Volcanic activities and Earthquakes

Eruption of the liquid or molten rock from the surface of the Earth is known as volcanism. The molten rock is called magma.

The eruption of lava from the internal part of the Earth is known as Volcanism. It is caused due to the internal heat of the Earth. Volcanism is responsible for the formation of the mantle of the Earth. The mantle is the secondary crust of the Earth. The volcanic eruption is caused due to different reasons such as the magma's interaction with water, magma being light in weight erupts, and others.

Causes of Volcanism

The temperature inside the Earth is high that causing the rocks to get molten. The rock when molten and converted into the liquid forms the volume of the substance increases. The molten substance is light in weight and thin in comparison to the adjoining rocks. The magma that is the molten rock then tends to rise up to the surface of the Earth. Due to the density issue of the magma in the interior of the Earth and the surface of the Earth, the magma comes out of the Earth's surface.

The interaction of magma with water is another cause of Volcanism. Magma consists of different types of gases and when it comes in contact with water there is an interaction that results in eruption. The pressure of the molten rock when it interacts with water rises and results in eruption.

Volcanic eruptions are caused by several factors, primarily involving the movement and behavior of magma beneath the Earth's surface. Here are the main causes:

1. **Magma Pressure**: The buildup of pressure from the magma in the magma chamber can force the magma to rise through cracks in the Earth's crust, leading to an eruption. This pressure is often due to the accumulation of gases within the magma.

2. **Tectonic Plate Movements**: Most volcanic activity is associated with the boundaries of tectonic plates. Eruptions can occur at:
   - **Divergent Boundaries**: Where plates are moving apart, magma rises to fill the gap, as seen in mid-ocean ridges.
   - **Convergent Boundaries**: Where plates collide, one plate is forced beneath another (subduction), causing melting and magma formation, which can lead to eruptions.
   - **Hotspots**: Volcanic activity can also occur away from plate boundaries, where plumes of hot mantle material rise, melting the crust and causing volcanic activity, such as in Hawaii.

3. **Buoyancy of Magma**: Magma is less dense than the surrounding solid rock, so it tends to rise through the Earth's crust. As it ascends, the reduction in pressure allows gases dissolved in the magma to form bubbles, further increasing the buoyancy and pressure, potentially leading to an eruption.

4. **Hydrothermal Systems**: Water interacting with magma can become superheated and expand, adding to the pressure in the magma chamber. When this pressure is released, it can result in explosive eruptions.

5. **Structural Weaknesses in the Earth's Crust**: Faults, fractures, and other structural weaknesses can provide pathways for magma to reach the surface more easily, facilitating eruptions.

These factors often interact in complex ways, and understanding them helps volcanologists predict eruptions and mitigate their impacts.

Types of Volcanoes

1. **Shield Volcanoes:**
   - Shape: Broad, gently sloping sides.
   - Lava: Flows easily, creating wide, flat layers.
   - Example: Mauna Loa in Hawaii.

2. **Stratovolcanoes (Composite Volcanoes):**
   - Shape: Steep, conical shape with layers of lava and ash.
   - Eruptions: Explosive and dangerous.
   - Example: Mount St. Helens in the USA.

3. **Cinder Cone Volcanoes**:
   - **Shape**: Small, steep-sided cones.
   - **Material**: Built from volcanic debris called cinders.
   - **Eruptions**: Short-lived and typically not very large.
   - **Example**: Paricutin in Mexico.

