

Rates of Weathering

Objectives

- **Explain** how the composition of rock affects the rate of weathering.
- **Describe** how a rock's total surface area affects the rate at which the rock weathers.
- **Describe** how differences in elevation and climate affect the rate of weathering.

I. Differential Weathering

A. What Is Differential Weathering? Differential weathering is a process by which softer, less weather resistant rocks wear away and leave harder, more weather resistant rocks behind.



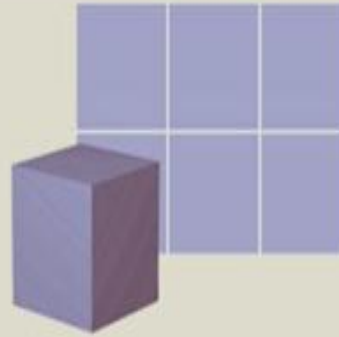
You can see a marked difference between the weathering styles of shale (marked with arrows) and sandstone. The shale is much less stable, and is easier to erode away. As a result, the shale layers are recessed into the face of the outcrop. The sandstone layers are enriched in the mineral quartz, which is very stable at Earth-surface conditions. The quartz-rich sandstone is therefore more resistant to erosion. Because it is tougher, it stands out in high relief on the face of the outcrop.

II. The Shape of Rocks

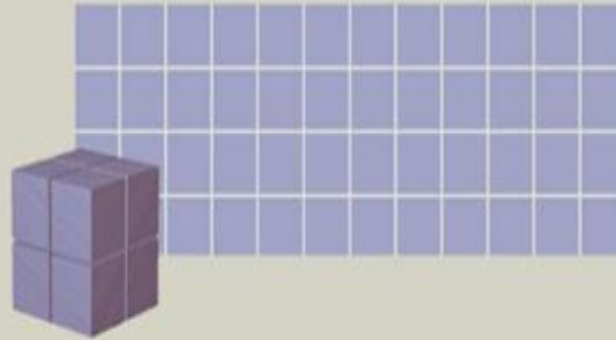
A. What Is Differential Weathering?

Weathering takes place on the outer surface of rocks.

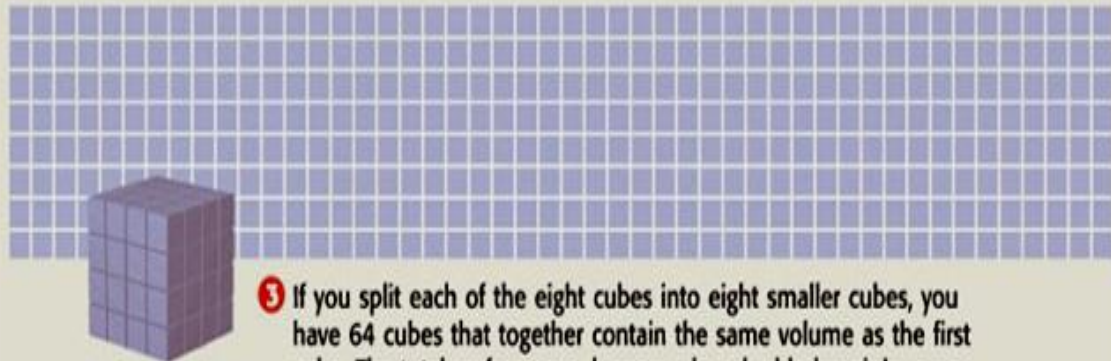
Therefore, the more surface area that is exposed to weathering, the faster the rock will be worn.



- ① All cubes have both volume and surface area. The total surface area is equal to the sum of the areas of each of the six sides, or the length multiplied by the width.



- ② If you split the first cube into eight smaller cubes, you have the same amount of material (volume), but the surface area doubles.



- ③ If you split each of the eight cubes into eight smaller cubes, you have 64 cubes that together contain the same volume as the first cube. The total surface area, however, has doubled again!

III. Weathering and Climate

- A. Climate Matters** The rate of weathering in an area is greatly affected by the climate of that area.
- B. Temperature and Water** The rate of chemical weathering happens faster in warm, humid climates. Water also increases the rate of mechanical weathering. Temperature is another major factor in mechanical weathering. The more often temperatures cause freezing and thawing, the more often ice wedging takes place.



IV. Weathering and Elevation

A. High Elevations Increases Weathering The rate of weathering happens on mountains in the same way it does everywhere else. However, rocks at higher elevations, are exposed to more wind, rain, and ice than the rocks at lower elevations are. This increase in wind, rain, and ice at higher elevations causes the peaks of mountains to weather faster.



B. Gravity Gravity affects weathering, too. The steepness of mountain slopes increases the effects of mechanical and chemical weathering.

Critical Thinking Time

1. Do different types of rocks weather at different rates?
2. Does chemical weathering affect the rate of mechanical weathering?
3. What factors contribute to accelerated weathering rates at high elevations?
4. Why does the peak of a mountain weather faster than the rocks at the bottom of the mountain?
5. Does the rate of chemical weathering increase or stay the same when a rock becomes more mechanically weathered? Why?