Turkey Earthquake

Why in news?

A major earthquake struck Turkey and Syria killing more than 2600 people and flattening thousands of buildings.

What is the issue?

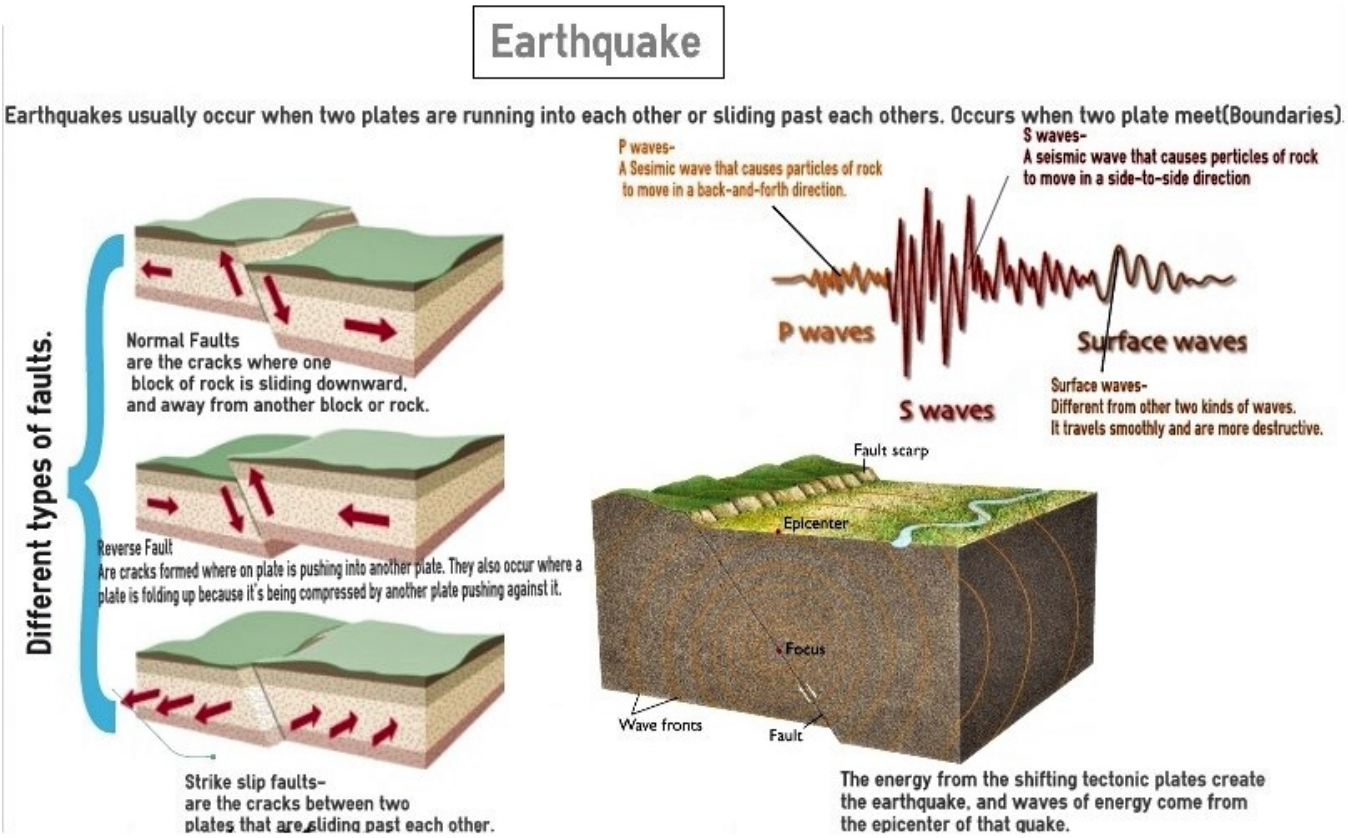
- The tremors of the first quake were felt on February 6 with the epicentre located near the city of Gaziantep in south-central Turkey, close to the border with Syria.
- A magnitude of 7.8 was measured on the **Moment Magnitude scale**.
- At least 40 **aftershocks** followed the first quake, with some of magnitude as high as 6.7.

What is an earthquake?

