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Q4

Discuss the geophysical characteristics of Circum- Pacific Zone.

UPSC Civil Services Mains 2020 · GS I · 10 marks · World's Physical Geography

Salient features of world's physical geography.

Core demand of the question

- Discuss the geophysical characteristics of Circum-Pacific Zone
- Keep the discussion within a 10-mark length

Revision summary

The Circum-Pacific Zone is the **Ring of Fire** around the Pacific plates.

Subduction at trenches produces Benioff earthquakes and volcanic arcs.

Andesite volcanoes, island arcs, and megathrust tsunamis are the typical signatures.

Most of Earth's active volcanoes sit on this ring.

It is a plate-tectonic zone, not a single mountain of one age.

Introduction

- **The Circum-Pacific Zone is the Ring of Fire:** a horseshoe of trenches, arcs, and volcanoes around the Pacific. Its geophysics is plate convergence, not a single mountain chain.

Body**Plate setting**

- Oceanic plates of the Pacific, Nazca, Cocos, and Philippine Sea sink at trenches under continents and island arcs. This is the world's main **subduction** factory.
- Transform and spreading edges, such as the San Andreas and East Pacific Rise, sit inside the same Pacific frame and add strike-slip and ridge earthquakes.
- The zone is not closed in the south in the same way; Antarctica and the Pacific-Antarctic ridge complete a different edge.

Geophysical signatures

- Deep ocean trenches (Mariana, Peru-Chile, Japan) mark the subducting slab. Benioff-Wadati zones show earthquakes down to hundreds of kilometres.
- **Volcanic arcs:** Andes, Cascades, Japan, Philippines, New Zealand, and the Aleutians. Magma is typically andesitic from hydrated slab melting.
- High seismicity and tsunamis follow megathrust ruptures, as in Chile 1960, Alaska 1964, Sumatra-Andaman 2004 (Indian Ocean edge of the same Pacific-Australian coupling), and Japan 2011.
- Island arcs, back-arc basins, and accretionary prisms are the landform kit.

Why it matters as a zone

- About three-quarters of the world's active volcanoes and a large share of great earthquakes sit on this ring.
- India is not on the ring, but Pacific tsunamis and global climate of volcanic aerosols still couple distant hazards.
- Geophysical unity is the subduction engine; local geology still differs from Andes cordillera to Japanese island arc.

Flow diagram

Pacific plates -> Subduction trenches
Subduction trenches -> Deep earthquakes
Subduction trenches -> Volcanic arcs
Deep earthquakes -> Ring of Fire
Volcanic arcs -> Ring of Fire

Conclusion

The Circum-Pacific Zone is a subduction-and-arc belt with trenches, deep seismicity, andesite volcanoes, and megathrust tsunamis. Discuss it as plate geophysics of the **Ring of Fire**, not as one rock type.

Facts & figures

Ring of Fire

Popular name for the Circum-Pacific belt of volcanoes and earthquakes.

Mariana Trench

Deepest subduction trench, a type site of Pacific-plate descent.

Benioff-Wadati zone

Inclined plane of earthquakes that maps the sinking slab.

Andes and Japan

Continental and island-arc examples of the same subduction volcanism.

Tohoku 2011

Megathrust earthquake and tsunami on the Japan Trench, a Ring of Fire event.