

Weathering, Soil, & Mass Movements

Chapter 5

5.1 Weathering

Weathering: the breaking down and changing of rocks at or near the Earth's surface.

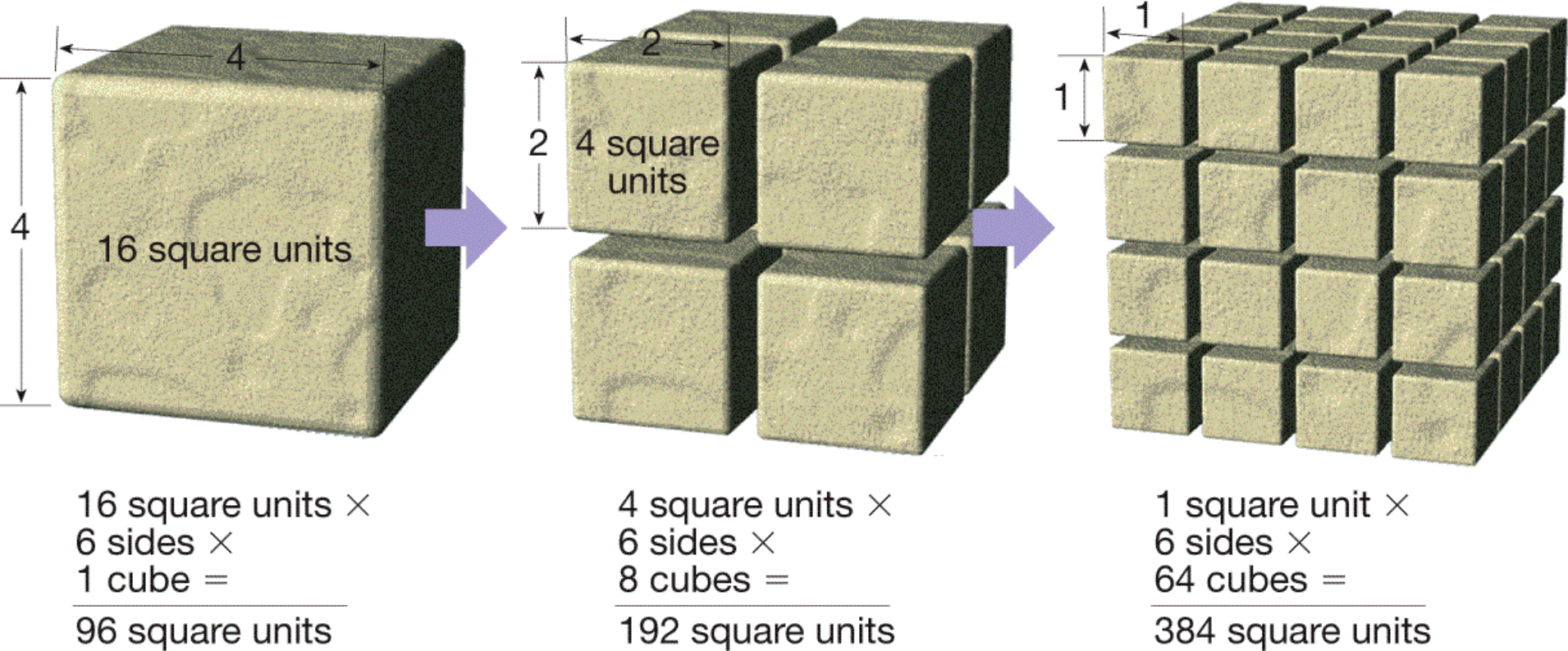
- Basic part of the rock cycle.
- 2 main types:
 1. **Mechanical Weathering**
 2. **Chemical Weathering**

5.1 Mechanical Weathering

Mechanical Weathering

- Occurs when physical forces break rock into smaller and smaller pieces *without* changing the rock's mineral composition.
 - Breaking a rock into smaller pieces increases total surface area of the rock.
 - More surface area = more area exposed to chemical weathering.

5.1 Mechanical Weathering



5.1 Mechanical Weathering

Mechanical Weathering

- There are 3 physical processes that cause mechanical weathering:
 1. **Frost wedging**
 2. **Unloading**
 3. **Biological activity**

5.1 Mechanical Weathering

Frost Wedging

- When liquid freezes, it expands (~9%)
- Expansion pushes force outwards – strong enough force to burst pipes in winter.
- In nature, water between cracks in rock freezes and expands; enlarges the cracks (frost wedging)
- Common in mountain regions in middle latitudes.



