



## Earthquakes in Turkey and Causes

**Prelims:** Tectonic Plates, Types of Earthquakes, Earthquake, its Distribution and Types, Strike-Slip Earthquake.

**Mains:** Earthquake, its types and Distribution.

### Why in News?

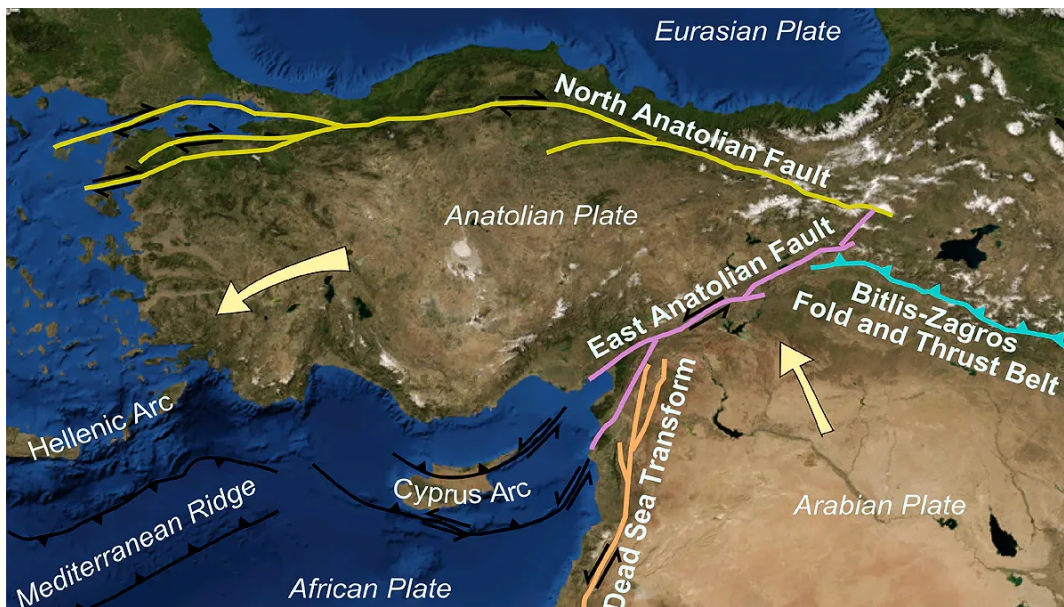
Recently, powerful tremors were felt in Turkey after an [earthquake](#) of magnitude 7.8 struck along a well-known fault line called the **Anatolia tectonic block**.

- The earthquakes emerged from relatively shallow depths and **were a “strike-slip quake”**.
- It is being described as the strongest Earthquake that Turkey has experienced in over a century and the worst disaster since 1939. The **1939 earthquake was the Erzincan Earthquake** that had caused “extreme damage in the Erzincan Plain and the Kelkit River Valley.

### What Makes Turkey Prone to Earthquakes?

- In the Eastern Mediterranean region comprising **Turkey, Syria and Jordan**, tectonics are dominated by **complex interactions between the African, Arabian, and Eurasian tectonic plates**, and the **Anatolian tectonic block**.
- Turkey sits on the Anatolian tectonic plate, which borders two major faults, the **North Anatolian Fault (NAF) that cuts across the country from west to east**, and the East Anatolian Fault (EAF) in the southeast.
  - The NAF line is the meeting point of the **Eurasian and Anatolian tectonic plates that is known to be “Particularly Devastating”**.
    - NAF is **right-lateral strike-slip structure** in northern Turkey accommodating much of the translational motion of the Anatolia block westwards with respect to Eurasia and Africa.
    - The EAF is the **tectonic boundary between the Anatolian Plate and the northward-moving Arabian Plate**. It runs 650 kilometers from eastern Turkey and into the Mediterranean.
- In addition to this, the **Aegean Sea Plate**, located in the eastern Mediterranean Sea under southern Greece and western Turkey, **is also a source of seismic activity in the region**.
- According to one estimate, almost **95% of Turkey's land mass is prone to earthquakes**, while about a third of the country is at high risk, including the areas around the major cities of **Istanbul and Izmir and the region of East Anatolia**.

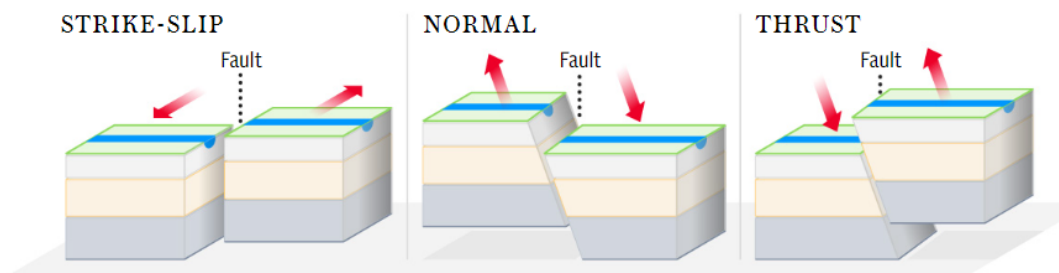
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## How Regular Earthquake is Different from Strike Slip Earthquake?

- **Plate Movement:** In a strike-slip earthquake, two tectonic plates **move horizontally past each other**, whereas in a regular earthquake, the movement is vertical.
  - Fault Zones, Tectonic Earthquakes, Volcanic Earthquake, Human Induced Earthquakes are the different **types of Earthquakes**.
- **Fault Type and Location:** Strike-slip earthquakes occur along transform boundaries such as the San Andreas Fault in California while regular earthquakes **occur along divergent or convergent plate boundaries** where the plates move vertically such as along the **Pacific "Ring of Fire"**.
- **Causes:** The cause of strike-slip fault earthquakes is due to the movement of the two plates against one another and the release of **built-up strain**.

