns soil into mud and then mud starts flowing down hills. As it descends down hills, the mud becomes thicker and thicker and pummels through anything it reaches.

Those two examples are slow examples of mass wasting.

Agents of Erosion

Gravity



Mass Wasting

Agents of Erosion

Wind



Wind is one of the most active agents of erosion, especially in beaches, fields, and deserts.

Loose materials on the ground in these areas are easily picked up by wind and can land anywhere.

Earth's surface is eroded by wind in two ways: deflation and abrasion.

Deflation is when loose sand, silt, and clay is moved by wind over short distances.

Abrasion is when larger pieces of sediment bounce along the ground as they are moved by wind. As they do so, wear away rocks on the ground that they hit by cutting and polishing them down.

Wind forms sand dunes, which are large hills of sand deposited by wind.

Agents of Erosion

Wind



Wind will carry fine, dry sediments over long distances.

Agents of Erosion

Glaciers



A glacier is a huge piece of ice and snow that moves, and this type of erosion is one of the most powerful types.

Ice from glaciers is eroded by being plucked away from the rocks underneath it, and by the process of abrasion.

When a glacier pummels through a valley, anything in its path is taken with it. Those rocks, boulders, and anything else in its path is called glacial debris.

As the glacier moves with this load of debris, the surface of the land it's traveling over grinds and polishes down the land.

So glacial erosion scrapes away anything it travels over and can even form mountains.

Agents of Erosion

Glaciers



Glaciers are large ice fields that slowly flow downhill over time.

Agents of Erosion

Running Water



Running water is the major cause of erosion and has the biggest effect on our Earth than any other type of erosion.

Rivers, rain, streams, and runoff (water that flows over the surface of the Earth) are three types of running water that perform erosion.

When there's a lot of rainfall, there is a greater amount of runoff. Runoff will carry particles of clay, sand, and gravel over land downhill through the water.

That sediment will form grooves in the soil called rills that become wider over time and will eventually form into gullies which are channels for runoff.

The amount of runoff is also affected by the amount of plant growth where places with little plant growth have greater erosion since there are less roots to hold soil in place.

Agents of Erosion

Running Water



Rivers, streams and runoff

Agents of Erosion

Waves



Waves are caused by earthquakes, tides, and winds.

They are very powerful and are constantly changing the shape of shorelines through erosion.

There are many ways that waves erode away the shoreline.

They carry small rocks and sand that chip off pieces of the shoreline.

When water is forced into cracks along the shoreline, the increased pressure makes the cracks become larger and eventually break.

Salt in water dissolves rocks, which is another type of erosion.

The size and force of the waves also affects the rate of erosion.

Agents of Erosion

Waves



Tidal action and waves carry away weathered materials.

Factors That Affect the Rate of Erosion in Running Water & Glacial Ice

Slope (gradient) of the land

As slope increases, the water velocity increases, the particle size that the water can carry also increases, therefore the amount of erosion increases.

Volume (size of the water or glacier)

As the volume of the water or glacier increases, their velocities increase, the particle size that they can carry also increases, therefore the amount of erosion increases.

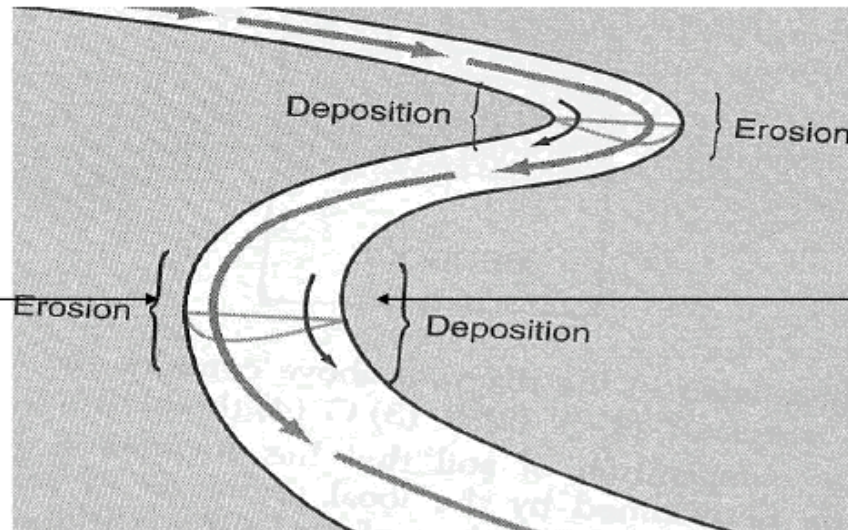
Position within the running water

Water is traveling faster around the outside of turns, therefore that is where more erosion occurs. Water is traveling slower on the inside of turns, therefore deposition occurs on the inside.

Factors That Affect the Rate of Erosion in Running Water & Glacial Ice

Meandering (Curving) River/Stream

Erosion happens on the outside of turns.



Deposition happens on the inside of turns.

Sediments are traveling the fastest in the center directly below the surface.



Straight Flowing River/Stream

Running Water

What is Deposition?

- Deposition is a process where sediments are released/dropped by their agent of erosion.

Most deposition happens in standing/still bodies of water (oceans/lakes).

Deposition is caused by the slowing down (loss of kinetic energy) of the agent of erosion.

There are four factors that influence the rate of sediment deposition:

1. Sediment size
 2. Sediment shape
 3. Sediment density
 4. Sediment velocity
-

What is Deposition?

➤ **Size**

Smaller particles settle more slowly than the larger particles, due to gravity. The smaller particles tend to stay in suspension for longer periods of time. This form of deposition is called graded bedding or vertical sorting..

➤ **Shape**

A round sediment compared to a flat (skipping stone) sediment of equal size will settle faster in a body of water.

➤ **Density**

If particles are the same size but have different densities the higher density particle will settle faster.

➤ **Velocity**

If the stream slows down during a drought period, the carrying power will decrease and the particle sizes carried and deposited will also decrease.

If a stream is flowing faster due to flood conditions, then the carrying power of the stream will increase and the sizes of particles deposited will increase as well.