

Weathering, Soil, and Erosion

Earth's surface is constantly changing. Movements at plate boundaries build up Earth's surface, forming mountains. At the same time, two other processes wear down Earth's surface. Weathering changes Earth by breaking rocks and other matter into smaller particles called sediment. Erosion sweeps these weathered particles away.

Weathering breaks up rock into smaller pieces, much like you might do using a hammer. Unlike using a hammer, the weathering of rock in nature is a gradual process. No matter how slowly, sooner or later, every rock that is in water or air will be weathered away. There are two main types of weathering: mechanical weathering and chemical weathering.

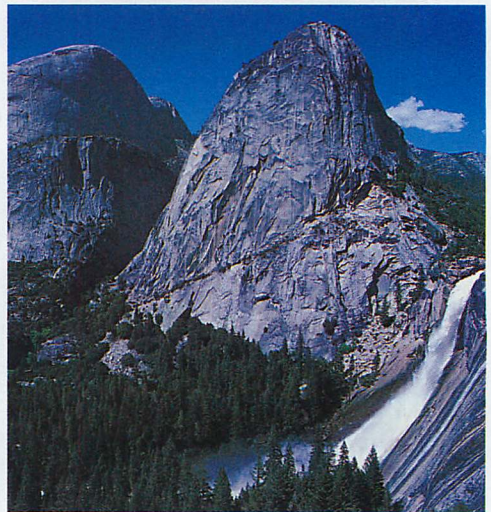
Word Watch!

Weathering means breaking rock apart by water, wind, and other agents. *Erosion* means the movement of those rock particles, often from a higher to a lower elevation.

Mechanical Weathering

Mechanical weathering, also called physical weathering, takes place when rocks are broken apart by a physical force.

- **Ice Wedging** When the temperature drops below the freezing point of water (0°C), water in cracks turns to ice. Water expands as it freezes, pushing apart the walls of the crack.
- **Release of Pressure** When a large mass of a rock such as granite reaches Earth's surface, the pressure on it is reduced. There is evidence that this release of pressure can cause pieces of the rock to flake off. As they start to flake, chemical weathering helps to speed the process.



- **Abrasion** Moving water and air (wind) can carry sand and other particles. When these particles strike rocks, they chip away the surface, much as you would if you rubbed a rock with sandpaper.
- **Plant Action** Plant roots can grow in cracks in rocks. As roots grow, they break apart the rock.



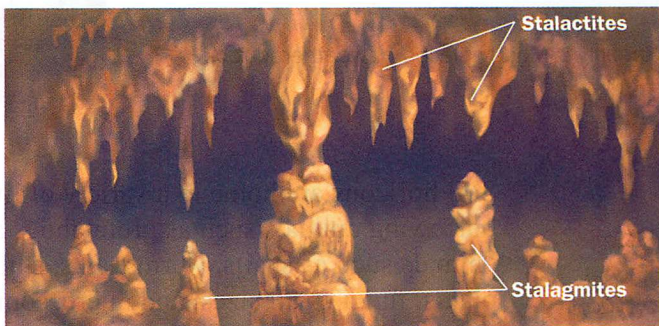
Chemical Weathering

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Chemical weathering changes the chemical makeup of rocks and minerals. Chemical weathering can remove certain minerals from some rocks. It can also change the minerals into new substances. There are two main types of chemical weathering.

- **Oxidation** The red-brown crust called rust is iron oxide. It forms when oxygen joins chemically with iron. Oxidation is the joining of oxygen with other substances. Oxidation can weaken and crumble rocks as well as metal.
- **Dissolving by Acids** Water can dissolve minerals. Water that contains acid dissolves minerals more quickly than neutral water. One source of acid is acid rain. Acid rain can form when chemicals given off by factories, power plants, cars, and volcanoes join with water vapor in the air. This forms acids that return to Earth in precipitation such as rain and snow. Some plants and fungi also make acids as they carry out their life processes.

Carbon dioxide that mixes with water forms carbonic acid. This acid dissolves calcium carbonate in rocks such as limestone. As water containing calcium carbonate drips from cavern ceilings and dries, it leaves behind stalactites, icicle-shaped spikes of rock hanging from the ceilings. Other spikes called stalagmites form when water drips from the stalactites onto the floor and then evaporates, leaving solid minerals behind.



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Soil

Soil is a mixture of rock, mineral particles, and organic matter.

Weathering forms the rock and mineral particles of soil. These particles are inorganic parts of soil. Other inorganic parts of soil are the water and air that fill the spaces between soil particles.

In life and earth sciences, **inorganic** substances are those that were not formed from living things. **Organic** substances are those formed by living things.



Most organic material in soil, called **humus**, comes from decaying animals and plants. Living things, such as bacteria and fungi, break down plant and animal remains and form humus.