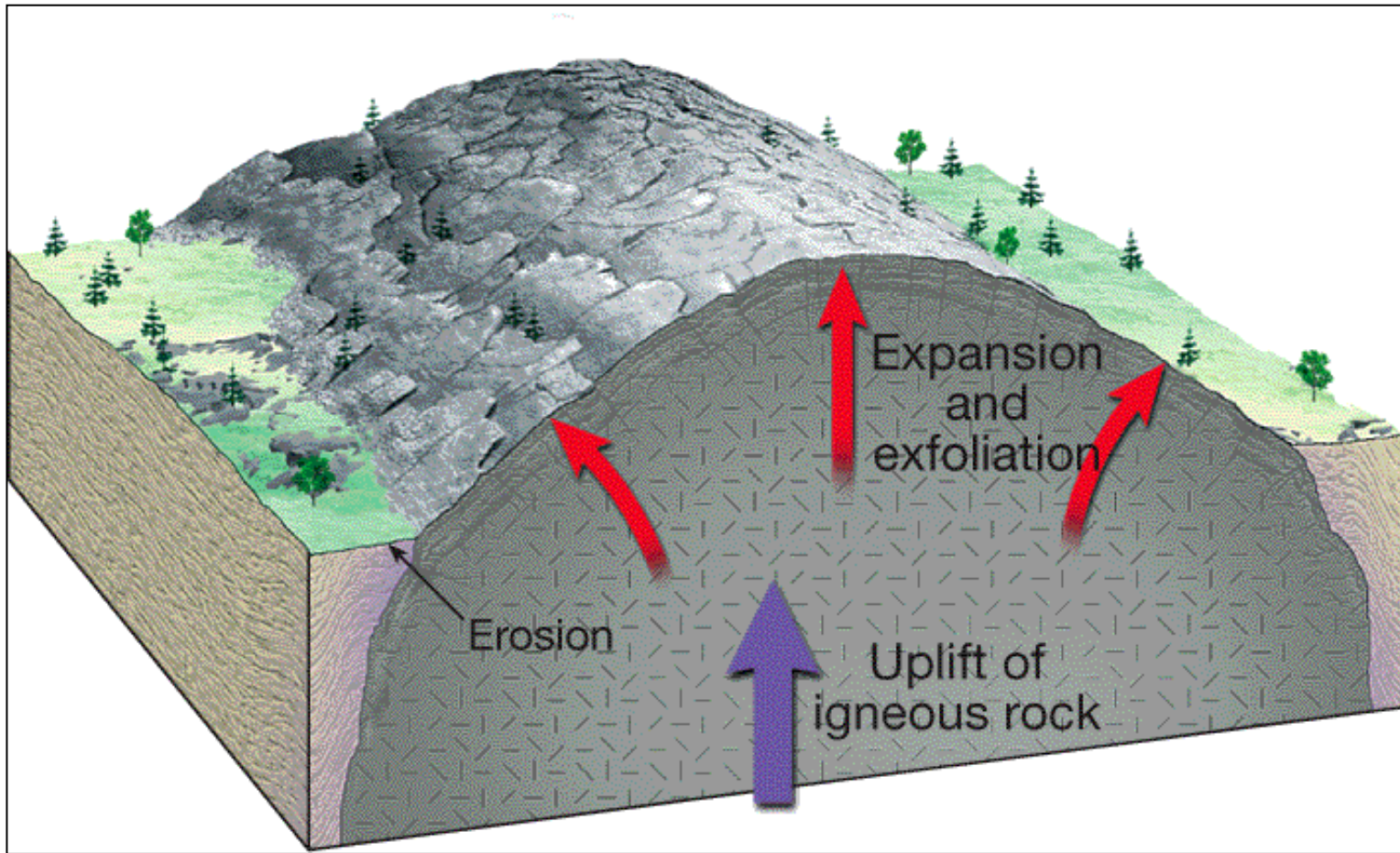
5.1 Mechanical Weathering

Unloading

- Igneous rock can be exposed when rocks overtop of it uplift and erode; this relieves pressure.
- Unloading causes outer layers of rock to expand more than the rock below.
- Exfoliation is when outer layers of rock separate and break loose.
 - Can result in large, dome-shaped rock formations.



5.1 Mechanical Weathering



5.1 Mechanical Weathering

Biological Activity

- The activity of organisms, including plants, burrowing animals, and humans, can also cause mechanical weathering.
- Plants grow roots into cracks in rocks – this wedges rocks apart.
- Burrowing animals move rocks to the surface where there is more weathering.
- Deforestation by humans speeds up weathering.



