

Weathering

Causes and Results

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SUMMARY

Over time rocks are subjected to the forces of nature. This wears down the rock. There are a variety of forms of weathering that cause this break down.

Rocks break down over time

- Over time, earth's surface changes. This is due to how nature affects rocks.
- Weathering is the process that causes rocks to break apart. There are two types of weathering: mechanical (AKA disintegration) and chemical (AKA decomposition).

Mechanical weathering produces physical changes in rocks

- Mechanical weathering is the break down of rock through physical changes (without changing its chemical composition).
- Over time, each piece of rock will become smaller but still be the same chemically. The result is many small pieces from one large piece.
- There are five types of mechanical weathering: frost wedging, salt crystal growth, pressure release, abrasion, and biological activity. Each process breaks apart rock without changing the rock's composition.
 - **Frost Wedging** occurs when water enters the crack of a rock, freezes, and expands forcing the rock apart. It is most common in places where the temperature rises above and falls below the freezing point of water (0°C)
 - **Salt Crystal Growth** occurs when water containing salt enters the crack of a rock, evaporates, and the salt crystallizes forcing the rock apart. This process most commonly occurs near ocean shores. It can also happen in areas where salt is used to deice the roads in the winter.
 - **Pressure Release (unloading)** occurs when large masses of igneous rock are exposed by erosion and begin to break loose. Confining pressure is put on intrusive rocks. When that pressure is removed, the intrusive rock is able to come to the surface. At the surface the rock is peeled away much like the layers of an onion.
 - **Abrasion** occurs when water, rock, or other objects wear down a rock by friction. When one of these objects hits or scrapes against a rock, it can break off small pieces of the rock. Water is able to do this on its own. However, water usually carries particles of rocks that will cause the abrasion.
 - **Biological activity** occurs when a living thing breaks down rock. This includes plant roots growing into rock cracks and breaking the rock as the root expands. Some bacteria break down minerals for energy also causing weathering.

Chemical weathering changes the chemical composition of rocks

- Chemical weathering is the break down of a rock that changes its chemical composition.
- There are many ways chemical weathering can occur including dissolving and rusting.
- **Dissolving** occurs when a solution, such as carbonic acid (water and carbon dioxide), breaks down minerals in a rock. Dissolving is caused by:
 - **Water** is the most important factor in chemical weathering. Water is essential in the formation of acidic solutions to dissolve a rock.
 - **Carbon dioxide** is important in forming acid solutions as it lowers the pH of the water.
 - **Organisms** naturally secrete very weak acids that cause dissolving to occur.
- **Rusting** occurs when oxygen in the air reacts with chemicals found in a rock. The most common example is when oxygen reacts with iron forming iron oxide (rust).
- It is also important to know what causes dissolving and rusting to occur.

Weathering occurs at different rates

- Most weathering occurs over long periods of time. Other time it can occur quickly (within a matter of weeks).
- Three factors control how quickly or slowly a rock can weather:
- **Surface area** is how much of the rock's surface is exposed to the forces that cause a rock to weather.
 - The more of a rock that is exposed to air and water, the faster it weathers.
 - Mechanical weather tends to break a rock apart and increase the rock's surface area. This allows chemical weathering to break down the rock faster.
- **Rock composition** is the mineral content of a rock that affects the rate of weathering.
 - Rocks made of soft minerals will weather faster than those made of hard minerals.
 - Rocks made of minerals that react easily with acids will weather faster than those that do not.
 - Example: Granite, which consists of quartz, a hard mineral that does not easily react with acid, weathers very slowly. Compare this to limestone, which consists of calcite, a soft mineral that easily reacts with acid, will weather very quickly.
- **Climate** factors including temperature and moisture affect the rate at which a rock weathers.
 - Water is needed for chemical weathering to occur and heat speeds up chemical weathering. Therefore, chemical weathering occurs faster in hot, wet regions than it does in cold, dry regions.