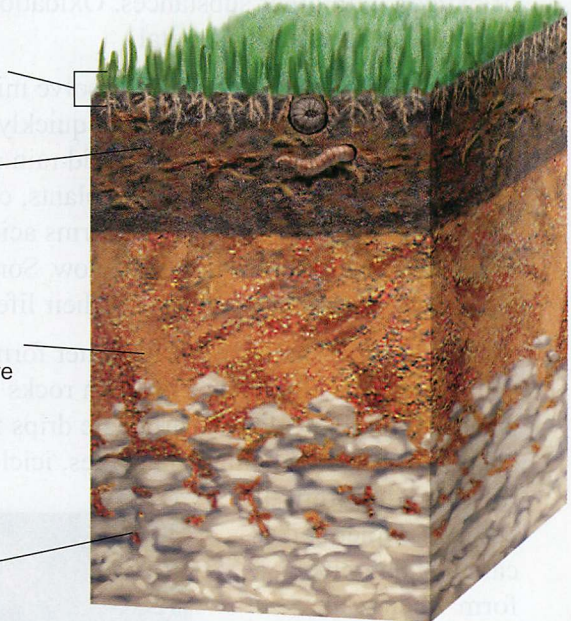
Soil is made up of layers called **horizons**. It takes thousands of years for a soil to mature. Mature soils have four horizons. Less mature soils have fewer horizons.

Horizon O Mostly decaying leaves, twigs, and animal remains and wastes

Horizon A (topsoil) Loose soil that is rich in organic material needed by plants, such as humus and nitrogen compounds

Horizon B (subsoil) Rich in minerals, such as iron and aluminum compounds, that were washed down from Horizon A by rainwater; Horizon B also contains humus and clays, the tiniest soil particles.

Horizon C Mostly pieces of weathered rock



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Kingdom

Soil horizons are home to a variety of living things. These include burrowing animals such as groundhogs and moles, and smaller animals such as snails, worms, ants, spiders, and centipedes. Many plants, fungi of all sizes, and microscopic bacteria and protists also live in soil.

Erosion and Deposition

Weathering breaks rocks into smaller pieces. These pieces can be swept away through **erosion**. Erosion takes away land in one place and builds land in another. When moving water, ice, wind, or gravity drops a load of Earth materials in a new place, it is called **deposition**.

Moving Water Rainwater running off land carries away sediment, leaving behind an eroded path called a gully. Over time, as water keeps flowing in the gully, it widens and deepens to form a stream or river. Great rivers, such as the Mississippi River, deposit the sediment they carry where they enter the ocean, forming a **delta**. Moving water affects sediment at the shore, too. Ocean waves and currents carry sand off one beach, and deposit it later on another beach somewhere else.

Streams are called by many names, such as creek, brook, and river. Scientists just use the term *stream*.



A gully forms where moving water erodes sediment.



Rivers slow down where they enter an ocean. The slower-moving water deposits sediments, forming a delta.

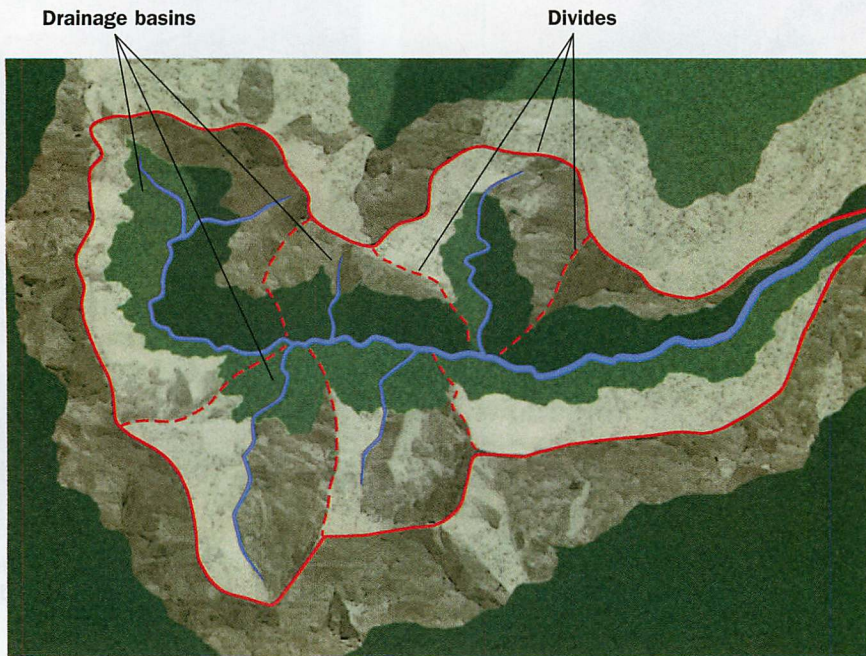
Ice Rivers and sheets of year-round ice called **glaciers** slowly move over land. As they travel, glaciers can move boulders the size of houses, as well as smaller sediments. Over time, the rocks and sediment carried by moving glaciers can carve or deepen valleys.

Wind Fast-moving wind can carry sand and dust that scour and weather the surfaces they strike. Wind erosion is greatest in dry areas, such as deserts, where there is little water to hold soil particles together or trees to block the wind's path. When the wind slows, it drops its load. This is how sand dunes are built.

Gravity Gravity is the underlying force of erosion and deposition. It causes water and glaciers to move downhill, and particles carried by water and wind to settle to a stream or lake bed and to the ground. Gravity can also directly cause erosion in the form of landslides and mudflows.

Divides and Drainage Basins

A **divide** is any line of high land where rainwater or snowmelt runs down one side or the other. A divide might cross a small hill or an entire mountain range.



This large drainage basin is made up of six smaller ones.