Types of Volcanoes

4. Lava Domes:
   - Shape: Rounded, dome-like.
   - Lava: Thick, sticky lava that doesn't flow far.
   - Eruptions: Slow and build up the dome over time.
   - Example: Mount St. Helens has a lava dome inside its crater.
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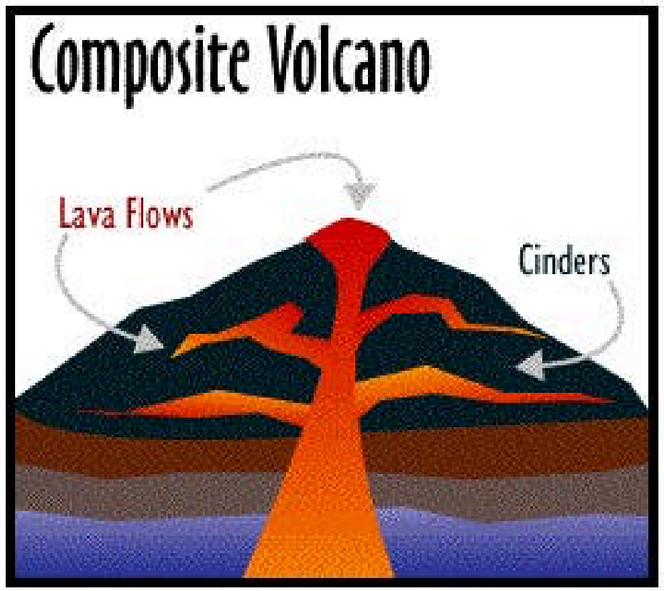
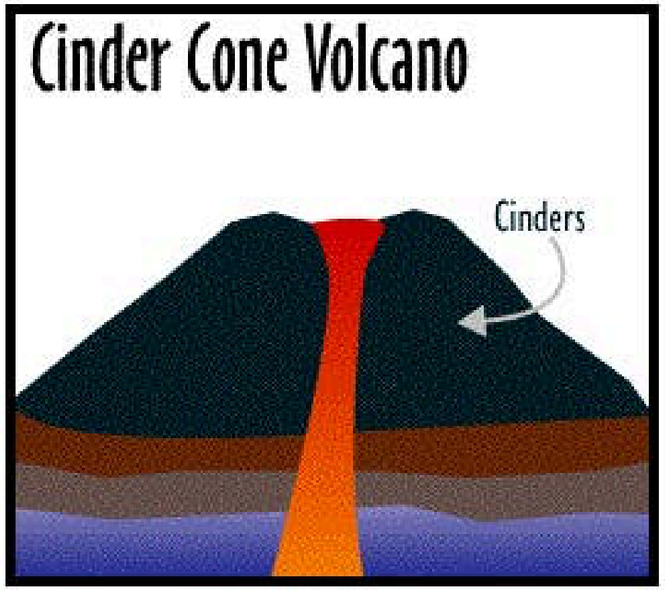
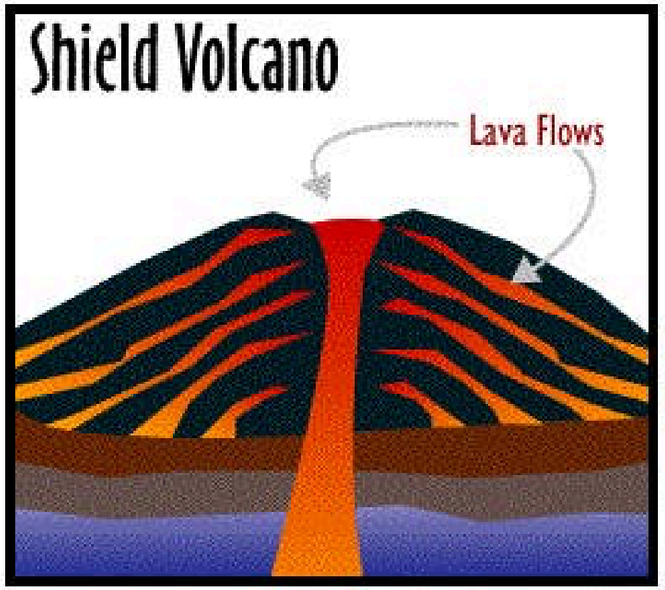
These types of volcanoes differ mainly in their shape, the type of eruptions they produce, and the materials they emit.







Positive and Negative Impact of Volcanic Eruption

The Volcanic eruption can have a positive impact on the Earth. A volcanic eruption can be helpful in adding nutrients to the soil that can increase fertility of the soil. This can result in increasing the quality of the soil thus creating favorable conditions for the growth of crops.

The negative impact of volcanic eruption is global warming caused due to the release of huge fumes, ash, and dust particles. The volcanic eruption that includes magma and explosion can destroy nearby places and kill thousands of people.