> **Fault** - A fracture in the rocks that make up the Earth's crust
>
> **Epicenter** - The point at the surface of the Earth above the focus
>
> **Plates** - Massive rocks that make up the outer layer of the Earth's surface and whose movement along faults triggers earthquakes
>
> **Seismic waves** - Waves that transmit the energy released by an earthquake
>
> **Focus (Hypocenter)** - The point within the Earth where an earthquake rupture starts

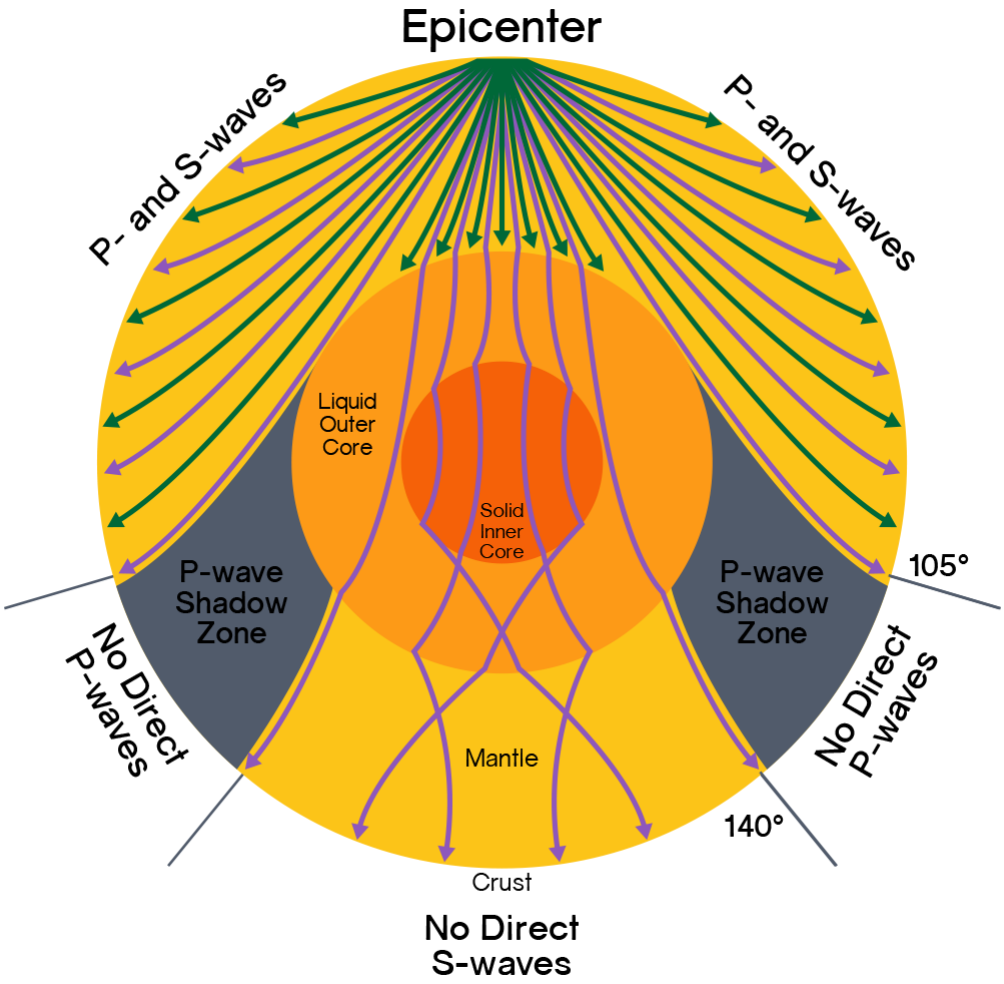
Earthquakes

- Earthquakes are caused by a sudden release of stress along faults in the earth's crust.
- The Earth's crust consists of 7 large lithospheric plates and numerous smaller plates **(tectonic plates)** that move
  - Towards each other (a convergent boundary)
  - Apart (a divergent boundary) or
  - Past each other (a transform boundary)
- The continuous motion of tectonic plates causes a steady build-up of pressure in the rock strata on both sides of a fault.
- It gets released as waves of seismic energy and propagate through the ground and over its surface and causes shaking as earthquakes.



