

Lesson 16: Weathering and Soils

Summary

This module is aimed at helping students understand the patterns and drivers of weathering and the formation of soils on Earth and Mars.

Learning Goals

Students will be able to:

- Differentiate, in photos, between mechanical and chemical weathering processes on Mars & Earth
- Discern, in hand sample, weathered vs. non/lesser weathered material
- Recognize and discern a soil and define soil-forming factors
- Critique the presence of “soil” observations on Mars

Context for Use

It is advisable that students are familiar with basic lithology and mineralogy to be successful in these activities and homework sets.

Description and Teaching Materials

In-Class Activity

In-Class Activity 1: Break a Rock!
(need rocks, hammers, and handlenses)

In-Class Activity 2: Is it a Soil?

Homework/Lab

Homework 1: Chemical vs. Mechanical

2. For In-Class Activity 1 conduct the exercise in a lab environment and/or outside

Assessment

Methods of assessment are within each individual *In-Class Activity* and *Homework*.

Teaching Notes and Tips

1. Depending on class size, samples for every student would be advisable to proceed with In-Class Activity 1. With classes size >20 or more students, simply provide a demonstration and have students record the methods and outcomes of what they are observing

Mars for Earthlings

References and Resources:

1. Image File: [Weathering and Soils](#)
2. This NASA webpage has a search function for many images related to weathering.
<http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA12994>
e.g. the word "soil" will pull up images of both Earth and Mars
3. Mars "blueberries" spherules NASA announcement:
http://www.nasa.gov/mission_pages/mer/multimedia/pia16139.html



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In-Class Activity 1

Weathering & Patterned Ground_MFE

Break a Rock!

Purpose:

Determine how the physical breakdown of rocks leads to increased rates of weathering and erosion.

Preparation:

Depending on class size the following is need for each student or team of students:

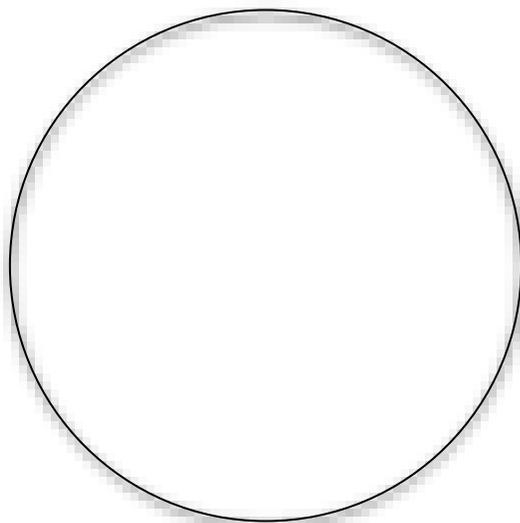
1. Rock hammers
2. Rocks (Geodes would be nice! Otherwise a rock with a weathering rind is good.)
3. Hand lens if possible, but not necessary

Engage

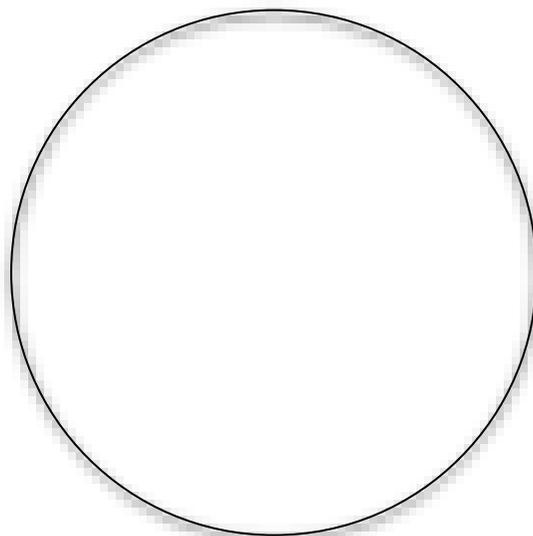
Use the rock hammer and rock provided by your instructor. Break the rock in such a manner that the students can see “the middle” of the rock.

Explore

Have students make a sketch in each circle below of the outside vs. inside of the rock (respectively). Students should note color changes, sizes of crystals, any mottling etc. Be as observant as possible. Also, they provide some sort of scale to understand the relative sizes of sketches.



Outside
Scale:



Inside
Scale:

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Mechanical vs. Chemical Weathering

Consider the sketches, do students see evidence for mechanical weathering and/or chemical weathering? Please list them.

