Earthquake Risk in Bangladesh

STUDENT VERSION

PASSAGE FOUR

Tectonics and Sedimentation in the Delta

Tectonic forces play an important role in the geography of Bangladesh. But on the world's largest delta, rivers, sedimentation, and floods also shape the landscape. Team members are investigating the connection between these two systems: tectonics and river system.

SCIENTISTS AT WORK

The research team collect sediment samples from wells along the Sylhet Basin north of Dhaka. ©AMNH

How can earthquakes affect rivers?

Rivers change course over time. In deltas, rivers can shift back and forth as they drop sediment, and then naturally flow into lower ground. Earthquakes and other tectonic activity can also steer a river. As plates shift, some parts of the landscape may drop and others uplift. This can send rivers on a new path.

"Our project is trying to understand the relationship between earthquakes and river systems," says sedimentologist Steve Goodbred. One way to do this is to study the sediment record. As rivers shift, they bring new sediments to an area. Over time, layers of sediment build up across the delta. These layers of sediment record the history of the rivers, including how rivers have changed course.

Clues in the sediment

Goodbred and his team have been examining the sediments across the delta. Using a local technique, they have dug over 150 wells. As they drill, they collect sediment samples every few meters. The deeper they dig, the older the sediment.

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By digging 100 meters down, they can piece together up to 20,000 years of the delta's history. Back in the lab, they analyze the sediments to learn how the landscape has changed. These are some of the clues in the sediment:

- **Grain size** can reflect the river's power or the distance from the main river channel. Typically, the larger the grain, the closer to the sediment was to the main riverbed.
- **Color** can show past environments. Dark brown or black sediment holds lots of decayed plants, and is usually found farther from the river. Tan or brown sediments are closer to the river.
- **Plant material** trapped in the sediment can be used to date when the layer formed.
- **Chemical composition** of the sediment tells which river deposited it. For example, sediment from the Brahmaputra River carries traces of strontium – an element found in much smaller amounts in the Ganges River sediment. That's because the Brahmaputra River flows from the Tibetan Plateau, where strontium is in the rocks.

Sediments also hold evidence of past tectonic activity:

- **Deformed sediment layers** are found in places where rocks have been uplifted by tectonic forces.
- **Sand dikes** form where fine sediment squirts up through cracks in the rock during an earthquake.
- **Abrupt changes in the type of sediment** may be caused by a sudden event like an earthquake.

Evidence of past river changes

Based on the sediment, the team is piecing together the history of the river system in Bangladesh. They've learned that, over time, the rivers have moved back and forth over the landscape. Some of these changes may be linked to tectonic activity. About 200 years ago, the Brahmaputra River changed its path in the decades after an epic earthquake along the Dauki fault. Over that time, the river shifted about 62 miles (100 kilometers) west.

Scientists think an earthquake could cause the Brahmaputra to shift again. The river's current path is actually higher than the Sylhet Basin, which is being pushed down by the weight of the Shillong Plateau. An uplifted area (probably formed by tectonic activity) is keeping the river from flowing back into that low-lying basin. "If there was an earthquake, it could force the river into that basin," says Goodbred.

If the Brahmaputra River were to change course today, "it would be a truly catastrophic event," says Goodbred. Towns that now thrive along the Brahmaputra would be abandoned without the river to support them. "Perhaps more devastatingly, whole areas of flood plain would have a 10-km wide river flowing through it." It is this interplay between the probability of an earthquake happening, weighed against the potential human consequences, that defines the level of ***risk*** it poses to the region.

Investigating changes today to prepare for tomorrow

As any geologist knows, Earth is constantly in motion. Evidence of this motion is everywhere in Bangladesh: floods cover the delta, mountains and plateaus rise, and

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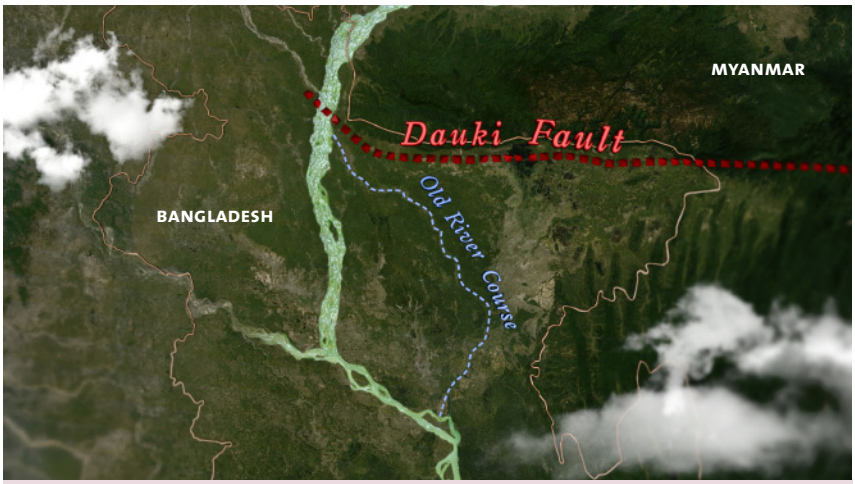
rivers shift courses. And while they may not happen often, massive earthquakes shape the landscape. Today, a major earthquake could devastate this poor, crowded nation. Scientists hope their work will help people in Bangladesh prepare for this risk. "The purpose of our research is to understand what the Earth does," says Seeber. "Probably even more important is convincing people that this is something real, that there is a risk."



BEFORE AND AFTER

This map shows the course of the Brahmaputra River before (in blue) and after (in green) the course change. ©AMNH

STOP AND THINK

BASED ON THE TEXT:

1. How are scientists investigating how river systems have been influenced by tectonic deformation?
2. How do they think an earthquake might affect the Brahmaputra River?
3. How do scientists define earthquake "risk?"

FINAL DISCUSSION:

4. What actions could be taken to minimize earthquake risk in Bangladesh?
5. Why would it be difficult for the people of Bangladesh to take these actions?
6. Considering all four passages and the science practices listed below, how does the investigation of earthquake risk in Bangladesh provide examples of how scientists work?

SCIENCE PRACTICES:

- Asking Questions
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information