5.1 Chemical Weathering

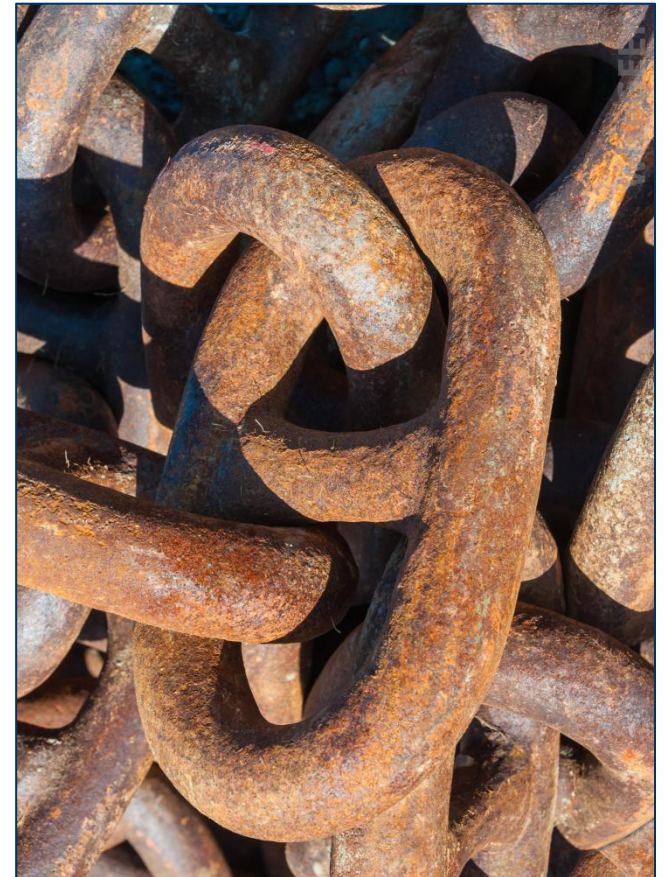
Chemical Weathering

- Occurs when rock is transformed into one or more new compounds.
 - New compounds stay unchanged, as long as they stay in the same environment.
 - Burning paper changes its chemical composition (releases CO₂) = chemical weathering.

5.1 Chemical Weathering

Chemical Weathering

- Water is the most important agent of chemical weathering.
 - Absorbs gases from the atmosphere and the ground – chemically react with minerals.
 - Oxygen dissolved in water reacts easily and forms oxides (ex. Iron oxide – rust that forms on iron)



5.1 Chemical Weathering

Chemical Weathering

- Water absorbs carbon dioxide when rain falls or from the ground (decaying organisms)
- Carbon dioxide dissolved in water forms carbonic acid (weak acid)



5.1 Chemical Weathering

Chemical Weathering

- Water absorbs sulfur oxides and nitrogen oxides (produced by burning coal)
- Major cause of acid rain.
- Acid rain speeds up chemical weathering of stone structures.



5.1 Chemical Weathering

Chemical weathering of granite

- Granite is made up of quartz and feldspar.
- Carbonic acid weathers granite by changing feldspar to clay minerals.
- Quartz does not change but get released from the granite into rivers.
- Main part of sand dunes and beaches.



5.1 Chemical Weathering

Chemical weathering of silicates

- Makes iron oxides and clay.

Spheroidal weathering

- Causes the corners of rocks to be rounded.



5.1 Rate of Weathering

Mechanical weathering affects how quickly chemical weathering happens.

- When rocks are broken into smaller pieces, there is more rock surface exposed to chemical weathering.

2 factors affect how quickly weathering happens:

1. Rock characteristics

- Mineral composition and physical features

2. Climate

- Temperature and moisture have a strong effect on weathering.

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at or near the Earth's surface.

