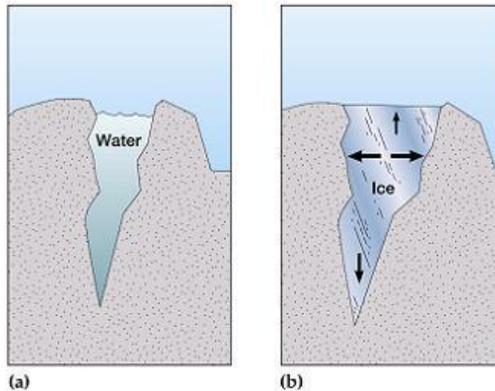


Chapter 12 Notes: Weathering and Erosion

12.1 Weathering Processes

- **Weathering** – physical or chemical change of rock materials _____ at earth's surface
- Two types of weathering:

1. _____ Weathering – (physical change)
 - WHAT HAPPENS? Physical breaking of rock into smaller pieces
 - HOW?
 - 1) **Ice wedging** – when water seeps into cracks and _____. The expansion of the frozen water eventually splits the rock apart.

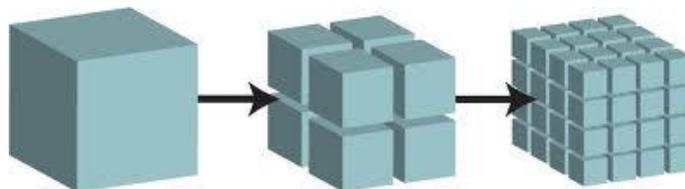


- 2) Organic activity (via plants and animals) – For example, plant _____ growth in cracks and digging/burrowing animals.
 - 3) Abrasion by colliding rocks with the help of gravity, running water, and _____.
2. _____ Weathering – (chemical change = change in composition)
 - WHAT HAPPENS? Chemical reactions lead to the formation of new _____ within the rock.
 - HOW?
 - 1) **Hydrolysis** – chemical reaction between _____ (H₂O) and a rock's minerals
 - Example: feldspar + H₂O → clay (called kaolin)
 - Some minerals will dissolve in water and will be carried down to deeper rock layers. This process is called **leaching** and is how _____ (aluminum ore) is formed.

- 2) **Carbonation** – when carbon dioxide (CO₂) from the air dissolves in water (H₂O) creating a weak _____ acid (H₂CO₃) that combines with particular rock minerals to form a new product.
 - H₂O + CO₂ → H₂CO₃ + calcite → calcium carbonate
 - This acid speeds up hydrolysis and aids in formation of features like underground _____
- 3) **Oxidation** – when _____ elements combine with oxygen (O₂)
 - 4Fe + 3O₂ → 2Fe₂O₃ (iron oxide or rust)
 - Rust prevention? Galvanizing – covering a metal with a _____ coating
- 4) **Acid precipitation** (“acid rain”) – when additional nitrogen and sulfur based compounds join with _____ water
 - Rainwater is naturally slightly _____ (due to dissolved CO₂)
 - Acid rain accelerates chemical weathering
- 5) Plant Acids
 - Example: Lichens and mosses grow on rocks and produce weak acids that can _____ the surface of the rock and cause cracking.

12.2 Rates of Weathering

- How fast does weathering occur? The simple answer is _____, but this rate is dependent on several factors:
 - 1) Rock Composition
 - Of all the common minerals, _____ is one of the hardest and is least affected by chemical weathering.
 - _____ and other rocks containing calcite weather very rapidly.
 - In sedimentary rocks, the rate of weathering can be highly dependent upon the material that _____ the rock together.
 - 2) Amount of Exposure
 - More exposure = _____ weathering



As rock breaks into smaller pieces, overall surface area increases.

- Fractures and joints increase the _____ area of a rock and allow weathering to take place more rapidly.

3) Climate

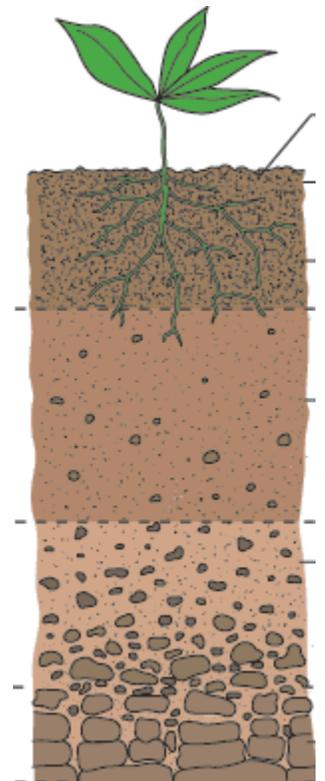
- In general, _____ and ice wedging (the freezing/thawing process) have the greatest effect on the rate of weathering.
- In cold OR hot, dry climates, weathering takes places _____.
- In warm, humid climates, weathering is fairly _____.
 - Example: Cleopatra's Needle (Egypt to NYC)

