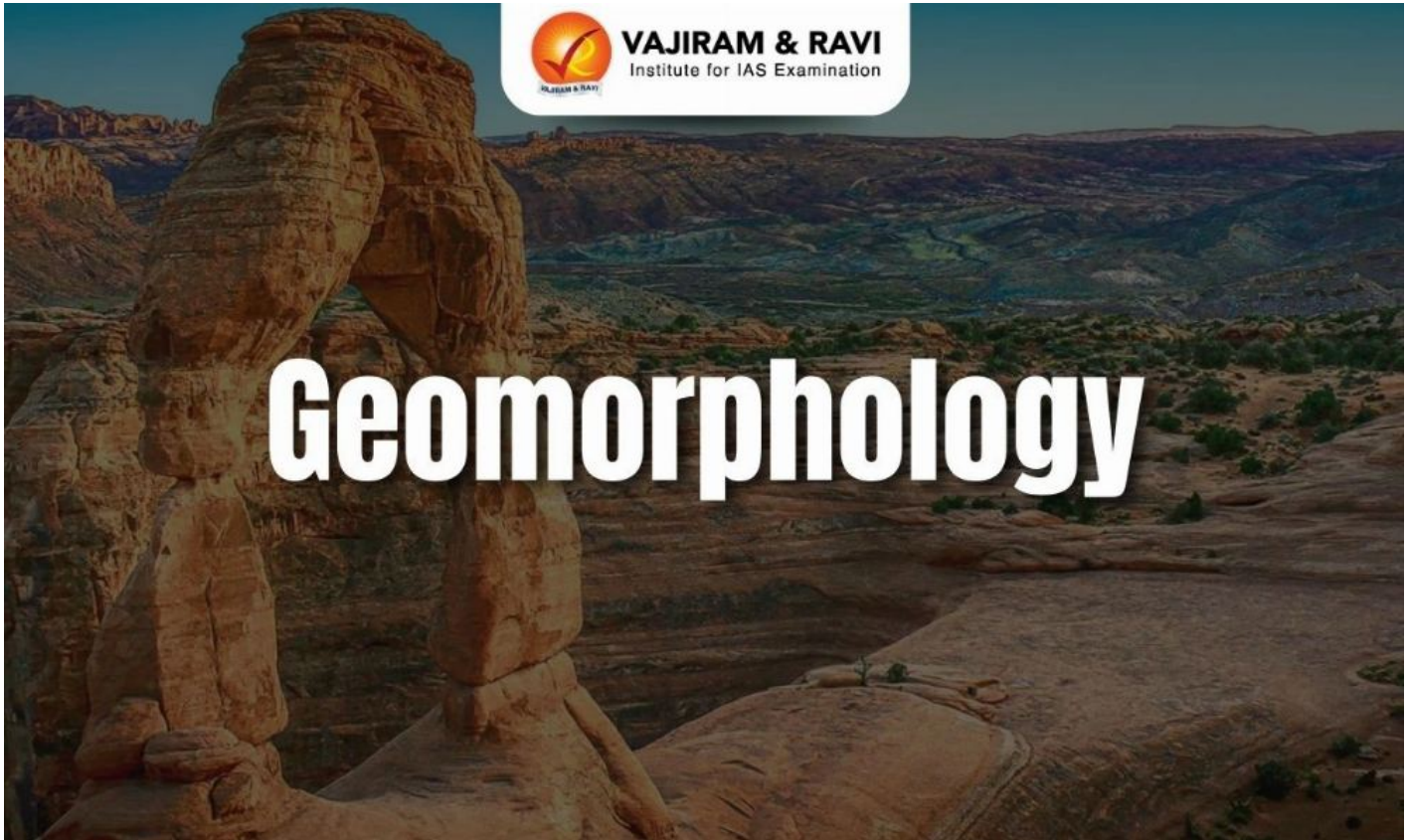


Geomorphology- Endogenic and Exogenic Geomorphic Movements

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Geomorphology deals with the study of landforms, their characteristics, and various processes - physical, chemical, biological, and extraterrestrial, responsible for their formation and changes. Geomorphic processes are influenced by both endogenic factors, powered from within the Earth such as volcanoes and earthquakes, and exogenic factors, powered by the sun's energy and acting through the climate system, such as rain, wind, and waves.

Both types of geomorphic processes - endogenic and exogenic processes are responsible for the formation of the various orders of landforms on the Earth as well as the landscape in a particular area.

Geomorphic Process

Geomorphic processes are the physical stresses and chemical reactions on Earth materials that cause changes in the configuration of the Earth's surface.

- **Results:** When these internal and external changes occur continually, they result in the production of **uneven terrains** or **landforms**.

- These landforms are modified in shape, size, and configuration due to the action of climatic factors, movements of **Earth's crust**, and changes in the intensity of the geomorphic processes.
- **Types of Geomorphic Processes: Endogenic Process and Exogenic Process**
 - The endogenic process is due to the release of internal energy from the interior of the Earth. They give rise to the landforms within the Earth or on the surface.
 - The exogenic process is due to the effect of climatic factors on the landforms produced by the endogenic process.
- **Geomorphic Agents:** Earthquakes and volcanism are the agents of the endogenic process whereas running water, groundwater, ice, wind, waves, currents, etc. are the agents of the exogenic process.
- **Source of Energy:** The main sources of energy behind endogenic and exogenic forces are **geothermal energy**, gravity, heat energy, and mechanical energy (water and winds) but the ultimate source of energy is the Sun.

Endogenic Process

Endogenic geomorphic processes have shaped the **earth's relief** and produced many of its most valuable minerals. They are driven mostly by energy emerging from within the Earth.

