

Earth movements: Endogenic & Exogenic Forces

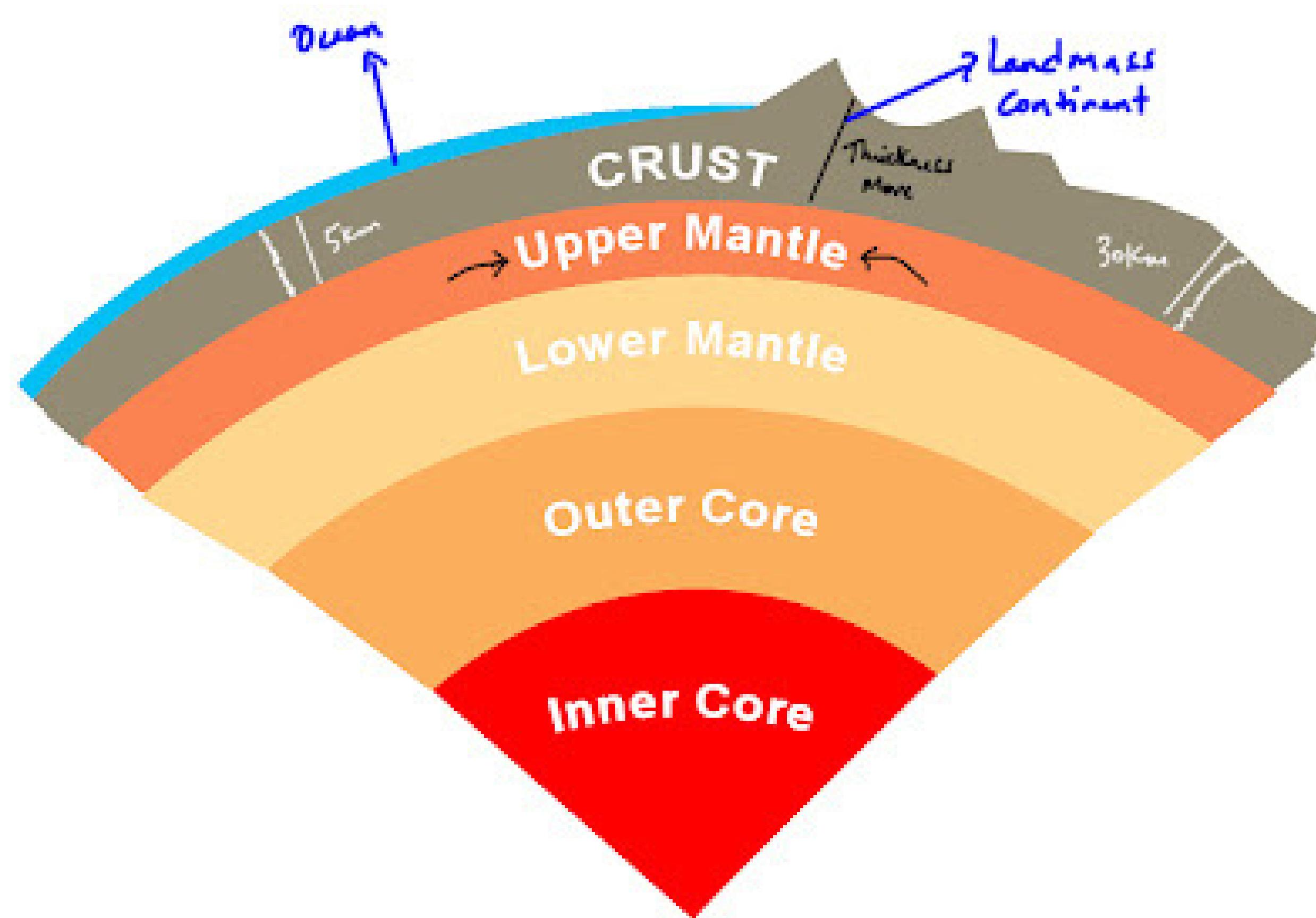
Geomorphic processes are the processes that cause changes in the land area or crust of the earth. Exogenic and endogenic processes are the two types of processes. Exogenic forces or external forces are forces that take their power from the earth's surface or originate within the earth's atmosphere. The term "endogenic forces," sometimes known as "internal forces," refers to the pressure that comes from within the ground.



**Endo- Inside
Genic- Origin**

Endogenic Forces:

1. Origin: These forces come from within the Earth.
2. Processes: They include processes like volcanic activity, earthquakes, and mountain building.
3. Impact: They can create new landforms like mountains and plateaus.



Volcanic Activity:

Volcanic activity is a prime example of an endogenic force, as it originates from within the Earth. This process is driven by the intense heat and pressure found in the Earth's interior.



Causes of Volcanic Activity.