Types of energy waves

- **P waves or primary waves** – They are the first waves to be detected.
- These are compressional waves that push and pull as they move through rock and fluids.
- **S waves or secondary waves** - They are the next waves to be detected.
- These waves move **only through solids**.
- They move up and down or side to side, perpendicular to the direction in which the wave is moving.
- **Surface waves** - It follow P and S waves and travel along the surface of the earth and thus cause the most damage.
- Surface waves can be characterized as
    - **Love waves** - Faster and move the ground from side to side, and
    - **Rayleigh waves** - Roll like waves on the surface of oceans and lakes

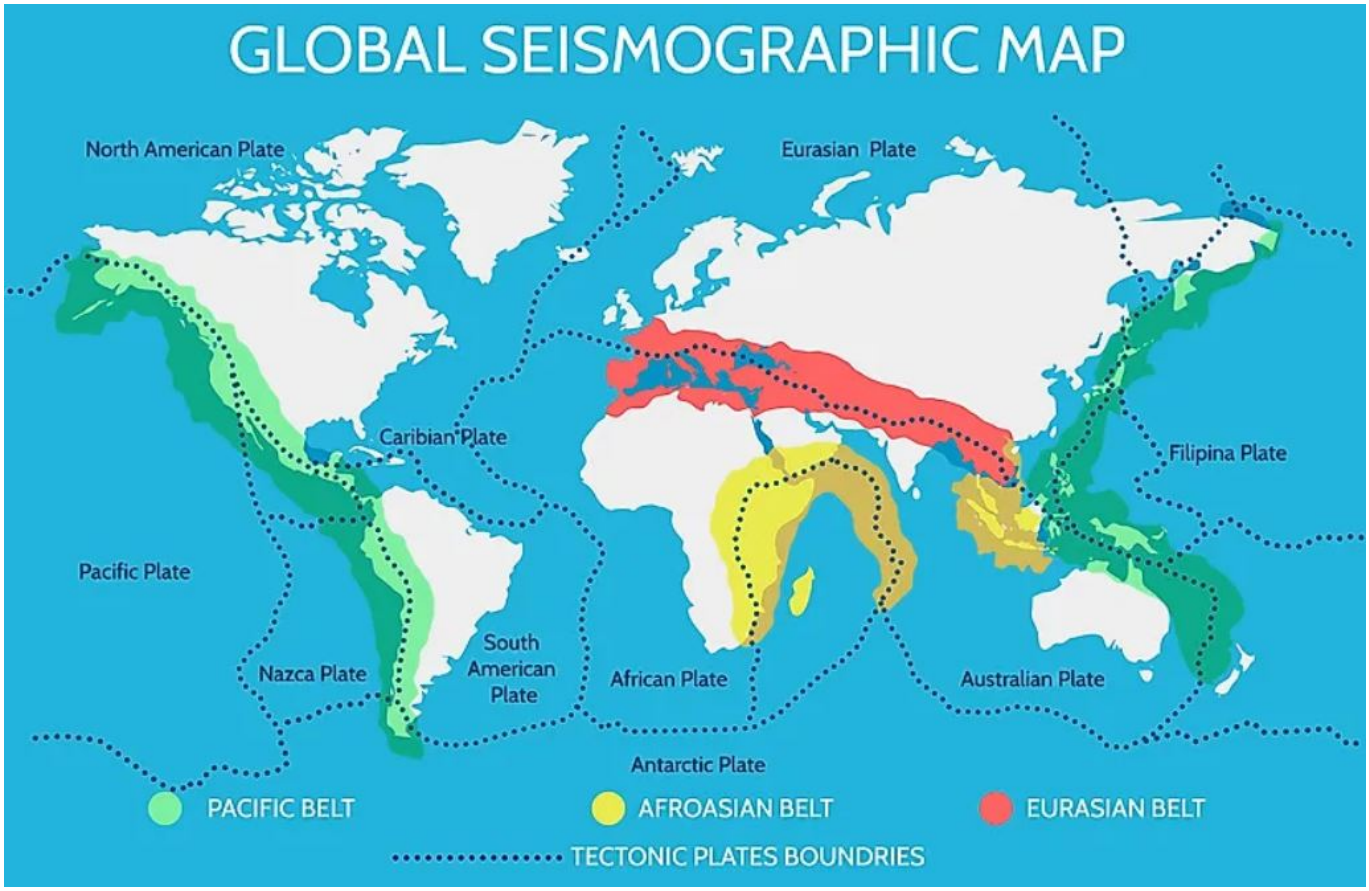


Types of earthquake

- **Tectonic -** Earthquakes that occur when the edges of the tectonic plates slide against each other in fault zones
- **Volcanic** - Earthquakes that occur in conjunction with volcanic activity
- **Collapse** - Smaller-scale earthquakes that result from the subterranean collapse of caverns or mines
- **Induced** - Quakes caused by human activity, like tunnel construction, filling reservoirs and implementing geothermal or fracking (hydraulic fracturing) projects

