

Weathering



What is weathering?

Rocks are different shapes and sizes because they are changed by the conditions in their environment.

The breakdown of rocks into smaller fragments is called **weathering**. Eventually the fragments become soil.

Can you think of anything that could cause weathering?

Rocks can be weathered by temperature change, water, frost and even plants and animals.



Types of weathering

There are three types of weathering:

- physical weathering
- biological weathering
- chemical weathering.



Which type of weathering is caused by each of these:

- temperature change
- acid rain
- plants and animals?



Physical weathering occurs when rock is broken down into smaller pieces by the effects of temperature and water.

- **Exfoliation weathering** (or 'onion-skin' weathering) is caused by very hot weather.
- **Freeze-thaw weathering** is caused by the melting and freezing of water.

Exfoliation and freeze-thaw weathering tend to occur in very different types of landscapes.

Which type of weathering do you think will primarily occur in the desert, and which will occur in the mountains?



Exfoliation weathering

Exfoliation weathering is common in very hot and dry places like Uluru (Ayers Rock) in Australia.

In these places the daytime temperature can rise above 40 °C.

While the inner layers of the rocks stay cool, the outer layers of rocks heat up and expand in the baking heat.



At night, when the temperature falls, the outer layers of rocks cool down again and contract. Eventually the repeated expansion and contraction of the rock causes the outer layers to peel like **an onion skin**.

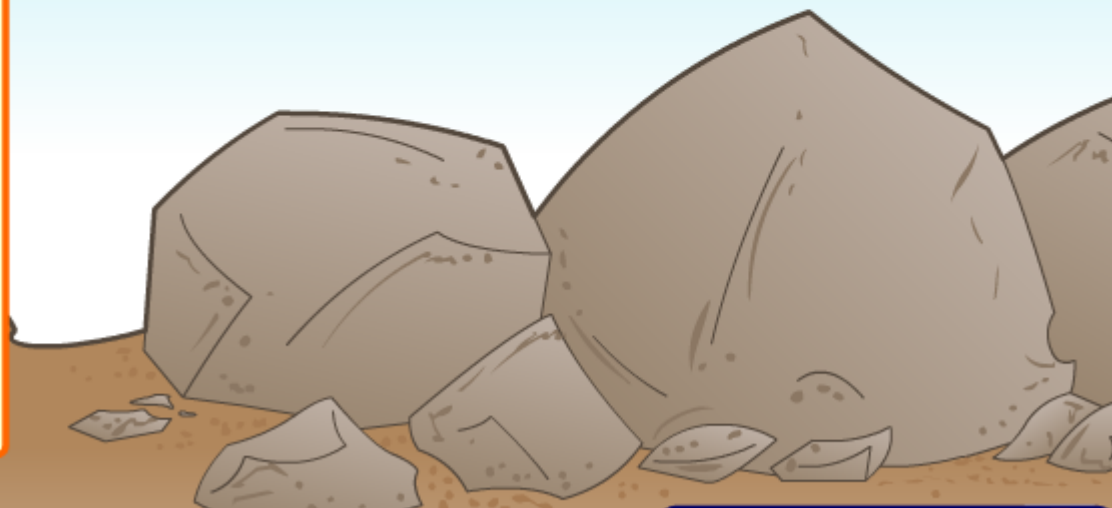


What is exfoliation weathering?

Exfoliation

weathering is the repeated heating and cooling of rock that causes the surface layers of the rock to flake off.

Click "**play**" to find out more.



