



Mains Practice Question

Q. Explain the process of weathering. How do different weathering processes contribute to the formation of various landscapes and soil types? **(250 words)**

21 Oct, 2024 GS Paper 1 Geography

Approach

- Introduce the answer by defining weathering
- Give Key Weathering Processes
- Delve into the Impact of Weathering on Landscape Formation
- Highlight its Impact on Soil Formation
- Conclude suitably.

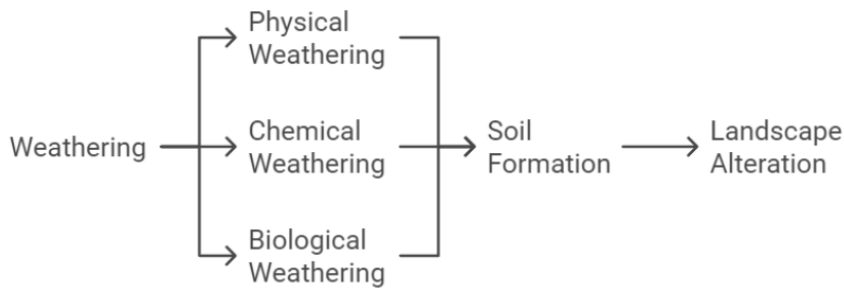
Introduction

Weathering is the **breakdown and alteration of rocks and minerals** at or near the Earth's surface through **physical, chemical, and biological processes**. It's a crucial component of the rock cycle and plays a significant role in **shaping landscapes and forming soils**.

Body

Key Weathering Processes:

- **Physical (Mechanical) Weathering:** Physical weathering breaks rocks without changing their composition.
 - Key processes involve **frost wedging** (water freezing in cracks), **thermal expansion** (heating and cooling), **salt weathering** (salt crystal pressure), and **exfoliation** (layers peeling off).
 - **Examples: Exfoliation domes** in places like **Yosemite National Park, USA**
- **Chemical Weathering:** Chemical weathering alters rock minerals, usually involving water.
 - Key processes involve **hydrolysis** (water replaces ions), **oxidation** (oxygen causes rust), **carbonation** (carbonic acid dissolves minerals, especially limestone), and **hydration** (minerals absorb water and expand).
 - **Examples: Reddish lateritic soils in tropical regions** due to intense oxidation
- **Biological Weathering:** Biological weathering involves the breakdown of rocks by organisms. Key processes involve **root action** (roots widen cracks), **organic acids** (from plants dissolve minerals), and **lichen/moss growth** (break down rock surfaces).
 - **Examples: Lichen-covered rocks** in temperate and arctic regions



Impact on Landscape Formation:

- **Differential Weathering:** Harder rocks resist weathering, forming ridges or peaks.
 - Softer rocks weather faster, creating valleys or depressions.
- **Karst Topography:** Formed by chemical weathering of soluble rocks like limestone.
 - Features include sinkholes, caves, and underground drainage systems. **(Tham Luang cave system in Thailand)**
- **Desert Landscapes:** Dominated by physical weathering due to extreme temperature changes.
 - Features like **mushroom rocks** and **pedestal rocks** form through differential weathering.
- **Coastal Landforms:** Wave action combined with weathering creates features like sea arches and stacks. **(Twelve Apostles along the Great Ocean Road, Australia)**

Impact on Soil Formation:

- **Residual Soils:** Formed in-situ from weathered bedrock. Characteristics depend on parent rock and local climate. (Terra rossa soils)
- **Transported Soils:** Formed from weathered materials moved by wind, water, or ice.
- **Soil Horizons:** Weathering intensity influences the development of soil layers (horizons).
 - More intense weathering leads to **deeper, more well-developed soil profiles.**
- **Soil Texture and Composition:** Physical weathering influences soil particle size.
 - Chemical weathering affects **mineral composition and nutrient availability.** **(Clay-rich soils in humid tropical regions** due to intense chemical weathering)

Conclusion

Weathering processes are fundamental in shaping the Earth's surface and creating diverse landscapes and soil types. The interplay between physical, chemical, and biological weathering, along with factors like **climate, topography, and time**, results in the rich variety of landforms and soil resources observed across the globe.