

EARTHQUAKE RISK IN BANGLADESH

PASSAGE TWO

Collecting Data

To better understand the risk of an earthquake in Bangladesh, scientists are investigating the region’s geography and tectonic activity. Here are some of the methods they’re using.

Outcrops: Looking into the past

Earthquakes occur along faults, so scientists are working to identify and investigate the active faults in and around Bangladesh. Seeber and his team of structural geologists look for rocks that are bent, folded, or broken. “We usually have faults beneath folds,” explains Ellie Ferguson, a Columbia University graduate student on the project. “We’re trying to understand faults that may tell us something about bigger faults that generate bigger earthquakes.”

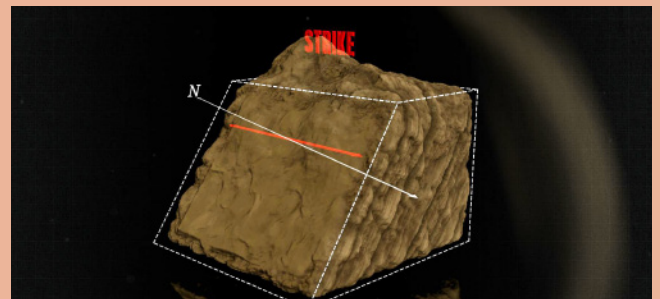
Finding exposed rock can be a challenge in this tropical environment. Since farms and thick vegetation covers much of the region, the team must drive and hike many miles in search of outcrops with exposed rock, such as cliffs and along rivers and roads. “A lot of what we do is hiking around trying to find rocks that we can access,” says Ferguson.

Another challenge is that many faults in the region are “blind,” or buried under miles of rock and sediment. So geologists look for signs of faults like anticlines – places where rocks have folded up into an arch.

Once geologists find exposed rock, they look for places where once-flat rock layers have tilted or been deformed by

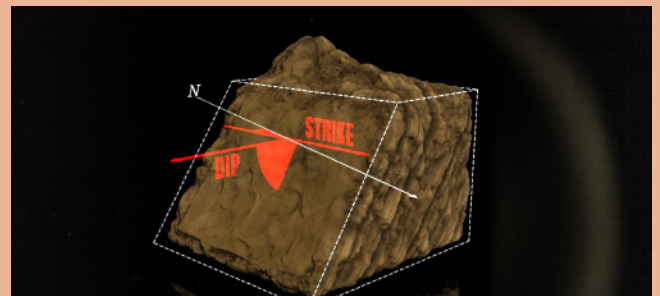
Describing Faults and Folds

To understand tectonic forces, scientists study faults or breaks in rock layers, as well as folds, where rock layers are deformed. Here are some ways that scientists measure and describe faults and folds:



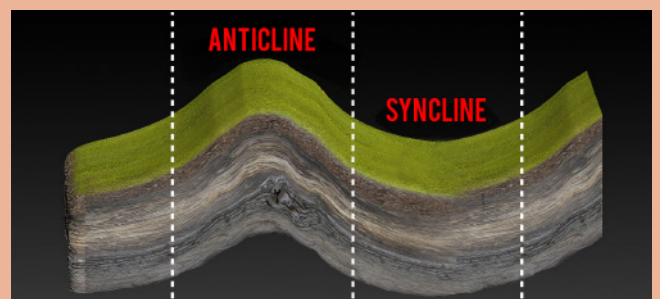
Strike

The direction of the horizontal break in Earth’s crust. Measured as a compass direction (such as “northeast”) or as an angle clockwise from north (from 0° to 360°).



Dip

The angle between the fault and the horizontal surface. Measured between 0° to 90°.



Anticlines and Synclines

Tectonic forces can cause rock layers to bend or fold. In an anticline, rock layers are folded upwards in an arch. In a syncline, the rock layers fold downwards.

CONTINUED

Collecting Data

Scientists measure strike and dip at an exposed outcrop. ©AMNH

tectonic forces. Next, the team uses a special geologic compass to measure the angles of the rock's strike and dip, and the rake – or motion – where a fault has broken the rock. “The position and shape of the rock tells you how it deformed,” says Seeber. “If you have a sandstone [that was] deposited horizontally by a river and now you find it dipping at 60 degrees, something must have turned it on its side.”