Earthquakes

About Earthquake

- All-natural earthquakes occur in the lithosphere.
- Seismic wave studies offer a full picture of the layered interior.
- An earthquake is, simply put, the shaking of the earth's crust.
- It is caused due to the energy release, which triggers waves that travel in all directions.
- The emanation of energy occurs along a fault.
- A fault is a sharp break in the crustal rocks.
- Rocks along a fault generally move in opposing directions.

Types of Earthquakes

- Tectonic earthquakes: The most common form of earthquake, is caused by the movement of loose fragmented pieces of land on the earth's crust known as tectonic plates.
- Volcanic earthquake: The less prevalent compared to the tectonic variety, these earthquakes happen before or after the eruption of a volcano. It is caused when magma leaving the volcano is filled by rocks being pushed to the surface.
- Collapse earthquake: This earthquake occurs in underground mines. The main cause is the pressure generated within the rocks.
- Explosion earthquakes: The occurrence of this type of earthquake is artificial. High-density explosion such as nuclear explosions is the primary cause.

Causes of Earthquakes

- It is caused due to the tectonic movements of the earth.
- The energy release produces waves that travel in all directions.
- The point where energy is released is called the focus or hypocentre. It is generally located at a depth of 60 km.
- This causes a release of energy, and the energy waves travel in all directions.
- The point where the energy is released is called the focus of an earthquake or hypocentre.
- The point on the surface of the earth which is vertically above the focus is called the epicentre. It is the first place to experience the waves.
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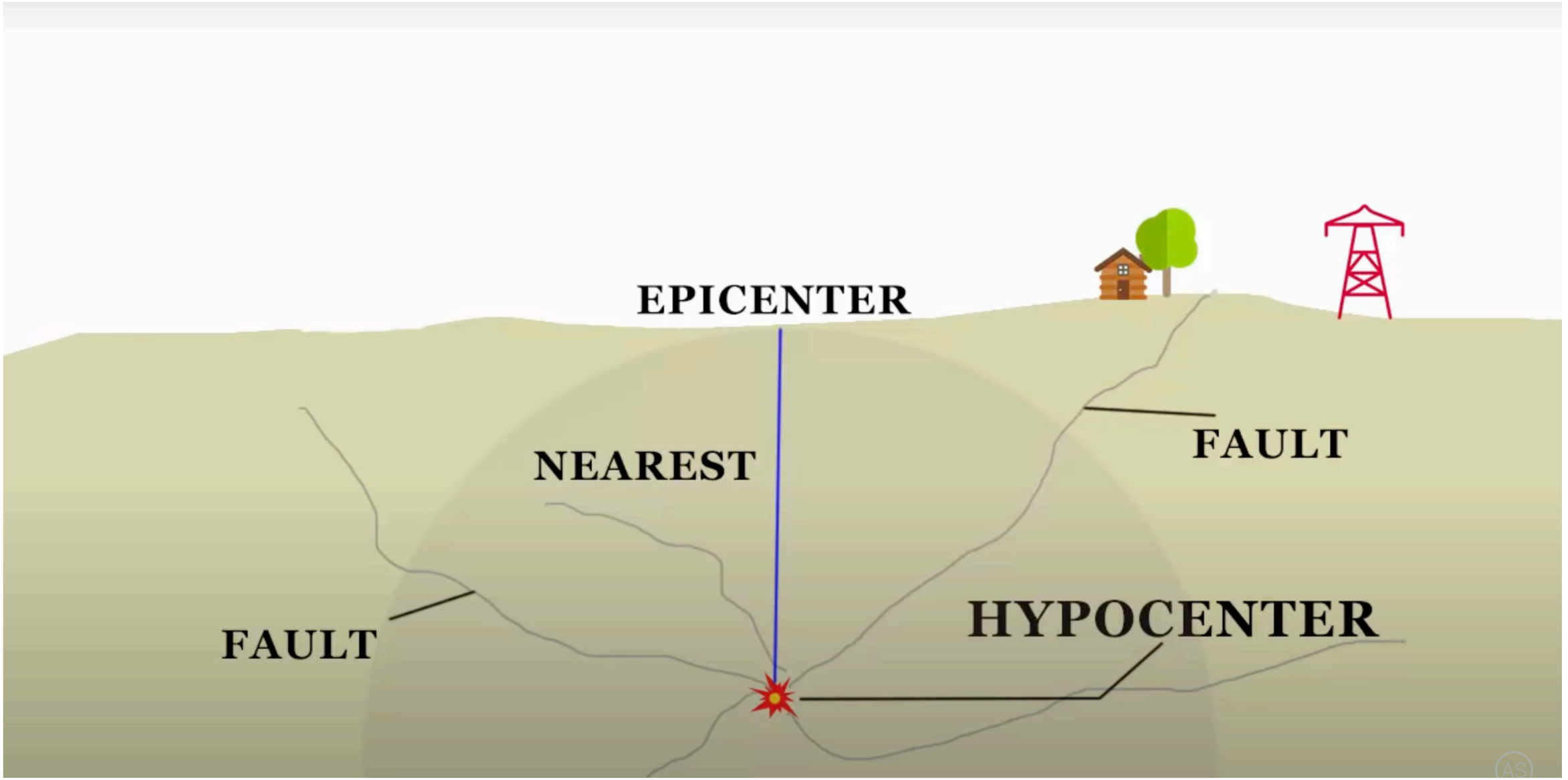