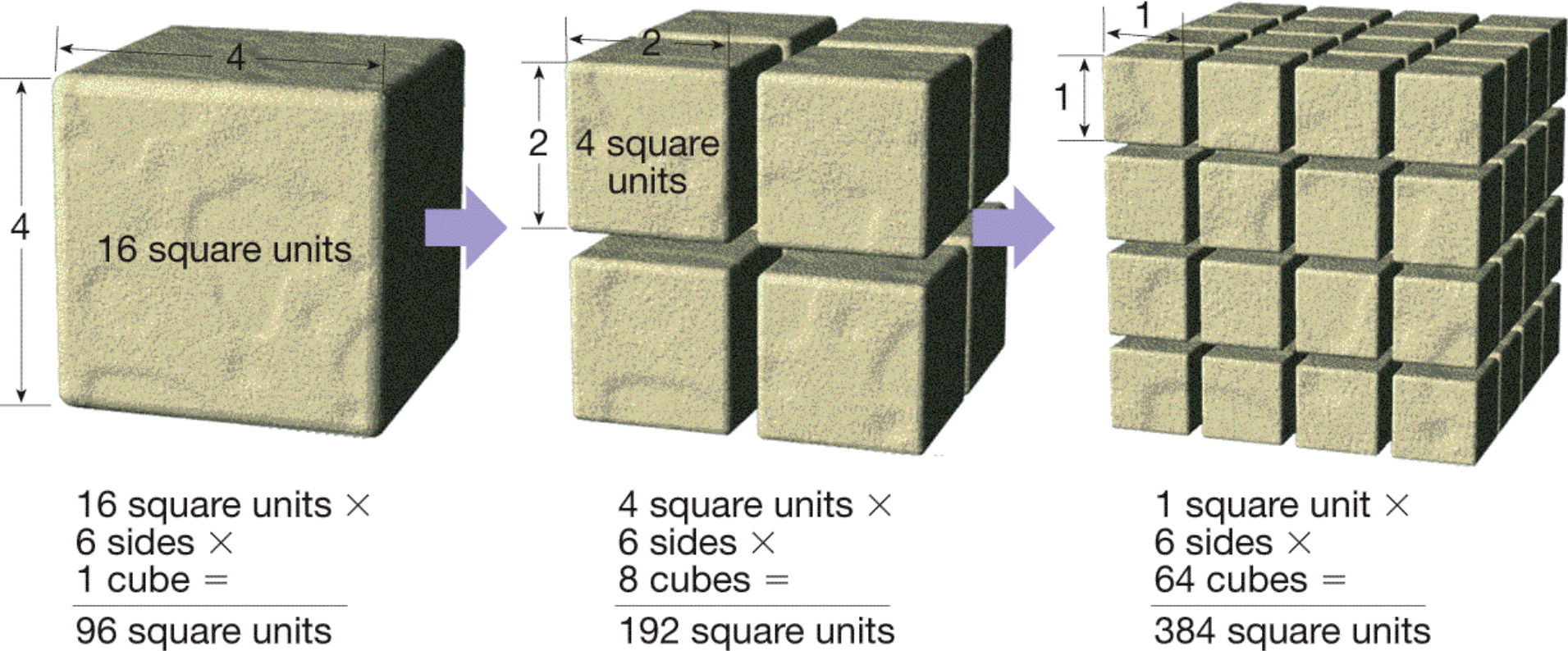
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Mechanical Weathering

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 - Breaking a rock into smaller pieces _____.
 - More surface area = _____ to chemical weathering.

5.1 Mechanical Weathering



5.1 Mechanical Weathering

Mechanical Weathering

- There are _____ that cause mechanical weathering:
 - 1. Frost wedging**
 - 2. Unloading**
 - 3. Biological activity**