- **Endogenic forces:** These are land-building forces that play an important part in the creation of the **earth's crust**.
 - **Primordial heat, radioactivity**, and tidal and **rotational friction** between the earth's layers result in the creation of this energy.
- **Two Major Forms:**
- **Slow Movements:** Also known as **diastrophism**, these processes develop gradually and take thousands of years.
- **Sudden Movements:** These processes are manifested in quick time.
- Diastrophism and sudden movements are related to each other and almost all these movements occur at the same place, most of the time.
- Slow and sudden movements are complementary to each other and almost all these movements occur at the same place, most of the time.
 - For example, folding causes mountain building as well as volcanism and earthquakes.

Diastrophism

All processes that move, elevate, or build up portions of the earth's crust come under diastrophism or **slow movements**. There are two types of such processes.

- **Epeirogenic Process:** This is the continental building process, due to the warping or upliftment of large parts of the earth's surface. These movements cause simple deformation in the continents.
 - **Examples:** Upliftment of the Deccan Plateau, Emergence of Andaman and Nicobar Islands, etc.
- **Orogenic process:** This is the process of mountain development that involves plate tectonics. However, oceanic crusts can also be the result of orogeny.

- Mountains can be formed due to folding or faulting caused by the relative motion of the two atmospheric plates. Volcanism can also result in the formation of a mountain.
- When two **tectonic plates** collide – either forcing material upwards to form mountain belts or causing one plate to be subducted below the other, resulting in volcanic mountain chains.
- **Examples:** Himalayas, Alps, etc fold mountains and Vosges, Sierra Nevada block mountains.

Sudden Movements

Sudden movements are caused by sudden endogenic forces originating **deep within the Earth**. They cause rapid events leading to massive destruction within and on the surface of the Earth.

- **Examples:** Sudden endogenic processes include **earthquakes** and **volcanism** that occur in short periods.
 - Although they are manifested in a short period, the energy buildup for these processes is long and gradual.
- **Volcanism:** Volcanism refers to the movement of **molten rock (magma)** onto or towards the earth's surface as well as the production of numerous intrusive and extrusive volcanic forms.
 - Magma is created when a portion of the earth's upper mantle or lower crust melts.
 - Volcanic eruptions are caused by excessive pressure imposed by magma and hot gases on the earth's crust.
 - Volcanic eruptions lead to the creation of **volcanic cones** and **mountains**.
- **Earthquakes:** An earthquake is a **sudden movement** in the earth caused by the abrupt release of energy accumulated slowly over a long period.
 - Plate tectonics are the major cause of the earthquakes. Convergent plate boundaries are the regions of most frequent earthquakes. Divergent plate boundaries (faulting occurs here) are also the region of earthquakes.
 - Examples: Pacific Ring of Fire, Himalayan regions, Atlantic Mid-Oceanic ridge etc.

Exogenic Process

Exogenic processes are those that occur on **Earth's surface** as a result of exogenic forces and agents. These processes include **mass wasting, weathering, erosion, and deposition**. All exogenic processes are called denudation, which means "to peel away" or "to reveal."

- **Exogenic forces:** Exogenic processes acquire energy from the atmosphere, which is determined by the **sun's ultimate energy** and gradients formed by **tectonic factors**.
- **Exogenic Agents:** wind, water, waves, gravity, etc.
- **Results:** The actions of exogenic forces result in the degradation (wearing down) of relief/elevations and aggradation (filling up) of basins/ depressions, on the Earth's surface.

Weathering

Weathering is defined as the mechanical disintegration and chemical degradation of rocks induced by interactions between various climate variables.

- **Types of Weathering:**

- **Physical weathering:** It happens when physical processes, such as temperature changes, or when the rock undergoes exposure to the forces of wind, rain, and waves.
- **Chemical weathering:** It describes the process by which chemicals in rainwater alter the minerals in rocks.
- **Biological Weathering:** It is caused by the movements of plants and animals. **For example**, a rabbit can burrow into a crack in a rock making it bigger and eventually splitting the rock.

Mass Movements

Mass movement or mass wasting or slope movement is defined as the large movement of fragmented rock material down the slope under the force of **gravity**.

- Mass movement of rocks can take place in several ways like flow, spread, slide, topple, and fall or their combinations.
- Mass movements can be divided into two major classes:
 - **Slow Movements:** Creep is one sort of this category that can occur on fairly steep, soil-covered slopes.
 - **Rapid Movements:** These movements are especially common in humid climate regions and can occur on gentle to steep slopes.

Erosion and Deposition

- Erosion is the **acquisition and transportation of rock debris** by geomorphic agents such as flowing water, wind, waves, glaciers, and so on.
 - Weathering enhances erosion, but it is not a prerequisite.
- Erosion is followed by deposition as the erosional agents lose velocity and energy on gradual slopes, and the materials they carry begin to settle.

Resultant Landforms

The mechanism of the endogenic and exogenic operations is different from one another and hence the landforms produced by each process may be differentiated. Thus, based on dimension and scale, the relief features of the earth's surface may be grouped into three broad categories of descending order.

First Order Landforms	- On the smallest scale and covering the largest area is world geomorphology which includes consideration of continents and ocean basins. • They are formed by the endogenic process such as plate tectonics and epeirogenic movements over a long period.
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Second Order Landforms	- The structural forms developed over the first-order landforms - continent or ocean basins are the second-order landforms. • These forms owe their genesis mainly to endogenetic forces but are shaped and developed by exogenic forces. • These include mountains, plateaus, plains, lakes, faults, rift valleys, etc.
Third Order Landforms	- These are the micro-level landforms developed on the second-order relief features by exogenic degradational and aggradational processes. - These landforms may be: • erosional (river valley, glacial valley, terraces, etc.), • depositional (flood plains, delta, sea beaches, sand dunes, etc.), • residuals (inselbergs) and • sometimes minor tectonic features.

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