EPICENTER
NEAREST
FAULT
FAULT
HYPOCENTER

Effects of an earthquake

The following are the immediate hazardous effects of Earthquake:

- Shaking of ground
- The disparity in ground settlement
- Natural disasters like Tsunami, landslides, mudslides, and avalanches
- Soil liquefaction
- Ground lurching and displacement
- Floods and fires
- Infrastructure collapse.

Measurement of Earthquake

All earthquakes are different in their intensity and magnitude. The instrument for the measurement of vibrations is known as Seismograph.

Magnitude scale

- **Richter scale** is used to measure the magnitude of the earthquake
- The energy released during a quake is expressed in absolute numbers of 0-10.

Intensity scale

- The Mercalli scale is used to measure the intensity of an earthquake
- It measures the visible damage caused due to the quake.
- It is expressed in the range of 1-12.

Earthquake Fault Types

Normal, reverse (thrust), as well as strike-slip faults are the three primary fault types that can all result in an interplate earthquake. Examples of dip-slip faulting include normal and reverse faulting when movement on the faults contains a vertical component and displacement all along fault is in the plane of dip.

Normal

- Normal faults primarily appear along divergent boundaries or other regions in which the crust is extending.

Reverse

- In regions where the crust is shortening, like near a convergent boundary, reverse faults develop.

Strike-slip

- Transform boundaries are a specific kind of strike-slip fault. Strike-slip faults are steep formations in which the opposing sides of the fault slip past one another horizontally. Movement on faults with both dip-slip and strike-slip components is a common cause of earthquakes.

When an earthquake occurs, it releases energy waves, known as Seismic waves. It is like the ripples created in water if you throw a stone in it. Seismic waves are like ripples that can travel through the inside of the earth and on the surface.

Types of Earthquake Waves

Based on the medium they travel in, earthquake waves can be classified under two categories:

- Body waves
- Surface waves

Body waves are those waves that travel through the earth. They originate at the epicentre of the earthquake and travel through the earth at amazing speeds. There are two types of body waves, namely,

