NTU study of ancient corals in Indonesia reveals slowest earthquake ever recorded
A ‘slow-motion’ earthquake lasting 32 years – the slowest ever recorded – eventually led to the catastrophic 1861 Sumatra earthquake, researchers at the Nanyang Technological University (NTU Singapore) have found.

The NTU research team says their study highlights potential missing factors or misinterpretations in global earthquake risk assessments today.

‘Slow motion’ earthquakes or ‘slow slip events’ refer to a type of long, drawn-out sliding phenomenon in which the Earth’s tectonic plates slide against one another without major ground shaking or destruction. They typically involve movements of between 0.1 cm/year to 0.1 cm/day.

The NTU team made the surprise discovery while studying historic sea-levels using corals called ‘microatolls’ at Simeulue Island, located off the coast of Sumatra. Growing sideways and upwards, the disc-shaped coral microatolls are natural recorders of sea level and land elevation, through their visible growth patterns.

Using data from the microatolls and combining them with simulations of the motion of Earth’s tectonic plates, the NTU team found that from 1829 until the Sumatra earthquake of 1861, south-eastern Simeulue Island was sinking faster than expected into the sea.
two tectonic plates met, said the NTU team. However, this stress was transferred to the neighbouring deeper segment, culminating in the massive 8.5 magnitude earthquake and tsunami in 1861 which led to enormous damage and loss of life.

The discovery marks the longest slow slip event ever recorded and will change global perspectives on the timespan and mechanisms of the phenomenon, says the NTU team. Scientists previously believed that slow slip events take place only over hours or minutes, but the NTU research shows that they could, in fact, go on for decades without triggering disastrous shaking and tsunamis seen in historical records.

Lead author of the study, Rishav Mallick, a PhD student at the NTU Asian School of the Environment, said, “It is interesting just how much we were able to discover from just a handful of ideally located coral sites. Thanks to the long timespans of the ancient corals, we were able to probe and find answers to secrets of the past. The method that we adopted in this study could also be useful for future studies of other subduction zones – places that are prone to earthquakes, tsunamis, and volcanic eruptions. Our study can therefore contribute to current earthquake risk assessments in future.”

Co-author Assistant Professor Aron Meltzner from the Earth Observatory of Singapore said, “When we first found these corals more than a decade ago, we knew from the patterns that something strange must have been going on while they grew. Now we finally have a viable explanation.”

The findings, published in the peer-reviewed scientific journal *Nature Geoscience*, will allow the authors to suggest that current earthquake risk assessments may be overlooking slow slip events in the observations, and hence not properly considering the potential for slow slip events to trigger future earthquakes and tsunamis.

**Possible ‘slow motion’ earthquake ongoing at Enggano Island**

Located far from land below kilometres of water, the shallower part of the subduction zone is typically ‘quieter’ and does not produce as many earthquakes. Its distant location also makes it difficult for land-based scientific instruments to detect activities and for scientists to keep track of what is going on.

Many scientists have therefore tended to interpret the ‘quietness’ of the shallow part of the subduction zone to mean that the tectonic plates lying underneath to be sliding along harmlessly.


Elaborating on their findings, Rishav said, “Because such slow slip events are so slow, they might have been missing them as current instrumental records are generally only 10-20 years long.”

He added, “If similar behaviour is observed leading up to earthquakes elsewhere, it might eventually be recognised as an earthquake precursor.”

Tapping on their methodology in the research, the NTU team also highlighted a potential ongoing drawn-out slow slip event at Enggano Island, Indonesia, located at about 78.5 miles (126 km) southwest of Sumatra.

Asst Prof Meltzner said, “If our findings are correct, this would mean that the communities living nearby this Indonesian island are potentially facing higher risk of tsunami and earthquakes than what was previously thought. This suggests that models of risk and mitigation need updating.”

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