

# WEATHERING

In this lesson you will:

1.2.1 Distinguish between the terms physical weathering and chemical weathering. (k)

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# Weathering vs. Erosion

- **Weathering** is the breakdown of rock and minerals.
- **Erosion** is a two-part process that starts with:
  - (1) the **breakdown of land** (weathering) and also includes the **movement** (transportation) of these weathered materials and is followed by
  - (2) **Deposition** of the eroded material occurs when it is dropped in a new location

# Denudation

- Refers to the **wearing down or smoothing off** of land features.
- The processes of weathering and erosion are **denudational**.
- They are also **gradational** because they grade the earth's surface.

# Physical Weathering vs. Chemical Weathering

- **Physical weathering** is the breakdown of rock and minerals by mechanical stress
- **Chemical weathering** breaks down rock with chemical reactions often including water.

# Physical Weathering

In this lesson you will:

- 1.2.2 Describe the mechanical processes by which physical weathering occurs. (k)

# Types of Physical Weathering

- Frost fracture
- Heat expansion
- Plant growth
- Burrowing animals
- Exfoliation

# Physical Weathering

- 1. **Frost fracture:** the expansion of freezing water that causes rocks to crack.



# Frost fracture

- Since water expands as it turns into ice, the cracks are wedged further open each time the temperature goes below the freezing point. Eventually the rock breaks apart.
- Rocks can also be wedged apart by clay which expands when it gets wet.



# Physical Weathering

- **2. Heat expansion:** rocks can expand and subsequently fracture.



# Physical Weathering

- **3. Plant growth:** expansion due to root growth as shown in the picture below.



# Physical Weathering

- 4. **Burrowing animals:** tunnelling animals can increase the size of existing cracks





# Physical Weathering

- **5. Exfoliation:** as internal pressure is released from certain rocks, it can cause layers to split and fall off.



# Environmental Affects on Physical Weathering

In this lesson you will:

- 1.2.4 Infer how the relationship between environmental conditions and the rate of physical and chemical weathering. (a)

# Environmental Affects on Physical Weathering

- **Fast temperature changes** like those that occur in the desert (hot during the day, cold during the night) increases the amount of physical weathering due to heat expansion.
- Oppositely, regions like the tropics where there is little temperature change the amount of physical weathering due to heat expansion is minimal.

# Environmental Affects on Physical Weathering

- Plenty of precipitation combined with alternating freezing/thawing temperatures increases the amount of frost fracture (Newfoundland would be a good place for this to take place).
- Oppositely, in parts of the world where both of these climatic conditions are not found, we see little frost fracture (this would be the case in tropical areas of the world).

# Environmental Affects on Physical Weathering

- Running water increases physical erosion as friction occurs between water and rock.





# Environmental Affects on Physical Weathering

- Ocean waves cause hydraulic pressure and abrasion on the shore, leading to physical weathering.



# Chemical Weathering

In this lesson you will:

- 1.2.3 Describe the main interactions that result in chemical weathering. (k)

# Chemical Weathering

- **Chemical weathering** is the breakdown of rocks and minerals by chemical reactions and usually involves the action of rainwater.



# Types of Chemical Weathering

- There are three different types of chemical weathering :
  - Formation of solutions
  - Hydrolysis
  - Oxidation

# Types of Chemical Weathering

- 1. Solution Formation:** As rainwater absorbs  $\text{CO}_2$  (carbon dioxide),  $\text{SO}_2$  (sulfur dioxide), and other chemicals from the atmosphere along with organic acids from the soil, they form solutions that react with rock and minerals, causing some to dissolve and move away.

# Types of Chemical Weathering

2. **Hydrolysis:** Like the first process, this involves the minerals in solution. In this case, carbonic acid reacts with silicates in some rocks leaving a soft clay from which potassium, sodium and magnesium are subsequently **leached**.
  - Coffee makers use the same idea. Hot water is poured over the coffee grounds. Some of the contents dissolve in the water and are carried down through the filter and into the cup.

# Types of Chemical Weathering

3. **Oxidation:** The reaction of **metallic minerals** to oxygen (mainly in water). This results in the formation of **oxides**, which tend to be softer than the original mineral.

For example, rust on iron.



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# Chemical Weathering

In this lesson you will:

- 1.2.4 Infer how the relationship between environmental conditions and the rate of physical and chemical weathering. (a)



# How Environmental Conditions Affect Chemical Weathering

- A. Heavy rain, running water and abundance of water increases the amount of dissolving that occurs.
- B. Oppositely, less water leads to less dissolving.

# Heavy rain...leads to mud slides



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C. High temperatures will increase the rate of chemical reactions. It is a fact of chemistry that heat increases the speed of many reactions like oxidation.

D. Ocean water contains salt which can increase the rate of many reactions like oxidation.

# Climatic extremes