4) Topography

- The topography, or elevation and slope of the land, influences the _____ of weathering.
- _____ wedging increases with higher elevations

12.3 Weathering and Soil

- **Regolith** – the layer of weathered _____ fragments covering much of earth's surface
- **Bedrock** – the solid, unweathered rock that lies beneath the _____
- **Humus** – dark, organic material formed from the _____ remains of plants and animals
- **Soil** – a _____ mixture of minerals, water, gases, and the remains of dead organisms
 - Soil is classified by particles _____: clay, silt, and sand
 - May be transported to a new location by water, wind, or _____.
- **Soil profile** – a cross section in which layers ("horizons") of the soil and the bedrock beneath the soil can be seen
 1. **A Horizon** – topsoil
 - Mixture of organic and small rock materials
 - Where _____ soil organisms are found; contains humus
 - Surface water _____ minerals in this layer
 2. **B Horizon** – subsoil
 - contains leached minerals from A Horizon, clay, and sometimes _____
 3. **C Horizon** – bottom layer of soil
 - Consists of _____ that has been partially weathered



12.4 Erosion

- **Erosion** – process by which the products of weathering are _____
- Agents of erosion: gravity, wind, glaciers, ocean waves and currents, _____, and groundwater
- Accelerated Soil Erosion:
 - Unwise farming and ranching methods increase the rate of soil erosion.
 - Over-_____ destroys the soil protection offered by plants
 - **gullying** – severe erosion caused by farming of _____ land
 - **sheet erosion** – when parallel layers of topsoil are stripped away, exposing the surface of the underlying subsoil or partially weathered _____
 - HOW DOES THIS OCCUR?
 - Continuous _____ washes away topsoil
 - _____ during very dry seasons blows away topsoil
- Soil Conservation
 - Rapid, destructive soil erosion can be prevented by soil conservation methods:
 1. Cultivating _____ plants to protect topsoil
 2. **Contour plowing** – where the soil is plowed in circular bands that follow the shape (or _____) of the land
 - Prevents gullying
 3. **Strip-cropping** – crops planted in alternate _____
 - Example: corn and alfalfa
 4. **Terracing** – construction of step-like ridges that follow the contours of a _____ field
 - Example: rice growing in Asia
 5. **Crop rotation** – planting of one crop one year and a _____ crop the next
- Gravity and Erosion
 - The movement of rock fragments down a _____ is called **mass movement**.
 - The resulting rock pile at the base of the slope is called **talus** (TAY-lus).
 - RAPID MASS MOVEMENTS:
 - 1) **Rockfall** – fall of rock from a _____ cliff
 - 2) **Landslide** – sudden movement of masses of loose rock AND _____ down the slope of a hill, mountain, or cliff
 - Triggered by heavy rainfall, spring thaws, volcanic eruptions, and _____

- 3) **Mudflow** – rapid movement of a large mass of _____
 - Occurs in dry, mountainous regions during sudden, heavy _____ or as a result of volcanic eruptions
 - California “landslides”
- 4) **Slump** – downhill movement of a large _____ of soil under the influence of gravity
- SLOW MASS MOVEMENTS:
 - 1) **Solifluction** – (meaning “soil flow”) – the slow downslope flow of wet, muddy topsoil over _____ or clay-rich subsoil
 - Often occurs in _____ and mountain climates where the soil is permanently frozen.
 - 2) **Creep** – _____ downhill movement of weathered rock material
 - Typically goes unnoticed unless buildings, fences, and other objects on the surface are moved along with it.
- Erosion and Landforms
 - **Landform** – physical _____ of the earth’s surface (for example: mountains, plains, plateaus, hills, valleys, and dunes)
 - Erosion of Mountains:
 - During the early stages of a mountain, it undergoes _____, which is usually faster than any erosion occurring.
 - Mountains being uplifted tend to have _____ peaks and deep, narrow valleys.
 - Example: Jura Mountains, Switzerland
 - Over time, a mountain is reduced to a low, almost featureless surface near sea level called a **peneplain** (PEEN-ih-PLANE) meaning “almost _____.”
 - Usually has low, rolling hills
 - Example: New England
 - **Monadnocks** – knobs of hard rock, such as _____, that resist erosion and protrude above the peneplain.
 - Erosion of Plateaus:
 - In dry climates, resistant rock produces plateaus with nearly _____ tops
 - As a plateau ages, erosion may create smaller _____-like formations called **mesas**.
 - With even further erosion, mesas will become _____, narrow topped **buttes**.