Volatile gas could turn Rwandan lake into a freshwater time bomb

November 16 2009

A dangerous level of carbon dioxide and methane gas haunts Lake Kivu, the freshwater lake system bordering Rwanda and the Republic of Congo.

Scientists can't say for sure if the volatile mixture at the bottom of the lake will remain still for another 1,000 years or someday explode without warning. In a region prone to volcanic and seismic activity, the fragility of Lake Kivu is a serious matter. Compounding the precarious situation is the presence of approximately 2 million people, many of them refugees, living along the north end of the lake.

An international group of researchers will meet Jan. 13-15 in Gisenyi, Rwanda, to grapple with the problem of Lake Kivu. A grant from the National Science Foundation won by Rochester Institute of Technology will fund the travel and lodging for 18 scientists from the United States to attend the three-day workshop. Anthony Vodacek, conference organizer and associate professor at RIT's Chester F. Carlson Center for Imaging Science, is working closely with the Rwandan Ministry of Education to organize the meeting.

"Rwandan universities suffered greatly in the 1994 genocide and there are few Rwandan scientists performing significant work on the lake or within the rift system," Vodacek notes. "We will work with the government to identify interested researchers."

Vodacek is convening the workshop with Cindy Ebinger, an expert in

East African Rift tectonics at the University of Rochester, and Robert Hecky, an expert in limnology—the study of lake systems—at University of Minnesota-Duluth. Core samples Hecky took in the 1970s initially brought the safety of Lake Kivu under question.

Addressing the lake as a whole system is a new concept for the workshop participants, who will bring their expertise in volcanology, tectonics and limnology to the problem. Vodacek's goal is to prioritize research activities and improve communication between the North American, European and African collaborators.

"Most scientists are fairly in agreement that the lake is pretty stable; it's not as if its going to come bursting out tomorrow," Vodacek says. "But in such a tectonically and volcanically active area, you can't tell what's going to happen."

One of the problems with Lake Kivu is that the 1,600-foot deep lake never breathes. The tropical climate helps stagnate the layers of the lake, which never mix or turn over. In contrast, fluctuating temperatures in colder climates help circulate lake water and prevent gas build up. Lake Kivu is different from both temperate and other tropical lakes because warm saline springs, arising from ground water percolating through the hot fractured lava and ash, further stabilize the lake. Scientists at the workshop will consider how these spring inputs may vary over time under changing climates and volcanic activity.

A number of catalysts could destabilize the gas resting at the bottom of Lake Kivu. It could be an earthquake, a volcanic explosion, a landslide or even the methane mining that has recently united Rwandan and Congolese interests.

Close calls occurred in 2008 when an earthquake occurred near the lake and in 2002 when a volcanic eruption destroyed parts of Goma in the

Democratic Republic of Congo, only 11 miles north of Lake Kivu. Although scientists were alarmed, neither event sufficiently disturbed the gas.

Vodacek likens the contained pressure in the lake to a bottle of carbonated soda or champagne. "In the lake, you have the carbon dioxide on the bottom and 300 meters of water on top of that, which is the cap," he says. "That's the pressure that holds it. The gas is dissolved in water."

When the cap is removed, bubbles form and rise to the surface. More bubbles form and create a column that drags the water and the gas up to the surface in a chain reaction.

"The question is, and what's really unknown, is how explosive is that?" Vodacek says.

Through his own research Vodacek plans to simulate the circulation of Lake Kivu. Modeling the circulation patterns above the layers of carbon dioxide and methane will help determine the energy required to disrupt the gas and cause Lake Kivu to explode.

Source: Rochester Institute of Technology (news : web)