Weathering

What is weathering? Weathering refers to the processes that impact how rocks change shape and wear down into smaller particles over time as they are exposed to a variety of environmental factors. These factors tend to fall under two categories: physical/mechanical or chemical.

Physical/mechanical weathering takes place without the aid of a chemical reaction. This type of weathering can occur in many different ways, such as: plants prying apart rocks with their roots (root wedging), water freezing in the cracks of rocks and prying them apart (frost wedging), cracking of rocks as pressure above them is released (exfoliation), and the scraping and wearing away of rock by other rock particles such as sand (abrasion). Chemical weathering is much more difficult to spot. As water in the atmosphere comes into contact with carbon dioxide, it forms a weak acid (carbonic acid) which falls to Earth. This weak acid can wear away surface rocks as the acid reacts with minerals within them. If carbonic acid infiltrates the ground and reaches bedrock, it can begin to wear away that as well. Rocks such as limestone (containing calcite) are most susceptible to this type of weathering. Water itself is also capable of dissolving bedrock such as rock salt (halite).

Two factors impact the rate of weathering: climate and bedrock type. Bedrock that contains harder minerals tends to be more resistant to physical weathering whereas softer minerals weather more easily. The type of bedrock (and its minerals) also dictates whether it will be susceptible to chemical weathering. In addition, warmer, wetter climates increase groundwater levels and chemical weathering while moist climates with variable temperatures and wind can increase physical weathering through frost wedging and abrasion.

Particle Shape

Rock particles subjected to mechanical weathering such as abrasion become smaller and more round with time. For example, if a rock breaks off from a cliff drops into a river, over time that rock will become smaller and rounder as sediments move past it in the river and gradually wear it down. This is the natural world’s equivalent of human sandpaper. The diagram below shows how particle shape changes over time. Eventually particles will become small enough that they dissolve as ions in the water of the river.
Types of Weathering

**Physical/Mechanical: Frost Wedging**

Frost wedging commonly occurs where daytime temperatures rise above the freezing point and nighttime temperatures dip below it. As water enters cracks in the rock, it freezes and expands, pushing the rock apart. The large image on the front page is of a rock that has been subjected to frost wedging.

**Physical/Mechanical: Abrasion**

Abrasion is common where wind-swept sand particles (such as in the desert) come into contact with rock. These particles can also be transported in a river. In either case, the collisions and subsequent scraping lead to abrasion. The picture on the bottom right is of cobbles that had been abraded in a river.

**Physical/Mechanical: Exfoliation**

Exfoliation occurs as pressure above a rock layer is released and that rock is uplifted. The picture on the bottom left is a good example of this type of physical weathering.

**Chemical: Acidic Rainwater/Groundwater**

Acidic rain and groundwater gradually wear away bedrock that contains minerals that react with acid. Since calcite is a mineral that reacts with acid, rocks containing calcite (such as limestone) begin to dissolve when exposed to even weak acids.

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**Cave Formation**

While beautiful, caves can ultimately be dangerous for humans. Often formed when acidic groundwater reacts with limestone, caves can form over hundreds or thousands of years. Caves are major tourist attractions but their formation comes with a risk: too little remaining bedrock on the ceilings of caves can lead to sinkholes that swallow homes.