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Statement no-1: Small scale earthquake in 100 per 1000 year for magnitude 4.

Statement no-2: Big earthquake in 1 per 1000 year for magnitude 9.

Question: - Based on those two ideas what is the probability to occur an earthquake?

Earthquake Probability: Earthquake Probability describe the long-term chances that an earthquake of a certain magnitude will happen during a time window. Most earthquake probabilities are determined from the average rate of historical events.

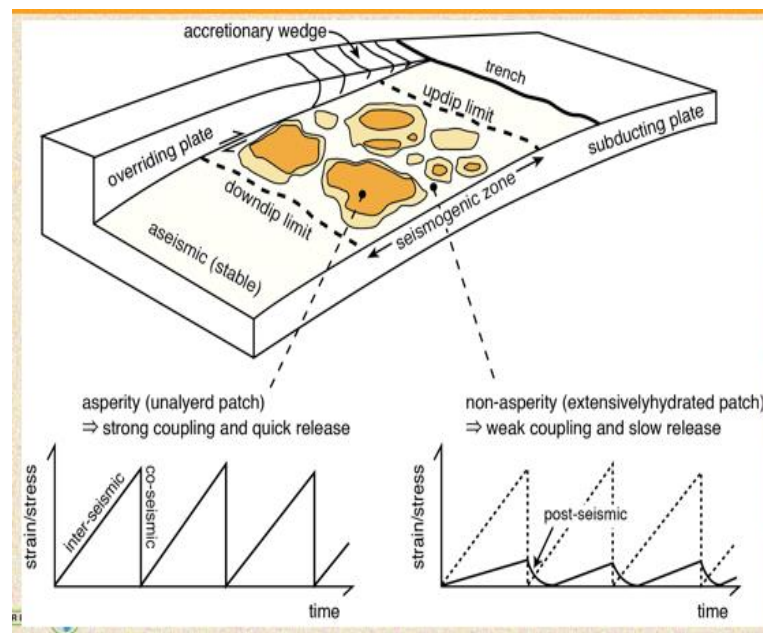


Figure 1: The Structure of the Earth and Plate Tectonics Probabilities

Based on Historical data of probability to occurring earthquake event, discussing both of the statements or ideas below:

Evidently, there is a large uncertainty in predicting future strong earthquakes based solely on historical earthquakes. It is relatively reliable to predict moderately-strong earthquakes with a quasi-period of a decadal scale. But for huge earthquakes, the quasi-period reaches from centennial to millennial scale, and seismologists have limited knowledge of this type of great earthquakes. For example, according to paleo seismic analysis, the seismic period of the Wenchuan Earthquake in 2008 is between 2000 and 3000 years.

Nowadays the moment magnitude scale is the one used by seismologists to measure earthquake events. The historic Richter magnitude is calculated by measuring the deflection on a seismometer corrected for distance from the event.

Magnitude	Notes
1	No fault
2	Only fault nearby
3	Visible fault
4	Often fault up to 10's miles away
5	Fault from more than 10' miles away
6	Starting great fault
7	Great fault
8	Great fault and damage
9	More extensive fault and damage

Regional Perception on earthquake occurrence

Bangladesh is a south Asian developing country which is used to struggle with various natural disasters and the earthquake is one of them. Bangladesh is the most earthquake venerable countries of the world. Here discuss about the risks of earthquakes in Bangladesh and the historical earthquakes that occurred in Bangladesh and its surrounding regions with some information. After that analyzed the earthquakes that were generated in Bangladesh and its very close regions (between 20.35° N to 26.75°N Latitude and 88.03° E to 92.75° E Longitude) for the last years. We have observed that under the area of concern most of the earthquake occurred were not devastating but the occurrences of those small magnitude earthquakes have been increasing significantly.

Condition of plate boundaries

After detaching from the supercontinent Gondwana 110 million years ago, the Indian plate started its journey towards north and collided with Eurasian plate about 50 million years ago during late cretaceous period. It was moving 20 centimeters per year before colliding, which was fastest among all other tectonic plates. The collision between the Indian plate and the Eurasian plate along the boundary between today's India and Nepal formed the Tibetan Plateau and the mighty Himalaya Mountains which are still rising. Currently the Indian plate is moving in north east at a speed of approximately 6 cm per year.