Finally, the team maps this information to get a larger picture of how the faults are moving and how much they've moved. “Ideally you have a number of minor faults exposed that you can measure,” says Ferguson. “And that can tell you something about the sense of motion on the big fault as well.”

Seismometers and GPS: Recording Ground Motion

While outcrops reveal past tectonic activity, seismometers and GPS help scientists investigate current activity.

Seismometers detect and measure sudden ground motion, particularly the seismic waves generated by earthquakes and small tremors far below the earth's surface. Currently, 17 seismometer stations are in use around the country: six are permanent and 11 are relocated every one or two years. They provide seismologists accurate data to pinpoint and map active faults in the region.

In general, seismic stations are placed near active faults. “The Dauki Fault is the source of many great earthquakes, so we chose this location to install a seismometer,” says Humayun Akhter. The portable stations also allow seismologists to adjust their location. “Whenever there are earthquakes, we move this [portable] station closer to the source of another earthquake,” says Akhter.

To study the slow movement of the crust, seismologists have installed a network of 25 GPS (global positioning system) devices around the country. Similar to the GPS in your phone or car, these devices use satellites to identify any location on Earth. But this equipment is much more sophisticated, able to measure a position within just a few millimeters. Over time, it can detect even the smallest movement in the crust. It also detects both horizontal and vertical movement, providing a three-dimensional look at the crust's motion.

Over time, points along active faults may get closer together or farther apart. This data not only tells scientists how faults are moving, but also helps them measure the tectonic strain — or energy building up — along faults. For example, a GPS station adjacent to the Shillong Plateau is tracking the plateau's slow movement south along the Dauki Fault.

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Collecting Data

“We’re trying to find out how fast that is moving to help assess the earthquake risk from this fault,” says Michael Steckler. “The GPS is accurate enough to see the strain that’s building up around the fault.”

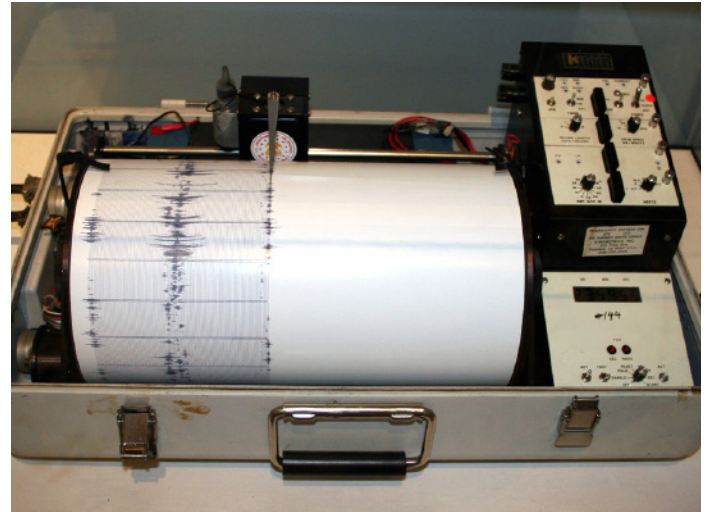
Seismologists use this information to investigate how active faults are moving — where they’re moving and how much — or whether they’re locked in places, storing up energy that could be released in an earthquake.

STOP AND THINK**BASED ON THE TEXT:**

1. What kinds of data are the scientists collecting? How does this compare to your answer from Passage 1?
2. What methods are scientists using to collect their data?
3. Which science practices were used by the scientists?

LOOKING AHEAD:

4. What questions do you think the scientists are trying to answer with this data?



A **seismometer** is an instrument that measures vibrations in the Earth. It works by measuring the difference in position as the ground moves up and down. A simple seismometer might use a spring and weight on a frame, with a pen and rotating “drum” of paper to record the movement. Today’s seismometers use electrical voltage and computers to record earth’s motion in all directions – not just up and down. ©USDOI