### THREE MAIN TYPES OF FAULTS CAUSING EARTHQUAKES



## Do Shallow Earthquake cause greater Damage?

- A shallow earthquake is an earthquake that **occurs at a shallow depth, usually within the Earth's crust**, near the surface. They typically have a **depth of less than 70 km** and can **result in strong ground shaking** and surface faulting.
- They are **often more damaging than deep earthquakes** because the energy from the seismic waves is released **closer to the surface, leading to stronger ground motion** and more intense shaking.
  - This can cause damage to buildings and infrastructure, as well as triggers landslides, rockfalls, and other secondary hazards.
- However, the amount of damage caused by an earthquake **depends on a number of factors, including the magnitude of the earthquake**, the distance from the epicenter, the depth of the earthquake, the type of soil and geological conditions at the surface.

# EARTHQUAKE



## ABOUT

- Shaking of the earth; caused due to release of energy, generating **seismic waves in all directions**

## HYPOCENTER

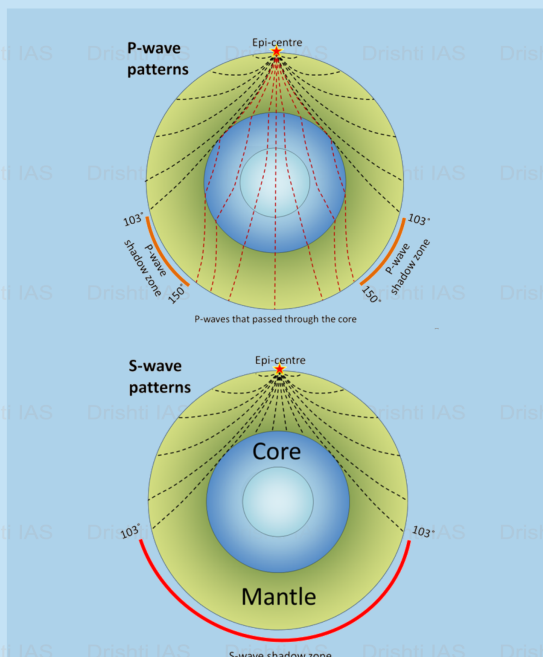
- Location where the earthquake starts (below earth's surface)

## EPICENTER

- Location right above the Hypocenter (on the earth's surface)

## EARTHQUAKE WAVES

- **Body Waves:** Move in all directions travelling through the body of the earth
  - **P Waves:** Move faster, First to arrive at surface, Similar to sound waves, Travel through gaseous, liquid and solid materials
  - **S Waves:** Arrive at surface with some time lag, Travel only through solid materials
- **Surface Waves:** Last to report on seismographs, More destructive, Cause displacement of rocks
  - **Love Waves:** Same motion as S-waves (horizontal) without vertical displacement, Sideways motion perpendicular to the direction of propagation, Faster than Rayleigh waves
  - **Rayleigh Waves:** Cause the ground to shake in an elliptical pattern, Spread out the most of all seismic waves, Move vertically and horizontally in a vertical plane



## CAUSES OF EARTHQUAKES

- **Release of energy along a Fault/Fault Zones** (break in the crustal rocks)
- Movement of **tectonic plates (most common)**
- **Volcanic eruption** (stress changes in rock-injection/withdrawal of magma)
- **Human activities** (mining, explosion of chemical/nuclear devices etc.)

## EARTHQUAKE IN INDIA

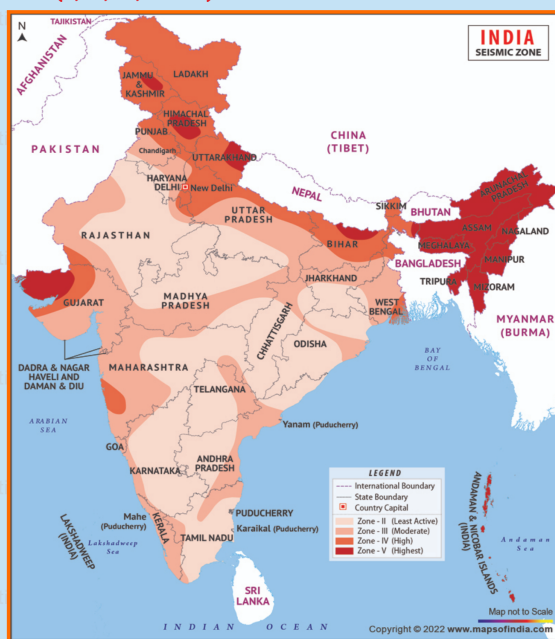
- India is **one of the highly earthquake affected countries** due to the presence of technically active mountains - the Himalayas.
- India has been divided into **4 seismic zones (II, III, IV, and V)**

## MEASURING EARTHQUAKE

- **Seismometers** - Measures seismic waves
- **Richter Scale** - Measures magnitude (energy released; range: 0-10)
- **Mercalli** - Measures intensity (visible damage; range: 1-12)

## DISTRIBUTION

- **Circum-Pacific Belt** - 81% of earthquakes
- **Alpide Earthquake Belt** - 17% of the largest earthquakes
- **Mid-Atlantic Ridge** - Mostly submerged underwater





## UPSC Civil Services Examination Previous Year Question (PYQ)

**Q.** The frequency of earthquakes appears to have increased in the Indian subcontinent. However, India's preparedness for mitigating their impact has significant gaps. Discuss various aspects. **(2015)**

**Q.** Discuss about the vulnerability of India to earthquake related hazards. Give examples including the salient features of major disasters caused by earthquakes in different parts of India during the last three decades. **(2021)**

[Source: IE](#)

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