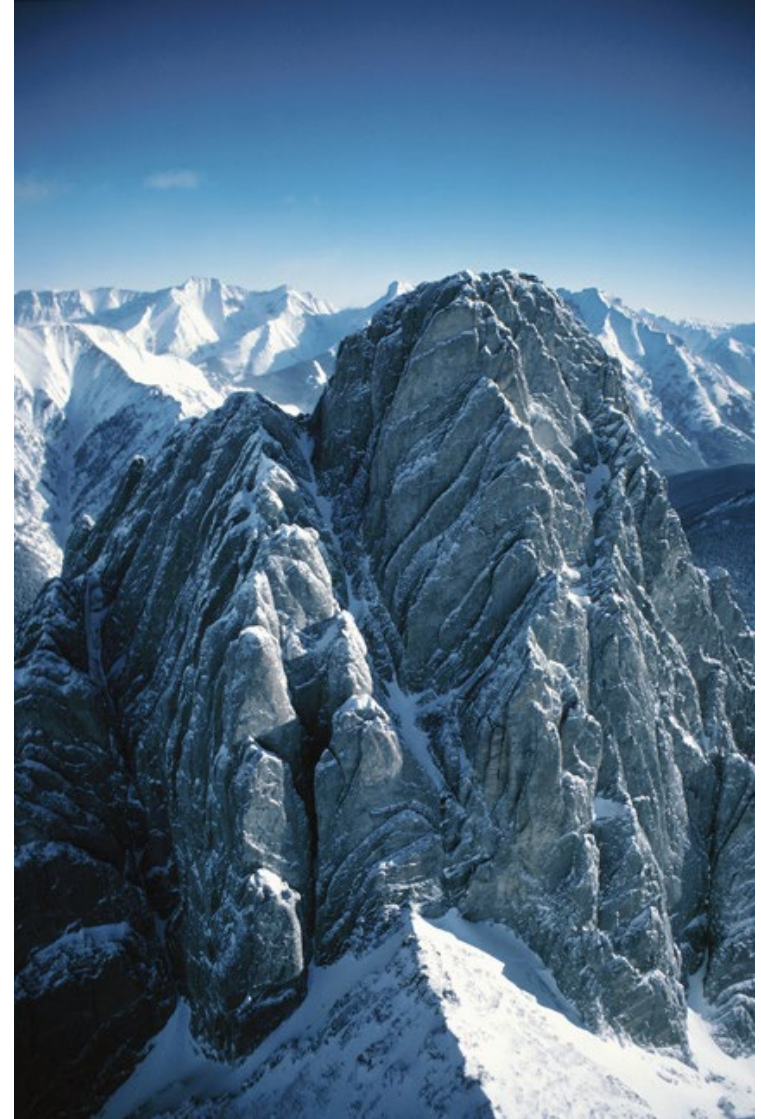
Freeze-thaw weathering

When rain water or melted snow seeps into the cracks in a rock and freezes, it can force the crack to expand.

When the ice thaws, the rock contracts and the water moves deeper into the crack. Later, when the water refreezes, the crack widens again.

Over time the crack widens until the piece of rock breaks apart.

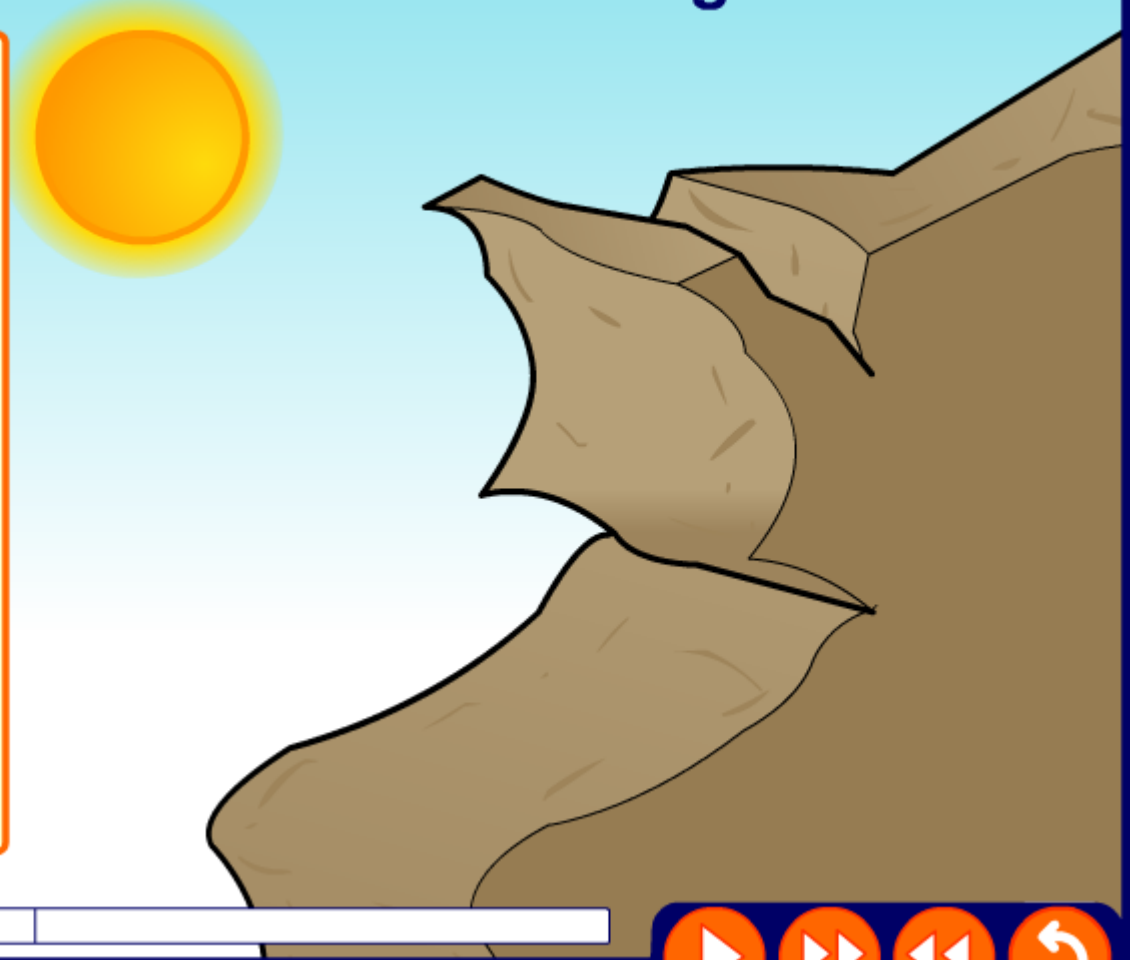
This slow cycle is called **freeze-thaw** weathering.



