Dating the earthquake that caused the Meghna River avulsion

October 15 2015, by Mike Steckler, Earth Institute, Columbia University

House in the middle of the wet fields. During the summer monsoon, it will be an island connected by the bamboo bridge. In a month it will be connected by dry land.

Six of us headed out on Oct. 8 for Brahmanbaria, northeast of Dhaka. Our target is a large winding abandoned river valley that we believe used to be the course of the Meghna River. Currently, the much smaller Titas River flows northward in the channel. Why would a river in the world's largest delta flow the wrong way? We think that an earthquake uplifted the Comilla District area to the south. That caused the Meghna River to shift westward to its present channel and the Titas to flow up the old channel. A well drilled in the channel in 2012 shows a layer of muds overlying coarser sands.

We think the sands represent sediments from the old Meghna and the muds are sediments filling up the channel. We will be using resistivity to image the channel and an auger to first sample and describe the sediments and then to collect samples for dating.

Finding organic matter to date by carbon 14 is rare, so we plan to use a technique called OSL dating. OSL stands for Optically Stimulated Luminescence. Electrons from the radioactivity of all rocks get trapped in defects in quartz grains. However, they are so weakly trapped that sunlight can release them. When traveling down the river, the electrons are released and then start accumulating when they are buried. By measuring the light released by the sample when optically stimulated, we can calculate the time since the sample last was exposed to light. By sampling the top of the sands and the bottom of the muds, we can date the time the river switches, or avulsed. The details of the procedure to get an OSL age are pretty complicated, but if this works, we will date the earthquake that caused the river avulsion.

This technique is new to me. I helped with some sampling the last time I was here, but I have not been in charge of doing it. I am also more comfortable with the quantitative data from the resistivity than the qualitative geologic descriptions we will make of the sediments. Luckily I have a good team with me, Céline, my postdoc, Matt, my former teaching assistant, and Alamgir, Atik and Basu from Dhaka University. I have spent time in the field with Alamgir and Atik before. Alamgir has conducted his own resistivity surveys. Basu was recommended to me as someone with a lot of experience in describing sediments.

We set out early in the morning for the four-hour drive. However, when we reached the river valley, we found it was almost completely flooded. We walked out on an elevated road and there was pani—the Bangla word for water—everywhere. The abandoned valley is still slightly lower in elevation than the surrounding land. Even that land has the rice fields

flooded with shallow water, although the boundaries between the fields are above water. But our main target is submerged! In the winter this will be dry land, but we are a month and a half too early. A number of scheduling issues required me to come now, although I knew it was too soon after the monsoon, but I didn't expect so much of the land to still be flooded. Time to come up with an alternative plan.

The large abandoned channel we hoped to work in is completely flooded.

For the resistivity, we need long straight stretches of dry land. We decided to do it west of the valley to try to image the thickness of the entire Holocene (last 10,000 years) section. It should vary because of the folding of the strata from the tectonics. Mapping the thickness will help us to map the position of the buried fold. For augering, we only need a small patch of land to stand on. To find it we headed south towards where the valley was uplifted more and might be drier. Not as ideal as the original location, but possible. The next morning we headed farther south and crossed the river valley. It was drier and we noted some potential augering sites. We continued to a location for resistivity. The six of us set up the >350 m long resistivity line, then Céline, Basu and I

headed back to try augering while the resistivity data was collected. The augering proved very difficult. We were very slow describing the core that the auger brought up, and while we were doing it the hole would start to collapse. The muddy sediment was very stiff, and we had to hammer the auger in. We only got to 2.7 m when we stopped, nowhere near the depth we needed. Things were pretty discouraging.

A group of children play in a pond while we try to figure out where to find land dry enough to work in.

Our resistivity meter set up in a rice field. We were able to collect data at the cost of very muddy legs.

Céline and Basu examine a core of samples brought up by the auger gouge.

Kids playing soccer on the open field where we did our first auger hole. The auger was hit by the ball several times.

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