

Impact of Earthquake on River Course

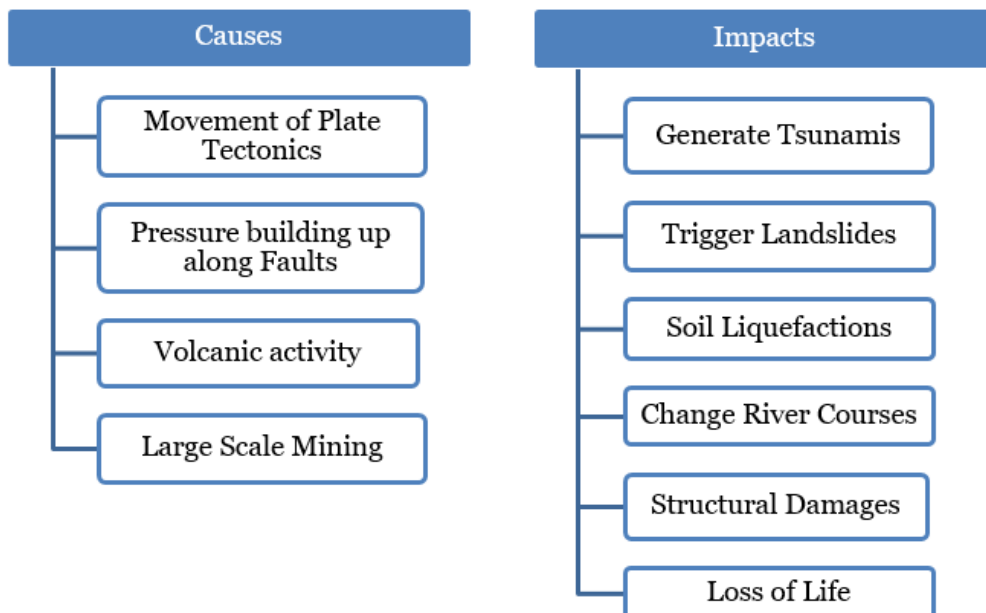
Why in news?

A recent study suggests that an earthquake about 2,500 years ago might have abruptly altered the course of the Ganga River.

What is an Earthquake?

- It is a sudden and rapid shaking of the Earth's surface.
- **Generation** - It is caused by the release of energy stored in the Earth's crust which generates seismic waves, which propagate through the Earth and cause the ground to shake.

A **seismic wave** is a mechanical wave of acoustic energy that travels through the Earth or another planetary body.



How earthquake changes river course?

- **Displaces riverbeds**- Earthquake can cause the ground to shift, and can alter the course of rivers by moving their beds or changing their direction.
- **Alters water flow patterns**- Shifts in the riverbed or new obstacles can change the

speed and volume of river flow.

- **Blockage by Landslides-** Landslides due to earthquake can block rivers and form temporary or permanent dams.
- **Alters sediment load-** An increase in sediment flow into rivers due to landslides or soil erosion, affects river morphology.
- **Creates new channels-** All these factors can result in creating new pathways for rivers, leading to the formation of new river channels.

What are the evidences showing impact of earthquake on River Ganga?

***The Ganga River**, originating in the Himalayas, merges with the Brahmaputra and Meghna rivers before flowing into the Bay of Bengal, forming the world's second-largest river system after the Amazon.*

- **Discovery of Paleochannel** - Using satellite imagery, researchers identified the former main channel of the Ganga, about 100 km south of Dhaka, Bangladesh.
- It is approximately 1.5 km wide and extending for about 100 km, runs almost parallel to the current river course.

***A paleochannel** is a section of an old river that is no longer part of an active fluvial system and carries no more fluvial discharge.*

- **Presence of Sand dikes-** Two large sand dikes were found to the east of the paleochannel showing earthquake-induced liquefaction.

***Sand dikes** are geological structures formed when sediment, typically sand, is injected into fractures within a rock or sedimentary layer.*

- The sand dikes and their composition, consisting of “fine sands” and “silty muds” provided **conclusive evidence** of a major ancient earthquake.
- **Sources of earthquake** - Researchers found features known as seismites in this area,

indicating earthquake activity which might be

- From a subduction zone to the south and east, where an oceanic crust plate is pushing under Bangladesh, Myanmar, and northeastern India (or)
- From faults at the Himalayas' base, which are rising due to the Indian subcontinent's collision with Asia.
- **Similar timing of earthquake & avulsion of river course** – The mineral samples from the sand dikes and the paleochannel were tested under optically stimulated luminescence (OSL) dating.

Optically stimulated luminescence (OSL) dating technique relies on estimating how long a mineral grain (i.e. a mineral particle less than a few millimetres in size, like quartz grains in sand or mud) has been buried by measuring the amount of natural radiation stored in it.

- **Paleochannel samples** – It reveals that the avulsion occurred around 2,500 years ago.
- **Sand dikes samples** – It shows that dikes had been formed around 2500 years ago confirming occurrence of earthquake.
- Thus the OSL technique of samples helped in strengthening their hypothesis that the earthquake led to the avulsion.

What are significances of the recent findings?

- It suggests that the impact of large earthquakes can be even more devastating than previously thought because avulsions have caused some of the deadliest floods in human history.
- The cascading impacts of earthquakes and flooding can be severe for heavily populated regions like the Ganges-Meghna-Brahmaputra delta.
- Rivers Ganges are more prone to avulsion now owing to factors like
 - Rapid subsidence, i.e. sinking of the ground near the river banks due to “widespread embankment

- Climate-change-induced rise in sea levels and extreme weather events
- Thus the lessons learned from this ancient earthquake may hold important insights for navigating the Ganga's ever-changing course in the years to come.

What lies ahead?

- Future research should focus on finding the frequency of such quake-driven avulsions have happened and how such major earthquakes can be forecast.
- Policy makers and the residents of the Ganga delta should prepare themselves against the risk from such avulsions.
- India, Bangladesh and Myanmar should work closely in terms of research, monitoring, preparedness, and support coordination.

References

1. [The Hindu | Study on Ganga river's course](#)
2. [Times of India | New Study on Ganga river](#)