

Exogenic Processes [Geography Notes For UPSC]

The processes that take place at or near the Earth's surface are called Exogenic Processes.

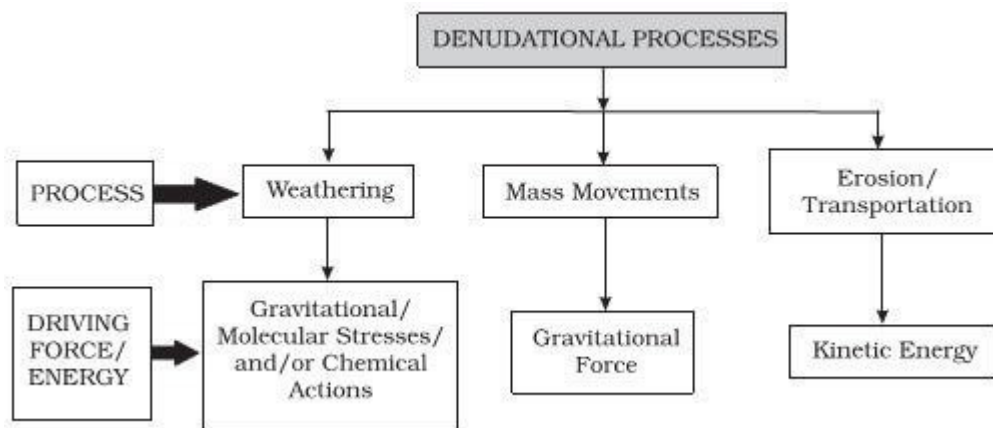
Exogenic Processes:

- The exogenic processes obtain their energy from the gradients generated by tectonic factors, processes, their corresponding driving forces and atmosphere determined by the energy from the sun.
- Precipitation and temperature are the two significant climatic components that regulate different processes.
- Whole exogenic geomorphic processes are covered under a common term, denudation which means to uncover.
- Weathering, transportation, and erosion are comprised of denudation.
- Gravitational force acts upon every material on earth having a sloping surface and incline to create the movement of matter in downward slope direction.

Exogenic Processes – Stress

- Force applied per unit area is called stress.
- Stress is created in a solid by pulling or pushing and this induces deformation.
- Forces acting along the surfaces of earth materials are shear stresses and it breaks rocks and other earth materials.
- The shear stresses result in slippage or angular displacement.
- Besides gravitational stress, earth materials become exposed to molecular stresses that may be caused by several factors amongst which crystallisation, melting, and temperature variations are the most usual.
- Chemical processes generally lead to loosening of bonds between grains, dissolving of soluble minerals or strengthening materials.
- Therefore, the fundamental cause that leads to erosion, mass movements, and weathering is the development of stresses in the body of the earth materials.
- The effects of most of the exogenic geomorphic processes are minor and slow.
- It may be imperceptible in a short time span, but will in the long run influence the rocks harshly due to constant fatigue.

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



Weathering:

Weathering is defined as the mechanical disintegration and chemical decomposition of rocks through the actions of various elements of weather and climate.

There are three major groups of weathering processes :

- (i) chemical Weathering;
- (ii) physical or mechanical Weathering;
- (iii) biological weathering

chemical Weathering:

- Chemical weathering processes include dissolution, solution, carbonation, hydration, oxidation and reduction that act on the rocks to decompose, dissolve or reduce them to a fine state.
- Water and air (oxygen and carbon dioxide) along with heat must be present to speed up all chemical reactions.
- Over and above the carbon dioxide present in the air, the decomposition of plants and animals increases the quantity of carbon dioxide underground.
- These chemical reactions on various minerals are very much similar to the chemical reactions in a laboratory

Physical or mechanical Weathering:

1. Physical or mechanical weathering processes depend on some applied forces. The applied forces could be:
 - a. Gravitational forces such as overburden pressure, load and shearing stress;
 - b. Expansion forces due to temperature changes, crystal growth or animal activity;
 - c. Water pressures controlled by wetting and drying cycles.

2. Many of these forces are applied both at the surface and within different earth materials leading to rock fracture.
3. Most of the physical weathering processes are caused by thermal expansion and pressure release.
4. These processes are small and slow but can cause great damage to the rocks because of continued fatigue the rocks suffer due to repetition of contraction and expansion.

Biological weathering:

1. Biological weathering is contribution to or removal of minerals and ions from the weathering environment and physical changes due to growth or movement of organisms.
2. Burrowing and wedging by organisms like earthworms, termites, rodents etc., help in exposing the new surfaces to chemical attack and assists in the penetration of moisture and air.
3. Human beings by disturbing vegetation, ploughing and cultivating soils, also help in mixing and creating new contacts between air, water and minerals in the earth materials.
4. Decaying plant and animal matter help in the production of humic, carbonic and other acids which enhance decay and solubility of some elements.
5. Plant roots exert tremendous pressure on the earth materials mechanically breaking them apart

Mass Movements:

1. These movements transfer the mass of rock debris down the slopes under the direct influence of gravity.
2. That means, air, water or ice do not carry debris with them from place to place but on the other hand the debris may carry with it air, water or ice.
3. The movements of mass may range from slow to rapid, affecting shallow to deep columns of materials and include creep, flow, slide and fall.
4. Mass movements are aided by gravity and no geomorphic agent like running water, glaciers, wind, waves and currents participate in the process of mass movements. That means mass movements do not come under erosion though there is a shift (aided by gravity) of materials from one place to another.
5. Several activating causes precede mass movements. They are :
 - (i) removal of support from below to materials above through natural or artificial means;
 - (ii) increase in gradient and height of slopes;
 - (iii) overloading through addition of materials naturally or by artificial filling;
 - (iv) overloading due to heavy rainfall, saturation and lubrication of slope materials;
 - (v) removal of material or load from over the original slope surfaces;
 - (vi) occurrence of earthquakes, explosions or machinery;
 - (vii) excessive natural seepage;

- (viii) heavy drawdown of water from lakes, reservoirs and rivers leading to slow outflow of water from under the slopes or river banks;
- (ix) indiscriminate removal of natural vegetation.

Erosion and Deposition:

1. Erosion involves acquisition and transportation of rock debris. When massive rocks break into smaller fragments through weathering and any other process.
2. Erosional geomorphic agents like running water, groundwater, glaciers, wind and waves remove and transport it to other places depending upon the dynamics of each of these agents.
3. Abrasion by rock debris carried by these geomorphic agents also aids greatly in erosion. By erosion, relief degrades, i.e., the landscape is worn down.
4. It is erosion that is largely responsible for continuous changes that the earth's surface is undergoing.
5. Denudational processes like erosion and transportation are controlled by kinetic energy.
6. The erosion and transportation of earth materials is brought about by wind, running water, glaciers, waves and ground water.