Earthquake prone zones

- The regions regularly exhibiting earthquakes include the
  - **Circum-Pacific seismic belt** - along the rim of the Pacific Ocean
  - **Alpide belt** - along the southern margin of Eurasia through the Himalayan Mountains, Sumatra, and Java
  - **Mid-Atlantic Ridge** - along the floor of the Atlantic Ocean



What scales of measurement are available?

Measuring the magnitude

- Earthquake magnitude is a measure of the size or amplitude of the seismic waves generated by an earthquake source.
- **Richter Scale** (denoted as ML) - Devised in 1935 by Charles Francis Richter, the Richter Scale is a logarithmic scale, where each step represents a tenfold increase in magnitude.
- Thus, an earthquake measuring 7 on the Richter Scale has 10 times the magnitude of one measured 6.
- **Moment Magnitude Scale** (denoted as Mw) – It is a logarithmic scale which is related to the total energy released in the earthquake.
- This scale provides a more accurate estimate of magnitude.

Measuring the intensity

- The intensity is related to the tangible impact a quake has.
- Intensity scales, like the **Modified Mercalli Scale** and the **Rossi-Forel scale**, measure the amount of shaking at a particular location.
- The Modified Mercalli Scale ranks earthquake intensity on a scale of I. (not felt) to XII. (extreme).
- The maximum intensity of Turkey earthquake in Modified Mercalli Scale is IX. (Violent)

S.No	Richter Scale	Mercalli Scale
1.	Has 10 levels	Has 12 levels

2.	Measures the magnitude of earthquake	Measures the intensity of earthquake
3.	Only describes the strength at the focal point	Describes damages at multiple locations

What are aftershocks and why do they occur?

- Aftershocks are a sequence of earthquakes that happen after a larger mainshock on a fault.
- Aftershocks occur near the fault zone where the mainshock rupture occurred.
- They can even continue for days, weeks, months, or even years for a very large mainshock.
- Although aftershocks tend to be weaker than the main seismic event, they can cause significant damage.
- In Turkey, reports suggest that significant damage that has followed the original quake has been a result of aftershocks.
- Shallower quakes are generally felt as more intense than deeper quakes due to their proximity from the surface.
- The aftershock in Turkey was extremely shallow, only 10 km deep, which worsens the shaking felt.

What makes Turkey a hotbed of seismic activity?

> *According to an estimate, almost 95% of the country's land mass is prone to earthquakes, while about a third of the country is at high risk.*

- Turkey is located on the **Anatolian tectonic plate**, which is located between the Eurasian and African plates.
- On the north side, the minor Arabian plate further restricts movement.
- **The North Anatolian fault (NAF) line,** the meeting point of the Eurasian and Anatolian tectonic plates is known to be devastating.
- **The East Anatolian fault line** is the tectonic boundary between the Anatolian Plate and the northward-moving Arabian Plate.
- **The Aegean Sea Plate,** located in the eastern Mediterranean Sea is also a source of seismic activity in the region.

What makes this one catastrophic in particular?

- **Turkey** - Turkey's President Recep Tayyip Erdogan said the earthquake that hit the area around Gaziantep, was the country's worst disaster since **Erzincan earthquake, 1939.**
- The impact of the earthquake on the lives of people is worrying.

> *The Erzincan earthquake measured 7.8 on the Richter scale, occurred on the North Anatolian Fault Zone (NAFZ), and created a 360-km-long surface rupture.*
>
> *It killed about 33,000 people and caused extreme damage in the Erzincan Plain and the Kelkit River Valley.*

- **Syria** - The situation is terrible in Syria, where quake-related destruction has taken hold of both government and opposition-occupied regions as they are facing devastating winter storms that make it difficult for humanitarian resources to reach these areas.

References

1. The Indian Express | Turkey hit by 7.8 magnitude earthquake

2. The Indian Express | ‘Aftershocks’ in Turkey after earthquake
3. The Indian Express | Turkey earthquake
4. The Indian Express | What happened in Erzincan
5. The Hindu | Why Turkey is prone to devastating earthquakes?