What is freeze-thaw weathering?

During the freeze-thaw process, rocks exposed to the weather undergo physical changes and break apart.

Click "**play**" to find out more.



How can freezing water cause damage?

You can see freeze-thaw weathering in action if you leave a bottle full of water in the freezer for too long.



The water inside the bottle expands as it freezes.

The ice that is formed creates huge forces on the bottle, which then cause it to break!

Because water expands as it freezes it can create immense pressure in confined spaces. Does this explain why water pipes often burst in the winter?



Biological weathering – plants

Have you ever seen plants growing in the cracks of sidewalk, a wall or rock? This happens because plants often use the wind to spread out their seeds.

When a seed falls into a crack it quickly germinates because of the moist and sheltered conditions.

However, as the seedling and its roots grow, they put pressure on the crack, causing it to become deeper and/or wider.



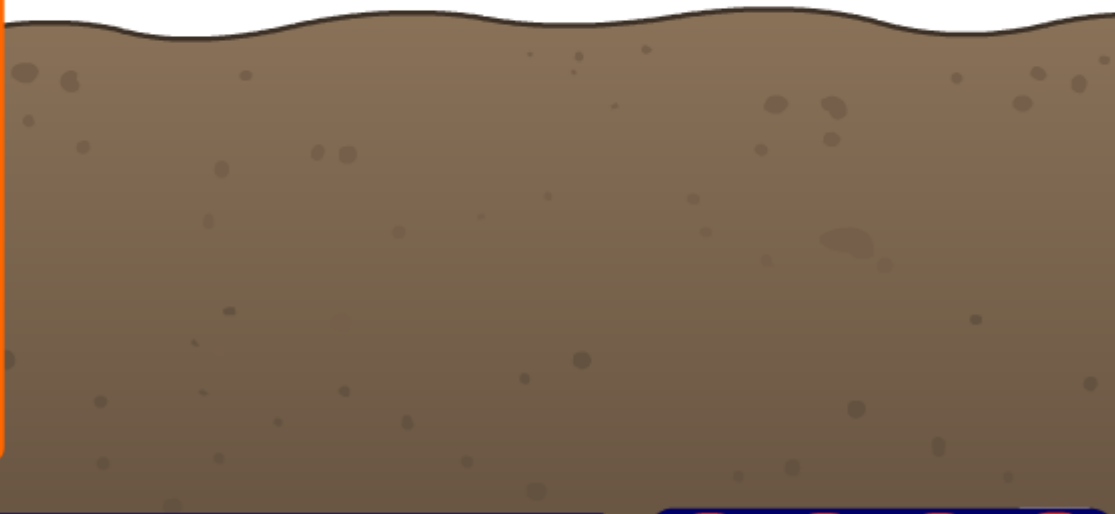
Plants like ivy cause similar damage because they cling to buildings by root systems that penetrate cracks between bricks.



How does biological weathering work?

Biological weathering is the disintegration of rock due to the actions of organisms such as bacteria, plants and animals.

Click "**play**" to find out more.



Biological weathering – microorganisms

Lichen are a combination of algae and fungi that live together like a single organism.

Each organism provides resources that the other benefits from. For example, while the fungus provides shelter for the alga, the alga uses sunlight to make energy, which it shares with the fungus.

Lichen slowly break down rocks at the molecular level, using the minerals released from the stone as nutrients.



Animals and weathering

Many types of animals, such as rabbits and moles, dig holes to look for food, or to create burrows for shelter.

If an animal digs into a crack in a rock it can cause it to shatter, split and break. The rock is then vulnerable to the freeze-thaw process and weathering by plants.



When an animal burrows it can also bring buried material to the surface, exposing it to weathering.

Rock can also be weathered by animals scratching it with their hooves or teeth while grazing.



What is chemical weathering?

Slow chemical weathering

- Rainwater is naturally a weak acid because carbon dioxide in the air reacts with rainwater to form carbonic acid.
- This weakly acidic rain reacts with minerals in rocks and slowly wears them away.

Rapid chemical weathering

- The burning of fossil fuels produces oxides of sulphur and nitrogen, which make rainwater more acidic.
- Acid rain reacts quickly with minerals, so the rocks get weathered more rapidly.



Examples of chemical weathering

How has chemical weathering affected these rocks?



Which type of weathering?

Which type of weathering is likely in each situation?

- 1 A rock sitting on an alpine mountain ▼
- 2 A seedling growing in the cracks between paving slabs ▼
- 3 A rock sitting on a sand dune in the desert ▼
- 4 A mole digging a burrow ▲
- 5 Acid rain falling on a headstone in a cemetery ▲



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