Endogenic & Exogenic Forces

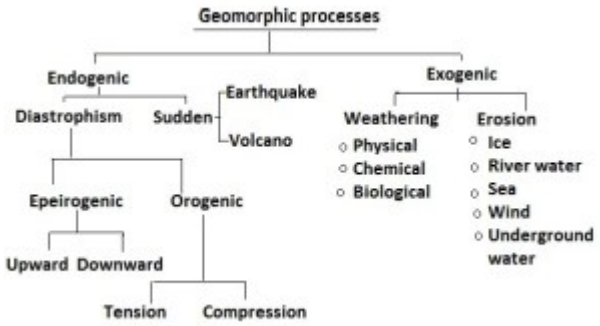
Description

Endogenic & Exogenic Forces

Introduction

Geomorphology examines the features of the Earthâ??s surface and their formation by different forces. These forces are categorized into two groups: endogenic (internal) and exogenic (external). These forces collectively induce the physical and chemical alterations that sculpt the Earthâ??s terrain, known as geomorphic processes.

- Endogenic geomorphic processes, including diastrophism and volcanism, take place within the Earthâ??s interior. Diastrophism refers to the deformation of the Earthâ??s crust resulting from tectonic forces, and volcanism pertains to the creation of volcanic landforms through the eruption of molten material.
- Conversely, exogenic geomorphic processes occur on the Earthâ??s surface and encompass weathering, mass wasting, erosion, and deposition. Weathering involves the disintegration of rocks and minerals through chemical and physical processes. Mass wasting is the downhill movement of soil, rock, and other debris driven by gravity. Erosion entails the transportation of earth materials by forces like wind, water, ice, and gravity, and deposition is the settling of these materials in different locations.
- Geomorphic agents, such as running water, glacial ice, wind, waves, and currents, are dynamic forces that enable the erosion, transport, and deposition of earth materials. They are instrumental in sculpting the Earthâ??s surface via a range of geomorphic processes.



Endogenic Forces

- The forces and movements within the Earthâ??s crust result from the interplay between matter and temperature. Earth movements are generally categorized into two types: diastrophism and sudden movements. The main driving force of these endogenic geomorphic processes is the energy emanating from within the Earth itself.

- The Earthâ??s internal energy mainly originates from radioactivity, rotational and tidal friction, along with the primordial heat retained since the planetâ??s formation. This energy, facilitated by geothermal gradients and heat flow, leads to diastrophism, the slow deformation of the Earthâ??s crust, and volcanism, the process of volcanic activity, within the lithosphere.

Diastrophism

Diastrophism is the general term applied to slow bending, folding, warping, and fracturing.

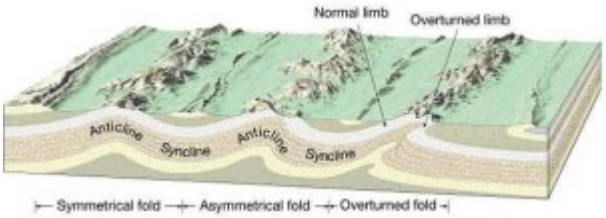
- Warp is the bent or twisted out of shape, make abnormal; distort.

All processes that move, elevate or build up portions of the earthâ??s crust come under diastrophism.

They include:

- Orogenic processes involve mountain building through intense folding, affecting elongated and narrow belts of the Earthâ??s crust. During orogeny, the crust undergoes significant deformation, resulting in folds.
- Epeirogenic processes involve the uplift or warping of extensive areas of the Earthâ??s crust. Epeirogeny can result in straightforward deformation. In contrast, orogeny refers to the process of mountain building, while epeirogeny pertains to the construction of continents.
- The processes of orogeny, epeirogeny, earthquakes, and plate tectonics can lead to faulting and fracturing of the Earthâ??s crust. These processes result in changes in pressure, volume, and temperature (PVT), which consequently induce the metamorphism of rocks.

Epeirogenic or Continent Forming Movements [Vertical Movements]



- Epeirogenic movement refers to the geological process that causes large landmasses, like continents, to slowly rise or sink over long periods. This process is characterized by long undulations or wavelengths and slight folding within the Earthâ??s crust. Cratons, which are the stable, ancient cores of continents, are especially prone to epeirogenic movements.
- Epeirogenic movements, also known as radial movements, occur along the Earthâ??s radius. They can lead to the subsidence of land (movement towards the Earthâ??s center) or its uplift (movement away from the Earthâ??s center). The effects of these movements are frequently evident in the geological features and landforms of the regions they impact.

Uplift

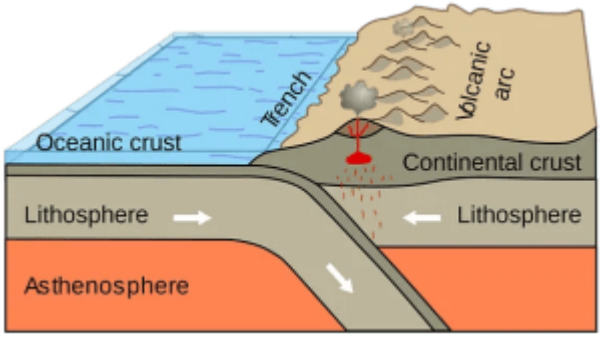
- Signs of uplift are evident in features like raised beaches, elevated wave-cut terraces, sea caves, and fossil-bearing strata situated above sea level. Along the coastlines of Kathiawar, Nellore, and

Thirunelveli, one can find raised beaches, some of which are elevated 15 to 30 meters above the present sea level.
- There are numerous examples of locations that were once coastal but are now inland. For instance, Coringa, near the Godavari Riverâ??s mouth, Kaveripattinam in the Kaveri Delta, and Korkai along the Thirunelveli coast, were bustling seaports around 1,000 to 2,000 years ago. These areas have moved inland as a result of the uplift process, highlighting the geographical changes over the centuries.

