



## Describe The Theory of Plate Tectonics In The Formation of Geological Features. (250 Words / 15 M) ( GS-1 Physical Geography )

### Approach:

1. Introduction
2. Define plates with major & minor plates.
3. Origin of plate tectonics.
4. Mention the type of plate boundaries with associated landforms.
5. Give a diagram of plate tectonics.

Developed from the 1950s-1970s, the **theory of plate tectonics** is the modern update to continental drift, an idea first proposed by scientist Alfred Wegener in 1912 which stated that Earth's continents had "drifted" across the planet over time.

Plate tectonics says that Earth's outer shell is divided into large slabs of solid rock, called "**plates**," that **glide over Earth's mantle**, the rocky inner layer above Earth's core. Earth's solid outer layer, which includes the crust and the uppermost mantle, is called the **lithosphere**. It is **100 km (60 miles) thick**. Below the lithosphere is the **asthenosphere** — a viscous layer kept malleable by heat deep within the Earth. It lubricates the undersides of Earth's tectonic plates, allowing the lithosphere to move around.

**Seven major plates** exist: the North American, Pacific, Eurasian, African, Indo-Australian, South American and Antarctic tectonic plates. The list of Earth's **minor plates** includes the Arabian Plate, Caribbean Plate, Cocos Plate, Nazca Plate, Philippine Plate, Scotia Plate, and more.

Plate tectonics unified all descriptions by saying that to describe all geologic features are driven by the **relative motion of these tectonic plates**. The driving force behind plate tectonics is **convection** in the mantle. Hot material near the Earth's core rises, and colder mantle rock sinks.

**When did plate tectonics start ?** : While the Earth is estimated to be **4.54 billion years** old, **oceanic crust is constantly recycled at subduction zones**. That means the **oldest seafloor** is still only about **200 million years old**. The **oldest ocean rocks** are found in the **north-western Pacific Ocean** and the **eastern Mediterranean Sea**. Fragments of **continental crust are much older**, with large chunks at least **3.8 billion years old** found in Greenland.

**Types of plate boundaries** : There are **three ways** in which plate boundaries meet, and each one triggers a unique geological feature.

- **Convergent boundaries** occur where plates collide into one another. Where those



plates meet, Earth's crust crumbles and buckles into **mountain ranges**. For example, India and Asia came together about 55 million years ago to create the **Himalaya**. As the mash-up continues, those mountains grow higher and higher. Geologists have discovered the **Swiss Alps** are being **lifted faster** than they are being lowered through erosion—and are thus **growing every year**, according to a 2020 study.

- But converging plates **don't always collide upward**. Sometimes, an **ocean plate** (which is made of **denser rock** than landmasses) **collides with a continental plate**, in which case it "subducts" or dives beneath the other plate. It then descends into the Earth's mantle, melts in the mantle's hot magma, and is spewed out in a **volcanic eruption**. Many spectacular volcanoes are found along subduction zones, such as the **"Ring of Fire"** that surrounds the **Pacific Ocean**.
- When **two oceanic plates converge**, a **deep trench** forms, such as the **Mariana Trench** in the **North Pacific Ocean** which is believed to be the deepest point on Earth. These types of collisions can also lead to **underwater volcanoes**.
- **Divergent boundaries** are tectonic boundaries where plates "diverge" or are tugged apart. This motion creates **giant troughs** on land, such as the **East Africa Rift**. In the ocean, this same process creates **mid-ocean ridges**. Hot magma from Earth's mantle wells up at these ridges, forming **new ocean crust** and shoving the plates apart. Underwater mountains and volcanoes can rise along this seam, in some cases forming islands. For example, the **Mid-Atlantic Ridge** runs directly through Iceland.
- The final type of plate boundary, **transform boundaries**, exist where plates move **sideways** in relation to each other. It's the **slip-sliding motion** of plate boundaries that triggers many earthquakes. **California's San Andreas Fault**, where the North American and Pacific tectonic plates grind past each other with a mostly horizontal motion, is one famous example of a transform boundary.