Geologists find ponds not the cause of arsenic poisoning in India's groundwater

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The source of arsenic in India's groundwater continues to elude scientists more than a decade after the toxin was discovered in the water supply of the Bengal delta in India. But a recent study with a Kansas State University geologist and graduate student, as well as Tulane University, has added a twist -- and furthered the mystery.

Arsenic is a naturally occurring trace element, and it causes skin lesions, respiratory failure and cancer when present in high concentrations in drinking water. The environmental crisis began after large traces of the element were detected in the groundwater in the Bengal Basin -- an area inhabited by more than 60 million residents. This has caused a water shortage, illness and death in the region, leaving residents unable to even use the water for ordinary tasks like washing dishes or ablution.

"It's an awful situation," said Saugata Datta, a Kansas State University assistant professor of geology. "This is one of the worst mass poisoning cases in this history of mankind."

Though no definitive arsenic source has been determined, many geologists have claimed that recent man-made ponds in the region are a major contributor, as the heavy rainfall and erosion have created high amounts of organic material -- containing arsenic -- in the ponds. From there the pond's water and organic material seep into the groundwaters.

Datta and colleagues recently completed a study looking at the ponds. Their findings, "Perennial ponds are not an important source of water or

dissolved organic matter to groundwaters with high arsenic concentration in West Bengal, India," was published in Geophysical Research Letters in late October, and it also appeared in the journal Nature.

"Our study suggests that ponds are not contributing substantial amount of water or this old organic matter into the groundwaters in the shallow aquifer in this region," Datta said. "These very high arsenic levels are actually coming from something else, possibly from within the organic matter contained in these Holocene sedimentary basins."

Datta, along with Tulane University colleague Karen Johannesson -- the study's other lead investigator -- came to this conclusion after modeling the transport of the pond's organic matter through the meters of sand and clay to the aquifers below. Because of the organic matter's highly reactive nature to minerals -- like arsenic -- researchers found that this organic matter actually serves as a retardant and causes minerals to absorb more slowly into the aquifer sediments.

"Characteristically the organic matter is very sticky and likes to glom onto mineral surfaces," Datta said. "So it takes much longer for the organic matter to move the same distance along a groundwater flow path than it does through just the water itself."

According to their model, it would take thousands of years to reach roughly 30 meters into the aquifers in the Bengal delta, which is where we see this peak of arsenic.

"These high arsenic waters at the 30 meter depth are approximately 50 years old," Datta said. "Since the ponds that supply the organic matter have been around for thousands of years, the current ponds would not be the source of this organic matter."

The team created their model based on stable isotope data at Kansas

State University's Stable Isotope Spectrometry Laboratory. The lab is operated by Troy Ocheltree, a biology research assistant who co-authored the study.

In the near future, Datta, Sankar Manalikada Sasidharan, a geology graduate student, India, and Sophia Ford, a geology undergraduate student, Wilson, will travel to the region to collect groundwater and aquifer sediment samples for an extensive study that accounts for various valleys and ponds. In addition to arsenic, the team will also monitor for high concentrations of manganese, as scientists are finding that the two metals often appear together.

"The work that we've started to look into this source mechanism release in the Bengal delta is still far from being solved," Datta said. "The mystery still remains. We just added a little bit more to it."

Provided by Kansas State University