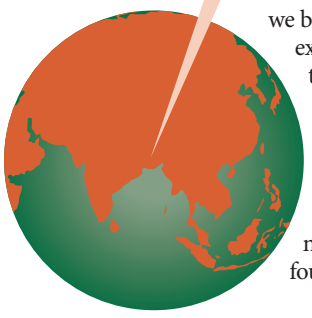
Poisoned backwaters

Charles Harvey and colleagues got to know a snake charmer and his cobras while trying to unravel the mystery of groundwater arsenic contamination in Bangladesh.

What was the objective of the work?
We wanted to find out why the groundwater at our field site in Bangladesh contains such high levels of arsenic, given that the sediments through which the water flows contain relatively little. We soon found out that groundwater arsenic levels and sediment composition do not match, and we directed our attention backwards to find the origin of the contaminated water. We guessed that patterns of dissolved arsenic in the aquifer were controlled by the source of the water, and the pattern of groundwater flow.

Why did you choose this particular location for the fieldwork?
We needed a location that was typical of rural Bangladesh, but accessible from Dhaka, the capital city and the site of Bangladesh University of Engineering and Technology, where two of us are based. There are no hotels in rural Bangladesh — tourists are unheard of — and the conventional wisdom is that it is safest to stay in the city. So we commuted to our field site every day; it took about an hour when the traffic was good, more than three when it was bad. It was always a great relief to arrive safely at our field site after navigating some truly gruesome traffic. The location in Munshiganj is a beautiful place. During the irrigation season from January to March the land is covered with emerald rice fields, and during the monsoon season, July to November, each small village becomes an island in an inland sea.

Any low points?
One trip to Bangladesh was dedicated to a series of injection–withdrawal experiments. We injected many cubic metres of groundwater — modified with different microbial substrates — into different wells. We then reversed the pump to extract the water to see what biogeochemical transformations we had induced. Unfortunately, we began the experiments at the start of the irrigation season, and the irrigation pumping swept our injected chemicals away, never to be found again.



REBECCA NEUMANN

Villagers pulling a drill rod out of a newly drilled well, so that it can be replaced with PVC piping.

Did you have encounters with dangerous animals?
A snake charmer, his family and their twelve cobras moved onto our small work plot while we were conducting the chemical injection–withdrawal experiments. We worked in close quarters with the charmer and his snakes during that week. We tried to discourage performances by simply ignoring the snakes, then on the last day we tipped the charmer handsomely, and he and the snakes gave us a fine performance. We also met a domestic elephant working as a toll-booth; the elephant blocked the road, only moving after extracting cash from inside the car with its trunk and passing it up to the person driving the elephant.

What was the highlight of the expedition?
It was really wonderful to return to the same field site time after time and develop relationships with the people in the area. I think that during our first visit, everyone was curious about us and confused about what we were doing, and thus kept their distance. Eventually, over the course of our seven month-long visits, we managed to get to know a handful of people well, despite the language barrier, by sharing photographs and miming stories. We were even regularly invited into their houses for lunch, which was a real treat. However, I don't think that the confusion about what we were doing ever completely vanished, as we were often covered in mud, glue, ink and sweat at the end of each day (especially on the days when one of us fell into the rice field!).

Did the trip give you any ideas for future research projects?
Our results indicate a couple of reasons to return. First, we would like to install deep community wells in several villages and shallow wells under rice fields, and then carefully monitor the extent to which pumping these wells alters the geochemistry along the flow paths that develop to supply the wells. We plan to conduct these experiments in collaboration with health researchers, who will monitor the villagers' health before and after they stop drinking contaminated water. Second, we would like to see if irrigation withdrawals can be reduced by preventing water losses through the highly permeable bunds (raised bits of land designed to keep the water in), perhaps by ploughing and rebuilding them. This idea grew out of our arsenic work, but has more to do with agricultural efficiency than arsenic poisoning.

This is the Backstory to the work by Rebecca Neumann and colleagues, published on page 46 of this issue.