

Weathering Gizmo

Vocabulary: abrasion, chemical weathering, clay formation, climate, dissolving, frost wedging, granite, limestone, mechanical weathering, rusting, sandstone, shale, weathering

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
Compare the two pictures at right. Both pictures show the same kind of rock, granite.

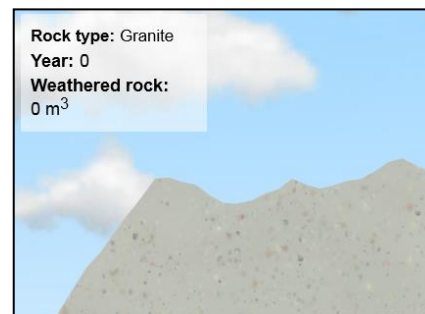
- Which rock do you think has been exposed on Earth's surface longer?
- Why do you think so?



Gizmo Warm-up

When rocks are exposed on Earth's surface, they are gradually broken down into soil by the actions of rain, ice, wind, and living organisms. This process is called **weathering**. To begin, select the SIMULATION tab. Notice the selected **Rock type** is **Granite**, a hard, dense rock.

- Click **Play** (▶). Wait for about 5,000 simulated years, and click **Pause** (⏸).
What do you notice?
- Click **Fastplay** (⏩). Wait for about 50,000 simulated years. What do you notice?
- Based on your observations, is weathering a fast or slow process?



<p>Activity A:</p> <p>Types of weathering</p>	<p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> Select the ANIMATION tab. Check that Frost wedging is selected. 	
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Introduction: **Mechanical weathering** occurs when rocks are physically broken or worn down. **Chemical weathering** occurs when the minerals in the rock are changed by chemical reactions.

Question: What are the most common ways in which weathering occurs?

- Observe: Read the text about **frost wedging**, then click **Play**.
 - In the process of frost wedging, how does ice cause cracks in rocks to become larger?
 - Is frost wedging more important in a warm or a cold climate?

2. Observe: Read about and look at the animations for the other major types of weathering: **Abrasion**, **Pressure release**, **Dissolving**, **Clay formation**, and **Rusting**.

A. What are three different ways that rocks can be worn down by **abrasion**?

B. How can a large block of granite form layers like an onion?

C. What type of rock is affected by **dissolving**, and what features result?

D. How does **clay formation** affect a rock?

E. Which part of a rock will undergo **rusting**?

3. Fill in: Scientists use the terms “oxidation,” “carbonation,” “hydrolysis,” and “exfoliation” for different types of weathering. Fill in each blank with the appropriate term.

Pressure release: _____

Dissolution: _____

Clay formation: _____

Rusting: _____

4. Observe: Select **Other**. Read the descriptions of each type of weathering, then match each to its description below:

_____ Salt weathering

A. Weathering from chemicals produced by colonies of algae and fungi.

_____ Heat expansion

B. Weathering that occurs when crystals grow.

_____ Root weathering

C. Weathering caused by the growth of trees.

_____ Lichen growth

D. Weathering common in desert climates.

5. Interpret: Based on the descriptions and images, guess which type of weathering is shown by each of the images below. Explain each answer.

“Honeycomb” rocks in Spain

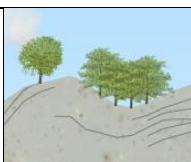


Stalactites in South Dakota



Split rock in Scotland



Activity B: Weathering of different rocks	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> On the Simulation tab, click Reset (↺). Set the Average temperature to 25 °C and Precipitation to 250 cm/yr. 	
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Introduction: The *Weathering* Gizmo lets you explore weathering of four common rocks. **Granite** is a very hard rock formed from the crystallization of magma deep underground. **Sandstone** forms when sand grains become cemented together. **Limestone** is formed from ancient corals, shells and skeletons. **Shale** is formed from compacted mud.

Question: How does weathering affect different rock types?

1. Observe: Below **Rock type**, select **Granite**. Click **Fastplay** and run a simulation of about 100,000 years.
 - A. Describe what you see:

 - B. Look at **Weathered rock** above the outcrop. How much rock was weathered?

- C. Observe: Click **Reset** (↺). Repeat the same procedure for **Sandstone**, **Limestone**, and **Shale**. Watch what happens over 50,000 years. Then, list the amount of weathered rock for each type, and describe your observations.

Sandstone

- Weathered rock:
- Observations:

Limestone

- Weathered rock:
- Observations:

Shale

- Weathered rock:
- Observations:

- D. Compare: Compare the results of weathering of different landscapes:
 - Which rock types tend to weather into rounded shapes? _____
 - Which rock weathers into caves and lumpy hills? _____
 - Which rock weathers most quickly? _____ Most slowly? _____

- E. Observe: Click **Reset**. Select **Granite** and click **Fastplay**. Run the simulation until you can see large cracks forming in the rock. (This may take a while, be patient!)

What type of weathering forms these cracks? _____

(Hint: You may need to review the different types of weathering on the ANIMATION tab.)

F. Infer: Some types of weathering only affect certain kinds of rocks. The **Types of weathering** that apply to each kind of rock are listed above the outcrop. If a type of weathering does not affect the selected rock, it is faded.

Select each rock and list the types of weathering that affect it.

Granite: _____

Shale*: _____

Limestone: _____

Sandstone*: _____

* *Note: Sandstones are only affected by clay formation when they contain minerals other than quartz. Sandstones that are pure quartz do not form any clay.*

G. Interpret: Based on the weathering patterns, guess the rock type shown in each photo.









<p>Activity C: Weathering rates</p>	<p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> • On the Simulation tab, select Sandstone. • Check that Frost wedging, Clay formation, and Other are all selected. 	
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Question: How does the climate and rock type affect how quickly a rock weathers?

- 1) Adjust the temperature up and down to see the effects on weathering. Describe the relationship between the two.
- 2) Adjust the precipitation up and down to see the effects on weathering. Describe the relationship between the two.
- 3) What combination of settings AND which rock give you the greatest amount of weathering? Why do you think this is?