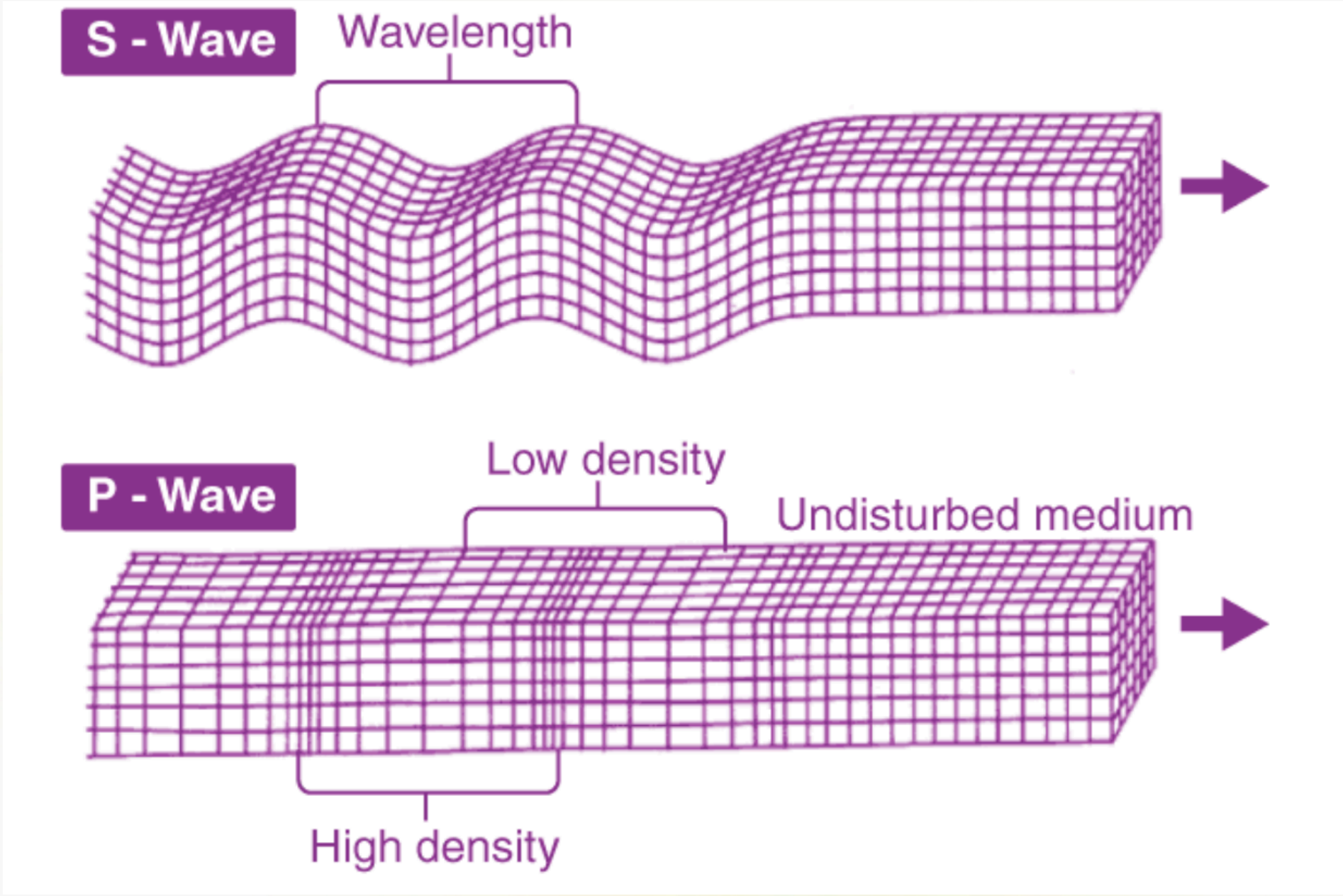
- P waves
- S waves

Surface waves are those waves that travel on the surface of the earth. The destruction caused by earthquakes is primarily done by these waves.

S waves and P waves

S waves also called secondary waves and shear waves, are the second waves to hit the seismographs. They are transverse waves, which means that the motion is perpendicular to the direction of wave propagation. S waves can only travel through solids, and scientists have successfully mapped the earth's interior by studying the routes of these waves.

P waves or Primary waves are the first waves to hit the seismographs when an earthquake strikes. They are longitudinal waves which means that the direction of motion and propagation are the same.



Aftershocks

A further earthquake, known as an aftershock, happens after the mainshock. The main sources of these aftershocks include the crust surrounding the ruptured fault line as it adjusts to the impacts of the mainshock, rapid changes in tension amongst rocks, as well as the stress from the first earthquake. A building that has already suffered damage from the original earthquake might still sustain more damage from an aftershock, despite the fact that they are always lesser in size. When an aftershock is greater than that of the mainshock, the mainshock that originally occurred is reclassified as a foreshock and the aftershock is reclassified as the mainshock. As the crust near the shifted fault plane adapts to the mainshock's effects, aftershocks are created.