1. **Magma Formation:** The Earth's mantle contains molten rock called magma. High temperatures and pressures within the mantle cause the rocks to melt, forming magma.
2. **Magma Ascent:** Magma is less dense than the solid rock surrounding it, so it rises towards the Earth's surface through cracks and fissures in the crust.
3. **Magma Chambers:** Magma can accumulate in magma chambers beneath the Earth's surface. When the pressure becomes too great, it forces the magma to erupt through the surface.



Types of Volcanic Eruptions

1. Effusive Eruptions: These eruptions involve the relatively gentle flow of lava onto the Earth's surface. They are characteristic of shield volcanoes, like those found in Hawaii.
2. Explosive Eruptions: These are violent eruptions that eject ash, gas, and rock fragments into the atmosphere. They occur when gas trapped in magma builds up pressure until it explodes, as seen in stratovolcanoes like Mount St. Helens.



Effects of Volcanic Activity

1. **Landform Creation:** Volcanic eruptions create various landforms, such as volcanic cones, calderas, and lava plateaus. Over time, repeated eruptions build up layers of solidified lava and ash, forming mountains and islands.
2. **Soil Fertility:** Volcanic ash is rich in minerals, which can create fertile soils beneficial for agriculture. Regions with volcanic activity, like those around Mount Vesuvius in Italy, often have rich, productive farmland.
3. **Geothermal Energy:** The heat from volcanic activity can be harnessed as geothermal energy, providing a renewable energy source. Countries like Iceland use geothermal energy extensively.



Geological Significance

Volcanic activity plays a crucial role in the Earth's geological processes. It is a fundamental part of the rock cycle, contributing to the formation of igneous rocks. Volcanic activity also releases gases like water vapor, carbon dioxide, and sulfur dioxide into the atmosphere, which can influence the climate and atmospheric composition.

Examples of Significant Volcanic Events

- 1. Mount Vesuvius (79 AD):** The eruption buried the cities of Pompeii and Herculaneum under ash, preserving them for centuries.
- 2. Krakatoa (1883):** The explosive eruption generated massive tsunamis and altered global weather patterns, leading to the "Year Without a Summer."
- 3. Mount St. Helens (1980):** The eruption drastically altered the landscape and provided valuable scientific insights into volcanic processes.



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Earthquakes

Earthquakes are another significant example of endogenic forces, as they result from the internal dynamics of the Earth. These natural phenomena occur due to the sudden release of energy in the Earth's crust, leading to ground shaking and sometimes surface rupture.



Causes of Earthquakes

1. Tectonic Plate Movements: The Earth's lithosphere is divided into tectonic plates that constantly move. Earthquakes primarily occur at plate boundaries where plates interact.
 - Divergent Boundaries: Plates move apart, and new crust is created. Earthquakes here are usually less intense.
 - Convergent Boundaries: Plates collide, and one plate may be forced beneath another, causing powerful earthquakes.
 - Transform Boundaries: Plates slide past each other horizontally, leading to significant earthquakes along faults like the San Andreas Fault in California.

2. Faulting: Most earthquakes are associated with faults, fractures in the Earth's crust where movement has occurred. Stress builds up over time along these faults until it is released suddenly as an earthquake.

- Normal Faults: Caused by tensional forces where the crust is being pulled apart.
- Reverse (Thrust) Faults: Caused by compressional forces where the crust is being pushed together.
- Strike-Slip Faults: Caused by horizontal shearing forces where the crustal blocks slide past each other.

- **Volcanic Activity:** Earthquakes can also be triggered by volcanic activity due to the movement of magma within the Earth. These are usually localized near volcanic regions.
- **Measuring Earthquakes**
- **Magnitude:** The magnitude of an earthquake is a measure of the energy released. The Richter scale, although historically significant, has largely been replaced by the Moment Magnitude Scale (Mw), which provides a more accurate measurement, especially for large earthquakes.
- **Intensity:** The intensity of an earthquake measures its effects at different locations. The Modified Mercalli Intensity (MMI) scale is commonly used to describe the intensity based on observed effects and damage.

- Effects of Earthquakes
- Ground Shaking: The primary effect, causing buildings and infrastructure to collapse, leading to casualties and economic losses.
- Surface Rupture: The ground displacement along the fault can damage structures and alter landscapes.
- Secondary Hazards: These include landslides, tsunamis, and liquefaction. Tsunamis can occur when underwater earthquakes displace large volumes of water, while liquefaction happens when saturated soils temporarily lose strength during shaking.

- **Importance of Studying Earthquakes**
- Understanding earthquakes is crucial for mitigating their impacts. This involves:
 - Seismology: The scientific study of earthquakes and the propagation of seismic waves.
 - Earthquake Engineering: Designing buildings and infrastructure to withstand seismic forces.
 - Early Warning Systems: Implementing systems to provide advance notice of seismic activity, allowing people to take protective actions.
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