5.1 Mechanical Weathering

Frost Wedging

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_____ (~9%)
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_____ – strong enough
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- In nature, _____
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enlarges the cracks (frost wedging)
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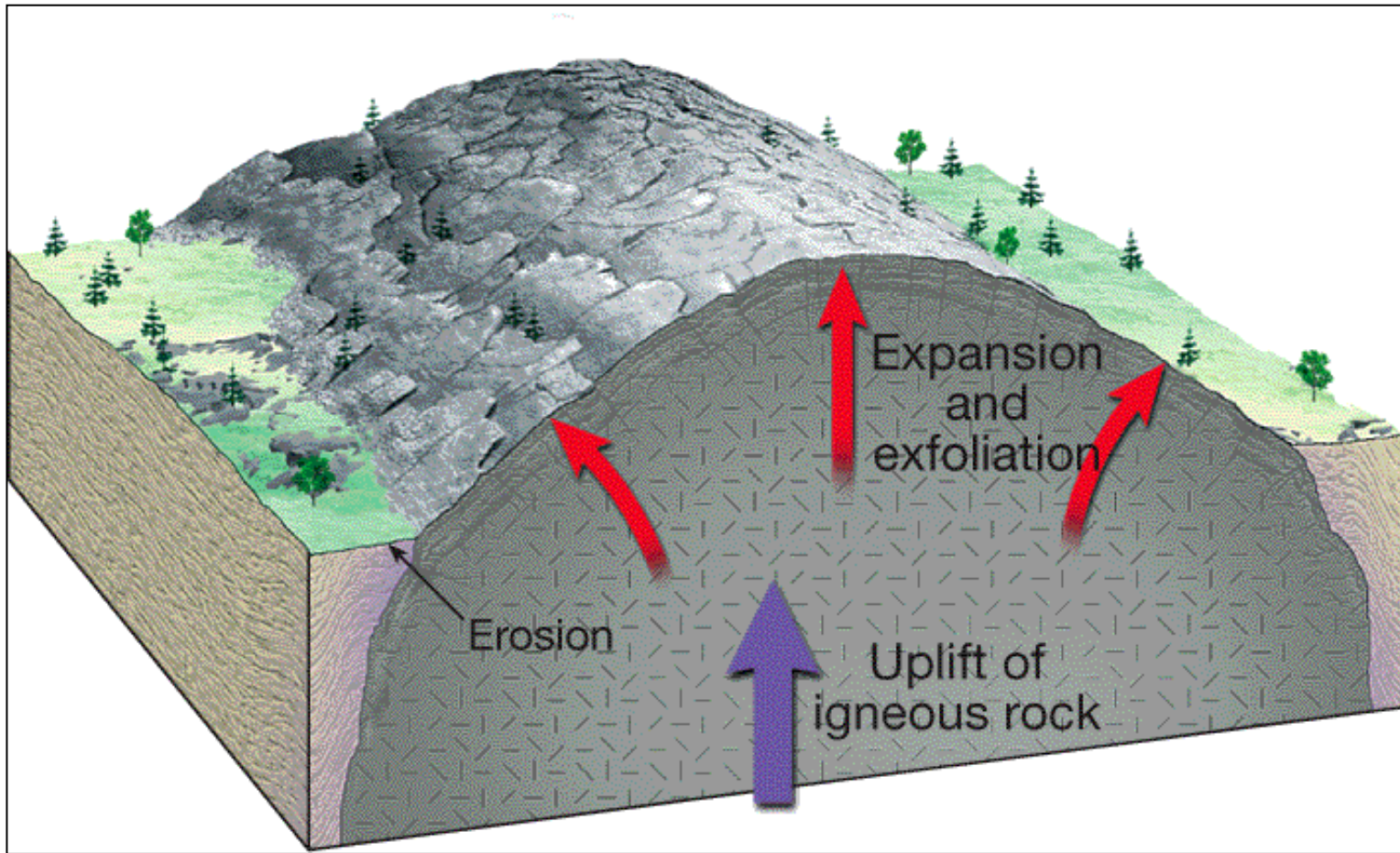
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- _____ by humans speeds up weathering.



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Chemical Weathering

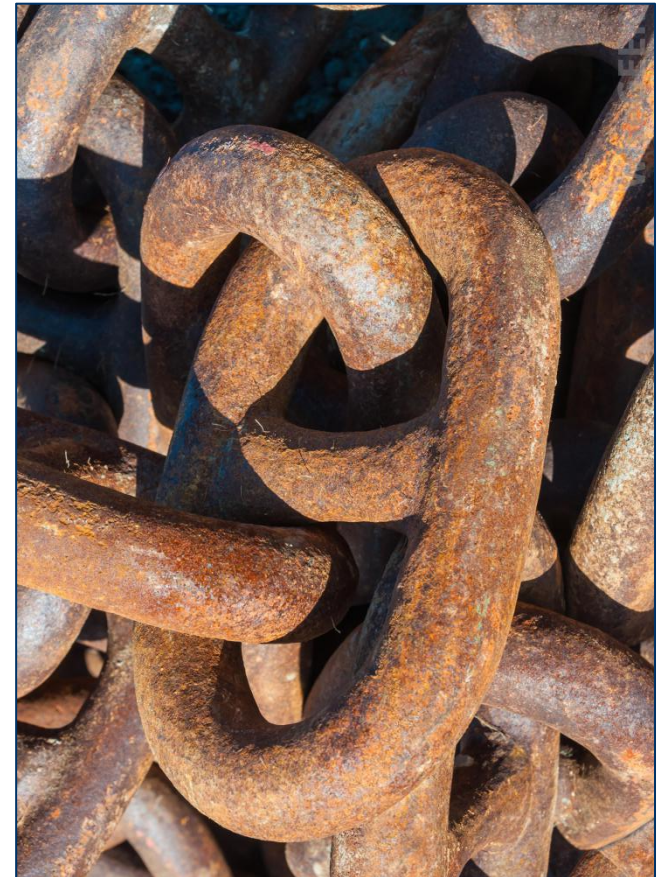
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- Acid rain _____ of _____ of stone structures.



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