Figure 1: Geographical location of Bangladesh in terms of tectonic

Fault zones of Bangladesh

Bangladesh is surrounded by a number of tectonic blocks responsible for many earthquakes in the past. Calcutta, Assam, Tripura are the three very earthquake prone regions that are joined to Bangladesh in the borders in the Northern, Western and North-Eastern part respectively. If we consider the tectonics and geology, five major faults are significant for the occurrences of devastating earthquakes and these are:

Table 1: Fault zone with their magnitude

Sl. No.	Fault zone	Maximum magnitude
1	Bogra fault zone	7.0
2	Tripura fault zone	7.0
3	Shilong plateau	7.0
4	Dauki fault zone	7.3
5	Assam fault zone	8.5

Dauki fault zone is a 300 km long north dipping reverse fault along the Meghalaya-Bangladesh border and inferred to go through the southern margin of Shillong plateau. It has a major role in deforming the surrounding areas. The Dauki fault is believed to be active in the past and it is most likely the fault associated with the magnitude >7 earthquake in Sylhet (Shilchar) known as Cachar earthquake (10 January 1869). Though it is inactive in the recent times still it is considered as one of the major threats for Bangladesh for the occurrence of devastating earthquakes.



Figure 2: Dauki fault zone

Table 2: Earthquake epicenter location with respect to Bangladesh

Name of earthquake	Fault name	Time of occurrence	Magnitude	Distance from Sylhet (in km)	Distance from Dhaka (in km)
Cachar earthquake	Tripura	1869	7.5	92	250
Bengal earthquake	Bogra	1885	7.0	234	170

Great Indian earthquake	Assam	1897	8.7	151	230
Srimangal earthquake	Sub Dauki	1917	7.0	71	150
Dhubri earthquake	Bogra	1930	7.1	195	250
The Assam Earthquake	Assam	1950	8.7	150	228
The Bay of Bengal Earthquake	North Andaman Islands, Myanmar	2009	7.5	-----	----
The Myanmar Earthquake	Myanmar	2016	6.8	-----	----

Comprising with Japan earthquake zone

When a big scale earthquake will be considered for magnitude 9 or above than the probability to occur easily measured by comparing high frequency fault zone such as **Japan**.

Analyzing Japan fault zones to identify the probability of occurrence on earthquake event where 9.1 Richter scale earthquake occurred in 2011.

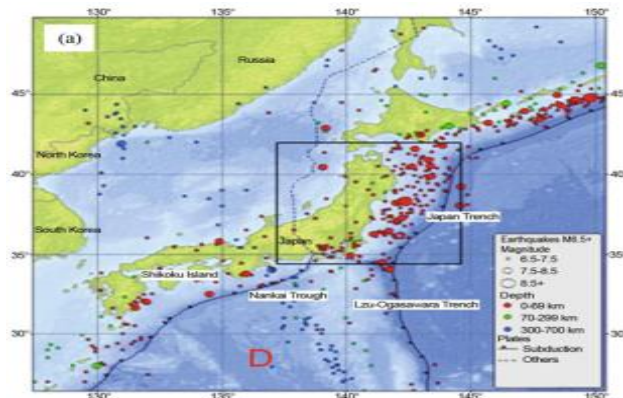


Figure 3: Earthquake prone area of Japan

- The oldest strong earthquake in history at Sanriku in Japan happened in 869, and the next strong earthquake occurred in 1611. Thereafter, three M8.0 or greater earthquakes with accompanying tsunami happened in 1677, 1896, and 1933 respectively.
- According to the predictions based on historical earthquakes, the probability of occurrence of M 8.0 earthquakes in northern and central Sanriku and its nearby seas is about 0.5–10 percent in the 97 years after 1933. In contrast, the probability of the occurrence of M 7.7 earthquakes centered offshore from southern Sanriku is 80–90 percent in the future 105 years.
- The time sequence and energy release of the last four earthquakes suggest that the interval between the first two earthquakes (one cluster) and the last two earthquakes (another cluster) since 1611 is short, about a few decades, while the interval between the two clusters is about 200–300 years.

Statement explanation with respect to the above description

The above mentioned table 1 and table 2 show that every fault zone in Bangladesh is vulnerable less than or approximately 9 magnitude in a Richter scale but upper than 4 magnitude. That means, the probability to occur earthquake events in 100 times within 1000 years in these fault zone not so little or very high frequencies but more vulnerable for magnitude 4 and 9.

For example, The April 2015 Nepal earthquake (also known as the Gorkha earthquake, Magnitude: 7.8 or 8.1) show a sign to occur a big earthquake in near future to these fault zones.

The evaluation and prediction were reasonable from the perspective of historical earthquakes. The truth, however, was that the M 9.0 great earthquake broke out just two days after the M 7.3 earthquake. The M 9.0 earthquake was not only the manifestation of the linkage of Miyagi and near seas with South Sanriku in Japan, but it also revealed the linkage of the entire northeast ocean trench of Japan because these areas formed a crack of 400 km along the ocean trench within several or 1000 years.