Explain

- The rates of weathering depend on a number of factors, from climate to grain size of the weathered lithology. Help students to recognize these different factors and perhaps what is most influential.
- Have students try to recognize weathered vs. non-weathered material and how it appears in hand sample.

Elaborate

1. Do you think smaller features will experience higher rates of weathering? Why or why not? What determines the “rate”?
2. Considering Figure 1, would the concept “the smaller the better” apply here? Why or why not? Note the scale in the caption.
3. Have students find an internet image of the weathered accumulations of these “blueberries” from other Opportunity explorations and explain what that that means about how an outcrop would erode over time.



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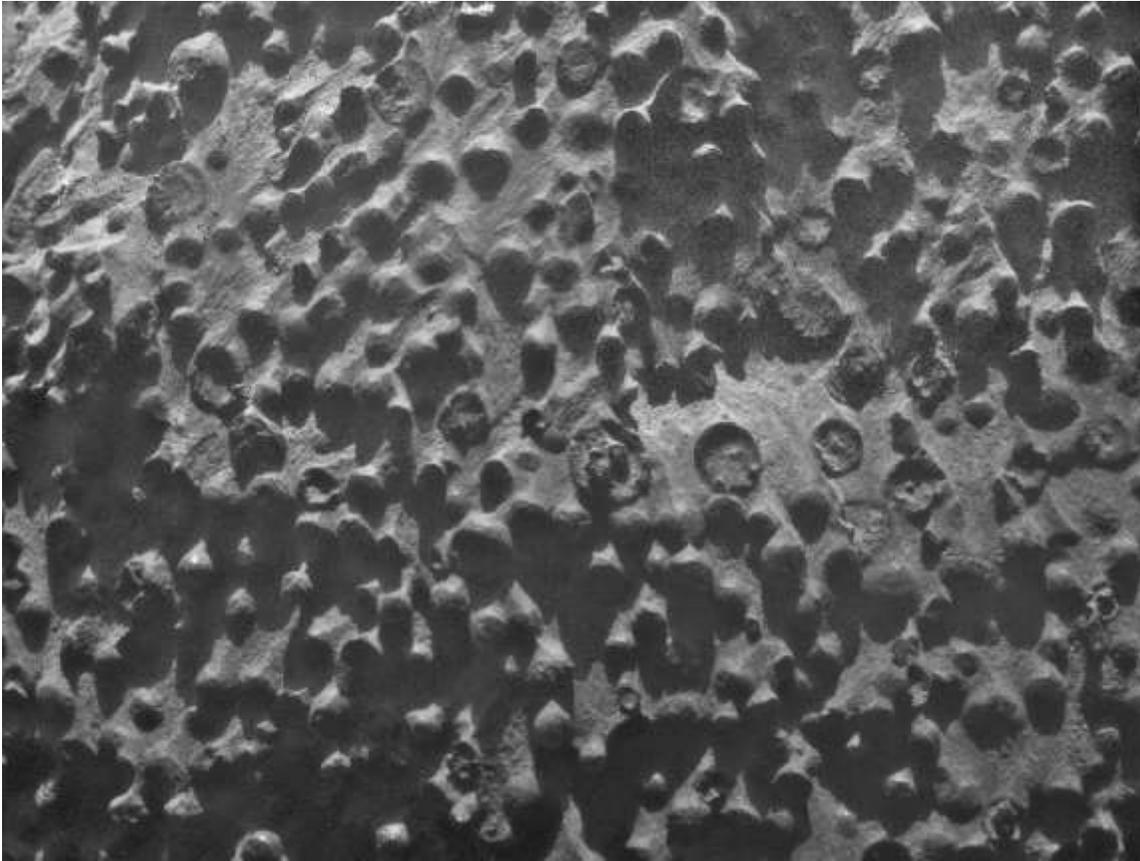


Figure 1: Image taken by rover Opportunity at Endeavor Crater: The view covers an area about 2.4 inches (6 centimeters) across, at an outcrop called "Kirkwood" in the Cape York segment of the western rim of Endeavour Crater. The individual spherules are up to about one-eighth inch (3 millimeters) in diameter. Image Credit: NASA/JPL-Caltech/Cornell Univ./ USGS/Modesto Junior College.

Evaluate

Ask students to list the most important factors in the rate of weathering (name 3 factors).

- 1.
- 2.
- 3.