Subsidence

- Submerged forests, valleys, and buildings are indicators of land subsidence, the downward settling of the earthâ??s surface. This was exemplified in 1819 when an earthquake caused a portion of the Rann of Kachchh to sink.
- The presence of peat and lignite beds below sea level in Tirunelveli and the Sunderbans suggests land subsidence. Moreover, the separation of the Andaman and Nicobar Islands from the Arakan coast is due to the submersion of the intervening land.
- Trees embedded in the mud approximately four meters below the low watermark have been discovered on the eastern side of Bombay Island. A similar submerged forest has also been observed along the coast of Thirunelveli in Tamil Nadu.
- A considerable area of the Gulf of Mannar and the Palk Strait is characterized by its shallowness, suggesting submersion in geologically recent times. Additionally, a section of the historic city of Mahabalipuram, situated near Chennai (previously known as Madras), is currently beneath the sea.

Orogenic or the Mountain-Forming Movements [Horizontal Movements]



- Orogenic or the mountain-forming movements act tangentially to the earthâ??s surface, as in plate tectonics.
- Tensions produce fissures (since this type of force acts away from a point in two directions) and compression produces folds (because this type of force acts towards a point from two or more directions).
- In the landforms so produced, the structurally identifiable units are difficult to recognize. In general, diastrophic forces that have uplifted lands have predominated over forces that have lowered them.

Sudden Movements

- Rapid alterations of the Earthâ??s surface, referred to as sudden geomorphic movements, primarily occur along the boundaries of lithospheric plates, or tectonic plate margins. These zones are notably unstable because of the significant pressure caused by the movement of magma within the Earthâ??s mantle, propelled by convection currents.
- As a result, these movements can cause significant alterations to the Earthâ??s surface within a relatively short timeframe.

Earthquakes

- Earthquakes happen when stress accumulated in the Earthâ??s interior is discharged through fractures on the surface. This energy release generates waves that vibrate and can cause destruction. Such seismic activity can have different effects, including the elevation of coastal areas. For instance, the 1822 earthquake in Chile caused the coastline to rise by one meter.
- Earthquakes can also result in changes to land contours, alterations in river courses, and the generation of tsunamisâ??seismic sea waves caused by underwater earthquakes, a term originating from Japan. These events may lead to significant shifts in coastlines. Furthermore, earthquakes have the potential to cause impressive glacial surges, as seen in Alaska, as well as landslides, soil creep, and extensive mass wasting, among other geological effects.

Volcanoes

- Volcanism is the process of magma, or molten rock, moving towards or reaching the Earthâ??s surface. This process results in the creation of various intrusive and extrusive volcanic structures. A volcano forms when magma from beneath the Earthâ??s crust escapes through vents and fissures, releasing steam, gases like hydrogen sulfide, sulfur dioxide, hydrogen chloride, and carbon dioxide, along with pyroclastic materials. The physical form of a volcano is influenced by the chemical composition and viscosity of the erupting lava.
- A pyroclastic flow is a fast-moving, dense mixture of solidified lava fragments, volcanic ash, and hot gases that occurs during some volcanic eruptions. It is exceedingly hot and has the capacity to incinerate anything in its path, with the potential to move at speeds reaching 200 meters per second.

Exogenic (Exogenetic) Processes

- External forces, also referred to as exogenic forces, arise from outside the Earthâ??s interior and mainly take place within its atmosphere. These forces play a significant role in eroding the Earthâ??s surface, hence they are often called land-wearing forces.
- Exogenic processes result from stress exerted on Earthâ??s materials by forces generated by solar heat. Stress, the force per unit area, arises from the push or pull exerted on a solid object.
- The formation of stress within Earthâ??s materials results in weathering, erosion, and deposition. Temperature and precipitation are two crucial climatic elements that affect these processes, significantly contributing to the stress experienced by Earthâ??s materials.

Denudation

- All the exogenic geomorphic processes are covered under a general term, denudation.

- The word â??denudeâ?? means to strip off or to uncover.
- Weathering, mass wasting/movements, erosion, and transportation are included in denudation.
- Denudation mainly depends on rock type and its structure that includes folds, faults, orientation and inclination of beds, presence or absence of joints, bedding planes, hardness or softness of constituent minerals, chemical susceptibility of mineral constituents; permeability, or impermeability, etc.
- The effects of most of the exogenic geomorphic processes are small and slow but will, in the long run, affect the rocks severely due to continued fatigue.

Denudation: 4 Phases

1. Weathering
2. Erosion
3. Transportation
4. Deposition

Conclusion

Geomorphology is the study of the Earthâ??s surface features and the dynamic processes that sculpt them. Both endogenic and exogenic forces are pivotal in molding the Earthâ??s terrain through a range of geomorphic activities, including diastrophism, volcanism, weathering, mass wasting, erosion, and deposition. Endogenic forces, originating from within the Earth, cause both gradual and abrupt movements, whereas exogenic forces, which are external, act upon the Earthâ??s surface and are primarily driven by temperature and precipitation. These forces, along with geomorphic agents, facilitate the ongoing transformation and development of the Earthâ??s surface through the intricate process of denudation.

Category

1. Geomorphology

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